

Communicating climate change impacts on Australian coastal and marine environments to their human communities

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This report was prepared on the country of the Kaurna people, and is based on an acknowledgment of their country, their knowledge and the contribution of their Elders and leaders - past present and emerging. I also acknowledge all the First Nations peoples of Victoria.

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The Victorian Marine & Coastal Council respectfully acknowledges the original custodians of what is now known as Victoria; their rich culture, deep affinity with the land and spiritual connection to it.

Contents

Executive Summary 01
Introduction05
Scope of the literature review06
Setting the scene – why do we need communications? 07
Current actions10
Methodology 11
Findings13
Marine and coastal contexts have particular communication challenges14
Deficit models of science communications do not work
Participatory (Dialogic) Processes offer potential as effective communication means of knowledge transmission
Core Decision One: Who is the target audience?19
Gauge level of climate literacy within the community20
Messages must be differentiated for different target audiences
Class, race, gender, age, political affiliation and ethnicity all also affect collective and individual motivation to address climate change21
Place attachment is an important driver in determining tailored communications to different communities24
Explore what or if experience of climate impacts affects communications25
Risk perception and identification influences success of communications25
The elephant in the room – incorporating/addressing uncertainty is crucial26

Core Decision Two: What is being communicated?......27

Climate change, climate adaptation and sea level rise while connected are distinct concepts and a climate communication strategy needs to respect and recognise that fact
What frames and messages are used matters
Using emotions - psychology matters
Delivery - Many forms of climate communication exist37

Trustworthy messengers and message sources are a	S
mportant as the message	49

Best Practice Climate Communications51

Discussion – what does this mean for Victoria's coastal communities?63

Road map for communicating climate change impacts on marine and coastal environments to Victoria's communities. 67	7
Conclusion72	2

Executive Summary



Sea level rise, increased storms and flooding are amongst the current and predicted future impacts of climate change for the coastal and marine communities of Victoria. While a range of mechanisms exist to address and adapt to these changes, how to communicate them remains an ongoing challenge. This paper provides information on how the State of Victoria could build an effective communications strategy for its marine and coastal communities.

The paper is based on a definition of climate communication from the Yale Centre of Climate Change Communications as follows: "climate change communication is about educating, informing, warning, persuading, mobilizing and solving this critical problem. At a deeper level, climate change communication is shaped by our different experiences, mental and cultural models, and underlying values and worldviews.".

The paper was prepared for the Victorian Marine and Coastal Council and had the following aims: (i) to review the scientific literature on multi-target communication strategies regarding climate change and its impacts on marine and coastal environments and their human communities, and (ii) provide recommendations on best-practice approaches that optimise communication to and with the human community about the impacts of and adaptation to climate change in marine and coastal environments.

A number of key findings emerged from the literature. Firstly, it must be acknowledged that building communications in marine and coastal contexts has challenges, partly due to the fact much of what happens in the coastal zones are 'sight unseen' but also because it is a zone with multiple and competing interests all fighting for attention. Historically, scientists and policy makers have sought to communicate science and climate knowledge via one-way communications that assume that if people *know* about the issue, they will *act* on it. This approach is called the deficit communication model. However, many studies have demonstrated that deficit models do not work and have started to implement communications based on two-way or more participatory communications. These participatory models offer much potential for communicating climate change impacts to coastal and marine communities.

The overarching message distilled from the literature is that climate communications must be (a) tailored to the right audience, (b) deliver the right messages and (c) be delivered by trusted messengers and sources.

This message can be distilled in turn into three key questions or decisions, that once answered can map the pathway required to implement effective communications. These questions are: (a) who is the target audience, (b) what is being communicated and (c) who will be delivering the messages?

03 Victorian Marine and Coastal Council

Know: Who is the target audience?

In getting to know the community, the review highlighted that as a first step gauging the climate literacy within the community is essential – what do they know, what do they *not* know, what is their perception of climate change and its impacts in their region and across the world. This knowledge will help build the scope of communications needed and what knowledge gaps exist. Many studies then point out the value of investigating and identifying the characteristics of the target community and the ways in which class, gender, age, politics, religion, and values may affect collective and individual motivation to address climate change.

Associated with this step, how place attachment and experience of climate change impacts further informs how the target community perceives climate change needs exploration. In some cases direct experience of climate impacts, affect how people feel, but in all cases, assessing the role of risk and how the community engages with climate uncertainty are additional factors that influence the success of communications.

All these factors together will help build a picture of who the community is, and significantly, provide key information about how to tailor climate communications of most relevance and impact to the target audience. This will ensure that *useful* information becomes *useable*.

What: is being communicated?

Once a deep understanding of the target community has been established, then the task of formulating the actual communication begins. The literature highlights many key lessons to be applied in this endeavour. Firstly, it is necessary to differentiate between the different climate concepts. Climate change, adaptation, and sea level rise for example, although similar phenomena, are all different and hence require the generation of different messages. Further, how these messages are constructed matters; many studies find that positive and negative messages about climate impacts have both been useful as well as inhibited the success of climate communications. Using emotions within messaging and deploying psychology to create impactful messages and lessen the psychological distance between people and their idea of climate change is another important dimension.

Analysis also shows that there are a diverse range of tools available to build effective climate communications and that visual tools (including GIS, story maps, interactive web sites, gaming and art installations), are especially effective.

Who: will be trusted messengers and sources?

However, the development of the right messages and communications is not enough *per se*, no matter how polished and beautiful they may be. It is the delivery of these messages by trusted messengers and sources that is the final step for success. The literature provides many examples that demonstrate that trustworthy messengers and message sources are as important as the message. Further analysis though, shows that overall Indigenous people are largely underrepresented in current communications, and this is a gap that needs to be addressed.

In answering these key questions, the bedrock for a strong and effective climate communications strategy will be established.

The report then presents a range of best practice communications, ones that have successfully engaged with the target audience, tailored key messages and have been considered trustworthy. They offer ideas and examples that can be modified for use in the State of Victoria.

The report then concludes with a suggested roadmap/ communications framework, which brings together the lessons from the literature and provides a stepped communications strategy could be conceptualised for implementation within marine and coastal communities in Victoria. The processes and principles suggested could also be applied to any climate communication strategy for any community.

Introduction





Image Credit: Andrew Bray

Climate change is an issue that is causing a wide range of impacts along Australian coastlines, solutions to which require the navigation of complex inter-relationships to facilitate the building of effective policy. The State of Victoria has multiple coastal communities, which are and will face a range of climate impacts - now and into the future, including sea level rise, ocean acidification, warming and increased and more intense storm surges and flooding.

Effective communication is core to understanding and beginning to address (via adaptation and mitigation) the impacts of climate change, yet the development of appropriate climate communications is challenging for many reasons. It is important to understand the multiple ways in which climate change is understood, including its complexity, and how to develop communications that acknowledge climate change as a chronic climate environmental stressor affected by risk, uncertainty, distance, and other factors (Ratter and Leyston 2021, Reser 2017). As Wolf and Moser (2011) and Moser (2017) stress, climate communications are about how individuals (i) understand (acquire and use accurate knowledge and information about climate change), (ii) perceive (e.g., subjectively experience and interpret others' beliefs and understandings), and (iii) engage (personal connections that include cognitive, affective, and/or behavioural dimensions).

This paper presents a review of the key ideas and themes about climate communications within the literature about what constitutes effective communication of climate change impacts on coastal and marine environments and communities in Victoria.

In Victoria, the *Marine and Coastal Act 2018* sets out an instruction that a new Marine and Coastal Policy (gazetted, March 2020) will be followed by a new Marine and Coastal Strategy (due early 2022) that will describe the actions required to deliver the policy.

Both DELWP and VMaCC have run extensive engagement programs with stakeholders during 2020. What has become clear in these discussions is that effective communication of climate change and the likely impacts of climate change, especially sea-level rise on coastal and marine environments is necessary to ensure that the Victorian community and their representatives are well-informed to develop adaptation strategies to minimise their impact.

Scope of the literature review

To aid the development of an effective communication strategy for Victoria on climate change impacts on coastal and marine environments, this paper responds to a request from VMaCC to undertake (i) a review of the scientific literature on multi-target communication strategies regarding climate change and its impacts on marine and coastal environments and their human communities, and (ii) recommendations on bestpractice approaches that optimise communication to and with the human community about the impacts of and adaptation to climate change in marine and coastal environments.

This review was to be based on peer-reviewed literature and where possible, with discussions with communities of practice. The paper is based on the IPCC definitions of climate change and adaptation.

The paper is also based on a definition of climate communication from the Yale Centre of Climate Change Communications as follows: "climate change communication is about educating, informing, warning, persuading, mobilizing and solving this critical problem. At a deeper level, climate change communication is shaped by our different experiences, mental and cultural models, and underlying values and worldviews".



Setting the scene – why do we need communications?

Climate change is now indisputably a major challenge world-wide, with multiple impacts on coastal regions increasing in frequency and severity, especially sea level rise, coastal flooding, storms, warming and coastal erosion. The IPCC uses different trajectories or pathways of greenhouse gas concentrations to model impacts of climate change. Four of these Representative Concentration Pathways (RCPs) were used for climate modelling and research for the IPCC Fifth Assessment Report (AR5) in 2014. By the 2030s, sea levels are projected to rise by around 12 cm (7–18 cm) (relative to 1986–2005) under medium (RCP4.5) and high (RCP8.5) emissions scenarios. By the 2070s, the emissions scenario has greater impact, with increases of around 32 cm (20–46 cm) under RCP 4.5, but up to 42 cm (26–54 cm) under RCP 8.5 (see IPCC (2021) summary below).

Related impacts derived from these projects include increased risk of coastal erosion and inundation which will threaten coastal ecosystems, local landscapes, coastal settlements, and infrastructure. However, again, due to uncertainty and variability, the extent, type, and nature of sea level rises will differ and be affected by differences in coastal topography and nearshore processes.

It is *very* likely to *virtually certain* that regional mean relative sea level rise will continue throughout the 21st century, except in a few regions with substantial geologic land uplift rates. Approximately two-thirds of the global coastline has a projected regional relative sea level rise within ±20% of the global mean increase *(medium confidence)*. Due to relative sea level rise, extreme sea level events that occurred once per century in the recent past are projected to occur at least annually at more than half of all tide gauge locations by 2100 *(high confidence)*.

Relative sea level rise contributes to increases in the frequency and severity of coastal flooding in low-lying areas and to coastal erosion along most sandy coasts (*high confidence*).

In coastal cities, the combination of more frequent extreme sea level events (due to sea level rise and storm surge) and extreme rainfall/riverflow events will make flooding more probable (*high confidence*).

Over the rest of the 21st century, *likely* ocean warming ranges from 2–4 (SSP1-2.6) to 4–8 times (SSP5-8.5) the 1971–2018 change. Based on multiple lines of evidence, upper ocean stratification (*virtually certain*), ocean acidification (*virtually certain*) and ocean deoxygenation (*high confidence*) will continue to increase in the 21st century, at rates dependent on future emissions. Changes are irreversible on centennial to millennial time scales in global ocean temperature (*very high confidence*), deep ocean acidification (*very high confidence*) and deoxygenation (*medium confidence*). (IPCC 2021, 41)

Box 1: Summary of IPCC predictions from the Summary for Policy makers (IPCC 2021)

Many factors, both individually and in combination, amplify the vulnerability of marine and coastal communities to climate change. These need to be borne in mind when developing communication strategies in ways that will support coastal climate management (Dean et al. 2019). They include: (a) level of economic and social resources; (b) density of development and population, including that of senior citizens and minority populations who may have underlying health issues and minority populations; (c) elevation of area/ region; (d) rate of locally apparent sea level rise; (e) history of and likely future exposure to extreme weather, harmful algal blooms, oil spills, chemical contamination, and other dangerous events; (f) status of and protection for critical infrastructure; (g) type of soil and subsidence; (h) availability of affordable property insurance; (i) governmental policies and regulations; and (j) effective community leadership (Sandifer and Scott, 2021, 1).

These impacts, both social and physical, will be felt at regional and local scales within Victoria's marine and coastal communities. Into the future, climate predictions estimate that Victoria will be warmer and drier overall, but variability will mean that relatively cooler periods as well as very wet years will still occur. This will mean that annual rainfall will decrease but that when extreme rainfall events do occur, they will be more intense. Temperatures will rise and are currently tracking to the upward limit of projections, which means that by the 2050s, Victorian towns could experience around double the number of very hot days each year compared to the 1986–2005 average. The implications of these increased temperatures are that Victoria will likely experience lengthened fire seasons and increasing sea level rise all along the coast. Sea level rise has already been observed along the Victorian coast, with increases between 1.57 cm and 5.31 cm per decade between 19931 and 2017. Since 1966, Melbourne's coastline has

experienced an average increase in mean sea level of 1.95 cm per decade (i.e., approximately 2 mm per year).

The frequency and intensity of sea level events will also amplify. Stronger winds, more intense storms and extreme storm tides will cause coastal erosion and flooding. Another risk that occurs is when coastal communities experience several climate extremes at the same time. For example, an extreme storm surge may coincide with high rainfall to cause severe coastal inundation, (as happened with the flooding of the Yarra River in Melbourne in June 2014).

These impacts will also have economic impacts: ongoing risk studies, point to climate change impacts including sea level rise being the biggest risk to the Australian economy, more so even than bushfires, heat stress or impacts to agriculture, with costs up to trillions of dollars without adequate intervention and planning (Kompas et al. 2021). Estimates indicate that the potential damages from climate change to Australia at current global emissions patterns are conservatively quantified as \$584.5 billion in 2030, \$762 billion in 2050, more than \$5 trillion in cumulative damages from now until 2100 (Kompas et al. 2021).

These impacts and adapting/ managing them is a huge task, and it is not one that governments can carry alone. Increasingly, managing (or 'future proofing') for climate change will require a concerted and integrated effort and require the building of partnerships between scientists, policy makers and the communities of interest that are most affected.







Current actions

There already exist a range of actions that have been set in place to address some of these impacts. For example, the Victorian state government has requested that all local governments plan for a 0.8m sea-level rise by the year 2100. Many local councils have undertaken specific and targeted work within their own regions to try and understand how to respond to - and the scope and nature of – the problem they will face. For example, the City of Greater Geelong has mapped the risk of inundation and identified 1,614 properties that are vulnerable. As a result, they have identified where new buildings and renovations will be needed to meet certain conditions, (i.e., making sure that floors are above predicted flood levels).

