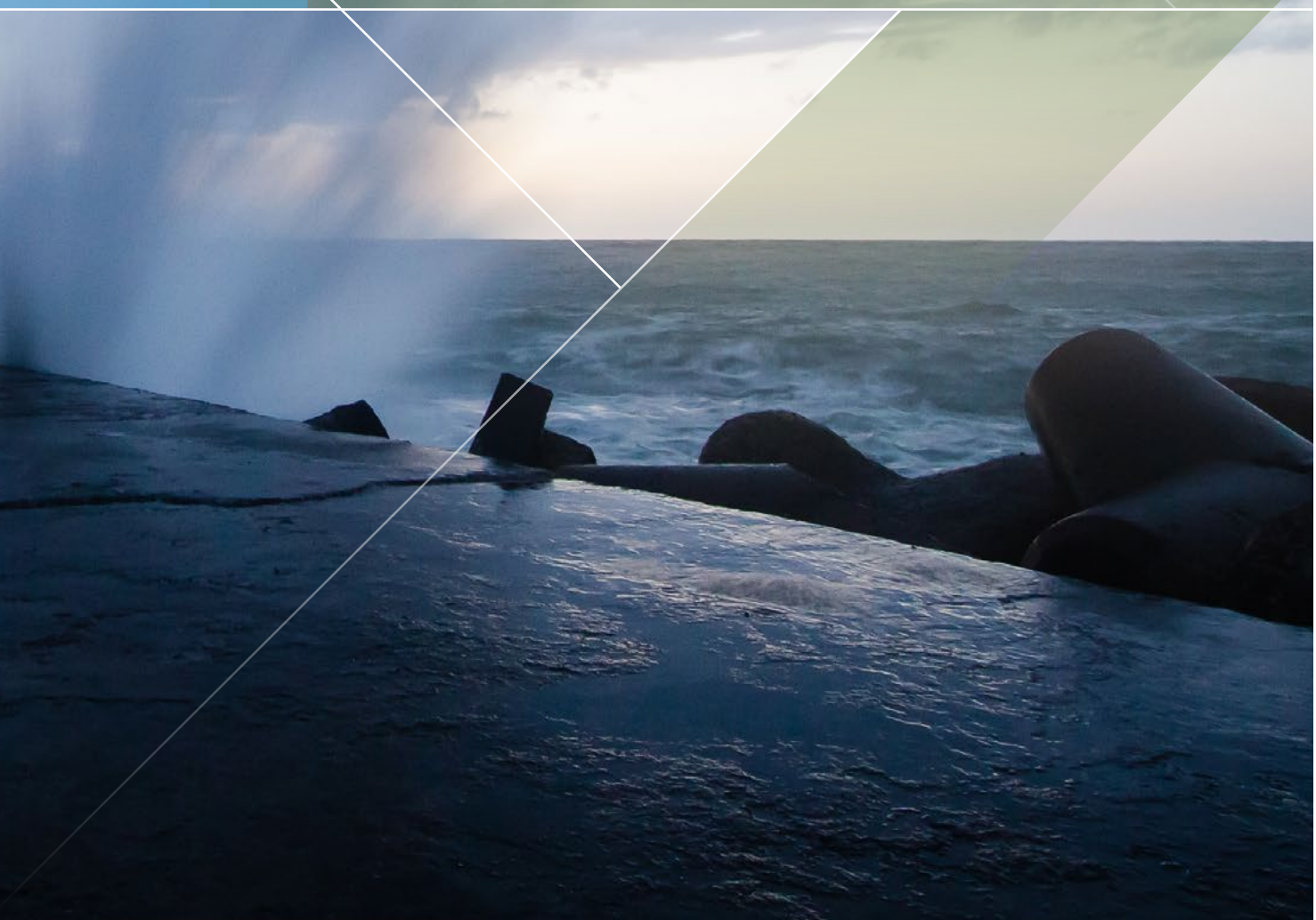
Climate Change Adaptation
Good Practice - Case Study

Climate Futures for Tasmania



About Adaptation Good Practice

Adapting to climate change is a relatively new concept to many. It is important to learn from practitioners who are undertaking adaptation activities and beginning to have tangible outcomes. Documenting examples of good practice and identifying the criteria that makes them work, enables those interested in adaptation learn how to take action.

