EARTHWATCH® INSTITUTE

DEAKIN UNIVERSITY

BLUE CARBON:

COUNTERACTING CLIMATE CHANGE

SCIENTIST FOR A DAY PROGRAM 2018- 2020

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The HSBC Scientist for a Day program is a multisector initiative empowering and transforming corporate staff into citizen scientists who advocate the value of wetlands, while contributing to Blue Carbon research.

The HSBC Scientist for a Day program was established between HSBC, Earthwatch Australia and Deakin University's Blue Carbon Lab to study, value and raise awareness of coastal wetlands.

Coastal ecosystems are important natural assets due to their capacity to offset carbon emissions, clean and store water, protect our coasts and enhance wildlife biodiversity. This program focused on the ability of coastal wetlands (mangroves, saltmarshes and seagrass beds) to fight climate change by sequestering atmospheric carbon dioxide 30 – 40 times faster than terrestrial forests. The program addressed research gaps on the value of wetlands (also known as Blue Carbon ecosystems) and the lack of awareness and investment in protecting and restoring these habitats.

With a financial support of $507.000 USD from HSBC, the program was delivered via "Earthwatch's Scientist for a Day model".

Twenty-one Scientist for a Day events connected corporate staff to science and nature and transformed them into citizen scientists who collected critical data to inform wetland management and climate change mitigation policies. By recruiting corporate staff as citizen scientists, the program up-skilled more than 350 employees from 23 businesses (including HSBC and many Qantas Future Planet partners) in topics such as natural capital and ecosystem services, whilst maximising field sampling.

HSBC citizen scientists surveyed over 300 vegetation plots and collected more than 1000 soil samples from coastal wetlands in Sydney, Melbourne and Auckland. Data is being used to prepare eight research publications that will advance our understanding of Blue Carbon ecosystems and their ability to fight climate change. Considering coastal wetlands are one of the Earth's most efficient carbon sinks, this information will support the creation of a Blue Carbon market that promotes the restoration and protection of coastal wetlands for carbon offsetting and climate change mitigation.

The educational and scientific success of the HSBC Scientist for a Day program was recognised through the 2019 Australian Financial Review Higher Education award for Industry engagement. The program was also showcased externally in several conferences, newspapers, website blogs, social media (#BlueCarbonArmy) and a tv news report.

THE CHALLENGE

As the Earth faces the devastation of increasing carbon emissions, water scarcity and sea level rise, a new field of research highlights coastal wetlands as one of the most efficient natural solutions for climate mitigation and adaptation.

WETLANDS AS KEY ECOSYSTEMS TO FIGHT CLIMATE CHANGE

Coastal wetlands – mangroves, tidal marshes, and seagrasses (Figure 1)– are collectively known as 'Blue Carbon' ecosystems. They are considered one of the Earth's most efficient carbon sinks, capturing carbon dioxide 30-40 times faster than terrestrial forests and quickly storing it in the damp and salty soils (Figure 2). The unique characteristics of these wetland soils and the associated microbial communities allow carbon to remain locked underground for millennia.

Given the **blue** colour of the ocean, all the carbon stored by oceanic and coastal systems receives the name 'Blue Carbon'.

Coastal wetlands are vital in the battle against climate change as they capture more than 50% of all the carbon in the oceans, yet they cover less than 1% of the Earth's floor. In Southeast Australia (New South Wales and Victoria), coastal wetlands store 36,000 tonnes of carbon dioxide per year, which is equivalent to taking 7,826 cars off the roads.

Additional to their carbon sink capacity, these ecosystems provide other services that benefit people and nature (Figure 3):

Water storage & filtration

Wetlands function like a sponge, soaking and filtering out pollutants (pesticides, fertilisers, heavy metals) from rivers and catchments.