However, to build the capacity and willingness of coastal communities to be part of the decision-making process, and for them to be amenable to the management options being suggested, sophisticated forms of engagement are required. Given the diversity of stakeholders and the complexity of climate science, this is difficult. When overlain with the challenge of trying to communicate impacts in the marine and coastal space it is additionally problematic.

Set against this background, this paper presents an analysis of how to communicate climate change, and its impacts/effects on the coastal communities of the State of Victoria, Australia. Based on a systematic review of the literature, it presents the key findings and concludes with a road map for how to communicate climate change to Victoria's coastal communities.

Methodology

To undertake the review a systematic methodology was used. This technique facilitates a rigorous and structured way of gathering data to show patterns within the literature (Berrang-Ford et al., 2015). It has been used successfully by many authors (Vink et al., 2013, Porter et al., 2014, and Pearce et al., 2018).¹ Studies of how to communicate climate change and its impacts are necessarily inter disciplinary (Palmer 2018) so this review spans engineering, science, social science, psychological and other disciplines. Collectively the review highlights key trends in how to communicate climate change and identifies that there is a gap in knowledge around climate change communication in coastal communities.





Findings



Image Credit: Nicola Waldron

Marine and coastal contexts have particular communication challenges

Climate communicators face a disproportionately large challenge in their attempt to deliver messages about climate change and outline expectations around how to respond. There are many structural, cultural, and institutional barriers that inhibit successful communication and then potential behaviour change (Ockwell, Whitmarsh and O'Neill 2009). Being able to raise awareness about climate issues and hazards does not always mean people will then identify solutions to address them (Friesinger and Bernatchez 2010, Furth and Gantwerk 2013). Moreover, perceived and actual responsibility for acting on those issues is often not clear (Harvatt et al. 2011). This challenge is additionally complicated in the marine and coastal space.

Marine and coastal communities and ecosystems have historically faced several stressors including population growth, overfishing, urbanisation, multiple industrial uses and climate change. This creates ongoing negotiations between conservation and resource use, leading to additional conflict and policy tensions. Marine and coastal regions are also characterised by having multiple stakeholder groups which inhibits information flow (Adan et al. 2020). It is important to acknowledge also that in Australia every marine and coastal region is also situated on Indigenous country.

Australians are in essence a nation of 'coastal dwellers' who are living their everyday lives in a culture strongly immersed in the coastal landscape (Foxwell-Norton 2018). In this context, trying to build effective communications about climate change presents multiple challenges (Geiger 2017). One of these is the fact that a marine/coastal environment is literally more 'fluid', and this factor has implications for how communications may be prepared and delivered: impacts are not always 'seen' if they are under water and given the dynamics of coastlines, often changing (Nursey-Bray et al. 2012). Another issue is the fact that international scientific messages, generated by global agencies do not have resonance at local (coastal) scales, a factor which needs to be addressed via simpler translations of the science (Reis and Ballinger 2020). Further, up until recently, the impacts of climate change have been for many, distant and outside of their personal and immediate experience, a factor additionally complicated by the fact that societies today, especially urban ones, are essentially disconnected from the natural world anyway (Moser 2010).

Another significant communication challenge is the fact that people's knowledge about the links between the 'ocean-coast-climate' is minimal (Moser 2013). This is partly because most people have mental models about and around the coast/marine environment that see it as vast, natural, resilient, a place of fun, recreation or provision of services – and it is hard as such for people to construct the coast/oceanic environment as one that is being profoundly affected by climate change (Moser 2013).



This fact is amply demonstrated by a substantial relatively recent study of coastal communications in Europe (see Box 2 below)

Aim:

A comprehensive opinion poll of 10,000 European citizens in 10 countries was conducted to establish levels of awareness, concern, and trust among different demographic groups (by age, gender, proximity to the coast) and nationalities about climate impacts on the coast.

Findings:

- Citizens exhibited varying levels of selfdeclared "informedness" and concern.
- Citizens from Germany, Italy and Spain claimed to be the most informed on marine climate change issues; those from Czech Republic, Netherlands and Estonia claimed to be least informed.
- Respondents were least aware of ocean acidification and most aware of melting sea ice, pollution and overfishing.
- Citizens of Italy suggested that they were generally most concerned about marine climate change issues.
- Respondents from coastal areas claimed to be both more informed and more concerned than those living inland, as did females and older age groups (54–64 years).
- European citizens obtain information about climate change in the seas and ocean from different sources, particularly television and the internet.
- Trust in the various media sources varies among countries and demographic groups.

- Television is trusted most in Estonia, Germany and Ireland and least in France.
- The internet is trusted most in Italy, Czech Republic and Estonia, but least in France and the United Kingdom.
- 18–24 year olds are the biggest users of the internet, but trust this source less than older age groups.
- Academic scientists or those working for environmental NGOs are trusted more than scientists working for government or industry.
- Citizens from France are more trusting of industry than any other country polled.
- Most respondents highlighted mitigation measures as opposed to local-scale adaptation.
- Younger participants prioritized actions associated with reducing carbon emissions, whereas older age groups prioritized improving coastal defenses (Buckley et al. 2017, 1)

Box 2: Summary of community responses to European survey about coastal communications

The whole issue of climate change thus is often one that is so big, that people perceive it as being beyond management, and further often feel a sense of hopelessness about it. This creates in turn a sense of being

overwhelmed, which create barriers to engagement including low levels of concern, detachment, and avoidance (Thomas et al. 2015). It is also difficult for people to understand how 'a few millimetres' of sea level rise for example can be problematic, a factor aggravated by the reality that coastal climate impacts are so differentiated, and not distributed evenly.

How can climate science be translated to create impetus for policy action in marine and coastal communities and build climate communication models that can work within and for marine and coastal communities?

Deficit models of science communications do not work

The first challenge is working out how to establish communications that are relevant to a particular area, so they personally resonate and create meaningful engagement and learning about the impacts of climate change (Armstrong 2018). Historically, in seeking to do so, much science communication has relied on one key model - the information deficit model. This model assumes that the gap between scientists/knowledge keepers and others actioning change is simply due to a lack of information and knowledge about the issue - in this case climate change (Suldovsky 2017). Climate communications based on this model, are essentially a one-way communication model, where information is deployed and disseminated *from* the information provider to the public/community. It is a model that assumes if people 'know' about the issue they will then act on it - or be inclined to support actions that remediate it. This model relies on climate science for its content and further, on a mode of transmission from the scientist to the public via various formal modes such as journal papers, newspapers and other media.

'Knowing' is however *not* a precursor to action and the deficit model of science communication has been heavily criticised for being one-way and too content heavy, with the terminology used jargonistic and inaccessible to wider publics (Cook and Zurita 2019). As Chess and Johnson (2007, 223) note: "information is not entirely consequential, but it is much over rated as a change agent". In a move away from the deficit model, contextual models of communication, while still one-way, allow for the shaping of messages as and according to the specific context, that are at the very least designed to align with the specific circumstances of any place.

Dissemination of science alone is then, not enough, and as such working our different ways of engaging the community on the impacts of climate change need to be implemented. In this context a range of what are called 'dialogic' or participatory forms of communicating science have been suggested. These approaches are underpinned by a commitment to trying to understand people, and what makes them 'tick', and then translate science in more culturally appropriate forms, ones which will be understood.

Participatory (Dialogic) Processes offer potential as effective communication means of knowledge transmission

In contrast to deficit models of communication, participatory approaches (discussed as dialogic in the literature) are based on two-way communication and discussion between communities, scientists, and policy makers, and acknowledge that we all live with competing and different values, power regimes, attachments to place and adherence to societal narratives (DeLorme et al. 2018). A dialogic, participatory approach to communications is influenced by many factors including community perspectives, identities, priorities, geographies, interests, language technology and their everyday practices.

They acknowledge and incorporate social conventions and make culture central and part of the communication package (Munshi 2020, Steentjes et al. 2017). Kahan et al. (2011) for example show that in the US attitudes towards scientific consensus are not formed based on the presence or intake of information but rather are based on cultural identity and understanding.

The development of communications that pay attention to these factors and how they influence interactions between stakeholders, is one way of addressing the weaknesses of the deficit model, and the drivers of these different domains. They make science a more

17 Victorian Marine and Coastal Council

democratic process. They also create an opportunity for uncertainties and concerns to be discussed by affected publics – so that the actual form and content of the messaging responds to, as much as informs, the public about these issues. Dialogic processes also lead to participatory models where stakeholders, in partnership with scientists or as part of citizen science projects, can also participate in the creation of the communications per se, creating a shift from bi, to multi directional communications.

Integral to successful dialogic processes is effecting a transition from USEFUL to USEABLE knowledge (Lemos et al. 2012). To make knowledge useable, it needs to be credible, viable, cognitive, affective and salient (Lemos et al. 2012). In assuring its utility, climate communications can also embed processes where partnerships enable a sharing of decision-making power, and facilitate generation of co-produced knowledge for management (DeLorme et al. 2018). Further, in the facilitation of dialogic communication processes, a range of tools can be used with good effect. In the Gulf of Mexico, focus groups, hand-outs, a web site and sea level rise planning models all supported participatory approaches and interactions between and amongst scientists and members of the public (De Lorme et al 2018).

Randy Olson (2019), an academic, turned film maker presents the ABT Framework, as a model of science

communication. He argues that all successful science communication is based on three propositions (i) **A**nd, (ii) **B**ut, (iii) **T**herefore (ABT) and suggests the construction of any communication strategy can use these three elements to ensure it is salient and impactful. The ABT Framework, connects people to a narrative, a story that they can connect with at a fundamental level: "Always be telling stories. That's what you want to do. Always be searching. Always be addressing problems and searching for solutions to them." (Olson 2019, 2).

Having established what model of communications to adopt, the next step is to make three core decisions, ones that will make up any effective communications strategy:

i. who is the target audience? andii. what is it that is being communicated?iii. who will be delivering the messages?

The next section of this paper, drawing on insights from the literature, will be structured to address these three elements. These three elements capture the core findings of the literature review, but they are presented this way so that the insights from the literature are practically applied to offer ideas around how to build a communications strategy.

There are three core decisions that need to be made to successfully communicate the climate change message:





Core Decision One: Who is the target audience?





Engaging the public on climate change is difficult and the communication of science to communities and into policy requires a wide range of skills and approaches (Suldovsky et al. 2017). Historically this has included implementation via public participatory engagement, citizen juries, science workshops, planning cells and scenario workshops (Kappel and Holmen 2019). It requires engagement with key beliefs and attitudes (Ackerlof et al. 2019).

Communications need to be aligned with an understanding of who the intended target audience will be. This requires research into who it is that the communications are seeking to affect and influence, and the extent to which the communications seek to inform, involve and collaborate with its audience. It is in fact, even hard to determine who the community is. In trying to understand who the community is, and thus shape communications, will require answering some key questions. Once it has been established who the target audience is, a number of other factors need to be considered.

Table 1: Key questions for development of climate communications

What is the scope?	What scale/size of community is being targeted? Just one group (i.e. fishers), or specific cultural group (i.e. Indigenous groups), or is the whole residential community in a specific place being targeted etc?
Nature of engagement?	To what extent is the community to be involved in the communications – as recipients, contributors, collaborators?
Nature of impacts?	What are the specific impacts that have been or are likely to be experienced by those communities in that particular geographical/physical location?

Gauge level of climate literacy within the community

Levels of climate literacy will influence the uptake of climate communications by targeted communities. Moser and Dilling (2009) in early reflections on this issue suggest that climate literacy needs building, noting it is often low for a range of reasons including that there is: (i) public lack of information and understanding, (ii) public fear, (iii) climate science as its usually relayed is not persuasive, and (iv) mass communications do not address local issues hence have limited efficacy. A survey within Melbourne and Regional Victoria highlights that ongoing climate literacy remains quite low (Holmes, Hall and Thompson 2018) with literacy about the status of climate change 36%, about climate science generally 39% and 58% re understanding of climate definitions. There is work to do at State level to redress this lack of literacy and community knowledge about climate change impacts, adaptation and mitigation.

Messages must be differentiated for different target audiences

Overall, analysis of the literature shows that there is a necessity for tailored climate communications, that are differentiated for different target audiences and sectors/segments within them, are much more effective (Leiserowitz et al. 2017, Maibach et al. 2016, Maibach and Nisbet 2018).

As Van Der Linden et al. (2015) note, even getting 'in the front door' is challenging. As coastal communities are so diverse, these considerations are even more important (Jefferson et al. 2015). For example, in an assessment of FishCom, which is a tool for managing conflict in commercial fisheries, Musshed-e-Jahan et al. (2014), reflect that face-to-face strategies were pivotal, as were informal meetings and multi-stakeholder engagement in engaging people on issues along the coast. Particularly relevant was the fact that a structured, face to face, targeted and deliberate rather than ad hoc communications strategy, tailored to each group, worked best of all. Further the act of differentiating communications acted as a mechanism by which conflict between stakeholders was managed (O'Donohue 1999).

Segmentation of the target community can also yield important insights into how to approach the target audience. In such a study, Leiserowitz et al. (2017) found that Americans can be segmented as being (i) alarmed, (ii) concerned, iii) cautious, (iv) disengaged, (v) doubtful, or (vi) dismissive. Similar work in Australia, with over 3000 Australians also found that Australians are (i) alarmed, (ii) concerned, (iii) uncertain, (iv) doubtful and (v) dismissive (Hine et al. 2013). Knowing about and identifying these forms of segmentation can assist in the development of broader messages that will 'speak' to each of these constructions (Hine et al. 2018). Van der Linden et al. (2015) argue that another way to achieve differentiated messaging is to bridge what is a gap between experts and non-experts and develop 'gateway' or 'inoculating messages' where climate

change is conceived as a scientific consensus. In this context, communicators trying to develop strategies about climate change must confront and understand how people understand climate and the extent to which their biases influence how they react to climate information.

Carlton and Jacobsen (2016) suggest that another way to do this is to use what are called 'mental models', that is dominant mental constructions about climate impacts to help different sectors understand and frame climate change.

Most people will also have what are called 'mental models' about climate change and other issues and these also drive 'confirmation biases' which make people look for information that they already think – or want to feel (Marlon et al. 2019). These biases assist people to avoid, dismiss or forget unpalatable information that may create fear, lead them to change their minds – or instigate behavioural change.

