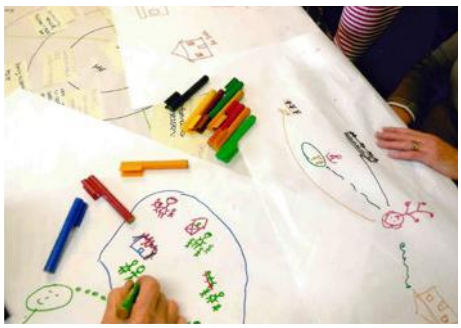
Social networks and disaster resilience: an introduction

Prepared for the Enhancing Networks for Resilience Project 2016



The purpose of this paper is to provide an introduction to social network concepts and their relationship to inter-organisational collaboration, disaster resilience and climate change adaptation. This paper is not a comprehensive or systematic review of literature but selects key theory, methods and concepts relevant to the Enhancing Network for Resilience research project.

Social network analysis has been used since the mid-1930s to advance research in the social and behavioural sciences. Researchers began using sociograms (a graphic representation of social links that a person has) to understand how informal work interactions affected productivity. An increasing interest in the link between social context and action saw a growth in similar studies and by the 1970s social network analysis was recognised as a distinct area of research.[1] The mathematical methods and information technologies used in network research continued to evolve enabling the modelling of complex human relations and information flows. As a consequence, network analysis is now applied across a range of disciplines from ecology, information technology, human microbiology, trade and international security.

In climate change adaptation and disaster risk reduction social network analysis can play a number of important roles. Understanding the socio-institutional dimension of climate change adaptation and disaster resilience is increasingly recognised as a critical factor in responding to risk and uncertainty, however, untangling the complexity within this sphere remains a challenge. Social network analysis provides a means to explore the social structures, processes and frames that drive decisions on risk, influence the flow of information, and ultimately whose adaptive capacity is built and how.[2]

Theoretical foundations

Social network analysis draws upon various theoretical foundations. Social capital has been an influential concept that underpins social network research. Social capital can be understood as 'networks together with shared norms, values and understandings that facilitate co-operation within or among groups'[3]. It allows people to trust each other, rely on each other for support, and work together. Since its popularisation in the 1980s and 90s social capital has between differentiated into three categories:

1. **Bonding social capital:** connections between people based on common identity, e.g. as they exist in families, among friends, or people who share a common culture or ethnicity. Bonding refers to very closely knit social networks that people rely upon for support, exchange and survival.
2. **Bridging social capital:** connections between people socially further removed from each other, where there isn't a strong sense of common identity, such as among distant friends, co-workers, or people who share an interest but live at a distance from each other. Here bridging refers to people creating connections that are looser than bonds but nevertheless important. A good example of the role of bridging social capital is when a person is looking for new employment and uses distant colleagues or a friend's friends to identify new job opportunities.
3. **Linking social capital:** connections to people who are further up or down the social ladder, such as links with people with political influence, with marginalised people, or people with economic power. A typical example of using linking social capital is where a group lobbies a politician and advocates for change to achieve a desired goal.

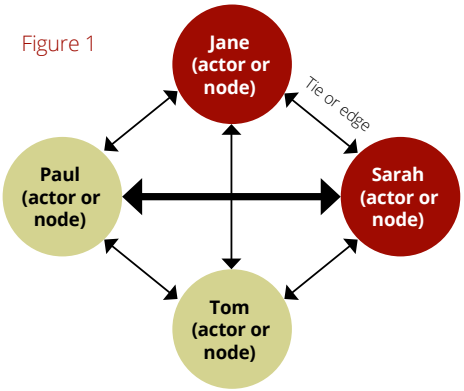
Social capital has been discussed in great detail and at time ferociously in academic circles, in particular because it is a concept that is difficult to define and hard to measure. Social network analysis, if conducted thoroughly, can provide some insights into the sub-types of social capital.

McCann, H, Fünfgeld, H, Brown, J and Wylie, R (2016): *Social networks and disaster resilience: an introduction.* Report prepared for the Enhancing Networks for Resilience Project. Hamilton, Australia: Southern Grampians Glenelg Primary Care Partnership.

The building blocks of social networks

- Social networks are a way of looking at a social system focusing on the *relationships* within a system. It differs from other types of social research that emphasise causal relationships via the attributes of **actors**. In social network analysis actors are most commonly people or organisations, but they can also be countries, teams, species, cities or businesses.

Figure 1



- Actors in a network are characterised by their **attributes**. Attributes of people may include gender, age, income, or for an organisation it may include core business, location or number of staff. In Figure 1 gender attributes are captured by the colour of the dots.
- The basic building blocks of a social network are pair of actors known as a **dyad**.[4]
- The basic unit of analysis are the **ties** between two actors. Ties between actors vary based on the type of network and the research question. Network research acknowledges that activities between actors in a network may be interdependent, and these activities can in turn affect the whole network.

Ties are also considered in terms of their strength and direction. Strength can be a qualitative measure, such as friendship over an acquaintance or a quantitative one, such as the number and diversity of ties, length of time of the relationship or regularity of interaction. The direction of a tie may mean that an exchange only happens one way, or both ways, such as information or money. It may also mean that one person may perceive someone as a friend but the other may perceive that person as an acquaintance.

Types of ties

A variety of ties can exist between two people as summarised in Table 1.[1] Ties between two people can be based on spatial or temporal similarities, such as live in the same neighbourhood, attend the same gym, length of workplace tenure. They can also be based on the roles or relationships between two people, whether the other person is family, friend, colleague; and they can be about feelings or thoughts; such as sharing the love of chocolate cake, perceptions about a particular person. One of the most common types of ties is based on interaction or flows, such as the flow of information, money, goods, or services.

BOX 1 Key terms

Actors (also referred to as nodes) are network members that are individuals (e.g. persons in a neighbourhood, clients of a service) or a collective (e.g. organisation or club). In a network map they are represented by dots.

Tie (also referred to as an edge) links actors in a network together. Ties are diverse in nature and can indicate the flow of resources, likes and dislikes, or types of association between two people. They are represented by lines on a social network map.

Attributes are the characteristics of actors and may include gender, age, income, or for an organisation it may include core business, location or number of staff.

Whole or complete networks have a well defined network boundary such as a workplace, neighbourhood team.

Ego network or personal networks are defined from a focal actor's perspective only (the ego).

Alters are the actors that an ego has nominated to be part of their network according to particular criteria, (such as meets once a month or talks to about work).

Dyad is a pair of actors.

Biparte networks (also known as two mode, or affiliation networks) are networks with two different sets of actors, and ties only exist between actors belonging to different sets.

Ties between organisations are different and can be ties between individuals within organisations, or solely the organisations. As indicated in Table 2,[1] when ties are analysed from an organisational level only, the flow of information is only categorised in terms of organisation. If the research question lends itself to a biparte analysis (see Box 1 and Table 3), the network will include the ties between two types of actors, for instance the ties between individuals and ties between organisations.