There are expectations that Adaptation Good Practice (AGP) includes a definite start and finish to a project. However, climate change practitioners' experiences show that adaptation projects are often steps in longer learning journeys. There are no golden rules on how to adapt and often practitioners across Australia are inventing the wheel that drives future AGP. This case study of Climate Futures for Tasmania is part of a series of 16 case studies that recognise exemplars for AGP in Australia. Through the development of these stories of successful adaptation it was refreshing to see an emergence of similar experiences and challenges regardless of the project or location. A synthesis of these stories can be read in the Synthesis Report 'Climate Change Adaptation Good Practice: Key lessons from practitioners experiences'. The report will help practitioners understand that they are not alone in their challenges and to see some of the clear lessons learned about what drives good practice in adaptation.

Following the Snapshot, there is a more in depth narrative of the experiences, learnings and network links to stimulate further engagements and knowledge sharing among the growing community of adaptation practitioners.

This project was funded by the Australian Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education

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The Adaptation Good Practice project was undertaken by
D. Rissik and N. Reis from the National Climate Change Adaptation Research Facility.

Acknowledgements: Clive Attwater, SGS Economics & Planning Pty Ltd The Climate Futures for Tasmania project was funded primarily by the State Government of Tasmania, the Australian Government's Commonwealth Environment Research Facilities Program and the Natural Disaster Mitigation Program. The project also received additional funding support from Hydro Tasmania. The Climate Futures for Tasmania project was managed by the Antarctic Climate & Ecosystems Cooperative Research Centre (ACE CRC). For more information about the project go to: www.acecrc.org.au or email climate.futures@acecrc.org.au. We thank Professor Nathan Bindoff (University of Tasmania) ACE CRC Program Leader, and Intergovernmental Panel for Climate Change Coordinating Lead Author for his time and contributions to the text.

Case study snapshot

Quantifying the Cost of Climate Change Impacts

Tasmania is surrounded by the sea and has a varied topography leading to significant differences in local climate on a scale that is far smaller than can be captured using a global climate model. In most global models, Tasmania is represented by at most four cells. This level of detail provides very little confidence to users that projections at a local scale are meaningful or helpful.

The Climate Futures for Tasmania project addressed the need for relevant, locally specific information about expected changes to climate that reflects the highly variable topography of Tasmania and many strong regional variations at a finer scale resolution than is available from global and national scale models.

Since 2010, Climate Futures for Tasmania has produced a series of products and reports of anticipated climate change impacts for new audiences, including summaries for local government areas. Key findings in these summaries are assisting end users including Hydro Tasmania in their work with climate change adaptation at a local scale, by helping them to understand key factors influencing risks and impacts that are likely to affect their local area over the coming century.

The project journey

The genesis of the Climate Futures for Tasmania project traces back to an email in 2003 from Hydro Tasmania to the Director of the Tasmanian Partnership for Advanced Computing (TPAC): 'How will climate change affect Hydro Tasmania's generating capacity?' An initial project undertaken by TPAC in conjunction with CSIRO and supported by the Antarctic Climate & Ecosystem Cooperative Research Centre (ACE CRC) ran from 2003 to 2006. It looked at the projected climate trends on a small scale specifically for Hydro Tasmania. This showed only about a 2% reduction in total rainfall, not obviously a major effect. However, when Hydro Tasmania hydrologists applied the geographic and seasonal distribution to their operational planning models, the effect was significant and worrying – it mattered!