Class, race, gender, age, political affiliation and ethnicity all also affect collective and individual motivation to address climate change

In working out how to develop appropriate messages and communications, studies demonstrate that underpinned by values (Crompton and Lennon 2018, Pearson et al. 2017), factors such as class, race, age, gender, political affiliation, religion and ethnicity all also affect collective and individual motivation to address climate change (Chapman et al. 2016, Rickard et al. 2016). Central to this challenge is working out how to ensure climate communications go beyond politics, to emotionally engage people, and not just 'preach to the converted' (Whitmarsh and Corner 2017). Politics will however, always play a role. For example, Tranter (2020) shows that engagement with climate communications can be politically differentiated and that "the information deficit model of science communication is likely to be efficacious among supporters of politically progressive parties in Australia, but less so among political conservatives" (Tranter 2020, 537). Another study which provided people with US specific information about the various effects and risks of sea level rise showed that communication of sea level rise was effective but also led to a general decrease in assertions of nationalism, and a correlative decrease in perceptions about the effectiveness of constructing sea walls and dikes (Velautham et al. 2019). This study highlights the inextricable links between climate change and politics. Other studies present the importance of building community capacity to take action (i.e., assert agency) by nurturing political citizen engagement, arguing that dominant climate communications are situated within political paradigms. These paradigms can constrain citizen political engagement by depoliticising climate change (Carvahlo et al. 2017, 2007).

For many communications, age is a factor to consider, as it can affect both how people perceive climate change but also their inclination to act on it. For example, one study highlights how children's knowledge about climate change affects communications (Azul and Reis 2018), others focus on what is required to target youth (Bassar and Yanindraputri 2018, Hu and Chen 2016) and in Europe, young people are prioritising actions that reduce carbon emissions while older people want to improve coastal defenses (Buckley et al. 2017).

Older people though, face their own challenges in dealing with climate change. An early study in the

US found that older Americans will be living in places that are more proportionately affected by climate change (and as in Australia, along coastal zones and within large coastal metropolitan areas) and found therefore that older people are more vulnerable to climate impacts (Gamble et al. 2013). This means that specific attention to what is the most appropriate mode of communicating impacts and responses will be required (Gamble et al. 2013). In Australia, a case study examining the perception of rock lobster fishers to climate change found that older fishers were almost all sceptical of climate change, whereas younger ones believed it was an issue for their business (Nursey-Bray et al 2012).

Age and political affiliation together can also have potent effects. For example, one study explores how millennial generation identity (i.e., the shared values and experiences of young adults born between 1980 and 1997) affects political polarization of climate change belief (Ross et al. 2019). They found that this specific generation's identity does influence climate change belief, but that political identity and associated polarization is also present - even among young adults. This study shows that factors like age and politics converge and need to be accounted for when trying to build communications (Ross et al. 2019).

Another important consideration is working out how to deliver climate communications to vulnerable populations (Heinrichs 2010). Many cities in Australia have large concentrations of people from low socioeconomic backgrounds, and not only it is important to ensure they are not overlooked, but again, that communication strategies are differentiated and tailored in delivery, according to the needs of these populations (Palmer 2018).

In all cases, it is clear that developing inter-generational communications is a key task (Brown and Lock 2018).

Culture, religion, and values also drive and influence the direction and shape of climate communications (Bock 2018). As Jenkins et al. (2018) argue: "insofar as climate change is entangled with humans, it is also entangled with all the ways in which religion attends human ways of being. Fully understanding climate change therefore requires understanding its religious aspects, especially the way religion is involved in human experiences of and human responses to climate change." This is an important factor because science cannot alone resolve problems such as climate change which are, as Hulme (2017) notes cultural in origin. Further, religious mind sets, will inform cultural practice and in turn, how climate change is perceived and understood. Communications need to take account of religious perspectives, be tailored appropriately and have efficacy.

Mapping community values is another key endeavour and can also facilitate the development of "co-

beneficial hooks", or common beliefs between experts and non-experts for use in the development of climate communications and then policy (Carlton and Jacobsen 2016). Collectively communities will always have a wide range of needs, values and opinions. As Painter notes: "The way individuals or groups of people respond to climate change messages is extraordinarily complex, dependent on all sorts of variables, like cultural, societal, and political values, personal experience, and the practice or desire for individuals to cohere with values characteristics of groups with which they identify" (Painter cited in Palmer 2018, 61).

A South African example (below) highlights the importance of ensuring that communications are appropriate to the cultural groups that are being targeted and of note, that this included delivery in the languages used in the region

Credit: Andrew Bray

Case study:

Integrating Climate Change adaptation and disaster risk reduction communications, East London South Africa (Busayo and Kalumba 2021)

In this case study two approaches to communication - climate adaptation and disaster risk reduction are combined in an attempt to deliver information about disasters and climate change in the city of East London, South Africa. This was based on the fact that in this region, provision of such information is low. The delivery of climate communications in this case was successful because it was locally tailored and delivered/framed in locally understood languages. This is an example where the government needed to be proactive and 'spread the word' and in so doing assisted build effective responses in times of and in the aftermath of disasters.

Box 3: Climate communications, South Africa

In Australia, all climate communications need to be underpinned by a recognition of the cultural value of and dependence on marine and coastal environments by Indigenous peoples, who, with different ways of seeing and doing, will require different messaging as well as culturally appropriate approaches to communication delivery.

A key take home message from all studies is that the acknowledgement of the diversity of communities and then development of climate change communications that incorporate and reflect class, gender, age and political diversity, will enhance the capacity to communicate to diverse publics, tailor messages according to that diversity and identify ways to broaden public participation overall (Pearson 2017). Communication strategies need to utlise science effectively and in a way that acknowledges user/ community differentiation *within* the places they live (Adan et al. 2020).

Place attachment is an important driver in determining tailored communications to different communities

Place attachment is another important driver in the development of climate communications. Analysis shows that understanding how the target audiences value and are attached to coastal places will reflect cultural values and beliefs. Communications that build on these values, become more meaningful to the audience and can empower specific action (Schweizer at al. 2013). This insight is clearly demonstrated in Scotland where videos of familiar places were used to try and understand how a sense of the weather affected or motivated place-based adaptation to climate change (Butts and Adams 2020). In China, a study that focussed on adolescent perceptions of climate change found that place based communication strategies that emphasized local impacts promoted much greater engagement with climate change (Hu and Chen 2016). The recognition of Indigenous Country in Australia as places around which entire cultures have been built (and are still being practised) is a necessary beginning in any climate communications with Australia's First Nation peoples.

Place-based communications that invoke experiential learning are another pathway as they link climate change with places and individuals or group-based experiences.

Proximity and distance may also be a factor in how people perceive and understand climate impacts (Reser et al. 2012). This means that communications often under-estimate/under-represent the social and cultural dimensions of climate change impacts (Akerlof et al. 2017). Another issue is the fact that international scientific messages, generated by global agencies does not reach local scales, and there needs to be further and simpler translation of science (Reis and Ballinger 2020).

McDonald (2017, 9) concludes by offering the suggestion that "framing climate change as close to the self in space and time may be an effective strategy to encourage belied in anthropogenic climate change and support for mitigation and adaptation initiatives".

Explore what or if experience of climate impacts affects communications

Many studies focus on the question of whether (or not) direct experience of climate impacts influence community perception about and inclination to act or change behaviour in relation to climate change. Interestingly, there are studies that show that experience both impacts perception and motivates action, but also that direct experience does not affect people at all. It is important therefore not to make assumptions about what the target community may or may not think in this regard.

For example, in Scotland, one study highlights that when people experience changing, difficult and unpredictable weather, people felt more bound to place and this experience influenced how they felt about themselves, their place and climate adaptation. In being able to accept the volatility of the weather, they were in turn able to react positively to changes wrought by the climate and further, did not perceive climate therefore as a destabilising force (Butts and Adams 2020).

A survey in Norway showed that people with individual flooding experience showed much greater concern for climate change than those with little or no flooding experience (Ogunbode et al. 2020).

In Adelaide, South Australia, a study found that seasonality matters – in this city people were more receptive to climate communications and showed higher levels of belief around climate change on hot rather than cold days (Palmer et al. 2017). Taylor, Yon Bornick and Raki (2017) corroborate this finding by also demonstrating that weather affects belief – if it is cold, scepticism increases, when it is hot, belief in climate change increases. In the US a large study found that exposure to hot dry days significantly increased individuals' perception that they have personally experienced global warming (Marlon et al. 2021). This insight has implications for how, when and where climate communications may be delivered - staggered perhaps over seasons and different times to have the greatest salience and efficacy

Other studies though, show that direct experience cannot be used as an indicator of climate belief. One example is of a US study by Lyons et al. (2018) on polar vortex and drought, where they find that there is a limited capacity for communicators to use direct experience of extreme weather in communicating climate change. In this case, it was not a powerful motivator for people to change.

Communicators who take the time to understand whether their intended audience has experienced direct impacts and whether this matters to them, can ensure that their communications are more specific, and relevant to local concerns (Whitmarsh 2008).

Risk perception and identification influences success of communications

As much as location and attachment play a significant role, communications may also need to work out how risk is perceived and understood, as this factor is an important corollary to the development of place-based communications about climate change (Khan et al 2012). Climate change is an ongoing as well as an impending threat and a key communication challenge is working out how you "illustrate possible future scenarios at meaningful scales while simultaneously involving the public in the difficult decision surrounding adaptation "(Lieske, Wade and Ronoss 2014, 84).

Communicating climate risk is complicated because; (i) people infer things without giving weight to the evidence, (ii) they are overconfident in their capacity to infer issues, (iii) they are arbitrary in their risk tolerance and (iv) their perceptions are heavily influenced by their background. Yet, most risk communication over relies on technical expertise, when it needs to assess the psychological state and perceptions of their audiences. It can also inhibit people's willingness to act as they become stymied by overconfidence in technical solutions, overlaid with unreasonable expectations or their reliability. This is turn, can push people into being maladaptive. Further, a lack of knowledge about risk communication is a "bottleneck" leading to "knowledge vacuums" (Lieske, Wade and Ronoss 2014, 84) and this in turn leads people to create their own mental models of risk which may not be appropriate or accurate. Risk perceptions of climate change thus can mediate climate messaging, as a case study of UK winter floods showed in 2015 (Cologna et al. 2018).

However, other analysis shows that using the language of risk in climate change communication is beneficial because: "It shifts public debate away from the idea that decisions should be delayed until conclusive proof or absolute certainty is obtained (a criterion that may never be satisfied), towards timely action informed by an analysis of the comparative costs and risks of different choices and options (including the risk associated with doing nothing)" (McGaurr, Lester & Painter 2013, p. 23).

This also opens spaces for new messages, ones wider than climate, that may have resonance to communities. These messages might be around risk, vulnerability and adaptation, and create space for messages about how to build emergency responses, floodplain management, landscape, development. Importantly they also open up the opportunity of deploying a much wider range of messengers. Again, as with direct experience of climate change, one cannot make assumptions about how the community perceives or understands risk, but it is likely that how climate risk is perceived will be an important driver influencing the success of climate communications, so is worth identifying up front.

The elephant in the room – incorporating/addressing uncertainty is crucial

Assessment of risk, however, also poses the challenge of working out how to present the (almost guaranteed) uncertainty around whatever the climate predictions are for each place under consideration (Schneider 2016). When there is no 'set point' which people can use to bound the communications and extent of the climate impact, it means it is much harder to communicate the gravity of impacts and also solutions. This remains an ongoing problem when trying to build place based and targeted communications yet could also be an opportunity (Davis et al. 2016). As Palmer (2018) observes, embracing uncertainty could also force people to be creative, and find solutions that are more robust and resilient. The work of explaining sea level rise exemplifies this communication challenge. Sea level rise differs, sometimes significantly, from coast to coast, even within the same local government area. Templates and generic communications about it will therefore not have much relevance.

Central to resolving this communication dilemma, is being able to construct ways of framing uncertainty, in ways that produce feelings of intent to act, and efficacy: *that are appropriate to the intended audience*. Uncertainty is not an inevitable barrier to action, provided communicators frame climate change messages in ways that trigger caution in the face of uncertainty (Gustafson and Rice 2020, Morton et al. 2011). Engaging with scepticism will also necessitate the engagement or deployment of certain frames (Sterman 2011). This leads us to the consideration of what exactly will be communicated, and what tools will be used in each instance to do so.

Core Decision Two: What is being communicated?





The task of knowing the community occurs simultaneously with the consideration of what messages will be delivered and how: they need to 'speak' to each other. Thus, to establish an effective communications strategy, the determination of exactly what is being communicated is a fundamental step and there are a range of factors that require careful consideration going forward. The first of these relates to scope – how wide are the communications going to beare they just meant to communicate one aspect of climate impacts, such as sea level rise, or do they also encompass climate change more broadly and include other concepts such as adaptation, mitigation vulnerability and resilience?

Climate change, climate adaptation and sea level rise while connected are distinct concepts and a climate communication strategy needs to respect and recognise that fact

This is important, because while they are connected, all these concepts are distinct concepts, each present their specific communications challenge and any communications strategy needs to respect and recognise that fact (Akerlof et al. 2017, 2016).

Climate change for example as a concept is hard to deliver in local contexts, as it is largely framed as a global issue, and scientists, politicians and policy makers are often reluctant to link local extreme events (such as king tides, storms, flooding) with global climate change. Since it takes a long time to 'feel' global warming, too often it is seen as a non-urgent and non-personal threat.

However, as sea level rise is a very place-based phenomenon and in terms of communications, it is also an impact that is visual, direct and often experienced/ observed by coastal communities. As such, it offers higher potential as an issue round which to communicate climate change more broadly. Sea level rise, on top of large tides and storms is now relatively common and experienced worldwide. The provision of specific information about the economic and geographical impacts of climate change and sea level rise on familiar coastlines increases acceptance of sea level rise as a phenomenon and in turn acceptance of global warming. Sea level rise is also one of the areas where adaptation has a clear utility, and hence can be used to communicate the need to adapt as well.

Yet in practice, the communication of sea level rise faces multiple challenges. For example, a study in North Carolina, in Mateo and Washington (Covi and Kain 2015), that explored public reception of sea level rise communications found that sea level rise was seen as temporally and spatially distant hence making it hard for communicators to relay the *urgency* of sea level rise as an issue. Also, while visuals and graphics were used, they found that many residents had trouble interpreting the graphs and maps. Significantly, it also became clear that the terms conventionally used to discuss and communicate sea level rise were simply not understood by users. Such words included: altimetry, tidal gauge, renourishment, mitigation, hazard reduction, IPCC, confidence, resilience, retreat, freeboarding, and revetment. Further, while some were familiar with the terms 'accommodate', 'retreat' and 'adapt' in relation to sea level rise, most people could not think of any examples of them.

