Community based perspectives on climate change and adaptation in the Shoalhaven region, New South Wales, Australia

Summary report

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Summary

Decisions about when, what, and how to develop, implement and fund adaptation are complex and contested (Burton et al., 2002). Both mitigation and adaptation are critical components of the planning and policy challenge. Yet, a lack of international commitment and investment in mitigation has meant that adaptation to the predicted impacts has become of paramount importance (Preston et al., 2011; Harman et al., 2014; Serrao-Neumann et al., 2013). Enabling effective adaptation at the local and regional scale will depend on a ‘wide range of socio-economic, political and institutional factors not just technological ones’ (Vincent, 2007, p. 12). The spatial distribution of climate risk and community vulnerability varies significantly across the Australian landscape. In recent years there has been a growing preference to better understand the dynamics across different communities in the context of climate adaptation (Berkes and Jolly, 2002). This is important because communities are not homogenous and as such ‘there can be no one size fits all’ approach to working with communities in relation to adaptation strategies (Green et al. 2009).

This report contributes to the broader project of the Science-Policy-Community Theme within the Adaptive Communities Node of the NSW OEH Adaptation Research Hub. The main objective of the project is to understand the interaction between the formal and informal networks within different communities, with a view towards developing a range of targeted options for policy makers to engage more effectively with local communities in relation to climate change adaptation. The report presents findings from 24 interviews conducted between March and April 2014 in the Shoalhaven region of New South Wales. Analysis of the social networks in the region indicates that people access information from a variety of sources. In comparison, the share network suggests people disseminate their knowledge in more dense clusters. Findings from the qualitative analysis suggest that there are opportunities to engage a larger proportion of the network to enhance knowledge exchange and build resilience. To do so will require a rethink in the way in which information about climate change and adaptation is framed and communicated. Key concerns for participants in the region include increased temperature, reduced rainfall, bushfire risk, sea level rise and weed infestation.
1 Background

Climate change is a significant challenge for planners and policy makers (Pidgeon et al., 2014). The spatial and temporal uncertainties along with the large number of vested interests and values that are mobilised within communities generate significant challenges (Serrao-Neumann et al., 2015). Understanding how different planning and policy approaches play out within and across different communities is important for successful adaptation. There can be no ‘one size fits all’ approach to community engagement as every community is unique (Green et al., 2009). Recent extreme weather events have highlighted the vulnerability of many settlements to future climate change impacts. The effectiveness of community engagement at the local scale can be significantly enhanced by improving our understanding of the community structure and their specific needs, concerns and perceptions in relation to climate change and adaptation. Community structures may be understood more deeply by uncovering the underlying social networks that are activated around particular issues, such as climate change.

By using social network analysis (SNA) we explore the social structures around this particular topic in the Shoalhaven region of NSW. In parallel with mapping the social network, we used semi-structured interviews to elicit the experiences and perceptions of the key stakeholders in relation to climate change and adaptation to determine their major concerns and information needs to improve community resilience and enhance their capacity to adapt. This summary report presents findings from the research conducted between March and April 2014 in the Shoalhaven region, New South Wales. The Shoalhaven region represents one of three case studies conducted as part of the broader Science-Policy-Community Theme within the Adaptive Communities Node of the NSW OEH Adaptation Research Hub. The main objective of the broader project is to understand the interaction between the formal and informal networks within different communities, with a view towards developing a range of targeted options for policy makers to engage more effectively with local communities in relation to adaptation issues. Understanding the structure and influence of networks is important to developing effective ways to engage with diverse communities at the local scale.

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1 The second and third case study areas include Bega and Orange in New South Wales
2 Aims and approach

This study employed a mixed methods approach using both quantitative and qualitative techniques. The quantitative component of the research used social network analysis (SNA) to map the formal and informal social network in the Shoalhaven region. Two social networks were mapped in the region. These related to ‘where participants access climate adaptation information’ (access network) and the second network related to ‘who they share their information with’ (share network). For more information on the social network analysis see (Cunningham et al., 2014). The qualitative component of the research was used to elicit the experiences and perceptions of the key stakeholders to improve knowledge and inform policy design for community engagement and climate change adaptation. In doing so, we investigated community perceptions about climate change and determined the community’s major concerns and information needs to enhance their capacity to adapt to a changing climate. We used a snow-ball sampling technique to recruit participants to ensure the most appropriate people were identified for interviews. Our initial scoping phase involved a desk top review of the region to identify a cross section of the community to ensure we had representation from a mix of stakeholders that cut across government, industry, non-government organisations and the broader community.

In total, 24 interviews were conducted between March and April 2014. Of these, 12 were conducted with government agencies (formal networks) and 12 from non-government, climate groups/community members (informal networks). Participants were given the option to opt out of interviews being audio recorded. Twenty interviews were audio recorded, transcribed, and imported into NVivo for coding and analysis. Pre-coding was used to become familiar with transcripts and identify potentially important segments of text (Layder, 1998). We employed a directed content analysis of the transcripts to enable a comparative assessment across the case studies. Note: the comparative assessment between cases is not part of this report but will form a distinct component of the ‘adaptation toolkit report’ to be finalised by late 2016. For more information on the second case study refer to report entitled ‘Engaging local communities in climate adaptation: a social network perspective from Bega Valley, New South Wales, Australia’ (see Harman et al., 2015). The themes were checked for overlap and duplication before further refinement. Interviews were conducted by the second and third authors of this report, with the first author completing all coding and qualitative analysis. The quantitative data collection was
undertaken as a distinctive sub-component of the semi-structured interviews, with specific questioning at the end of each interview. In broad terms the interviews explored:

i. perceptions of climate change and adaptation;
ii. community concerns and personal experiences;
iii. roles and responsibility for adaptation policy;
iv. adequacy and usefulness of information and community engagement processes;
v. types of information that interests people the most; and
vi. potential changes people have made to improve liveability and business efficiency under changing climatic conditions.

