Rapid literature review of impacts of severe weather and effects of long term climate related issues on communities

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Summary

This rapid literature review for the Scottish Communities Climate Action Network (SCCAN) forms part of a two stage piece of research to increase understanding of the awareness of climate change and the likely impacts of climate change on communities in Scotland. The literature reviewed, therefore is for places that have comparable systems of government/governance and/or climate to the Scottish context. The research questions for this literature reviews are:

- What are the impacts on communities following severe weather events?
- What are the effects on communities of long term climate related issues?

This is a rapid literature review of academic and grey literature, undertaken over a short timescale, so is not an exhaustive review of all available literature. Further research may be required to explore some of the issues identified in more detail.

Search terms used were: impacts, communities, severe weather events, climate change, Scotland, long term.

Key findings from the literature of impacts on communities of severe weather events:

That flooding is one of the most significant climate change challenges facing the UK. Flooding can have a number of adverse short to long term impacts, including injury, death, loss of livelihoods, damage/destruction of structures and infrastructure, loss of assets and fracturing or uprooting of communities. Small and medium businesses will be exposed to increased property insurance and excesses costs in the event of a future flood event, which may have implications for ongoing viability of some SME businesses.

People affected by flooding are more likely to experience adverse health outcomes, both direct, such as injury or death, or indirect, such as an increased risk of infectious disease outbreaks. The operation of health care services can also be impacted by extreme weather events through their effects on the built, social, and institutional infrastructures, at a time when demand for the services may increase. Extreme weather conditions in the UK are having a detrimental impact on people's mental health, with those who experience storm or flood damage to their home having poorer mental health. Mental health problems as a result of severe weather events are attributable in particular to displacement through a loss of sense of place and those affected are disproportionately from more deprived communities/socio-economic groupings.

Wellbeing in general was also shown to be adversely impacted for those who had to be evacuated during a flood event, compared to those who stayed in their homes through a 'fracturing' of community relationships. Negative wellbeing outcomes are linked to ongoing

insecurity from concerns about future flood events and other material and socio-economic consequences from flooding. Forms of social capital and relations in a community have been found to play an important role in mitigating the adverse consequences to wellbeing from flood events.

Key findings from the literature on the long term impacts of climate change and severe weather events on communities:

Most of the literature reviewed was on coastal communities, which is unsurprising given they face the combined climate and socio-economic challenges and also relevant for Scotland, as coastal communities make up 41% of the total Scottish population. The majority of the literature focused on climate adaptation, recognising that impacts of climate change are already present and affecting coastal communities. More than 80 flood prevention schemes are in place across Scotland, but the Scottish coastline is the least protected in the UK, with only 7% lined with coastal defence works or fronted by artificial beaches. Almost 20% of Scotland's coastline is at risk of erosion within the next 30 years. Around 27,000 properties across Scotland's coastline are at risk from a one in 200 year coastal flood event.

Coastal adaptation planning at a local level will become increasingly important, as risks of coastal erosion and inundation increase. Meaningful engagement of local communities in adaptation planning at an early stage is crucial. In doing this, it will be important to recognise that imbalances in power, resource and capacity may limit the ability of disadvantaged individuals and communities to adapt to climate change, thereby exacerbating inequalities, so steps need to be taken to engage with these individuals and communities from the early planning stages to minimise adverse impacts. Whilst incremental adaptation strategies do provide communities with short-term solutions to climate risks, this is not sufficient to protect communities from greater risks in the future. Adaptation planning includes relocation of communities. There are a number of challenges that need to be addressed in such circumstances, including loss of assets and reduced property values, as well as loss of sense of place and community, all of which contribute to adverse impacts on mental health.