Climate adaptation is an even more opaque concept, one that requires people to create mental models that will enable them to 'see' the change and therefore the need to adapt to it (Moser 2017).

Adaptation may require unpleasant transformational change which means not everyone will 'win'. In reaching the limits of what is possible, some stakeholders will suffer enduring consequences from climate change where despite attempts at adaptation, it cannot be ameliorated. This itself, is a huge communications challenge. Moser (2017) argues that communicating adaptation is composed of three constituent elements: (i) instrumental, (ii) cognitive and (iii) tactical. Importantly, she also notes that effective communications to climate change are based on a composite of community understanding of 'appropriate threat appraisal' and 'response appraisal factors' (see Table 2), only achieved via effective communications. Together, they help people accept and then motivate people to become involved in building solutions.



Box 4 : Threat Appraisals

Appropriate Threat Appraisal Factors	 Generalized good understanding of anthropogenic climate change to appropriately contextualize local experiences or available communication about climate risks in the longer-term context; Clear and vivid risk awareness ("feeling at risk"; ability to imagine and feel the potential consequences of climate change):
	Strength of belief in local effects of climate change ("seeing is believing");
	 Degree and understanding of uncertainty, attitudes toward uncertainty (tangibly communicated);
	• Degree of non-adaptive behavior (e.g., persistence of denial, wishful thinking);
	• Existence and belief in safety of existing protections (moral hazard of past protective behaviors and maladaptation);
	Cultural cognition of risk (motivated reasoning); and
	• Trust in the source of scientific information, projections, and related tools.
Response Appraisal Factors	• The (quality of) information available about possible adaptation options/actions (i.e., the perceived usefulness, credibility, legitimacy and salience of the information to a specific audience);
	• People's perception of the relevant actor's adaptive capacity, which may include their sense of self-efficacy (i.e., the confidence in their own ability to enact the adaptation, including skills, health, sense of control over decisions; sense of power of helplessness); group efficacy (similar dimensions applied to collective adaptive action); and response efficacy (i.e., confidence in the effectiveness of a particular adaptation option to solve the problem, which is often aided by knowledge about the effectiveness of similar actions in the past);
	• Knowledge of and judgments about the potential costs of adaptation actions vs. access to the necessary resources (sometimes communicated in terms of cost effectiveness, investment in the future, or as efforts to buy time or restore certain conditions);
	• Clearly perceived benefits of adaptation options, including nonmonetary, intangible benefits such as protection of culturally significant places or activities, the restoration of certain environments or environmental justice);
	• Perceived fairness (of who bears risks, costs, benefits of certain courses of action);
	• Social acceptability of adaptation options (which can be influenced by a wide variety of prevalent values and the process of arriving at (compromise) solutions;
	 Social influences on decision makers and the factors listed (e.g., social norms, peers exhibiting adaptive behavior), often expressed or evident in variable degrees of community or political support and social capital; and
	• Pre-existing levels of trust in authorities (cited from Moser 2017, 6).

In Australia, an additional challenge is the fact that there remains a perception around what Moser (2015) calls 'the normality of extremes'. Given the Australian climate is highly variable anyway, it is quite easy for community members to defer adaptation or thinking/planning about a climate impact on the grounds it is perceived to be following a normal weather pattern or type, even when destructive such as a storm or drought.

What frames and messages are used matters

Whatever concept – or groups of concepts – have been chosen as the focus of a communication strategy, there are further decisions to be made regarding the messaging both about and within each domain. How information is deployed, used and presented about each concept, and what the messages are matters and can affect policy communications at all levels (Bertolotti and Catellani 2014).

Framing is one very popular tool that is used to assist the building of communications strategies and ensure messages reach non-specialised audiences (Biddlecombe-Brown et al. 2018). Framing theory assists communicators organise central ideas about an issue and can be defined as "the way in which individuals and the mass media turn the flow of everyday life into narrative events" (Chandler and Munday 2020). They can help define problems, diagnose causes, evaluate, and prescribe solutions (Palmer 2018, 66). Frames enable communications to be endowed with multiple dimensions and can help communicate problematic issues such as climate change at multiple levels (Moernaut et al. 2018).

Frames condense messages in 'catchy' ways, whether via catch phrases, historical references, cartoons or images (Shome et al. 2009). Communicators use selected frames to create and deploy narratives through words and images, to alert the audience to key points, and guide people how to think about an issue. In the climate change context, frames add complexity, help build interactions between the information and those delivering it (Davis and Russ 2015) and assist in engaging the public in an uncertain world (Palmer 2018). In so doing, they can bind individuals together, even align and bind them into collectives that advocate for change.

One example, of a science-based exhibition on the beaches of Cascais in Portugal used framing to present climate science via past and present images (frames) of beaches, to successfully 'sell' a visual message about change (Carapuco et al. 2017). Framing also works for children via the provision of strategic climate stories that appeal to their demographic (Lawson et al. 2018) and can be used to provoke or reduce inclinations to act (Levine and Kline 2017).

The ways in which frames are developed requires careful consideration, so they do not get derailed, excite indifference (rather than engagement) or present information in inaccurate ways. The actual *words* used will matter. Shome and Marx (2009) for example advocate for the use of words that align with those people who see 'preventing' climate change as a duty (eg. use words like ought, maintenance, responsibility, prevent, duty, safety security, stop etc) as against people who see addressing climate change as an 'ideal', something to be promoted (eg. use words like ideal, hope, wish, advance, promote, aspire, nurture, support). Other frames might incorporate messages around 'now versus the future', 'loss versus gain' and 'local versus global impact'. The choice of the right frame and then words to express them, will become an important and effective tool in shaping people's perception and understanding of the issue, building motivation as well as understanding (Altinay and Williams 2019).

The (negative) power of framing can be illustrated in the Pacific, where the normalisation of various discourse frames about sea level rise has resulted in a 'do nothing' policy and thus apathy in policy development. In this case, the normalisation of climate change and sea level rise has led to an international acceptance that there is very little hope for Pacific Atoll countries, which in turn has meant that Pacific Atoll countries are perceived to face finite futures and hence must migrate/leave their tribal homes (Barnett 2017). This has subsequently led to the implementation of various forms of policy where adaptation is seen as "palliative care", the step prior to mass migration.

Yet, in the Pacific itself, despite the normalisation of what is a 'loss' discourse, communities are being creative and are simply refusing outright to accept the normalisation process. In a study of this concept in Tuvalu, rather than emphasise a loss discourse (and the argument that in being normalised, it should be accepted), Barnett (2017) argues for a more creative/ hopeful delivery of adaptation. One that seeks to ask the Pacific Islanders what *they* consider is intolerable and where it is argued that the uncertainly attendant on predictions, in themselves, could offer an opportunity to build towards a future, one that actively promotes the need for mitigation, and advances an agenda of proactive adaptation. In such cases, international countries have responsibilities to address climate change in atoll countries, not ignore them. In this case the dominant framing and: "normalising the loss of atoll countries obscures recognition of these responsibilities"

(Barnett 2017, 12). This study offers important insights into how frames might be developed in the context of communication climate change to Torres Strait Islander communities, and Torres Strait Islanders living in Victoria, where migration, due to island flooding and sea level rise has also been suggested as a climate management option.

Another dominant trend in the literature, is the exploration of whether to use 'positive' and 'negative' frames about climate change. Many commentators argue for the utility of using one or the other. For example, some argue that the use of fear within a 'negative' framing of climate change is integral as the 'fear appeal' can promote precautionary motivation and self-protective action" (Reser and Bradley 2017). Other studies present opposition to this position and assert that negative framings of climate change cause hopelessness and disinclination to act; they advocate the use of positive messaging instead. Table 3 shows some of the further arguments for and against negative framing of climate change



Arguments for using fear in climate communications/appeals (drawn from Reser 2017)

- the need to enhance message salience and audience attention
- the arousal and motivational force of fear
- the argument and some evidence that fear appeals promote systematic elaborated processing of risk information
- the appeal-implied adverse consequences if ameliorative actions are not taken
- the conventional wisdom of increased acceptance of or compliance with suggested harm avoidance actions
- the extensive research evidence from other fields, particularly personal preventive health and safety, that fear appeals (if accompanied by appropriate behavioral instructions and efficacy supports) can assist with message acceptance and engagement
- the widespread precedent of using such a strategy—with this being particularly the case for emergency warnings in the case of environmental threats such as extreme weather events and natural disasters and in the case of preventive health messaging
- a general belief that fear appeals can be effective with respect to communication and influence success.

Arguments against using fear in climate communications /appeals (drawn from Reser 2017)

- Fear appeals have been shown to be counterproductive in particular contexts, having the opposite effect of what was intended and at times referred to as a "boomerang" effect.
- Fear appeals can heighten existing levels of fear—and other related emotions such as anxiety and stress—and in effect reduce the efficacy of the communication.
- The complexity of the phenomenon, threat, and current unfolding reality of climate change makes the selection of the content of the fear appeal problematic.
- The notional psychological distance of climate change with respect to temporal and geographic distance and the difficulty of imagining such a future global phenomenon are factors.

- Chronic use and overuse of fear appeals can diminish issue salience and dangerousness and taxes a "finite pool" of worry.
- Media saturation and sensationalized coverage of projected dangers and implications of climate change appreciably erode public attention and issue engagement.
- There exist multiple ethical arguments relating to or cautioning the use of fear

The use of negative and positive frames can also affect psychological mobilisation about climate change. As Marlon et al. (2019) note: "Hope is not always good and doubt is not always bad; the combination of constructive hope and doubt may actually be motivating, whereas false hope and fatalistic doubt may lead to avoidance, distancing, and inaction (Marlon et al. 2019, 2). Carvahlo et al. (2017) argue against using either frame, noting that "the moralisation of climate change contributes to a particular framing choice – its 'good' or 'bad'" and that "(re) politicising communication practices" speaks to a need to create spaces for alternative modes of communicating climate change (Carvahlo et al. 2017).

33 Victorian Marine and Coastal Council
This conclusion is supported by Wong-Parodi and Feygina (2021) who argue that the need to recognise that the dominance binary of positive/negative frames is more nuanced in practice. They describe a study where US residents were shown images of the North Pole, designed to incite emotions. The results demonstrate that when residents experienced negative emotions, they expressed increasing concern about and willingness to act on climate change. However, interestingly, positive images *also* elicited acceptance, concern and willingness to act on climate change. What this study shows is that the use of positive and negative climate narratives is key in provoking both positive and negative emotions as both were factual and emotionally laden (Wong-Parodi and Feygina 2021).

The ongoing discussion around the utility of positive and negative frames illustrate the role and power of *language* in climate communications. The choice of what frames to use and how they can incite action, is an essential decision that will enable communication practitioners and policy makers to go beyond information production to include awareness raising, concern and then response (Nerlich et al. 2010). As such, there have been many alternative linguistic frames (see Table 4) that have been used and which break this 'positive/negative' binary and may be influential in communicating climate change.

Table 3 : Typology of Climate Framing (Nisbet 2009), 18).
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Frame: Climate change as	Defines science related issue as
Social Progress	A means of improving quality of life or solving problems; alternative interpretation as a way to be in harmony with nature instead of mastering it.
Economic development and competitiveness	An economic investment; market benefit or risk; or a point of local, national, or global competitiveness.
Morality and Ethics	A matter of right or wrong; or of respect or disrespect for limits, thresholds, or boundaries.
Scientific and Technical uncertainty	A matter of expert understanding or consensus; a debate over what is known versus unknown; or peer-reviewed, confirmed knowledge versus hype or alarmism
Pandora's Box/Frankensteins Monster/Runaway science	A need for precaution or action in face of possible catastrophe and out-of-control consequences; or alternatively as fatalism, where there is no way to avoid the consequences or chosen path.
Public accountability and governance	Research or policy either in the public interest or serving special interests, emphasizing issues of control, transparency, participation, responsiveness, or ownership; or debate over proper use of science and expertise in decision making ("politicization").
Middle way/alternative path	A third way between conflicting or polarised views or options
Conflict and strategy	A game among elites such as who is winning or losing the debate, or a battle of personalities or groups (usually a journalist driven interpretation)

In most cases, a suite of frames may need to be developed, each differentiated in message and orientation (i.e. negative/positive etc), designed to suit different communities or sectors within them.

Many communicators for example choose to use frames that present climate change as a suite of risks. Several studies have also shown that framing climate action around the health benefits that would occur, is another successful way of engaging particular groups and audiences (Leiserowitz and Smith 2018, Myers et al. 2012, 2015, Maibach and Nisbet 2018, Nisbet 2009). In a study of OECD communication programs, themes of sustainability, responsiveness and prevention were effective (Wirth et al 2014).

However, frames can be dangerous if not correctly used (Lidstrom 2018). In one study, the use of frames that focussed on the geology of sea level rise and its incursion as sudden events (rather than the more likely incremental change) depoliticised sea level rise and in so doing enabled coastal residents to ignore it (Lidstrom 2018).

Frames can also be collated into wider climate narratives and delivered to good effect. This finding is echoed by a UK study where a range of climate narratives were developed and tested amongst residents. In this case, climate narratives about: (a) waste, (b) 'the good life', (c) great British energy and (d) social justice were trialled. Analysis found that all the narratives worked except one about social justice. This study showed that the use of narratives: "offers clear implications for how climate change communicators can move beyond preaching to the converted and initiate constructive dialogue about climate change with traditionally disengaged citizens" (Whitmarsh and Corner 2017, 122).

Studies also show that the development of messages and frames need to establish means by which *misinformation* is corrected. In a media fluid world, the proliferation of 'fake' information is rife (Cook 2017, Thaler and Shiffman 2015). Industry groups and others use persuasive climate frames that connect climate change to consumption in advertising campaigns. These campaigns embed forms of greenwashing and generate climate (mis) understandings based on incorrect information (Atkinson 2017). Neutralising these pervasive forms of misinformation is an important part of the communication challenge when delivering to the intended audience (Cook 2017). There are two approaches which can be used here (i) one that refutes all myths, debunks dominant anti climate narratives and (ii) to deliver pre-emptive, accurate information so 'inoculating' the public before the 'fake' information is released (Cook 2017).