After completion of the coding a word frequency analysis was conducted. The results of the word frequency analysis were visualised as a word cloud (Figure 1). Given the focus of the research it is perhaps not surprising to note that the dominant words, as articulated by the word frequency analysis, related to ‘what people in the community think about climate change’.

Figure 1: Word frequency analysis
Study Area- Shoalhaven Region

Shoalhaven City is located approximately 160km south of Sydney on the south coast of New South Wales, Australia (see Figure 2) (Shoalhaven City Council, undated-a). Shoalhaven is a dispersed region spread over 125km of coastline with the vast majority of its population located in the north east around Nowra, Jervis Bay and Sussex Inlet (Shoalhaven City Council, undated-a).

Figure 2: Shoalhaven City LGA

The region is a growing residential and tourist area, encompassing an area of approximately 4,531km² including substantial areas of national park, state forest, bushland, beaches and lakes (Shoalhaven City Council, undated-a). Most of the population is concentrated along the coastal fringe, in major centres and numerous small settlements. Rural land is still used primarily for dairy farming, beef cattle, nurseries, and a growing number of more intensive agricultural activities. The area has a strong manufacturing base including goods such as paper, starches, ethanol, cheese, boats, avionics, and building products (Shoalhaven City Council, undated-a). The main sectors of employment within the region are manufacturing, government (including defence), retail and tourism (Shoalhaven City Council, undated-a). These sectors are supported by building and construction, community services and education (Shoalhaven City Council, undated-a). The region also has a strong cultural history with links to indigenous communities, the Wodi Wodi and
Wandandian Aboriginal people, which have inhabited and utilised the region since before European settlement. Table 1 provides an overview of some of the characteristics of the region.

<table>
<thead>
<tr>
<th>Table 1: Overview of the Shoalhaven Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (2014)</td>
</tr>
<tr>
<td>Median Age</td>
</tr>
<tr>
<td>Unemployment</td>
</tr>
<tr>
<td>Area</td>
</tr>
<tr>
<td>Towns, suburbs and localities</td>
</tr>
<tr>
<td>Nowra: Bangalee, Bomaderry, Cambewarra, Cambewarra Village, Mundamia, North Nowra, Nowra East, Nowra Hill, South Nowra, Tapitallee, Terara, West Nowra, Worrigee</td>
</tr>
<tr>
<td>Jervis Bay: Basin View, Bream Beach, Callala Bay, Callala Beach, Erowal Bay, Huskisson, Hyams Beach, Myola, Old Eowal Bay, Sanctuary Point, St Georges Basin, Vincentia, Woollamia, Worowering Heights, Wrights Beach</td>
</tr>
<tr>
<td>Sussex Inlet: Berrara, Cudmirrah, Swanhaven</td>
</tr>
<tr>
<td>Ulladulla: Burrill Lake, Dolphin Point, Kings Point, Milton, Mollymook, Mollymook Beach, Narrawallee</td>
</tr>
<tr>
<td>Coastline</td>
</tr>
<tr>
<td>Land use</td>
</tr>
<tr>
<td>Dairy farming, beef cattle, nurseries, and a growing number of more intensive agricultural activities. The area has a strong manufacturing base including goods such as paper, starches, ethanol, cheese, boats, avionics, building products, surfboard and surf-wear.</td>
</tr>
</tbody>
</table>

Source:(Shoalhaven City Council, undated-a; Wikipedia, 2015)

In 2014, the estimate resident population for the Shoalhaven City was 99,016 people, translating to a density of 0.22 persons per hectare (ABS, 2013). Analysis of the service age groups indicates that the Shoalhaven region had a lower proportion of people in the younger age groups (0-17 years) and a higher proportion of persons in the older age groups (60 + years) compared to regional NSW in 2011 (see Figures 3 and 4) (Shoalhaven City Council, undated-b). The main differences between the age structures of Shoalhaven in comparison to regional NSW, include:

- A larger percentage of 'Seniors' (13.6% compared to 10.3%)
- A larger percentage of 'Empty nesters and retirees' (14.6% compared to 11.9%)
- A smaller percentage of 'Young workforce' (8.4% compared to 10.4%)
- A smaller percentage of 'Parents and homebuilders' (17.7% compared to 19.5%)

(Shoalhaven City Council, undated-b)
Figure 3: Service Age Groups – Shoalhaven City
Source: Shoalhaven City Council 2011

Figure 4: Service Age Groups - Regional NSW
Source: Shoalhaven City Council 2011
3 Findings from the quantitative SNA

This section provides a brief overview of the findings from the quantitative SNA. For more information on the Shoalhaven social network refer to previous report (see Cunningham et al., 2014).

**Accessing climate information**

In total, the 24 participants interviewed in this study reported a total of 165 entities from which they obtained their climate adaptation information (inclusive of the participants themselves). Of these, 12 were international entities, 45 government entities (either local, state or federal), 14 non-government organisations, 25 community based organisations, 23 mass media entities (e.g., tv, radio, newspaper), 12 mass communication channels (e.g., internet, mobile), 5 social media outlets, 6 research organisations, and 16 other entities, such as individual community members. Figure 5 shows the climate information access network. Nodes are coded for affiliation by colour and for degree by size. When analysing the cohesion of this network, the average degree of each node was 2.558, with an average distance or reach for each node was 4.417. This means that on average, each node had ties to 2.5 alternate nodes, and through these alters could reach up to a further 4.4 alters. There was only one component and 0 fragmentation in this network which had a diameter of 9 (diameter meaning that it took only 9 nodes to make a path through the network) with a degree of closure of 0.15 (for full cohesion measures please see the following Table 2).