Table 1: Summary of types of ties between individuals

Relational states							Relational events	
Similarities			Relational roles		Relational cognition			
Location	Participation	Attribute	Kinship	Other role	Affective	Perceptual	Interactions	Flows
Same spatial and temporal space	Same clubs, same events	Same gender same attitude	Mother of, sibling of	Friend of, boss of, competitor	Likes, dislikes	Knows, knows of, perceives as happy	Sold to, talked to, helped, fought with	Information, beliefs, money

Table 2: Summary ties between organisations and individuals within organisations

Types	Organisations as entities	Via individuals
Similarities	Joint membership in a professional association, co-located in the district	CEO of organisation A sits on the same board as CEO of organisation B
Relations	Partnerships, alliances, competitors	Chief scientist of A is friends with chief scientist of B
Interactions	Sells to, changes business in response to	Representatives of A attend the same conference as representatives of B
Flows	Information flows, cash transfer, technology transfer	Employee of A provides information to employee B

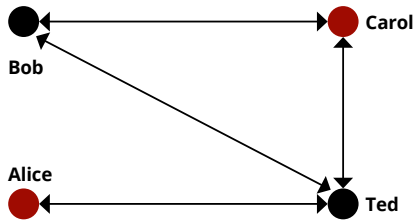
How are social network maps developed?

Social network maps are derived from an adjacency matrix (Figure 2)[5] and are analysed using concepts from graph theory and statistics. Ties are categorised into binary, nominal or ordinal data and the visualisations derived from graphs and a matrix are known as social network maps. The example below is a matrix where each row represents what each person has stated about the presence of a tie with each other person. Because it is categorised as being present or not present, in the form of a 0 or 1, this is binary data. Figure 3 illustrates how this is transformed into a social network map.

Figure 2

	Bob	Carol	Ted	Alice
Bob	---	1	1	0
Carol	0	---	1	0
Ted	1	1	---	1
Alice	0	0	1	---

Figure 3



BOX 2

Binary data distinguishes between ties as being absent (coded zero), and ties being present (coded one).

Nominal or qualitative is data that is coded by its type, rather than its strength (e.g. friend, family, or colleague).

Ordinal data is coded by strength (very often, often, not often, never) and given a value.

Types of social networks

Whole networks and ego networks

There are two main social network types: an **egocentric** or personal network, and a **whole** or **full network** study. In an ego network an individual actor is the focal point. The ego is asked who is in their network according to particular criteria (for example, friends that they have spoken to in the last two weeks, or colleagues that they share information with) and this is how the actors in the network (known as **alters** in an **ego network**) and the boundary of the network are established. Whether ties exist between each alter, is normally asked of the ego. Many ego network studies are concerned with impacts of a personal network or social environment on an individual.[6] For example an ego network study may examine how an individual's social network may affect their drug and alcohol intake.

A **whole network** has a pre-existing well-defined boundary, such as a workplace, sporting club, or neighbourhood, or trade network. Whole networks focus on the network structure and patterns of interactions and how they affect network outcomes. For example, a study may investigate if a team with many external ties is more efficient at delivering on organisational outcomes. It may also highlight particular persons that enable links to other parts of the organisation, that without, effective coordination would not occur.[4]

Outcomes of interest

Whether looking at a whole network, ego-network, a network of people or a network of organisations, the outcomes of interest, and independent variables may vary. For example, the analysis may consider the outcomes for an individual actor; outcomes for the relationship between two actors; or the outcomes for the whole network. Variables that could affect the outcomes may include the attributes of actors, the type and strength of relationships, or patterns or structures in the whole network.[1]

These varied points of analysis complicate the examination of outcomes, as what might be good for an individual actor may not be good for network level or system outcomes. Subsequently interrogating multiple causal relationships between network variables (actors, relationships and network structures) is important (albeit complex) in providing insights into network dynamics.

Analysing social networks: key features and concepts

Density is the most commonly analysed feature in a network. A network's density is the ratio of the number of ties in the network to the total number of possible ties between all pairs of actors in a network. It measures how well connected a network is. A well connected network can have various benefits such as easy and efficient information flow; it may indicate high levels of trust and thus suggest a network that is able to effectively collaborate. However it may also present challenges. High network density can lead to network closure, preventing the introduction of new ideas and consequently leading to a network which is homogenised in its knowledge and experiences. It may also point to the need for higher levels of coordination (for example where a client accesses multiple well connected services but there is no coordinating administrator leading to duplication or other efficiency issues).[6]

Centrality is the other most commonly considered network feature and can reveal who are the most important actors in a network. There are various types of centrality measures each serving a different purpose. The most basic type, ***degree centrality*** refers to how many ties an actor has. A high degree of centrality means an individual actor has more ties comparative to others in the network. ***Betweenness centrality*** is the degree to which an actor connects other actors who would not otherwise be connected and ***closeness centrality*** is the distance of one actor to all others in the network.[4]

Centrality measures are useful in determining which actors are the most popular and who is most influential. For example, what actor is best placed to spread information, who is the most accessed, and the risk of network fragmentation if a particular actor was not in the network (**network vulnerability**). Closeness centrality is useful when looking at the efficiency of particular resources or information getting from one place or actor to another. It may also highlight an important actor that is being underutilised or is isolated compared to others in the network. Betweenness centrality can become important when wanting to link different groups together, known as **clusters or cliques**. Actors with high betweenness centrality can become important bridges between cliques with specialised knowledge, and enabling the introduction of new ideas and innovation, and preventing network fragmentation or network closure.[1]

Betweenness centrality is closely linked to the concept of bridging social capital. Bridging social capital can be an important component of building adaptive capacity and resilience as it brings diverse knowledge, organisations, values, and localities together. This diversity is often required in responding to complex governance challenges, like climate change and disaster.

