



Report

National Environmental Science Program Climate Systems Hub – Knowledge Broker Social Network Analysis

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Executive summary

Introduction

The Climate Systems Hub is one of four multi-disciplinary research hubs funded through the Australian Government's National Environmental Science Program (NESP). A distinguishing feature of the Climate Systems Hub is its interjurisdictional knowledge brokering team.

State, territory and local governments are key end users for tailored climate science. To reach them, the Hub has built a network of state and territory Knowledge Brokers, with dedicated co-funded roles in NSW, Victoria, WA and SA, and a National Knowledge Broker who supports these roles. Other jurisdictions are covered through a buddy system involving regular check-ins and information-sharing sessions by various members of the team. Through the buddy arrangement, the team covers the Northern Territory, the ACT, Tasmania, and Queensland, which do not have a resident Knowledge Broker. Two of the five roles are part-time (SA at 0.2 FTE, WA at 0.1 FTE).

These Knowledge Brokers sit at the interface between climate scientists and decision-makers. They help to ensure research is co-designed and co-produced with the people who need it to inform their decisions. Despite growing recognition of the value that knowledge brokers can add in applied research programs, the empirical evidence base for these roles remains limited, particularly in the Australian context. First Person Consulting (FPC) was engaged to undertake a Social Network Analysis (SNA) of the Knowledge Broker team's network. SNA is a relational mapping technique that generates visual and quantitative representations of the connections between actors in a network.

Approach

The project had two objectives:

1. to map the networks established by the Knowledge Brokers across jurisdictions and identify patterns of connection, information flow, and knowledge use
2. to explore the value the Knowledge Broker team provides to those within their networks, including how climate science information is shared and applied.

The project drew on Knowledge Broker-held contact data combined with survey-based relational data. The approach involved scoping with the Knowledge Broker team; consolidation of each Knowledge Broker's contact database of who they engaged with; design and distribution of a Qualtrics survey; and visualisation, analysis, and reporting through the [Kumu platform](#). The survey received 202 responses, with 181 respondents providing network data — a strong response rate for surveys of this kind, comparable to other published Social Network Analysis studies in environmental and climate-policy settings (Cvitanovic et al., 2017; Juhola et al., 2024). Ethics approval was obtained through Iris Ethics (HREC approval number S00055).

Fast facts

The Knowledge Broker network at a glance:

Feature	Value
Total individuals in the network	924 (including knowledge brokers)
Knowledge Brokers	5 (across NSW, VIC, SA, WA, and a National role)
Total relationships between individuals	1,881
Connections involving a Knowledge Broker	1,594 (85%)
Unique organisations	220
Survey respondents	202 (181 provided network data)
Non-Brokers connected to multiple Knowledge Brokers	212 (23% of 919, excluding knowledge brokers)
Value of knowledge brokers	94% of survey respondents believe their interactions with Knowledge Brokers contributed to their work or thinking
State and territory government individuals reached	572
National climate science agency staff connected	87
Climate Systems Hub-affiliated researchers connected	84
Federal government policy officers connected (including DCCEEW, Climate Change Authority, Parks Australia, others)	44
Local government individuals connected	58 (including 39 in SA across 24 councils)
Reciprocity rate (two-way reported interactions)	37% overall; 100% between Knowledge Brokers; 27% Knowledge Broker to non-Broker; <2% non-Broker–non-Broker

Key findings

The findings below align to the project objectives, and taken together, point to a consistent conclusion: the Knowledge Brokers have, to a large extent, created the networks they sit in, and they are the ones who hold those networks together.

- 1. The connections in the network are valued by those within it.** Almost all (94%) of survey respondents believe their interactions with Knowledge Brokers contributed to their work or thinking in some way. Over half of Knowledge Broker–respondent interactions were rated as contributing to work or thinking

on climate change either 'quite a lot' or 'a great deal'. Just over half (57%) of interactions were rated as strengthening access to relevant people or networks. Respondents most frequently valued the Knowledge Brokers' ability to translate complex climate science into accessible insights, the Knowledge Brokers' role as an efficient point of contact across networks, and the two-way nature of the brokering relationship, including feeding user needs back to researchers.

2. **The project produced an in-depth understanding of the Knowledge Broker network.** The map covers 924 individuals, 1,881 relationships, all eight states and territories, and 220 unique organisations. The literature has consistently identified the absence of established methods for assessing knowledge broker effectiveness as a barrier to the sustained implementation of these roles (Cvitanovic et al., 2017). This project has demonstrated how such things can be undertaken.
3. **The Knowledge Brokers are the connective tissue of the network.** The five Knowledge Brokers account for 86% of the connections in a network of 924 individuals. If the Brokers were removed (leaving 919 actors), the network would fragment. The next most connected non-Broker would hold ten connections, and very few common third parties link different parts of the network to one another. The Knowledge Brokers bridge researchers to decision-makers, one jurisdiction to another, and state government to federal climate science. Without them, the information pathways this network represents would largely be ad hoc and fragmented.
4. **The Knowledge Brokers connect state and territory governments into national climate science and federal policy infrastructure.** Across every jurisdiction, the network extends into national climate science agencies (CSIRO, the Bureau of Meteorology, the Australian Climate Service, Natural Hazards Research Australia) and into Climate Systems Hub-affiliated researchers at partner universities. It also reaches into federal policy departments such as the Department of Climate Change, Energy, the Environment and Water (DCCEEW), the Climate Change Authority and Parks Australia.
5. **The four Knowledge Broker-hosted jurisdictions show distinct network characteristics shaped by local institutional contexts.** South Australia's network has extensive local government engagement (39 individuals across 24 councils, a feature unique to SA in this dataset). Victoria's network has the highest rate of cross-jurisdictional connection. NSW has a comparatively high indegree (82) relative to the size of their network, giving them the highest recognition-to-network-size ratio of the five Knowledge Brokers. This suggests that the people in their network are particularly aware of and engaged with the Knowledge Broker's role. Western Australia has the strongest connection to national climate science of any state-based jurisdiction, with a quarter of its network affiliated with the Climate Systems Hub, this could be related to the FTE of the WA knowledge broker limiting outreach capabilities.
6. **Jurisdictions covered through the buddy system show meaningful connectivity, though it varies.** Tasmania is well integrated, with strong engagement from state government and community individuals supported by the Victorian and National Knowledge Brokers. The ACT shows concentrated engagement at the territory environment directorates, supported by the NSW Knowledge Broker.

Implications

The data from this project provides empirical support for the role and value of an embedded, interjurisdictional knowledge broker model. The breadth and density of the network, and the value reported by respondents in data collection, suggest that sustained, embedded brokering is producing the kinds of trust-based, two-way relationships the literature identifies as central to effective knowledge exchange (Cvitanovic et al., 2017; Lomas, 2007). Variation across jurisdictions reflects the model's adaptability and the importance of context. South Australia's reach into local government, for example, has created pathways into a level of decision-making that national programs typically find difficult to access.

The Knowledge Broker team had five Knowledge Brokers in place at the time of this assessment. It has provided an insight into the current infrastructure and mechanisms for knowledge dissemination and collaboration across jurisdictions – including those without a dedicated Knowledge Broker.

The concentration of connectivity amongst the five Knowledge Brokers is a strength of the model, but it is also important to recognise that the relationships and institutional knowledge that each Knowledge Broker holds is not easily transferred or rebuilt. About 10% of respondents raised concerns about the team's capacity and continuity, and about 12% called for a Knowledge Broker in every state and territory. What this project does highlight is that where there is a Knowledge Broker, there is a denser and more connected network around them, and that is highly valued by those engaged through this project.

Contents

1 Introduction.....	8
1.1 Background.....	8
1.2 Project objectives	9
2 Methodology	10
2.1 The approach.....	10
2.2 Considerations.....	11
3 Results in detail	13
3.1 Reported value of the Knowledge Brokers	13
3.2 Social Network Analysis of the Knowledge Brokers' Network	22
4 Conclusion	51
Appendix 1 Knowledge Broker Social Network Analysis Survey	52
Appendix 2 References.....	55

Tables

Table 1: Network structure by jurisdiction	25
Table 2: Network composition by organisation type	27
Table 3: Summary of network metrics and figures	32
Table 4: Mean indegree by type and % connected to multiple Knowledge Brokers	33

Figures

Figure 1: Overall extent to which Knowledge Broker-respondent interactions contributed to work or influenced thinking in relation to climate change and climate science (n=318)	14
Figure 2: Extent to which Knowledge Broker-respondent interactions contributed to work or influenced thinking in relation to climate change and climate science, by jurisdiction.	14
Figure 3: Overall extent to which Knowledge Brokers strengthened access to relevant people or networks to support work (n=330)	16

Figure 4: Extent to which Knowledge Brokers strengthened access to relevant people or networks to support work, by jurisdiction	17
Figure 5: Map of the NESP Climate Systems Hub Knowledge Brokers' network	23
Figure 6: Network map with the Knowledge Brokers and their connections removed.....	23
Figure 7: Knowledge Broker network by jurisdiction	24
Figure 8: Network map by organisation type	27
Figure 9: Network map showing where multiple Knowledge Brokers are identified	30
Figure 10: Reciprocity by whether a Knowledge Broker is involved in the relationship.....	31
Figure 11: Network map with individuals sized by number of incoming connections.....	32
Figure 12: Network map sized by closeness centrality.....	35
Figure 13: Knowledge Brokers and the top 3 non-Knowledge Brokers – the largest shapes in the map.....	36
Figure 14: Network map at the National level, with the National Knowledge Broker highlighted	38
Figure 15: Network map for New South Wales with NSW Knowledge Broker highlighted	40
Figure 16: Network map for South Australia with organisations highlighted	41
Figure 17: Network map for Victoria with Victorian Knowledge Broker highlighted.....	43
Figure 18: Network map for Western Australia with WA Knowledge Broker highlighted	44
Figure 19: Network map for the ACT with organisations highlighted	46
Figure 20: Network map for the Northern Territory with organisations highlighted	47
Figure 21: Network map for Queensland with organisations highlighted	48
Figure 22: Network map for Tasmania with organisations highlighted	50

Abbreviations

ACT	Australian Capital Territory
FPC	First Person Consulting
NESP	National Environmental Science Program
NSW	New South Wales
SA	South Australia
SNA	Social Network Analysis
VIC	Victoria

Social Network Analysis Terminology

Betweenness centrality	measures the extent to which a Knowledge Broker sits on the shortest path between other individuals in the network. Higher values indicate greater potential to act as a bridge between otherwise disconnected parts of the network.
Connections	are the lines that connect the elements, representing identified relationships and flows of communication or collaboration.
Closeness centrality	measures how close (in terms of network distance) a Knowledge Broker is to all other individuals. Higher values indicate that the Knowledge Broker can reach others in the network more quickly.
Degree	is the sum of indegree and outdegree (see below).
Elements	are the dots (also referred to as nodes) in the network map, representing the individuals identified through the survey process and consolidation of Knowledge Broker contact lists.
Indegree	is the number of times a Knowledge Broker was nominated by survey respondents as someone they interact with. This is a measure of recognition and visibility within the network.
Outdegree	is the number of outgoing connections from the Knowledge Broker to individuals in the network. This reflects the size of the contact list each Knowledge Broker provided.
Reciprocity rate	Rate of two-way reported interactions between individuals

Suggested citation

First Person Consulting (2026). National Environmental Science Program Climate Systems Hub –Knowledge Broker Social Network Analysis. Prepared for the National Environmental Science Program.

1 Introduction

1.1 Background

The Climate Systems Hub is an applied science partnership that brings together Australia's leading climate and adaptation experts, alongside key government agencies and decision-makers. It is one of four multi-disciplinary research hubs funded through the Australian Government's National Environmental Science Program (NESP).

A distinguishing feature of the Climate Systems Hub is its interjurisdictional knowledge brokering team embedded within different public-sector organisations. While the Hub itself started in 2021, the function was fully established by 2023 once all appointments to the roles had been made. The current team have worked together since 2024. As of 2026, there are full time Knowledge Brokers embedded in the University of Tasmania (the national Knowledge Broker), New South Wales and Victoria, and part time Knowledge Brokers in South Australia (0.2 FTE), and Western Australia (0.1 FTE). Together they work through a 'buddy system' to support colleagues in the ACT, Queensland, the Northern Territory, and Tasmania to create a national network.

These growth and coverage arrangements are important context for the numbers presented later in this report: the network is the result of a team that has been built over time, not a baseline of a static team. These Knowledge Brokers sit at the interface between climate scientists and decision-makers, building partnerships to ensure research is co-designed and co-produced with the people who need it to inform their decisions. In doing so, they help to bridge the well-documented gap between the production of scientific knowledge and its use in policy and practice (Cvitanovic et al., 2015) and vice versa.

Knowledge brokering has received growing attention in the environmental governance literature as a mechanism for improving knowledge exchange between researchers and decision-makers (Meyer, 2010). Knowledge brokers are broadly understood as agents who develop relationships and networks with, among, and between producers and users of knowledge, building capacity for evidence-informed decision-making (Lomas, 2007). Their effectiveness depends on being perceived as relevant, legitimate, and credible, and on possessing strong communication skills alongside an understanding of both the science and the operating environments of decision-makers (Cvitanovic et al., 2016).

Despite this theoretical promise, the empirical evidence base remains limited, particularly in the environmental sector, partly due to the lack of established methods for assessing the contribution that knowledge brokers make (Cvitanovic et al., 2017). Social Network Analysis (SNA) offers one approach for addressing this gap. SNA is a relational mapping technique that generates visual and quantitative representations of the connections between actors in a network (Prell, 2012), and previous studies have demonstrated its utility for tracking how knowledge broker networks develop over time and how knowledge is brokered within science-policy interfaces (Cvitanovic et al., 2017; Juhola et al., 2024).

First Person Consulting (FPC) was engaged by the Climate Systems Hub Knowledge Brokers to apply an SNA process to their network. This report outlines the objectives, methodology, and findings of the project.

1.2 Project objectives

The purpose of this project was to:

- Map the networks established by the Knowledge Brokers across jurisdictions and nationally, and identify patterns of connection, information flow, and knowledge use
- Explore the value that the Knowledge Broker team provides to those within their networks, including how climate science information is shared and applied.

This report is structured as follows:

- Section 2 outlines the methodology for the project
- Section 3 presents the findings

The appendices include the survey used to collect data, references, and key figures.

2 Methodology

2.1 The approach

There were five stages to the design and implementation of the SNA for the Knowledge Broker function of the Climate Systems Hub.

1. **Kick-off and scoping.** This involved a virtual planning meeting between FPC and key Knowledge Broker team members. In the meeting we:
 - a. Confirmed the objectives for the work, including what 'success' looks like
 - b. Discussed the data collection tool design
 - c. Confirmed the approach to implementation, including timing
 - d. Discussed the next steps. Following the kick-off meeting, a brief project plan was prepared to provide a common point of reference for the remainder of the project.
2. **Data collection tool design.** SNA involves the collation or collection of data that encompasses relationships between nodes in a network. In this context, the data collection covered:
 - a. The Knowledge Brokers, their network with each other, and the Hub
 - b. The individual Knowledge Broker networks within and across jurisdictions
 - c. The networks that those within each jurisdictional network hold, make use of, or disseminate climate information and policy/decision making insights to or through.

Development of the network map involved initial collation of data provided by Knowledge Brokers based on who they engage with. This was followed by the collection of primary data from individuals across the Knowledge Broker networks via an online survey. The survey was designed in Qualtrics and asked respondents about:

- a. Which of the Climate Systems Hub Knowledge Brokers they had interacted with
 - b. The nature and frequency of those interactions
 - c. The value of those interactions to their work
 - d. Who else in their network they had shared that value with.
3. **Implementation of data collation and data collection.** This occurred as follows:
 - a. Each Knowledge Broker (n=5) prepared spreadsheets containing the names, organisational affiliations, and other contextual information for individuals in their networks. These spreadsheets were consolidated, duplicate entries removed, and a master list produced.
 - b. Relevant details were uploaded to the Qualtrics directory. This removed the need to ask respondents to identify themselves, and meant they could opt out at the initial invitation stage. It also allowed for monitoring of response rates and bounce-backs.
 - c. The survey was open for a three-week period. Following the initial invitation, two reminders were sent: one at the mid-way point and one in the final 48 to 72 hours. Respondents could opt out through a link provided in each communication.
 - d. Following the completion of data collection, a data cleaning process was undertaken. This included the development of consistent naming conventions, clarification of near-duplicates, and removal of insufficiently complete responses. An appropriate level of de-identification was then applied to ensure anonymity in the network. The identifiable

master list was password protected to prevent access by anyone outside the FPC research team.

4. **Invitations were sent to 853 individuals¹. There were 202 respondents to the survey (24% response rate)², of whom 181 provided further data on their own networks.** The question about each respondents' networks was designed to capture a secondary layer of the network, mapping how climate science and policy information might flow beyond the Knowledge Brokers' immediate contacts.
5. **Visualisation, analysis and reporting.** The final stage involved descriptive analysis of survey questions related to the value of the Knowledge Brokers, how they facilitate access to wider networks, and lessons for the Knowledge Brokers. We then produced network maps using Kumu, a network visualisation platform with onshore (Australian-based) data storage via FPC's Enterprise-level subscription. Analysis consisted of the production of network metrics to identify the relative positions of the Knowledge Brokers and other actors within the network. Answers to free-text questions in the survey were analysed thematically, grouping responses under higher-level categories with quotes used to demonstrate the theme.

Ethics approval for this project was obtained through Iris Ethics (HREC approval number S00055).

2.2 Considerations

There are several considerations relevant to interpreting the findings of this project.