**Table 2: Full cohesion measures – access network**

<table>
<thead>
<tr>
<th>#</th>
<th>Measure</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Avg Degree</td>
<td>2.558</td>
</tr>
<tr>
<td>2</td>
<td>H-Index</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>Density</td>
<td>0.016</td>
</tr>
<tr>
<td>4</td>
<td>Components</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Component Ratio</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>Connectedness</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Fragmentation</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>Closure</td>
<td>0.015</td>
</tr>
<tr>
<td>9</td>
<td>Avg Distance</td>
<td>4.417</td>
</tr>
<tr>
<td>10</td>
<td>SD Distance</td>
<td>1.417</td>
</tr>
<tr>
<td>11</td>
<td>Diameter</td>
<td>9</td>
</tr>
<tr>
<td>12</td>
<td>Breadth</td>
<td>0.739</td>
</tr>
<tr>
<td>13</td>
<td>Compactness</td>
<td>0.261</td>
</tr>
</tbody>
</table>
Figure 5: Where do you access your climate information?

Node shape denotes gender: Female = Circle, Male = Square, Not applicable = Triangle. Node size denotes popularity or the number of times the node was mentioned by other participants: small node = less mentioned, large node = most mentioned. Node colour denotes the type of org: International = red, Federal Government = orange, State Government = yellow, Local Government = green, NGO = light blue, Community Based Organisation = blue, Mass Media (tv, radio) = indigo, Mass Communication Channels (internet, mobile sms) = violet, Social Media = magenta, Research Centre = black, Individual = kaki, Other = Deep burgundy, political party = forest green

Further analysis of the access network using keyplayer software revealed that although individuals gather information from other sources such as personal weather stations, websites, reports, and other mass media devices, the three nodes #6, 14 and 76 could reach almost the entire network with a reach of 84.2% (see Table 3).

Table 3: Keyplayer results for access network

<table>
<thead>
<tr>
<th>Keyplayer</th>
<th></th>
<th>Bureau of Meteorology</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td></td>
<td>ABC Radio</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>Sydney Morning Herald</td>
</tr>
<tr>
<td>76</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

No. of distinct persons reached by the key players: 139 (84.2% of network)
Disseminating climate information

While participants accessed information from a range of sources, including the three key nodes listed above, they disseminate their knowledge in more dense clusters. In particular, interviewees primarily shared information within their local professional and often geographical group only. The 24 participants reported a total of 194 entities with which they shared climate information (inclusive of participants themselves). Of these, none were international entities, 47 were federal, state or local government entities, 15 were non-governments organisations, 79 were community based organisations and members, 6 were mass media (e.g., tv, radio, newspaper), 7 were mass communication channels (e.g., internet, mobile), 5 were social media, and 3 were research centres. In addition, there were 32 other entities, such as individuals, friends, and neighbours.

Figure 6 shows the climate information share network. When analysing the cohesion of this network, the average degree of each node was 1.990, with an average distance or reach for each node of 4.249. This network was far more fractious than the information access network (Figure 5) having 7 components with a fragmentation factor of 0.449. The main component had a diameter of 7 with a degree of closure of 0.007 (for full cohesion measures please see Table 4).

Table 4: Full cohesion measures – share network

<table>
<thead>
<tr>
<th></th>
<th>Avg Degree</th>
<th>1.990</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>H-Index</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Density</td>
<td>0.010</td>
</tr>
<tr>
<td>4</td>
<td>Components</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>Component Ratio</td>
<td>0.031</td>
</tr>
<tr>
<td>6</td>
<td>Connectedness</td>
<td>0.551</td>
</tr>
<tr>
<td>7</td>
<td>Fragmentation</td>
<td>0.449</td>
</tr>
<tr>
<td>8</td>
<td>Closure</td>
<td>0.007</td>
</tr>
<tr>
<td>9</td>
<td>Avg Distance</td>
<td>4.249</td>
</tr>
<tr>
<td>10</td>
<td>SD Distance</td>
<td>1.457</td>
</tr>
<tr>
<td>11</td>
<td>Diameter</td>
<td>7</td>
</tr>
<tr>
<td>12</td>
<td>Breadth</td>
<td>0.847</td>
</tr>
<tr>
<td>13</td>
<td>Compactness</td>
<td>0.153</td>
</tr>
</tbody>
</table>
Figure 6: Who do you share climate information with?

Node shape denotes gender: Female = Circle, Male = Square, Not applicable = Triangle. Node size denotes popularity or the number of times the node was mentioned by other participants: small node = less mentioned, large node = most mentioned. Node colour denotes the type of org: International = red, Federal Government = orange, State Government = yellow, Local Government = green, NGO = light blue, Community Based Organisation = blue, Mass Media (tv, radio) = indigo, Mass Communication Channels (internet, mobile sms) = violet, Social Media = magenta, Research Centre = black, Individual = kaki, Other = Deep burgundy, political party = forest green

Further analysis of the share network using keyplayer software revealed that the local radio station (#6) along with two key individuals (#26, 54) could reach approximately 70% of the entire network (see Table 5). The key nodes with the longest reach were those who communicated information to government in addition to community based organisations.

Table 5: Keyplayer results for share network

<table>
<thead>
<tr>
<th>Keyplayer Results</th>
<th>6</th>
<th>2ST Radio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>26</td>
<td>Interviewee #4</td>
</tr>
<tr>
<td></td>
<td>54</td>
<td>Interviewee #7</td>
</tr>
</tbody>
</table>

No. of distinct persons reached by the key players: 136 (70.1% of network)
4 Observations from interviews

This section presents an analysis of the main themes that were developed as a result of coding the data from the 20 interview transcripts. The main themes relate to perceptions of climate change and risk, concerns and information needs, and communicating climate change. The research team’s interpretation of the implications of these themes is presented in the following section.