However, as climate scepticism remains one of the core challenges facing climate communicators, thinking about how to build frames and messages that relay scientific consensus in climate communications is a fundamental task.

Ultimately, while the science itself is important, getting the right 'pitch' or frames that will communicate it properly can be even more so (Bernauer and McGrath 2016).

Using emotions - psychology matters

Climate change is not just a scientific issue but an emotional one and there is a clear need to understand how to deal with emotion about climate change (Chapman 2017). The communication challenge is to ensure each message has the right 'emotional recipe' to guarantee effectiveness.

How climate change is psychologically conceptualised will often determine how emotional individuals will be or how they will emotionally react/act on climate change. Psychological distance is one driving factor: Jones et al. (2017) highlight that most people view climate change as psychologically distant (to them) and hence the articulation of communications that address and reduce this distance are important to successful public engagement about climate change. McDonald (2017) confirms this point in a US study, that shows that the psychological distance people have from the impacts of climate change (more or less) correlates with their belief in and concern about it (more or less).

Political ideology can also affect the psychological distance people perceive from climate change. McDonald's study also found that democrats are more likely to support distant climate victims to republicans who will support closer victims. This message is corroborated by Weiner et al. (2021) who find that partisan understandings of hurricanes are influenced by immediate proximity to them as a natural hazard. Another study, of visual communications in the UK and Germany also highlights further the power of emotions. In this case, the use of climate images provoked a range of emotional responses. A familiar image like a polar bear, while easily understood was viewed with cynicism, but images of places closer to home, depicting impacts people would imagine feeling, evoked more concern. In this case, the authenticity of the image was related to the distance it was perceived to have to 'real life'. This case study showed that the emotions people felt about climate change, and their motivation to do something about it was mediated by imagery that invoked a sense of it being real or authentic, close to or far away from them (Chapman et al. 2016).

Trying to provoke people into 'caring', the subject of another study, found that when people can link climate change and its impacts to 'objects of care' (to them), then strong emotions can be generated which in turn can be used to prompt action (Wang et al. 2018).

Two further observations are provided here in relation to use capitalisation of emotions in communications: (i) do not assume that anger is a negative, it is often used as and has rectified social injustice, and (ii) one can't assume that emotional responses will lead to behavioural change (Chapman 2017). This insight leads to the additional reflection that it is also always important to be clear on what *the point* of the communication program is: to inform, to involve or to indeed facilitate behavioural change?

While there are no 'magic words' that guarantee successful climate communication, these studies suggest that the capacity to use emotions in climate communications, *can* start important conversations (rather than provoke argument) and encourage more participatory conversations: "where more substantive levels of engagement are likely to be engendered in a genuinely conversational setting, and defence reactions to explicitly persuasive communications are less likely" (Whitmarsh and Corner, 2017, 132).

Delivery - Many forms of climate communication exist

Once the key messages and frames have been determined, a decision needs to be made around what form/s of communication will be used to deliver them. Climate communications are dominated by web sites, printed materials, mass media, workshop events, telephone apps, exhibits, advertising, competitions and advisory boards (Wirth et al. 2014). As Box 4 shows there are many to choose from.



Box 5: Forms of climate communication

Over and beyond these tools, the literature suggests that citizen science offers strong potential as an avenue to develop relevant communications about climate impacts on coasts (Muradaua et al. 2020). Citizen science has the capacity not only to actively involve publics, but also to make science matter, and to communicate it in ways that have efficacy and relevance (Cigliano et al. 2015). It can enable large scale data collection, while increasing the scientific literacy of its users and making, potentially, the participants, advocates for the issue (Johnson et al. 2014). Citizen science often offers a more experiential way of 'seeing' impacts and then generating activity to resolve them (Nursey-Bray et al. 2018, Pecl et al. 2019). Importantly, citizen science is also a means by which multiple knowledge systems can be drawn together and connected to each other in creative ways.

Some examples of relevant citizen science programs are in Box 6 below.

Case study:

Tide Gauge Digitisation Project – Citizen Science CSIRO

(https://research.csiro.au/slrwavescoast/extremes/tide-gauge-digitisation/) This project engages volunteers to assist in the digitisation of historical tide data to help scientists and policy makers understand how the coasts have changed and extent of sea level rise

Wicked High Tides program: SciStarter, Northeastern University, NISE Network, Arizona State University and Museum of Science, Boston are working together on a **National Oceanic and Atmospheric Administration-funded project** to educate and engage the public in climate hazard resilience planning. This includes engaging participants with citizen science, deliberative forums and civic action as part of the citizen science projects: ISeeChange and My Coast. MyCoast invites participants to document tides, storm damage, beach cleanups and more via their app, and ISeeChange asks citizen scientists to investigate how weather and climate change impact their lives and community by sharing photos and stories about multiple hazards, including sea-level rise

MyCoast: https://scistarter.org/noaa-museumofscience/noaa-museumofscience-mycoast

ISeeChange: https://scistarter.org/noaa-museumofscience/noaa-museumofscience-iseechange

Witness Kind Tides:

http://www.witnesskingtides.org/

Witness King Tides is a fun community photography project that helps us visualise the potential future impacts of sea level rise. When king tides hit, we ask coastal communities around Australia to head out and snap pics of local landmarks during the very high tide. These photos capture what our coastal communities may look like in the future, as global sea levels rise. Together, these images build a picture of the threat posed by sea level rise across Australia and help track the future impact of climate change.

REDMAP

(https://www.redmap.org.au/)

Using the tag line Spot, Log Map! Redmap (Range Extension Database & Mapping project) invites the Australian community to spot, log and map marine species that are uncommon in Australia, or along particular parts of the coast. Helps raise awareness of the impacts of climate change on marine species and in turn economic impact of these changes on sectors like fishing

Box 6: Case studies of citizen science for communicating climate change



Another reason why citizen science could play a pivotal role in building communications and community engagement with climate change is that it also often enables access to key information that scientists/ academics often have but which are not within the reach of others (Cosarini et al 2014). The relationships that can be built between scientists and practitioners and the community can often reveal information, including grey literature, which is useful to all.

Visual forms of communication are very effective, and offer diverse and dynamic pathways for communication

Analysis of the literature shows that visual communications are particularly useful means of implementing climate communications as they can be used to shape individual perceptions of complex scientific issues. Visual methodologies assume that in 'seeing' issues, people will be more responsive and motivated to act on them (Wirth et al. 2014). The use of pictures and images make it possible for people to experience climate change impacts and then visualise adaptation options in ways that elicit emotion, relate to their value systems and motivate audiences (Culloty et al. 2019, Wirth et al. 2014).

Visual communications can help inspire emotional responses on climate change (Bieneck-Tobasco et al. 2019) and a wide range of studies consider how affective images can also play a role in shaping public perception (Leisorowitz and Smith 2017). Affect in this sense is meant to describe a person's positive or negative evaluation of specific content or images. The use of affective imagery assumes that human thought largely consists of images - broadly construed to include words, sounds, smells, real and imagined impressions (Leisorowitz and Smith 2017). In an affect study of the perceptions of climate change in Australia, respondents were asked to describe the three top images that came to mind when they thought of climate change. They thought of sea level rise, drought and melting ice caps - all of which were perceived as 'bad' (Leviston, Price and Bishop 2014). The study then

asked respondents to sort through a set of 82 images (representing image associations and places they most associated with climate) and place them on to what is called an emotion grid. In this grid, different discrete emotions were situated along two axes: active vs. inactive and positive/pleasant vs. negative/unpleasant.

Results showed that climate images were the most relevant category (for communications): images associated with disasters and extreme events provoked feelings of alarm, anger, and fear. Imagery around "icemelt" caused feelings of upset and frustration, while those representing drought and denuded landscapes resulted in people feeling upset and miserable. Ultimately, what this study highlights, is that it is useful to be able to identify what images might provoke what range of different emotional reactions, as they in turn may prompt a range of different adaptive responses and help the design of appropriate messages and frames (Wang et al. 2018).

Studies also show that it is important to use images carefully – in some cases, where one image is used too often – perhaps that of the polar bear on thinning ice –image fatigue can occur (Chapman et al. 2016). Analysis of the effectiveness of current communications shows that while use of iconic visual image is important, that the *"iconography of climate"* change shows that global iconic motifs, such as polar bears, have contributed to a public perception of the problem as spatially and temporally remote" (Schroth et al. 2014, 413). Further, people also find it easier to engage with the message if the images used include people and visualisations of direct impacts that may affect them, in their specific locations.

Computer based visual communications are also very effective. Newell and Canessa (2017) suggest a role for the use of geovisualisation techniques that can immerse citizens and educate them via engagement with real life visualisation of impacts in their communities. As Alejandrino et al. (2016) show in relation to shallow landscape hazard mapping in the Philippines, such visualisations, (especially of sea level rise) are useful as they allow full navigability of what are ongoing dynamic elements and flexibility to change the tool over time. Landsat imagery can also be used to communicate climate impacts at various scales (Miller et al. 2016). There are several tools (see examples below) where this type of depiction can be used to show what sea level rise might look like.



This site allows people to select a local government area and see what sea level rise is predicted to – or has already reached – in the region – according to a range of IPCC scenarios

Link: https://coastadapt.com.au/sea-level-riseinformation-all-australian-coastal-councils

 $\ensuremath{\text{Box 7:}}$ Sea level rise and future climate information for coastal councils



In this study, the utility of visual frames to communicate climate change and sea level rise was tested in Louisiana. Images conveying environmental loss and images referring to the future that conveyed urgency and importance were used. Results showed that showing people negative images may increase awareness but lower motivations, but that there was a correlation between willingness to support public solutions when visual imagery showed short term goals and successes. The fact based visualisations "Climate Outreach" and "Carbon Visualisation" show that building environmental literacy is crucial

Link: https://climatevisuals.org/asset/1112/

Box 8: Use of visual imagery in Louisiana to communicate sea level rise (Altinay and Williams 2019)

Beyond sea level rise though there are also a range of tools that can be used to map coastal risk more generally. One example is the National Oceanic and Atmospheric Administration (NOAA) *Digital Coast*, as is the Coast Adapt Risk Tool and Coast Adapt tools for Australia (see Box 9 below). One of the key features of the Digital Coast tool is that it builds and relies on partnerships between scientists and the coastal management community.



More Than Just Data

The Digital Coast was developed to meet the unique needs of the coastal management community. The website provides not only coastal data, but also the tools, training, and information needed to make these data truly useful. Content comes from many sources, all of which are vetted by NOAA. Data sets range from economic data to satellite imagery. The site contains visualization tools, predictive tools, and tools that make data easier to find and use. Training courses are available online or can be brought to the user's location. Information is also organized by focus area or topic.

See: https://coast.noaa.gov/digitalcoast/tools/flood-exposure.html



Coast Adapt

Provides risk management tools for sea level rise, shoreline monitoring and inundation mapping. **Risk assessment templates**: CoastAdapt provides four risk assessment templates that allow users to systematically follow the **guidelines for assessing climate change risks**, and record relevant information gathered at each step of a risk assessment.(i) **Template 1: First-pass risk screening:** for a quick screen of climate change hazards and associated risks, (ii) **Template 2: First-pass risk screening**: useful if you want to redo the first-pass risk screening with more information and effort, (iii) **Template 3: Second-pass risk assessment**: to record information during a second-pass risk assessment workshop, (iv) **Template 4: Thirdpass risk assessment**: to record information during a third-pass risk assessment workshop. **See: https://coastadapt.com.au/tools**

COASTAL RISK AUSTRALIA

Coastal Risk Australia

It is an interactive map tool designed to communicate coastal inundation associated with sea level rise to the year 2100. Using **Google Earth Engine** technology, CRA allows you to investigate the extent of coastal inundation using the latest 3D models of the Australian coastline. Data have been captured using airborne LiDAR technology to create detailed digital elevation models (DEMs), which are then combined with 'bucket-fill' inundation modelling to create the map-based visualisations.

See: https://coastalrisk.com.au/home

Box 9 : Different coastal risk mapping tools

These types of risk and management tools allow users to visualise change 'in their backyard', translate the science into useable formats and assist communicators to deliver their messages.

Interactive games are another type of visual tool that provide a different type of communication opportunity (Hansen et al. 2018). One of these is called Future Delta (see Box 9), which is an interactive game, based in British Colombia.

Link: https://calp.forestry.ubc.ca/home/future-delta-2-0/

Future Delta 2.0 is a place-based educational video game to explore climate change challenges and solutions. The project is unique in its use of video gaming to encourage exploration of climate change challenges and solutions. This research builds on the Collaborative for Advanced Landscape Planning teamwork in Delta, British Columbia, visualizing local and regional climate change. The beta video game was co-designed and evaluated with students and teachers from the Delta School District to create a fun and interactive tool to explore scenarios that stimulate awareness, concern and learning at a variety of scales.

Future Delta 2.0 is structured around 3 Acts that are time and locale-specific. Each act features new tools including

- 1. Act 1: CIMA vision. A way to discover climate change Causes, Impacts, Mitigation and Adaptation within the North Delta landscape
- 2. Act 2: Carbon Vision. A way to see carbon emissions and sequestration within the industrial context of Tilbury
- 3. Act 3: Future Vision. A way to explore future adaptation solutions in residential Boundary Bay and the municipal center of Ladner

Another game is one called Climate Jam 2018, where game developers have collaborated with climate scientists to build a game that effectively informs and educates players about climate change, and what to do about it (Folz et al. 2019). Game jams are events where participants from diverse backgrounds, such as art, programming and design, create aames under the constraints of a time limit and theme (Chatham et al., 2013; Cook, 2015). Other games include ones called On Thin Ice, Issoropoia (a climate city aame) and Climate Cards (Folz et al. 2019).

Box 10 : Future Delta Tool



Story Maps

Story Maps offer another opportunity to communicate information in innovative ways. A story map is a web map that has been thoughtfully created, given context, and provided with supporting information so it becomes a stand-alone resource. It integrates maps, legends, text, photos, and video and provides functionality, such as swipe, pop-ups, and time sliders, that helps users explore this content (see Box 11 for examples).