1. The SNA captures a snapshot of the Knowledge Broker networks at a single point in time. Networks are inherently dynamic, with relationships forming, strengthening, and sometimes fading as people change roles or priorities shift. The findings therefore reflect the state of the network at the time of data collection rather than its full history or trajectory. The methodology has, however, been designed to be repeatable, which would allow for longitudinal comparison in the future.
2. The network maps are shaped by who responded to the survey. As with any survey-based approach, the resulting picture of the network is influenced by response rates and the degree to which respondents accurately and completely reported their connections. Individuals who did not respond are not represented in the map beyond being nominated by others, which may understate the true extent and density of the network. This is a common feature of SNA research and has been noted in comparable studies (Cvitanovic et al., 2017; Juhola et al., 2024).
3. The secondary network layer, which captures the onward sharing of information by survey respondents, relies on recall. Respondents were asked to identify people with whom they had shared information or contacts originally obtained through the Knowledge Brokers. This is a reasonable approximation of knowledge flow, but it is likely to capture more prominent or recent instances of sharing rather than the full extent of dissemination.

¹ Some invitations bounced due to individuals no longer being in the role. This figure reflects the valid email addresses.

² This is a strong response rate for surveys of this kind, comparable to other published Social Network Analysis studies in environmental and climate-policy settings (Cvitanovic et al., 2017; Juhola et al., 2024).

4. The de-identification process, while necessary to protect participant privacy, means that some granularity in the network is lost when reporting findings. Organisational affiliations are reported at a general level, which may limit the ability to draw detailed conclusions about specific inter-organisational relationships. This trade-off was made deliberately to maintain trust with participants and uphold the ethical commitments of the project.
5. This project is exploratory in nature. It is not an explicit evaluation of the Knowledge Brokers or their performance, but rather an effort to make visible the networks they have built and the value those networks provide. The findings should be read in that spirit, as a contribution to understanding the role and reach of knowledge brokering as a function of the Climate Systems Hub.
6. The five Knowledge Brokers operate at different FTE allocations (New South Wales, Victoria, and the National Knowledge Broker at 1.0 FTE; South Australia at 0.2 FTE; Western Australia at 0.1 FTE). These time proportions should be considered when interpreting the SNA results.
7. Queensland, Tasmania, the Northern Territory, and the ACT are covered through a buddy system rather than through a resident Knowledge Broker. Numbers for those jurisdictions reflect a deliberately different model of engagement and should not be compared directly with the resident-Knowledge Broker jurisdictions.
8. Finally, some of the network maps reflect the locations of respondent's organisations. For some, such as universities, we recognise that their work crosses state boundaries despite many of them being substantially based in a single state and territory. This should be kept in mind when interpreting the visualisations.
9. Due to the nature of the Kumu application, visualisations of the network are dynamic and shift, meaning the views may alter over time, while data and information in the maps remains the same. The images captured in this report a static image of network maps, but those in Kumu may look slightly different in orientation as time progresses.

3 Results in detail

The detailed results are presented in two parts: first, what survey respondents said about the value of the Knowledge Brokers; second, the network maps produced through the SNA.

3.1 Reported value of the Knowledge Brokers

3.1.1 Value related to understanding or use of climate science

NESP Climate Systems Hub knowledge brokers delivered clear value to people in their networks, survey comments praised knowledge brokers' skill in brokering complex information, translating research into clear, relevant insights for end users and bridging and connecting researchers with stakeholders. Respondents appreciated their role as an accessible point of contact and support, providing efficiency through access to people, resources, and networks.

Survey respondents were asked to rate the extent to which the Knowledge Brokers they reported interacting with had contributed to their work, or influenced their thinking in relation to climate change or climate science. As a single respondent could interact with multiple Knowledge Brokers, Figure 1 reflects the total ratings across all respondents for each Knowledge Broker they interacted with.

Survey respondents provided further detail on the value of relationships, 318 responses were provided (each relating to a reported Knowledge Broker-respondent interactions³), **94% believe their interactions with Knowledge Broker contributed to their work or thinking either in some way**, with over half (53%) noting a significant influence, with 'a great deal' (28%) or 'quite a lot' (25%). A further 22% reported that interactions contributed somewhat and 19% reported 'a little contribution,' while 6% of interactions were rated as not contributing at all. **This suggests that most people who engage with the Knowledge Brokers find the interaction meaningful to their work, with the distribution clearly pointing towards the positive end of the scale.**

³ Excludes those respondents who marked this question as 'not applicable'.

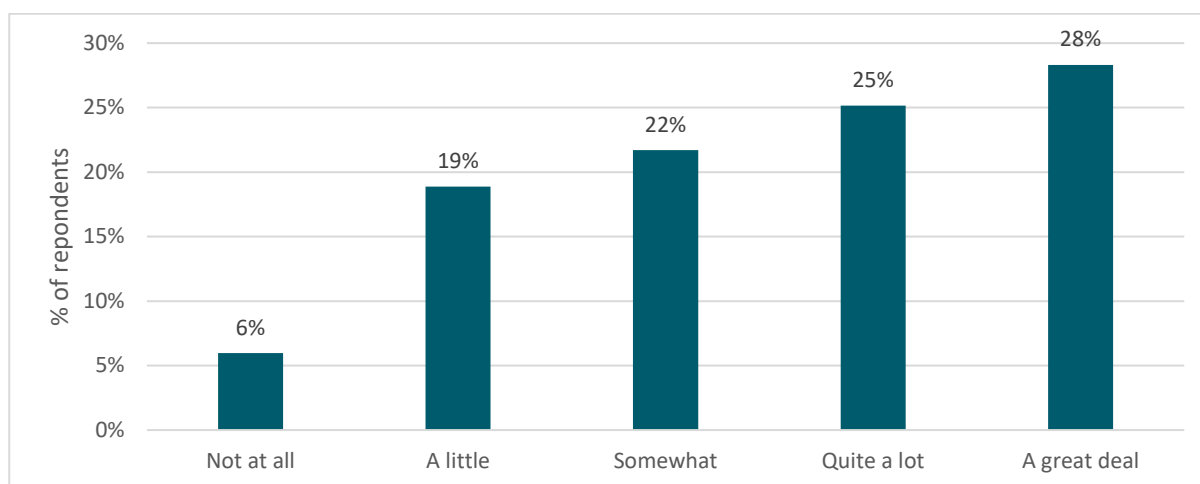


Figure 1: Overall extent to which Knowledge Broker-respondent interactions contributed to work or influenced thinking in relation to climate change and climate science (n=318)

These positive results are broadly consistent across jurisdictions (see Figure 2), with most reporting that interactions contributed to work or thinking either quite a lot or a great deal. The variation across jurisdictions likely reflects differences in the nature of the networks each Knowledge Broker works within, the types of stakeholders they engage with, and the stage of development of those relationships.

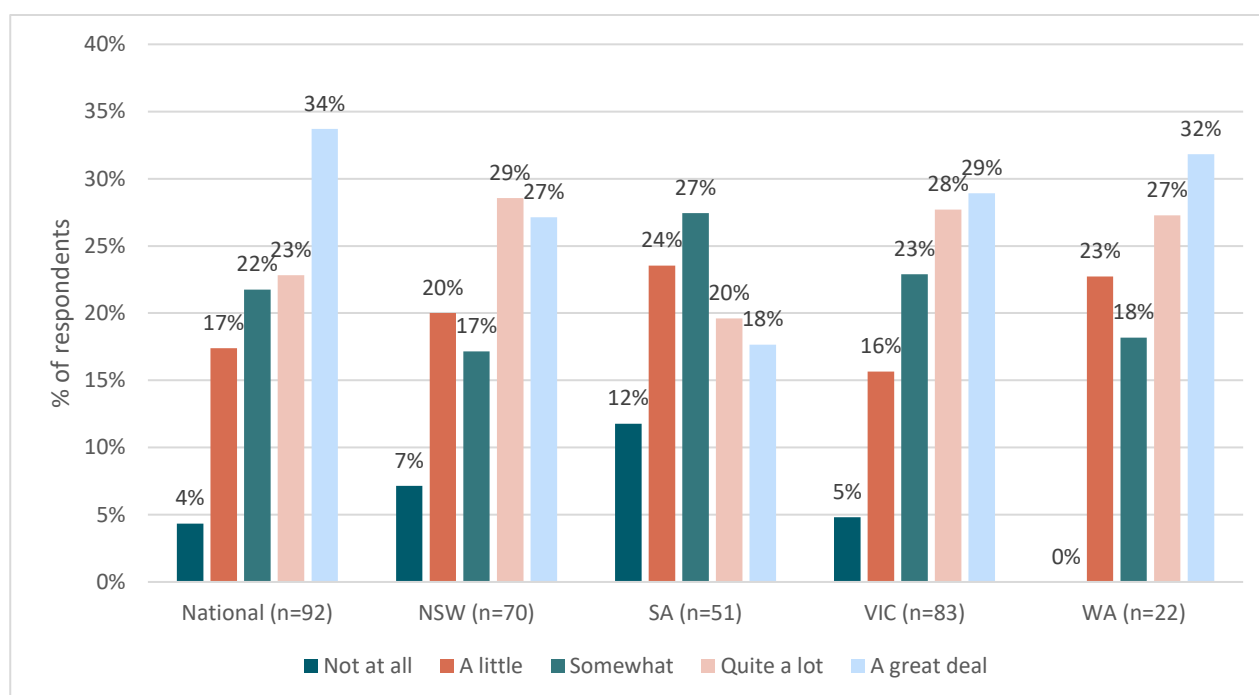


Figure 2: Extent to which Knowledge Broker-respondent interactions contributed to work or influenced thinking in relation to climate change and climate science, by jurisdiction.

The n= figure is the total number of survey respondents for the jurisdiction who answered the question.

Survey respondents were invited to provide open-ended comments on what they valued most about the Knowledge Broker roles (n=117 substantive responses). In terms of what respondents valued, the following themes emerged in relation to climate science information:

- Respondents reported the **most valuable aspect of the Knowledge Brokers is their ability to translate and communicate complex climate science into accessible, relevant insights for different audiences** (30% of responses). Respondents valued that Knowledge Brokers hold deep knowledge of current and emerging research and can communicate its relevance and findings in clear and practical ways, tailored to the needs of different users.

"I value most the Knowledge Broker role's ability to connect scientific research with real-world decision-making. It plays a vital part in translating complex climate science into practical information and tools that support policymakers, land managers, and communities in adapting to climate change."

"They make a complex topic accessible and interesting to a range of audiences (including those of us who aren't scientists or SMEs, we are more at the layperson end of the scale, but still have an interest in learning what the results are of the activities."

- Knowledge Brokers were also valued for keeping people across the broader field of climate science research and policy, both nationally and across jurisdictions (15% of comments). Respondents described the value of having someone who is across what is happening in other states, what projects are underway, and what is emerging in the research. This scanning and curating function helps people situate their own work within a broader context.

"They keep us across what's currently going on in the climate research space, and what is happening in other government jurisdictions."

"[I value them] being across developments in climate science research and policy, national and across states. Also, [their] understanding of implementation of climate science in decision making."

- A number of respondents specifically valued the two-way nature of the Knowledge Broker role, noting that Brokers do not simply 'push science outward' but also feed user needs and priorities back to researchers (approximately 10% of comments). This was seen to support co-design processes and help ensure that research is targeted to real needs rather than operating in isolation from end users.

"It is the feeding 'up' of users' needs to the NESF scientists and related research and data activities that I most value, which helps to get the research better targeted to needs. (so less about the top-down sharing/broking of knowledge)"

"They play a crucial role in facilitating the sharing of research findings and two-way dialogue between researchers and stakeholders who are end users of that research. This increases the value and the impact of the research, while helping ensure the research is better designed and focused on meeting end user needs."

3.1.2 Facilitating access to networks

Knowledge brokers effectively strengthened participants' access to key networks and people, earning strong survey support as a valuable bridge for collaboration. Survey comments highlighted knowledge brokers' role in linking scientists, stakeholders, and decision-makers. Respondents also valued their communication bridging divides across academia, agriculture, communities, and government, fostering accessible science and inclusive events.

Survey respondents were asked to rate the extent to which each Knowledge Broker they interacted with had helped strengthen their access to relevant people or networks to support their work.

Survey respondents provided further detail on how knowledge brokers facilitated access to networks, 330⁴ responses were provided (each relating to a reported Knowledge Broker-Respondent Interaction), 57% reported that Knowledge Brokers had strengthened their access to relevant people or networks either a great deal (32%) or quite a lot (25%) (see Figure 3). A further 23% reported that access was strengthened somewhat. Only 7% of interactions were rated as not strengthening access at all. The distribution results were slightly stronger than those for the 'influence on thinking question', potentially speaking to the importance of both functions being performed by the Knowledge Brokers.

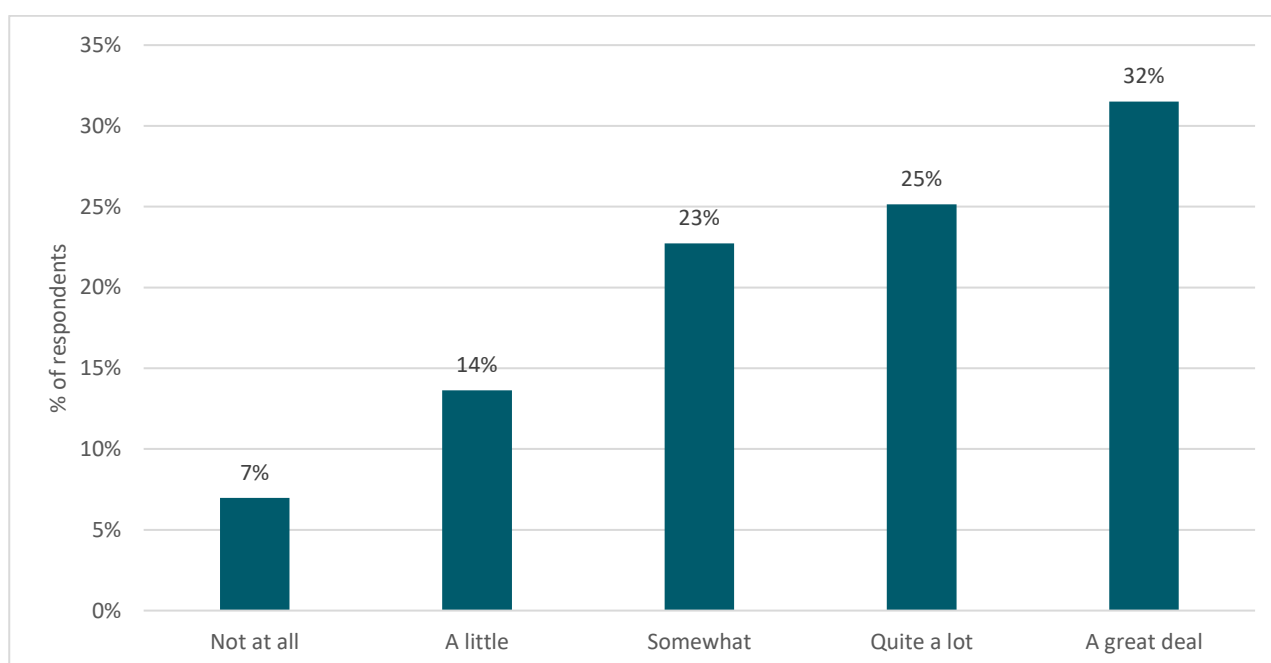


Figure 3: Overall extent to which Knowledge Brokers strengthened access to relevant people or networks to support work (n=330)

⁴ While 181 people responded to the survey, each respondent could respond to relationships with any of the 5 knowledge brokers they held relationships with. This means the number of responses to questions can vary.

When broken down by jurisdiction (Figure 4), the results followed a similar pattern, with all jurisdictions reporting that at least half of individuals' interactions strengthened access to networks either quite a lot or a great deal. The spread across jurisdictions was somewhat narrower for this question than for the influence on thinking question, suggesting that the networking and connection function of Knowledge Brokers is a consistently valued aspect of the role across different contexts.

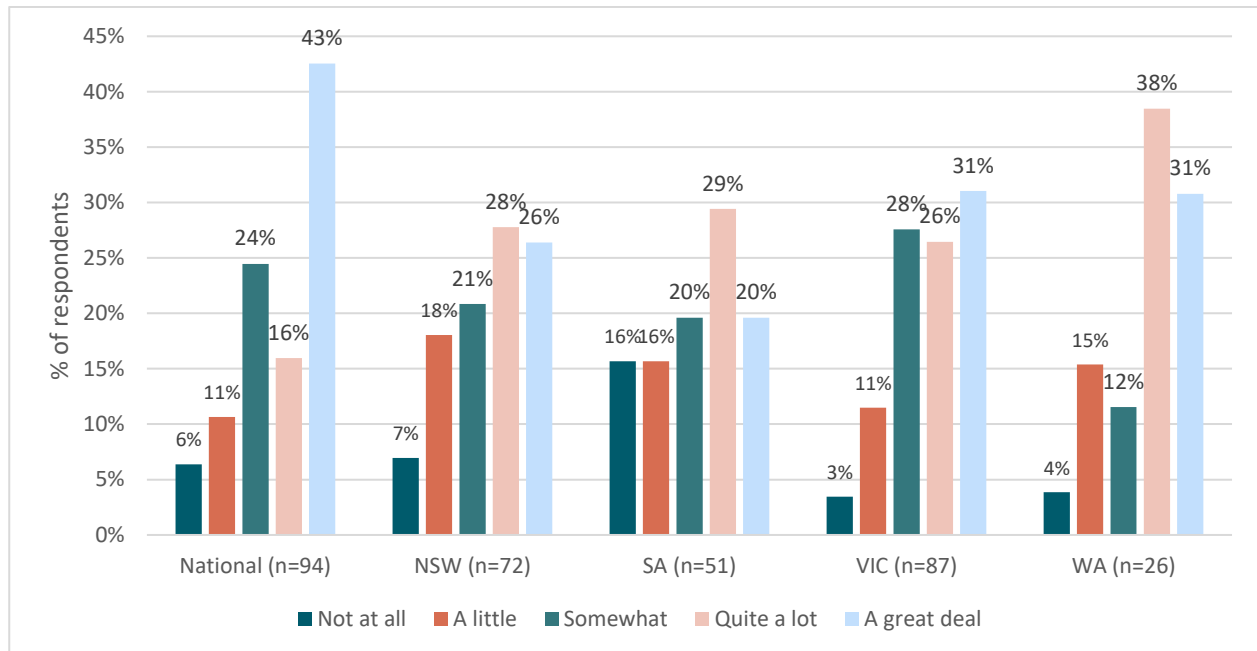


Figure 4: Extent to which Knowledge Brokers strengthened access to relevant people or networks to support work, by jurisdiction

The n= figure is the total number of survey respondents for the jurisdiction who answered the question.