Table 3: A selection of commonly analysed social network features

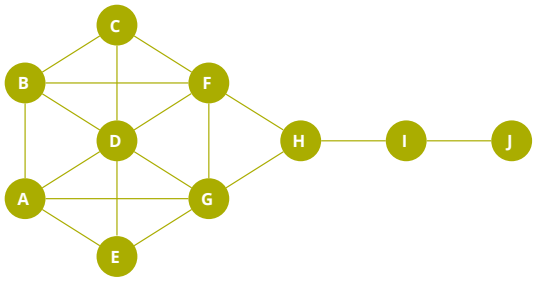
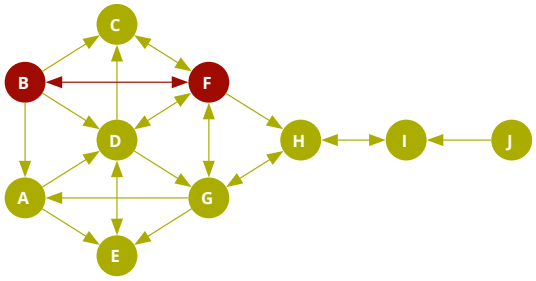
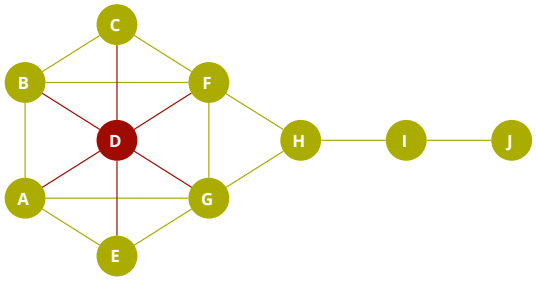
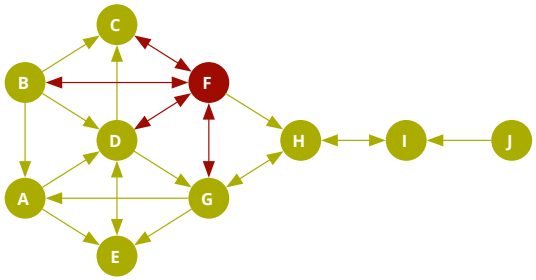
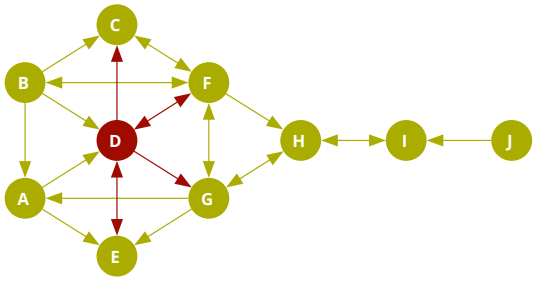
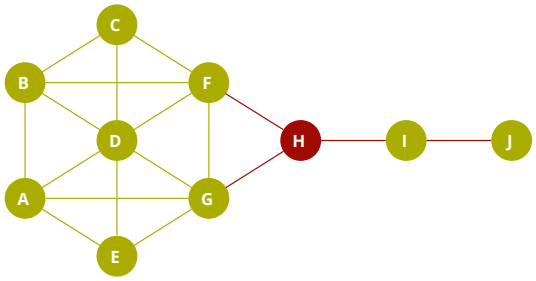
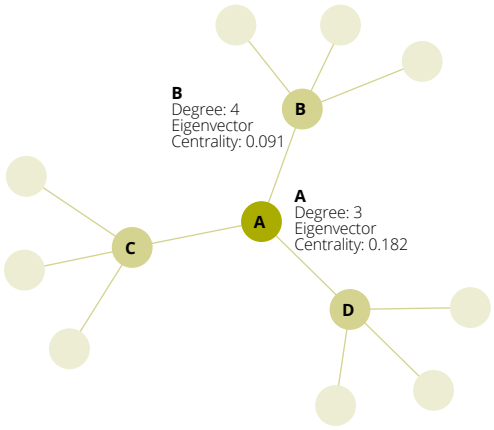
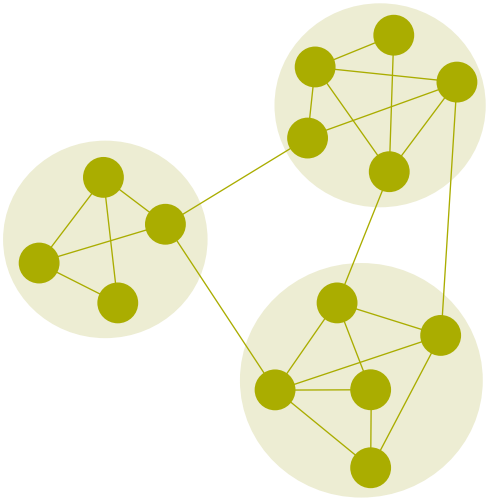
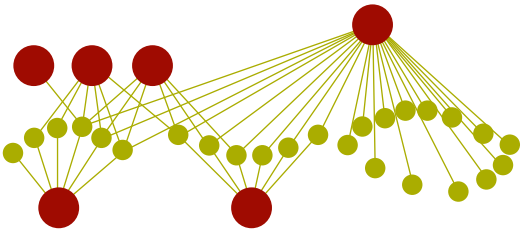
Characteristic	Description	Social network map representation
Density	The number of ties in the network as a proportion of the total number of possible ties. Density = $\frac{\text{Actual connections}}{\text{Potential connections}}$ In the map to the right 40% of the network potential is connected therefore the density is 0.4. Density = 18/45 = 0.4	
Reciprocity	A directed graph illustrates if relationships are reciprocated between actors. Arrowheads indicate the direction of the relationship. An arrowhead at each end of a tie shows a reciprocal relationship; one arrowhead illustrates a one way relationship. If a graph has no arrowheads, it is a undirected graph. Actor B and F in the map have a reciprocal relationship as the arrowhead goes to both actors. Other relationships, for example between A and E are not reciprocal as the arrow is only directed to actor E.	
Degree centrality	For an undirected graph, the degree is the number of ties emanating from a particular actor. Node D has a the highest degree of 6.	
Indegree	In a directed graph the indegree is the number of ties directed towards it. Indegree can indicate the most popular actor in a network, or those most sought after for information, resources or activity. In the map to the right, actor F has the highest indegree.	
Outdegree	In a directed graph the outdegree is the number of ties directed away from an actor. It may indicate an actor that is sharing or seeking out resources. In this map actor D has the highest outdegree.	
Betweenness centrality	Measures how many times an actor acts as bridge along the shortest path between two other actors. In this map, although F is quite central, H has a very close connection with I and J, and if H was removed, the network would collapse and J would be separated from the network. This means H has the highest betweenness centrality and plays a key role as a broker.	

Table 3: A selection of commonly analysed social network features

Characteristic	Description	Social network map representation
Eigenvector centrality	A measure of how popular an actor's partners / alters are. A is connected to nodes that are more connected to other nodes and B is connected to less-popular nodes. Therefore A has a higher eigenvector centrality than B.	
This diagram combines all centrality concepts and demonstrates how different actors may have different advantages based on their position in the network		
Clusters or cliques	A clique is a sub-set of a network in which the actors are more closely and intensely tied to one another than they are to other members of the network. This network map illustrates three distinct cliques or clusters.	
Biparte or two mode network	A network with different types of actors, for example people and their organisations. In this map the red actors may be organisations or clubs and the green nodes may be people.	

Extracted from Ortiz-Arroyo, D. (2010) Discovering Sets of Key Players in Social Networks. In A. Abraham, A-E. Hassanien, & V. Snásel (eds) *Computational Social Networks Analysis: Trends, Tools and Research Advances.* New York: Springer, 27-47.

Social network methods, tools and challenges

Rationale for network studies

Social network analysis brings a range of unique insights and methods to a research project. However alongside its strengths and benefits there can be challenges and misconceptions. It is not uncommon for a project to be lured into SNA due its reputation for innovation, ability to deal with complexity and its visual aids. For example, a researcher may seek to include a social network analysis because they want to communicate large data sets; employ a cutting edge approach, or simplify a very complex research problem.[4]

Although these can be acceptable drivers for applying SNA, they alone are insufficient. Without a clear research question, underpinned by relevant concepts and theory, a project may end up with collection of dots and lines that they cannot extract meaning from. Seeking input on the research objectives and methods from those in the network study (where appropriate or practical), before it begins will help ensure network data is decipherable, interesting, and useful.[6]

Data collection

There are a variety of data types, collection methods, and analysis tools in social network research. Their selection will depend on the research question, network type (ego or whole) as well as practical considerations such as participation, costs and timeframes. Primary data can be collected via interviews, online surveys, or observational data (although this is often time consuming and potentially expensive). Existing data may also be useful in building network information alongside or instead of new data. Electronic data such as emails, social media or phone records can track flows of information between individuals and organisations. Archival records such as patient transfer records, minutes of board meetings, or annual reports could reveal information about actor attributes, and exchanges.[4]

There are a number of data challenges in network studies however two are the most prevalent - one relates to ego networks and the other whole network studies. In ego network studies the researcher is relying on the participant to accurately recall a set number of contacts according to quite specific criteria as well as particular details about their interactions. The reliability of the information provided can depend on a number of factors including the number of alters, ties and relevant timeframes. In addition, the information requested about a large number of alters may create respondent fatigue and impact on the quality of data.

In whole network studies it can be difficult to get all actors within the defined boundary to respond. However if there is missing data the features and dynamics of the network can be easily misrepresented. For instance the presence or absence of a tie may significantly shorten a path from one actor to another, bridge a structural hole, or imply one actor is more central than another. Having a sense of the response rate and the implications of particular missing responses is important prior to starting a whole network study.