East Anglia Fenlands Coastal Inundation -ArcGIS StoryMaps

See: https://storymaps.arcgis.com > stories

This site is a digital Story Map that uses GIS technology and other mapping techniques to visualise the impacts of coastal inundation on the Fenlands in East Anglia

In Australia ESRI offer opportunities to build Digital Story Maps for any subject and is a potential useful resource for VMACC –

See: https://www.esri.com/en-us/arcgis/ products/arcgis-storymaps/overview

A few specifically focus on climate science -

See: https://storymaps.arcgis.com/stories/ f3eb9adef95b425a9e50cc2a00a5bfef

The Atlas for a Changing Planet Story Map enables scientists, policy makers, planners, and activists to examine detailed spatial information that is critical for adapting to a warmer future.

See: https://storymaps.esri.com/stories/2015/ atlas-for-a-changing-planet/

Box 11 : Examples of Story Maps

Image Credit: Andrew Bray

E-engagement

Many of the visual tools described above rely on the use of powerful images to capture audiences and get them engaged and informed about climate change, and sometimes motivate action. However, analysis shows that there are also a wider range of e-engagement tools, designed to communicate climate change to communities in other, innovative ways. In this context, online engagement has a lot of future potential as, increasingly, the internet and social media are being used to deliver climate communication programs (Li and Su 2018).

One of these, in Cornwall, tested how science communications could be deployed in real time and used online videos and social media over a 5-week period, on a 300-mile trek around the coast of Cornwall to inform the public about climate impacts (Pavelle and Wilkinson 2020). An online public opinion survey was also used to evaluate how useful the online tools were. Results found that the use of real time did create a communications gateway that raised awareness about climate science. User engagement increased the more the trek continued. The personal interaction between audience and the presenter was valued, but by and large, engagement came from those in the local area. Further, the integration of sharing tools like Twitter amplified project dissemination. The project also benefited from pre-project dissemination and advertisement by key agencies prior to the trek itself.

Ultimately, evaluation of this project concludes that: "effective online video use requires a balance between crafting an informative yet entertaining narrative without compromising scientific accuracy; yet ultimately, social media platforms may represent a potential "stepping-stone" for practitioners to consider implementing in a journey toward "upstream engagement" (Pavelle and Wilkinson 2020, 1). Other explorations of digital media communications about climate change demonstrate the importance of developing the right information and then making sure it is delivered in the most appropriate forms, relevant to the audience (Jensen 2017). Ongoing e-engagement via social media and mobile apps and with local media news and other outlets will also help build the profile of the climate communications program (Dehorme et al. 2018). A project called MC is an example of a program that successfully facilitates e-dialogues in coastal regions. This project shows the potential of electronic communication for delivery of key climate communications in coastal regions and highlights the ways in which they facilitate two way expert and practitioner collaborations (Newell and Dale 2015).

The use of art is another form of visual climate communication and engagement with much potential. Its use can encourage pro-environmental behaviour through the communication of information in engaging ways, the creation of empathy towards natural spaces, and the development of communications that are more attractive and engaging (Curtis et al. 2014). Art can also be used as a form of climate communication where science and creative practices can meet, mutate and experiment (Gabrys and Yusoff 2010). Sommer et al. (2019) explore this further by reflecting on the utility of the art installation "Pollution Pods" in Trondheim Norway and Somerset House, London. These are immersive experiences where people enter into pods to 'feel' climate change. In this analysis, the use of environmental art was an effective form of communication. A range of other art exhibitions have been held that use art forms to describe and disseminate climate messages, examples of which are shown below (Box 12).



Box 12: Examples of art installations, Australia

The use of film is also gaining increasing traction as a medium that can be deployed to build climate communications in creative ways (Cortese 2018, Bieneck-Tobasco et al. 2019). An analysis of the film The Age of Stupid (Howell 2011) and the film Sizzle by Randy Olsen, shows how it is possible to communicate the urgency of climate change to audiences via film.

Core Decision Two: What is being communicated?

The choice of what frames and messages are to be used and what tools will be deployed to deliver then, is crucial and will dictate the effectiveness - or not – of delivery. This decision needs to be made in conjunction with/aligned to the values/needs of the target audience/community.

Pilet ...

Who though, will deliver those messages?

Image Credit: Andrew Bray

Core Decision Three: Who will be delivering the messages?





Image Credit: Andrew Bray

It is not just the ways that messages are framed, differentiated to the audience, and the tools that are used, that are important to developing effective climate communications. Multiple studies highlight that *who* delivers the message is as important as how the message is delivered (Morrison, Duncan and Parton 2013, Sherley et al. 2014, Roberston and Murray-Prior 2016, Song et al. 2019). What then is the role of government, the scientist, policymakers and community influencers as climate messengers?

Scientists are key figures in climate communications, and yet often suffer from an inability to convey the power of their knowledge. To become effective communicators, they need to acknowledge human nature (Brennan and Valcic 2012), and span the divide between themselves and stakeholders (Shaw et al. 2013). Scientists also need to be accurate, relevant and clear in the ways they present their findings (Fischhoff (2007). Further, scientists need to distinguish between their assertion of 'objective' results from a more 'subjective' community interpretation. Scientists may need to move from a dependence on the deficit model of communications described earlier, to a model that insists on public engagement with science: to accept the 'messiness' of it all.

In so doing, how can the communication role a scientist may actually play be articulated? This is a challenge that both scientists and policy makers face, and why the choice of the right communicators will make all the difference.

In this context, identifying what type of scientist may be involved in the communications endeavour is one key decision. Pielke (2007) identifies a range of roles that scientists play: (i) the pure scientist, (ii) the science arbiter, (iii) the issue advocate and (iv) the honest broker of policy alternatives. In deciding how to use to deliver the communications, it may be useful to ascertain what kind of scientist is the best 'fit'.

Overall though, the lack of clarity about how to use scientists has by and large resulted in an 'ivory tower' model where communities either feel, or are, left out of the picture (Anderegg 2010, Brennan and Valcic 2012). This begs the question as to whether scientists need to be involved at all in the communications? With the increasing democratisation and devolution of environmental and climate management to communities, there are now multiple opportunities to use multiple messengers, well beyond the domain of science.

Governments for example, can play a key role in expediting or assisting to communicate coastal climate impacts (Palmer 2018). Governments in Australia both face and are implementing significant planning initiatives to combat climate related impacts, but how they then communicate them to their stakeholders is less clear. For example, in South Australia, while every local government has local community adaptation plans, stakeholder engagement with and 'know how' about them is very low (Palmer 2018).

The media can be a key climate messenger (Tindall 2018) and influential (van Eck et al. 2019). As Boydstun (2013, p. 25) notes, "news coverage frequently shapes which issues people think about, how they think about them, and often what actions government takes." The media can play the role of 'watch dog', 'lap dog', and 'guard dog' in the public sphere (Boykoff and Luedecke

2016). The media can also help link natural events and disasters to climate change (Hopke 2020). Media also can assist in the development of policy networks and discourses which once established are hard to unseat (Tindall et al. 2018).

The media has often played a key bridging role in the translation of climate change science into policy and various publics and can have a lasting effect on national climate change communications, which are now a lot less prominent and largely low key (Eskjaer 2017).

The literature clearly identifies that there are multiple opportunities to use multiple 'messengers' over and above the climate scientist, and that within each target community, there will be a range of choices.

Trustworthy messengers and message sources are as important as the message

However, whoever the 'messenger' is, to be successful, they need to be trusted. Buys et al (2014) in a study of trust in Australian rural towns reveal that politicians, journalists and government were seen as completely untrustworthy messengers. In Adelaide, a case study of how climate adaptation communications were relayed to socio-economically vulnerable populations identified a lack of community trust in the government as a significant barrier to the effectiveness of the communications (Palmer et al. 2017). In the program *Climate Matters*, where TV meteorological forecasters were used to communicate climate change – they were seen as trustworthy and thus effective messengers of climate messages as they were seen as impartial (Maibach 2016).

As much as there needs to be trust in the messengers, there also needs to be high levels of trust in information sources. Different sectors within each community will have their 'favourite' type of information, whether it is the TV news, social media, newsletters and flyers, radio, group web sites or newspapers. In Australia for example,

in a study of 1008 Australians across four towns, climate risk perceptions were clearly mediated by the level of trust in the communications, and whether or not they were seen as appropriate vehicles for messaging (Boon 2016).

Another Australian survey, which investigated levels of receptivity to television as a trusted source of information study showed that 74.9% of respondents were interested in learning about climate change in a weather bulletin, that they were primarily interested in hearing about extreme weather, and that local climate impact information was preferred over global data (Holmes, Solano and Hill 2017). The ABC science show *Catalyst* is also a 'trusted' source, as it makes people feel they are getting a balanced view, or what Debrett (2017) calls 'responsible rhetoric', and this makes viewers feel the information they receive about climate change is legitimate. When people feel the source has 'vested' interests, trust in it is minimal (Buys et al. 2014). Other studies show that social media is a preferred source for climate information, and can also be a predictor of pro social beliefs about climate change (Diehl et al. 2021).

The coastal zone has multiple stakeholder groups and therefore could use multiple types of trusted messengers to deploy key messages. These people are often trusted by community members and can ensure that the responsibility for communications about climate change and its impacts on coastal and marine environments, is not the sole province of climate scientists. There will also be a wide range of trusted sources that can be used to deliver climate information. In addition, then, to working out WHO is best placed and most trusted to deliver the communications program, it is important to establish WHAT the preferred means of communication is (Wilkins et al. 2018). Ultimately, when people distrust the message or the messenger, they will also be less likely to accept the call to action about climate change, or even, accept it is an issue (Smith and Mayer 2018).

Indigenous peoples are under-represented in current communications

However, in considering *who* will be effective climate messengers/communicators, analysis shows that there is a clear gap in the literature around the potential role played by Indigenous peoples either as recipients of or contributors to climate communication strategies. This overlooks the potential of Indigenous culture, knowledge, and voices to contribute to climate policy and communications (de Freitas et al. 2018, Bulian 2020, Chirisa et al. 2018).

In Australia sea level rise, storms, warming waters and flooding affect the Sea Country of many Indigenous peoples, including access to and use of fishing sites, coastal middens, and wetlands. Communications in this context need to recognise and incorporate Indigenous peoples and voices in ways that will have cultural resonance, and this may be quite different to what will work for the wider residents in the region. The way in which these communications are delivered is also important – as studies have shown, the social media landscape is often popular and used by Indigenous groups (Twitter, Facebook, and others), enable cultural groups, sometimes torn apart physically, to (re) meet each other and engage (Chadwick 2013, Carvahlo 2007). As Green and Raygorodetsky 2010, 242) note:

"Even if sweeping global climate change agreements are reached swiftly, the present global responses to climate change—either proposed or already implemented—will ultimately fail unless they are grounded in recognition of such basic human rights as the territorial, land, and resource rights of local custodians of global biocultural heritage—the backbone of strategies for adaptation and resilience. Such recognition is inseparable from creating an equitable and respectful space for knowledge co-creation that brings together local Indigenous and conventional scientific paradigms for the purpose of developing climate change mitigation and adaptation strategies and actions".

Further, in Australia, climate changes now impact ages-old knowledge systems that have already been disrupted by colonisation and current communications about Indigenous peoples and climate change rely on dominant constructs of Indigenous vulnerability and victimhood, as well as romanticised notions of Indigenous resilience and the perceived potential of traditional knowledge for adaptation (Nursey-Bray et al. 2020). The dominance of these constructions about Australian Indigenous peoples means climate communications are not currently differentiated to reflect their cultural diversity but also do not address what are persistent issues - social justice, scale, and how to support Indigenous agency (Calliston 2017).

Culturally appropriate climate communications must then be built to convey not just messages about climate change but advance twoway messages that advance social justice and agendas, so they privilege Indigenous voices and knowledge. In other words, invite Indigenous peoples to also become climate messengers.

Best Practice Climate Communications

So far this report has presented a range of learnings, based on the literature, that provide information about how to build effective communications in coastal and marine contexts. The development of effective climate communications is the result of making decisions about the intended audience, the key messages and who will deliver those messages. The synthesis of the literature to date has provided evidence of rich and diverse range of activities and messages that can and are being used to assist in that decision making to develop effective and salient climate communications strategies for marine and coastal communities. Case studies and experience show that there are also a range of barriers and influencers that affect the success of these strategies upon delivery.



Image Credit: Nicola Waldron

Moving forward, the literature and desk top review also shows that there currently exist a range of best practice principles and practices that give guidance on how to implement effective climate communications. In this section, a range of existing models is presented, and then, drawing on these principles, and the specific geographic and climate information for the region, the paper concludes with a communications roadmap for the State of Victoria.

To start with, Moser (2017) suggests that the adoption of principles to achieve effective communication of climate adaptation could include to: (a) link science to lived experience, (b) improve the understanding of risks, (c) connect risks to solutions, (d) avoid adaptation jargon (e) discover jointly deliberated adaptation options and (f) have balanced climate messages.

A review of 278 communication formats amongst 10 OECD countries (Austria, Germany, Switzerland, France, Spain, Denmark, Netherlands, UK, USA and Australia) also provides useful insights. In this case a set of success factors were mapped against data collected from interviews with practitioners (Wirth et al. 2014) to reveal some important conclusions as summarised below:

- Climate change is complex to communicate
- Uncertainty is a concept and factor that makes it difficult to engage people
- Perception of distance i.e. distance of climate change to groups and individuals, matters
- Conflicting values and interests hinder development and delivery of climate communications
- Climate scepticism still exists
- There is very little work on how to communicate climate adaptation (Wirth et al. 2014).

Importantly, this study also identified suggestions for best practice that relate to both content and process. Firstly, they find that content that relates to people, and makes climate change mean something to everyday life, in ways that make sense, and that suggest solutions were the most successful (Wirth et al. 2014). Secondly, they suggest that in terms of process, that it is important to use information to 'join the dots' for community, connect them and the information to local identity and knowledge and to relate good adaptation examples /actions to people (Wirth et al. 2014). Thus, framing the issues and targeting them according to the audience, using accepted and trusted messengers and opinion leaders to deliver them, are also fundamental aspects of good practice. These insights resonate with the findings of the review overall.

Delorme et al. (2018) propose a different but also useful three stage schemata for the development of best practice communications. This model is particularly relevant for sea level rise and it includes commitments to (i) making sure the target audience is understood, (ii) that messages are appropriate and (iii) that delivery is aligned to (i) and (ii).



Picking up on many of these insights, Moser (2017) articulates a clear set of best practice principles/steps for delivery of climate communications (Box 13 below).