In terms of the qualitative comments (n=117) analysed to understand what respondents valued, the following themes emerged in relation to strengthening access to people and networks:

- The most prominent theme across survey responses was the value of Knowledge Brokers in connecting people across organisations, sectors and jurisdictions (approximately 35% of comments). Respondents described how Knowledge Brokers link scientists with decision makers, connect people working on similar challenges in different states, and bridge divides between academia, government, industry and community. This connecting function was seen as something respondents could not easily replicate on their own.

"It is a unique way to connect across the states and territories. Each state and territory faces similar challenges, and this enables a connection to stakeholders in other jurisdictions facing the same climate challenges. It also connects me with information from projects I would have had no idea are happening."

"The connections with industry and local government have been hugely beneficial to ensure that my research can be used for decision-making / policy decisions (in addition to tackling the important science problems)."

"That strong connections are made between states and territories that share knowledge and have a collaborative approach to tackling large-scale issues like climate change. Community is how you make change, not working in isolation."

- Knowledge Brokers were also valued as a single, accessible point of contact who can quickly direct people to the right information, the right person, or the right opportunity (approximately 15% of comments). Respondents emphasised the efficiency gains that come from having someone who knows the field and can reduce the time spent on complex institutional arrangements. This was particularly valued by those in smaller jurisdictions or organisations with limited internal capacity.

"I value the Knowledge Broker roles as a trusted single point of contact for the Climate Systems Hub. They simplify engagement by connecting stakeholders directly to the right expertise, ensuring clear communication and timely access to relevant research. This streamlined approach makes collaboration efficient and impactful."

"They are so connected. If I have a question, they know the answer or know who to ask."

"[Knowledge Broker's] have the potential to save you time when it comes to knowing who to talk to about Climate Science Hub research or what information is available or when it might become available."

- Respondents also highlighted the role of Knowledge Brokers in reducing duplication of effort and helping people discover what others are already doing (approximately 10% of comments). By being across multiple networks and organisations simultaneously, the Knowledge Brokers were seen to identify overlaps and create efficiencies that individual researchers or practitioners would not be able to achieve on their own.

"Someone is aware of the work we do AND the work that others are doing, so they can connect the dots. This connection means work isn't unnecessarily duplicated, and our work can be informed and evidence-based."

"There is a real opportunity for these roles to support efficiency and remove duplication of various people/organisations trying to do the same thing by being across what is going on and communicating that by having regular contact with all the touch points."

3.1.3 Lessons for NESP Climate Systems Hub Knowledge Broker program

Survey respondents were asked if they had suggestions for improvements or changes to the Knowledge Broker roles to better support the uptake of climate science information in their jurisdiction or context (n=85 substantive responses). Several respondents noted that they could not identify areas for improvement, with comments such as "I honestly can't think of anything. I could never have imagined this network would exist, and I'm still so impressed that it does." Among those who did offer suggestions, the following themes emerged.

- The most common suggestion was to broaden the scope and remit of the Knowledge Broker roles beyond their current focus (approximately 18% of comments). Respondents saw opportunities to expand beyond physical climate science into other areas of climate adaptation, and to extend engagement beyond state government departments to include local government, industry, the private sector and community organisations. Some respondents noted that the current focus on state government, while valuable, means other important audiences are not being reached.

"I think encouraging a stronger emphasis on engaging with science engagement and education practitioners would be helpful. These practitioners are less involved in the network, and they play a hugely important role in influencing and supporting decision-making and behaviour change."

"Feels too constrained to State Governments. Would suggest broadening their remit in future programs."

"I think the NESP Climate Science Hub Knowledge Brokers have an opportunity to extend their reach to climate risk managers in the private sector."

- A number of respondents highlighted the need for greater awareness and clarity about the Knowledge Broker roles (approximately 14% of comments). Some respondents noted that colleagues within their own organisations were unaware that Knowledge Brokers existed or what they could offer. Others suggested that clearer communication about the role, its scope and how to access it would help broaden uptake.

"Something to raise awareness within each organisation that the Knowledge Brokers are available to help with sharing climate science information? Have been working in climate adaptation for a while but only recently found out about the Knowledge Broker roles."

"I don't think many people know who the Knowledge Broker is within each institution."

"Improved visibility and promotion of both knowledge brokers and NESP's work, communication regarding the application/value of NESP's work, improved clarity on the role of knowledge brokers and what services they offer/can assist with."

- Respondents in jurisdictions without a dedicated Knowledge Broker expressed a desire to see coverage⁵ expanded to include all states and territories (approximately 12% of comments). This included specific calls for Knowledge Brokers in Queensland, the ACT, the Northern Territory and Tasmania. Some respondents extended this to a vision for a complete national network with at least one Knowledge Broker in every jurisdiction.

"We would like a knowledge broker in our team in QLD. "

"Need specific ACT, QLD, [Northern Territory and Tasmania] Knowledge Brokers to help close the circle, could be part time."

"It would be more impactful to have dedicated roles for all States."

- There was a desire among respondents to see more accessible information products and resources from the Knowledge Broker team (approximately 12% of comments). Suggestions included a centralised website or repository of current projects, regular jurisdictional newsletters, and more high-level summaries that could be shared with non-expert audiences. This seemed to stem from a recognition that the volume of available information can be difficult to navigate without dedicated support.

"It would help if our Knowledge Broker could populate / share some sort of mind map / repository of projects going on with and outside of NESP, so I can search keywords and find projects relevant to work."

- Several respondents raised concerns about the capacity and continuity of the Knowledge Broker team (approximately 10% of comments). Respondents observed that the team is small relative to the breadth of networks they manage (as is discussed in Section 3.2), and expressed concern about roles being tied to time-limited program funding. There was a strong sentiment that the relationships and networks built by Knowledge Brokers take time to develop and would be difficult to rebuild if lost.

⁵ Meaning a jurisdictionally-based Knowledge Broker, as we note that the buddy system means that there is some form of access or coverage provided.

"They have so much on for such a small team. Maybe increasing their team to help increase their capability. I see them as being extremely valuable but at times, stretched thin."

"Please keep the Knowledge Broker program going to enable this important engagement to continue! Sustaining and nurturing trusted relationships takes time especially in the busy climate change space. Much of the science research is ongoing (beyond the life of this Hub) so there are also benefits (such as consistency of approach and continuity of corporate knowledge) to not starting such work again from scratch."

"Ensure continuity of the roles in future NESP Hubs as building the relationships and networks takes time and building the capacity to enable the uptake of the science takes time and effort."

- A smaller number of respondents suggested that the two-way function of the Knowledge Broker roles could be strengthened (approximately 8% of comments). While respondents valued the outward flow of information from researchers to users, some felt there was an opportunity for Knowledge Brokers to more systematically feed user needs and priorities back to the research community, and to provide researchers with feedback on how their outputs are being used.

"I would like to see feedback from users/stakeholders making its way back to the scientists. For example, who downloads our fact sheets? Do they find them useful or have any further feedback?"

"There's not really an active role in asking us what we need. The broker is just on sharing information that I mostly get direct from NESP anyway. When I have asked for help, they have been very helpful and supportive."

3.2 Social Network Analysis of the Knowledge Brokers' Network

3.2.1 Overview

The Knowledge Broker network generated through this project is comprised of 924 people and 1,881 connections (see Figure 5). The network map includes the five Knowledge Brokers - as they are members of their network – both as facilitators and as participants identified by respondents.

Figure 6 represents the same network data **with the five Knowledge Brokers removed from the network**. This removes all the connections that they held and leaves 287 connections remaining.

This means that the five Knowledge Brokers collectively hold 1,594 of the network's connections, or 85% of all relationships. As Figure 6 depicts, their removal leaves a series of smaller sub-networks, and a large collection of otherwise disconnected staff in organisations.

These figures are visible on the following page, presented side by side for ease of viewing. The two figures represent different networks, with the first showing Knowledge Brokers as essential linkages within a complex network, while the second map shows a theoretical visualisation of the network without the Knowledge Brokers, which is a dispersed network and with only a few connections.

Paired with the discussion in Section 3.1, this reinforces the purpose and value of the Knowledge Broker roles for staff across jurisdictions as facilitators of access to a much wider network, and that over time the Knowledge Brokers have developed and maintain a very large network.

In summary, the five Knowledge Brokers represent 0.5% of the network's members but are responsible for most of its connections. The Knowledge Brokers' network spans all Australian states and territories, federal government policy makers, national climate science organisation staff, as well as a staff from a small number of international organisations.



Figure 5: Map of the NESP Climate Systems Hub Knowledge Brokers' network

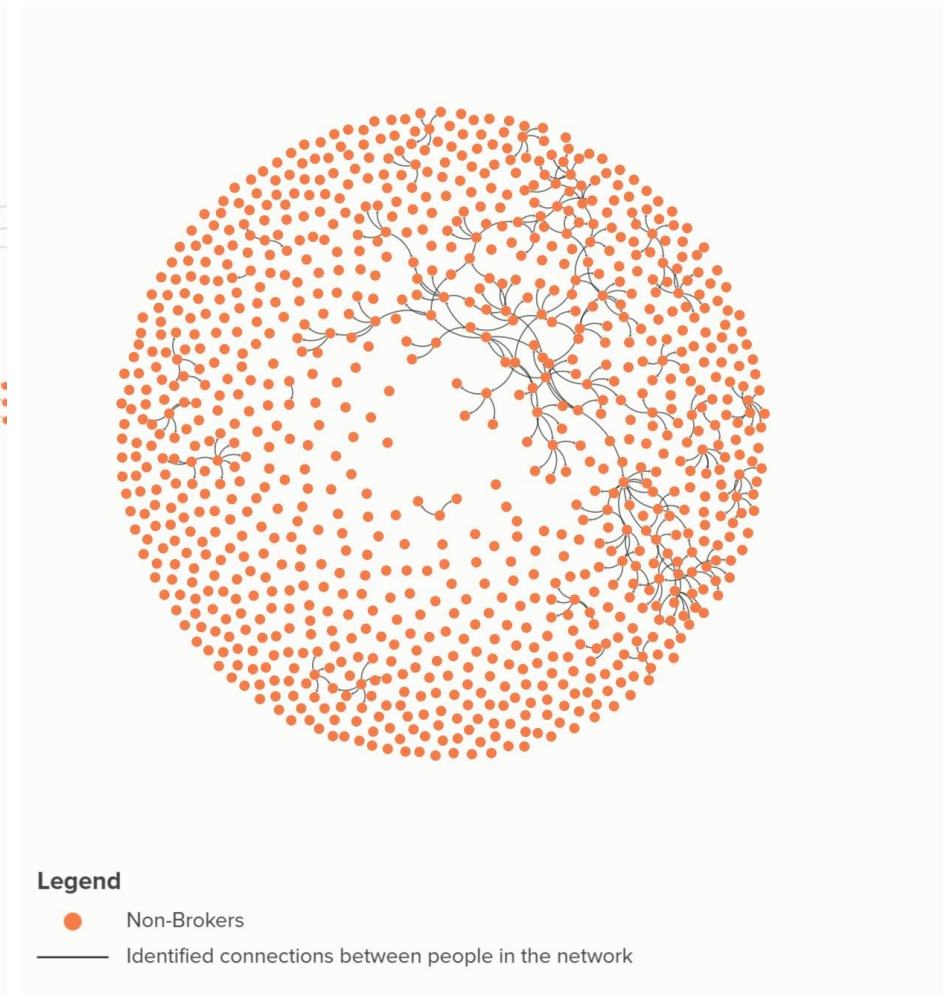


Figure 6: Network map with the Knowledge Brokers and their connections removed

3.2.2 Jurisdictional spread

Figure 7 presents the network colour-coded by jurisdiction⁶. The observed clustering pattern reflects the embedded placement of each Knowledge Broker in that jurisdiction. This means there are distinct jurisdictional clusters visible with large numbers of connections for South Australia, New South Wales, Victoria, Western Australia, and at the National level. The centre of the map reflects a smaller network of individuals who are mixing across jurisdictions and multiple Knowledge Brokers.

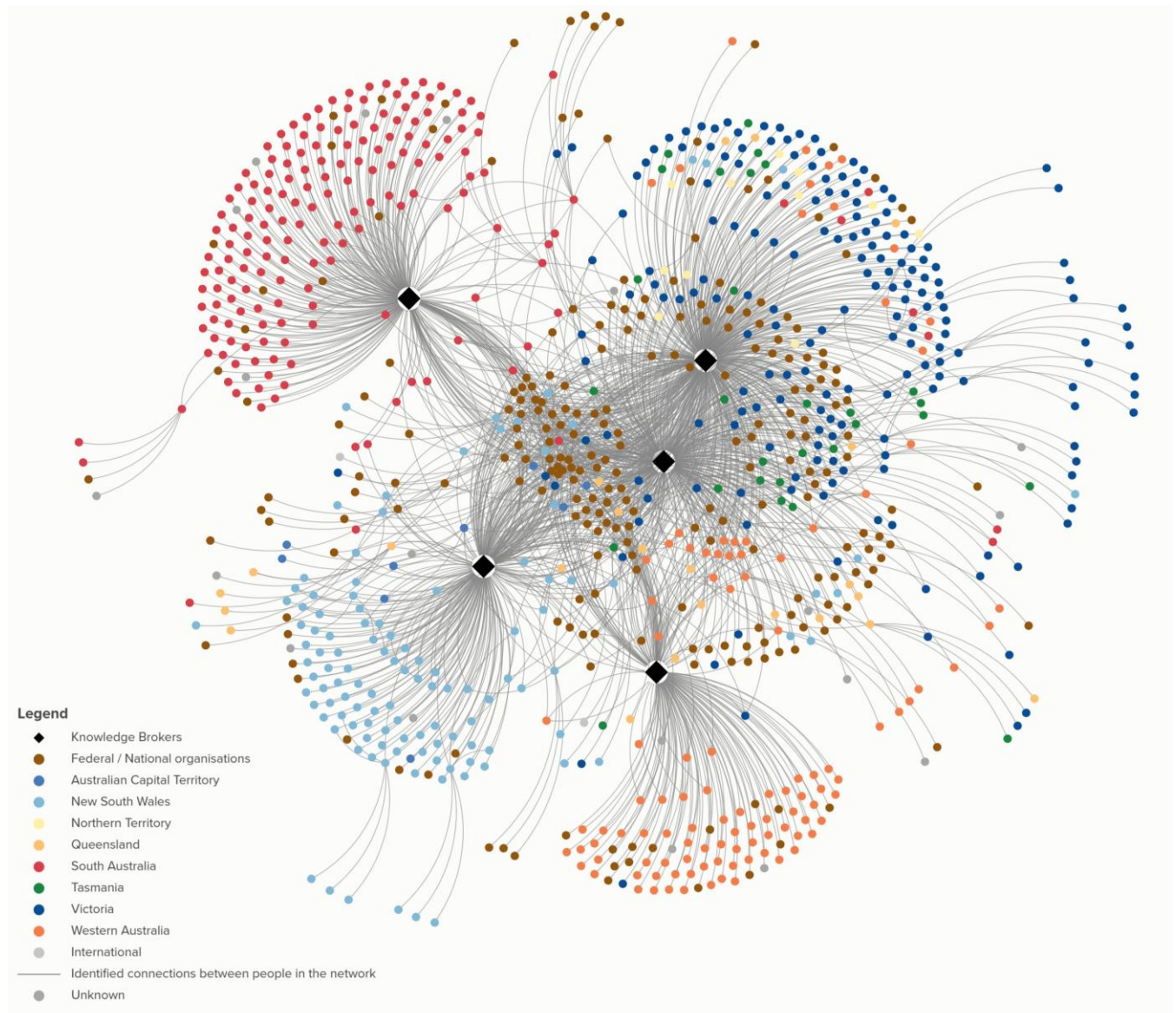


Figure 7: Knowledge Broker network by jurisdiction

⁶ The coding by jurisdiction generally reflects the remit of the organisation. Exceptions to this are universities where they are allocated to their location (e.g. University of Tasmania is coded as the Tasmanian jurisdiction).

Table 1 summarises the structure of the network shown above in Figure 7. For each jurisdiction the table shows the number of individuals (the elements in the map), the number of unique organisations represented, how many survey respondents contributed relational data to the network, and the proportion connected to more than one Knowledge Broker. Notably, four jurisdictions without a resident Broker are still represented in the network, a point explored in more detail later in Section 3.2.7.

Several insights emerge from this breakdown:

- Victoria has the largest representation in the network (201 individuals across 39 organisations), consistent with the Victorian Knowledge Broker holding the highest number of outgoing connections (381). Interestingly, more than a third of individuals in the Victorian network are connected to multiple Knowledge Brokers.
- SA has the second-largest network by individual count (177) and the widest organisational reach (53 organisations). This is driven in part by a strong local government presence, with 39 individuals from 24 local councils, and natural resource management region contacts. SA has the lowest rate of multi-Knowledge Broker connections among the Knowledge Broker jurisdictions (5%), suggesting a more self-contained jurisdictional network.
- The National network (160 individuals across 42 organisations) has the highest proportion of individuals connected to multiple Knowledge Brokers (53%). This makes sense given that the Knowledge Broker's role spans jurisdictions, and many of those in the national network interact with multiple state-based Brokers as part of their work. This is discussed further in Section 3.2.4.
- NSW and WA each contribute 126 individuals. NSW has a higher survey response rate and more multi-Broker connections, while WA's network is more concentrated within state government.

