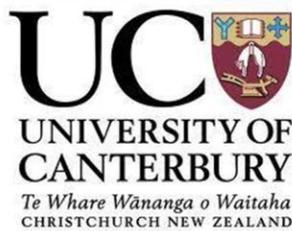


# Spatial Aspirations in the Red Zone

Euan Cox, Daniel Gilmour, Paul Goodhue,  
Lyndsey Kelly, Natalie Van Looy



# Table of Contents

<b>Executive Summary .....</b>	<b>3</b>
<b>Introduction.....</b>	<b>4</b>
<b>Theoretical Framework.....</b>	<b>4</b>
<b>Methods.....</b>	<b>6</b>
Social Data Methods .....	6
Spatial Data Methods .....	7
<b>Results .....</b>	<b>8</b>
Social Data Results .....	8
Spatial Data Results .....	10
<b>Discussion.....</b>	<b>13</b>
<b>Limitations.....</b>	<b>13</b>
<b>Conclusions.....</b>	<b>14</b>
<b>Acknowledgements .....</b>	<b>14</b>
<b>References .....</b>	<b>15</b>
<b>Appendices.....</b>	<b>17</b>

## **Executive Summary**

**Research Question:** What are the interests of community groups, how can they be spatially realised and what influence does their engagement have on disaster recovery: A study along the Avon-Otakaro Red Zone

**Context:** The Canterbury earthquake series beginning 4th September, 2010 caused widespread damage along the Avon-Otakaro River corridor. Over 400 hectares of land was deemed unfeasible to rebuild on, thus zoned red. The Avon-Otakaro Network (AvON) formed in response to the red zoning of residential land, with the aim of transforming the Avon-Otakaro corridor into a reserve and river park. The purpose of this project is to determine the interests of community groups affiliated with AvON, assess how these aspirations can be spatially realised within a GIS database, and to assess to what degree engagement within the groups has influenced their post-disaster recovery.

**Methods:** AvON-affiliated participant community groups were canvassed for semi-formal interviews, while physical datasets were collected freely from government organisations and crown research institutions to be integrated into a GIS database. Post-disaster recovery responses were analysed using a theoretical framework through comparisons to previous literature.

**Key Findings:** Through the integration of methodologies, an overlap of interests and aspirations was discovered and spatially realised within the physical constraints of the land. Distinct commonalities arose between responses and previous literature, suggesting the importance of connection to space and community engagement to facilitate recovery in a post-disaster environment.

**Limitations:** Limitations relate to sample size and time with regards to both the interview process and GIS analysis.

**Future Research:** Future research potential lies in the canvassing of non-AvON affiliated groups to provide contrasting perspectives on aspirations and constraints. In-depth investigation on the processes of post-disaster recovery between affiliated and non-affiliated groups would also be an area for future research. Additionally, the investigation of the implications of aspirations on communities outside the Red Zone would no doubt be valuable information.

## **Introduction**

We sought to investigate concepts of space attachment, community, participation and communication and the roles they have in personal post-disaster recovery. This report begins with a theoretical framework based on existing literature that has guided our investigation. Our methods and results are divided into social and spatial elements, respectively, as relating to our three-part research question.

In the aftermath of a natural disaster, the challenges of recovery faced by communities and decision-making authorities are complicated by differing perceptions of participation and communication. According to literature, communities embroiled in the reconstruction of devastated environments are likely to recover more successfully when greater levels of consultation are sought by decision-making authorities (Davidson, Johnson, Lizarradle, Dikmen, & Sliwinski, 2007). This is attributed to the sense of ownership created through consultative practice and the re-establishing of community connection created through interaction. Unfortunately, these processes are often time consuming and conflictual due to differing objectives, making consultation unappealing to governmental authorities (Smith, 2010).

Following the Canterbury earthquake series of 2010 and 2011, various Christchurch communities located along the banks of the Avon-Otakaro River suffered irreparable damage to their homes and surrounding natural environment leading to the permanent relocation of residents to lower risk areas. However, the sense of community prior to the earthquakes and the bonds strengthened through vulnerability has resulted in a reluctance to sever ties with pre-earthquake spaces of attachment. Through the desire to maintain connections with the Red Zone, the Avon-Otakaro Network (AvON) was established in early 2011 with the aim of rejuvenating and nurturing the long-term well-being of Christchurch by establishing a community-driven and science-informed living memorial. Their aim is “to turn tragedy into an opportunity, a polluted drain into a vibrant river system, and exhaustion and despair into hope and inspiration” (Smith, 2012). Various environmental, cultural, recreational, community, and economic areas of recovery and redevelopment are encompassed within the AvON vision. Reference Groups have been established that represent these visions and that engage with, and represent a community of interest (Avon-Otakaro Network, 2012). The main challenge currently facing AvON appears to be articulating and communicating their ideas to governmental authorities in the hopes of achieving implementation.