4.1 Perceptions of climate change and risk

Interview participants were asked to comment on their understanding of climate change and adaptation. Perhaps not surprisingly, there were mixed opinions in relation to perceptions of climate change and the risks associated with this global phenomenon. Some respondents believed that climate change is not real and in fact linked specific events or trends to what many perceive as climate variability. This was seen to be predominately a view held within the farming community. Indeed, there is extensive evidence of farmer experiences in dealing with adverse effects from climate variability (Below et al., 2015; Brown et al., 2015; Crimp et al., 2010). For others there was the belief that climate change was occurring and in fact was accelerated by humans. Others had some support for climate change but were not convinced of the scientific arguments and felt that more effort needed to focus on scientific consensus. As one respondent claimed:

‘... I get really annoyed with a lot of climate change proponents, because there’s a whole industry built up around people trying to prove we’re responsible for accelerated climate change. We may well be, but there’s no definitive proof of it. I get really annoyed when people start throwing things in that I know are technically incorrect.

Interestingly, others shared similar views despite being active participants within the emergency management sector, as one interviewee noted:

I’ve seen, I’ve heard and I understand a lot of the debate that’s going on in regards to climate change and seen the result especially within the job of emergency management. Whether it’s because of climate change, because it’s manmade caused or whether it’s a natural occurrence. Whether it’s the cyclic weather conditions over thousands of years. I’m not sold on that aspect of it.
However, most of the interviewees indicated that they were aware of climate change and its associated impacts, but there was also a common perception amongst interviewees that within the broader community there was a certain degree of ignorance and disbelief in the context of climate change and adaptation. Much of the disbelief was thought to be attributed to the demographic profile within the region – consisting of a high proportion of older retirees that believe that they won’t experience the impacts of climate change in their lifetime, as one interviewee noted:

...this is an interesting one and I think this is probably true for a lot of people - that you don’t really think that you will see the full impact in your lifetime. I don’t think you can get around that. But people seriously don’t think they will see the full impact of climate change within their lifetime and don’t sort of necessarily associate the minor events, which are still severe activities, with the longer-term change that we’re considering.

The temporal issue of dealing with longer term risks such as climate change was also supported by another respondent who stated:

But people here mostly they just don’t care. How many of them say, I said it myself, I won’t live that long. So I won’t be seeing this.

Participants who believed in climate change and adaptation tended to link their own personal experiences and observations over the last 10 to 20 years to the longer term trends associated with climate change. These observations or experiences were best expressed through notable changes in flora and weather related extremes, as a number of interviewees indicated:

There’s a lot of talk about things are weird and flora’s - the flowering times are changing, they’re either earlier or later, just depending on which particular flora species you’re talking about.

Another respondent noted:

Now I know from observations in the field, because I’m regularly out in the field on my own and with others, that plants which flowered from the end of August when the moisture level in the soil disappeared, there were less plants. The plants were physically smaller. Those that carried
five or six flowers probably only carried two or three flowers and those flowers were actually smaller. That’s continued on until right now.

And:

Last year we recorded over seven sites and over 300 plants we got four orchids in flower and that’s it. You’re looking at less than one per cent flowering and no new recruits as they say. That’s been falling away for the last few years. I know one year we had one and a half per cent or two and a half per cent flowering.

Others expressed concern over the magnitude of events as an indicator of climate change:

I guess it's not necessarily subtle changes like temperature or anything like that, but it's very much more extreme events. So when we get a fire we get big fires. When we get flooding we get big flooding or rain events.

Conversely, other participants suggested that they had not really noticed any changes in weather related extremes and indicated that perhaps sensitivity towards notable temperature changes may in fact be the result of ageing as opposed to actual physical changes in climate. This supports scholarly findings that human comfort levels change with age (Blatteis, 2012). In addition, it was suggested that incremental changes in climatic conditions were hard to detect. Regardless of whether participants believed in climate change or not there was a strong sense that society as a whole needed to change the way it managed resources, as one Landcare coordinator noted:

...I work in this area, I will proactively be supporting efforts around mitigation, around adaptation, you name it, I believe even if it's - and the evidence is obviously proving it, but even if it wasn't about human induced climate changed, it's about finite resources and living sustainably on the planet. That we all need to reduce the amount of energy we consume, well the amount of things we consume, so that our resources are available for longer. So they are finite, the quicker we use them, the quicker they'll be gone.

For the interviewees that did believe in climate change there was some concern that not enough was being done at the political scale to mitigate the risks. As one community based organisation representative expressed:
Well, my personal view is...well, I certainly understand the science or some of the science. I’ve come to the conclusion that it’s real and that I - but I actually personally, with what’s gone in the last 10 years, don’t actually believe that the world community will respond in a meaningful way. I think they’ll just fiddle around at the edges...because I just don’t think politically we’re able to deal with it with long term problems, which is very sad. So adaptation will become increasingly important...

Given the demographic profile of the region there were concerns that communication and engagement efforts needed to focus on the older generation to build knowledge and enhance capacity to adapt to climate change. As one local government participant expressed:

We’re going to see exponential changes. I think that we’re going to see - I’m 44 years of age and I am going to experience those changes because I already am experiencing some of those changes in my life and I am afraid - not afraid, not panicking - but I am really concerned for my kids. Our generation and the baby boomers are really doing very little - if you look at the between 40 and 65 or 70-year-olds, and if that’s the active, healthy dominating age group in this country, then we’re really doing very little to promote or do anything about it.

While there was broad support for managing climate change at higher scales, there were also suggestions that efforts should focus on what individuals can do at the local scale:

But I think that I’d rather put my energy into changing what we can on the ground in our own local community...

Supporting individuals and groups within the community was seen to be a key role for Local Land Services (LLS) but not just in the context of climate change adaptation but also in terms of capacity building and resilience to other socio-economic drivers.