The significance of this jurisdictional spread is that the Knowledge Brokers have built networks that are both deep within their own jurisdictions, reflecting local context in terms of represented organisations, and breadth across the country. The ability of the Knowledge Broker network to span jurisdictions means that climate science information and scientists have multiple pathways to reach the people who need it including decision and policy makers.

Table 1: Network structure by jurisdiction

Jurisdiction	Individuals	Unique organisations	Survey respondents	Individuals connected to multiple Knowledge Brokers (n=)	Individuals connected to multiple Knowledge Brokers (%) ⁷	Knowledge Broker
Victoria	201	38	42	55	28%	Yes
South Australia	176	52	28	7	4%	Yes
National	161	41	36	72	45%	Yes

⁷ The percentage is based on the number of individuals within a jurisdiction that were identified as being connected to more than one Knowledge Broker. For example, in Victoria out of 201 individuals in the network 55 of them were connected to at least one of the other four Knowledge Brokers.

Jurisdiction	Individuals	Unique organisations	Survey respondents	Individuals connected to multiple Knowledge Brokers (n=)	Individuals connected to multiple Knowledge Brokers (%) ⁷	Knowledge Broker
New South Wales	126	19	35	15	14%	Yes
Western Australia	126	20	18	19	16%	Yes
Tasmania	53	19	15	28	52%	No
Queensland	33	19	5	9	27%	No
ACT	14	5	6	8	57%	No
Northern Territory	11	5	0	0	0	No
International	3	3	0	0	0	N/A

3.2.3 Organisational composition

There are **220 unique organisations** across the network, spanning all Australian states and territories, as well as a small number of national and international organisations. The 20 individuals with no organisation recorded are excluded from this count but are still represented in the map. Figure 8 shows the network coded by organisation type. The most visible feature is the dominance of state government agencies (blue squares) clustered around each Knowledge Broker, consistent with their placement within State and Territory departments. At the centre of the map three groups of actors appear as cross-cutting bridges in the network:

- National climate science organisations
- Hub-affiliated researchers from universities
- A smaller number of federal policy staff.

The first two make up most of the central cluster, with many of those actors reachable through more than one Knowledge Broker. In turn, this means that many actors within a jurisdiction can reach those central actors via the Knowledge Brokers – reflecting the bridging role that they place.

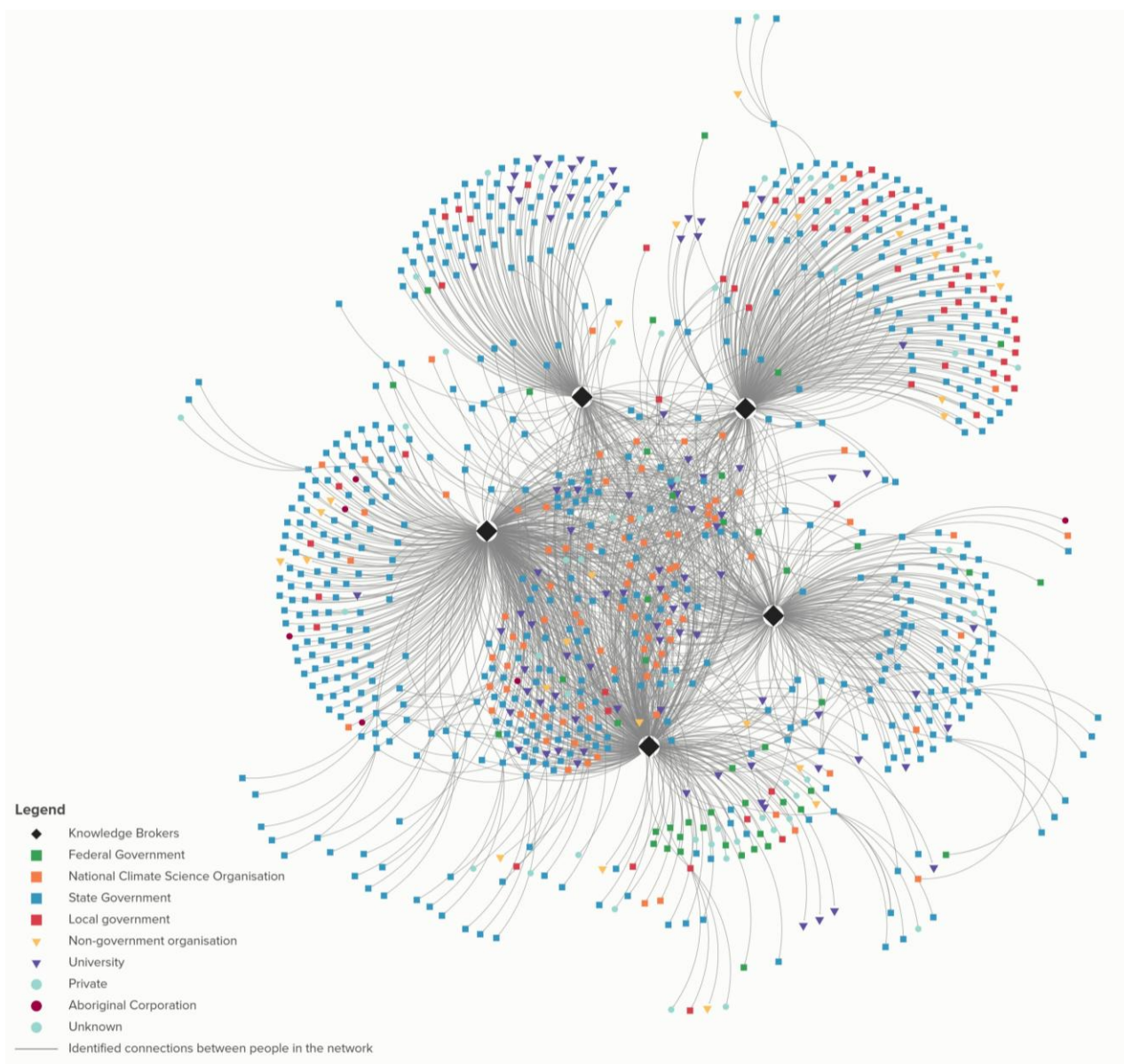


Figure 8: Network map by organisation type

Table 2 presents the distribution of unique organisations across the network by type and jurisdiction. Each row represents an organisation type, with the count in each column reflecting the number of distinct organisations of that type with at least one individual in the network from that jurisdiction. State government is the most represented type (90 unique organisations), followed by local government (35), universities (32), private sector (22), NGOs (20), federal government (9), national climate science organisations (7) and then Aboriginal Corporations (5). South Australia has the widest organisational reach of any jurisdiction (49 organisations), with 23 of these local councils. The composition of the network by organisation type is discussed further below. The number of affiliated individuals is also included.

Table 2: Network composition by organisation type

Organisation type	Total organisations	Total individuals
State Government	90	572
Local Government	35	58
Universities	32	84
Private	22	28
NGO	20	25
Federal Government	9	44
National climate science organisation	7	87
First Nations Corporation	5	6
Total	220	904

The breakdown of individual members of the network across organisation types is as follows:

- **State government:** 572 individuals (63%, n=904 of the non-Knowledge Broker network). This is the dominant group, which may be expected given four of the Knowledge Brokers' are based out of state departments.
- **National climate science organisations:** 87 individuals (10%), drawn from CSIRO, the Bureau of Meteorology, the Australian Climate Service, and Natural Hazards Research Australia, with many connected through Climate Systems Hub partnerships.
- **Universities:** 84 individuals (9%), spanning institutions across all states. Tasmania stands out with 25 university-affiliated individuals, largely from a Climate Systems Hub partner institution.
- **Local government:** 58 individuals (6%), with SA contributing the majority (39 individuals) seemingly through its extensive local council network.
- **Federal government:** 44 individuals (5%), drawn from policy and operational agencies such as DCCEE, the Climate Change Authority, and Parks Australia.
- **Private sector:** 28 individuals (3%), predominantly national or Victorian-based consultancies and service providers.
- **NGOs:** 25 individuals (3%), with most based at a national level.
- **Aboriginal Corporations:** 6 individuals across four jurisdictions (VIC, NSW, WA, QLD)

This mixture of organisation types is important to understand as it demonstrates how the Knowledge Brokers' networks are not confined to their home organisations. They extend outward to the research community, to other levels of government such as the community sector, and beyond. The distribution of organisation types across the jurisdictions is varied, which may suggest that who Knowledge Brokers are

reaching – or who reaches out to Knowledge Brokers is tied to specific sector or organisation needs within those contexts. At the core of this though are the relationships at the centre of the network that facilitate multiple ways in which information can disseminate through the network.

3.2.4 Cross-jurisdiction connectivity

Figure 9 distinguishes between Knowledge Brokers (black), individuals connected to a single Knowledge Broker (blue) and those connected to two or more (orange). Where there is more cross-connection between individuals within the map, the closer to the centre they will be drawn. This is reflected in the densely interconnected core of the map where these cross-jurisdictional networks converge.

The rate of multi-Knowledge Broker connections varies substantially by jurisdiction:

- National (53%): Over half of individuals in the national network are connected to multiple Knowledge Brokers. This reflects the way national staff (e.g. from the Climate Science Organisations) are routinely engaging with both state-based Brokers as well as the National Broker.
- VIC (35%): Victoria has the highest rate of multi-broker connections among the four state-based Knowledge Brokers.
- WA (14%) and NSW (14%): Both networks are more jurisdictionally contained, with most contacts connected only to their local Knowledge Broker.
- SA (5%): The lowest rate of cross-jurisdictional connection, indicating a particularly self-contained network. This potentially reflects the composition of SA's network, which leans heavily toward local organisations whose work is place-specific.

The Knowledge Brokers are also highly connected to each other directly. Where multi-Knowledge Broker connections within a jurisdiction are high, information can reach a contact through more than one channel - both their own Knowledge Broker and the Knowledge Brokers' conversations with each other.

For jurisdictions without a resident Knowledge Broker there are still instances of multiple Knowledge Broker connections. For instance, Queensland has 33 people identified in the network, with nine of them connected to multiple Knowledge Brokers, this is due to close working relationships between the national Knowledge Broker and people in QLD. Though this highlights that without a resident Knowledge Broker developing networks may generally be more difficult.

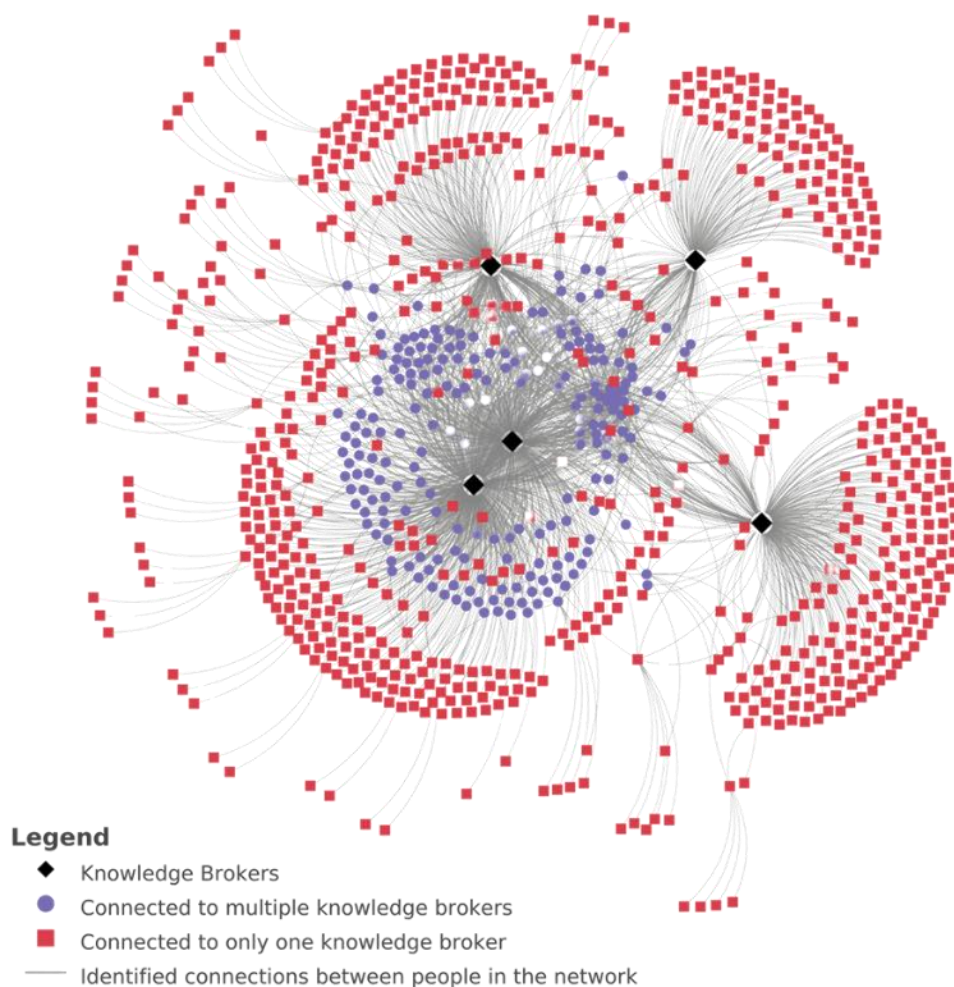


Figure 9: Network map showing where multiple Knowledge Brokers are identified

3.2.5 Reciprocity across the network

Reciprocity is the share of relationships in the network that run in both directions. When Person A reports interacting with Person B, and Person B also reports interacting with Person A, the relationship is reciprocated.⁸ When only one direction is reported, it is one-way. **Across the 1,881 directed connections in this network, 696 are reciprocated and 1,182 are one-way. This means that the reciprocity rate for the network is 37%.** As can be seen in Figure 10, Knowledge Broker relationships are entirely reciprocal (i.e. each Knowledge Broker is connected to each other Knowledge Broker). Relationships that involve a Knowledge Broker and a non-Knowledge Broker are reciprocal 27% of the time (333 connections out of 1,239), and relationships without a Knowledge Broker as either party reciprocate less than 2% of the time

⁸ Reciprocity = (number of reciprocated directed connections) ÷ (total directed connections)

(5 connections out of 281). **This means that non-Broker parts of the network are predominantly one-way, and that reciprocity (two-way reported interactions) increases when a Knowledge Broker is involved.** Higher levels of reciprocity are often markers of stronger relationships, greater trust, and more effective two-way exchange of information.

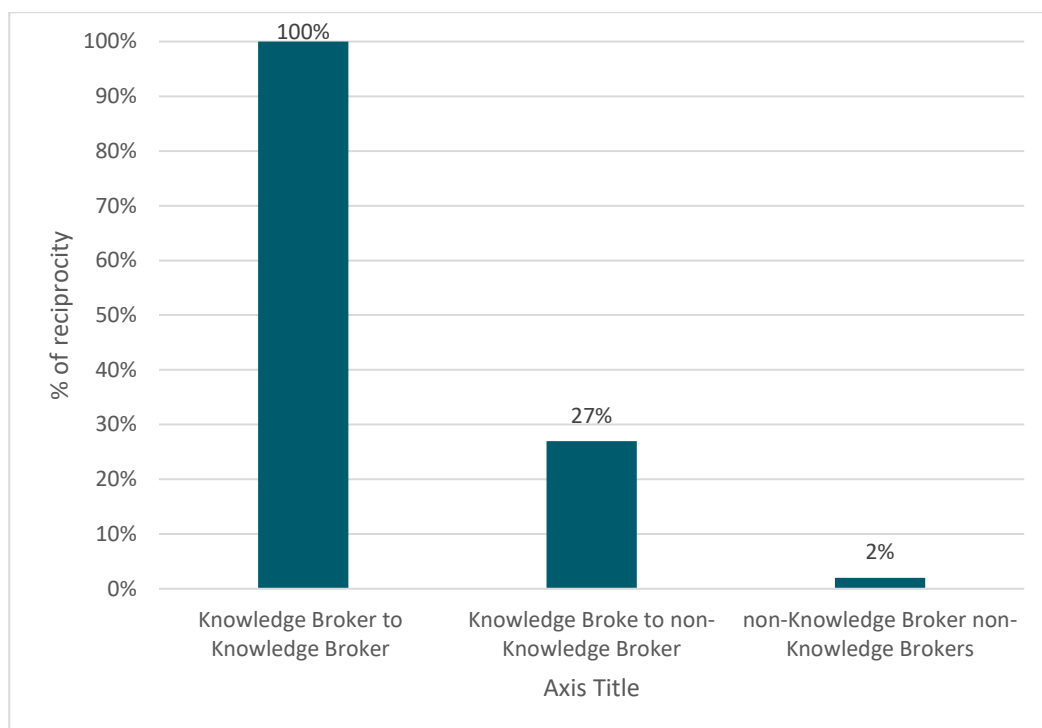


Figure 10: Reciprocity by whether a Knowledge Broker is involved in the relationship⁹

3.2.6 Knowledge Broker influence within the network

Network analysis metrics provide insight into the structure of the network, identifying patterns that we would not otherwise see. When undertaking this project, we initially used the database of contacts that each Knowledge Broker held of their network. The survey that was distributed to participants included a question “which of the NESP Climate Systems Hub Knowledge Brokers have you interacted with?” A checkbox allowed respondents to identify those they could recall interacting with, along with five free text fields for respondents to identify up to five other people that they shared information with.

This section reports on network analysis metrics that were produced – specifically indegree (number of incoming connections), closeness centrality (how close each person is to every other person in the network), and betweenness centrality (proportion of instances someone links two other isolated people). Table 3 presents a summary of the network metrics for each of the jurisdictions. These results are discussed further in the below subsections.

⁹ These use a slightly different definition for calculating reciprocity due to smaller counts – the only difference is ignoring the direction of the relationship, but it still requires both parties to nominate the relationship exists.