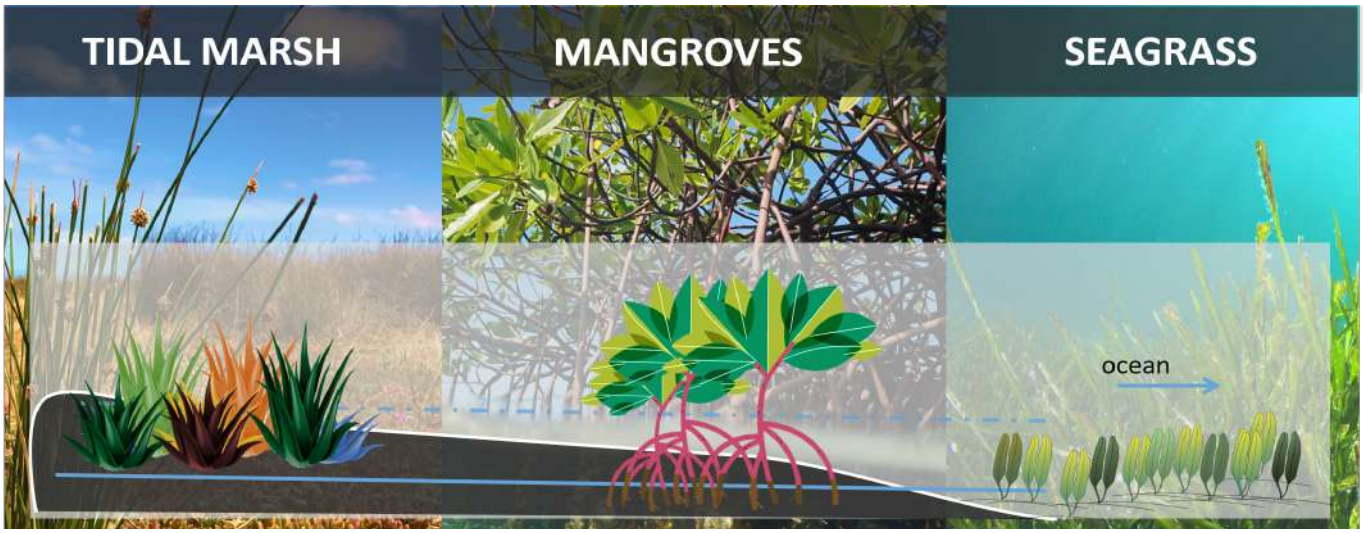

Figure 1. The three main coastal ecosystems sequestering carbon dioxide from the atmosphere.

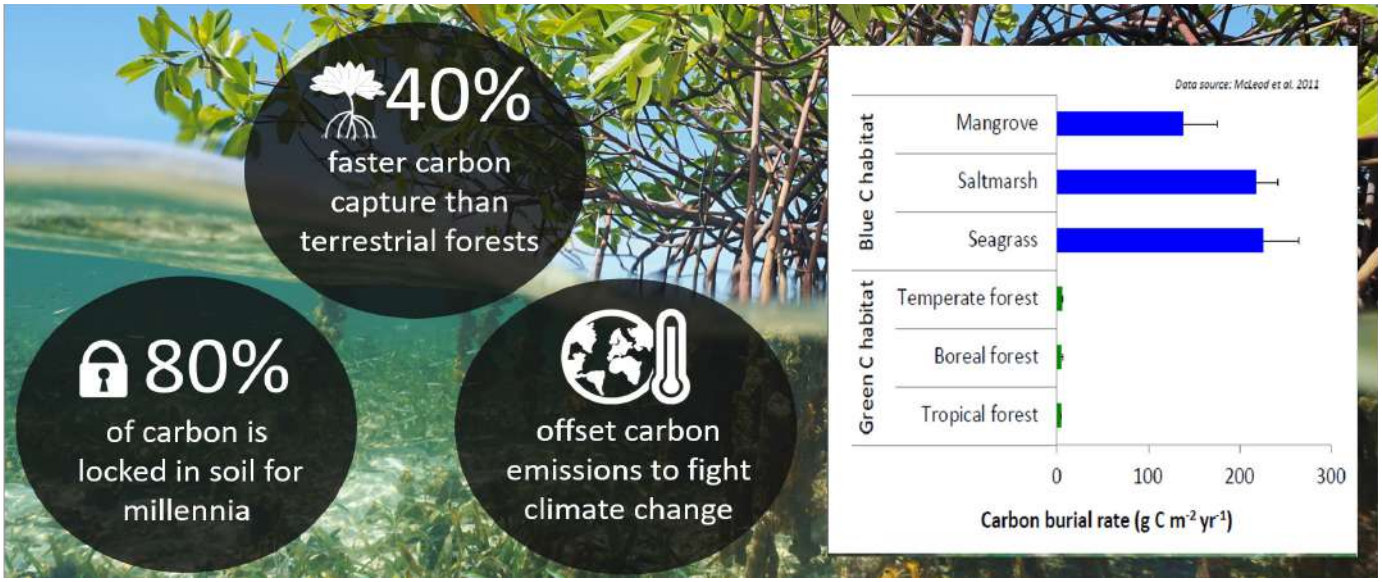

Figure 2. Key attributes that make wetlands very efficient at absorbing carbon dioxide from the atmosphere and locking it underground.

Coastal protection

Wetland vegetation and intricate root system keeps shorelines in place reducing erosion and damage from waves and wind.

Biodiversity hotspots

Their unique location between water and land, makes them the preferred habitat for waterbirds, shellfish, fish and many endangered species.

Fisheries

95% of all commercial fish species depend on coastal habitats for food or shelter at some point during their life cycle.

Tourism & recreation

Most of world's population lives close to the coast. Coastal wetlands provide a natural place for people to enjoy, relax and unwind.