## **Theoretical Framework**

The Avon-Otakaro River has shaped the growth of Christchurch and its people and is a vital part of our identity as a city. Prior to European settlement in the 1830's, the land along the Avon-Otakaro river corridor was predominantly swamp and marshland (Wigram, 1916). Maori who lived in the region utilised this lively ecosystem as a key source of food and travel corridor. Early European use of the river mirrored that of the Maori, with the river serving as a key transport route and source of food and water. As the city expanded, the land along the corridor was transformed into farmland, which in turn was slowly subdivided into residential suburbs. As this urbanisation occurred, the banks of the river were transformed from their natural state into "beautified" and

groomed banks, planted with predominantly exotic English trees and areas of mown grass in an effort to create an English-type boulevard (Lamb, 1981).

The river has become steadily more polluted due to its use as a storm water and drainage outflow facility for much of the twentieth century (Horn, 2010). As the city has developed and grown, the use of the river corridor for recreational activities has increased particularly with rowing and kayaking groups. By the late twentieth and early twenty-first century, development of the region began to focus on environmental repair and preservation with increasing attempts to improve the water quality of the river and the establishment of Travis Wetland Nature Heritage Park in 1996 (Horn, 2010).

Urbanisation continued in eastern areas with the development of more residential housing in suburbs such as Bexley. The rich history of the Avon-Otakaro corridor highlights its significance within Christchurch.

Much disaster literature focuses on the psychological impacts natural disasters have on survivors. Following the Indonesian tsunami of 2006, the World Health Organisation recognised the need to implement psychological support systems in post-disaster environments to stem the rate of Post Traumatic Stress Disorder (PTSD) evidenced (Herrman, 2012). Much debate exists as to what the causes of PTSD are and whether it is an appropriate term to describe the behaviour evidenced amongst survivors (Summerfield, 2006). What is undisputed is the detrimental impact natural disasters have on mental health and the association it has with the degradation of physical environments (Carroll, Moreby, Balogh, & Araoz, 2009; Herrman, 2012; Johnston, Becker & Paton, 2012; Summerfield, 2006). The decline of mental health relative to physical and social environments is largely attributed to people's attachment to space as everyday life is mostly localised; our homes, places of work, activity, routines and communities (Carroll et al., 2009; Li, Airriess, Leong, & Keith, 2010). As we create meaning out of experiences, our identity becomes increasingly tied to the physical spaces we inhabit (Perkins & Thorns, 2012). Research suggests that PTSD is the result of insecurity and uncertainty as bonds with spaces are broken. People and communities are often forced to relocate; losing personal relationships, livelihoods, homes, possessions and ultimately identities, but yet it is these attachments that prevent them from moving on (Li et al., 2010; Carroll et al., 2009; Dugan, 2007; Herrman, 2012).

Summerfield (2006) stated "Recovery' is not a discrete process: it happens in people's lives rather than in their psychologies" (p. 256) suggesting that one of the best methods of PTSD prevention is the re-establishment of normality, thus the spaces of attachment must be quickly reconstructed. Carroll et al. (2009) agree but note that the same level of pre-disaster normality is often unachievable. In the process of post-disaster reconstruction, community participation is deemed to be the most important aspect, with Johnston et al. (2012) highlighting the reduction of anxiety in post-disaster victims through consultation processes related to building community resilience.

The activities of AvON display these elements of building community resilience and attachment to space. Whilst recognising that many residences are no longer inhabitable, their desire to maintain connections to the Red Zone have manifested in the formation of a new community network and various land use proposals. Whether their involvement has facilitated PTSD reduction or the formation of new, but positive, subjectivities is unknown.

Community involvement is a crucial part of post-disaster recovery and without effective participation and communication within a community, recovery is slow and resilience can be lost. Communication within the community is an important factor in community participation as it facilitates strong social ties or networks with its members (Bird, Chaque-Goff, & Gero, 2011; Patterson, Weil, & Patel, 2009; Forbes, Jones, & Reupert, 2012). Powell (2011) explores the benefits of bottom-up participative approaches to post-disaster reconstruction in Gujarat, India. The findings of his article indicate that involvement in the construction of housing creates pride, a sense of self, and belonging to the community and the new infrastructure. Owner driven approaches encompass the sharing of knowledge, time and resources with the community allowing them to focus on recovery and involvement, which in turn boosts the resilience of the community. Davidson et al. (2007) express in depth the positive outcomes from bottom-up approaches and contrasts them with top-down approaches which often have negative impacts on community recovery and can establish resentment towards officials and create an 'us' against 'them' mindset.