Social network maps are the most helpful when combined with good research design and good analysis. It is important to consider the most significant ties and attributes, as the more information on one map, the more difficult to interpret it can become.[4]

Figure 4: A map of the top 50 Twitter PR presences in the UK and their respective followers.[7]

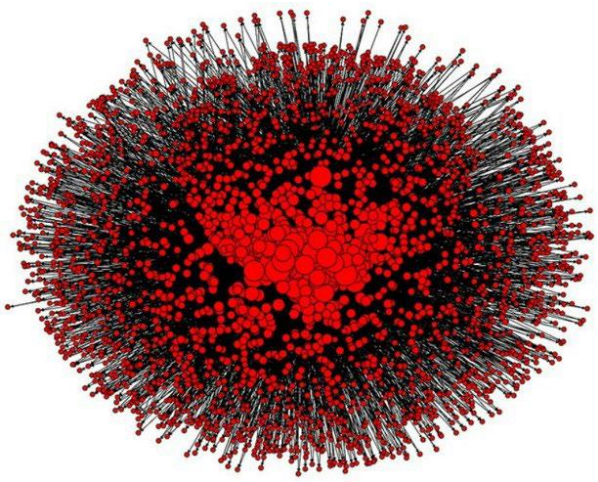


Table 4: Selection of social network analysis software

Product	Main Functionality
EgoNet	To collect and analyse all the egocentric network data
OrgMapper	A comprehensive cloud-based platform for social and organisational network analysis (SNA/ONA).
Pajek	A program package for analysis and visualisation of large networks
Polinode	Online web application for visualising and analysing network data. Includes integrated data collection functionality
UCINET and NETDRAW	Social network analysis and visualisation
Gephi	Graph exploration and manipulation software
ORA (software)	Network analysis tool
Visone	Visual social network analyses and exploration
SocioViz	Network overview, influencer discovery and exploration. Twitter scraping.
Tulip	Social network analysis tool

Temporal limits

Temporal considerations are significant when planning a network study as a network map is only a snapshot in time. Networks, particularly informal and personal ones, are dynamic and the structure and attributes can co-evolve and interact. For example, a person might be influenced by their friends to like certain sports but choose new friends because they like those sports. Like other social research, a project may undertake longitudinal studies to examine changes over time, however as with other research, this requires time and resources.[4]

Network software

There are a range of network analysis software that can support data collection, synthesis and development of visualisations (social network maps). Table 4 outlines a selection of software available for network research.

Networks and inter-organisational collaboration

Social network analysis is often employed in the study of inter-organisational networks. Research into inter-organisational collaboration can reveal much about informal and formal governance processes, including trust, organisational learning and the ability to achieve collective outcomes.

Network governance

Theory and concepts in network governance provide a useful framework for investigating inter-organisational networks. The most shared characteristic of network governance is a process of networked and decentralised decision making that is enabled by predominantly informal mechanisms (such as trust, shared understandings and accountabilities) as well formal ones. It is contrasted to types of governance which are highly hierarchical and driven purely by legal agreements or markets.

Kenis and Provan[8] developed a typology of network governance with characteristics, strengths and weakness for each network governance form. No particular type is positioned as better or less effective than another, but rather utilised for reasons related to specific outcomes.

Participant governed networks are governed by participants themselves. They are highly decentralised, involving members interacting on a relatively equal basis in the process of governance. Typically, they depend on the commitment of all or a significant subset of organisations that comprise the network. Shared goals of the network are facilitated by an equal level of involvement. Decisions are made collectively and there is no formal administrative entity, although some tasks may be allocated to a subset of the group.

In **lead organisation networks** all significant activities and decisions are coordinated by a single participating member. This lead organisation typically provides administration for the network and facilitates delivery of network goals which may be closely aligned with their own organisation's goals. The lead organisation may underwrite the costs of administration, receive contributions, or control access to funds through external sources. Selection of the lead may be driven by members perception of the most efficient and effective organisation, or be mandated from an external source. This form of governance normally is highly centralised.

Network administrative organisation is based on a separate administrative that is set up specifically to govern the network and its activities. The administrating organisation is not a member organisation (like the lead organisation model) providing it owns services, but its key role is to coordinate and sustain the network. Although members may still interact or make shared decisions the administration is centralised. NAOs are often modest in scale and may be a not for profit or government entity. They may also have a board to enhance the network legitimacy and to deal with unique and complex network level problems to reduce the complexity of shared governance.

Characteristics, strengths and weaknesses of network governance

Table 5 summarises the characteristics, strengths and weakness of each network governance type. Efficiency refers to how quickly and simply network activities are achieved and inclusiveness is the level of involvement of members in network decisions and activities. Internal and external legitimacy is whether members or external stakeholders support and validate the model in which the network is working. Flexibility considers if and how the network combines resources and expertise rapidly in ways that hierarchical structures may struggle to accomplish. Flexibility allows networks to respond quickly to changing stakeholder needs, external threats and opportunities. Stable networks are often in opposition to flexible ones, contain long-term relationships, and utilise an understanding of members' strengths and weaknesses to maximise outcomes. Stability can be important for developing consistent responses to stakeholders and for efficient network management.

Table 5: Summary characteristics strengths and weaknesses of network governance typologies[8]

Type of network governance	Characteristics			Strength and Weaknesses					
	Number of participants	Trust	Goal consensus	Efficiency	Inclusiveness	Internal legitimacy	External legitimacy	Flexibility	Stability
Participant governed networks	Few	High	High	Weakness	Strength	Strength	Weakness	Strength	Weakness
Lead organisation network	Moderate	Low density, highly centralised	Moderately low	Strength	Weakness	Weakness	Strength	Weakness	Strength
Network administration organisation	Moderate to many	Moderate density	Moderately high	Balance	Balance	Balance	Balance	Weakness	Strength

Social network analysis: governance diagnostic

Social network analysis is a useful diagnostic tool to interrogate the presence of particular network characteristics. Examining density, centrality, cliques and structural holes and other network dynamics can inform researchers about if and how network outcomes may be achieved, and opportunities to evolve relationships or change network structures to enhance shared objectives.

Governance and networks in resilience and climate change adaptation

Disaster resilience and climate change adaptation are often characterised as "wicked" or complex due to the interconnection of unpredictable variables in complex social-ecological systems. The need for new governance approaches which move away from linear, market based or command and control processes has been recognised since the 1970s.[9] These approaches require collaborative, iterative, multi-institutional arrangements that consider various temporal and spatial scales.[9,10] Network governance is a useful starting point to explore these approaches in addition to the concepts of adaptive capacity and adaptive co-management.