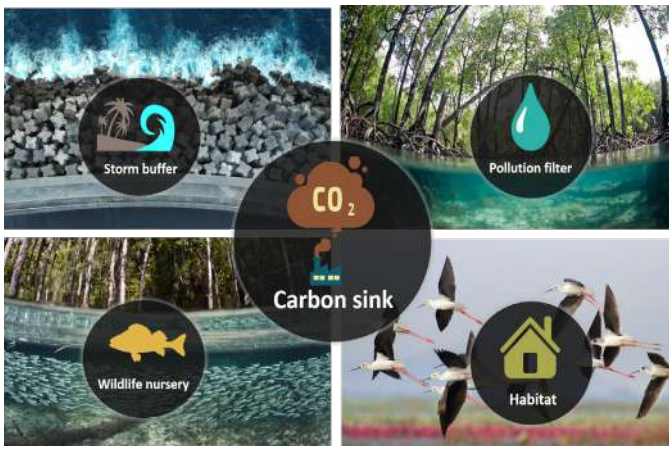

Figure 3. Ecosystem services provided by coastal wetlands.

ECOSYSTEMS UNDER THREAT

Blue Carbon ecosystems are in rapid decline globally, with the main causes largely driven by human activities. Common drivers are changes in land use for agriculture/farming, pollution from both land and sea, and industrial and urban development. All these factors are further exacerbated by climate change.

When coastal Blue Carbon ecosystems are degraded, disturbed or converted, they shift from being major carbon sinks to becoming significant carbon-emitters leading to even more negative climate effects. It is estimated that each hectare of Blue Carbon ecosystem lost has an equivalent impact of losing between 10 and 40 hectares of tropical forest in terms of carbon emissions, due to the extremely long-term storage of carbon in Blue Carbon soils.

AUSTRALIA'S OPPORTUNITY

Australia's coastal zone holds one of the world's richest stores of 'Blue Carbon', with a sequestration value worth billions of dollars. At the United Nations' Climate Change Conference in Paris (2015), Australia committed to accelerating action in the use of coastal Blue Carbon for climate change action. Several steps have been taken to set up a 'Blue Carbon market' that allows Australians to capitalise from this nature-based approach to offset carbon emissions.

1. Establishment of an International Partnership for Blue Carbon
2. Inclusion of Blue Carbon within Australia's greenhouse gas inventory
3. Development of a technical review of opportunities for including Blue Carbon methodologies within the Australian Emissions Reduction Fund [ERF]
4. Development of ERF Blue Carbon Roadmap

THE BIG CHALLENGES

Despite the potential of Australian coastal wetlands for climate change mitigation (via carbon sequestration), there are several challenges slowing the creation of a Blue Carbon market, as well as protection and restoration of coastal Blue Carbon systems, including:

LACK OF AWARENESS

Australians have limited understanding of climate science and the value of coastal wetlands. People have little connection with nature, and hence lack awareness of the power of nature-based solutions to fight climate change. Research shows 35 % of Australians have never been to a wetland and more than half do not know of their carbon storage potential.

RESEARCH GAPS

Australia is at the forefront of Blue Carbon science. However, many knowledge gaps related to soil carbon inventories, sampling methodologies, and carbon offsetting need to be addressed to make a strong case for their use as an effective climate mitigation strategy and the establishment of a Blue Carbon market.

LACK OF INVESTMENT

If Australia's coastal wetlands are renewed, they could serve as a tremendous asset in achieving the Sustainable Development Goals (SDG) and delivering Nationally Determined Contributions (NDCs) through carbon sequestration. Further investment is required for their protection and restoration.

WRONG PERCEPTION

Mangrove forests provide an estimated US$1.6 billion each year in ecosystem services that are imperative to human survival and wellbeing. While many countries are losing mangrove forests (~50% global loss in the past 50 years), New Zealand's mangroves are rapidly expanding due to (1) elevated sediment inputs associated with coastal farming; (2) reduced water flow from the construction of bridges; and (3) increased ocean temperatures that promote mangrove growth. New Zealand's policy makers and resource managers are facing intense public pressure to remove mangroves due to the perception that they reduce coastal amenity (Figure 4).

Figure 4. Clearing of mangrove forests in Auckland, New Zealand.

THE SOLUTION

In response to the lack of awareness and research gaps on coastal wetlands, the HSBC Scientist for a Day program was created to transform corporate staff into citizen scientists who advocate the value of wetlands while contributing to research that underpins coastal restoration and protection.

