Lincoln Quilliam University of New South Wales

CLIMATE CHANGE ADAPTATION FOR EASTER ISLAND

Easter Island is the most isolated inhabited island on earth. Even as a high relief volcanic island, Easter Island is vulnerable to coastal climate change as its only settlement and iconic cultural heritage monuments are located on the coast. This study assessed the coastal climate change impacts on Easter Island based on projections contained in the International Panel on Climate Change Assessment Report 4. A consultative risk-based approach was adopted in the development of an overview of potential coastal impacts with a focus on coastal (oceanic) inundation. Valuable information was obtained in meetings with key stakeholders during an ACCARNSI funded two week field trip to the Island. Stakeholders consulted included the Governor and Mayor, the Chilean Navy, utilities management authority, national parks authorities, public works and other governmental agencies and local elders and fishermen.

MAJOR FINDINGS AND OUTCOMES:

Climate Changes on Easter Island for 2100

The magnitude of climate changes on Easter Island will be less than the global mean and significantly less than that experienced on the continents due to the evaporative cooling effect and greater thermal inertia of the oceans and its location within the south pacific gyre. Climate Changes projected to be experienced on Easter Island for 2100 by IPCC AR4 are shown in the table below. A1B, A2 and A1FI are equally likely emissions scenarios developed by IPCC.

Climate Parameter	Projected Change for Easter Island in 2100
Annual average temperature increase	A1B: 1.4° C - *Global average: 2.8°C* A2: 1.8° C - *Global average: 4.0°C* Heat waves likely to increase in intensity and duration
Rainfall	-10% to -15% annually -20% to -30% during summer -5% to -10% during winter Dry spells and storm intensity likely to increase
Sea Level Rise	A1FI : 0.26 – 0.79m *Global average for A1FI: 0.26-0.59m*
Winds	As the Hadley cell expands and weakens, the SE trades may weaken but dominate for a greater period of the year Winter storms may increase in intensity
Wave climate	Southerly swells may increase due to stronger mid latitude and Antarctic storms
Climate drivers	General background climate likely to move to more "El Nino like" conditions

Potential Climate Change Impacts

Water supply security due to changes in rainfall and evaporation has been identified as the greatest potential impact with water supply security in threat within a decade based on current supply infrastructure and resident and tourist population growth.

Estimates for up to a 100 year average recurrence interval storm event under current and projected 2100 sea levels found that some significant cultural sites are at risk of inundation and overtopping. All harbour infrastructure is likely to be at risk of regular tidal inundation in 2100. It was found that tsunami inundation risk is greater than that estimated for the 100 year ARI event.

Beach shoreline recession is likely to cause one of the two beaches on the island to be permanently inundated. Sea cliff instability may be exacerbated due to rainfall intensity and the potential for greater wave energy reaching the cliffs.
Fishery stocks are likely to be impacted due to rising sea surface temperatures. Agriculture and existing erosion issues are likely to be impacted due to changes in evaporation and rainfall.

Outcomes
Potential engineering adaptation options were also discussed but Easter Island will face greater challenges within the next decade perhaps before any serious effects of climate change are experienced. However, effective adaptation may require effective planning and decisions now to deliver a sustainable future for Easter Island.
A paper was presented on this project at the Coasts and Ports Conference 2011 titled: *Coastal Climate Change Impacts for Easter Island in 2100*. A paper has also been submitted to the Rapa Nui Journal, an Academic Journal published by the US based, Easter Island Foundation. This paper further discusses potential engineering and planning adaptation options and considerations for all future decisions. All stakeholders on the island were very interested about this project and the Rapa Nui Journal paper is well awaited. Copies of the Thesis have also been sent to the key stakeholders on Easter Island.

SIGNIFICANCE:

This project took climate change impact, vulnerability and adaptation knowledge gained in Australia and applied that knowledge in a remote island where the resources or motivation for a project of this nature may not be normally commissioned. As such it was essentially a case study which succeeded in obtaining a broad first pass assessment of climate change impacts and potential adaptation options.
In order to understand the impacts climate change may have on the island, a depth of understanding of the island's current climate, economy, governance, dominant industries and infrastructure, environmental and social drivers and cultural heritage was required. After this was gained and the climate changes likely to be experienced were defined, the potential impacts were discussed with all stakeholders on the island to verify the most significant impacts and develop potential adaptation options.

FURTHER RESEARCH SUGGESTIONS:

Further climate change related research opportunities for Easter Island are summarised in a priority order based on stakeholder consultations and the results of analyses conducted during the course of this project:

1. Geological, Hydrogeological, Geophysical, and Hydrogeochemical investigations to determine the size, quality and sustainable yields for the groundwater resources on the island.
2. Aquaculture and Agronomic studies
3. Scaled physical modelling of high risk coastal sites in a wave flume and further geologic and structural assessment to determine the risk of damage to Ahu's and Moai.
4. Engineering geology investigation regarding the sea cliffs.

ACKNOWLEDGEMENTS:

This project was initiated by Petra Campbell from International Help Fund Australia (IHFA). IHFA has worked extensively to educate and improve waste management in Easter Island in the past decade and was instrumental in gaining background information for this research project. A Rapa Nui local, Alvaro Atan, provided great value to the project by way of organising all stakeholder meetings and generously donated up to 14hrs per day of his time in translation, field surveying and transport services and assistance during the field trip. All stakeholders who met with me during the field trip were very supportive of the project and offered much time and knowledge also providing valuable unpublished data and reports. Thanks to the Chilean Lands Office and UNSW Surveying for loan of and training in surveying equipment for coastal profile surveys undertaken during the field trip. Thanks also to staff from GHD and the UNSW Water Research Laboratory for technical advice.

Grant Holder: Lincoln Quilliam, Bachelor of Environmental Engineering (Honours Class 1), School of Civil and Environmental Engineering, University of New South Wales

Honours Thesis Supervisor: Associate Professor Ron Cox

NCCARF
National
Climate Change Adaptation
Research Facility
Adaptation Research Network
SETTLEMENTS AND INFRASTRUCTURE