Table 3: Summary of network metrics and figures

Metric	VIC	National	NSW	SA (0.2 FTE)	WA (0.1 FTE)
Indegree	99	106	82	60	38
Closeness centrality	0.697	0.654	0.598	0.594	0.554
Betweenness centrality	0.077	0.064	0.054	0.058	0.029

Indegree centrality

Firstly, indegree, which is the number of incoming connections, provides the means to understand how often those respondents have nominated a given individual as someone they are connected to. It can be understood as a measure of recognition or influence within the network. Figure 11 presents the network with the element size scaled by indegree, where the indegree score is greater than 5, so that more frequently nominated individuals appear larger. The five Knowledge Brokers are immediately visible as the largest nodes, reinforcing their central position in the wider network from the perspective of the survey respondents.

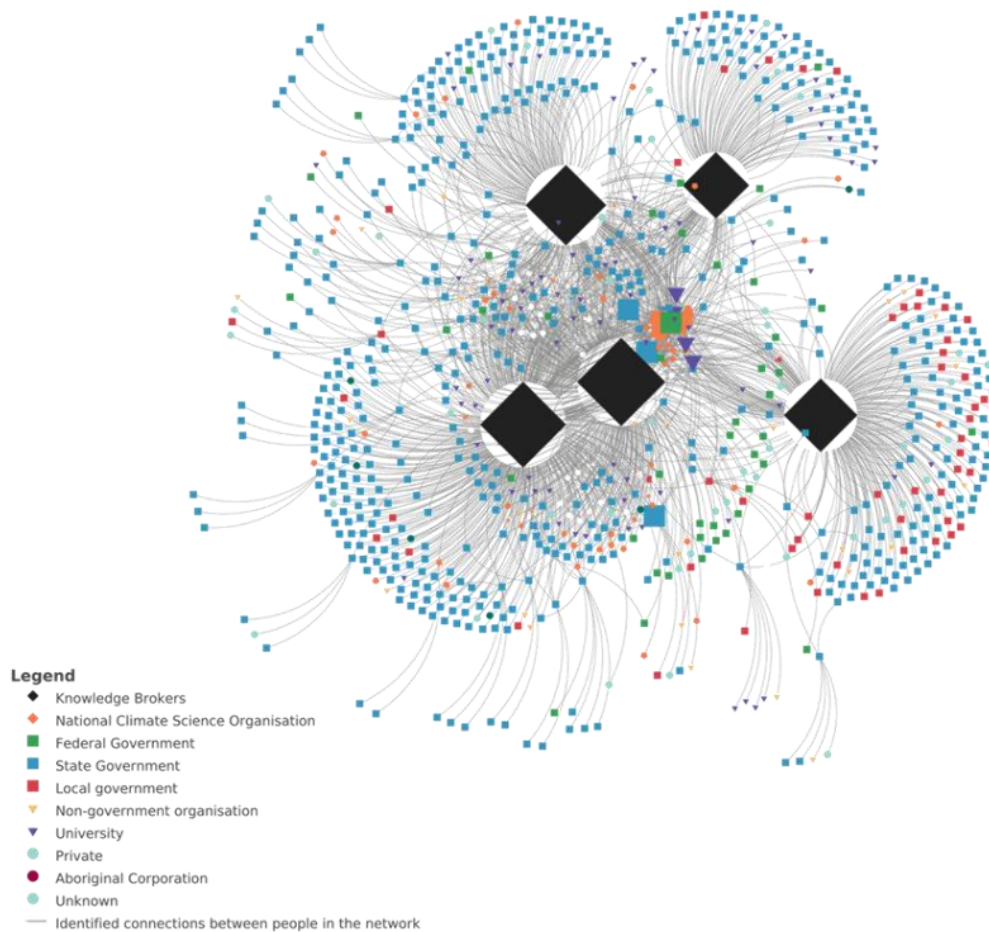


Figure 11: Network map with individuals sized by number of incoming connections

Beyond the Knowledge Brokers themselves, several non-Knowledge Broker individuals stand out with comparatively high indegree scores, many are based at national climate science agencies or Climate Systems Hub-affiliated universities. Those with the highest indegree scores include:

- A staff member at a Victorian Catchment Management Authority (indegree of 8)
- A climate scientist at the Bureau of Meteorology, connected through the Climate Systems Hub (indegree of 8)
- A staff member at a NSW state government department (indegree of 8)
- A researcher at a Tasmanian university affiliated with the Climate Systems Hub (indegree of 7)
- Climate Systems Hub-affiliated researchers at universities in Victoria, the ACT, and Tasmania, alongside climate scientists at CSIRO (through the Hub), the Australian Climate Service, and the Bureau of Meteorology (indegree of 6 each)
- A federal policy officer at the Department of Climate Change, Energy, the Environment and Water, and a second staff member at the NSW state government department mentioned above (indegree of 6 each).

When examining indegree by organisation type it appears that the national climate science organisations and the Hub researchers at universities sit at the centre of the network. As shown in Table 4 individuals at national climate science organisations have a mean indegree of 2.63, and 78% are connected to multiple Knowledge Brokers. Universities sit close behind (mean indegree 2.19, 59% multi-Broker). Conversely, Local Government, NGO and Aboriginal Corporation members tend to have indegree 1 – usually their single Knowledge Broker connection – with multi-Broker rates of 7%, 16% and 0% respectively. State Government, the bulk of the network, sits in the middle (mean 1.48, 19%).

The mean indegree scores combined with the percentage of organisations connected to multiple Knowledge Brokers suggest that there are two key structures operating within the network. First, national climate science agencies and Climate Systems Hub affiliated universities are acting as shared reference points with multiple Knowledge Brokers engaging the same few key individuals in these organisations. Second, these Knowledge Brokers can share the information coming from those organisations through their networks to the jurisdictions where there are only single connections – likely from Knowledge Brokers – which tend to be those with mean indegree scores less than 1.5.

Table 4: Mean indegree by type and % connected to multiple Knowledge Brokers

Organisation type	n=	Mean indegree	% connected to multiple Knowledge Brokers
National climate science organisations	76	2.63	78%
Universities	71	2.19	59%
Private	24	1.50	25%
Federal Government	34	1.59	24%

Organisation type	n=	Mean indegree	% connected to multiple Knowledge Brokers
State Government	478	1.48	19%
NGO	19	1.28	16%
Local Government	46	1.16	6.5%
Aboriginal Corporations	3	1.17	0%

This pattern is notable for two reasons. First, it demonstrates that the Knowledge Brokers are not the only recognised figures within the network, and that a small number of individuals from research institutions and government agencies also hold positions of relative prominence. Second, many of the highest-scoring non-Knowledge Broker individuals are affiliated with Climate Systems Hub partner organisations, suggesting that the Hub's broader institutional relationships are reflected in, and reinforced by, the network that the Knowledge Brokers have built.

Closeness centrality

Closeness centrality measures how easily a person can reach the rest of the network. A person with a high closeness score sits close to everyone else in the network, in the sense that information from them can travel to anyone else through few intermediaries. The lower the closeness centrality score the longer it takes for them to pass information through the network, and conversely the higher the score the faster it is to spread information. The Knowledge Brokers have the highest closeness scores in the network, ranging from 0.83 to 0.87¹⁰ (see Table 3). This is to be expected given their role - they sit at the centre because that is what they are there to do.

The top non-Knowledge Broker closeness scores belong almost entirely to individuals at Climate Systems Hub-affiliated universities and the national climate science agencies (between 0.77 and 0.81). This means that these individuals can reach, and be reached by, almost the entire network in only a few steps – and that is largely due to their direct link to the Knowledge Brokers. Local Government, NGO and Aboriginal Corporation members score zero in nearly every case. Information from them has to travel via their single Knowledge Broker connection to reach anyone else.

The implication is that Climate Systems Hub-affiliated researchers and national climate science staff occupy a near-Knowledge Broker tier. They sit close to everyone in the network, which makes them obvious channels for moving evidence across jurisdictions via the Knowledge Brokers.

¹⁰ Closeness centrality is between 0 and 1 – with 1 being the 'closest' to all others in the network.

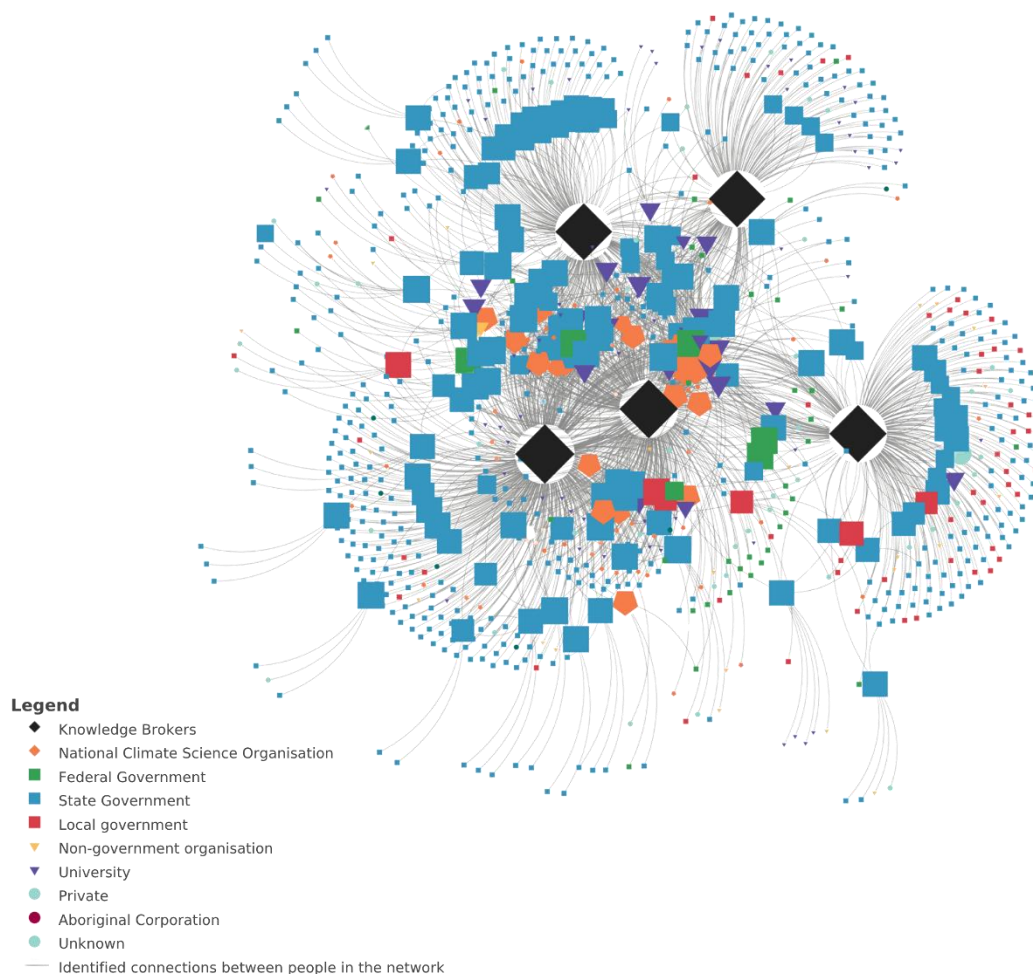


Figure 12: Network map sized by closeness centrality

Betweenness centrality

Betweenness centrality, is another key term often used in social network analyses, and offers a complementary perspective. Where indegree captures recognition, betweenness identifies individuals who sit on the shortest paths between other people in the network. These are the people who, by virtue of their position, act as bridges between otherwise disconnected parts of the network. Betweenness also provides the starkest illustration of the Knowledge Brokers' structural importance. Even the lowest-scoring Knowledge Broker (0.029) has a betweenness score roughly 24 times higher than the highest-scoring non-Knowledge Broker individual (0.001). This gap is considerably larger than the equivalent gap observed for indegree (by approximately five times), suggesting that the Knowledge Brokers' bridging function is even more concentrated than their recognition within the network (see Figure 13).

The implications of this are that the Knowledge Brokers are the structural connectors of the network. Information that moves from one part of the network to another almost always passes through at least one Knowledge Broker. Among non-Knowledge Broker individuals, the three highest betweenness scores belong to:

- an individual from a South Australian state government drought program

- a Tasmanian university researcher affiliated with the Climate Systems Hub
- an individual from a Queensland state government water utility.

What is notable about these individuals is that two of the three have very low indegree scores (one and three respectively), meaning they are not widely recognised across the network but occupy structurally important positions that connect parts of the network that would otherwise be more distant from one another. Their presence reinforces the finding that while the Knowledge Brokers are the primary connective feature of the network, they can leverage the bridging role of others to support further dissemination of information into different jurisdictions or organisations.

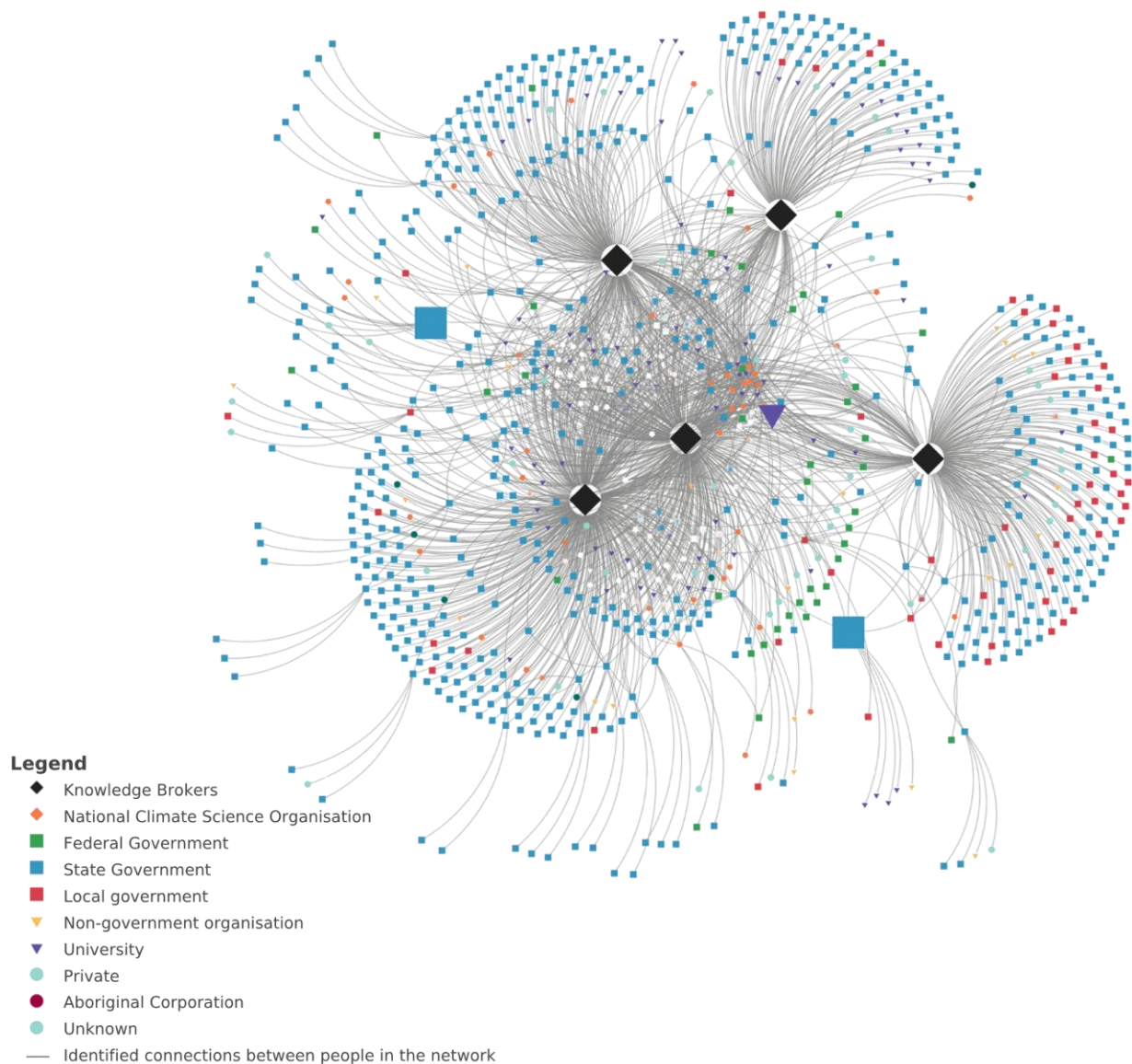


Figure 13: Knowledge Brokers and the top 3 non-Knowledge Brokers – the largest shapes in the map

3.2.7 Network maps for each jurisdiction

Each of the sub-sections below present the Knowledge Broker's network individually, with organisation types highlighted to show the composition of each cluster. Non-Knowledge Broker jurisdictions are also included.

National

The National Knowledge Broker has the highest indegree of any individual in the entire network (106), meaning they are nominated by more survey respondents than any other person, including the other four Knowledge Brokers. Their network spans 160 individuals across 42 organisations, heavily composed of federal staff and Climate Systems Hub-affiliated researchers. The cross-jurisdictional nature of the role is reflected in the fact that 45% of individuals in the national network are connected to multiple Knowledge Brokers, the highest rate of any jurisdiction. Where the state-based Knowledge Brokers build depth within their own jurisdictions, the National Knowledge Broker seemingly builds breadth across them.

Key findings for the national network include:

- The network is composed almost entirely of nationally affiliated individuals (130 individuals, 81%), drawn from three groups: national climate science agencies (CSIRO, the Bureau of Meteorology, the Australian Climate Service, Natural Hazards Research Australia), Climate Systems Hub-affiliated universities, and federal government departments and agencies (DCCEEW, the Climate Change Authority, Parks Australia, and others). Smaller representations come from the private sector (15) and NGOs (14).
- 43 individuals (27%) are affiliated with the Climate Systems Hub.
- The most recognised non-Knowledge Broker individuals in the national network are climate scientists at the national climate science agencies and Climate Systems Hub-affiliated researchers, alongside a smaller number of federal climate policy officers.