4.2 Scale and governance

Climate change is often seen as a global problem. Because of the scale and nature of the problem many individuals and communities feel disempowered or ignorant when it comes to climate change (O’Neill and Nicholson-Cole, 2009). A recent national study found that ‘anger, fear, and powerlessness were rated as the most commonly felt emotion in response to climate change’
(Leviston et al., 2015, p. x). Measures to manage climate change risks are often based on reactive planning approaches as opposed to proactive measures. As one town resident suggested:

So I guess we play a very small part in the broader picture and I think that's one of the problems that we have in that climate change is a broad picture thing and it's not - there are things that local communities could do, but again, I think with our group there needs to be a disaster before there'll be action and that's too late obviously.

There were also concerns within the Shoalhaven community that politicians were unable to make the hard decisions and deal with long term problems such as climate change. As one community based organisation representative stated:

Well, my personal view is... I've come to the conclusion that it's a real and that I - but I actually personally, with what's gone in the last 10 years, don't actually believe that the world community will respond in a meaningful way. I think they'll just fiddle around at the edges...because I just don't think politically we're able to deal with it with long term problems, which is very sad. So adaptation will become increasingly important...

Frustration around the lack of involvement from all levels of government in managing climate change risks was also evident, as one local government representative responded:

I'm pretty aware of what the implications are going to be. Disappointed with the lack of planning for it at all levels of government. My little bugbear around these areas is so much of the foreshore land, whether it's beaches or - mainly beaches - is all Crown land and if that's going to go with sea level rise, it's going to push the shoreline into the private properties. Where are our kids going to go to the beach?

The need for stronger leadership and support at higher scales of governance in times of uncertainty is recognized in the literature (Taylor et al., 2013). Yet, in many instances local authorities are not receiving sufficient support and leadership from the state which increases uncertainty and potentially community vulnerability. The lack of adequate leadership and political will in the context of dealing with complex and ill-defined problems, such as climate change, was a clear frustration for one interview participant who spoke about the importance of state leadership in terms of local level decision making:
...and then of course there's the angst that's around the political decision making of people not actually wanting to make those decisions. So the State Government walking away gave the political part of council the excuse to go soft and not be quite so strong in its response.

As a means to overcome such limitations local governments often engage in strategies of scaling up and scaling out to reduce these risks (Taylor et al., 2013). The opportunity to partner with other local authorities to deal with the risk of sea level rise in the absence of higher level support and leadership from the state was an important point made by one local government interviewee:

> At the moment an interesting project we are part of with Eurobodalla Council is to develop some sea level rise projections for this area and a policy response framework based on a risk management approach. It's a project that has been triggered by the coastal reform in New South Wales and the fact that the State Government does not endorse anymore the previous sea level rise benchmarks and basically told the councils you can adopt your own projections, your own benchmarks regionally. Which basically was not really helping us and left the door open to a number of interpretations and a number of inconsistencies between what's happening at the local government scale.

While adaptation efforts tend to be ad hoc and predominately reactive (Harman et al., 2014), there is evidence of proactive adaptation within the farming sector of the Shoalhaven region despite the absence of any explicit policies. Farmers are already seen to be responding to localised manifestations of climate variability and emerging climate risks in the Shoalhaven region. While many farmers may not agree with climate change in philosophical terms, there were suggestions and indications that many in the region were implicitly adapting to climate change through modified business and management practices. As one local government interviewee noted:

> I think, and again I deal a lot with farmers, landowners, and I think they've certainly adapted. They might be sowing their crops later or earlier depending on soil temperatures and things like that. Certainly they've changed the way in which they conserve fodder...now they start a lot earlier, they can wrap it up with moisture content in there. So there's probably some changes there just in the farming community...

These changed management practices however, are often driven by other motivations such as economic efficiency and increased profitability at the farm level. For example, the adoption of shelter sheds for cattle for improved milk supply generate both an economic return for farmers
and also better equip them for climate change. In many cases, farmers perhaps do not even realise that they are in fact adapting to climate change but perhaps see this as dealing with climate variability or weather related extremes. There is a substantial body of literature around agriculture and farm scale adaptation (Crimp et al., 2010; Brown et al., 2015). Much of this literature attributes adaptation efforts to the fact that farmers are familiar with dealing with variability across environmental and socio-economic terms, and have demonstrated sufficient adaptation measures to ensure ongoing farm viability. Moreover, efforts to adapt to other exogenous factors in both the farming sector and other policy areas has often been labelled a ‘no regrets’ approach as there are often benefits that occur even in the absence of climate change (Ash et al., 2010). Failure to adapt to the existing set of risks ultimately results in loss of income.

### 4.3 Concerns, information needs and challenges

Given its proximity to the coast and the bush there were a number of concerns raised by participants in relation to the regions exposure to certain climate change impacts. Both bushfire risk and coastal inundation as a result of sea level rise and storm surge were popular concerns amongst interviewees. Of these two, bushfire risk was the most common concern raised by participants. There were significant concerns in relation to the region’s capacity to respond to extreme bushfire events under conditions of climate change scenarios. In particular, there were concerns around the management of bushfire risk in the context of emergency management, as one state government participant stated:

*That just reminded me about the whole safe place movement or policy that the RFS is working towards, that they really don’t have any safe places in the Shoalhaven, but then legally there’s a whole lot of issues around that.*

In terms of bushfire risk a number of participants expressed concern that many in the region were not well prepared or equipped to deal with extreme events. This apprehension stemmed from the belief that many had not dealt with such extremes and thus were unable to apply learning from personal experiences which is often considered a central component of learning to adapt (Ojha et al., 2004). Previous studies have also found that ‘those with past experiences of disasters are inclined to see current weather events as influenced by climate change’ (Higginbotham et al., 2014, p. 708). According to one local government respondent:
So the issue is that people have difficulty accepting in their own minds the magnitude of a fire event if they don’t have any practical experience on what a fire’s like, if you haven’t been through it, and what it can do.