The subsequent project, Climate Futures for Tasmania, was conceived as an integrated assessment of the high-resolution, dynamically downscaled climate models (about 10 km cells across Tasmania) with operationally meaningful models, combined with a dedicated engagement and communications program to embed the scientific information with the end users. The published project results were tied very closely to the specific information that the participating end user groups such as Hydro Tasmania, grape growers and aquaculture operators required for their operational decision-making. The project results allowed them to apply anticipated future conditions to their decisions to see how they would have to adapt.

This direct link makes the adaptation task faced by end users much clearer and purposeful, as it does not rely on generalities or averages. The project highlights the specific climate factors that affect end users and makes it easier for them to assess adaptation options once this link is clear. End users reported that with this type of information available to them, the power of a directly relevant approach was immediately obvious.

Figure 1: Case study location, state-wide Tasmania

The project addressed the need for relevant, locally specific information about expected changes to climate that reflects the highly variable topography of Tasmania and many strong regional variations at a finer scale resolution than is available from global and national scale models.

Driver for adaptation action

Realisation that key to success was integration of the climate models with the downstream models of impacts on operations (catchment models, wind impact models etc. already held by some users) and participation by the users in project development and communication of the results.

Adaptation action

The real benefit and success of the Climate Futures for Tasmania project was in demonstrating to other researchers how to make interpretive assessments of the climate simulations relevant and applicable to specific industries, communities and government, and how to communicate them. A complementary researcher noted the "doors opening" for people, as they start to appreciate how climate change may impact their lives when information is presented in ways that are relevant and directly applicable to grass-roots operations. In the words of one user: "Now we have the diagnosis, we know what we have to work with."

Risks and impacts addressed

Hazard definition as revealed by down-scaled, (10 km) future climate trends. Risk and impact assessments of:

- Catchments and flows
- Agricultural impacts
- Extreme events including coastal maximum storm tide events
- General climate trends at a small-scale.

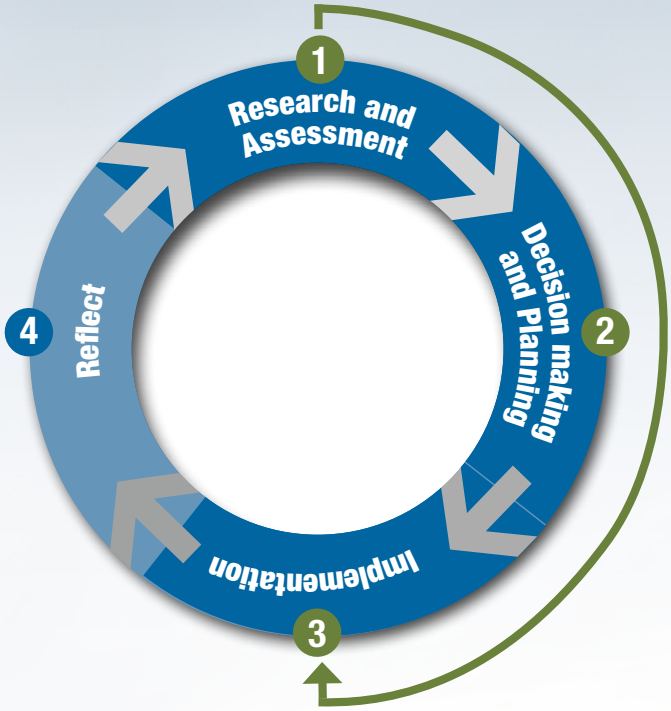


Figure 2: Climate Futures for Tasmania Adaptation Good Practice phase

Key project aims

The aim was to prepare and present future climate trends in ways that were directly applicable to making operational decisions that will adapt to climate changes as they develop for a number of priority sectors in Tasmania. The downstream models of impact were very important in the success of the project.

Outcomes achieved

- Climate maps, graphs, tables of trends in key climate parameters at a local scale
- Application of future climate conditions to operational models showing impacts
- Climate trends for each Local Government Area (LGA).