The Intergovernmental Panel on Climate Change defines adaptive capacity as "the ability of systems, institutions, humans and other organisms to adjust to take advantage of opportunities or to respond to consequences".[11] Adaptive co-management as a governance approach can be regarded as the enabling conditions for networks of organisations, or human individuals to develop adaptive capacity.[10]

Various definitions of adaptive co-management exist however common to them all is the vertical and horizontal integration of diverse actors in decision making, normally in response to complex natural resource management issues. Adaptive co-management is also characterised by iterative reflection and learning to respond to numerous uncertainties and contested values. Plummer describes the potential of adaptive co-management:

"adaptive co-management enables collaboration amongst heterogeneous actors with diverse interests and institutions that are flexible and nested across scales and levels, and promotes analytic deliberation that develops understanding through multiple knowledge systems, builds trust through repeated interactions and fosters learning and adaptive and continuous feedback through continuous feedback"[10]

Figure 5

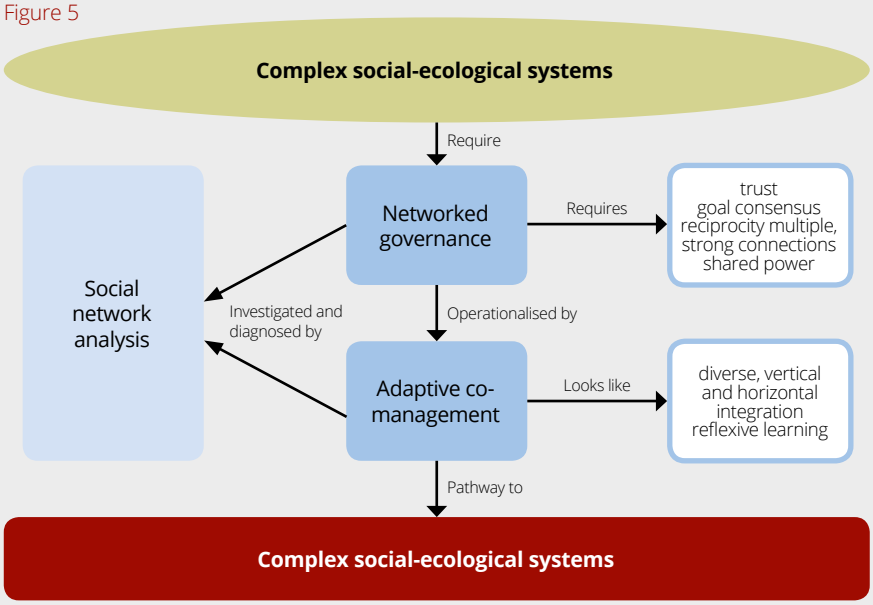


Figure 5 illustrates how network and adaptation concepts interrelate in support of adaptive capacity and resilience. Network governance is a decision making approach best able to deal with complex issues like climate change or disasters. But what does network governance look like and how is it achieved? Adaptive co-management can operationalise network governance by enabling diverse actors to work collectively towards shared goals, build trust, and learn from each other. But how do we know this is happening? Social network analysis maps these complex relationships to examine the type and strength of relationships, decision making and institutional processes. Are diverse actors coming together? Is there trust? Are there important bridges that bring diverse actors together to enable the learning and understanding of different "frames" required for complex problems.

Table 6: Summary characteristics of social network case studies

Case study	Network type	Network characteristics investigated	Research interests & objectives	Relevant theory	Methodology	Key conclusions
Queensland flood response	Whole	Density	Disaster management (floods)	Network governance	Telephone survey	• Network enablers: trust and knowledge, shared goals, IT systems • Collaboration barriers: silos, bureaucracy, lack of engagement • Importance of network governance to adaptive capacity
United States Healthy Aging Research Network	Whole network	Density Centrality Cliques Reciprocity	Chronic disease prevention and management	Network governance	Online survey	• Importance of a coordinating agency to enable effective collaboration
Community emergency preparedness in Tasmania	Whole network	Density Centrality	Disaster management (Floods)	Social capital	Interviews Playful triggers	• All types of social capital important • Who and what types of social capital are emergent and context specific • Challenges typical notions of vulnerability and community "leaders" • SNA useful in understanding social capital
Floods in Northern England:	Whole and ego network	Density Centrality Cliques Reciprocity Ties Strength	Disaster management (Floods)	Social capital	Semi structured interviews and workshops	• All types of social capital are important in creating vertical and horizontal integration in support of resilience outcomes • SNA needs to be well planned and integrated early into research design

Social network case studies

The following section provides brief summaries of social network studies undertaken in a variety of contexts, with varied parameters and conclusions. The first two focus predominantly on inter-organisational collaboration, and network level outcomes, drawing on key success factors for effective network governance, such as shared goals, trust and external coordination support. The second two case studies draw more on notions of social capital and look at what types of social capital support disaster resilience outcomes. The case studies employed a variety of data collection methods, including interview, online survey and workshops and looked at diverse network features such as density, centrality cliques, reciprocity. Table 6 provides a summary overview of the case features and conclusions.

Collaborative responses to the Queensland floods

The following was extracted from Kinnear, S., Patison, K., Mann, J., Malone, E and Ross, V (2013) Network governance and climate change adaptation: Collaborative responses to the Queensland floods, National Climate Change Adaptation Research Facility, Gold Coast, Australia.[6]

In 2011, NCCARF funded a project to explore how climate change adaptation efforts may be enhanced by understanding the collaborative networks of disaster and water management organisations involved in the 2010-11 Queensland floods. The research sought to identify the organisations that were essential to the network during floods and routine operations; how the network structure changed from routine to flood operations; levels of reciprocity and if there were correlations between collaboration and trust.

The study examined two networks, one in Brisbane and one in Central Queensland which comprised of subnetworks in Rockhampton and Emerald. Participation was garnered from 63 organisations across all three tiers of government, water entities, the private sector and community organisations. Quantitative and qualitative primary data was collected via a semi-structured telephone survey and two stakeholder workshops disseminated findings and sought feedback on the findings.

The findings indicated that both the Brisbane and Central Queensland network had slightly higher levels of collaboration during floods. Both networks featured high levels of reciprocity and trust, with only a low level of difficult ties reported.

The study observed differences relating to organisation type and valued network characteristics. Government organisations were more linked to top down approaches with clear network structures, and community organisations and industry to inclusive and flexible networks. Across the networks collaboration was said to be enabled by participant availability, common goals, information systems, trust and knowledge and barriers included 'siloed' approaches, bureaucracy, and lack of engagement.

More than half the participating organisations expected their collaborative arrangements to increase in future years, given the likelihood that climate-related disasters would also increase. The research highlighted network governance as means to understanding and enabling adaptive capacity.

Figure 6: The network of collaboration for Brisbane during routine operations and flood operation