The engagement of the community in post-disaster recovery and management can aid in the communities ability to re-establish and can guide communities towards a better outcome (Lawther, 2010). Effective communication between government officials and the community has many positive effects for long-term recovery and resilience and needs to be in the forefront of official's minds (Patterson et al., 2009). Resource funding from outside investors can help quicken recovery efforts. However, as investors become more involved the community can feel excluded, resulting in a negative outcome (Smith, 2010). The more communities are involved, the better the recovery outcome is likely to be, and the traumatic events of the disaster will fade with time as the community becomes, once more, resilient.

AvON appears to be at the communicative stage of the recovery process in which their ideas relating to land use need to be articulated to decision-making authorities, a necessary step in order to achieve implementation. As AvON's objectives are geographically defined, so too should they be geographically articulated, hence digital maps appear to be the key to their success. It is undetermined whether ownership of land use ideas will be maintained following the consideration from governmental authorities such as the Christchurch City Council (CCC) and the Christchurch Earthquake Recovery Authority (CERA). The aim of this research is to investigate community aspirations, how these aspirations can be spatially realised as an effective communicative tool, and the influence of community, communication, and participation on post-disaster recovery.

## **Methods**

### *Social Data Methods*

Our research methodology consisted of semi-formal interviews and focus groups with both closed- and open-ended questions. Research interviews took place between 16th August and 5th September, 2012. Participants included representatives from Christchurch community groups affiliated with AvON that belong to particular Reference Groups. AvON affiliated groups were canvassed for interviews through the recommendation of Bryan Jenkins, a member of the Strategy Group for AvON, and our project mentor.

Through his recommendation and contacts we interviewed five groups: Lower Avon Heritage Trail, Forest and Bird, Christchurch Community Gardens Association, Sport Canterbury, and River of Life. The interview questions remained relatively consistent between the groups where applicable, however sub-questions were asked as needed during the flow of conversation to gain a better understanding of the groups' and their aspirations. Some questions were also reworded as needed to make applicable to particular groups, most notably regarding questions specific to proposals. Our semi-structured approach was required due to our inability to know or assume themes or issues that would arise during the flow of conversation. A more structured approach would have resulted in the incorporation of pre-existing assumptions.

Our interviews covered three primary themes (refer to Appendices A & B). Part I asked questions regarding community groups' interests and key goals in the Red Zone. This provided important background information of the group to aid further questioning while providing an opportunity for the groups to express their objectives and key interests in their own words. Part II asked questions regarding the spatial needs of the community groups seen as critical to realising their vision. This information guided our GIS analysis. Finally, Part III sought to determine the extent to which the Canterbury earthquake series has affected their members and influenced post-disaster recovery. This information contributed to our theoretical analysis in which we analysed community, communication, and participation factors and their influence on post-disaster recovery.

### *Spatial Data Method*

Spatial analysis was carried out on the Avon-Otakaro Red Zone to determine the physical limitations to spatial allocation of proposed features as discovered in our interviews. This analysis was achieved using spatial and non-spatial datasets obtained freely from primarily government organisations and crown research institutions. Electronic datasets were gathered from CCC, CERA, Landcare Research, Land Information New Zealand (LINZ), and the National Institute of Water and Atmospheric Research (NIWA). Spatial data hardcopies were obtained from Ngai Tahu and the Heritage Trail group and digitized into electronic copies.

Using a dataset from CERA of the different CERA land zones in Christchurch, the area of the Avon-Otakaro Red Zone was extracted, which became the focus of our spatial analysis. The initial spatial analysis involved a survey of the physical changes to the land as a result of the Canterbury earthquakes. This involved analysing two Light Detection and Ranging (LiDAR) datasets obtained from CCC. These two LiDAR datasets were aerial surveys of the land that were carried out in July 2003 and May 2011, providing pre- and post-earthquake comparisons. From these two LiDAR datasets, ground elevation models were derived using Inverse Directional Weighting (IDW) interpolation, as outlined in Babak and Deutsch (2009).

The two ground elevation models, for July 2003 and May 2011 respectively, were the basis of further analysis to determine changes in ground elevation and changes to tidal flooding as a result of the earthquakes. Simple map algebra was used to determine the changes in land elevation between 2003 and 2011. The two ground elevation models were then used to compare the normal maximum high tide levels between 2003 and 2011. This comparison was achieved by deriving a mean normal maximum high tide level from LINZ tidal data and predictions for every tide from 2010 through to 2014 inclusive, and

portraying this relative to mean sea level as ‘bathtub’ flooding models. In this approach, a cell is flooded if it’s elevation is below the projected maximum high tide level, and each cell is treated individually with no connectivity taken into account (Poutler & Halpin, 2008). Tidal flooding analysis was also analysed using the 2011 ground elevation model, the derived maximum high tide models, and projected sea levels for the years 2040 and 2090 based on NIWA predictions.