Literature review

The International Panel on Climate Change (IPCC) concluded in their 2014 assessment that climate-related disasters have increased in frequency and intensity and that this trend is projected to continue throughout the 21st century, with the effects of these on health and wellbeing expected to substantially worsen overtime[1]. Globally, the number of disasters (related to either a weather, climate or water hazard) has increased by a factor of five over a 50 year period, from 711 recorded for 1970–1979 to 3,536 recorded for 2000–2009. Between 2010-2020, 83% of all disasters triggered by natural hazards were caused by extreme weather and

[1] 'Climate change 2014 : impacts, adaptation, and vulnerability.

climate-related events, such as floods, storms and heatwaves. Floods affect more people globally each year than any other disaster[2].
The IPCC identifies that climate change will create new poor to the end of the century in both developing and developed countries.[1] The most disadvantaged people around the world, including in the UK, will be the most vulnerable to the impacts of climate change, and climate change is expected to exacerbate existing vulnerabilities and inequalities[3].

Firstly we consider the impacts on communities of severe weather events.
The types of extreme weather events impacting Scotland are mainly rain and wind, often combining in storms, with less frequent or extreme snow and heatwave events. Whilst there is evidence that some people in developed countries are vulnerable to heat stress, in particular the elderly people and people with circulatory and respiratory conditions[1], only one relevant literature source was found relating to heat - an adaptation measure to urban overheating. The majority of literature identified for this review is focussed on inundation and flooding, which is not entirely unexpected given floods affect more people globally than any other disaster related to weather, climate or water hazards.[2] The review, therefore, is focused on impacts on individuals and communities as a result of inundation, which can be coastal, fluvial or surface water, leading to flooding of land and property, damage to buildings and infrastructure and erosion.

Flooding from rivers, surface water and coastal waters is one of the most significant climate change challenges facing the UK, with an estimated 6.1 million people in the UK currently living in flood prone areas. In addition to the current estimates of people living in flood prone areas, additional at-risk areas are identified due to sea-level rise. Under a 'modest warming scenario' of 2°C increase in global temperature, that number is projected to increase 61% by 2050. The increase in flood risk in the UK is largely driven by coastal flooding. Whilst this will mainly impact England, it will affect the whole of the UK[4]. Flooding can have a number of adverse short to long term impacts, including injury, death, loss of livelihoods, damage/destruction of structures and infrastructure, loss of assets and fracturing or uprooting of communities.[2]

Limited literature was found of the impacts of flooding on businesses, however, research into the impacts of flooding on small and medium-sized enterprises (SMEs) in Cockermouth following the floods of 2009 found that SMEs tended to focus on the direct tangible impacts of flooding, which limited their ability to realise the true costs of flooding. A strong correlation was found between direct, physical flood impacts and the post-flood costs of insurance, with significant increases in the costs of property insurance and excesses.[5] This suggests that SMEs will be

[2] World disasters report 2020 come heat or high water
[3] Social vulnerability to climate change: a review of concepts and evidence
[4] Health Effects of Climate Change (HECC) in the UK: 2023 report Chapter 3. Climate change, flooding, coastal change and public health
[5] Small businesses and flood impacts: the case of the 2009 flood event in Cockermouth

exposed to increased costs in the event of a future flood event, which may have implications for ongoing viability of some SME businesses.

People affected by flooding are more likely to experience adverse health outcomes. These can be direct, such as injury or death, or indirect, such as an increased risk of infectious disease outbreaks. There can also be adverse health impacts through interruptions in power and water supply, or disrupted access to health and care services[4,6]. Extreme weather events have also been found to impact the operation of health services through their effects on the built, social, and institutional infrastructures that support health and health care. There are also changes in service demand for healthcare as extreme weather impacts on human health[47], so it is possible that at a time when healthcare services are in higher demand, the extreme weather events will impact their delivery.

