



**Earth Systems and
Climate Change
Hub**

National Environmental Science Programme



Platform-based science and services supporting climate action

An EU-Australia bilateral knowledge exchange workshop on developing and using web-based resources to enhance climate intelligence and support climate action

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Contact

Enquiries regarding this report should be addressed to:

Geoff Gooley

Program Manager, Earth Systems and Climate Change Hub
CSIRO Climate Science Centre, Oceans & Atmosphere
geoff.gooley@csiro.au

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This workshop was jointly sponsored by the *Stepping-Up Knowledge Exchange between Climate Adaptation Knowledge Platforms* (KE4CAP) Project funded by the European Commission, the National Environmental Science Program's Earth Systems and Climate Change Hub (National Climate Science Advisory Committee *Climate Services National Capability* Project) and the CSIRO *Navigating Climate Change* Mission. This report was prepared by the workshop organising committee including representatives from the ESCC Hub/ *Climate Services National Capability* and KE4CAP Project teams in association with Dr Simon Torok, Scientell.

Executive Summary

The workshop entitled *Knowledge Exchange: Services and Science Supporting Climate Action* was convened at CSIRO Aspendale (Melbourne, Australia) from 3-5 March 2020 under joint sponsorship of:

- the Stepping-Up *Knowledge Exchange between Climate Adaptation Knowledge Platforms* (KE4CAP) project funded by the European Commission
- the National Environmental Science Program (NESP) Earth Systems and Climate Change (ESCC) Hub (specifically the Hub's *National Climate Science Advisory Committee (NCSAC) National Climate Services Capability for Australia* project), and
- the CSIRO Navigating Climate Change (NCC) Mission.

KE4CAP is a forum focussed on learning and sharing knowledge associated with developing and using web-based platforms to enhance climate adaptation. It helps people share information, learn from different approaches, and work together to address challenges.

The Melbourne workshop is the first of three Bi-lateral Knowledge Exchange (BKE) events involving the European Union (EU) and Australia, Japan and Canada respectively, along with other bi-lateral and multi-lateral knowledge exchange events and activities with various countries. This will include a final synthesis workshop that will draw together lessons learned, good practice, and possible next steps. The activities will link climate adaptation and disaster risk reduction, look at how information is being shared, and how web-based platforms can help. With the growth of available data and information (intelligence), users need to have access to platforms and enablers that enhance relevance and utility.

The objectives of the Australian BKE workshop were to:

- share information between EU and Australia to inform best-practice approaches to developing a national climate intelligence capability for Australia, with development of a national (digital and domain) climate services capability as a core component
- identify the steps towards further bilateral and multilateral collaborative partnerships to facilitate ongoing engagement, knowledge exchange and longer-term learnings.

Each day of the workshop included a combination of plenary seminars, panel discussions and small group break-out discussions. The workshop agenda is provided in Appendix 1.

Day 1: Australian perspectives and EU reflections

The first day of the workshop examined Australian climate service platform examples and perspectives through the lens of existing platforms and projects/initiatives at national and state-level. Presentations included overviews of the KE4CAP project, the NCSAC National Climate Services Capability project, the CSIRO NCC Mission and the Bureau of

Meteorology climate research strategy, along with shorter presentations of a cross-section of existing Australian climate platforms and projects/initiatives for which new platforms are being developed and/or enhanced.

Panel and small group discussions explored the theme of ***national challenges and potential solutions*** by addressing three questions (what is the current state of platform-based climate intelligence/services, what is the preferred future state, and how do we get there?) in relation to designated topics:

- Standards and quality control
- Linking, integrating and coordination
- Linking science and services
- Business models and IP management, and
- Linking traditional knowledge with science.

Key findings from Day 1 concluded there is a need for a nationally coordinated climate platform capability in Australia with an agreed, clear and coherent value proposition underpinned by structured governance arrangements designed to facilitate delivery of:

- Standardised (core) and tailored (differentiated) products and services which are:
 - relevant, authoritative/trusted, scientifically credible and with improved traceability and quality assurance/control standards
 - fit-for-purpose, legitimate, highly contextualised and where appropriate customised with different levels of detail consistent with the needs and capacities of different users.
- Business models and associated networks that:
 - enhance coordination and facilitate effective partnerships between levels of government and between public and private sectors (public-private partnerships) that support proactive rather than reactive adaptation
 - have core products and services supported by public funds
 - have differentiated products and services supported by public-private-partnerships and private consultancies
 - demonstrate the value of climate services to building resilience, create new markets and jobs, and enhance economic productivity.
- Better accessibility of data and information by both digital (web-based) and domain (people-based) capability
- Ongoing monitoring and evaluation to report on and improve performance and path-to-impact as part of real-time adaptive management

- Requisite communication, knowledge brokering and capacity development capability for both providers and users as part of a deliberate co-design/co-production of knowledge imperative.

Day 2: EU perspectives and shared EU-Australian challenges

The second day provided EU examples and perspectives and identified shared challenges and potential solutions. Presentations included overviews of the EU web-based climate platform landscape and user perspectives, Copernicus Climate Services, Climate-ADAPT, Climate Ireland and local government climate adaptation initiatives in the Republic of Ireland. Key findings included:

- A set of benchmarks is required to assess platforms; benchmarks exist in Europe and could inform Australian platforms. The evaluation can't be led by scientists; it needs to be independent, user-centric and engage heavily with the user community. We need to identify the future state of a national climate platform capability we are looking for to help users judge where they are on the journey and the current quality of information. If we were to undertake an evaluation, we need to set the baseline from the start and then monitor it – the best benchmarks will allow comparison of changes over time.
- Lessons from an evaluation need to be used in design. There's no typical platform, so a new or modified platform needs to be specific to needs and capabilities of the targeted region/sector using it and is determined by what the audience wants. A Community of Practice can enable sharing of lessons and foresighting. Learning from what's going on in other countries and engaging in other forums is critical to moving forward. Understanding where Australia is in the international scene is an important part of this.
- An adaptation platform may not be responsive to shocks in the system over time – a platform needs to respond to changes in policy and environmental change and needs to be adaptive and iterative.

The workshop participants had small-group discussions focused on challenges and solutions for the following topics:

1. Value proposition
2. Stakeholder engagement
3. Integrating third-party knowledge
4. Governance and resourcing
5. Evaluation and review

Key conclusions were:

- We need a value proposition for a climate-resilient Australia by 2030, with significant social, economic and environmental benefits, underpinned by a

nationally coordinated climate platform capability. The value will flow to users from providers through a growing, effective and efficient market for climate products and services.

- The value proposition needs to be framed as: the what (a climate platform capability supporting use by all Australians and users overseas to understand risks and solutions); the why (to deliver value to all users for economic, social, and environmental benefit), and the how (integrating science-based knowledge and services from across disciplines and co-designing/developing/producing the platform with users).

Based on the agreed value proposition, governance arrangements need to be developed and implemented to facilitate exploration of business models, stakeholder networks (including partner organisations and individuals), and associated strengths, weaknesses, opportunities, threats, etc.

The NESP ESCC Hub, the National Climate Change Adaptation Research Facility (NCCARF) and associated platforms (e.g. Climate Change in Australia, CoastAdapt) provide lessons for potential governance models in Australia, with parallels to Climate-ADAPT and Copernicus in the EU. The governance system ultimately must ensure quality assurance/control, and credibility of content, products, etc. There is a role for both technical expertise (climate and adaptation science) and end users (verifying if information is useable, legitimate and relevant) to contribute to platform content and functionality.

Day 3: Collaborative development and roadmap

The third day covered the value proposition for an Australian national climate platform capability (effectively an ‘ecosystem’ of existing and new platforms) and discussed the basis for future collaboration between the EU and Australia.

Following an initial presentation about the value proposition for a national climate services platform capability, the workshop participants had small-group discussions focused on three questions (1: governance and strategy development, 2. Business models and partnerships, 3. Barriers and enablers) for the following sectors:

1. Government
2. Private sector
3. Research
4. Indigenous people

All participants agreed on a consortium approach, involving industry, researchers, government, and Indigenous groups. Addressing the value proposition requires a multi-user response. The approach recommended by the Taskforce for Climate-related Financial Disclosure (TCFD) is driving the Australian finance industry, electricity industry, water sector and infrastructure sector to re-assess current and future climate risks and adaptation strategies in collaboration with scientists. There is a need to further build

bridges and connections between government, non-government organisations, science and industry groups. Australia also needs to address the current fragmentation of climate science and adaptation services, inadequacies in governance and business models, weaknesses in the alignment between user needs and available climate services, and gaps in capabilities and resources to deliver those services effectively and efficiently.

There is a need for business models to address public good and private value. An important option is the ‘club good’ model and mechanism – creating incentives to do things collectively, including through an appropriately designed public-private partnership to enable sustainability of platform capability without relying solely on government funding. There is also a need to demonstrate value and relevance to all players in servicing their requirements for platform-based climate knowledge.

What priority issues need action?

The Australian provider and research community should use the opportunity created by the strategic climate resilience policy imperative that exists now and over coming months, i.e. proposals for a new NESP Climate System Hub supported by around \$70 million over 6 years, plus development of the CSIRO NCC, plus development of a Bureau of Meteorology climate service strategy, plus development of an implementation plan for the National Disaster Risk Reduction Framework. The next step is to get the climate services value proposition into each of these initiatives, noting there’s a sense of urgency, in light of recent drought, heatwaves and fires and associated national reviews.

The key stakeholder ‘community of interest’ (those willing to be involved directly in next steps) for development of a platform-based national climate intelligence and climate services capability needs to consider the following priority actions:

- Pull together ideas and demonstrate the value of this approach, including practical examples, case studies, etc
- Demonstrate to government the existing capability of platforms and providers and the demand (gaps/needs) from end-users
- Review published national and international literature on climate services, identify ‘best practice’ as well as gaps and needs, and build a vision of the way forward
- Demonstrate the costly risk of ‘doing nothing’ or ‘business as usual’ for government and industry, and the potential benefits of climate resilience
- Review Australian climate service capabilities and existing platforms, assess strengths, weaknesses, opportunities and threats (SWOT), key environmental factors (e.g. political, technological, legal) and how the network of service providers and users is linked
- Highlight how we might build on what we already have, mapped in a way that can be communicated to a particular region’s or sector’s needs and opportunities

- Evaluate existing activities and identify what end users think of what is already out there and identify the gaps
- Identify an initial cohort of key private sector users and providers for public sector counterparts to work with, to start framing ongoing future needs and find a way forward
- Drive the value proposition for a national capability by drawing on input from all key stakeholder groups, including governments, private sector, NGOs, Indigenous communities and research and associated science/technical expert networks
- Be ready as a community to respond to opportunities (political and/or industry driven) that may arise in the near term including having proposals, ideas, planning ready to roll out at short notice
- Continue to engage in a meaningful and culturally sensitive way with Indigenous communities as part of the co-design/co-production process to address needs and incorporate Traditional knowledge where appropriate
- Consider the longer-term vision, creating ideas about how projects will build on each other to provide services for all Australians, with equity of access
- Work with KE4CAP to identify priorities on which to focus, and to develop a national climate platform capability as part of international cooperation.