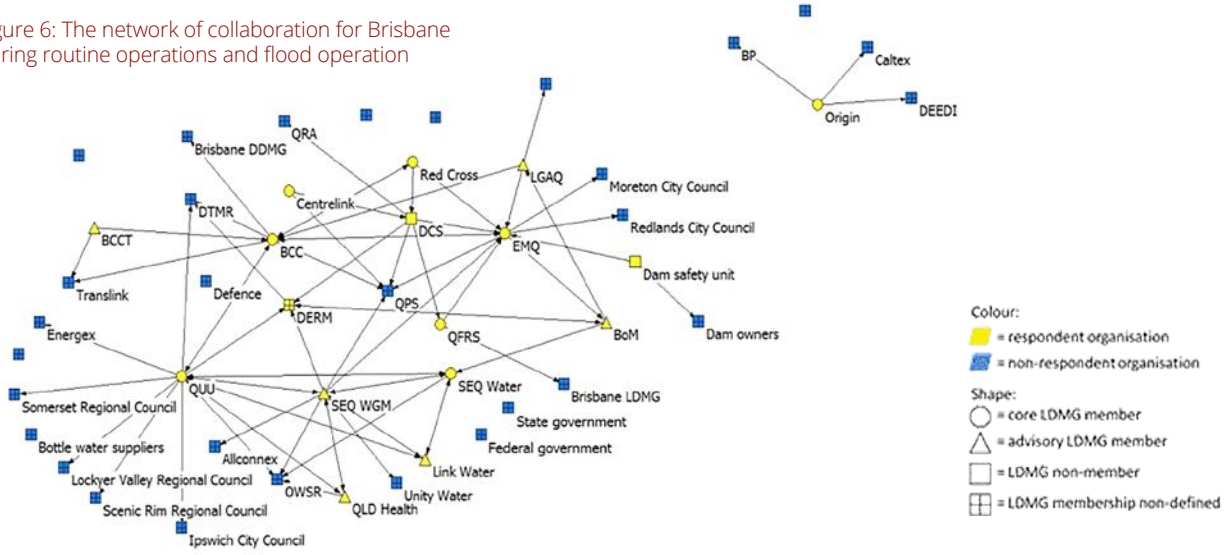
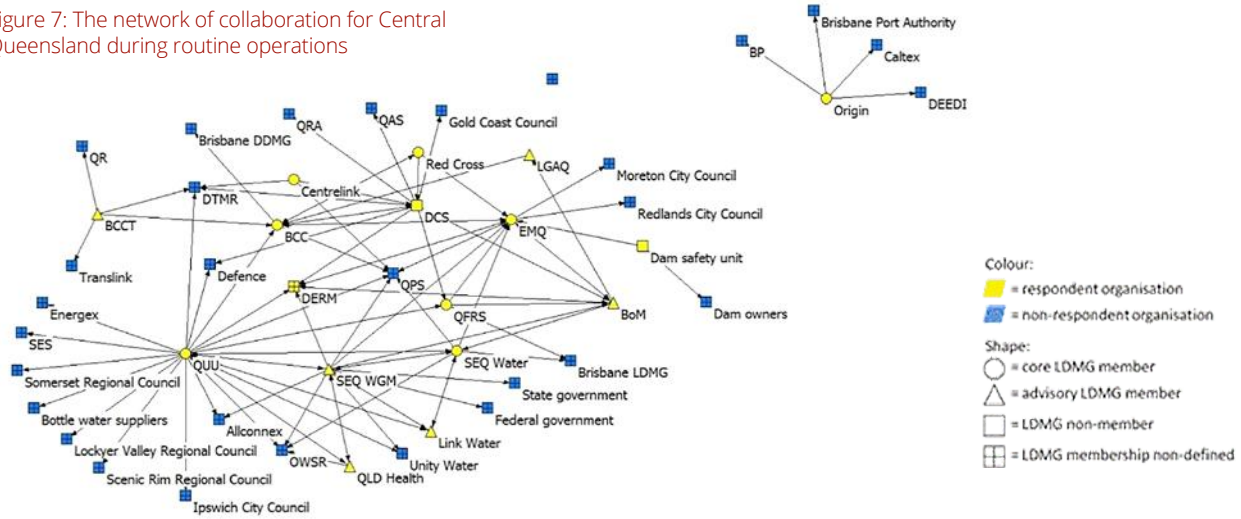


Figure 7: The network of collaboration for Central Queensland during routine operations



Healthy Aging Research Network

The following was extracted from Petrescu-Prahova, M., Belza, B., Leith, K., Allen, P., Coe, NB and Anderson, L, A (2015) Using social network Analysis to assess mentorship and collaboration in a public health network. Preventing Chronic Disease: Public Health Research, Practice and Policy, 12(150), 1-10.[12]

The Healthy Aging Research Network (HAN) created by the centre for Disease Control and Prevention in the United States undertook a study to examine the mentorship and collaboration within the network. Collaboration was defined by interaction between two or more partners that facilitates the sharing of knowledge and completion of tasks with respect to a mutually shared goal. It was measured by examining: published articles; in progress manuscripts; grant applications; tools; research projects; presentations. Mentoring included helping another person to improve their skills, understand the organisation, advice on career advancement or emotional support could occur formally or informally. 97 members were invited to participate in an online social networks survey and 63 completed the survey.

Network measures investigated included density, number of activities shared (tie strength) and centrality. 74 % of HAN members were connected through mentorship ties and all 97 members were connected through at least one form of collaboration.

Figure 8

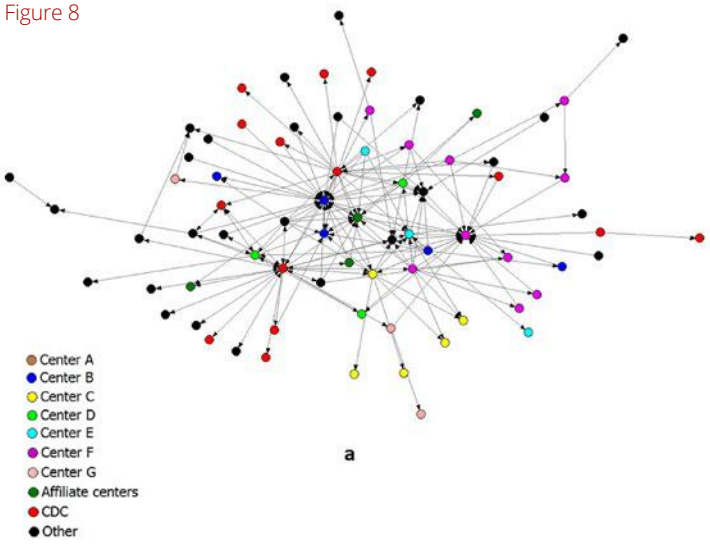
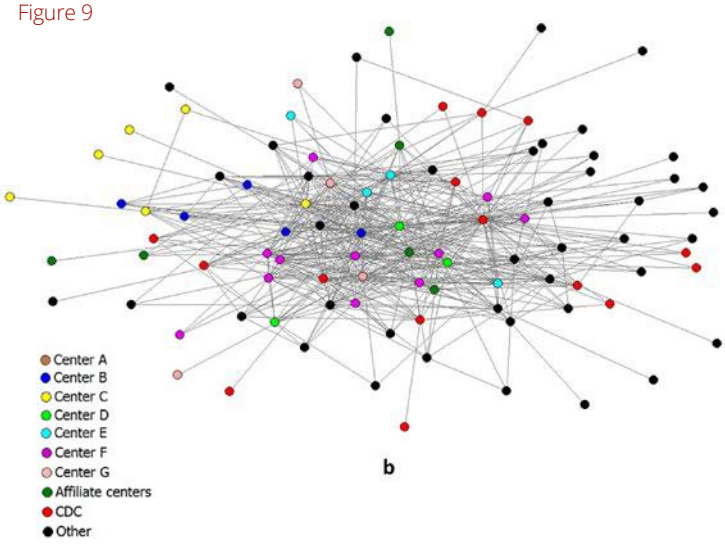


Figure 9



Sociograms of the individual-level mentorship (Figure 8) and collaboration (Figure 9) networks of the Healthy Aging Research Network members and partners.

The collaboration network is almost twice as dense as the mentorship network, with research projects as the largest type of collaboration ties and grant applications tools and presentations the most centralised collaborations.

Overall the research indicated that the HAN was successful in bringing together researchers and practitioners with different areas of expertise and at different stages of their career. Members reported that at least one activity of collaboration was as a result from the HAN and that the network possessed collective impact characteristics that enable collaboration: common agenda, shared measurement, reinforcing activities, ongoing communication and backbone support. Collaborative networks were observed not only for their ability to lever resources but to generate solutions that are not achievable by a single organisation – typical of complex problems like chronic disease prevention.