There is increasing evidence that extreme weather conditions in the UK are having a detrimental impact on people's mental health, with those who experience storm or flood damage to their home having poorer mental health.[8] However, the evidence varies on whether those experiencing flooding are at higher risk of long term impacts on mental health, including depression, anxiety, and post-traumatic stress disorder (PTSD) and also the degree of severity of the mental health impacts[8,9]. Effects can be compounded by certain factors, including displacement - particularly without warning, extent of flood damage in the home (including depth of flood water), disruption to utilities or health services and secondary stressors such as dealing with insurance claims.[4,6,8]

Mental health problems as a result of severe weather events are attributable in particular to displacement, loss of sense of place and home and disturbances to social capital, and disproportionately affected those in more deprived communities/socio-economic groupings.[7]

Specific groups of people are identified as being more likely to experience mental health problems associated with flooding. A number of UK studies show that women were more likely to report psychological distress and PTSD from having their home flooded then men. Other groups identified as more likely to experience deteriorations in mental health after exposure to flooding include those who: have lower income levels, are unemployed, are economically inactive and those with prior medical conditions.[8]

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[6] Impact of extreme weather events and climate change for health and social care systems, Curtis, S. et al (2020)
[7] Health and housing consequences of climate-related disasters: a matched case-control study using population based longitudinal data in Australia
[8] Effect of Extreme Weather Events on Mental Health: A Narrative Synthesis and Meta-Analysis for the UK Cruz, J. et al (2020)
[9] Wellbeing in the aftermath of floods

Relations and forms of social capital in a community have been found to play an important role in mitigating the adverse consequences to wellbeing from flood events, with community spirit identified as the one positive thing for some communities to come from their experience of flooding.

Other forms of community support, including networking beyond the immediate geographical community can also have a positive impact on wellbeing and can also bring in volunteers to help. However, if volunteers arrive in a flood affected community in an uncoordinated way, this can also have a negative effect on the wellbeing of local residents.[3]

Responses to flooding that made use of existing community social resources were found to play a key role in mediating between institutions and communities and delivering responses to support wellbeing and recovery, forming a bridge between professionalised governance organisations an communities. However, research found that the state of a community prior to a 'disaster situation', such as a flood, is only 'partially indicative' of how they will respond in the context of a disaster.[3]

Negative wellbeing outcomes are linked to ongoing insecurity from concerns about future flood events and other material and socio-economic consequences from flooding, such as a drop in house prices, ability to sell houses or to get insurance. Research found that wellbeing was also shown to be adversely impacted for those who had to be evacuated during a flood event, compared to those who stayed in their homes, attributed in part due to the challenges of maintaining community relations, described as a 'fracturing' of community relationships.[3]

Early flood disadvantage mapping work by the Scottish Government found that 2.8% of Scottish neighbourhoods were estimated to be 'extremely flood disadvantaged', i.e. they typically 'have a high potential for losses in well-being and a high proportion of residential properties potentially affected by flood events[10]. The mapping was of communities that were most socially and spatially vulnerable to potential flood events in terms of their underlying characteristics, such as age and health, and spatial and physical characteristics of the neighbourhood, combined with probability of being flooded. Note the flooding included in the mapping was only associated with coastal and fluvial (river-related).

Some longer term impacts on communities of severe weather events

Some mental health problems as a result of severe weather events can last long beyond the events themselves. Research indicates long-lasting effects on mental health and wellbeing from flooding, including stress, anxiety, depression and post-traumatic stress disorder.[9] A study in Australia found that exposure to home damage from climate-related disasters had significant negative effects on people's health and wellbeing in the disaster year, with some effects lasting

[10] 'Flood disadvantage in Scotland: mapping the potential losses in well-being'

for up to two years after the disaster. Those effects were more severe for people who had housing affordability stress or were living in poor quality housing before the disaster[7].

Negative impacts on wellbeing from a major flood event may also be felt over sustained periods, potentially years not months, which will require interventions to improve wellbeing over a sustained period.[9]

As mentioned earlier, the wellbeing of those who have to be evacuated from their home following a flood event can be adversely impacted in part due to 'fracturing' of community relationships. Those who do remain in their homes can also experience stress and anxiety long after a flood event, through 'secondary stressors', such as noise as a result of recovery works taking place.[9]

The second question for the literature review is 'What are the effects on communities of long term climate related issues?'