This report summarises the proceedings from the workshop, including key issues, insights and outcomes. Outcomes include shared knowledge and learnings between Australian and EU stakeholders, and enhanced understanding of the way forward for developing a platform approach to mainstreaming Australia's climate intelligence and associated climate services capability. Going forward, these outcomes will inform the final reporting of the NCSAC National Climate Services Capability project for Australia, and will be addressed on an international basis as part of the ongoing implementation of the KE4CAP project in collaboration with the EU and partner countries.

1 Background

The workshop entitled *Knowledge Exchange: Services and Science Supporting Climate Action* was convened at CSIRO Aspendale (Melbourne, Australia) from 3-5 March 2020 under joint sponsorship of:

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- the National Environmental Science Program (NESP) Earth Systems and Climate Change (ESCC) Hub (specifically the Hub's *National Climate Science Advisory Committee (NCSAC) National Climate Services Capability for Australia* project), and
- the CSIRO Navigating Climate Change (NCC) Mission.

The KE4CAP initiative started in late 2019 (see [here](#) for more information). KE4CAP is a forum focussed on learning and sharing knowledge associated with developing and using web-based platforms to enhance climate adaptation. It helps people share information, learn from different approaches, and work together to address challenges.

The Melbourne workshop is the first of three Bi-lateral Knowledge Exchange (BKE) events involving platform operators and related research providers and users from European Union (EU) countries European-wide platforms, and Australia, Japan and Canada respectively, along with other bi-lateral and multi-lateral knowledge exchange events and activities with various countries including a final synthesis workshop that will draw together lessons learned, good practice, and possible next steps. The activities will link climate adaptation and disaster risk reduction, look at how information is being shared, and how web-based platforms can help. With the growth of available data and information (intelligence), users need to have access to platforms and enablers that enhance relevance and utility.

The objectives of the Australian BKE workshop were to:

- Share information between EU and Australia to inform best-practice approaches to developing a national climate intelligence capability for Australia, with development of a national (digital and domain) climate services capability as a core component¹.

¹ In the context of this Australian workshop we are taking 'intelligence' to refer to science-based data, information and associated knowledge. The 'services' transform this knowledge into 'actionable knowledge' and/or facilitate application of this knowledge. The 'platform' provides the mechanism including the governance and associated architecture to manage, make accessible and facilitate the user application of the science/services and associated knowledge. The collective term 'climate platform' variously encompasses aspects of these specific definitions and is also used throughout this report for convenience.

- To identify the steps towards further bilateral and multilateral collaborative partnerships to facilitate ongoing engagement, knowledge exchange and longer-term learnings.

The agenda for the workshop is provided in Appendix 1.

The first day of the workshop examined Australian climate platform examples and perspectives through the lens of existing platforms and projects/initiatives at national and state-level. The second day provided EU examples and perspectives and identified shared challenges. The third day covered the value proposition for an Australian national climate platform capability (effectively an ‘ecosystem’ of existing and new platforms) and discussed the basis for future collaboration. Each day of the workshop included a combination of plenary seminars, panel discussions and small group break-out discussions.

This report summarises the proceedings from the workshop, including key issues, insights and outcomes. Outcomes include shared knowledge and learnings between Australian and EU stakeholders, and enhanced understanding of the way forward for developing a platform approach to mainstreaming Australia’s climate intelligence and associated climate services capability. Copies in pdf format of all plenary presentations delivered at the workshop are available on the [Earth Systems and Climate Change Hub website](#).

The workshop followed an extraordinary Australian summer that reminded governments, businesses and communities of the urgent need to improve climate adaptation and disaster risk reduction. The combination of hazards (e.g., bushfire, heavy rain and flooding, damaging hail, drought and extreme temperatures), exposure (e.g. lots of people, animals and businesses in risky/remote areas) and vulnerability (e.g. early warning systems, fire-fighting resources, evacuation policies, recovery processes) demonstrated that many risks are increasing with climate change. The unprecedented events of summer 2019-20 in Australia serve as a backdrop to everything discussed at the workshop.

KE4CAP Definition:

A platform is a virtual way of communicating knowledge and guidance to making decisions. A platform can be called a portal; the idea is it is a vehicle to transmit information. This might include knowledge, policies, data, decision-support tools, advice for adaptation funding and activities, case studies, guidance on using tools and information, and a variety of other content. It is primarily delivered via the web, but can be face-to-face (such as a gathering of people across the country, supported by a web-based holder of information).



Day 1: Keynote plenary presentation providing an overview of the KE4CAP project: Dr Roger Street, Oxford University/KE4CAP Project Leader

2 Australian perspectives and EU reflections (Day 1)

2.1 Towards a national climate services capability for Australia

The NESP ESCC Hub is presently undertaking a project on behalf of the National Climate Science Advisory Committee (NCSAC) to scope development of a climate services capability for Australia. This project involves consultation with key climate service users, providers and purveyors (i.e. individuals or organisations who both use and provide climate services) across multiple sectors and agencies in Australia. The focus is on identifying the climate services capability needed at a national level to capture opportunities and better manage the risks of a variable and changing climate for decision-makers in both public and private sectors. It includes consideration of both web-based (digital) and person-based activities, turning data into useable knowledge to facilitate impact.

The climate services landscape in Australia which incorporates the capability to deliver science-based data and information ('intelligence') is complex and changing rapidly. Users of climate services include three tiers of government (federal, state/territory and local), statutory authorities, Indigenous communities, and the private sector. These users are looking for authoritative, accessible and legitimate data and, information to raise awareness, build capacity and more specifically to inform policy development, risk, resilience and adaptation assessments, investment analysis, adaptation and disaster risk management planning and associated decision-making. Providers and purveyors of climate services in Australia include CSIRO, the Bureau of Meteorology, Geoscience Australia, State Government agencies and other statutory authorities, and various universities and associated collaborative partnerships, NGOs and private sector consultancies. A visual representation of the current Australian climate services landscape (including users, providers and purveyors) is provided in Figure 1.

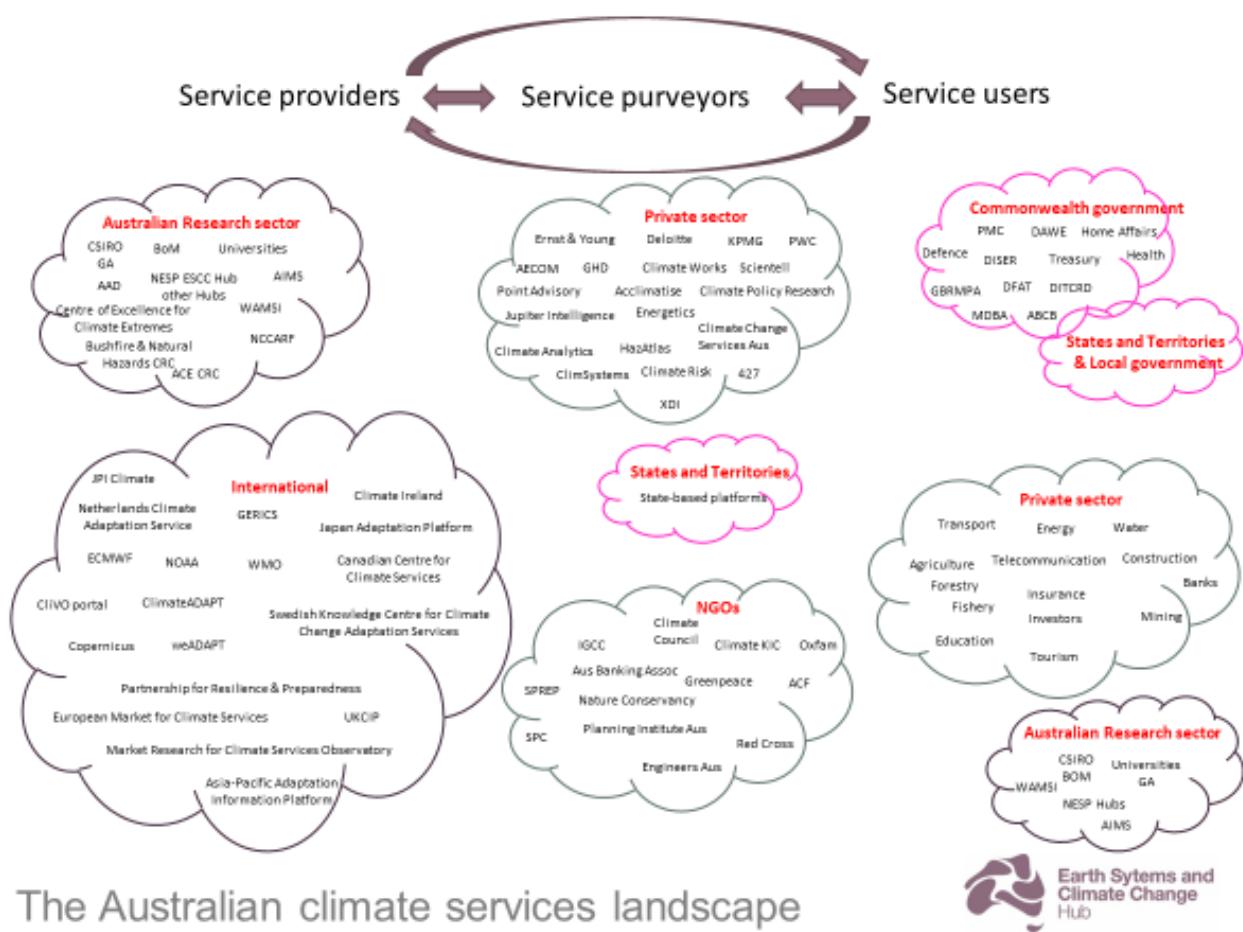


Figure 1: Visual representation of the current Australian climate services landscape

Australia is not currently limited by availability of existing ‘climate intelligence’ for existing needs however we have limited alignment, coordination and integration of existing platforms. We are also limited to varying degrees by:

- Both user/provider capacity for practical applications to address current and future climate risk
- Availability of detailed scientific knowledge and decision-support tools, with user-uptake enabled by a range of climate services, to inform new and emerging risk-management decisions.

This limitation is further constrained by lack of a unified view across relevant knowledge domains and the user/purveyor/provider landscape more broadly on strategic drivers, mechanisms, priorities and opportunities. There is much to learn and leverage from existing platforms, both in Australia and internationally, and we also have much to offer.