- Identify and get to know your audience(s)

 (i.e., common concerns and interests; core values; pre-existing knowledge and beliefs; misconceptions; and lack of knowledge).
- **Specify a desired communications outcome** (i.e., increased ocean-climate literacy; engagement or interest; behavior change; or support for policy).
- Strategically select and use the right opportunity and method for communication to engage the audience(s) (i.e., the where, when, how, how often, by what channel(s), and through which messenger(s) people can best learn about and interact with ocean-climate issues).
- Form a bond around what you share, e.g. stewardship, love of nature, connection to place, and excitement.
- Use observed changes and or current news items as hooks to engage audiences and to tap into existing curiosities. This opens opportunities to talk about the things they most care about or about a wider range of ocean-climate impacts.
- Explain processes briefly and in simple terms, rather than just listing facts, impacts, problems, or solutions, because people understand and retain knowledge best when it is causally linked.
- Always give people a sense of hope that "together, we can solve the problem" (i.e., the problem is serious and urgent, but can be addressed through concerted policy actions at all levels, and every person can help through specified actions and civic/political engagement).
- **Repeat simple messages often** (e.g., climate change and its impacts on oceans are real, happening now, and human caused; the vast majority of scientists agree on this.) Specific recommendations from the FrameWorks Institute: More specifically,

ocean communicators can overcome the aforementioned challenges of communicating ocean-climate impacts and solutions using the following approach:

- Use observed changes, experiences, or visualizations of future impacts to make coastal impacts and response options "real" in particular places. This helps overcome the misperception that sea-level rise happens in the distant future, in faraway places, and to other people. The King Tides Initiative is an example of encouraging people to share experiences during regularly occurring extreme tides.
- Depending on the audience and available science stay agnostic or attribute observed changes to human-caused climate change.
 Answer questions people have about causes, but stay engaged with those who refuse to believe sea-level change can be linked to climate change.
- Listen and make space for people to share their experiences and feelings. This will reveal how the audience understands and thinks about causes, effects and solutions; where members of the audience share common concerns, feelings, and values; and which misconceptions may need to be addressed through education.
- Help people understand that uncertainty is not a good reason for inaction, as things can turn out more or less severe. Work with scenarios to explore impacts.
- Be as specific as possible. If adaptation is an unfamiliar or negatively loaded term, describe concrete actions communities and households can take and frame it as extensions of responsible planning and management.
- **Tap into values that resonate broadly** (i.e., preparedness, stewardship, responsibility, precaution, leadership).

Box 13: Key processes for developing climate communication strategies (Moser 2017).

At international scale, Table 5 sums up suggestions from leading agencies, including the IPCC, about what from their perspective constitutes effective and best practice climate communications.

Table 4: Examples of Best Practice from the IPCC, OECD, CRED

Summary Advice from the IPCC Expert Group in Communications (Corner et al. 2018)

1. Be a confident communicator

Scientists are generally highly trusted. By using an authentic voice, you can communicate effectively with any audience.

2. Talk about the real world, not abstract ideas

Although they define the science and policy discourse, the 'big numbers' of climate change (global average temperature targets and concentrations of atmospheric carbon dioxide) don't relate to people's day-today experiences. Start your climate conversation on common ground, using clear language and examples your audience is more likely to be familiar with.

3. Connect with what matters to your audience

Research consistently shows that people's values and political views have a bigger influence on their attitudes about climate change than their level of scientific knowledge. Connecting with widely-shared public values, or points of 'local interest' in your communication and engagement makes it more likely that your science will be heard.

4. Tell a human story

Most people understand the world through anecdotes and stories, rather than statistics and graphs, so aiming for a narrative structure and showing the human face behind the science when presenting information will help you tell a compelling story.

5. Lead with what you know

Uncertainty is a feature of climate science that shouldn't be ignored or sidelined, but can become a major stumbling block in conversations with non-scientists. Focus on the 'knowns' before the 'unknowns' and emphasise where there are areas of strong scientific agreement around a topic.

6. Use the most effective visual communication

Choosing images and graphs is just as important to do in an evidence-based way as verbal and written communication. The Climate Visuals project, plus new guidance from the Tyndall Centre, offer a useful set of tools for how to communicate effectively in the visual medium.



Case studies of good practice – communications in OECD Countries



Klimaportal:

German climate communication website https://www. deutschesklimaportal.de/

DE/Home/home_node.html



Climate communication, Aspen, Global Change Institute:

Trains scientists how to be better climate communicators, amongst other things https://www.agci.org/project/ climate-communication



Film series

NORDWEST 2050 (climate films) https://www.youtube.com/ watch?v=mAExPsCCF54



Climate Wisconsin

(story telling app) https://climatewisconsin.org/



Jungfrau Climate Guide:

multi media climate guide https://www.jungfrauklimaguide.ch/index.php/en/ climate-science

Climate change communication principles (Center for Research on Environmental Decisions , CRED, 2009)

Know your audience

- Get your audience's attention
- Translate scientific information into concrete experience
- Beware the overuse of emotional appeals
- Address scientific and climate uncertainties
- Tap into social identities and affiliations
- Make behaviour change easier

Across the world, local governments are also taking the lead on the implementation of a diverse suite of climate communications and dialogue-based partnerships, in efforts to address climate change at local and regional levels. Table 5 below sums up a range of these options and illustrate many ideas that could be adopted and applied to coastal contexts in Victoria.

Table 5 : Climate communications for local government

Approaches based on communications media	Description
C40 Cities for Climate Leadership Group	The C40 Cities Climate Leadership Group is a group of 97 cities around the world that represents one twelfth of the world's population and one quarter of the global economy. C40 is a network of the world's megacities committed to addressing climate change. C40 supports cities to collaborate effectively, share knowledge and drive meaningful, measurable and sustainable action on climate change.
ICLEI	ICLEI- Local Governments for Sustainability is a global network of more than 2500 local and regional governments committed to sustainable urban development. Active in 125+ countries, they seek to influence sustainability policy and drive action for low emission, nature based, equitable, resilient and circular development.
Urban Sustainable Directors Network	A network of local government professionals across the United States and Canada dedicated to creating a healthier environment, economic prosperity, and increased social equity to share best practices and accelerate the application of good ideas.
Durban Adaptation Charter	The Durban Adaptation Charter commits Local Governments to local climate action in their jurisdiction that will assist their communities to respond to and cope with climate change risks thereby reducing vulnerability.
US Conference of Mayors Climate Protection Center	Mayors are on the front lines of impacting human behavior – from their work on recycling to public health initiatives, they are changing human behavior every day. This is one of many reasons why 1066 Mayors continue to join The U.S. Conference of Mayors' Climate Protection Agreement, vowing to reduce carbon emissions in their cities below 1990 levels, in line with the Kyoto Protocol. Seattle Mayor Greg Nickels was the founder of this movement.
Rockefeller Foundation of 100 Resilient Cities	In 2013, The Rockefeller Foundation pioneered 100 Resilient Cities to help more cities build resilience to the physical, social, and economic challenges that are a growing part of the 21st century. Cities in the 100RC network have been provided with the resources necessary to develop a roadmap to resilience
American Society of Adaptation Professionals	The American Society of Adaptation Professionals (ASAP) supports and connects professionals to better prepare for climate change. ASAP helps members strengthen their professional network, exchange best practices and practical advice, and accelerate innovation - all leading to a more equitable and effective climate adaptation practice

Consultation Approaches to Communication – examples

New York City Panel on Climate Change (NPCC2)	The New York City Panel on Climate Change (NPCC) is a critical part of MOR initiatives. New York City Panel on Climate Change (NPCC), a 20-member independent advisory body that synthesizes scientific information on climate change and advises City policymakers on local resiliency and adaptation strategies to protect against rising temperatures, increased flooding, and other hazards. NPCC started in 2009 and was codified in Local Law 42 of 2012 with a mandate to provide an authoritative and actionable source of scientific information on future climate change and its potential impacts.
London Climate Change Partnership	The London Climate Change Partnership offers free support and advice about adaptation in London, including peer learning, research, events, and other activities related to sectors and climate risks.
Toronto Climate Change Network	The Toronto Climate Action Network (TCAN) is a network of action- oriented organizations working together to address the threat of climate change.
Southeast Florida Regional Climate Change Compact	The Southeast Florida Regional Climate Change Compact is a decade- old partnership between Broward, Miami-Dade, Monroe, and Palm Beach counties, to work collaboratively to reduce regional greenhouse gas emissions, implement adaptation strategies, and build climate resilience within their own communities and across the Southeast Florida region.
San Diego Regional Climate Collaborative	The Collaborative was established in 2011 as a network for public agencies to advance climate change solutions that mitigate greenhouse gas emissions and adapt to the effects of climate change. Partnering with academia, non-profit organizations, and business and community leaders, the Collaborative raises the profile of regional leadership, shares expertise, and leverages resources. Their mission is to connect the region to advance climate change solutions. "By bringing people together, we envision a region that is prosperous and resilient with a commitment to maintaining a high quality of life, and fostering a green and growing economy with an equitable and unified approach. Together, we are prosperous and resilient."
Quito Panel on Climate Change in Ecuador	Quito is one of the few Latin American cities that have a local policy instrument such as the Climate Change Strategy, which together with the use of the city's ecological footprint as a planning tool, put the city at a vanguard in local responses to climate change.
Surat Climate Change Trust in India	Surat Climate Change Trust in India (SCCT) is one of the first city level multi-stakeholder trusts in India with the following objectives: (i) to engage in policy addressing problems arising out of urbanization and climate change; (ii) to facilitate capacity building of City of Surat to address challenges of urbanization and climate change and facilitate / prepare a Roadmap to face these challenges; (iii) to take steps for mitigation of natural calamities like floods and to manage emergencies; and (iv) to support and to undertake interventions that increase resilience of vulnerable sectors and communities in the society to the adverse impacts of urbanization and climate change.

In Australia, local governments are also initiating a range of communication programs, often in coastal areas, that again furnish a range of examples (see Table 6 below) to draw from in terms of managing for and communicating climate impacts in Victoria.

Table 6: Examples of Australian best practice

Case study	Description
Climate Communicators	Following a successful launch in Melbourne on the ABC & Seven Network in May 2018, Climate Communicators expanded into Queensland in April 2019. The ongoing Victorian and Queensland programs of Climate Communicators receive advice and guidance from a panel of climate communication, media and meteorological experts.
	The program was born from the results of the Australian Weather Presenter Survey which found that 71% of Australian weather presenters said they would be comfortable using climate graphics in their reporting. Similarly, the MCCCRH's 2018 survey of capital city television audiences found that there was a parallel desire from audiences for television-based climate information from trusted sources such as weather presenters.
Hunter Joint Organisation (NSW) Disaster Resilience Program	Link - https://www.hunterjo.com.au/projects/disaster-resilience/
	This project, run by Hunter JO aims to do the following -
	 Increase council capability to prepare, respond to and recover from disaster events
	Improve collaboration between local councils and agencies
	 Strengthen local emergency management plans, based on rigorous assessment of risk
	• Establish local recovery plans that are adaptable to a range of risks
	 Identify priority systems, strategies and investments (within and across Council areas) to mitigate risks to the community, Council operations and critical infrastructure
	 Integrate climate change adaption strategies into emergency management systems
	 Enable councils to engage communities and businesses to prepare for / build resilience to disasters
	 Establish regional networks focused on building Council and community resilience
	Councils involved in the project include: MidCoast Council, Port Stephens Council, City of Newcastle, Lake Macquarie City Council, Central Coast Council, Maitland Council

Case study	Description
Tasmanian Coastal Adaptation Pathways Project	The Tasmanian Coastal Adaptation Pathways (TCAP) project aims to help Tasmanian communities and decision-makers to adapt to climate change impacts by:
	 raising the communities' awareness of their vulnerability to the impacts of coastal inundation and erosion;
	 improving the ability of coastal councils and communities to plan and respond to likely climate scenarios; and
	 examining risk management and adaptation options that will improve communities' ability to manage risk and reduce the impacts of inundation and erosion.
	The TCAP approach is to work step-by-step with local councils and communities to consider adaptation options for vulnerable coastal areas.
	Step 1 - Councils nominate coastal areas that are vulnerable to climate change
	Step 2 - Using coastal hazard mapping and a risk management approach, the coastal risks for each of the coastal communities are identified and analysed
	Step 3 - The project takes this analysis to the relevant local councils and communities and supports them to consider adaptation options using a flexible planning pathway (JPEG)
	See: http://www.dpac.tas.gov.au/divisions/climatechange/Climate_Change_ Priorities/climate_risks_and_opportunities/coastal
Coast ADAPT	CoastAdapt is an information delivery and decision support framework. It is for anyone with an interest in Australia's coast, the risks it faces from climate change and sea-level rise, and what can be done to respond to those risks.
	CoastAdapt contains information and guidance to help people from all walks of life understand climate change and the responses available to manage the impacts. Although there is a focus on Australia's coastal regions, CoastAdapt also links the user to climate change resources on the NCCARF website and beyond that are relevant to Australia more broadly.
	https://coastadapt.com.au/
QCoast2100	On 2 June 2016, the former Minister for Environment and Heritage Protection, the Honourable Dr Steven Miles MP and the former LGAQ President, Margaret de Wit, officially launched the QCoast2100Program. QCoast2100 is a Queensland Government commitment to a \$13.234 million fund to assist councils advance coastal hazard adaptation planning.
	The Program represents an unprecedented opportunity for local governments impacted by coastal hazards to get on the front foot in adaptation planning to implement cost-effective mitigation measures over the medium and long term, plan for development and growth, budget for higher costs, collaborate regionally and seek investment opportunities.
	https://www.qcoast2100.com.au/about/home

Image Credit: Andrew Bray

Case study

Climate Wise Communities - Ready Check Program, Ku-ring-gai Council, NSW

Climate Wise Communities is an award-winning initiative developed by Ku-ring-gai Council in consultation with emergency management agencies and government. Everyone has a responsibility to prepare for extreme weather events – households, communities, emergency management agencies and government all working together. The program started in 2010 as part of Council's Climate Change Adaptation Strategy. Initial efforts focused on Council resources and assets before widening to include the community and households.

Ku-ring-gai's natural bushland provides vital habitat for native flora and fauna, and is a source of much enjoyment for our community. Along with the serenity and amenity of the bushland comes the risk of extreme weather events. With these online resources and the **Ready Check** the Council seeks to actively engage individuals and communities in strengthening their homes and neighbourhoods.