To some extent, the network at this level serves as a 'connective layer' across the entire map. Its high rate of multi-Knowledge Broker connections means that national organisations act as conduits between the state-based Knowledge Broker clusters. Figure 14 highlights the positions in the network of national-level organisations, including the Knowledge Broker.

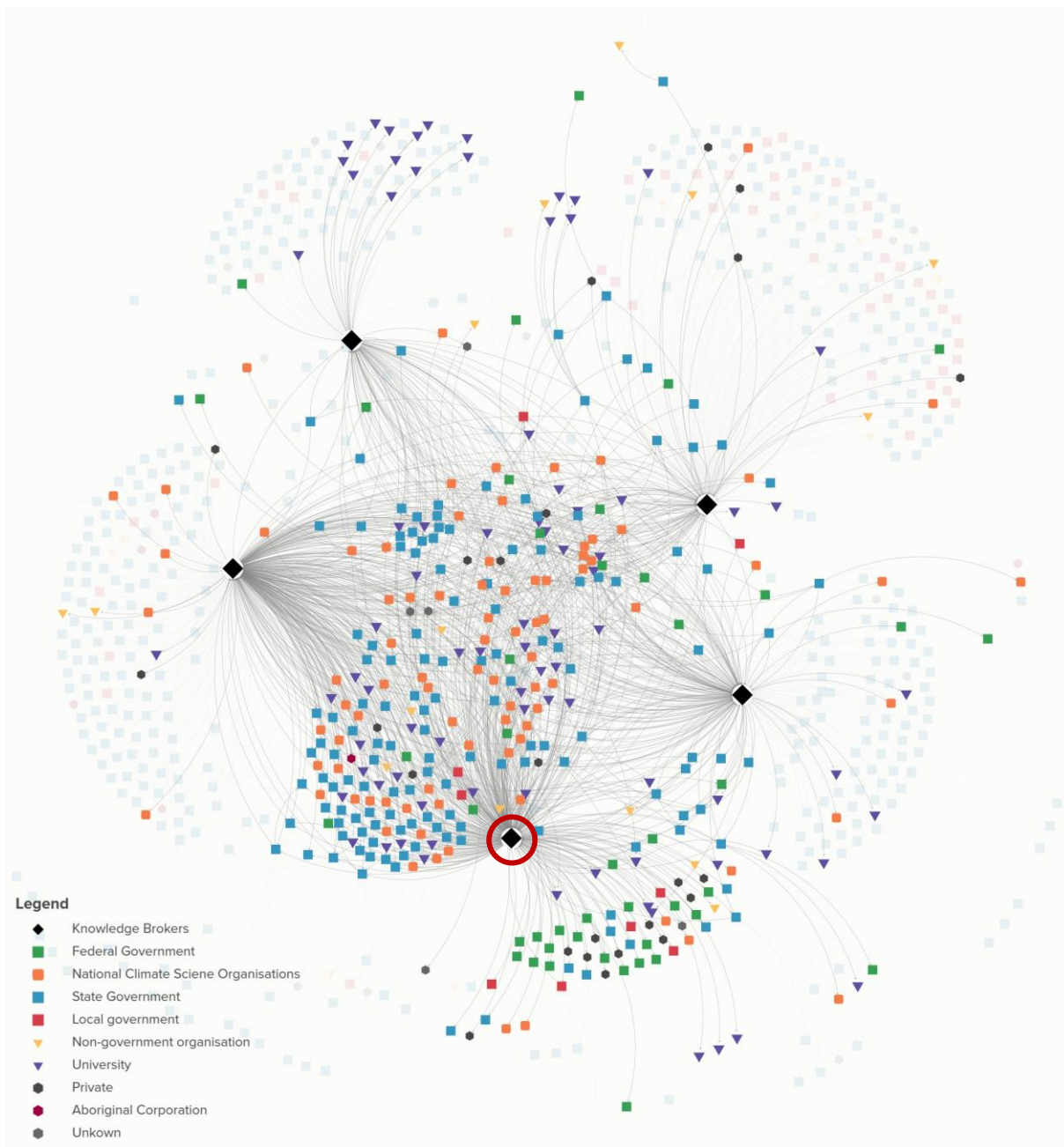


Figure 14: Network map at the National level, with the National Knowledge Broker highlighted

New South Wales

The NSW Knowledge Broker has a comparatively high indegree (82) relative to the size of their network (126 individuals, 206 outgoing connections), giving them the highest recognition-to-network-size ratio of the five Knowledge Brokers. This suggests that the people in their network are particularly aware of and engaged with the Knowledge Broker's role. In total, 12% of individuals in the NSW network are connected to other Knowledge Brokers.

Key findings for the NSW network include:

- State government dominates the network (113 individuals, 90%), primarily from a single department. University researchers (9), private sector contacts (3), and an Aboriginal Corporation representative (1) make up the remainder.
- The NSW Knowledge Broker's network reaches into national-level organisations relevant to NSW's climate work. Eleven individuals (9%) are affiliated with the Climate Systems Hub, and the network includes connections to climate scientists at national climate science agencies (CSIRO, the Bureau of Meteorology, the Australian Climate Service) and to federal policy officers at DCCEEW. These ties give the NSW Knowledge Broker direct lines into the research and policy infrastructure that NSW's climate work connects into.
- The most recognised non-Knowledge Broker individuals in NSW are all from the state environment and climate department, with the highest-ranked person holding an indegree of eight. To put that in context, the average non-Knowledge Broker individual in this network has an indegree of 1.5, and indegree of 8 places this person in the top 1% of all non-Broker individuals — meaning they are recognised by eight different survey respondents as someone they interact with.
- 34 non-Knowledge Broker individuals from NSW responded to the survey, the second-highest non-Knowledge Broker response count of any jurisdiction.

The NSW network is notable for its concentration within a single department, which reflects the organisational home of the NSW Knowledge Broker. The high survey response rate suggests strong engagement from within that department. This concentration means that the Knowledge Broker's influence runs deep within their host organisation, with more targeted reach to external bodies such as universities, the national climate science community, and federal agencies.

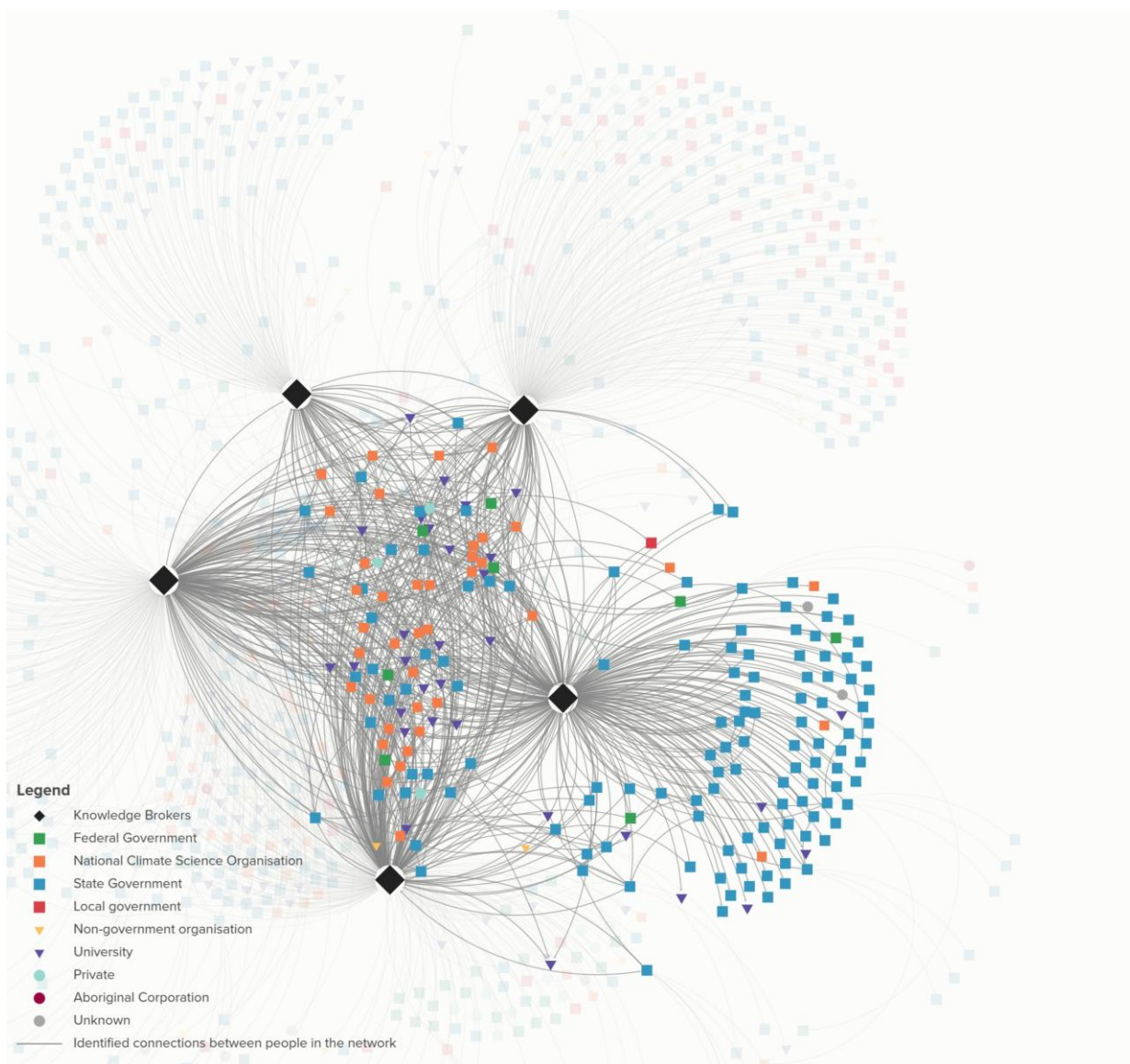


Figure 15 highlights the positions in the network of NSW organisations, including the Knowledge Broker.

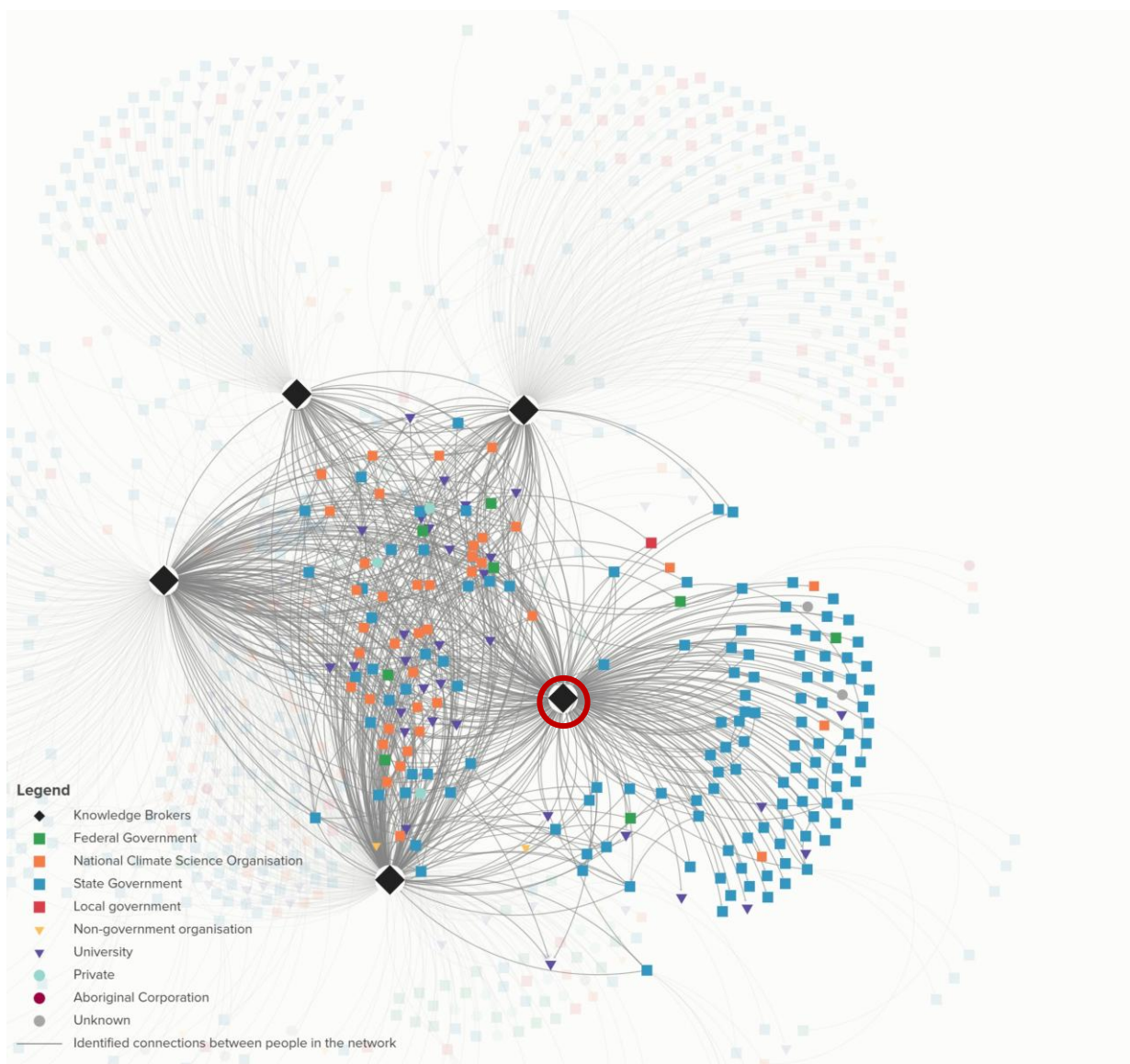


Figure 15: Network map for New South Wales with NSW Knowledge Broker highlighted

South Australia

The SA Knowledge Broker has built the widest organisational reach of any individual Knowledge Broker, with contacts spanning 53 organisations across 177 individuals. This breadth is driven by an extensive local government network, with 39 individuals from 24 local councils, a feature unique to South Australia within the SNA. In line with that, only 5% of individuals in the SA network are connected to other Knowledge Brokers, the lowest rate of any jurisdiction, likely reflecting the place-specific nature of much local council work.

Key findings for the SA network include:

- State government accounts for the largest share (129 individuals, 73%), followed by local government (39 individuals, 22%), NGOs (6), and university researchers (2).

- The 39 local government individuals span 24 councils, giving South Australia a uniquely broad sub-state footprint. No other jurisdiction in the network has this degree of local government coverage based on the data collected.
- The SA Knowledge Broker's network also reaches into national-level organisations relevant to SA's climate work. Thirty individuals (17%) are affiliated with the Climate Systems Hub, including climate scientists at CSIRO and the Bureau of Meteorology, and Hub-affiliated researchers at partner universities.
- The most recognised non-Knowledge Broker individuals in SA are from the state environment and water department (indegree of 5) and the state local government association (indegree of 4). To put that in context, the average non-Broker individual in this network has an indegree of 1.5, so an indegree of 5 places this person in the top 5% of non-Brokers — meaning they are recognised by five different survey respondents as someone they interact with.
- 27 non-Knowledge Broker individuals from SA responded to the survey.

The SA network's distinctive feature is its extensive local government engagement, which reflects both the SA Knowledge Broker's organisational design and the broader institutional set-up in SA that supports council-level climate work. This matters because local councils are often the level of government most directly responsible for implementing climate adaptation measures on the ground, from coastal management to heatwave planning. The SA Knowledge Broker's success in connecting with 24 councils means that climate science information has pathways to reach a level of decision-making that can be difficult for national programs to access. Figure 16 highlights the positions in the network of SA organisations, including the Knowledge Broker.

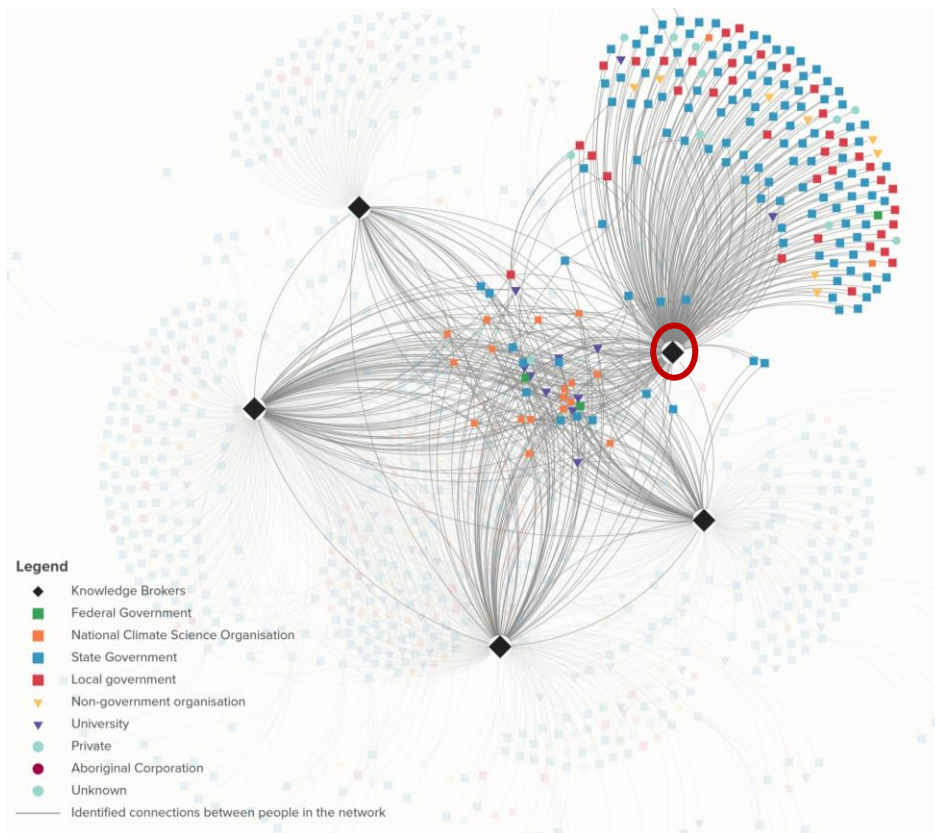


Figure 16: Network map for South Australia with organisations highlighted

Victoria

The Knowledge Broker has built the largest network of the five Knowledge Brokers, with 381 outgoing connections to 201 individuals across 39 organisations. They hold the highest betweenness centrality of any individual in the network, indicating that they sit on the greatest number of shortest paths between other people. Their indegree of 99 is the second highest among the Knowledge Brokers, and 28% of individuals in their network are connected to at least one other Knowledge Broker, the highest rate among the four state-based jurisdictions.