There is a compelling case for development of a coordinated and well-resourced ‘best practice’ platform approach to a national climate service capability. This is based on recognising a fundamental market driven shift in the understanding and management of climate resilience, systemic risks and emerging opportunities for decision-makers, dictating the need for a forward-looking, nationally-coordinated, fit-for-purpose approach to providing data, information and associated knowledge in the form of climate services.

Services should be outcome focused, tailored and highly contextualised to the needs of target users: ***decision-driven and science-informed, rather than science-driven and decision-informed.***

This workshop with KE4CAP provides a key part of this process of consulting with a wide range of stakeholders. It also allows the NCSAC climate services project to be informed by the wider EU/global perspective. The project is exploring how to get from the current state of climate services capability (including identification of key issues/constraints, gaps/needs and opportunities) to where we need to be, i.e. a coordinated, well-resourced, best practice climate services platform capability supported and used by the private and public sectors.

A potential conceptual model for a platform-based national climate services capability that is underpinned by a climate intelligence platform for Australia is schematically presented in Figure 2.

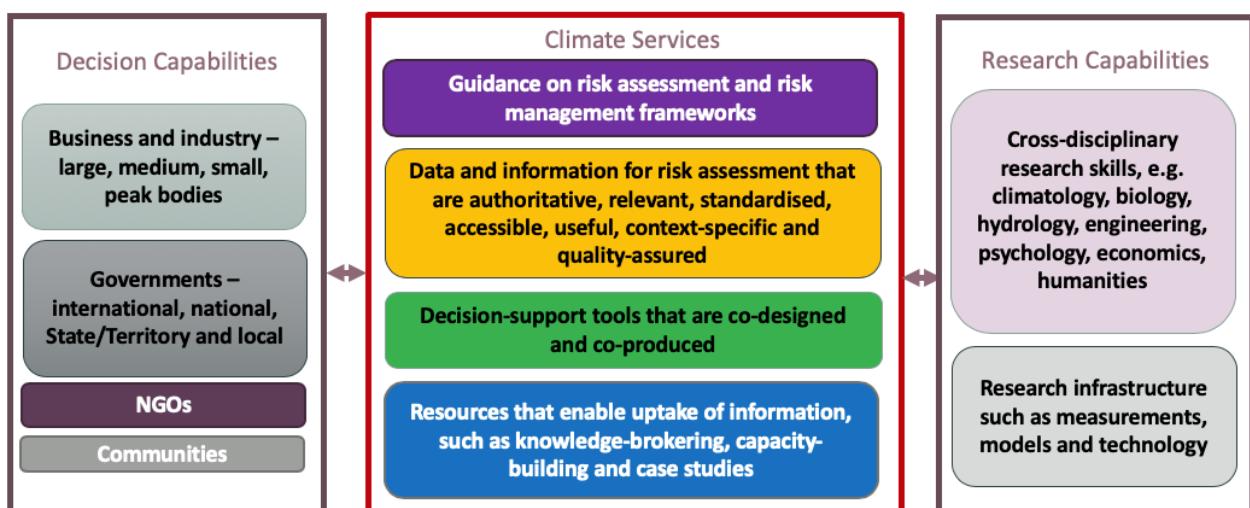


Figure 2: A potential model for a national climate services capability for Australia that underpins a national climate intelligence platform

As a step towards a national capability, CSIRO is working on unlocking climate intelligence for all Australians through the **Navigating Climate Change (NCC) Mission**. According to the Mission, we are at a critical point in using climate science (and other relevant science domains) and services to better prepare Australia and the globe for climate change impacts. The NCC Mission involves business units across CSIRO (including Energy, Agriculture, Land and Water, Oceans and Atmosphere) and across Australia (including the Bureau of Meteorology, universities, and users and purveyors of climate information). The NCC Mission is initially identifying methods for the delivery of climate products and services that meet needs of the financial services sector in the first instance but with relevance also to the agriculture and infrastructure sectors. The NCC Mission must be user-driven, informed by the science, co-designed and co-developed, aligned with government and industry initiatives, and support new business models.

The **Bureau of Meteorology (Bureau)** is planning a seamless environmental weather-climate service. The Bureau plays a key operational role as Australia's national meteorological service, including a partnership with CSIRO and the UK Met Office, in

meeting the increasing demand for climate information. Changing climate-related risks and greater user sophistication for applications require different and additional climate information services which need to be readily accessible. The Bureau's weather, climate and water services are predicated on 'zero lives lost from weather, climate and water hazards, and \$2 billion of added social and economic value'. Sectors using climate information services from the Bureau are summarised in Figure 3.

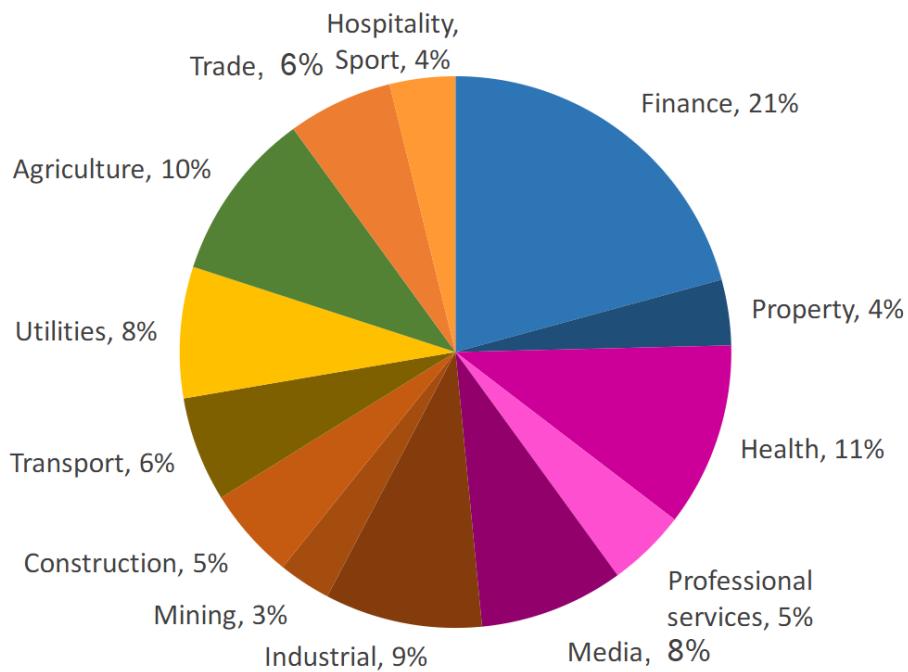


Figure 3: Sectors using climate services information from the Bureau of Meteorology

2.2 Australian case studies (science informing services)

A number of nationally relevant projects and initiatives are presently underway which in practice represent case studies of 'science informing services' to demonstrate both needs and (user/provider) capability for science-based climate services, including the innovation pathway for science informing services. It is noted however that there is limited coordination between them in order to optimise benefits at a national level.

The Climate Measurement Standards Initiative (CMSI) is an industry-led collaboration linking the climate science and financial sectors to develop open source standards for climate risk disclosure for buildings and infrastructure. It aims to enable widespread adoption of the guidelines for risk disclosure developed by the Task Force on Climate-related Financial Disclosures (TCFD).

This collaboration project is looking to identify how best to connect with, and integrate, authoritative and standardised climate scenarios into decision-making processes. The aim is to reduce sector-wide costs, and to achieve standardisation within the industry to avoid 'climate projection shopping' and allow risk assessment comparability (e.g. between banks and insurers).

The project involves banks, insurers and re-insurers, accountants, actuaries, investment analysts, the NESP ESCC Hub (including CSIRO, the Bureau of Meteorology and

university researchers), hazard specialists, natural catastrophe modellers, companies and regulators. Climate-KIC is administering the project and will publish the results.

The **Electricity Sector Climate Information** (ESCI) project is a \$6 million, 2.5-year initiative funded by the Australian Government and involving CSIRO, the Bureau of Meteorology and the Australian Energy Market Operator. It is investigating key climate risks faced by the electricity sector and how improved weather and climate information can guide long-term investment decisions to improve resilience of the National Electricity Market. The project evolved from the Finkel Review in 2016, which looked into the future security of the National Electricity Market. One of the key findings was that the electricity market is exposed to risks from climate change and needs to improve the system integrity and the accuracy of forecasting.

This project is developing a standardised methodology for analysing climate risk, including requisite data and information for climate-sensitive decisions. This information sits within a broader climate risk assessment framework supported by guidance, case studies, capacity building and knowledge-brokering.

The Bureau's **National Hydrological Projections** pilot project is investigating climate change impacts on Australia's water resources, driven by user needs for information that is consistent across jurisdictional boundaries. Many people need hydrological projections, and while there is high-quality information about the impacts of climate change on water resources for particular regions, this can't be applied consistently across regions.

The project uses downscaled climate model simulations to deliver temperature, rainfall and wind data, as input to a continental-scale hydrological model that simulates runoff, soil moisture, and potential evapotranspiration. Information is to be delivered through a web-based portal, with demonstration cases and guidance material. The portal will be linked to the Climate Change in Australia (CCiA) website.

The **National Disaster Risk Information Service Capability** (NDRISC) aims to establish a national platform for information to support disaster risk reduction, including climate-related disasters. Engagement across government and private sectors started in April 2018. The National Disaster Risk Reduction Framework and guidance have been completed. Pilot projects and case studies are being developed, and there are now opportunities to implement NDRISC in response to the recent summer of bushfire disasters.

The NDRISC platform involves a core pool of subject matter experts and knowledge-brokering practitioners from the domains of science, disaster risk, policy, and emergency management. There is planned to be an innovative technology platform to facilitate access to services, data and methods, with standards-based protocols, tools and resources to ensure that information is authoritative and pertinent.

NDRISC will be a web-based platform linked to a service centre, so climate and weather services, with global connections, are essential for it to operate. Also essential is a community of practitioners tailoring information for users with information flowing two ways between users in government, industry, and research.

The **Climate Change in Australia** (CCiA) website is the principle platform used by CSIRO and the Bureau of Meteorology to disseminate national projections data and related guidance material. It was released in 2015, with new content and functionality having been added ever since. The site annually records 300,000 unique user sessions.

CCiA was supported by the Australian Government's Regional Natural Resource Management Planning for Climate Change Fund (with focus on the NRM sector), along with co-investment from CSIRO and the Bureau of Meteorology. It was developed after consulting with natural resource managers around Australia, assessing user needs, designing the tools for delivering data and information for different audiences, and supporting uptake through knowledge-brokering and capacity-building. Annual user-surveys have informed continuous improvement of the platform. Next steps for the project involve engaging with a broader range of potential users and responding to the changing needs of existing users – using the CSIRO NCC Mission to develop a blueprint for a new/updated version of the website to meet future needs.

The National Climate Change Adaptation Research Facility (NCCARF) developed **CoastAdapt** as a platform to support coastal decision-makers (especially local councils) to adapt to the risks and impacts of climate change by providing comprehensive and targeted information in appropriate language, linked to local policy initiatives.