BLUE CARBON CITIZEN SCIENCE

By connecting people with nature and strengthening climate change knowledge, the program provided immersive experiences to inspire effective advocacy, increase public awareness, and eventually lead to policy change. Equally important, the active engagement of the community in scientific Blue Carbon work was expected to build scientific trust and generate key data to advance climate change science. Research was aimed to contribute to the global case for increased investment in protection and restoration of wetlands and aid in development of Australia's Blue Carbon market. The following program objectives were addressed through the execution of several research projects (Table 1):

Objective 1. Measure the carbon sequestration capacity of wetlands using novel, low cost, and scientifically-proven techniques.

Objective 2. Undertake wetland restoration work at selected sites.

Objective 3. Effectively compare the Australian results with the global TeaComposition H2O project.

Objective 4. Engage and empower 460 citizen scientists including up to 360 HSBC employees and 100 external stakeholders.

	Research question / project	Obj 1	Obj 2	Obj 3	Obj 4
Field research					
1	What is the effect of nutrient enrichment on Blue Carbon stocks and fluxes?	x			x
2	How can different features of the soil and the vegetation (e.g. nutrient content of the soil, plant size, and microbe community living within the soil) influence the carbon storage of coastal wetlands?	x			x
3	What is the importance of swamp oak forests for Blue Carbon budgets?	x			x
4	TeaComposition H2O. What is the carbon retention rate and microbial cycling across wetland types and climatic regions?	x		x	x
5	How mangrove restoration enhances carbon capture and storage?	x	x		x
6	What are the Blue Carbon sequestration benefits of mangrove expansion?	x	x		x
Survey research					
7	Can immersive experiences change attitudes towards wetlands?				x

Table 1. Objectives and research questions addressed by the HSBC Scientist for a Day program.

RESEARCH PROJECTS

The seven research projects were designed by marine and social scientists to tackle the program's objectives while collecting the greatest quality and quantity of data to advance our understanding of coastal ecosystems.

- Objective 1 was achieved by measuring aboveground and belowground carbon stocks from 10 different sites in Sydney, Melbourne and Auckland to feed **Research Questions #1-6**. Research involved data collection activities such as taking vegetation surveys, collecting soil cores for microbe or carbon stock analyses, and recording greenhouse gas fluxes.
- Objective 2 experienced challenges as the project progressed, such as the need for permits to work on privately-held property and lack of baseline data to effectively conduct wetland restoration activities at this time. The program however, quantified the benefits from current mangrove restoration projects to help create the financial and environmental case for wetland restoration (**Research Questions #5-6**).
- Objective 3 was achieved by implementing **Research Question #4** in which household tea bags were used to measure litter decomposition. Research is still underway as it requires 3 years of field deployment.
- Objective 4 was tackled by engaging HSBC participants in the seven research projects/questions. All research data was collected by the citizen scientists via fieldwork or survey questionnaires (Figure 5).

Figure 5. Citizen scientist collecting data from a mangrove ecosystem in New Zealand.

THE TASK FORCE

The HSBC Scientist for a Day program was delivered by Deakin University's Blue Carbon Lab and Earthwatch Australia. While Earthwatch engaged participants through the educational component and coordinated logistics and OH&S, the Blue Carbon Lab was in charge of the research program and the data collection activities.

BLUE CARBON LAB

Deakin University's Blue Carbon Lab (BCL) is a multi-disciplinary research team focused on understanding and responding to impacts of climate change on freshwater, coastal and marine ecosystems.

Deakin University was established in 1974 and is now Australia's eighth largest university. Deakin ranks 45 in the Times Higher Education ranking of the world's universities under fifty years and ranks in the top 2% of the world's universities. Deakin combines excellence in teaching and research with a strong focus on strengthening communities locally, nationally and internationally.

BCL offers innovative research solutions aiding in mitigating climate change and enhancing our blue economy, while simultaneously supporting aquatic biodiversity, economic growth, capacity building, and community wellbeing. With its applied focus, BCL's research is underpinned by a mission to achieve 'Science for Impact'.

BCL's in-house expertise spans ecology, biogeochemistry, microbiology, environmental economics, modelling, and mapping/remote sensing (Figure 6). Led by Associate professor Peter Macreadie, BCL's core team consists of 19 researchers including 6 postdoctoral fellows, 2 project coordinators, 8 PhD candidates, a science communicator and a research assistant. BCL scientists have published over 100 peer-reviewed papers in high-impact journals such as Nature Climate Change, PNAS, and Global Change Biology. According to ISI Web of Science, BCL scientists are the most published authors on the topic of 'Blue Carbon'.

BCL has attracted more than 20 awards for its track record in wetland research and its commitment to industry engagement. BCL and its parters currently have research projects in over 30 countries, supported by a range of funding sources including corporate (e.g. Qantas) and federal funding (e.g. Australian Research Council).

Figure 6. Researchers from Deakin's Blue Carbon Lab.