Here we consider long-term climate related issues as impacts of climate change that develop over a number of years. This could also include impacts of instances of repeated weather events across a number of years, as a result, for example of many rivers in the UK experiencing flood events far more frequently than before.[11] For communities that have an ongoing threat of an increasing likelihood of experiencing floods, the impacts on wellbeing responses are likely to be cumulative. In such instances, individual flood events should not be treated in isolation. This highlights the importance of 'institutional memory' to ensure the responses are adapted to the needs and perspectives of those affected[8].

The one literature source identified relating to heat as an impact of climate change was on the use of green infrastructure as an adaptation approach to tackle urban overheating in the Glasgow Clyde Valley Region. The study found that a 20% increase in green cover could reduce surface temperatures by 2°C in 2050 and eliminate between a third to a half of the expected extra urban heat island effect. The research also found that over half of the street users would consider a 20% increase in green cover in the city centre to be thermally acceptable, even under a warm 2050 scenario. The results suggest that green infrastructure could play a significant role in mitigating the urban overheating expected under a warming climate in the Glasgow Clyde Valley Region, so could be replicated in other communities to tackle heat stress.[12]

Most of the literature found regarding the long term impacts of climate change and severe weather events on communities is focussed on coastal communities. This is unsurprising given the additional climate challenges they face of precipitation, storms, rising sea levels and coastal

[11] 'Extreme UK flood levels are happening much more often than they used to, analysis shows'
[12] Green infrastructure as an adaptation approach to tackling urban overheating in the Glasgow Clyde Valley Region, UK

erosion,[13] combined with the challenges experienced of coastal communities of lower productivity, poorer health outcomes and digital and physical connectivity large behind other areas, including:

- Coastal towns are often adversely affected by inadequate transport connectivity, hindering the realisation of their economic potential
- Limited access to education, in particular to FE and HE institutions, curtails opportunities for young people in some coastal areas
- Many seaside towns are suffering from skills shortages
- High levels of population transience
- Disproportionately high levels of people claiming sickness and disability benefits

As coastal communities (within 5km of the coast) make up 41% of the total Scottish population, it is important to recognise how climate change is impacting them. The focus, understandably is often on the negative impacts of climate change, but there may also be some positive or overall neutral effects as well. For example, one potential impact on coastal communities in Scotland associated with the transition to Net Zero is that the expansion and development of the offshore renewable energy sector may support coastal economies and provide jobs as the oil and gas industries decline.[11] This may be particularly important given the more precarious nature of coastal economies.

There is recognition that climate change is already having an impact on ecosystems and the human population, so adaptation measures need to be taken to minimise harm, reduce vulnerabilities and risks. Most of the literature identified on long term effects of climate change on coastal communities is focused on adaptation. The IPCC describes adaptation as 'the process of adjustment to actual or expected climate and its effects'[14] recognising that impacts of climate change are already present and affecting coastal communities.

More than 80 flood prevention schemes are in place across Scotland, but the Scottish coastline is the least protected in the UK, with only 7% lined with coastal defence works or fronted by artificial beaches[15]. Nearly a fifth of Scotland's coastline is at risk of erosion within the next 30 years[16]. Taking into account threatened infrastructure, loss of productive land and social services it is estimated coastal flooding in Scotland causes £19m worth of damage per year; much less than flooding through rivers alone (£34.5m). Around 27,000 properties across Scotland's coastline are at risk from a one in 200 year coastal flood event.[11]

One example of an adaptation measure to protect a coastal community in Scotland is the flood defence scheme at Aberdeen beach, an area at risk of inundation and coastal erosion, which also

[13] Coastal Adaptation Planning in Fairbourne, Wales: lessons for Climate Change Adaptation
[14] IPCC SYRAR5 Glossary
[15] Scotland's Coastal Assets [PDF]
[16] https://www.gov.scot/news/scotlands-coastline-at-risk/

encompassed the neighbouring Queen's Links area. Together, these make an important economic and social contribution to the city through tourism and leisure activities. The sea wall was reaching a critical point, after which the structure would be compromised due to exposure of its foundations through coastal processes. If the wall were breached, this would have resulted in the loss of large sections of road, buildings, tourism sites and a potential risk of contamination from disused refuse sites. This led to the implementation of a flood defence scheme in 2006, incorporating beach nourishment and groyne construction along a 600m stretch of beach.[11]