CoastAdapt was designed to be authoritative and up-to-date, accessible and easy to navigate, with case studies for non-specialists to learn from one another. It was developed following consultation through user surveys, workshops and community committees.

The portal includes climate change and coastal geomorphology information, sea-level and inundation maps, risk management guidance, and information on adaptation action including business plans. The challenge is to renew information to ensure data remains up-to-date and of interest to users. CoastAdapt is funded to the end of 2021.

A panel discussion in plenary followed, involving a cross-section of presenters and a Q&A session with all participants, as a segue to prime the small breakout group discussions in the following afternoon session on Day 1.



Panel discussion on Day 1 of the workshop following morning session presentations

2.3 Small breakout group discussions: National challenges and potential solutions

Under the overarching theme of **National Challenges and Potential Solutions** (for Australia), each of the small discussion groups was assigned to a specific sub-theme and asked to consider three key questions in the context of the current and future state of Australian climate intelligence and associated services; specifically:

- Why is your topic particularly important in context of the current state?
- What does an enhanced future state look like?
- How do we get to an enhanced future state?

Each of the groups reported key outcomes from their discussions which were then discussed by all participants in plenary, including perspectives from the workshop's EU delegates on Day 1 presentations and discussion outcomes.



Small group discussion on Day 1 of the workshop

Standards and quality control

Improved transparency, comparability and credibility is needed in the available data and information. Comparability is more important than precision when it comes to big decisions: there is confusion about different climate projections, and there is 'projection shopping', i.e. going on to find the answers people want. An overarching authority is required, with a governance body or 'council of councils' providing a transparent and agreed process to maintain standards. It is important for user communities to have a prominent role in these bodies.

Linking, integrating and coordinating platforms

There are many platforms, so organisations need to avoid duplication and streamline resources. There will never be a one-size-fits-all platform, but better connectivity is needed between platforms to obtain people's trust, understanding of the data underpinning portals, and credibility of data sets. There should be national agreement on a standardised set of climate scenarios so people know what is being used and why. Appropriately qualified independent third-parties should evaluate platforms and provide guidance on which platforms are fit-for-purpose for specified needs. Better communication is needed between providers and purveyors to enhance community cooperation, and more cooperation is needed between scientists in developing projections.

Linking science and services through platforms

Improved communication is needed between users and providers. Information needs to be tailored for easy use; so providers need to simplify and tailor data to meet user needs and to be outcome/decision focussed. Standardising core climate information across state jurisdictions is required to make applications easier and more comparable. Scientists need to use professional knowledge brokers, translators and communicators to interact with users, to discover their needs, and improve translation of information.

Business models and IP management

There are legal and sensitivity issues with data use, such as those relating to flood information and property risk/value, so users may be reluctant to use them routinely. Australia needs a cost-benefit analysis of climate change impacts with and without adaptation and mitigation, which would indirectly inform the value of climate services. The emergence of private climate service providers introduces potential to build on public-private partnerships (PPPs), which will enable greater innovation. However, the boundary needs to be defined between core 'standardised' services (likely funded by public sector, with federal and State/Territory governments showing leadership to enhance public value) and tailored 'differentiated' products (funded and delivered by PPPs or privately). Publicly funded data should always be open-source, readily accessible and available to all. Likewise, privately funded data should also be shared where at all possible, although it is understood that much privately funded data is proprietary protected/commercial-in-confidence in accordance with market circumstances.

Linking traditional knowledge with 'western science' decision-making systems

Contemporary (or so-called 'western') science and Indigenous approaches are in many cases complementary and where possible should be integrated at the start of any engagement process, as the two knowledge systems have the potential to add value to each other. Traditional knowledge highlights impact on Country using long held and widely respected cultural methods of communication; western decision-making systems integrate knowledge (quality-controlled information and data), values (what people care about) and rules (policy, institutional arrangements, legislation). In addition, there are great opportunities for exploring the role of traditional knowledge systems by engaging other

First Nation countries, sharing dialogues around climate change and discussing the need for climate services. The NESP ESCC Hub's process to facilitate a national dialogue on climate risk with Australia's Indigenous communities has enabled partnerships between Traditional and contemporary science-based decision-making systems, built on mutual trust and respect.

The key issues (including needs, opportunities, constraints and challenges) raised in plenary during the subsequent panel discussion and open-forum discussions by all participants are summarised below:

- Delivering spatial and temporal granularity of data is required by clients
- Integrating rapidly evolving machine learning into the platform development process
- Ensuring the sources of data and information are suitable for a range of audiences including non-specialist and non-technical users such as primary producers and other business practitioners
- How to manage very large data sets in terms of storage, processing and analytics
- Delivery of climate information, services and data in a seamless way so people can obtain what they need across multiple domains, timescales, applications etc.
- Ensuring availability and open-licensing of data, which requires an understanding of the value chain of information delivery and cost-benefit
- Integrating Indigenous knowledge into contemporary science for two-way benefit, with the need to engage Indigenous people from the start and throughout the co-design process.
- The importance of integrating end-user needs before planning starts, and allowing sufficient time for consultation
- Private sector users (such as banks) working across state platforms are faced with confusing differences in data and approaches in climate projections, so national coordination and standardisation are vital
- There is good science available already, but it is underutilised; scientists need to understand how users' decision systems operate (such as incorporating climate information in building codes, financial models or in decision systems for multi-year investments)
- Quality-assurance is important so the scientific validity and credibility of results should be based on well-established and peer-reviewed research.

2.4 Summary of key points

A summary of key points based on a recap of Day 1 presentations and group/panel discussions was provided on the morning of Day 2 and is presented here for convenience. The scope of climate services is broad in Australia, with various definitions. The current state of climate platforms/services and associated intelligence is characterised by the following key points:

- The supply-side of the Australian market is established but fragmented and poorly coordinated; the demand-side is rapidly emerging and evolving
- There are core and differentiated market needs and associated business models involving public and private sector actors, with implications for public-good vs private-profit
- There has been mixed success of public investment in climate products and services due to limited coordination and funding
- Clients want authoritative, relevant, standardised, accessible and quality-assured products and services
- Lack of good governance has hampered the development, coordination and uptake of climate services, and clients are ‘projections shopping’ from a wide range of different products and services.

The current situation presents a range of challenges and opportunities for stakeholders in order to meet priority gaps and needs of users, including the need for:

- Building trusted relationships and ensuring co-design/co-production of knowledge where appropriate across institutions, disciplines and users and providers
- Navigating cross-sectoral interdependencies
- Enhancing data accessibility and traceability
- Managing uncertainty in data and information for decision-making
- Provision of seamless information from days to weeks, months, years and decades
- Provision of information about extreme weather risks at local scales
- Ensuring transparency, comparability and credibility of data/information
- Tailoring information and portals for different purposes and audiences
- Enabling uptake of information in planning and decision-making
- Assessing the socio-economic value of climate services in terms of return on investment, jobs/economic growth, effectiveness and efficiency

- Outreach to support decision-makers, to help those affected by the decisions made, and to understand why they're being made
- Exploring potential for Traditional Knowledge to inform climate services.

In this context, the vision for a ‘future state’ platform-based national Australian climate services and intelligence capability includes where appropriate:

- Services that are decision-driven and science-informed, rather than science-driven and decision-informed
- Quality assured products and services that are based on scientifically authoritative, user relevant and accessible, and standardised and globally consistent
- Transparent links with functional inter-operability between core and tailored products and services
- Transparent and robust governance to promote both public and private investment in climate services
- Better understanding of climate impacts and associated risk profiles of users and a strategic, approach to development, delivery and use of science-based services to inform climate risk assessment and management
- Greater representation of Traditional Knowledge and Traditional Owners as part of UNFCCC international negotiations including at COP meetings.

Best practice involves strong and sustained leadership, agreed objectives and scope, a cyclic and iterative risk/opportunity assessment process, agreed methods/scenarios/data, products and services that target different audiences and decision-points, and access to enablers such as knowledge-transfer and capacity-building. In particular, the strategy and next steps for how to reach this future state include the following requirements:

- A centralised and trusted, national level ‘authority’ for coordinating the development and delivery of core climate services
- Innovative business models, featuring appropriately designed Public-Private-Partnerships, to facilitate the development and delivery of tailored climate services (leveraged/aligned/integrated with core climate services where appropriate)
- Mapping of the existing and emerging climate services landscape including market offerings, capability and capacity, governance and organisational arrangements, resourcing etc, to identify priority gaps and needs, assess what areas need priority investment, and develop a compelling business case
- Better coordination and alignment of climate service development and delivery between different levels of government, in particular at national and state/territory level

- The development and delivery of climate products and services to be in line with a science, technology and innovation roadmap to facilitate best practice
- Better communication and coordination between climate services providers and purveyors
- Support for enablers such as knowledge-brokers and other purveyors, capacity-building and case studies to facilitate collaboration, capacity development and continuous learning
- More effective monitoring and evaluation to assess performance, measure impact and facilitate adaptive management
- Where it is important to produce new knowledge and give access to this knowledge, it is also important to understand and respect people's values and governance systems – these interact to either enable decisions or present barriers; particularly relevant in relation to Indigenous communities and Traditional Knowledge.

In summary, there is a need for a nationally coordinated climate services platform capability in Australia with an agreed, clear and coherent value proposition underpinned by structured governance arrangements designed to facilitate delivery of:

- Standardised (core) and tailored (differentiated) products and services which are:
 - relevant, authoritative/trusted, scientifically credible and with improved traceability and quality assurance/control standards
 - are fit-for-purpose, legitimate, highly contextualised and where appropriate customised with different levels of detail consistent with the needs and capacities of different users.
- Business models and associated networks that:
 - enhance coordination and facilitate effective partnerships between levels of government and between public and private sectors (public-private partnerships) that support proactive rather than reactive adaptation
 - have core products and services supported by public funds
 - have differentiated products and services supported by public-private-partnerships and private consultancies
 - demonstrate the value of climate services to build resilience, create new markets and jobs, and enhance economic productivity.
- Better accessibility of data and information by both digital (web-based) and domain (people-based) capability
- Ongoing monitoring and evaluation to report on and improve performance and path-to-impact as part of real-time adaptive management, and

- Requisite communication, knowledge brokering and capacity development capability for both providers and users as part of a deliberate co-design/co-production of knowledge imperative.

3 European perspectives and shared European-Australian challenges (Day 2)

3.1 European case studies

Europe has a well-developed climate services capability – arguably a world-leader. Starting with UKCIP in 1997, it was recognised that effective climate adaptation is founded on high-quality data, tools and knowledge. Initially, national meteorological services produced climate data platforms, with researchers as the primary beneficiaries. The focus changed in the early 1990s to better support, and be informed, by users. By the early 2000s, web-based climate adaptation platforms emerged internationally to make information more accessible, providing knowledge and decision-support tools. By 2013, there was increasing interest in developing web-based platforms as challenges emerged about why and how they were being created and used, their visibility, and their engagement with users. There are now at least 371 public and private climate service providers in the EU Member States, dominated by public organisations and advisory services. The main sectors targeted include decision and policy makers in water, energy, agriculture and urban planning. The European Commission has invested over €900 million over 5 years on science to inform climate services, in addition to other spending at the national level driven by policy, jobs and business opportunity. The next steps should involve greater focus on interdisciplinary thinking, collaboration and platform linkages, and regular platform evaluation and updating to remain relevant and make the best use of new technology and knowledge.