EARTHWATCH

Earthwatch is an international environmental organisation which supports scientific research by working with companies, communities, individuals, educators and students to empower people to save the natural world (Figure 7). Understanding the complexity of the Earth's ecosystems requires careful study to amass the large amounts of data required in order draw scientific conclusions. Earthwatch connects willing helpers in the form of citizen scientists with leading researchers, in order to make the required data collection possible. These hands-on conservation and education experiences educate participants and creates knowledgeable and enthusiastic environmental stewards within organizations and communities.

The environmental issues we face today are beyond the capacity of our world leaders and scientists alone to solve. The Earthwatch model relies on the use of citizen scientists to achieve our mission of empowering people to save the natural world. Citizen science is an extremely powerful tool, contributing to both scientific results that inform environmental policy and management strategies, while increasing an individual's personal knowledge and scientific literacy empowering them to take positive action towards the environment. Over the decades, Earthwatch citizen scientists have helped to unravel some of the complex surrounding issues such as climate change, increasing marine debris and species loss.

We know that Earthwatch expeditions are both educational and empowering experiences that have had significant impact on our citizen scientists from analysis of our post expedition surveys. Results show an average participant rating of 9.4/10 relating to the comment that Earthwatch expeditions are "useful to acquire new knowledge" and 9.3/10 to the idea that Earthwatch expeditions are "useful to better understand environmental issues".

Earthwatch-supported research has helped protect the quality and quantity of habitats and ecosystems, and sustained wildlife populations at regional, national and international levels. Our efforts have also made significant contributions to various conventions, management and development plans, and government policies.

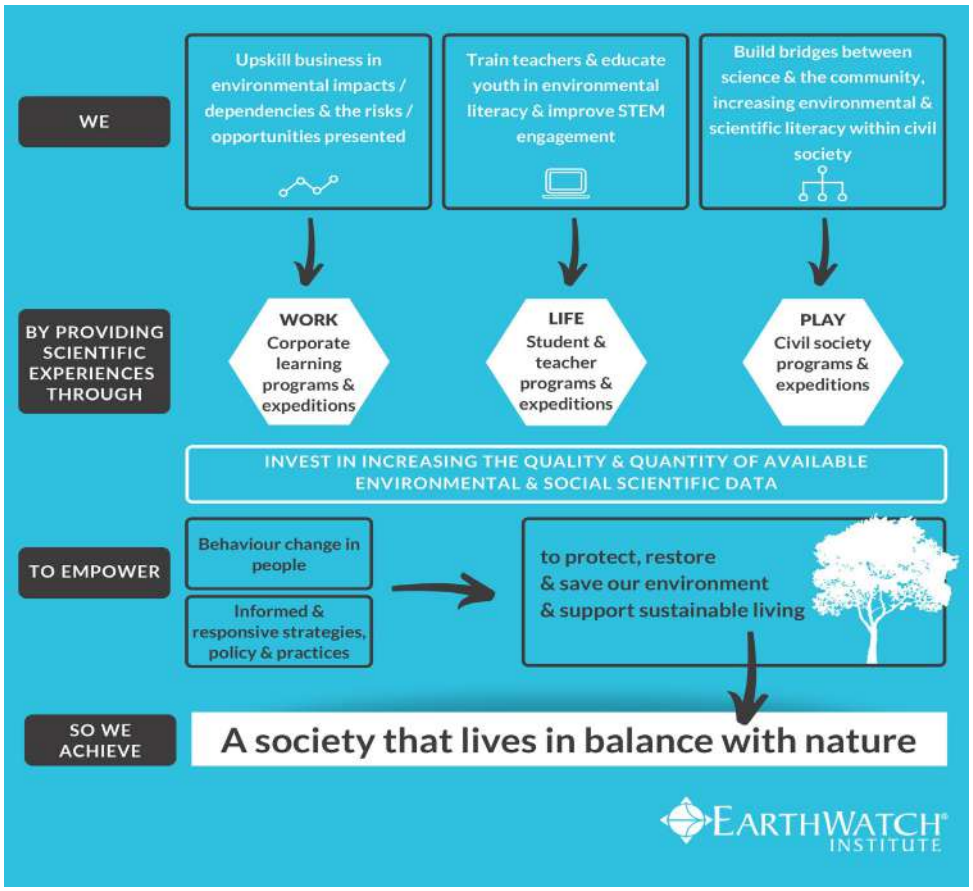

Figure 7. Eartwhatch's blue print.

THE PROGRAM

The HSBC Scientist for a Day program was designed as an full-day immersive experience combining educational talks and data collection activities in a local wetland. A total of 21 HSBC citizen science days were delivered in the 2-years of the program.