Social network analysis was acknowledged as a method matched to investigate complex systems like collaborative networks and that in the area of health prevention it was underused and future research may benefit from:

- Quantifying the benefits of network participation (with consideration to level of investment, knowledge transfer and creation)
- Examining the relationship between network structure and outcomes.

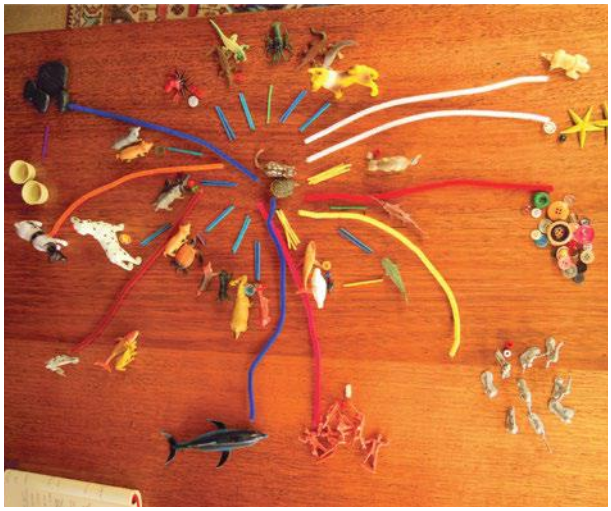
Research of this type was noted for its ability to support decision makers and funders evaluating the impact of public health collaborative networks.

Tasmanian Bush Fires

The following was extracted from Akama, Y., Chaplin, S and Fairbrother , P (2014) Role of social networks in community preparedness for bushfire. International Journal of Disaster Resilience in the Built Environment, 5 (3) 277 – 291, and Akama , Y. and Chaplin , S (2013) Understanding social networks for bushfire preparation. Fire Note 104, 1-4.[13,14]

The study was undertaken in the Kingsborough and Huon Valley municipalities in south east Tasmania. The research examined the role of social capital in place based communities during an emergency. Ten individuals were selected to participate in a detailed study based on their age, gender and involvement in their local community.

Figure 10



Interviews were complemented by design led methodology using objects called Playful Triggers to help participants to visualise the type of relationships in their personal network, (see Figure 10).

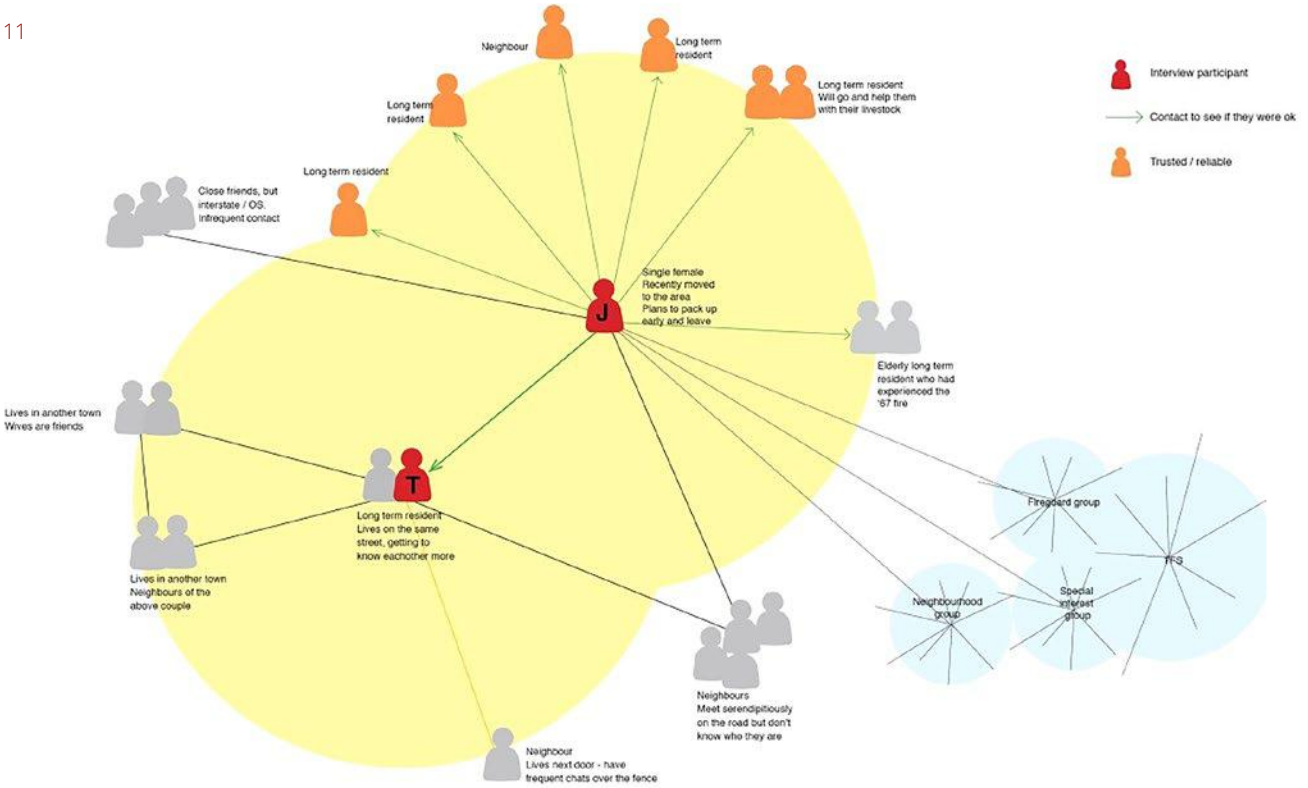
The research describes a long term male resident Male T in Figure 11 with an insular bonding network. Although he had knowledge of most of the local residents he said he would not contact or be contacted by anyone since his plan was to leave early. A new female resident, Female J moved into the neighbourhood very recently and had been using her professional networks to improve community preparedness, including developing a phone tree. Female J engaged Male T in preparedness activities when he had been previously difficult to engage.

The research noted the limitations of insular bonding networks. Some families had lived in the area for a long time and had little reason to go "past the family" and therefore had not expanded their social networks. Others that were normally defined as vulnerable (elderly, those living alone or geographically isolated) did not have family close but had people in their networks that they could turn to in the time of an emergency.

The research challenged traditional notions of vulnerability and "leaders" and highlighted that people's roles can be contextual and emergent. More generally types of social capital can be useful in understanding preparedness but the types of capital are unique to the place and situation and all social capitals can have a significant and interactive role to play. The research concludes that there is hidden social capital that is enacted in a time of an emergency, but that administrative boundaries can segregate places limiting the development of bonding and bridging capital.

The research encourages agencies to engage with community networks and support those who play important bridging and linking roles which in turn strengthens their potential for adaptive capacity in mitigating bushfire risk. It notes how the hazards literature acknowledges the role of agents of social change, champions, gate-keepers, and that some of these self-identify (e.g. volunteer) and others may not suspect that they are important in a network.