The final part of our spatial analysis involved mapping the proposed features in the Avon-Otakaro Red Zone based on the proposals and physical land constraints as identified in the interviews. This was accomplished using the analysed constraints, gathered datasets and the proposed features from the community groups.

## **Results**

### *Social Data Results*

Results from Part I of our interview portray a clear overlap in interests, providing a positive affirmation of AvON’s progress. Interests and objectives between the five community groups interviewed can be broken down into two main themes: community and environment. Key terms that were raised regarding community aspirations included: the enhancement of social connections, community well-being, revitalisation (especially of Christchurch’s “garden city” image), economic development, and the expansion of recreational opportunities to encourage activity. Education and history were also key points of interest especially with regards to understanding natural processes in an urban environment. Key terms regarding environmental aspirations included: biodiversity, sustainability, access to fresh and healthy food, resource management (particularly in regards to river health and flood management), and the preservation of built and natural heritage sites. Regardless of specific proposals or projects, a central objective among the groups interviewed supports a sustainable, socially, and economically viable land use option, and see the earthquake as an opportunity to transform the land into something that enhances Christchurch’s image.

Despite these distinct overlaps in interests and objectives, various political and social constraints were identified as limiting, or potentially limiting, aspirations. Constraints varied according to the community group, and their progress in the realisation of aspirations. The Christchurch Community Gardens Association identified the need for co-ordination facilitation roles as a primary constraint: "There are different levels in which you can become involved ... we're nowhere near the stage where somebody is actually beginning to co-ordinate that interest and apply it to something like a specific project." The challenge of “generating volunteers” and “maintaining energy” was also identified. With regards to political constraints, the Heritage Trail group identified CERA as a primary constraint in hindering the progress of their proposal. As they were the only community group interviewed with an official proposal, so too were they the only group to acknowledge political constraints. Additionally, integrating the interests and objectives of various community groups was acknowledged by Sport Canterbury as a challenge moving forward.

Part III of the interview revealed valuable information regarding the influence of the Canterbury earthquake series on community groups. All groups agreed their current

interest in the area had been strengthened by the earthquake events and the opportunity for change that has been created. Those that also had previous, but different interest in the area were the Heritage Trail group, River of Life, and Sport Canterbury (the latter on behalf of previously active sports groups in the area). Those that made reference to emotional or personal attachment to the area were the Heritage Trail and River of Life groups with the former expressing it was "...my sense of loss..." that inspired involvement. Sport Canterbury indicated that the earthquake and Red Zone events had created job opportunities for them, clearly stating it had personally affected them but not emotionally.

Question eighteen aimed to assess whether their involvement had facilitated post-disaster recovery on a personal level. All interviewees agreed that participation with AvON had facilitated their own personal recovery in some way. The Christchurch Community Gardens Association, for example, noted: "It's really important for community well-being that they have something positive to get stuck into and that's inherently, across the board, healthy and good." Opportunity to change their physical and social environments for the better was also a source of inspiration and can be evidenced in this quote from River of Life "Opportunity to do things differently [to before] is what drives me."

The Heritage Trail group discussed how involvement in their proposal had taken time away from other things, resulting in higher levels of stress, with one respondent saying: "It has held us back ... I mean it's taken a huge amount of time and energy that really should be directed at other things." The other respondent noted: "We envisaged that his retirement [referring to husband] would mean we had time to travel, time to write his book, and time to pursue some of our interests. It's all gone west." They identified CERA as the primary cause for this stress, noting that in the absence of this constraint the process of creating something "useful and beautiful" would be "joyful" and "uplifting." The desire to save the community remained a primary source of motivation, and the positive personal impacts this process has had would inspire them to do it all again if forced to.