EDUCATIONAL TALKS

The HSBC Scientist for a Day began with three educational talks (Figure 8). The first one defined natural capital, climate change and provided study cases for sustainable practices in businesses (delivered by Dr Maria Garcia, Field Operations Manager at Earthwatch Australia). The second talk highlighted the ability of Australia's financial sector to steer towards a sustainable economy and explained participants the commitment of HSBC to green finance (delivered by Alpa Bhattacharjee, Head of Corporate Sustainability at HSBC Australia). The last talk introduced participants to coastal Blue Carbon ecosystem and provided an overview of the fieldwork ahead (delivered by Dr. Maria Palacios, Citizen Science Program Manager from the Blue Carbon lab).

DATA COLLECTION ACTIVITIES

FIELDWORK

Once on site, Deakin scientists explained the research and demonstrated the field protocols. Participants then worked in teams to collect soil cores for carbon stock analysis, measure wetland vegetation (mangroves,

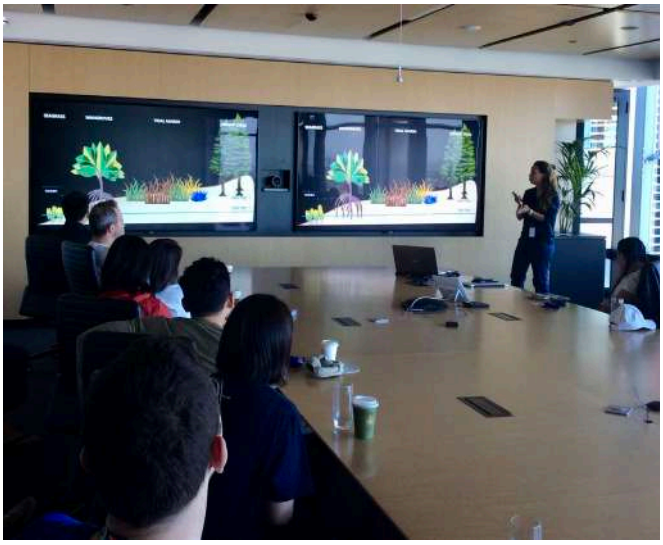

Figure 8. Educational talks delivered at HSBC's office, before doing fieldwork in a local wetland.

Figure 9. HSBC citizen scientists measuring saltmarsh vegetation from Towra Point Nature Reserve, Sydney.

Figure 10. Group of citizen scientists measuring the height of mangrove trees at Towra Point Nature Reserve, Sydney. Vegetation measures were then used to calculate aboveground biomass and carbon stocks of coastal vegetation.

saltmarsh and swamp oaks, Figure 9), plant/retrieve tea bags, among other field activities. Fieldwork slightly differed from site to site depending on the research project and wetland visited.

Vegetation surveys:

Measures of vegetation density, height, stem diameter and canopy width (Figure 10) were collected along transect lines or within plots. This information was used to correlate the vegetation aboveground biomass with the underground carbon stocks and fluxes.

Soil core samples:

Cores of wetland soil were collected to quantify underground carbon stocks, carbon sequestration rates and/or microbial cycling. Superficial cores were collected using 50ml syringes, while deep ones with 1m-long PVC pipes (Figure 11).

Tea planting/retrieval:

As part of the TeaComposition H2O global initiative, household tea bags (Figure 1) were planted 10 cm under the wetland soil and retrieved 1, 3, 6, and 9 months after their deployment. This fun, low-cost protocol was used to determine the ability of the wetland to decompose matter and sequester carbon. The lower the decomposition rate, the higher its carbon storage potential.

Figure 11. Deep soil core collected from Jawbone reserve in Melbourne. Soil samples were sliced in the field and processed in the lab to quantify belowground carbon stocks.

FIELD SITES

Citizen scientists from Sydney visited Towra Point Nature Reserve (Figure 9,10), a RAMSAR wetland of International importance, with extensive areas of saltmarsh vegetation, mangrove trees and swamp oaks. Participants from Melbourne collected data from Jawbone Flora and Fauna Reserve or Stony Creek backwash; two urban mangrove forests planted and restored in the 80's (Figure 11). In Auckland, fieldwork took place in Hobsons Bay, Bayswater and Pt Chevalier (Figure 14). These three sites have a similar landscape dominated by a dense stand of dwarf mangroves.

Social Surveys:

The impact of this HSBC Scientist for a Day program on participants' awareness and perceptions towards wetlands, was quantified by requesting participants to complete three short questionnaires.

The first questionnaire was provided before the Citizen Science Day and was aimed at developing a baseline understanding of the participants' awareness and perceptions toward wetlands and the ecosystems services they provide. Participants completed a second questionnaire immediately following their participation in the Citizen Science Day – this questionnaire sought to determine any changes in attitudes and perceptions towards wetlands, and any intention to adopt pro-environmental behaviours as a result of their participation in the program. Finally, participants took a third questionnaire 6 - 8 weeks after they took part in the Citizen Science Day, to evaluate the level of retention of any identified changes in awareness, perception and behaviour.