The reliance on volunteers within the RFS was also recognised as a significant challenge in terms of managing bushfire risk, as one community based organisation representative noted:

We’re also dealing with membership issues. We’ve got, you know, I won’t say they’re issues but constraints. We’ve got a limited number of volunteers. We’ve got volunteers within our service that aren’t always available to go out to long campaign fires. You know, they’ve all got to earn a living. We don’t pay them. So at times we undergo restrictions where not everybody is available.

There were also challenges associated with the demographic profile of the region. For example, interviewees spoke about hobby farmers that commute from Sydney on weekends providing challenges for emergency management as they tend to lack the discrete local knowledge required to manage their land in a way that reduces risk:

... and in Shoalhaven now we’ve got a lot of people, I guess you call them rural lifestyle type blocks, that are not deriving an income directly from the land. That’s becoming more and more prevalent, a lot of them are absentee landowners, so people in Sydney come down on the weekend and play around on five or 10 acre farm. So we tend to deal with those people, and they’re the ones that are really inquiring about things. You get all these questions of oh well what weed’s that? What should I do about it? Why are these weeds worse than those weeds? Why isn’t the grass growing down in that corner of the paddock?

Some participants were also concerned about the manner in which planning and development decisions were being made in terms of safeguarding houses from bushfire risk. While buffer zones are routinely implemented as a means to manage bushfire risk, it was believed that these would not be adequate under extreme bushfire conditions as projections suggest under climate change scenarios. This issue is further exacerbated by the fact that there has been a significant change in the ‘normal’ Hazard Reduction (HR) season for the RFS. According to one respondent, the window of opportunity to conduct prescribed burning is diminishing which is forcing RFS to conduct HR prescribed burning during the hotter and dryer months. However, these prescribed burns are only conducted provided certain conditions are met. Nevertheless, any prescribed burning outside of
the ‘normal’ HR season potentially increase the risk of more intense bushfires. As one community based organisation respondent stated:

What we’re seeing now is that historically, especially in regards to us conducting hazard reductions. What I’m saying with that is prescribed burning; we used to have a very wide open window during the winter months where we’d get a lot of burning able to be done because of the favourable weather conditions. What we are seeing now is that those favourable weather conditions don’t seem to be allowing us for that window of opportunity to open as regularly or for a longer period that it used to do.

In addition to bushfire risk participants were also concerned about the influx of pests and weeds as conditions proceeded to get hotter in the region under climate change conditions, as one town resident noted:

Obviously lantana is a real concern with changing climate because we don’t want it to spread too much further south from here, and it is a huge problem of course all the way up the coastline. The other thing that’s been noted in the area is the increase in cissus hypoglaucia, the five-leaf water vine, which even though it’s a native vine is actually - can take over areas that don’t necessarily have the canopy to protect them.

Shifting rainfall patterns and reduced rainfall was also a concern for participants. While the region already experiences rainfall variability there was concern that rainfall could become even more unpredictable in the future. This was particularly problematic for the farmers in the region who are highly dependent on water for irrigation purposes. In particular, the dairy industry is sensitive to increased heat stress, reduced rainfall and drought conditions. The vulnerability of the dairy industry was perhaps best described by one local government interviewee who suggested:

When it comes to changes in climate - so the farming community are particularly exposed. The dairy farmers, they are a dying breed. This area used to have a high degree of dairy farming but that’s reduced significantly. They’ve got issues to do with herds being too hot and not producing milk in summer. Whether they’re taking notice of that - I mean, obviously they do. There’s places that are spraying their animals to try and keep them cool, keep them in production.
Despite these concerns, there was a sense that industry were perhaps more proactive than other sectors and segments of the community given their longstanding ability to adapt to a wide range of environmental and socio-economic conditions.

In terms of information needs, participants indicated that they are interested in information on temperature, rainfall, bushfire risk and sea level rise. However, it was suggested that the information needed to be communicated in a way that reached all segments and sectors of the community. As one local government respondent indicated:

*Because even though the council made the best - perhaps the best decisions that it made 20, 40, 30 whatever years ago, under the conditions of knowledge then, the knowledge now would never have allowed those things to go ahead. So yeah, it’s interesting. That’s why I think the language has to come back to being that basic language with the complex tricky stuff left to the academics or the people who are - who want to have - so it’s about - I think it’s about layering the message. Making sure that the people who want the intense information can still get access to what they need, in layman’s terms.*

According to one local government participant engaging communities on climate change issues is extremely challenging and it is important to ensure that the process is treated as a conversation between stakeholders to enable opportunities for co-learning:

*Or as we're doing at the moment, developing a coastal development control plan, which is still in draft form. That's when you've really got to pay attention to getting your community engaged and trying to take them with you. If you don't take them with you you'll lose them permanently on that particular issue. It's a matter of getting the strategies right. It's not easy to engage with the community because they're - everyone's busy with their own lives. It's very hard to - even though you use all the best processes out there to engage with the majority, it's very hard. Almost impossible.*

In parallel with the challenges associated with the demographic profile of the region, there were concerns relating to how information is accessed², as one town resident stated:

*I am of a generation that still reads paper newspapers and a lot of our community, it's a retirement area. While there are a lot of us who use the internet, I don't use social media. I've got friends who wouldn't know one end of a computer from another, don't read a newspaper,*

² For more information on how information is accessed and shared with the region see first report entitled ‘A preliminary assessment into the utility of social networks for engaging local communities in climate adaptation policy’.
listen to radio that’s not ABC or the more factual radio, so how do you get information that to me is right and proper through to them? A huge difficulty. So I really don’t know the best answer to all of this. Very difficult.