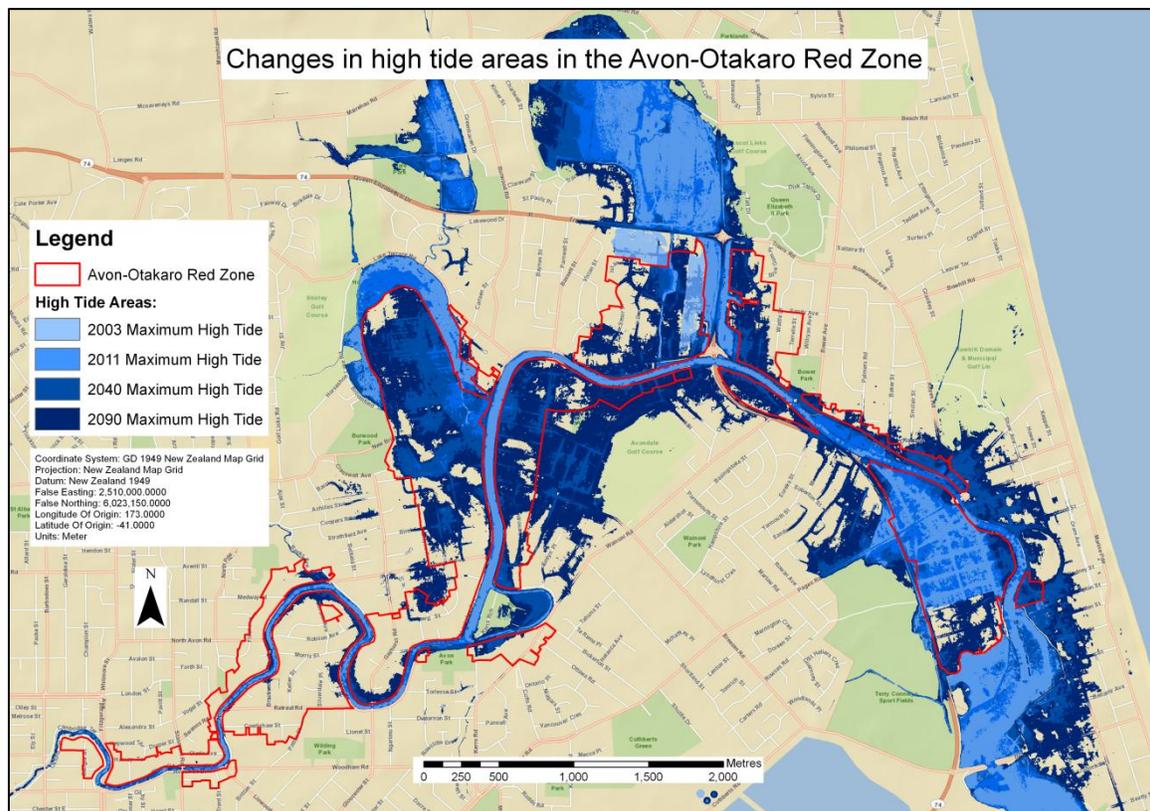
When investigating the impacts of participation amongst members of other community groups, River of Life cited that for other members of the wider AvON community group, the initiatives that were being put forward helped create social and fiscal security that in turn helped members on a personal level. River of Life also stated that their particular focus on spiritual and ecological well-being of the river helped people process loss and recovery in their own way; the group simply provided the space and opportunity to address this. The way in which AvON has recreated a sense of community and provided the opportunity for connectivity with other parts of Christchurch City, was cited as part of a wider resilience strategy that provided strength and security to members.

Communication and participation are two key elements influencing post-disaster recovery and processes of decision-making. River of Life was acutely aware of this. When asked what part of the project they consider most important if only one aspect was to be realised, they stated that it is the "... process that is the most important thing ... Community lead ... Science informed."

### Spatial Data Results

Various physical constraints were identified by AvON and affiliated community groups that could potentially influence the progress of their aspirations. Such constraints include: changes to high tide levels, flooding vulnerability, and horticultural soil classes. Furthermore, the Heritage Trail group have identified multiple sites of environmental or historical significance, as spatially outlined in Figure 3.

The results from the flooding analysis can be seen in Figure 1 below. This map shows the maximum normal high tide level based on the LINZ tidal data and predictions, and the ground elevation models for 2003 and 2011 respectively. The future flooding predictions for the years 2040 and 2090 are based on NIWA mean sea level predictions for those specific years and the 2011 ground elevation model. Although the changes in tidal flooding zones have changed between 2003 and 2011, we believe that this is caused primarily by the changes to land elevation as a result of the Canterbury earthquakes, and not by a rise in mean sea level like the 2040 and 2090 predictions. This flooding analysis shows that most of the flooding will occur along the Avon River, with the exception of the Bexley suburb, Travis Wetland, and the Horseshoe Lake Reserve (refer to Appendix B). The results from this analysis outline limitations to the spatial allocation in the Avon-Otakaro Red Zone.