Figure 14. Participants from HSBC Auckland measuring dwarf mangroves and collecting soil cores from areas of mangrove expansion in Hobsons Bay, Bayswater and Pt Chevalier. Data is being used to understand the Blue Carbon gains due to mangrove expansion.

PROJECT OUTCOMES

The HSBC Scientist for a Day program successfully achieved its research targets and significantly advanced coastal Blue Carbon research. In less than two years, it maximized the sampling from 21 field trips enabling the completion of seven research projects.

SCIENTIFIC OUTCOMES

Field Datasets

HSBC participants maximised the amount of field data collected. In only 21 field trips, they helped scientists sample six coastal wetlands from Sydney, Melbourne and Auckland and collect measurements of above-ground and below-ground Blue Carbon. Participants provided a means to collected 50% more data than that originally targeted by this program's research proposal. Whilst this program's proposal was set to collect 1300 samples and measure 100 vegetation plots, the program delivered 1755 samples and 341 vegetation plots (Figure 15). Without the citizen scientists a field campaign of this magnitude would have taken an excessive amount of resources and time to complete.

During the HSBC Scientist for a Day field trips, citizen scientists collected the following data:

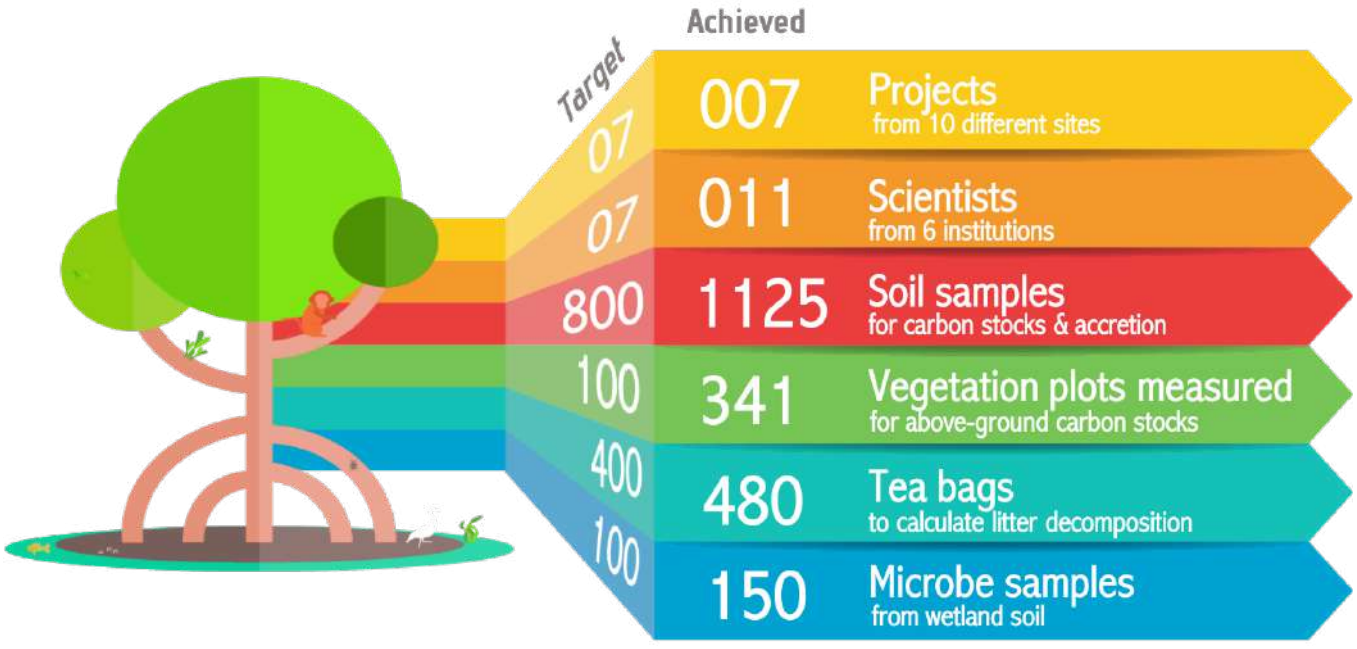

Figure 15. Summary of the data collection targets and achievements for the HSBC Citizen Science program

Coastal Vegetation

Citizen scientists surveyed 341 vegetation plots and took biomass measures from 1630 mangrove trees, 149 swamp oaks and 4 species of saltmarsh. For each tree, participants quantified tree height, tree stem diameter, canopy width and root density.

Data showed mangroves from Sydney were the tallest (more than 6 m height), but those from Melbourne reached the highest density (up to 6,000 trees per hectare). Biomass results are being used to quantify aboveground carbon stocks for the different projects.