Key findings for the Victorian network include:

- The network is predominantly composed of state government staff (173 individuals, 86%), spanning departments, Catchment Management Authorities, and emergency service agencies. University researchers (16), private sector contacts (7), Aboriginal Corporation representatives (3), and NGOs (2) make up the remainder. Thirty-four individuals (17%) are affiliated with the Climate Systems Hub.
- The most recognised non-Knowledge Broker individuals in the Victorian network include a catchment management authority contact (indegree of 8), who also holds the fourth-highest betweenness centrality among all non-Knowledge Broker individuals, and two University of Melbourne researchers affiliated with the Climate Systems Hub (indegree of 6 and 5 respectively).
- Forty-one non-Knowledge Broker individuals from Victoria responded to the survey, the highest response count of any jurisdiction.

The presence of catchment management authorities, emergency services, and university researchers alongside state government departments indicates that climate science information is flowing to a wide range of end users. The high rate of multi-Knowledge Broker connections suggests that the Victorian network is well integrated with the broader national map. Figure 17 highlights the positions in the network of Victorian organisations, including the Knowledge Broker.

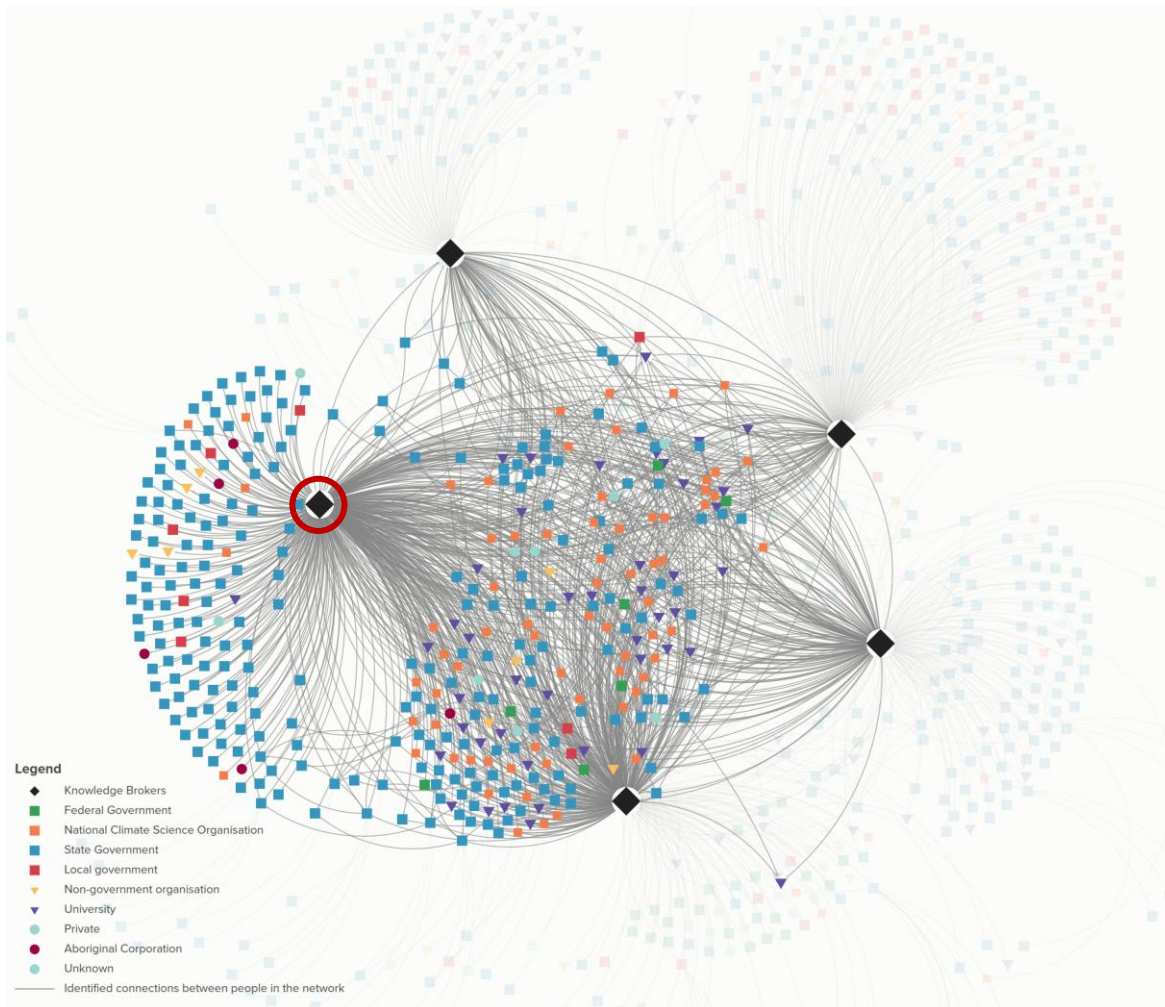


Figure 17: Network map for Victoria with Victorian Knowledge Broker highlighted

Western Australia

The WA Knowledge Broker has the most compact network of the five, with 136 outgoing connections to 126 individuals across 20 organisations. Their indegree of 38, while the lowest among the Knowledge Brokers, is still nearly five times higher than the highest-ranked non-Knowledge Broker individual in the entire network. In total, 15% of individuals in the WA network are connected to other Knowledge Brokers.

Key findings for the WA network include:

- State government accounts for the majority (102 individuals, 81%), with a notable university presence (16 individuals, 13%). This may in part be due to the WA Knowledge Broker working in a team that partners with a WA university. Local government (5), private sector (2), and an Aboriginal Corporation representative (1) make up the remainder.
- The WA Knowledge Broker's network has the strongest connection to national climate science of any state-based jurisdiction. 32 individuals (25%) are affiliated with the Climate Systems Hub, including climate scientists at CSIRO and the Bureau of Meteorology, and Hub-affiliated researchers

at WA partner institutions. The network also includes researchers associated with other NESP Hub programs.

- The most recognised non-Knowledge Broker individuals in WA include three individuals from the state water and environment department (indegree of 5 each) and a university researcher affiliated with another NESP Hub (indegree of 5). To put that in context, the average non-Broker individual in this network has an indegree of 1.5, so an indegree of 5 places these individuals in the top 5% of non-Brokers — meaning each is recognised by five different survey respondents as someone they interact with.
- 17 non-Knowledge Broker individuals from WA responded to the survey.

The WA network, while smaller in overall size, shows a particularly strong connection to the research community. The high Climate Systems Hub affiliation rate and the prominence of university researchers within the network suggest that the WA Knowledge Broker is well positioned to bridge between state government decision-makers and the climate science research being produced in the state. The comparatively lower number of outgoing connections may reflect the WA Knowledge Broker's more recent establishment, FTE time dedicated to the role, or the geographic and institutional context of climate policy in Western Australia. Figure 18 highlights the positions in the network of WA organisations, including the Knowledge Broker.

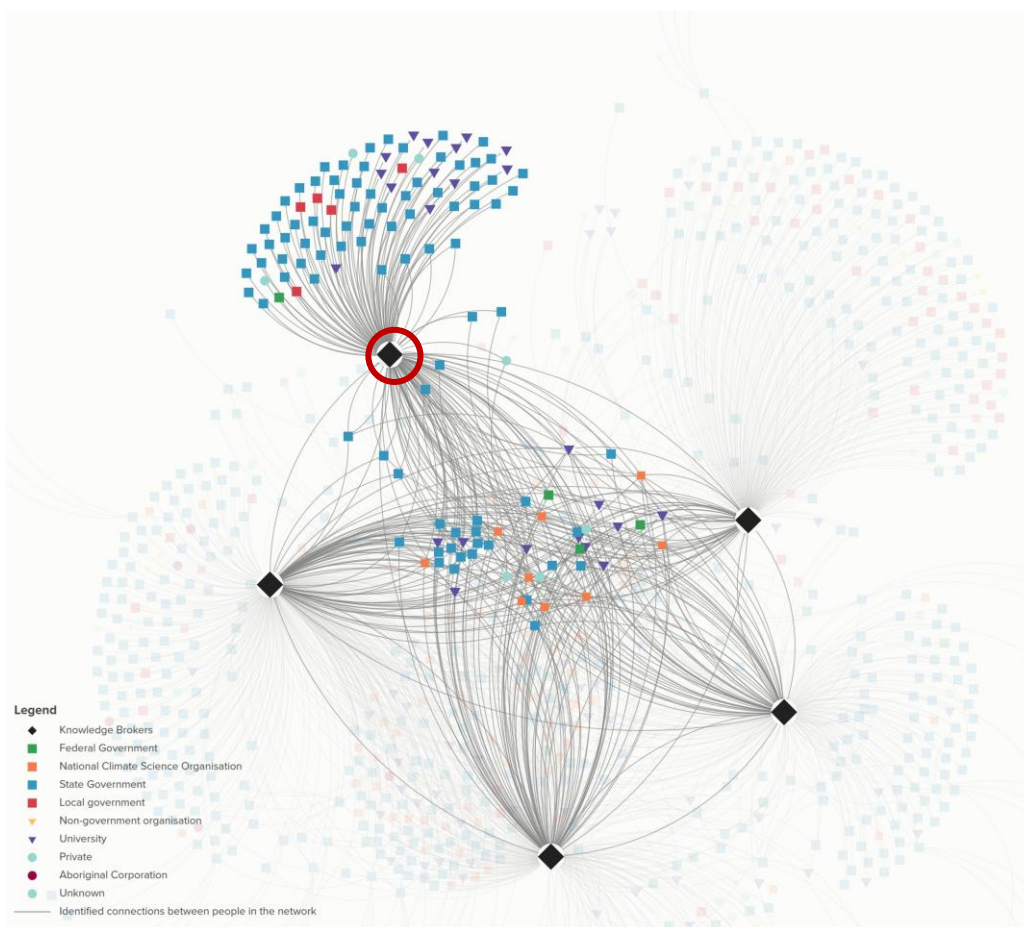


Figure 18: Network map for Western Australia with WA Knowledge Broker highlighted

Australian Capital Territory

The ACT, which does not have a dedicated Knowledge Broker, has nine individuals coded to the territory across two organisations. All nine are ACT-level government staff, with eight from the territory environment and planning directorates and one from the ACT Council of Social Service. Six of the nine are connected to multiple Knowledge Brokers.

Key findings for the ACT network include:

- The ACT network as coded consists entirely of territory government staff. Federal government policy officers, national climate science agency staff, and ANU researchers — although physically based in Canberra — sit in the 'national' segment of the network because of how organisations have been coded. The interpretation here is therefore about ACT government engagement specifically, not about Canberra-based climate work as a whole.
- The most recognised ACT individuals are three staff from the Environment, Planning and Sustainable Development Directorate (indegree of 4 each). To put that in context, the average non-Broker individual in this network has an indegree of 1.5, so an indegree of 4 places these individuals in the top 5% of non-Brokers — meaning each is recognised by four different survey respondents as someone they interact with.
- Despite its small size, the ACT network generates meaningful betweenness centrality. The highest-ranked ACT individual on betweenness is a staff member at the same directorate, suggesting that some territory government contacts play a bridging role between the research and policy parts of the network.

The ACT's high rate of multi-Knowledge Broker connection reflects two things. First, the small number of ACT-coded individuals are heavily concentrated in a single directorate that has reason to engage broadly with climate science work across jurisdictions. Second, this engagement has been actively supported by the work of the NSW Knowledge Broker, who manages the buddy-state relationship with the ACT and has developed strong connections with ACT government counterparts. The ACT's connectivity is therefore as much a reflection of the NSW Knowledge Broker's outreach as it is of ACT staff initiative. Figure 19 highlights the positions in the network of ACT organisations.

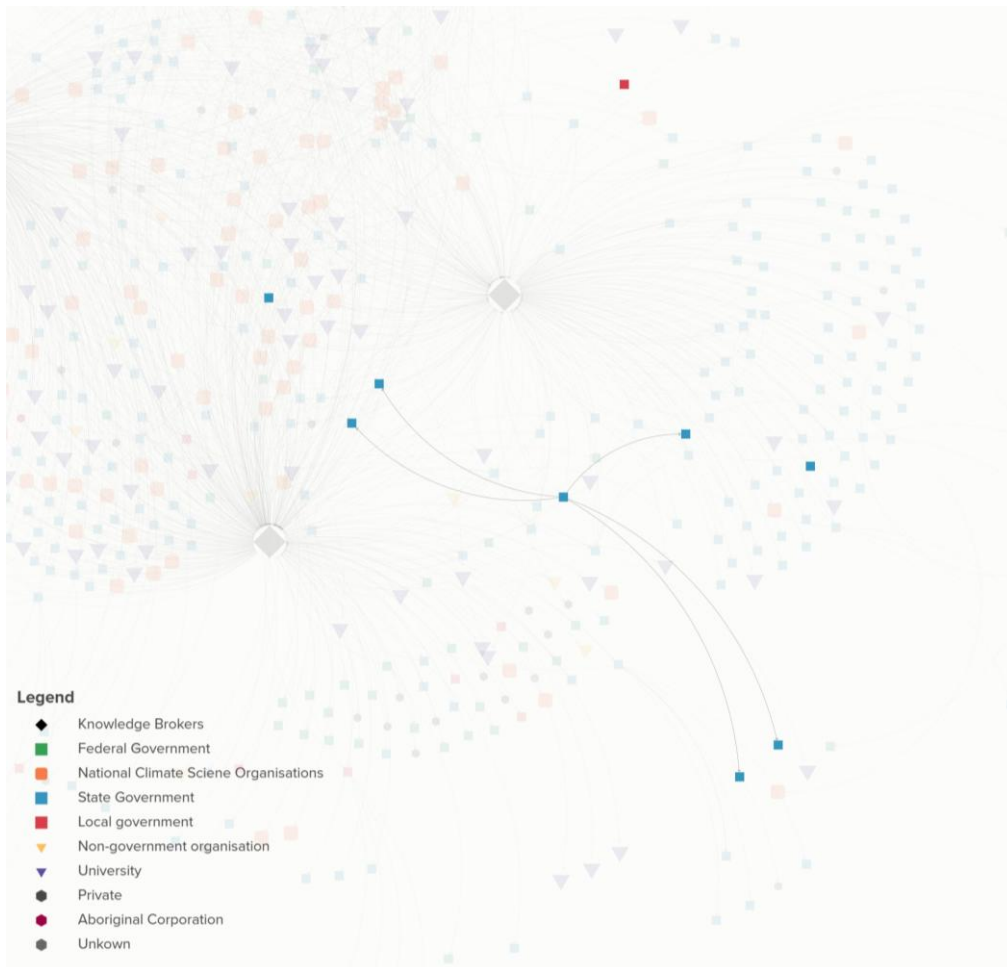


Figure 19: Network map for the ACT with organisations highlighted

Northern Territory

The Northern Territory has the smallest representation in the network, with 11 individuals across 5 organisations. All are state government staff and appear in the network because Knowledge Brokers nominated them as contacts, rather than from completing the survey.

While the NT footprint is modest, its inclusion in the network is itself a positive finding. It demonstrates that the Knowledge Brokers' reach extends to Australia's most geographically remote jurisdiction despite challenges to staffing levels. Given the NT's particular exposure to climate risks, including extreme heat, cyclone activity, and sea level rise, there may be value in exploring how the Knowledge Broker model could be extended or adapted to strengthen climate science connections in the territory. Figure 20 highlights the positions in the network of NT organisations.

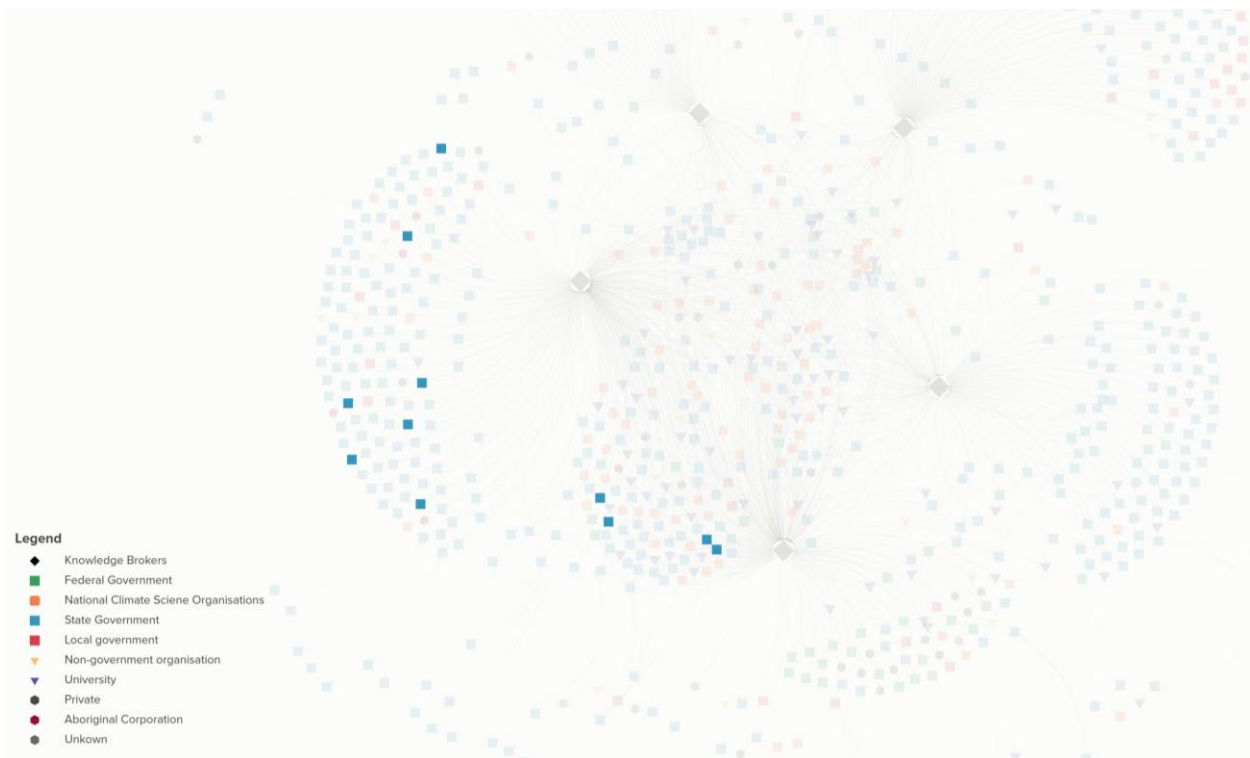


Figure 20: Network map for the Northern Territory with organisations highlighted

Queensland

Queensland is represented by 33 individuals across 19 organisations. Queensland is currently covered through a buddy-state arrangement supported by the National Knowledge Broker, after the dedicated Queensland Knowledge Broker role ended in 2024 following machinery-of-government changes. The numbers below reflect that change in coverage model. While smaller than Tasmania, the Queensland network is notable for its organisational diversity, spanning state government agencies, universities, local councils, and an Aboriginal Corporation.