Copernicus (<https://climate.copernicus.eu>) is a cloud-based online platform that translates petabytes of climate observations, including those from the EU Earth Observation and Monitoring Programme, into kilobytes of useful and useable data. Copernicus provides authoritative information on past, present and future climate, sectoral impacts, tools for operational decisions on adaptation and mitigation, training and education material, and outreach including a website, social media and publications. There are over 35,000 users, increasing by a couple of thousand each month, with 60 data sets, increasing by a couple per week. The team has systematically collected information from users about their requirements, with extensive metadata, for sectors including agriculture, water, insurance, health, and tourism, and this has been used to inform the design and associated functionality of products and services.

The trans-national **Climate-ADAPT** service (<https://climate-adapt.eea.europa.eu/>) integrates tool outputs and results to disseminate information, cases studies and other information about the European climate adaptation strategy that was released in 2013. Climate-ADAPT is a complementary (not competitive) platform that is linked with platforms in individual EU countries, interacting with national reference centres in 32 member and collaborating countries. There are two main components: web content (including policies, country and city details, and knowledge) and a database (with searchable information,

publications, case studies, adaptation options and support tools). Further development will include an improved adaptation support tool, a pilot observatory on climate change impacts on human health, increasing linkages with platforms in other countries, and ongoing interactions with users.

Development of a climate intelligence framework, in an ideal world, would involve the translation of useful climate information produced by researchers into useable information to be incorporated into actionable decisions. Researchers need to understand the capacity of people making decisions very quickly, and on short (tactical) and long (strategic) timescales. Platforms also need to evolve to changing policy and knowledge conditions. Training is an opportunity for mutual learning, so providers can understand the basis of decision-making and how to best address this. It is important to understand that adaptation is an iterative process of learning by doing.

Climate Ireland (<https://www.climateireland.ie>) is a source of climate impact and adaptation information to develop capacity and support national adaptation policy and planning. It works in partnership with science, practice and policy stakeholder groups. Initially developed a one size fits all approach, but need to develop this to address the range of decision-making needs, especially as the profile of decision-makers evolves. Decision-makers have advanced their capacity to understand and use climate information, providing a challenge to platform providers to support the demands of users Climate Ireland provides regionally downscaled climate information, working at the boundary between decision-makers and local authorities. It delivers climate and adaptation information to improve understanding of current and emerging risks. National climate platforms need to connect science, policy and practice, and hence co-design, co-development and co-delivery are important.



European case study presentations on Day 1 of the workshop: Barry O'Dwyer, University College Cork/Climate Ireland

Climate action by local authorities is assisted in Ireland by **Climate Action Regional Offices** (CARO), which divide the country into four regions based on climate risk. CARO's mandate is to drive climate action by coordinating engagement and translating sectoral efforts to a local government level. The work involves local authority adaptation strategies; research and projects; training and education; communication; and mitigation. The Climate Ireland platform provides information needed on extreme events and to support emergency and adaptation response planning. Training and awareness are key to climate services and climate action, and for transforming science into policy and practice (see also Figure 4).

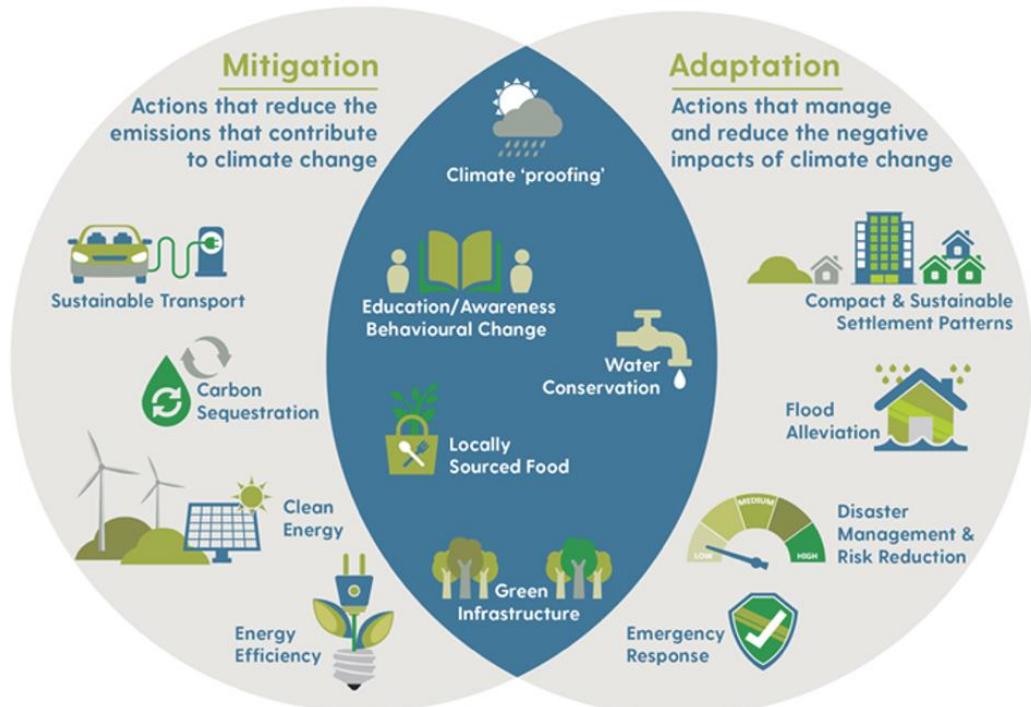


Figure 4: Overlap of CARO mitigation and adaptation activities highlighting linkages between climate services and climate action (transforming science into policy and practice) in Ireland

Using the example of *Climate Ireland* for purposes of **Mapping User Expectations to Current Climate Adaptation Support** it was noted, similar to Australia, Ireland has its population mainly on the coast, and mainly in the east. In both cases with climate change comes opportunities in a blue economy, tourism, and improved climate.

From an EU perspective, a platform is defined as a source (and exchange) of knowledge in whatever form that helps you move/takes you from A to B, including advice. Climate adaptation platforms in the EU adopt a wide range of user engagement approaches from passive to active, with the primary aim to ensure that information is of relevance to user groups. There is a need to consider a common language, measuring value, addressing user needs, and have a co-design, co-development and co-evaluation approach to ensure platforms are user focussed. It should aim to be complementary with other platforms.

Natural systems are complex, but people are even more so. We need to ask lots of questions to ensure mutual understanding. With platforms, we need to consider more than the data – also need to consider the look and feel of the visualisation, access, and responsiveness. We can use this to map expectations to the platform design. Users expect

climate adaptation platforms to provide all the relevant climate and non-climate information for adaptation planning, so it is important to host a wide range of datasets to support this.

A panel discussion in plenary followed to address the question - **similarities and differences: what can Australia learn from Europe?** - involving a cross-section of presenters and a Q&A session with all participants, as a segue to prime the small breakout group discussions in the following afternoon session on Day 2. Key outcomes from this panel session follow.

The EU has more government funding than Australia for climate services, showing what can be done with significant investment. Very few platforms have climate data, but they point to platforms that do (for example, Climate-ADAPT is a one-stop shop that is complementary to other existing platforms, e.g. Copernicus). It is important they consider climate hazards as well as exposure and vulnerability. Platforms are dominated by public providers, but the needs are also in industry, so partnerships are important. Different users have different levels of requirements, so there is a need for co design, co-production and co-delivery of information. Platforms need to translate sectoral efforts to local scales and need to consider local climate plans and international drivers. They operate over multi-decision timescales. Platforms are operational, authoritative, involve a quality assurance effort, and include training and workshops for users (and learning by doing). They aim to mainstream climate change in decisions. There are synergies and trade-offs between adaptation and mitigation. Evaluation of platform functioning is important.

Regarding the extent to which climate providers understand decision makers' needs, success starts with a decision focus. If not, the value decays. Decision-making by local authorities is complex, and providers need to understand this and how we can take climate science into that decision-making process. We need to address decision-making needs at their level. Spatial planning is a key hook on how to include climate data in decisions.

There are varying degrees of depth required for training – to identify who to train, you can target high-level leaders to get them on board as champions to ensure staff buy-in; but some staff require more detailed training.

Resources are put towards communication and keeping the platform's web site going: Climate Ireland has just three or four people managing the platform, offering training, developing the app development, etc. CARO has a communication strategy, but actions are delivered through partners rather than reinventing the wheel: every LGA has a climate awareness officer to help get the message out, and they also work with NGOs and other groups. Climate-ADAPT has a small number of people working on management and communication. It is important to undertake evaluation of the effectiveness of communication, and to respond to this.

Interactions with the private sector need to be balanced with engagement with government. Such interactions do occur but are not as visible as in Australia. Industry is interested in being clean and green but is less interested in funding data collection and delivery unless it is through philanthropic funding matched by government funds. The insurance industry is interested in this space, but only recently. European examples can be used to identify a pathway for Australia to move forward and increase funding interest.

3.2 Small breakout group discussions: Shared challenges and potential solutions

Under the overarching theme of ***Shared Challenges and Potential Solutions*** (for Australia), each of the small discussion groups was assigned to a specific sub-theme and asked to consider the same three key questions as were addressed by the small group discussions on Day 1; this time incorporating learnings from the EU where appropriate. Each of the groups reported key outcomes from their discussions which were then discussed by all participants in plenary, including perspectives from the workshop's EU and Australian KE4CAP/ESCC Hub delegates on Day 2 presentations and discussion outcomes.

The value proposition (for a national approach to climate platform development)

Current situation:

- Climate resilience outcomes are not well articulated across key stakeholders
- There is presently a lack of clear federal government policy and direction, but some state governments are on board
- There is patchy understanding of the value of climate services
- There is good climate service capability collectively within the research community, some states, and consultants, but effort is fragmented and poorly coordinated
- Projects such as ASFI, CMSI, ESCI, NDRISC indicate growing interest in the finance, electricity and disaster risk sectors
- Deloitte (2013) report says current cost of natural disasters is \$18 billion per year, and will be \$39 billion per year by 2050, but this excludes the costs and benefits of climate action and inaction (and noting recent extreme events: drought, fires, floods and hail)
- The large uncertainty in climate projections is a barrier to action.

Future vision:

- There is a need for clear articulation of the social, economic and environmental benefits of climate services for risk management
- Estimation of the costs and benefits of climate action and inaction.