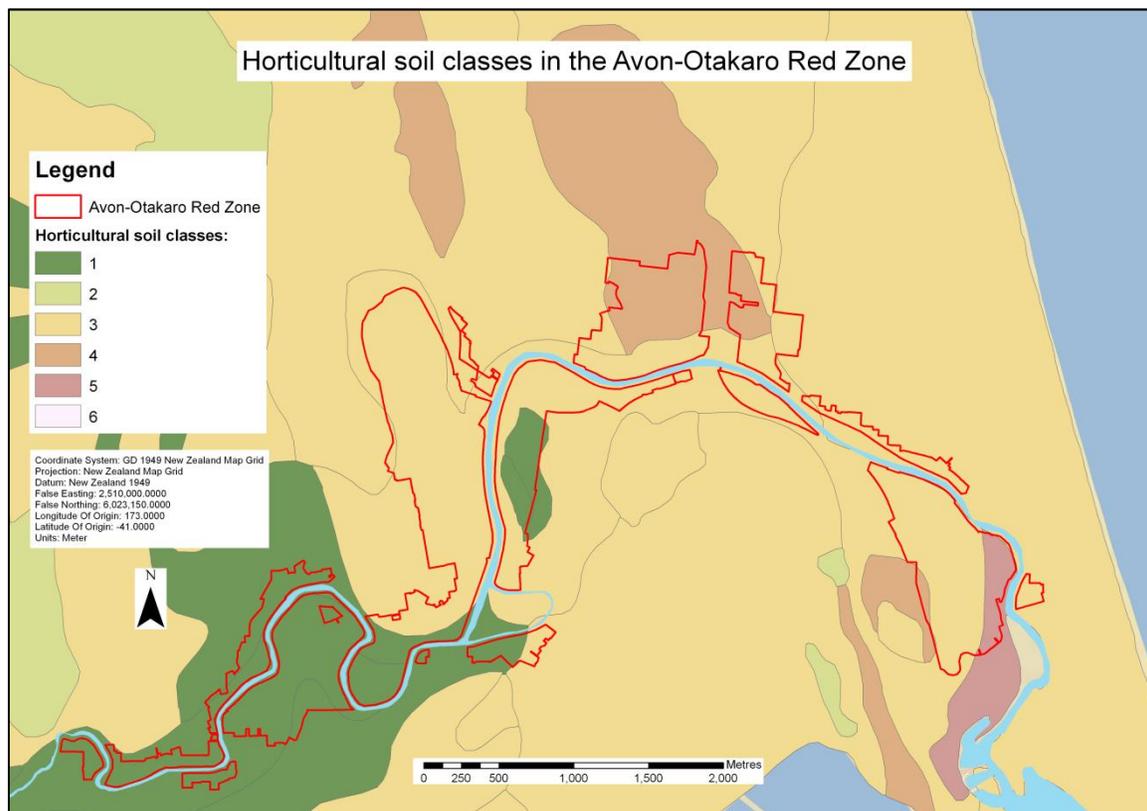


**Figure 1:** Changes in high tide from 2003 to 2090 in the Avon-Otakaro Red Zone

The Christchurch Red Zone along the Avon-Otakaro corridor has three prominent soil classes. There are up to six soil versatility classes in the classification produced by Landcare research (Webb, Smith, & Trangmar, n.d). Each soil class is comprised of different material, with Class 1 soils being the most preferable, whilst Class 6 is the least. The Red Zone is predominately Class 1, 3, and 4 soils.

Class 1 soils are highly versatile capable of very high yields of many horticultural crops. There is little to no need for soil management such as addition of nutrients or intensive management. These areas are suited for urban agriculture or community gardens (Webb et al., n.d). Much of the Red Zone consists of Class 3 and Class 4 soils that are not suitable for crop production without large inputs and intensive management. Although these soils are defined as arable, many crops cannot be grown or the production of some crops is consistently lower for these soil classes. These areas would be better suited to native vegetation rejuvenation or for recreational use.

Many groups have outlined aspects of importance in the spatial realisation of their aspirations within the Red Zone. The horticultural soil classes are particularly relevant to proposals concerned with urban agriculture or community gardens. The Christchurch Community Gardens Association identified Class 1 and Class 2 soils as most suitable for community garden schemes. Recreational aspirations of Sport Canterbury, on the other hand, could potentially be realised where higher rated soil classes are prevalent (i.e. Class 3 and above), as soil classes were not identified as a constraint. Forest and Bird have identified Travis Wetland as critical to their aspirations as these areas have poorer soils but are suitable for native vegetation rejuvenation.



**Figure 2:** Horticultural soil classes in the Avon-Otakaro Red Zone as defined by Landcare research



## **Discussion**

Disruption to space attachment as a result of natural disaster events has been noted as a contributing factor to the production of negative subjectivities and the growth of mental health disorders such as PTSD (Dugan, 2007). Given that many members of AvON are former Red Zone residents and have been forcefully relocated would suggest that they have experienced such disruption and may be further developing negative subjectivities. Through participation with AvON the opportunity to retain more involved connections with physical and social spaces in the Red Zone has been provided. By asking how involvement with AvON has facilitated the recovery of members we were able to gauge whether the literature was correct in suggesting that maintaining connections to space is an essential part of the recovery process. Maintaining connections with space through participation with AvON appears to have assisted disaster recovery, with only positive responses cited. No responses have been cited suggesting negative effects of involvement (in the absence of cited political constraints by Heritage Trail).