In addition to the above-mentioned challenges, participants expressed concern about the potential bureaucratic impediments to information exchange at the local scale:

I’m really not supposed to pick up the phone and contact her directly. I’m supposed to go to her supervisor and ask the question...So there’s this weird local government hierarchy that is actually a barrier to information rather than supporting information exchange

In terms of challenges for adaptation policy and community engagement in the Shoalhaven region, it was widely acknowledged that there is a real challenge of reaching both the older and younger segments of the community. As one community based organisation interviewee stated:

Well the older generation doesn’t believe in that. Of course they don’t have much information but also they just wouldn’t read it. The young generation don’t care. There’s a lot of people, I’m sorry to say, they finish school at 16 and that’s it.

4.4 Framing climate change adaptation

While there were mixed responses in relation to perceptions about climate change and adaptation there were consistent messages from participants in regards to how information should be framed. Many respondents felt that it was a long term problem and given the demographic in the region it was not a high priority for the broader community. Some respondents where comfortable with the science and the adaptation responses required while others were still unsure about the argument of anthropogenic climate change but remained positive in terms of the need to be proactive based on broader sustainability principles. Others indicated that many in the region were simply disinterested and disengaged. Some respondents spoke of the challenges of engaging the community in relation to future risks and suggested it was important to focus on the existing set of risk when communicating with the community:

Maybe what I would like to point out is unfortunately when it comes to flood risk management or coastal risk management I really believe the debate around climate change has muddied the picture. A lot of people are basically saying no, no there is no coastal risks, there is no flood risks because your projections and your benchmarks are all wrong. I keep saying forget about climate change, look at your risk right here right now. I feel that because of these uncertainties
around climate change the certainties about today have been completely forgotten and basically they include existing risks now into the debate and I feel that's a little bit of an issue for me. So when I communicate with my communities I tend to focus on the existing risks.

Farmers were seen as being used to dealing with climate variability and reacting to short term challenges, and therefore do not talk about climate change as bringing a new set of risks or challenges to the region. There was belief that you are more likely to engage the broader community if the language is about managing variability or extremes. As one state government respondent suggested:

Yeah climate change can polarise people... So I think climate change as a term is yeah it's not, people - it is polarising so it doesn't necessarily engage people and it doesn't encourage people to be engaged. Adaptation is language that's worse. What do we mean by adaptation if we're talking to - if I'm talking to a farmer how are you going with your adaptation strategies? It's not their language. If you ask me what is their language again it varies. I haven't cracked the nut on what's good language. Changing climate and variable climate works. I think climate change is linked to all that higher level debate and discussion and gets linked to are we the cause of it or not and the reality is it doesn't matter if there's more variable climate we need to plan for and manage it, be prepared for it.

The issue around language was also raised by several other interview participants:

For the last six years, how I've seen the staff handle that is through soft language that isn't confrontational. It has been around risk management, and it's been about handling natural disasters. So it's shifted from that terrifying climate change, climate catastrophe kind of language to oh hell's bells, we've got to do something so let's just talk about risk management.

And,

Well, I think a lot of people will find the - I think adaptation will be a new topic for a lot of people in this area. I think it will have to be presented in a way which is appropriate for the community that's receiving the information...Also put in a way that it doesn't cause too many problems with any entrenched beliefs that people might have and, as I was saying, the way we've approached those things is saying, look, we have these problems now. All the adaptation issues in this issue really, they're a continuation of existing problems. They're not really new things.
In addition to the need to change the language it was suggested that the messages needed to be simplified. Reporting on a complex issue such as climate change needs to be presented in a way that does not deter people from being engaged:

> When you want to put out some information, if you put out 15 pages because that’s the best way to explain it, no one’s going to read it anyway. So as the whole issue becomes more complex, there’s got to be a way of trying to break it down into bite-sized pieces so that whether anyone trusts a government or not, if it’s a smaller amount approach, I think people are more likely to listen.

There was also a strong sense of making logical connections between climate change and potential impacts on individuals, as one state government participant stated:

> The whole interconnection of it all is, you know people don’t work in an ecological system. They certainly work in a how does this impact on me approach. So drawing those connections, those lines is - probably more effectively would be a good thing for that interface between the information and how people receive it.

In terms of when and how to engage the broader community on climate change was perhaps more problematic. Nevertheless, there was some suggestion that the events needed to be well timed and face to face:

> So that’s a really hard question. I don’t think I’ve got the right answer, but I think if we had, if it was well timed, face-to-face discussions, information sessions would certainly work for Wreck Bay, but I think our broader community is a little bit more not as connected to the impact that climate change can have on land and on the way that they use the environment.

Previous work has shown that communities are perhaps more engaged in public discussions when public forums have been timed with recent weather related extremes (see Serrao-Neumann et al. 2014). Taking advantage of public engagement initiatives in these contexts also provides an opportunity to discuss the existing set of risks and to make stronger connections to climate change and future risks. This may also enable the public to better reflect on personal experiences with disasters and link to climate change.
5 Key insights and policy implications

The Shoalhaven region faces significant challenges in the context of climate change impacts, in particular, bushfire risk, flooding and weed infestation. Community members interviewed generally considered that these challenges are exacerbated by both demographic and leadership constraints within the region. In terms of demographics there were concerns that both the older and younger generations were completely disengaged when it came to climate change and adaptation. This parallels findings from recent research by Lim-Camacho et al. (2014) who also found that the older demographic, particular males, either did not believe in climate change or believed it to be a natural phenomenon. Interestingly, it is the older and younger generation that is perhaps most vulnerable when it comes to climate change impacts. Recent research in the U.S. also found that the older demographic are likely to live in locations projected to be increasingly affected by climate stressors (Gamble et al., 2013). The lack of interest on the topic was seen to be directly related to the fact that climate change was typically viewed as being a long term global problem that individuals within the community had little influence over. This finding also parallels academic literature which suggests people often think about climate change as being a long term global problem in which they have limited ability to influence the outcome at an individual level (Spence et al., 2011; O’Neill and Nicholson-Cole, 2009). Furthermore, many of the older demographic suggested that they would not be around to experience the impacts of climate change given that it was seen to be a long term problem. It was evident that many did not link more recent weather related extremes or climate trends to climate change but suggested it was more about climate variability. There was also a sense that the younger generation did not care about climate change. Perhaps there is an opportunity to promote awareness of climate change and sustainability more broadly by embedding it within the curriculum and development thinking of young students in both primary and secondary education.