Articulation of the benefits is required to understand the value for users. These have to be developed and accepted by the user community, in collaboration with science and service providers. Overarching and sector specific value propositions need to be developed. This can be done by:

- Consulting decision makers about what risks would lead to 'failure' and what decision-making processes are relevant e.g. stress testing

- Demonstrating value of climate services for different stakeholders
- Obtaining assistance with marketing – how, to whom, and for what (need professional input on growing the quality and supply)
- Estimating the return on investment in climate science and services, e.g. extreme event projections, sectoral risk assessments, evaluating adaptation pathways, and implementation of climate resilience actions
- Provision of:
 - integrated, authoritative, quality assured and standardised datasets for increasingly complexity of hazards, exposure and vulnerability
 - risk assessments that are fit for purpose and decision-centric
 - decision-support tools and enablers including knowledge-brokers, capacity-building, case studies and communities of practice
 - better information about extreme weather at local scales.
- There is a need for a consortium of government, business and NGOs supporting the value proposition – a broad range of advocates led by a user community that brings the science, policy and practice together to develop the value proposition
- The value proposition is double-sided: need to look at the net benefits of science-driven innovation, and of decision-driven resilience.

Engagement (co-design, co-development and co-production)

Current situation:

- There is not a shared view of what co-design is and there have been poor approaches in the past
- There has been patchy application and often confined to vulnerability and risk identification
- Not everyone is on the same page and we need to be able to start the conversation by demonstrating something.

Future vision:

- Best practice engagement involves co-design, co-production and co-evaluation of climate services between users, purveyors and providers
- Engagement is facilitated by a community of practice, co-produced case studies and a significant knowledge brokering capability
- Designated advocates or champions take responsibility to drive engagement in specific sectors and regions.

The process:

- There is an appetite to do this, but the value proposition needs to be articulated
- The process can be resource intensive, so need the space and resources to do it
- There are learnings from the private sector, especially leading/innovative consultancies
- One option for driving the process is to use the ‘big stick’ approach with legislative backing
- There are funding barriers, so need to work out how to best generate/share funding
- People should want to (not have to) do co-design – possibly by showing cost of inaction
- Encourage cross-organisation and inter-organisation links, move away from academic-oriented KPIs linked to publications and, instead, showcase successful co-design projects.

Integrating 3rd-party knowledge

Current situation:

- Traditional owners and Indigenous knowledge systems need to be better incorporated into platforms
- Platforms tend not to integrate third-party knowledge very well, and they are often inaccessible for such third parties to use
- There is lot of siloing of information, with little integration across three levels of government
- In the case of Indigenous knowledge there is not much structured engagement, with people flocking in, taking what they need and leaving with limited acknowledgment or flow of benefits to those providing the knowledge.

Future vision:

- There is a need to consider what third parties need, and to make scientific information accessible
- Co-production should be continuous and structured engagement from beginning to end
- Information should be layered (simple, intermediate, advanced) to ensure applicability, and comparable across jurisdictions to ensure providers are used and interpreted effectively to allow seamless decisions

- Cultural information needs to be embedded more effectively, with acknowledgement of third-party (especially Traditional Owner) knowledge in any research results, with appropriate consent, traceability, and attention to IP terms and conditions, including acknowledgement of ownership or provenance of information.

The process:

- Use traditional third-party knowledge e.g. to ground truth much of the science
- Better embedding of cultural frameworks is required and need to define what is authoritative, as the concept may derive from sources other than what we think of, such as Traditional owner Elders, and
- There needs to be improved use of vocabulary for traditional knowledge.

Governance and resourcing

Current situation:

- Fragmented governance and limited resourcing, driven by project development at national and state level
- There is now a large (policy) signal from government on building climate and disaster resilience in the economy, environment and communities
- There is also a growing signal from the private sector (e.g. finance, energy, infrastructure) to assess, disclose and manage climate risk.

Future vision:

- We want to see more enduring, long-term solutions to help drive our climate response
- The ambition is to be a harmonised and reputable climate resilience service which recognises the value of adaptation in and across all sectors
- Increase ambition to deliver user-driven outcomes at regional and sectoral levels
- Creation of a framework for climate services to coordinate activities.

Role of governance in the context of a climate resilience service:

- Involvement of sectoral partners and users throughout the process, with researchers secondary (providing capability and expertise but not driving the product itself)
- Have an Advisory Board, with resources from a mixed-funding model involving state and federal governments, along with private sector partnerships
- Be responsive, with services to deliver to user needs and provide them with a competitive edge, and updated with new research, and

- Need for communication and training to ensure impact of resilience planning, and to track benefits of resilience action.

The process and how to get there:

- Need compelling statements and vignettes of information available across sectors to communicate how the process works and the benefits
- Assess the intersection between value proposition, business models, governance and resourcing as part of a climate services roadmap for Australia
- Need to build a matrix to evaluate the existing stock of portals and other tools available
- Need for cost-benefit analysis of climate resilience and to identify pathways to reach target through agencies and government.

Evaluation and review

Current state:

- There is a challenge without good governance in doing meaningful measurement and evaluation, learning, and review without a strategic basis, otherwise the difference made is difficult to measure and is therefore unknown
- In Europe there is a clear mandate driven by progressive policy environment, which is presently absent in Australia; private sector in Australia is running ahead of government in progressive climate action, driving interest and investment in climate platforms.

Future vision:

- There is an underpinning rationale for doing evaluation and review, and all climate-related projects should ensure evaluation and review to identify learnings, and share these with broader audiences even if they appear negative or not helpful
- Given the lack of investment in climate services, there's logic in doing a national review; but myriad project level reviews can be confusing and fatiguing for users
- In the absence of a national mandate, how can a national survey of users be done to lift the level of the conversation to plan what's next in national interest – to drive investment, and improve development and utility of current platforms?
- Options to drive a national effort include a collaboration of chief scientists, or a new version of the national climate science advisory committee with strong state government representation
- There is no point evaluating if you don't learn from or have an audience for the results, so we need a governance structure to drive strategy.

3.3 Panel and open forum/plenary discussions: Key points from Day 2

A panel discussion followed the small group discussion presentations on Day 2. Some of the key points raised during this panel discussion relevant to ‘shared challenges and potential solutions’ are summarised as follows:

- A set of benchmarks is required to assess platforms; benchmarks exist in Europe and could inform Australian ones. The evaluation can't be led by scientists; it needs to be independent, user-centric and engage heavily with the user community. We need to identify the future state of a national climate platform capability we are looking for to help users judge where they are on the journey, and the current quality of information. If we were to undertake an evaluation, we need to set the baseline from the start and then monitor it – the best benchmarks will allow comparison of change over time.
- Lessons from an evaluation, or from the EU, need to be used in design. There's no typical platform, so a new or modified platform needs to be specific to the region/sector using it and is determined by what the audience wants. A Community of Practice can be informed by lessons learned by others, to enable sharing and involvement. Learning from what's going on in other countries and engaging in other forums is critical to moving forward. Understanding where Australia is in the international scene is an important part of this.
- An adaptation platform may not be responsive to shocks in the system over time – a platform needs to respond to changes in policy and environmental change and needs to be adaptive and iterative.
- We don't have an adequate value proposition for the task ahead of developing a platform in Australia. We have a large body of science, but we need to consider stakeholder engagement, governance, business models, resourcing, and what is feasible. It's an opportunity to do a stocktake of the building blocks we have in place and the elements we need.
- For credibility, we need advocates or ‘champions’ articulating the value proposition – such as the banking community. How to have information flow from decision-makers to science to services and to investment, and then back into science innovation will be critical to be able to progress forward – that should be part of the value proposition and business model. The value proposition has to consider the private and public value. A focus on dealing with the private sector is necessary, but not sufficient alone as also need a strong public good investment to be successful.
- Climate services is a term with limited and mixed benefits, and people in the wider community (non-specialists) do not know what it is. It is about knowledge, information and data informing decisions, and being co-designed and co-produced in a way that is accessible, useable, and credible.

Perspectives from the NESP ESCC Hub and CSIRO NCC Mission on Day 2 presentations, panel discussions and small group discussion outcomes are summarised as follows:

CSIRO Navigating Climate Change Mission perspective

The NCC Mission team has been engaging with a wide range of government and private sector stakeholders. There are groups who need a basic understanding, through to groups that are more sophisticated in understanding; so this consortium needs to be coordinated to deliver climate services in a consistent way.

A platform needs to be responsive to policy settings and exhibit adaptive learning to a changing environment. It would be good to design platforms that enable, support and capture user learning. The NCC Mission involves several work packages – the investment resilience package involves banking and insurance, but there is no project that is investment-ready as there is no authoritative framework to deliver these resilience projects. There is no understanding of the benefits of investment in resilience, so it is hard to justify investment in this area.

Through NDRISC there is a clear handshake between climate services and climate adaptation. There are lessons about how to organise the delivery of support and guidance at different levels and to different sectors. However, it is unclear how to move forward unless there is an implementation plan with significant resourcing.

NESP Earth Systems and Climate Change Hub perspective

After 30 years of climate science in Australia, we have had mixed success in demonstrating impact. Over the past 5 years, the NESP ESCC Hub has placed greater emphasis on stakeholder engagement, co-production of information, and evaluation of impact. The Hub can now deliver climate information for risk assessment and adaptation.

There was value seeing the climate services principles discussed on Day 1 put into action on Day 2. We need to talk to users to clearly articulate what the value proposition is. It was interesting to hear about Copernicus and Climate-Adapt, as both platforms are multi-national one stop shops, which may be how Australia approaches a future platform.

We need to move beyond the currently constrained resources to think what might be possible. Leadership is essential, using influencers in user communities to build support. And we need to build a community to speak with one voice.

It is important to bring in Traditional Owner knowledge and have co-production from the beginning. Consistency is important, as there's so much going on, presented in different ways, which is a barrier to incorporating third party knowledge. Coordination is also important, as there can be silos across CSIRO, the Bureau and government departments, and a lack of coordination accessing information and engaging stakeholders. We also need transparency to be able to map out where information is from, involving acknowledgement and consent, especially for Traditional Owner knowledge. A publication process for science is required for robustness, but publications need to include stakeholders to demonstrate co-production.

4 Collaborative development and roadmap (Day 3)

4.1 Developing a value proposition

The theme for Day 3 (drawn on outcomes from Day 1 and 2) was based on **developing a value proposition for a national climate platform capability for Australia** with the following vision:

Resilient Australia by 2030 with significant social, economic and environmental benefits

It was agreed the value proposition should be put forward by users in association with partners and other champions in collaboration with scientists and other experts.

We need to frame the value proposition as: **the what** (a platform for use by all Australians to understand climate risk); **the why** (to deliver value to all users for economic, social, and environmental benefit), and **the how** (integrating science across disciplines and co-developing the platform with users).