Emerging outcomes

Complementary spin off projects included ClimateAsyst® tool and study into the Australian edible oyster industry. More information is available on page 7.

The project

Earlier work for Hydro Tasmania had shown relatively small changes in average rainfall, when resolved at a higher resolution both seasonally and geographically, led to significant operational impacts when catchment flows were modelled across the whole system. Time of year and distribution of rainfall meant that there were significant losses with high peak flows, but insufficient flows at other times and places, having significant impacts on the overall system performance. This underscored the need for higher resolution data, and also to integrate the climate modelling with operational models at the higher resolution to determine the impacts with greater confidence.

Risks and impacts addressed

Risk and impact assessments were of catchments and flows, agricultural impacts, extreme events including coastal maximum storm tide events and general climate trends at a small-scale.

The first core assessments were of:

- Catchments and flows
- Impacts on agriculture
- Extreme events including coastal maximum storm tide events
- General climate trends at a local scale.

The project provided climate information to others undertaking complementary assessments of impacts on other assets and operations. More than 50 complementary projects occurred subsequently, as expected and intended, either directly linked to the original project or based on the demonstration effect of the project.

The project provided the first fine-scale climate information for Tasmania by dynamically downscaling six global climate models with two emissions scenarios

Response strategy

The project provided the first fine-scale climate information for Tasmania by dynamically downscaling six global climate models with two emissions scenarios (high emissions scenario - A2 and lower emissions scenario - B1) to generate climate information from 1961 to 2100.

The climate modelling was linked to pre-existing catchment models, wind impact models, agricultural suitability models and extreme tide models, among others, to transmit the climate changes modelled into the operational impacts expected to occur for these different areas of interest. Complementary projects took the projected changes and applied them to a wide range of other sectors of interest, each with their own key parameters often in specific geographic areas.

Climate Futures for Tasmania also summarised the results for each of Tasmania's 29 LGA's.

The project findings show the areas most profoundly affected are water management, specifically water storage and availability and peak flow; and storm surges on the coast. Since the project was completed, further work has revealed potentially larger impacts of changing populations of pest species on biodiversity and agriculture.

Implementation phases

Seven technical reports were released over two years during the project focussing on specific aspects of climate change or impacts on particular sectors. They included: in October 2010, the Climate Futures for Tasmania: General Climate Impacts Technical Report that sets out the projected changes to Tasmania's climate during this century, including higher temperatures and changes in rainfall patterns.

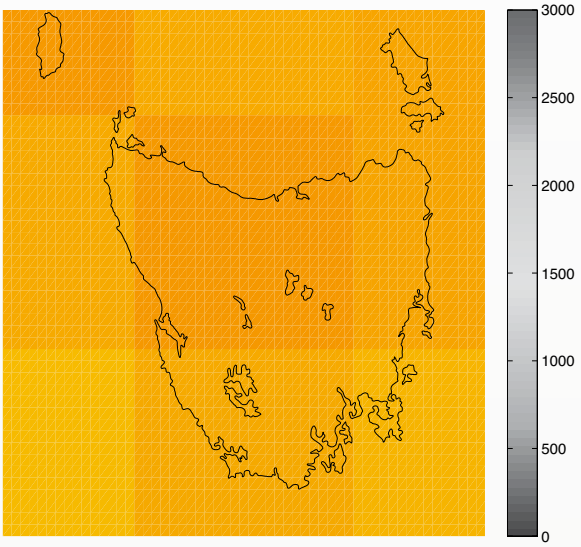
The Climate Futures for Tasmania: Climate Modelling Technical Report details the performance of the model simulations in reproducing the Tasmanian climate and assesses the likelihood that the simulations accurately project future climate change for Tasmania.

In March 2011, the Climate Futures for Tasmania: Impacts on Agriculture Technical Report addressed the impacts on Tasmanian agriculture from projected climate change. The report examines the key climate indices of frost, drought, chilling and growing degree-days, and focuses on the key agricultural sectors of perennial horticulture, pasture production, grain crops, wine and issues around bio-security.