For many participants, particularly in the farming sector, the legacy of extremes (e.g. floods and drought) was believed to be linked to climate variability or natural cycles. Farmers and other stakeholders within the agricultural supply chain are familiar and experienced with dealing with climate variability (Howden and Stokes, 2010). Dealing with such variability has typically resulted in incremental adjustments within the system to cope with environmental changes or stresses. However, under climate change scenarios, weather related extremes are predicted to become more intense and more frequent. Incremental adjustments are unlikely to be effective when it
comes to managing changing risk over longer time frames. Some argue that transformational changes within and across all sectors and scales of society are needed to manage the impacts of climate change (Nelson et al., 2008). Transformational change however, needs to be well planned to avoid costly and potentially irreversible disruptions within the community.

Analysis of the social networks in the region indicates that people access information from a variety of sources. In comparison, the share network suggests people disseminate their knowledge in more dense clusters. In particular, participants primarily shared information within their local professional and often geographical group only (Cunningham et al., in press). Three key nodes (boundary spanners) were identified as being critical to the network, having ties to both formal and informal actors (Cunningham et al., in press). Although central nodes are important there are compelling arguments to consider engaging the less connected individuals within the network. For example, engaging with multiple, less central nodes is important to enhance knowledge exchange and build resilience (Dowd et al., 2014; Singh, 2005). Attempting to engage with others less well connected will be challenging however, given that these are typically the ones who are less concerned or interested in climate change or adaptation. Findings from the qualitative analysis suggest that there are opportunities to ensure a larger proportion of the network is engaged to enhance knowledge exchange and build resilience. To do so will require a rethink in the way in which information about climate change and risk is framed and communicated to the broader community (Lacey et al., 2015). Failure to adopt such an approach in terms of climate policy and community engagement more broadly will undoubtedly result in poor uptake and lack of preparedness within the community. Information needs to be tailored and pitched at a level that is easily communicated and understood by the broader community. It is apparent that in the Shoalhaven community, not all are familiar or comfortable with the terms of climate change or adaptation. There is a sense that perhaps climate change and adaptation may be best expressed and communicated through terms such as risk management and climate variability. Linking the broader impacts to individuals in socio-economic terms is paramount to gaining support and to encourage the uptake of (or support for) adaptation measures. Both the quantitative and qualitative analysis suggest that there would be benefit for policy makers to use a wide variety of media (e.g. tv, mass media, radio and social media) to capture a wider audience. Efforts to communicate and engage the Shoalhaven community on climate adaptation should also take into account the particular concerns, information needs and challenges as outlined above.
Tailoring information based on the findings of this report will help encourage broader dissemination and uptake of climate adaptation policies and practices across different sectors and segments of the community. Public engagement should also comprise face to face discussions and would benefit from being timed with extreme weather events. Aside from increasing attendance rates it is also an opportunity to provide tangible links between changing risk profiles under climate change scenarios and the direct impacts on individuals. In addition, it provides opportunity to foster important relationships between both formal and informal networks within the community which are critical to meeting broader public policy objectives. This is particularly important in the context of climate change adaptation where goals and objectives are often highly disputed or ill-defined. In any case, there is merit in developing win-win or no-regrets strategies which have multiple benefits across all sectors and scales of the community. No-regret actions are considered to be cost effective measures that ‘yield benefits even in the absence of climate change’ (Hallegatte, 2009). Win-win measures contribute to climate adaptation as well as provide a range of other social, economic and environmental policy benefits (Viguié and Hallegatte, 2012).
6 Conclusions and future research

Climate change adaptation is an important yet challenging task. Engaging communities requires an intricate understanding of the dynamics that play out within and across different types of communities. This is important because communities are not homogenous and perceptions of risk vary between and within communities. Recent research has emphasised the differences in people’s perceptions of climate change adaptation and risk in Australia (Higginbotham et al., 2014). The authors also found that climate adaptation can be ‘advanced through targeted place-based information that make the most sense to those living locally’ (Higginbotham et al., 2014, p. 710). Understanding a particular community’s needs and preferences is critical to informing the design of climate adaptation policy. This is important in the context of broadening the scope and potential uptake of policies and practices that seek to deal with climate change adaptation both implicitly and explicitly. Insights from the qualitative analysis suggest that the reality of climate change and the need for adaptation is not widely accepted within the Shoalhaven community. The findings also suggest that while adaptation is not widely talked about within the community, there is evidence of autonomous adaptation efforts in the farming sector. These efforts however, are not directly linked to managing the impacts of climate change but more importantly climate variability and risk more broadly. Major concerns for participants in the region included increased bushfire risk, reduced rainfall, increased temperature, coastal flooding and inundation as a result of sea level rise and storm surge, and weed infestation. Consideration needs to be given to the framing and communication of climate change and adaptation given the dispersed nature of the knowledge sharing network and the preferences of the Shoalhaven community. Information dissemination should also focus on what individuals can do to manage current and future risks. However, given the diverse views, interests and values, these messages need to be framed in a way that people can relate to most and where possible create win-win solutions.

Future research should focus on ways of scaling up SNA through more cost/time-effective ways to collect data. There may also be scope to investigate the relative influence or importance of roles versus individuals in knowledge networks by using a longitudinal case study approach. In addition, there would be benefit in doing a comparative case study assessment using a typology of cases capturing a number of different communities in different settings such as coastal and inland.
7 References


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