4.2 Small breakout group and panel discussions: Roadmap for climate services

In this context, under the specific theme of a **Roadmap for Climate Services**, four small group discussions aggregated around key stakeholder groupings of government, research, private sector and Indigenous communities were convened to address the following issues:

- Governance and strategy development
- Business model(s) and partnerships, and
- Barriers and enablers.

A summary of the outcomes from the small group discussions follows and noting that, where appropriate, the Indigenous stakeholder perspectives were integrated across the other three stakeholder perspectives.



One of several small break-out group discussions on Day 3 of the workshop

Government/policy perspective

The value proposition should address the need that end users have for a climate platform (that is, capability including people, knowledge, information, and guidance), to manage climate risks for all Australians, to support informed decision making based on credible, useable information, and enabling climate resilience.

A key attribute to make such a platform authoritative and robust is good governance (the authorising environment). This should be underpinned by investment and involve some form of committee or body that reaches beyond small agencies and into key end-user groups to enable co-design. The governance model needs to be dynamic and learn from itself; it should not just establish a new committee for the sake of it. The information architecture needs to consider the social architecture of all relevant stakeholders: the communities of interest, culture and attitudes. There are opportunities for the design to include international links, and links between sectors.

Seamlessness of information needs to take into account geo-political scales (federal, state, local and catchment) and timescales (short, medium, and long term). Quality control and assurance of data is essential to ensure it is credible and authoritative. Standardisation and continuity are required to ensure connection with end-users.

The next step is to get the overarching pitch right, rather than being caught up in details, to take advantage of the window of opportunity right now, i.e. proposals for a new NESPM Climate System Hub supported by around \$70 million over 6 years, plus development of the CSIRO NCC, plus development of a Bureau of Meteorology climate service strategy, plus development of an implementation plan for the National Disaster Risk Reduction Framework. There's a sense of urgency in light of recent extreme climate and associated national reviews to pull together ideas and demonstrate the value of this model (with relevant examples). There is a need for inter-jurisdictional governance particularly at the national and state/territory level, bringing science and end users together, to collectively

move beyond providing only climate projections to providing risk and vulnerability products at various scales.

Private sector/industry perspective

We are working in a big, complicated landscape, so for the most part business doesn't want excessive details, it just wants a definition of the problem and what to do about it. The latter is more the domain of a small consultancy rather than a large research organisation, so we need a climate services ecosystem model, e.g. based on a shopping centre analogy – with a large provider at one level for users who know what they want, through to smaller 'shops' to help those without expertise obtain more detailed technical analytics.

Corporate Australia is realising climate variability and change presents material risks that need to be assessed and managed. A partnership is required between scientists and end-users, key consultancies, big organisations, and 'boundary riders' (those understanding how businesses work and bringing science into industries that use it). The partnership model requires a 'wicked problem' approach – we can't focus on one problem (e.g. bushfire) as it is all interconnected.

Climate platform development to realise a 2030 vision for a climate resilient Australia needs to have much stronger 'user-pull' and end-users need to be elevated more prominently into the governance arrangements going forward.

Research/technical perspective

Resilient can mean different things (for example, bouncing back to the original state may not be ideal) so the term needs more thought. The triple bottom-line impacts need to be quantified for the value proposition.

Core and differentiated climate services need to be considered. One option is for core services to involve business-as-usual partnerships but enhanced to bring together CSIRO/BoM/CCIA + NCCARF/CoastAdapt + GA + state and federal government portals, with government funding, capability deployed in Australia and overseas, and enhanced resources for industry communities of practice focussed on adaptation. Another option is to use a CRC model, involving researchers but driven by industry. A third option is to enable longer resourcing for an enduring 'institute for climate resilience', with a focus on delivering impact on the ground and funded through co-investment from a consortium involving government, industry, research and Indigenous stakeholders.

Attached to any of these models would be tailored services which would draw on, and be consistent with, the core services. These services could involve PPPs including consultancies to add value through co-design, co-production and co-delivery.

Governance needs to be inclusive and harmonised across all levels of government, industry, NGOs, research and Traditional owners. There is a need for governments to show leadership, but eventually that would be increasingly shared with business models shifting to co-investment and PPPs.



Small group discussion on Day 3 of the workshop

A panel discussion and open-forum Q&A session followed the small group discussion reports. Key outcomes relevant to developing a value proposition for developing a national climate platform capability for Australia are summarised here:

- The NESP ESCC Hub business model combined with an NCCARF business model may be appropriate (with strong parallels with ClimateADAPT and Copernicus). The governance system will need to ensure quality assurance, quality control, and credibility of products. There is a role for both technical expertise (climate science and adaptation policy) and end-users (verifying if information is useable and relevant) to contribute to quality.
- The approach needs to be decision-driven and science-informed, rather than science-driven and decision-informed. Purveyors can tell scientists what stakeholders want, but engagement needs to be iterative and sustained to allow stakeholders to increase their understanding of what science can and can't provide, and thereby allow scientists to provide information that is always relevant and fit-for-purpose.
- The business model out to 2030 needs the 'science to services' transition to be faster than what we have now. Business wants results turned around quickly, but science organisations aren't nimble enough; so we need to deal with fragmentation and develop capability with universities and ensure resourcing for capacity.
- Private good and public benefit are not mutually exclusive. It is necessary to look at extracting private benefit from public good and vice versa, i.e. in a mutually beneficial way. It is feasible to have a public good/private good service delivery that is complementary. Public investment can stimulate private interest.
- We need to demonstrate existing capability, and interest from end-users, to government now. Demonstration stories with end-user groups who want the work

could lead to a future vision of what can be achieved. However, it is a moving target as user needs in 2030 will be different to today. We need an adaptation framework to be itself adaptable.

4.3 Plenary discussion: Key workshop outcomes and next steps

To close out Day 3 and the overall workshop, an open-forum plenary discussion was undertaken with the objective:

Realising future collaboration based on key outcomes / identified shared opportunities for Australia, including next steps/taking the learning and challenges forward within KE4CAP

Commonalities across discussion groups

All discussion groups (viz. research, government, private sector and Indigenous) identified similar timescales, looking for a longer-term basis for developing decision support that may not be delivered by a current structure like a NESP Hub that applies over six years, and trying to think to 2030.

All agreed on a consortium approach, involving industry, researchers, government, non-government organisations and Indigenous groups. Addressing the value proposition requires a multi-user response. The approach recommended by the Taskforce for Climate-related Financial Disclosure (TCFD) is driving the Australian finance industry electricity industry, water sector and infrastructure sector to re-assess current and future climate risks and adaptation strategies in collaboration with scientists. We need to build bridges and connections between government, non-government organisations, science and industry groups. Australia also needs to address the current fragmentation of climate science and adaptation services, inadequacies in governance and business models, weaknesses in the alignment between user needs and available climate services, and gaps in capabilities and resources to deliver those services effectively and efficiently.

There is a need for business models to address public good and private value. An important area is the ‘club good’ model and mechanism – creating incentives to do things collectively. This is what the finance sector engagement is aiming for right now, and agriculture is an area where this could also be applied. The model requires mutual understanding that is achieved through the governance model.

Unless there is an important ongoing operational requirement for this platform, it will not be ongoing –operational agencies at state and federal level (Geoscience Australia, Bureau of Meteorology, Bureau of Statistics, and related state agencies) need to see this as part of their core business and have the necessary resources and capabilities. This may require changes in legislation for some agencies, or legislation around climate risk as a whole of government process. Otherwise the platform would not survive with a three-year funding model. We need to demonstrate value and relevance to all players in servicing their needs, perhaps through a PPP to enable sustainability without relying on Government funding.

What priority issues need action?

- Embrace the opportunity that exists now and over coming months. Perhaps do a policy stress test for climate adaptation and resilience using existing information to demonstrate the costly climate risk for government and industry and get attention on this topic.
- Need clear mapping of current capabilities and existing platforms already available across Australia, to highlight how to link them and build on what we already have. Map existing capabilities in a way that can be communicated to a particular sector. Assess strengths, weaknesses, opportunities and threats (SWOT), key environmental factors (e.g. political, technological, legal) and how the network of service providers and users is linked
- Review published national and international literature on climate services, identify 'best practice' as well as gaps and needs, and build a vision of the way forward
- Identify five to seven major private sector users and providers to work with, to start framing their on-going future needs and find the way forward.
- Evaluate existing activities and identify what end-users think of what is already out there and what the gaps are, e.g. what do people think of CCIA, CoastAdapt? A concrete way to engage end-users in strategic thinking of future programming is to elevate end-users in the process of platform development and implementation.

More on next steps

We need to draw on aspects from all key stakeholder groups to drive the value proposition:

- The government stakeholder group could be the starting point for the vision for a climate resilient (or climate adapted) Australia by 2030.
- Business models: an enhanced business as usual approach to climate services could be the starting point on which to build, with aspects from alternative models brought in over stages. A highest priority is to come up with a mechanism to bring private sector, government, research and associated networks and organisations together.
- There is a massive opportunity to leverage existing opportunities in CSIRO through the NCC Mission. NDRISC will also be a major player – the proposed national climate platform may be the climate node of NDRISC. CSIRO and BoM are the largest providers, but a national platform can't be achieved without the states and territories, the universities and the private sector.
- The future state has some way to go in terms of governance and how to get there. We don't have all the required players in the room but there'll be plenty more consultation as part of the next steps. We recognise the need for much wider discussion and consultation over the next 12 months – this workshop is a start, but

there are key stakeholders who are absent from this workshop (such as local government). We've got plenty out of this workshop, and further direction will come out of the NCSAC Climate Services project discussion paper.

- Cultural change is required in the climate services landscape in Australia, perhaps considering a hypothetical business model that is 100 per cent privately funded, to generate new ideas. Looking at the needs of the sector through a 'club good' approach with input from industry groups may help. We need nimbleness and ability to deliver quickly in this business model. Central leadership with regional delivery is a model that works for all stakeholders across both public and private sector.
- It is important to demonstrate value to maintain funding in the private sector. In Europe, most platforms are created as part of projects, so if tool delivery depends solely on a project it won't be sustained – longevity is required through PPPs and as part of the model and planning. Consider a levy similar to RDCs, applied to industry that creates resources to maintain services rather than relying on individual organisations or councils (NSW Gov has a levy system along these lines; and Tasmania has considered a levy on stakeholders requiring information). Could leverage off existing platforms to ensure longevity, with inter-operability and joining the puzzle pieces together, with consistent and comparable information as a starting point – identifying or creating critical national infrastructure that everyone can draw on.
- Are we moving fast enough to make use of the window of opportunity that is currently open? In the next six months there is an opportunity to propose to industry the need to maintain a climate stress database in perpetuity for Australia – there is currently no database the finance sector can rely on. The Federal budget is another timeline to align to. Positioning as a community has improved, but we need to have something in the 'back pocket' ready to go if the opportunity presents.
- Indigenous communities in Australia are engaged in climate activity. A Second National Dialogue will occur later this year through the NESP ESCC Hub, following the success of the First National Dialogue in 2019. Being part of the discussion has helped build trust and ensure input from Traditional Owners into the vision and planning and we need to build on this experience.
- The need for a federated, modular platform design is clear, and in the absence of a strong political mandate we need to look for opportunities like the finance domain that have traction. For the longer-term picture need to create an idea about how projects will build on each other to provide services for all Australians, with equity of access (that is, not everything can be fee-for-service). Need a climate platform to enable an analytical layer that accounts for communities that can't pay.