In March 2011, the Climate Futures for Tasmania: Impacts on Water and Catchments Technical Report was released with projected river flows,

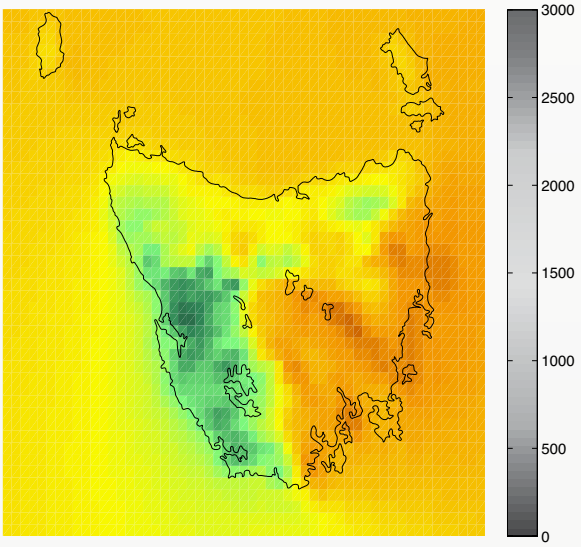
Before:

Four regional based data projections



After:

Local projections on a state-wide 10 km^2 grid



Grose *et al* (2010)

Figure 3: Climate Modelling Data Comparison: Before - Global (IPCC) projections; and After - Climate Futures Tasmania projections

to 2100, for more than 1900 sub-catchments in 78 river catchments that cover more than 70 per cent of Tasmania. The future operations of Tasmania's hydro-electric system and 14 major irrigation storages were also simulated to 2100.

In October 2011, the Climate Futures for Tasmania: Extreme Events Technical Report was released, examining extreme rainfall, temperature and drought events in the Tasmanian context to determine how climate change might alter the characteristics of these events in the 21st century. The summary report also includes information on coastal vulnerabilities, wind hazard and impacts on infrastructure.

In May 2012, the Climate Futures for Tasmania: Extreme Tide and Sea-Level Events Technical Report was released. This report describes the development of spatial maps that provide a basis for the investigation of the possible impacts of future climate change due to sea level rise and changes in weather conditions, and provided information for subsequent coastal assessments around Tasmania.

In May 2012, the Severe Wind Hazard and Risk Technical Report was released in conjunction with Geoscience Australia (GA). Geoscience Australia was a partner within the Climate Futures for Tasmania project, investigating the severe wind hazard and risk to residential buildings in the Tasmanian region, both under current climate and also for two 21st century climate change scenarios. That report laid the foundation for the exploration of whether the community and government believe the risk is acceptable or if adaptation strategies are required.

Outcomes achieved

Fifty complementary projects used the simulations and/or interpreted results in their research into specific areas of climate change. These complementary projects were not confined to Tasmania, and several projects were based at other universities around Australia using the 60 km grid simulations covering Australia.

Other outcomes include updated assessments of coastal erosion, biosecurity and energy production.

Emerging outcomes

Two examples of complementary spin off projects are:

1.

Infrastructure and buildings are sensitive to changes in several climate variables, and sometimes to a combination of climate variables. Climate simulations do not give the answers required for planning and adapting infrastructure for climate change. ClimateAsyst is a tool developed in conjunction with ACE CRC by Tasmanian engineering firm, Pitt and Sherry. It has helped infrastructure managers, planners and local government to assess what climate change impacts identified are critical to specific infrastructure and interpret them against their own assets or planned locations for future assets. The tool provides a snapshot assessment in a GIS format with links to documentation and building code standards.

2.

The interpreted results of Climate Futures for Tasmania were were used by NCCARF's National Adaptation Research Network for Marine for Marine Biodiversity and Resources in a study into climate adaptation options for the Australian edible oyster industry. Changes to climate conditions likely to impact the oyster industry include extreme flooding events impacting oyster harvesting operations and heat waves. The study titled *Climate Change Adaptation in the Australian Edible Oyster Industry: an Analysis of Policy and Practice* identifies the key collective actions and opportunities for adaptation in the industry.