This is one approach to climate adaptation, but such flood defence schemes will not be feasible for all communities that are at risk of flooding. There are other less financially costly flood management systems, such as the leaky dam approach for inland communities, piloted in Pickering, a flood prone town in North Yorkshire that was shown to reduce the risk of flooding in the town from a 25% chance in any year to a less than 4% chance.[17] Other approaches to climate adaptation will also need to be considered.

The severity of damage in coastal areas from extreme climate events will reflect the different levels of exposure, vulnerability and the mitigation of risk through planning and strategies, such as disaster management, resilience and adaptation strategies.[18] Coastal adaptation planning at a local level, therefore, will become increasingly important, as risks of coastal erosion and inundation increase. For institutions and organisations who have responsibility for elements of adaptation planning for and with coastal communities, a number of studies identify the importance of meaningfully involving local people or sector experts in the adaptation planning for their community,[19,20] which could be a geographic or sector based community. However, there isn't a level playing field for all communities and individuals that need to engage in adaptation planning. The IPCC identifies that 'the ability to adapt to and cope with climate change impacts is a function of wealth, technology, information, skills, infrastructure, institutions, equity, empowerment, and ability to spread risk',[21] so consideration needs to be given at an early stage of adaptation planning as to how engage and involve everyone within a community. In doing this, it will also be important to recognise that imbalances in power, resource and capacity may limit the ability of disadvantaged individuals and communities to adapt to climate change, thereby exacerbating inequalities.[22] Steps will need to be taken to engage with these individuals and communities from the early planning stages to minimise any adverse impacts.

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[17] Slowing the flow at Pickering

[18] Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. Summary for policymakers

[19] Climate change and health: three grand challenges

[20] Overcoming social barriers to learning and engagement with climate change adaptation: experiences with Swedish forestry stakeholders

[21] IPCC Vulnerability to Climate Change and Reasons for Concern: A Synthesis, Ch 19 Vulnerability to climate change and reasons for concern: a synthesis

[22] Studying local climate adaptation: A heuristic research framework for comparative policy analysis

Key conditions necessary for transformative adaptation by communities include capacity-building, leadership, differentiation in forms of scaling, and inclusive, enabling governance.[24]

As described earlier, mental health problems can be attributed to and exacerbated by displacement as a result of extreme weather events, such as flooding.[7] In the UK, such displacement is almost always temporary. However, for some communities the long term effects of climate change could potentially result in permanent displacement. Work on planning for such eventualities in the UK is relatively recent, so examples are limited, but there may be lessons to be learned from these for communities facing similar climate impacts in Scotland.

The rest of this literature review, therefore focuses on an example at the more extreme end of the spectrum of effects on communities of long term climate related issues, where a community is facing a potential relocation due to the effects of climate change. This aligns with research that shows that whilst incremental adaptation strategies do provide communities with short-term solutions to climate risks, this is not sufficient to protect communities from greater risks in the future.[23]

The community in question is Fairbourne, a coastal village in North Wales of approximately 600 households, which is one of the largest residential areas in the UK of a community where planning has begun for withdrawal of the village from the coastal area and eventual resettlement due to concerns related to climate change and sea level rise.[14]

This withdrawal is described as 'decommissioning', to mean removal of the village and is a key part of the implementation of recommendations in the Shoreline Management Plan 2 (SMP2).[24] SMPs are non-statutory, but are the key means of conducting coastal risk management and for setting coastal policy in England and Wales. In Scotland, there have been Flood Risk Management Strategies in place for each of the 14 Local Plan Districts that 'set the national direction of future flood risk management, helping to target investment and coordinate actions across public bodies'. [25] The Scottish Government is in the process of producing Scotland's first Flood Resilience Strategy.[26]