5 Workshop close; where to from here?

As stated on Day 1, the outcomes of the workshop including **priority actions and next steps** will be reviewed by the NESP ESCC Hub as part of the NCSAC Climate Services Project, and where appropriate will be addressed and/or otherwise incorporated in the final report for this project to the Department of Agriculture, Water and Environment (DAWE) of the Australian Government.

In closing out the workshop, KE4CAP has put together themes that people want to see addressed, listening to the operators and owners of the platforms. These have evolved over years of working within Europe and now being expanded internationally. This will lead to identification of priorities on which to focus. This workshop is part of the process needed in Australia with support of KE4CAP to develop a climate adaptation platform and specifically to address priority themes and associate issues, and as part of international cooperation more generally. These themes are provided in Appendix B and should form the basis for next steps and for addressing issues for platform development in a consistent manner across national and international jurisdictions.

The KE4CAP project also provides an opportunity for further engagement to facilitate knowledge exchange between the EU, Australia and other countries through proposed 1) bilateral knowledge exchange events including Canada and Japan, and 2) other multi-lateral knowledge exchange events with various other countries as part of an emerging climate platform community of practice going forward.

Appendix A Workshop agenda

Knowledge Exchange: Services and Science Supporting Climate Action

An EU-Australia bi-lateral workshop on developing and using web-based resources to enhance climate intelligence and support climate action

Melbourne, Victoria (3rd – 5th March 2020)

Day 1 - Tues 3rd March (CSIRO Aspendale): Australian Perspective / EU Reflections

| Time | Item | | | | | Notes |
|---------------|---|---|--------------------------------------|---------------------------------------|---|---|
| 08:15 onwards | REGISTRATION with coffee and tea | | | | | |
| 09:00 – 09:15 | Acknowledgement of Traditional Owners Welcome – Workshop Objectives & introductions | | | | | Hilda Mosby, Torres Strait Regional Authority Facilitator: Neil Plummer |
| 09:15 – 09:30 | The KE4CAP initiative – need for, and benefits from EU – Australia bi-lateral exchange on supporting climate action | | | | | Roger Street, Oxford University/KE4CAP |
| 09:30 – 10:00 | Session 1: National Climate Services Capability Project | | | | | Geoff Gooley, NESP ESCC Hub |
| 10:00 – 10:30 | Session 2: CSIRO Navigating Climate Change Mission | | | | | Helen Cleugh, CSIRO Climate Science Centre |
| 10:30 – 11.00 | Session 3: Bureau of Meteorology 2020-30 R&D Plan: Toward a Seamless Environmental Weather-Climate Service | | | | | Gilbert Brunet, Science and Innovation BOM |
| 11:00 – 11:30 | Coffee | | | | | |
| 11:30 – 12:00 | National Case Studies: CMSI/ASFI, ESCI, NHP and NDRISC (5-7 mins each) | | | | | Nick Wood, CMSI Judith Landsberg, ESCI Louise Wilson, NHP Paul Box, NDRISC |
| 12:00 – 12:45 | Session 4: Australian 'Climate Intelligence' Platform Capability: Panel discussion involving CCIA, CoastAdapt and other national/state-based platforms) | | | | | Facilitator/Moderator + Jean Palutikof/John Clarke & other panel members TBC |
| 12.45 – 13:30 | Group photo and Networking Buffet Lunch | | | | | |
| | Parallel (small) Group Discussion: National Challenges and Potential Solutions | | | | | Facilitator: Kevin Hennessy |
| 13:30 – 14:30 | Session 1 Standards and QA/QC | Session 2 Linking, integrating & coordinating | Session 3 Linking science & services | Session 4 Business models & IP m'ment | Session 5 Traditional knowledge & science | Discussion Group Leaders/Rapporteurs |

| | | |
|---------------|---|---|
| 14:30 – 15:00 | Coffee | |
| 15:00 – 15:30 | Plenary Feedback from Parallel Session (5 x 6 minutes each) | Rapporteurs from parallel groups 1 -5 |
| 15:30 – 16:30 | Panel Discussion of key outcomes from small Group Discussions | Facilitator with panel comprised of 5 Discussion Group Leaders + Rapporteurs |
| 16:30 – 17:00 | Initial reflections to Day 1/Group discussions from an EU perspective | KE4CAP/EU Partners |
| 17:00 – 18:30 | Networking reception with platform demonstrations | CCiA, INDRA and other national/state-based platforms (TBC) |

Day 2 - Wed 4th March (CSIRO Aspendale): EU Perspective / Shared Challenges

| Time | Item | Notes |
|---------------|--|--|
| | | Facilitator: Kevin Hennessy |
| 09:00 – 09:30 | EU1: Climate Services – EU web-based platform landscape and next steps | Roger Street, Oxford University/KE4CAP |
| 09:30 – 10:00 | EU2: Copernicus (virtual presentation) | Carlo Buontempo, Copernicus Climate Change Service, European Centre for Medium-Range Weather Forecasts |
| 10:00 – 10:30 | EU3: Transnational Services Climate-ADAPT | Sergio Castellari, European Environment Agency |
| 10:30 – 11:00 | EU4: National Services – Climate Ireland (virtual presentation) | Barry O'Dwyer, University College Cork/Climate Ireland/KE4CAP |
| 11:00 – 11:30 | Coffee | |
| 11:30 – 12:00 | EU5: End User Perspectives | David Dodd, Dublin Metropolitan Climate Action Regional Office |
| 12:00 – 12:30 | EU6: Mapping User Expectations to Current Climate Adaptation Support | Jeremy Gault, University College Cork/Climate Ireland/KE4CAP |
| 12:30 – 13:00 | Open Forum Q&A/EU Panel Discussion | Facilitator/Moderator: Kevin Hennessy + EU/KE4CAP panel members |
| 13:00 – 13:45 | Networking Buffet Lunch | |
| | Parallel (small) Group Discussions: Shared Challenges and Potential Solutions | Facilitator: Neil Plummer |
| 13:45 – 14:45 | Session 1 Session 2 Session 3 Session 4 Session 5 | Discussion Group Leaders/Rapporteurs |

| | The value proposition | Engagement (co-design, co-development and co-production) | Integrating 3rd-party knowledge | Governance & resourcing | Evaluation & review | |
|---------------|---|--|---------------------------------|-------------------------|---|--|
| 14:45-15:15 | Coffee | | | | | |
| 15:15 – 15:45 | Feedback from Parallel Session (5 x 6 minutes each) | | | | Rapporteurs 1-5 Facilitator | |
| 15:45 – 16:45 | Panel Discussion | | | | Facilitator with panel comprised of 5 Discussion Group Leaders + Rapporteurs | |
| 16:45 – 17:15 | Reflections on Day 2 | | | | ESCC Hub/CSIRO/BOM | |
| 18:00 – 19:30 | Workshop dinner | | | | All; Doyles, Mordialloc | |

Day 3 - Thurs 5th March: Collaborative Development and Roadmap

| Time | Item | | | | Notes |
|---------------|--|-----------------------------|-----------------------|-------------------------|--|
| 09:00 – 09:45 | <ul style="list-style-type: none"> Value proposition for national climate platform capability: Resilient Australia by 2030 with significant social, economic and environmental benefits | | | | Facilitator: Geoff Gooley |
| 09:45 – 11:15 | Parallel (small) Group Discussions: Roadmap for Climate Services | | | | |
| | Session 1 Government | Session 2 Private sector | Session 3 Research | Session 4 Indigenous | Facilitators/Rapporteurs |
| | Key questions: <ul style="list-style-type: none"> Governance and strategy development Business models and partnerships Barriers and enablers | | | | |
| 11:15 – 11:45 | Coffee | | | | |
| 11:45 – 12:15 | Feedback from Parallel Session | | | | Rapporteurs 1-4 Facilitator |
| 12:15 – 13:00 | Panel Discussion | | | | Facilitator with panel comprised of 4 Rapporteurs plus four (e.g. one additional member from each theme) – mixture of members |
| 13:00 – 14:00 | Networking Buffet Lunch | | | | |
| 14:00 – 15:30 | Realising future collaboration based on key outcomes / identified shared opportunities for Australia, including next steps/taking the learning and challenges forward within KE4CAP | | | | Facilitator: Roger Street |
| 15:30 | Workshop Close | | | | Roger Street and Geoff Gooley |

Appendix B

Suggested KE4CAP themes for guiding cross-jurisdictional climate platform development

| KE4CAP THEMES |
|---|
| A. Roles of platforms and content |
| Data provision |
| Decision-support tools and resources |
| Awareness, capacity building and education |
| Supporting monitoring, evaluation and reporting |
| B. Sustainability Governance Resources |
| Business models (the value proposition) |
| Funding requirements |
| Human resource requirements |
| Lifecycle planning |
| Interoperation of platforms |
| C. User needs and relevance |
| Understanding (evolving) users + user needs |
| Policy/decision-maker needs |
| Sector-specific needs |
| Indigenous peoples' needs |
| Remote and rural community needs |
| Undertaking user testing |
| Enhancing policy and practice relevance |
| Retaining relevance |
| Guidance development and updating |
| D. Platform design and technical and structural features |
| (Information) architecture |
| Functionality and features |
| Navigability and accessibility |
| Integrating innovations to enhance utility: |
| Visualisations |
| GIS data |

| |
|---|
| Timeseries data |
| Storylines and narratives |
| E. Integrating different knowledge types |
| Co-learning co-development approaches |
| Integrating and linking to other data and information |
| Linking science and service |
| Integrating third-party knowledge |
| Integrating Traditional Local Indigenous knowledge |
| F. Outreach communications/engagement models |
| User engagement |
| Eliciting user needs |
| Eliciting input from science and practitioners |
| Balancing online and offline – digital-domain balance |
| Encouraging/supporting peer-to-peer comms |
| G. Monitoring, evaluation and learning Effectiveness |
| The evaluation process & feedback |
| Performance measures/metrics |
| Need for and role of Standards and QA/QC |
| Learning from and responding to viability assessments |
| H. Interoperability Linking of platforms Quality assurance |
| Standards and QA/QC |
| Connecting platforms Strengthening connections |
| Governance – linkages and relationships |
| Enhancing providers capacities |
| Shared technologies/approaches |
| Taxonomy/ontology |
| Performance measures/metrics |
| Need for and role of Standards and QA/QC |



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