Some of the key factors noted in the literature as essential to effective post-disaster recovery are community, participation, and communication (Davidson et al., 2007; Johnston et al., 2012; Powell, 2011). Whether consciously or unconsciously, AvON has managed to successfully incorporate these aspects into their missions and objectives to varying degrees. The interview questions were not tailored to investigate these elements of successful recovery separately but sought a more integrated approach. By non-suggestively questioning whether involvement has affected their process of earthquake recovery, a clear depiction of the impacts of involvement was gained. Through participation they have been given choices rather than forced decisions allowing them to process needs and desires related to space attachment. It has also included them in decision-making for the future, leading to empowerment as opposed to the disempowering process of top-down decision-making and enforcement (Davidson et al., 2007). The information gained from the interview process regarding community aspirations, and their integration into a GIS database provided an effective communicative tool in which to further their participative endeavours with decision-making authorities.

## **Limitations**

The main limitations we encountered relate to sample size and time. As we only interviewed key members of AvON, we were only able to gain a small scope of the ways community participation has facilitated post-disaster recovery. If we had more time we would perhaps change some of the interview questions to reveal more specific information. This then would require us to re-interview all participants, something neither the participants nor us had likely time for. Overall, results can only be said to be indicative of trends, potentially serving as a preliminary analysis for future research on social impacts of community participation in post-disaster recovery.

We also identified limitations with our spatial analysis. This was mainly in the use of 'bathtub' flooding models for the tidal flooding analysis. As stated in the methodology, this type of model does not take into account the connectivity of cells; therefore each cell is treated individually. This can return erroneous results, as flooding is

less likely to occur in such a uniform way and in areas that are disconnected from the flooding source. However, we determined that ‘bathtub’ flooding models were sufficient for this project as they are good indicators of areas that are potentially prone to flooding, and more in-depth flooding models would be beyond the scope of this project.

## **Conclusions**

The struggles faced in the wake of the newly emerging post-disaster Christchurch display the strong connection between community and attachment to space. The social data gathered reflects the need to retain these bonds through communication and participation. AvON has ensured that community ties remain, creating a community-driven bottom-up process. The Canterbury earthquakes shook the land and the community creating an atmosphere of vulnerability. As community groups reconnect these bonds between communities, they increase the likelihood of resilience. Attachment to space has been a major driving factor for community involvement. Although the earthquake has caused damage to the city, so to has it created a clean slate for the community to have ownership of space. The top-down processes in post-disaster recovery usually hinder the ability for societal recovery. Community driven approaches allow the community to become involved and this aids them in embarking on the journey back to resilience. Spatially articulating community aspirations through the utilisation of GIS can effectively communicate ideas and potentialities, which allow the community to engage at a greater scale and brings them closer to the realisation of proposals. A struggle remains with communication between government organisations and community groups such as AvON. The ability to create mutualism between these two groups will construct a new and resilient Christchurch, one made by the people for the people.

Future research potential lies in the canvassing of non-AvON affiliated groups to provide contrasting perspectives on aspirations, constraints, and processes of post-disaster recovery. In-depth investigation on the processes of post-disaster recovery between contrasting groups would also be an area for future research. Additionally, the investigation of the implications of aspirations on communities outside the Red Zone would no doubt provide valuable information.

## **Acknowledgements**

We would like to acknowledge Bryan Jenkins and the Avon-Otakaro Network, including: Lower Avon Heritage Trail, Forest and Bird, Christchurch Community Gardens Association, Sport Canterbury, and River of Life for their time and thoughtful responses to our interviews. We would also like to acknowledge the sources from which spatial data was obtained, which include: Ngai Tahu, Christchurch City Council, Land Information New Zealand, Landcare Research, Christchurch Earthquake Recovery Authority, and the National Institute of Water and Atmospheric Research. And finally, many thanks to Professor Ross Barnett and the Geography Department at the University of Canterbury for assistance and access to instrumental and academic support.