The West of Wales SMP2[25] identifies Fairbourne as an area 'where properties may be lost due to increased risk or where there is greatest need for adaption'. It recognises that whilst relocating communities or developing an adaptive approach to major change 'is a problem that has not regularly been faced in the past', but that the projected rise in sea levels means this will have to be addressed. The plan recognises that this will have to be through discussion with local communities, but cannot be done solely at a local level, so will require involvement of

[23] Transforming places together: transformative community strategies responding to climate change and sustainability challenges
[24] West of Wales SMP2
[25] Flood Risk Management Strategies
[26] Scotland's Flood Resilience Strategy

government and institutions at a national level.[27] Without further defensive interventions, as a result of sea level rise (SLR) associated with climate change, the village would be subject to regular tidal inundation and eventually would be lost to the sea. As shown in Figure 1, The SMP2 sets out the transition of policies for Fairbourne from 20-100 years from 'Hold the line' to 'No active intervention'.

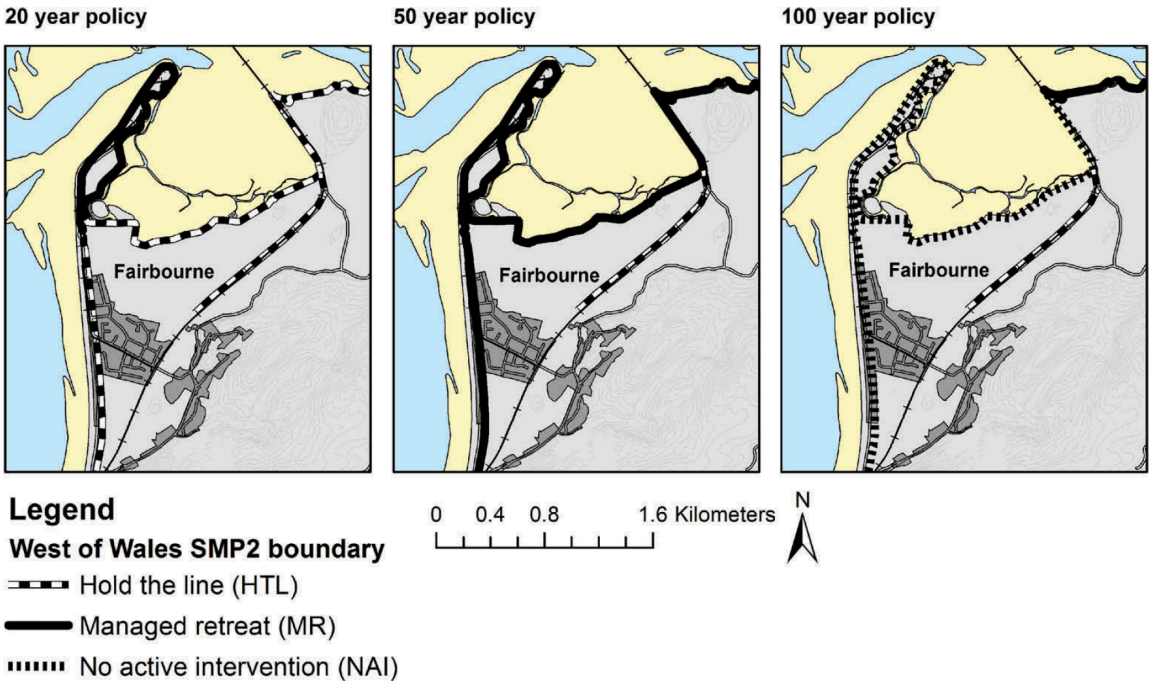

Figure 1. SMP2 transition of policies over the three epochs for policy units 11.4 (Ro Wen coast), 11.5 (Ro Wen Spit), and 11.6 (Fairbourne Embankment).