Critical success factors

AGP analysis of the project

Success of this project was driven by strong leadership, outstanding engagement between the partner organisations, connectivity with users and analysts and sustainability.

This project is strong in:

- **Leadership**
- **Engagement**
- **Connectivity**
- **Sustainability**

Close consultation with users of the results ensured that the climate parameters most needed were presented in a way that was meaningful to users. This allowed users to anticipate and visualise the future impacts on their assets, operations and values as the climate changes, with climate models feeding directly into operational models for specific sectors of interest. The project design and execution engaged user groups from early in the project, and where relevant, researchers from agriculture, catchment management (Hydro Tasmania and water resources), and emergency response sectors were directly involved in developing parts of the research. Senior management in both funding and user organisations were also involved in the project oversight and review of findings to ensure they met their organisation's objectives.

Lesson learnt:

There is a need to consult with the users of the results, to present them in the most meaningful way.

The leadership of the project also had a clear vision for engagement and participation as a foundation for communicating the results effectively to users.

Leadership

The project was championed from the start by an ACE CRC Manager who had been involved in the Intergovernmental Panel for Climate Change assessment report and developed good ideas about getting good outcomes from climate modelling. The manager was also well connected with many of the participating organisations.

It was emphasised however, that leadership included great team work, and many participants 'hunted as a pack' to obtain funding, structure the project and seek participants, models and a project design that would meet the vision for a truly integrated assessment of impacts.

The leadership of the project also had a clear vision for engagement and participation as a foundation for communicating the results effectively to users.

Leadership lesson learnt:

Working as a team on project objectives creates results that are greater than the individual could have achieved.

Engagement

The project was initiated by a two-day workshop to define the process of engaging all groups effectively, making sure that several levels (researchers, operations and senior management) of participating organisations were engaged, not just one, in both the research and the governance of the project.

Climate Futures for Tasmania was an interdisciplinary and multi-institutional collaboration of twelve core participating partners:

- Antarctic Climate and Ecosystems Cooperative Research Centre
- Australian Department of Sustainability, Environment, Water, Population and Communities
- Tasmanian State Government
- Australian Attorney-General's Department
- Hydro Tasmania
- Tasmanian State Emergency Service
- CSIRO
- Geoscience Australia
- Bureau of Meterology
- University of Tasmania
- Tasmanian Institute of Agricultural Research

Tasmanian Partnership for Advanced Computing.

Engagement lesson learnt:

Different levels within an organisation need to be engaged; communications and channels may need to be adjusted accordingly.

The extensive involvement of Tasmanian agencies at a number of levels means that the work is deeply embedded into government through the state agencies

Connectivity

The large number of complementary projects shows that the project connected with many users, other analysts and information providers. The project has supported many sectors within Tasmania who have used Climate Futures Tasmania's modelling results. Similar initiatives from around Australia have learned from the experiences and approaches of the Tasmanian initiative.

The Climate Futures for Tasmania project complements climate analysis and projections done at the continental scale for the Intergovernmental Panel on Climate Change's Fourth Assessment Report, at the national scale in the Climate Change in Australia Report and data tool, as well as work done in the south-east Australia region in the South Eastern Australia Climate Initiative. The work also complements projections done specifically on water availability and irrigation in Tasmania by the Tasmania Sustainable Yields Project.

→ Connectivity lesson learnt:

Ensuring that other existing and planned tools could intersect well with the Climate Futures outputs improved their utility and transferability.

Sustainability

Initially, the level of confidence in the projections of climate change varied among participants and users, but was developed to provide 'bounded uncertainty' about the estimates. As time passed, the estimates have been consistent with observed changes to date, and confidence has generally increased.