Key findings for the Queensland network include:

- The network comprises state government staff (15, 45%), university researchers (10, 30%), local government representatives (7, 21%), and an Aboriginal Corporation representative (1).
- No individuals in Queensland are affiliated with the Climate Systems Hub. The university researchers present are instead affiliated with other NESP Hubs.
- 27% of Queensland individuals are connected to multiple Knowledge Brokers.
- Five individuals from Queensland responded to the survey, contributing 23 outgoing connections.
- The most recognised individuals in Queensland are from Queensland government (indegree of 5) and one of the universities (indegree of 4). Notably, the two individuals with the highest betweenness centrality in Queensland, one from a state government water utility and one from a local council, each have an indegree of just 1. These individuals are not widely recognised across the network, but they occupy structurally important bridging positions.

Queensland's network is spread across state government, universities, local government, and an Aboriginal Corporation, and mirrors the organisational diversity seen in larger Knowledge Broker-hosted jurisdictions, though at a smaller scale. In effect, Queensland reflects what a network might look like when a Knowledge Broker is absent – there are connections there but not equivalent to what could be in place, as in Knowledge Broker jurisdictions. Figure 21 highlights the positions in the network of Queensland organisations.

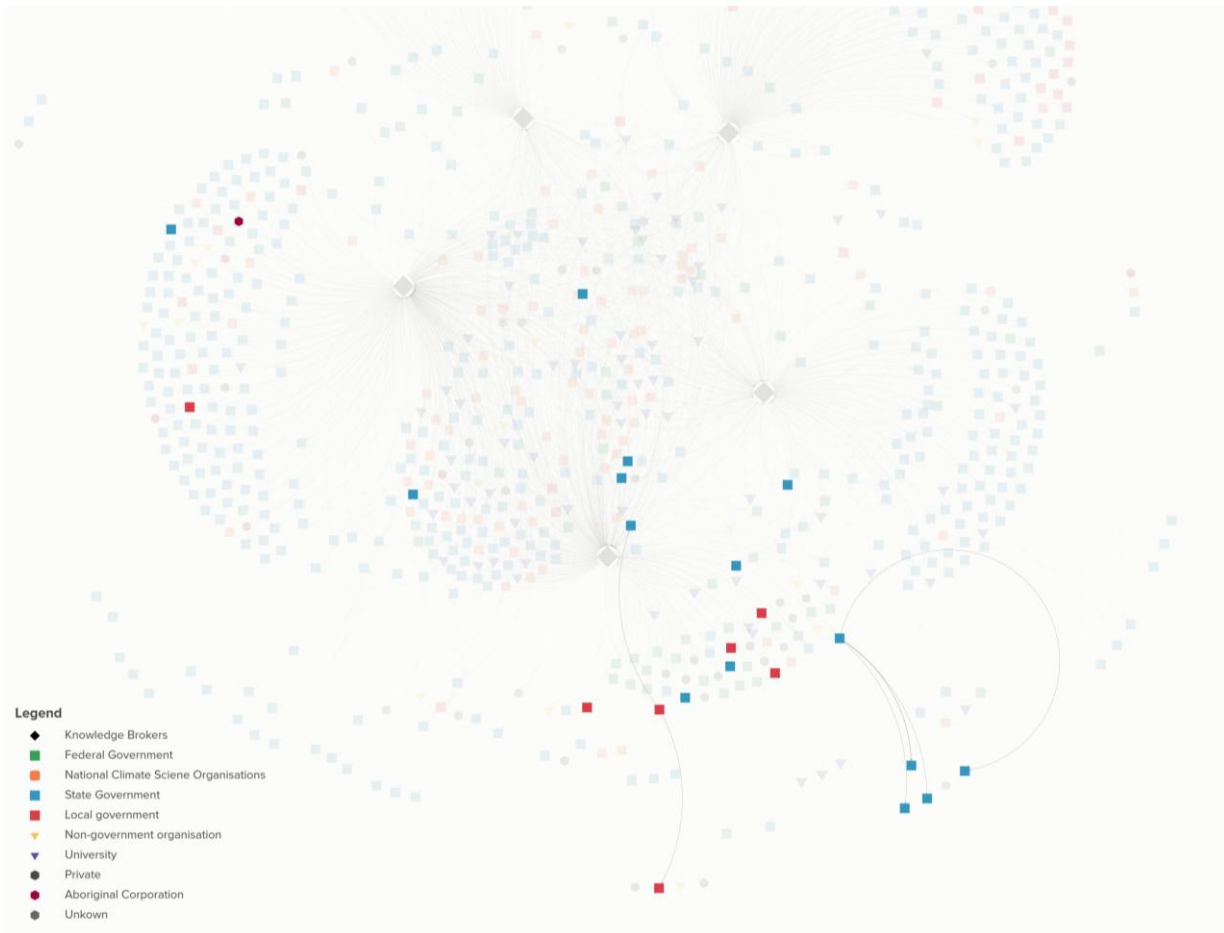


Figure 21: Network map for Queensland with organisations highlighted

Tasmania

Tasmania has 29 individuals coded to the state across 14 organisations, the strongest representation of any jurisdiction without a resident Knowledge Broker. The state is well integrated into the broader network through the success of the 'state buddy' system. Half of these Tasmanian-coded individuals are connected to multiple Knowledge Brokers, and the average indegree is comparable to that of the Knowledge Broker-hosted jurisdictions. Tasmanian survey respondents have contributed strong engagement for a jurisdiction without a dedicated Knowledge Broker.

Key findings for the Tasmanian network include:

- The Tasmanian network as coded consists of state government staff (21, 72%), local government (6), and NGOs (2). University of Tasmania researchers — including UTAS staff who are physically based in Tasmania and affiliated with the Climate Systems Hub — sit in the 'national' segment of the network because of how organisations have been coded. The interpretation here is therefore about Tasmanian government and community engagement specifically, not about climate work in Tasmania as a whole, much of which involves UTAS-affiliated researchers visible elsewhere in the SNA.
- The state government presence is concentrated at Renewables, Climate, Future Industries Tasmania (7 individuals) and the Department of Natural Resources and Environment (3 individuals), with smaller numbers at the Department of Premier and Cabinet, Parks and Wildlife Service, and the State Emergency Service.
- The most recognised Tasmanian-coded individuals are at Renewables, Climate, Future Industries Tasmania (indegree of 4), the Derwent Estuary Program (indegree of 3), and the Department of Natural Resources and Environment (indegree of 3). To put that in context, the average non-Broker individual in this network has an indegree of 1.5, so an indegree of 4 places this person in the top 5% of non-Brokers.
- Tasmania is covered through the buddy-state arrangement, with regular check-ins and information-sharing supported by the Victorian and National Knowledge Brokers. The figures above are consistent with what that arrangement is designed to do, particularly given the strong UTAS presence visible in the national segment of the network.

Tasmania's position in the network is notable for several reasons. The high rate of multi-Knowledge Broker connections and above-average indegree scores indicate that Tasmanian government and community individuals are not peripheral to the network — they are well recognised and well connected across it. The presence of state government staff across multiple departments suggests that the Knowledge Brokers' reach extends into the Tasmanian government's climate-related functions despite the absence of a Tasmania-based Knowledge Broker. Figure 22 highlights the positions in the network of Tasmanian organisations.

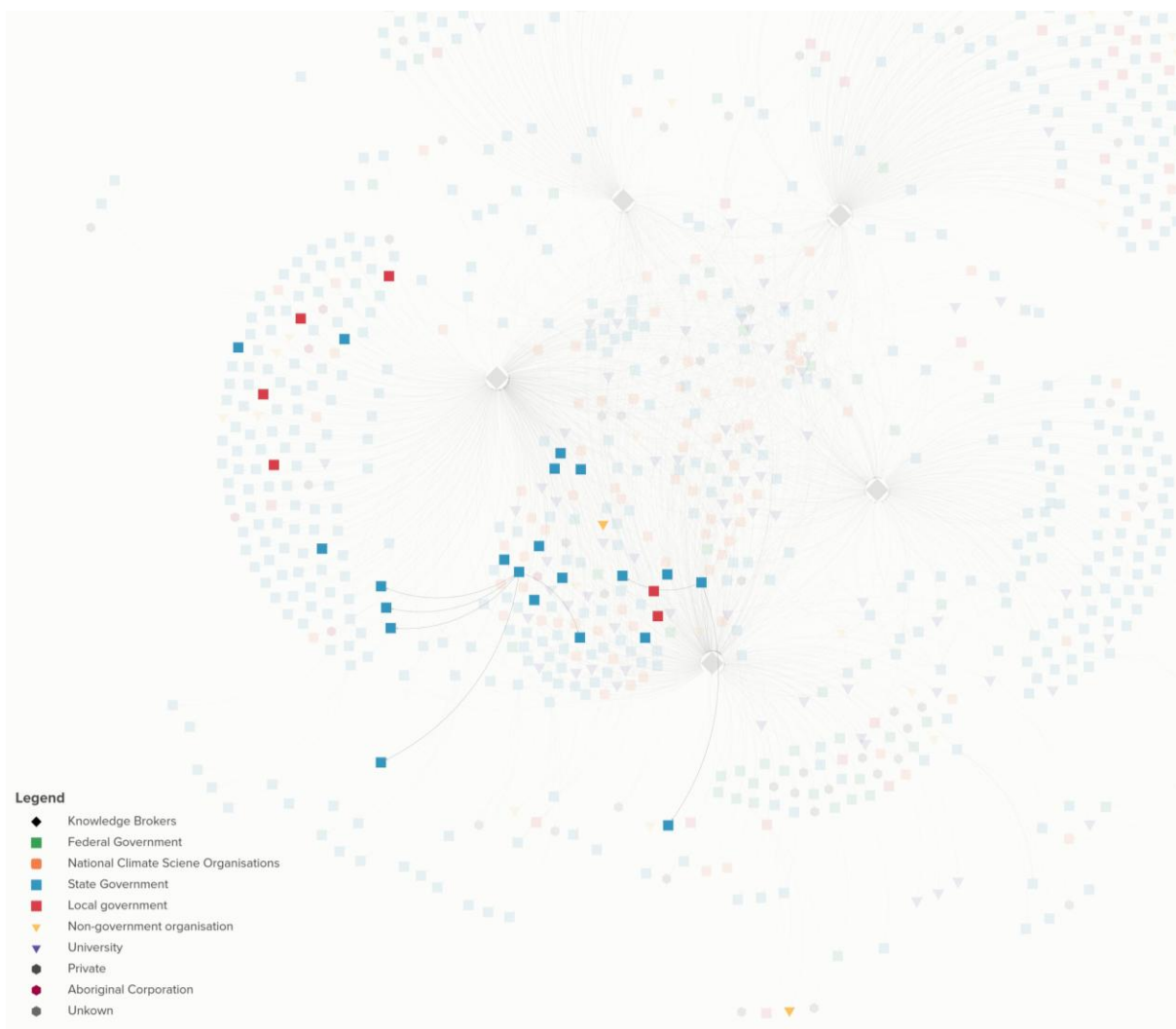


Figure 22: Network map for Tasmania with organisations highlighted

4 Conclusion

This project has produced an evidence base for what the Climate Systems Hub's Knowledge Broker team does and how their work is valued by the people they reach. Knowledge brokering is relational work, and its outputs are hard to capture through conventional monitoring, evaluation and reporting. This project provides an example of how relational networks of this kind can be examined empirically in a field where they have been under-evidenced.

The variation across jurisdictions reflects the institutional contexts the Knowledge Brokers work within and the relationships they have built. South Australia's local council reach, NSW's depth within a state department, Victoria's cross-jurisdictional connection, WA's research community focus, and the National Broker's role linking the team are different responses to different conditions. The buddy system, similarly, is showing how knowledge brokering works in jurisdictions without a resident Knowledge Broker, with Tasmania the clearest example of a state showing strong relationships without a dedicated knowledge broker.

The findings show that the team holds together a network that would not exist as a connected whole without them, and that the people in that network find their interactions with the Knowledge Brokers valuable for their work in climate change and adaptation.

Appendix 1 Knowledge Broker Social Network Analysis Survey

This appendix reproduces the Knowledge Broker Social Network Analysis survey as it was administered to respondents through Qualtrics. The survey took approximately ten minutes to complete.

Project Information

The NESP Climate Systems Hub is undertaking a survey to understand how the Climate Systems Hub's Knowledge Brokers add value to climate science and information networks across Australia. As part of this survey, we are undertaking a Social Network Analysis (SNA). SNA involves the creation of network maps, in this case the networks established by the Hub's Knowledge Brokers.

The survey will take about 10 minutes or less to complete depending on how much you have to say.

The Climate Systems Hub Knowledge Brokers have engaged First Person Consulting (FPC) to undertake this project on their behalf. All data collected through this survey will be stored onshore in Australia. Personal information (names) will be anonymised during the data cleaning process. If you would like to withdraw your consent and the data contributed, please get in touch with the FPC project manager (details below). Ethics clearance has been obtained through Iris Ethics (Iris Ethics HREC – S00055).

You can read more about the project via the Research Project Information Sheet ([hyperlink provided](#)).

All questions about the SNA can be directed to FPC Project Manager, Matt Healey (admin@fpconsulting.com.au) or NESP Climate Systems Hub National Knowledge Broker Coordinator, Ramona Dalla Pozza (ramona.dallapozza@utas.edu.au).

I have read and understood the research project information. I consent to participate and for my data and information to be used for this project and future related projects.

- ☐ Yes, I consent to participate
- ☐ No, I do not consent to participate

Survey

1. Which of the NESP Climate Systems Hub Knowledge Brokers have you interacted with? Select all that apply.
 - ☐ Ramona Dalla Pozza (National)
 - ☐ Heidi Evans (NSW)
 - ☐ Susan Sweeney (SA)
 - ☐ Helen Bloustein (VIC)
 - ☐ Julia Oliver (WA)
2. What type of interaction or role did they fulfil?

	Provided or facilitated access to climate science or other information	Facilitated connections to others relevant to my work
Ramona Dalla Pozza (National)	☐	☐
Heidi Evans (NSW)	☐	☐
Susan Sweeney (SA)	☐	☐
Helen Bloustein (VIC)	☐	☐
Julia Oliver (WA)	☐	☐

3. Consider the questions below in relation to each Knowledge Broker that you have engaged with.

	To what extent has your interaction contributed to your work or influenced your thinking in relation to climate change / climate science?	To what extent has each Knowledge Broker helped strengthen your access to relevant people or networks to support your work?
Ramona Dalla Pozza (National)	▼	▼
Heidi Evans (NSW)	▼	▼
Susan Sweeney (SA)	▼	▼
Helen Bloustein (VIC)	▼	▼
Julia Oliver (WA)	▼	▼

[Response options: Not at all / A little / Somewhat / Quite a lot / A great deal / Not applicable]

4. Are there any comments you would like to share in relation to your answers to the above questions?

5. A key part of knowledge brokering is how information circulates and influences work across broader networks. To help us understand how the NESP Climate Systems Hub Knowledge Brokers support cross-organisational knowledge sharing, **please list up to five people with whom you have shared information, insights, or contacts that you originally obtained through the Knowledge Brokers.**

To help you think about this, include **people whom you feel benefited from the information or connections you passed on** – whether directly (e.g. they used the information) or indirectly (e.g. it shaped their work, decisions, or collaborations). **Please include their name and organisation at the time you shared the information.**

All names will be de-identified during data collation. Individuals will not be contacted, nor will any person be identifiable in the resulting network analysis. These names are used solely to map the patterns of knowledge flow. For example, we want to understand whether several people nominate the same individuals to reveal how information moves through the wider network.

Please use the following convention for the five individuals: First name Last name – Organisation. For example:

- Joanne Lake – CSIRO
- John Smith – DEECA
- Taylor Swift – DCCEEW (NSW)
- Tom Jones – LGNSW
- Sabrina Carpenter – Orange City Council

Person 1	
Person 2	
Person 3	
Person 4	
Person 5	

6. What do you value the most about the Knowledge Broker roles associated with the NESP Climate Systems Hub?

7. Are there any things that could be improved or changed about the Knowledge Broker roles to better support the uptake of climate science information in your jurisdiction or context?

8. Are there any other comments you would like to share?

Appendix 2 References

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