Figure 11



Flooding in Northern England

The following was extracted from Matin, N., Taylor, R., Forrester, J., Pedoth, L., Davis, B., Deeming, H and Fordham M (2015) Mapping of social networks as a measure of social resilience of agents, Stockholm Environment Institute, Stockholm, Sweden.[15]

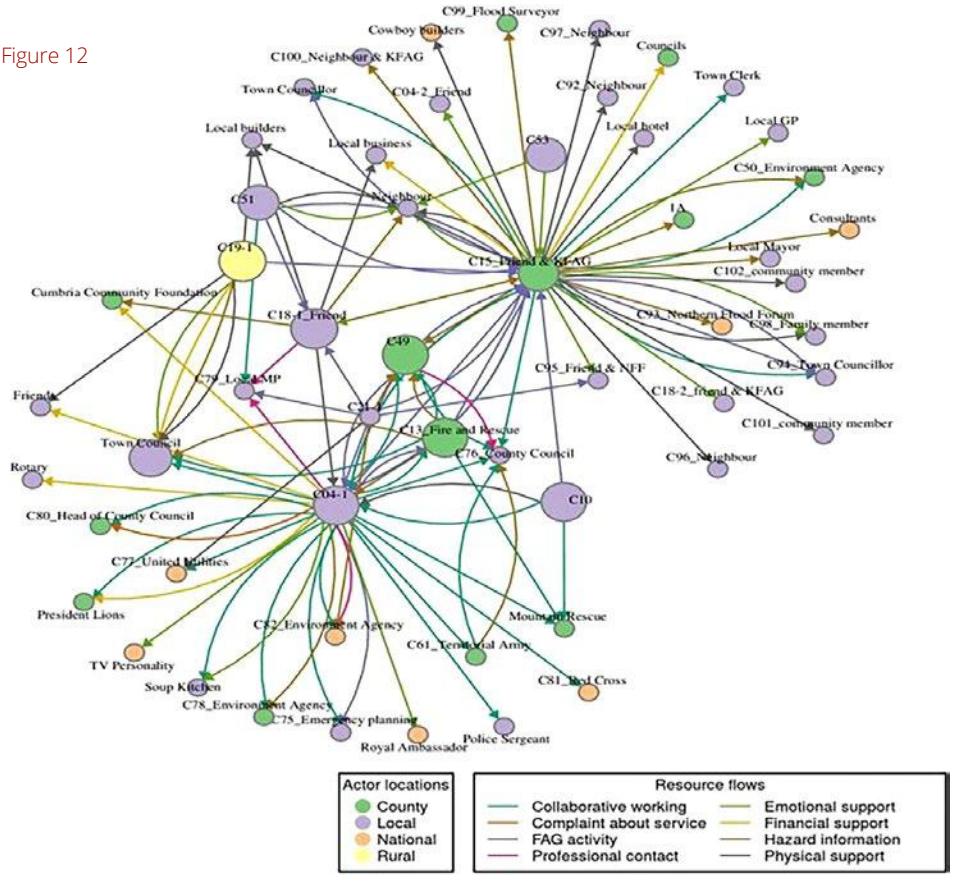
The study sought to understand the flow of resources and support between key disaster management agencies, businesses, community organisations and community members in Cumbria Northern England, following severe flooding in 2005 and 2009.

The study did not set out to undertake social network analysis but preliminary research indicated the usefulness of a network approach to understanding the complex roles and interactions in local disaster management activities. Data was collected from approximately 60 semi structured interviews and then used to analyse ties and attributes. Because social network analysis was determined post data collection challenges were met in boundary definition and incomplete data sets.

The research examined ties based on the following categories: mitigation, preparedness, response or recovery; type of activity (service complaint, collaboration, action group activity); frequency of interaction; quality of interaction (negative or positive); and types of social capital (bonding, bridging or linking). Attribute data was categorised according to: Council service or not; location (e.g. local, regional, national); sectors to which the actor belongs; (e.g. local or central government, third sector, private sector and environmental sectors) and gender.

Following the development of a network map with all 60 actors, the project sought to undertake an ego analysis of the two most central actors. The community-based Flood Action Groups were of particular interest due to their ability to access and distribute resources through their well-connected group members. A female and male actor from the Keswick Flood Action Group were selected for the ego study. The combined egonet studies C4 and C15 is pictured.

Figure 12



The study revealed that the higher the numbers of connected members are in a given community, the better off the community will be in its potential to access resources. When a number of well-connected individuals come together in a group, such as a flood action group, a pooling of resources increases the reach of the group and strengthens its ability to pull in even more resources.

The project also emphasised the cooperation between the Keswick Flood Action Group and institutions such as local councils and the environment agency, allowing local and scientific knowledge to be combined. This cooperation promoted locally based technical and community-based solutions. Risks of exclusion and equity were raised for comparable community based disaster management activity as resource mobilisations can often fall to those with the capacity to do so, and subsequently exclude others and their needs from the process.

The research concluded by acknowledging that all types of social capital – bonding, bridging and linking can have an important role play in disaster management. Dense networks with a diversity of vertical and horizontal ties link actors to local and national knowledge, skills and resources.

References

1. Borgatti, SP, Everett, MG and Johnson, J, C (2013). *Analyzing Social Networks*. London: Sage

2. Bodin, O, and Prell, C, et al. (2011). *Social Networks and Natural Resource Management: Uncovering the Social Fabric of Environmental Governance*. Cambridge: Cambridge University Press.

3. Keeley, B (2007). Human capital: How What You Know Shapes Your Life. *OECD Insights*, Paris: Organisation for Economic Co-Operation and Development.

4. Robins, G (2015). *Doing Social Network Research: Network-based Research Design for Social Scientists.* London: Sage.

5. Hanneman, RA and Riddle, M (2005). *Introduction to Social Network Methods.* Riverside: University of California

6. Kinnear, S, Patison, K, Mann, J, Malone, E and Ross, V (2013). *Network Governance and Climate Change Adaptation: Collaborative Responses to the Queensland Floods*, Gold Coast: National Climate Change Adaptation Research Facility.

7. Porter Novelli Global (2008). Flickr *Map of top 50 UK PR twitter people and their followers.* Viewed May 2016, Flickr < https://www.flickr.com/photos/porternovelli/3102296497>.

8. Provan, KG and Kenis, P (2008). Modes of Network Governance: Structure, Management, and Effectivenes. *Journal of Public Administration Research and Theory* 18 (2): 229-252.

9. Folke, C, Hahn, T, Olsson, P and Norberg, J (2005). Adaptive Governance of Social-ecological Systems. *Annual Review of Environment and Resources,* 30: 441-473.

10. Plummer, R, Crona, B, Armitage, DR, Olsson, P, Tengö, M and Yudina, O (2012). Adaptive Comanagement: A Systematic Review and Analysis. *Ecology and Society* 17 (3): 11.

11. IPCC (2014). *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: University Press.

12. Petrescu-Prahova, M, Belza, B, Leith, K, Allen, P, Coe, NB and Anderson, LA (2015). Using Social Network Analysis to Assess Mentorship and Collaboration in a Public Health Network. *Preventing Chronic Disease: Public Health Research, Practice and Policy,* 12 (150): 1-10.

13. Akama, Y, Chaplin, S and Fairbrother, P (2014). Role of Social Networks in Community Preparedness for Bushfire. *International Journal of Disaster Resilience in the Built Environment*, 5 (3): 277–291.

14. Akama, Y and Chaplin, S (2013). Understanding Social Networks for Bushfire Preparation. *Fire Note* 104, 1-4.

15. Matin, N, Taylor, R, Forrester, J, Pedoth, L, Davis, B, Deeming, H and Fordham M (2015). *Mapping of Social Networks as a Measure of Social Resilience of Agents*. Stockholm: Environment Institute.

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http://sggpcp.com/projects/enhancing-networks-for-resilience/

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