Following the production of SMP2, research found that a BBC news report on this portraying that Fairbourne would be '*left to the elements*' and '*lost to climate change*' and other subsequent media reports[28] that sensationalised the issue led to anxiety and anger within the local community. This suggests that the existing requirements for consultation within the SMPs may have underestimated the contentious nature of these plans, particularly as climate change adaptation is more comprehensively integrated into their development and implementation.[14]

Whilst the BBC news report and other reporting did generate anger and anxiety in Fairbourne, it is also credited with generating awareness and local involvement in shoreline planning and the large climate adaptation process, with one research interviewee reporting that 'residents were completely unaware of the shoreline management plan' until that point.[14]

[27] SMP2 Overview of Plan Section 5 Summary and Implications of Preferred Plan
[28] Welsh Villagers Trapped In 'Zero Value' Homes

Communities need a voice in order to get involved in decision-making and climate governance, to give them the capacity to develop just, equal and inclusive responses to climate change.'[24] Following the news reports, a local group Fairbourne Facing Change (FFC) was set up to 'galvanise the community to actively challenge the inaccuracies of the reporting and coverage of the SMP2 and to focus on influencing the 'direction of travel' for the various policies within it.' FFC hired a barrister to mount a legal challenge to some SMP2 policies. This could be attributed as the community finding their own voice to get involved in the decision making on the adaptation planning for Fairbourne. One research interviewee involved in the SMP2 development thought that with hindsight, more outreach could have been done earlier in the process for Fairbourne.[14]

Fairbourne Moving Forward (FMF) , a multi-agency Project Board was established in 2013 to support the community in the transition towards long term relocation. One of their areas of responsibility will be the production of a Fairbourne Master Plan - the central mechanism through which to implement the SMP2 including 'decommissioning of the village and relocation of its residents'. It is expected that the plan will include further studies of sea-level rise, groundwater levels and the general impacts of coastal change on the village's built and natural environment as well as social and economic assets.[14]

FMF are also initiating projects and programmes to mitigate some of the more immediate impacts of the SMP2 policy and the longer-term health and wellbeing of residents. These include a flood warning group, monitoring of ground water resources and erosion and a counselling service to help residents manage impacts of SMP2 and effects it may have on their mental wellbeing.

One of the key concerns identified in Fairbourne was the links between increasing flood risk and a decline in economic and social wellbeing. Research cites that according to the 2016 FMF annual report, the risk of inundation over the next few decades is expected to contribute to decline in property values, economic blight of the community, and a decline in health and welfare of local residents.[14]

The potential decline in property values identified here echoes the earlier findings on the impacts on communities of severe weather events. The situation in Fairbourne could potentially also leads to an inability to sell properties due to the planned 'de-commissioning' of the village. This led to FMF investigating the possibility of setting up a Community Interest Company (CIC) to enable residents to sell their properties. A feasibility project on this was taken forward by Gwynedd Council and FMF, with funding from NESTA to test whether a CIC could purchase houses from their owners, who might be keen to move but left unable to sell by the proposals in SMP2. The idea would be for the CIC to then let these houses as a social landlord, easing pressure on the Council's waiting list, and reinstating some choice to those residents living in Fairbourne.[29]

[29] Gwynedd Council: Developing a Fairbourne Community Interest Company

The study looked into how to create a financial model for the CIC, that would provide a solution for people wanting to sell their homes, and create additional social housing capacity for the Council. As the study developed, new elements were introduced to the plan to increase well-being in the village, including a community-run cafe, office space, and a consulting room to enable residents to see health practitioners closer to home. This resulted in a move away from the social housing focus and a repayable loan offered by Innovate to Save was no longer the best source of finance for the project. Alternative funding sources for the project are being explored.

Useful learnings from the study were that it was really important to have the involvement of a strong and active community group to influence and gather information from residents the project would affect, but the voice of those intending to move to Fairbourne was not as strong as those already part of the community,[30] which could potentially lead to some views that could be useful in informing the project being missed.

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