Key objectives

- Raise awareness of local risk factors
- Promote shared responsibility for extreme weather events
- Build communication/social networks that enable communities to prepare, respond and recover from extreme weather events

Link: - https://climatewisecommunities.com.au/

Box 14 : Case study of best practice climate communications





Discussion – what does this mean for Victoria's coastal communities?

The overarching message distilled from the literature is that climate communications must be (a) tailored to the right audience, (b) deliver the right messages and (c) be delivered by trusted messengers and sources.

Image Credit: Andrew Bray

This message can be distilled in turn into three key questions or decisions, that once answered can map the pathway required to implement effective communications. These questions are: (a) who is the target audience, (b) what is being communicated and (c) who will be delivering the messages?

In getting to know the community, a first step to try to gauge the climate literacy within the community is essential – what do they know, what do they *not* know, what is their perception of climate change and its impacts in their region and across the world. Associated with this step, the literature highlights that place attachment is important as is, in some cases direct experience of climate impacts in those places.

Engaging with and explaining risk and climate uncertainty are additional factors that influence the success of communications. Mapping age, gender, ethnicity, socio-economic circumstances, values, politics and religion will help create a sophisticated picture of the target community/audience.

All these factors together will help build a picture of who the community is, and significantly, provide key information about how to tailor climate communications of most relevance and impact to the target audience. This will ensure that *useful* information becomes *useable*.

Once a deep understanding of the target community has been established, then the task of formulating the actual communication begins. The literature highlights that it is vital to differentiate between the different climate concepts. Climate change, adaptation, and sea level rise for example, although similar phenomena, are all different and hence require the generation of different messages. The review also revealed the power of language, frames, narratives to create strong messages and climate communications. These messages will be mediated by emotions and psychology.

Nonetheless there is a vast array of tools available for use to deliver messages. Visual tools (including GIS, interactive web sites, gaming), are especially effective, while citizen science, story maps, art installations offer additional opportunities for innovation. There are a range of best practice communications to draw upon, ones that have successfully engaged with the target audience, tailored key messages and have been considered trustworthy. They offer ideas and examples that can be modified for use in the State of Victoria.

Finally, analysis reveals that the development of the right messages and communications is not enough *per se*: it is the delivery of these messages by trusted messengers and sources that is the final step for success. The literature provides many examples that demonstrate that trustworthy messengers and message sources are as important as the message. Indigenous peoples, however, are largely underrepresented in current communications, and this is a gap that needs to be addressed.

For a State like Victoria, which is experiencing multiple climate impacts on its coastal and marine environments and human communities that live within them, these findings can offer guidance on how to build, and then implement a rigorous and effective communications strategy. Ones that can lead to climate resilient communities and ecosystems.

A synthesis of these findings is below:

- Building communications in marine and coastal contexts has particular communication challenges
- Models that assume knowing about the issue will create action (deficit communication models) do not work
- Participatory (Dialogic) Processes offer potential as effective communication options
- Three core decisions define an effective communications strategy: (i) getting to know the community/intended audience, (ii) aligning and differentiating the right frames, messages and tools and (iii) choosing the right messengers.
- Messages must be tailored to the place and differentiated for different target audiences
- Different cultural contexts, whether Indigenous, gender, race, class, age and political inclination will affect how communications are crafted and then implemented; as will partnerships between knowledge brokers, policy makers, scientists and communicators
- Risk perception and identification influences the success of communications
- Incorporating uncertainty is necessary
- Place attachment is an important driver in determining tailored climate communications
- Climate change, climate adaptation and sea

level rise while connected are distinct concepts and climate communications need to respect and recognise that fact

- What frames and messages are used will affect the effectiveness of communications
- Psychology and emotions matters in determining appropriate communications
- Direct experience of climate change impacts is a factor in how people respond/engage with climate messages
- Many forms of climate communication exist
- Visual forms of communication are very effective, and offer diverse, dynamic pathways for communication
- Trustworthy messengers are as important as the message
- Indigenous peoples are under-represented in current communications
- There is no 'one size fits all' climate communications strategy, but there are a range of baseline principles that can be used as starting points
- A number of best practice examples and programs already exist, and which provide good models for effective coastal climate change communication

Box 15 : Synthesis of key findings in the literature

Overall, insights from the literature suggest that effective communications revolve around a set of decisions that (i) ensure a careful alignment between people and place, their culture and values and (ii) are delivered by trusted and authentic messengers and tools. In the next section, a communications roadmap is suggested as one pathway for the State of Victoria to progress an effective communications strategy.





Road map for communicating climate change impacts on marine and coastal environments to Victoria's communities.

To begin it is suggested that the State of Victoria, commit to a series of communications principles, examples of which are suggested below.

Step 1: Agree on key operational principles that will guide the communications strategy

These may include the following (as a starting point):

- Know your community
- Acknowledge diversity of actors and communities
- Recognise the sea country of as well as the Indigenous owners of the region
- Implement two-way communication strategies
- Recognise and engage with uncertainty
- Identify, acknowledge and work with Indigenous
 owners of marine/coastal country
- Less is more: invest properly in whatever is decided
- Commit to the time required to deliver appropriate communications

Step 2: Determine the overall objective/purpose of the program

Climate communications are very complicated, and hence it is really important to be exceptionally clear about what the objective and scope of the program is first and foremost. Is the intent to simply inform the public of climate impacts in that particular coastal region? Or is the intent to galvanise behavioural change? Is the intent to build community resilience and/or adaptive capacity? Or is the rationale for the communications to educate community about climate change and a call to action adaptation? Are communications designed to scare or inspire people, or are they meant to create public-private partnerships, resulting in infrastructure and policy change? Are communications designed to create social license to operate for local governments and others to implement climate governance arrangements?

The answer to these questions will define the communications and provide underpinning assumptions for what desired outcomes of the communications program will be.

Step 3: Determine the team and resource scope of the communications program

The establishment of a strong communications team will be vital to the subsequent successful roll out of a communications program.

At the very least it is suggested that a Climate Communications Advisory Group (CCAG) be established and which will include: -

- Key coastal managers (local and State government)
- Skilled climate communicator
- Indigenous representatives
- Member of local community group
- Coastal climate scientist/and or an academic skilled in development of surveys and community engagement

It will also be important to be clear on what the resource scope for the project will be as that will determine what tools/people can be used. It is suggested that a core group (government coastal managers and communicators) oversee the entire project, but that according to the site, different Indigenous and local representatives could be invited to participate.

Step 4: Choose your sites

The development of targeted communications will require choices about certain sites. Sites may be delineated via habitat/coastal type, or sites may be delineated according to population, or economic importance etc. Sites may be identified according to key (known) climate impacts. It will be important to be clear up front, what type of site will be used, as that will partly determine the messaging later on.

Step 5: Develop a profile for each site

For each site a profile will be developed which will assist in mapping what the key risks are in that area, what the uncertainties are, what are the observed, current and future predicted impacts – and how they will all interrelate to each other.

A range of coastal visualisation tools can be accessed to assist in developing of risk profiles.

Step 6: Know the Audience.

Getting to know who the community is for each site/ instance will enable alignment with frames and messages. Working out who the community is can be undertaken via (i) stakeholder mapping/analysis, (ii) ABS/Census analysis to obtain demographic, political and socio-economic information

If resources are available to do so, it would also be ideal to gain some appreciation of what community values are, and what knowledge/climate literacy already exists within the community/site about climate change and further, what experience people have already had of climate impacts. This information could be gathered by development and then delivery of a survey.

In this step, it would also be important to identify and contact the Indigenous owners of the relevant coast and sea country (ies).

One of the key challenges for any engagement is to 'engage the disengaged'. This will be a priority for a communications strategy. One suggestion is to apply a "Communities of Practice" (COP) approach. In any local government/coastal site there will be multiple COPs, and most of them will *not* be concerned or interested about climate change (Nursey-Bray et al. 2016). Every local government will have a data base of such COPs, which nonetheless will represent 'community'. Surveys and communications could target these groups, and then disseminate and engage people and groups who normally would not be interested, but who will be affected anyway. Of course, engaging those COPs (eg. life saving clubs, Coast care groups, etc) who will be interested is important, as they will be powerful advocates – and messengers for the communications.

Step 7: Identify an overarching communication framework/approach per site

Using the information from Steps 1 – 5, it will now be possible to determine what types of communication/ approach will be taken to develop the communications strategy. This approach will include consideration of what the key messages will be, how they will be framed, how they will align with community values and who will be the climate messengers.

It will also be important at this stage to establish the times that the communications will be delivered.

Another facet of this step is making decisions about the extent to which community will be involved – are they recipients, participants, or collaborators?

A further element is to decide whether this communication process/project is to be an ongoing long-term endeavour, or more of a short term, or periodic venture. Or will it be implemented over time, but staggered on a site by site basis?

Finally, at the very specific level, decisions will be made as to how to structure the messages/narratives in the most persuasive way possible – perhaps building on models like Randy Olson's ABT mode.

Step 8: Identify the Main Messages.

This step will result in the creation of key messages about climate change impacts, their resolution, and what community can do to contribute to this endeavour. Given the coastal context of this project, identification of key messages, will harness people's familiarity with, and attachment to the coast to boost message efficacy.

It is possible at this stage, to develop these messages with the community, perhaps by way of a Community Advisory Group, or via place based workshops so as to get an idea of what key issues are and what different communities of practice might find salient. Involving Indigenous owners in this step is crucial also to ensure cultural relevance/differentiation of messages where needed.

Step 9: Choose the Communication Tactics

In this step, decisions are made about how to deliver and who will deliver the key messages.

This may be a very targeted approach using only one or two tools, or may use a wide range, from historical and known techniques such as via news, flyers, workshops or via social media, visualisations, art installations and other modes of information dissemination.

The priority is to use the right tools/tactics that will work for the stakeholders in that site, so aligning the messages and tactics to the sites chosen will be mission critical

Decide who will deliver the communications or how they will be delivered. Again, this may require a range of people and tools
Step 10: Pilot communications in one or two sites

Once messages and tactics have been agreed, it would be ideal to pilot them at one or two sites. Lessons learned from this pilot will give an indication of how to amend/progress into other areas, the appropriateness of the messengers chosen and whether or not the messages work.

Step 11: Deliver the communication program

Once the pilot program has concluded, and the communication strategy revised, the overall communication program can be implemented

Step 12: Evaluate the program, then amend

Any engagement program, especially one based on communications, needs to ascertain whether or not it worked. Hence, undertaking an ongoing formative and then summative evaluation, conducted by an independent party, will enable the program to be strengthened via amendment and continuous improvement.

In sum

This suggested roadmap is based on lessons learned from the literature and ideas drawn from best practice.

The key to success will be in paying attention to detail, and in differentiating the target audience/s, to align the communications so they are trusted, salient and achieve their purpose.







Conclusion

This paper distils the key themes and lessons in the literature about how to effectively communicate climate change impacts to communities. While the literature is vast, three key findings emerge: (i) know the community, (ii) tailor messages and communities in differentiated ways to align with that community and (iii) choose trusted messengers and forms of communication to deliver them. Within each of these domains, several additional insights give guidance on how to achieve these three goals. Many best practice examples also exist that can be used as benchmarks and starting points for development of a climate communication strategy in Victoria. To assist with this, a suggested road map is outlined, with some advice on key needs and ideas to progress.

Ultimately climate communications need to connect local knowledge as much as communicate the science in a comprehensive way. It must go beyond the content level – more than information is needed.

In regions with extensive coastlines at risk of sea level rise, building tailored, differentiated and inclusive place-based communications: ones that create awareness not just about the issue but offer solutions for it, will motivate communities to respond in favourable ways.

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Appendix 1: Methodology for systematic review

To undertake the review a systematic methodology was used. This technique facilitates a rigorous and structured way of gathering data to show patterns within the literature (Berrang-Ford et al., 2015). It has been used successfully by many authors (Vink et al., 2013, Porter et al., 2014, and Pearce et al., 2018). For example, Preston et al. (2011) analyzed 57 adaptation plans from Australia, the United States, and the United Kingdom; and Berrang-Ford et al. (2011) reviewed 39 academic articles documenting adaptation initiatives implemented in developed nations and many others

A range of platforms were used to obtain the final texts used for evaluation. These included the Web of Science, Scopus, Google Scholar and SciVal. A specific search was also made within the journals *Frontiers in Communication, Global Environmental Change, WIRES Climate Change*, and *Environmental Communication*. Finally, the *Oxford Encyclopedia for Climate Change* was screened, with an additional 33 articles identified as useful. A desk top analysis also identified a range of technical reports produced by various local governments, that discussed climate change/ sea level rise and how to communicate it. The time period from 2006 – 2021 was used, as that period covers almost all the IPCC reporting periods.

The following search terms were used (and variations thereof): sea level rise, storm surge, flood, storm, climate change, adapt, communication, normalisation, coast, policy, Australia, Victoria. The initial search of all these data bases yielded 790 specific results. Abstracts of all these items were then reviewed for each paper according to the following criteria: (a) discussion of



climate change and communication, (b) extent to which it related to coastal management, (c) whether or not it discussed communications relating to sea level rise, (d) what information it provided that may be relevant to Australia (e) if it was an Australian case study (f) if it provided insights into how to effectively communicate sea level rise and coastal climate issues, (g) if it provided insights into lessons learned and indications of best communication practice.

The final set of texts that were used for analysis in this review include the 33 articles gathered from the Oxford Encyclopedia, over 110 peer reviewed articles and chapters from 6 books in the Springer Handbooks for Communicating Climate Change series. The review also draws on commentary from the **George Mason Center for Climate** Communication and the UK based **Climate Communication Project web** sites. The decision to stop reading and start analysing and writing up was made once information saturation was achieved - in other words, that the same themes and information albeit in different locations – kept recurring,

and no new ideas or concepts were emerging. Thus, this review is replicable and robust.

The texts that were collected were analysed using thematic analysis. Thematic analysis allowed the identification and generation of patterns and similarities within the literature, and which were then discussed and presented as a theme in the review. Collectively the review highlights key trends in how to communicate climate change and identifies there is a gap in knowledge around climate change communication in coastal communities around sea level rise in particular.

There is a huge corpus of information about how to communicate climate change, and similarly there is a vast amount of information about sea level rise as an issue, but the subject of how to communicate sea level rise *per se* has received little treatment. However, it has been possible to bring these two strands in the literature together in this document, to make some suggestions, moving forward, that the State of Victoria can consider, in terms of how to implement best practice and effective communications.