The long-term will, of course, be affected by actual greenhouse gas emissions, but the climate change trend for Tasmania for the next few decades has now been relatively well documented by the project.

One of the findings from the project was that many assets may face a higher risk from present day conditions, than expected at the time they were built. In particular, modelling of extreme wind impacts for individual dwellings shows that as development has expanded to hillsides, houses are potentially exposed to more extreme winds today, than the design standard applied at their construction. Similar findings apply to coastal settlements exposed to storm events to a higher probability than would be considered acceptable.

The project results are also designed to be available widely on an ongoing basis. The project reports were written and presented to a high standard, and peer reviewed to ensure a high standard and confidence in the results. Rather than restrict access to detailed findings and data sets, the main results are available on 'theLIST', the Tasmanian Government's web-based, spatially integrated land information delivery system. As well as being widely accessible and maintained by theLIST support team, the data can be integrated with a wide range of other data sets such as built assets, natural resources and ecosystems mapping and access to tools to overlay and combine these data sets. For those with appropriate expertise, the data sets can also be applied to assess impacts on other assets and systems that have not yet been assessed. For example, they are currently being used for the National Environmental Research Program to assess climate impacts on ecosystems and species.

The extensive involvement of Tasmanian agencies at a number of levels means that the work is deeply embedded into government through the state agencies that address agriculture, aquaculture, water access and use and emergency services, and is expected to spread to other agencies over time.

→ Sustainability lesson learnt:

Linking climate projections with a range of other models supported long term decision making across a number of fronts and helped make them sustainable into the future.

Cost

Project partners invested more than $7.5 million by way of direct cash funds and in-kind contributions. The total direct funding was about $3.2 million, primarily from the State Government of Tasmania, the Australian Government's Commonwealth Environment Research Facilities Program and the Natural Disaster Mitigation Program. The project also received additional funding support from Hydro Tasmania.

Good results were obtained from the timely investment in this project. It has put the project's investment partners in a great position to deal with climate change issues in Tasmania. Additionally, they have saved substantial costs associated with the many follow on projects, which otherwise may have relied on poor data and potentially delivered wrong options.

→ Cost lesson learnt:

The tools support a lot of other tools and initiatives and because a well connected approach was taken can save significant costs in a multitude of fields.

Conclusion

Climate Futures for Tasmania was effective in assisting decision makers to make practical decisions for adapting to expected changes in power generation, agriculture, infrastructure design and other sectors. The project triggered a range of flow-on and downstream projects that have adopted similar targeted analyses for other geographic locations and sectors.

Gaps and future challenges

With more than 140 variables and thousands of possible climate indices to calculate, Climate Futures Tasmania assessed only those variables requested by stakeholders. As the project progressed, other climate indices and risks were identified by additional stakeholders and these led to subsequent projects and analysis by other researchers as part of complementary projects.

Links to more information and projects

The following projects:

- Climate Futures for Tasmania: General Climate Impacts Technical Report, October 2010
- Climate Futures for Tasmania: impacts on Agriculture Technical Report, March 2011
- Climate Futures for Tasmania: Impacts on Water and Catchments Technical Report, March 2011
- Climate Futures for Tasmania: Extreme Events Technical Report, March 2011
- Climate Futures for Tasmania: Extreme Tide and Sea-Level Events Technical Report, May 2012
- Severe Wind Hazard and Risk Technical Report, May 2012, released in conjunction with Geoscience Australia

Can all be found at
www.dpac.tas.gov.au/divisions/climatechange/adapting/climate_futures/climate_futures_for_tasmania_reports

For more information see:

www.acecrc.org.au/Research/Climate%20Futures

www.climatechange.tas.gov.au

www.dpac.tas.gov.au/divisions/climatechange/adapting/climate_futures/climate_futures_for_tasmania_reports

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www.pittsh.com.au/documents/climateasyst.pdf

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The Climate Change Adaptation Good Practice project was funded by the Australian Government and delivered by NCCARF