## References

- Avon-Otakaro Network. (2012). *AvON Ōtakaro Network: Structure 2012*. Retrieved September 28, 2012, from <http://www.avonotakaronetwork.co.nz/AvON-Otakaro-Network-Structure.pdf>
- Babak, O. & Beutsch, C.V. (2009). Statistical approach to inverse distance interpolation. *Stochastic Environmental Research and Risk Assessment*, 23(5), 543-553.
- Bird, D.K., Chague-Goff, C., & Gero, A. (2011). Human response to extreme events: a review of three post-tsunami disaster case studies. *Australian Geographer*, 42(3), 225-239.
- Brown, H., & Norton, T. (2011). *Interim Land Management Options For Christchurch Residential Red Zones*. Christchurch NZ. Te Runanga o Ngai Tahu.
- Carroll, B., Morbey, H., Balogh, R., & Araoz, G. (2009). Flooded homes, broken bonds, the meaning of home, psychological processes and their impact on psychological health in a disaster. *Health & Place*, 15(2), 540-547.
- Davidson, C.H., Johnson, C., Lizarradle, G., Dikmen, N., & Sliwinski, A. (2007). Truths and myths about community participation in post-disaster housing projects. *Habitat International*, 31(1), 100-115.
- Dugan, B. (2007). Loss of Identity in Disaster: How Do You Say Goodbye to Home? *Perspectives in Psychiatric Care*, 43(1), 41-46.
- Forbes, R.J., Jones, R., & Reupert, A. (2012). In the wake of the 2009 Gippsland fires: Young adults' perceptions of post-disaster social supports. *Australian Journal of Rural Health*, 20(3), 119-125.
- Herrman, H. (2012). Promoting Mental Health and Resilience after a Disaster. *Journal of Experimental & Clinical Medicine*, 4(2), 82-87.
- Horn, C. (2010). *Waitaha wai Waterways of Christchurch*. Christchurch NZ. Environment Canterbury.
- Johnston, D., Becker, J., & Paton, D. (2012). Multi-agency Community Engagement During Disaster Recovery: Lessons from two New Zealand earthquake events. *Disaster Prevention and Management*, 21(2), 252-268.
- Lamb, R. C. (1981). *From the Banks of the Avon: The Story of the River*. Wellington NZ. A.W Reed Ltd.

- Lawther, P.M. (2009). Community involvement in post-disaster re-construction- a case study of British red cross Maldives recovery program. *International Journal of Strategic Property Management*, 13(2), 153-169.
- Li, W., Airriess, C., Leong, A., & Keith, V. (2009). Katrina and Migration: Evacuation and Return by African Americans and Vietnamese Americans in an Eastern New Orleans Suburb. *The Professional Geographer*, 62(1), 103-118.
- Patterson, O., Weil, F., & Patel, K. (2010). The Role of Community in Disaster Response: Conceptual Models. *Population Research and Policy Review*, 29(2), 127-141.
- Perkins, H. & Thorns, D. (2012). *Place, Identity & Everyday Life In a Globalizing World*. Great Britain: Palgrave MacMillan.
- Poulter, B. & Halpin, P.N. (2008). Raster modelling of coastal flooding from sea-level rise. *International Journal of Geographical Information Science*, 22(10), 167-182.
- Powell, J.P. (2011). Post-disaster reconstruction: a current analysis of Gujarat's response after the 2001 earthquake. *Environmental Hazards*, 10(3), 279-292.
- Smith, E. (2012). *Avon-Ōtakaro Network Submission on Draft Annual Plan Christchurch Ōtautahi 2012-2013*. Retrieved September 28, 2012, from <http://www.avonotakaronetwork.co.nz/AvON-CCC-Annual-Plan-Submission.pdf>
- Smith, G. (2010). Lessons from the United States: Planning for post-disaster recovery and reconstruction. *The Australasian Journal of Disaster and Trauma Studies*, 2010-1.
- Summerfield, D. (2006). Survivors of the tsunami: dealing with disaster. *Psychiatry*, 5(7), 255-256.
- Webb, T.H., Smith, S.M., & Trangmar B.B. (n.d). Land Resources of Christchurch City. Retrieved September 15, 2012, from <http://iris.scinfo.org.nz/file/208-land-resources-of-christchurch-city/>
- Wigram, H. F. (1916). *The Story of Christchurch New Zealand*. Christchurch NZ. Lyttelton Times Co.

## Appendices

### Appendix A: Interview questions

#### Part I. Key goals of the community group

1. How many members are in your group? How many are active members?
2. What suburb(s) of Christchurch is (are) your group from and most active with?
3. How did your group's involvement in the Red Zone come about?
4. What are your group's key interests?
5. Do you have a current proposal regarding the future use of the Red Zone?
6. Are you involved with any other community groups in the process of realising your objectives? If so, who?
7. Is the Council involved in your proposal?
8. How far along in the political process are you in realising your vision?
9. Why is your proposal of value for the future of Christchurch?

#### Part II. Areas of spatial realisation

10. What areas of the Avon-Otakaro Red Zone do you see as critical to realising your vision?
11. How much land area is needed to realise your vision? (to be outlined on map by group if applicable)
12. What are the primary physical or social constraints you see limiting your project?
13. What is the anticipated timescale for the completion of your proposal?
14. What component of your proposal do you see as most important, and that you'd like to see realised?
15. How much land area is needed to realise this component? (to be outlined on map if applicable)
16. What area of the Avon-Otakaro Red Zone do you feel best suits this component?

#### Part III. Impact of the earthquake on community group

17. Have your interests in the Avon-Otakaro River been influenced by the earthquake?
18. How has your involvement in this project affected your earthquake recovery?
19. How has the earthquake affected the involvement of your members?

Appendix B: Red Zone Map used to supplement interview questions 11 & 15