Litter decomposition

HSBC participants from Sydney planted 240 tea bags, which were collected after 56, 104, 161 and 277 days of deployment. Results showed that mangrove ecosystems have slower decay rates and are better at storing organic carbon than tidal marshes. However, disturbances like nutrient overload can adversely speed up the decomposition of litter on these ecosystems. Participants additionally helped retrieve 240 tea bags as part of the global initiative TeaComposition H2O, which compares litter decomposition rates across more than 300 wetland sites around the world (including more than 30 countries).

Soil carbon

A total of 322 soil cores were collected; 153 from mangrove, from 149 saltmarsh and 20 from swamp oak ecosystems. Processing of the cores led to 1,125 soil samples that were used to calculate soil carbon stocks, soil carbon accretion rates and hydrocarbon content. Overall, results showed these coastal wetlands are storing between 12 – 40 tonnes of carbon per hectare and accumulating between 1.6 - 15 mm of soil each year.

Microbial community

A total of 150 microbe samples were collected from Towra Point (Sydney). After DNA sequencing in the lab, we found a diverse bacterial community composed of 19 class-level taxonomic groups. Interestingly, high nutrient levels such as those from fertilizers negatively impacted the bacteria diversity.

Publications

This program significantly advanced our understanding of Blue Carbon systems. Data collected through the HSBC Citizen Science program fuelled seven research projects and will lead to seven publications (Table 2) addressing knowledge gaps on the variability of Blue Carbon stocks, the benefits of mangrove expansion for carbon storage, and the importance of raising awareness on nature-climate solutions. These publications will be submitted to scientific journals in the following 18 months. Earthwatch is coauthoring the social research project.

This new of body of research positions Australia at the forefront of international efforts to understand the value of coastal

Title	Authors	Journal	Subm. date
Field research			
Effect of acute nutrient enrichment on Blue Carbon ecosystems	M.Palacios, S.Trevathan-Tackett, M.Malerba, P.Macreadie	Plant Soil	30.05.20
Variability in Blue Carbon stocks with plant size, type, elevation, and position within a geomorphic setting	M.Palacios, J.Kelleway, P.Macreadie	Science of the total environment	30.06.20
Estimates of atmospheric greenhouse gas flux suggest a novel Blue Carbon ecosystem	J.Kelleway, M.Palacios, P.Macreadie	Ecology	30.05.20
Carbon retention rate and microbial cycling across wetland types and climatic regions	S.Trevathan-Tackett, J.Kelleway, P.Macreadie	Global Change Biology	31.12.21
Mangroves retain and remediate sediments contaminated with petroleum hydrocarbon	P.Waryszak, P.Carnell, M.Palacios, S.Trevathan-Tackett, P.Macreadie	Marine Pollution bulletin	30.05.20
Sediment age dating as proxy of blue carbon gains from mangrove rehabilitation & reestablishment	P.Carnell, M.Palacios, S.Trevathan-Tackett, P.Waryszak, P. Masque, P.Macreadie	Ecological indicators	30.05.20
Blue Carbon opportunity from mangrove expansion in New Zealand	R.Bulmer, M.Palacios, C.Lunquist, P. Masque, L.Schwendenmann, S.Trevathan-Tackett, P.Waryszak, P.Macreadie	Science of the total environment	31.12.20
Survey research			
Citizen science and corporate volunteerism: Changing public perceptions of coastal wetlands	E.McKinley, M.Garcia, M.Palacios, P.Macreadie	People and nature	30.06.20

Table 2. Scientific publication being prepared as part of the HSBC Scientist for a Day program.

wetlands for climate change mitigation. Our results provide factual data on the importance of connecting people with nature, protecting coastal wetlands from anthropogenic impacts, and restoring Blue Carbon ecosystems to offset carbon emissions.

Research Collaborations

The HSBC Citizen Science program led to an inter-institutional collaboration between eleven scientists from six research organisations. In Australia, research partnerships were established between Deakin University (VIC), the University of Wollongong (NSW) and Edith Cowan University (WA), while in New Zealand research included the University of Auckland and the National Institute for Water and Atmospheric Research-NIWA. And Internationally, the social research is being supported by Cardiff University UK. The success of the program has enabled Deakin to begin additional projects with these institutions.

CORPORATE STAFF ENGAGEMENT

Participation

The HSBC Citizen Science program engaged 323 corporate staff including 197 HSBC employees and 135 participants from 22 external corporations including: Qantas, Sydney Fish Makerts, KPMG, ANZ, Energetics, NextDC, Allens, QBE, Green Collar, Cairns Airport, Department of Conservation New Zealand, EY, Woodside, Geelong Ports, the Rotary International, Frasers Property, the Australian Post, BCD travel, DELWP VIC, HESTA, Kids teaching Kids Program and Aesop. Participating staff came from a wide range of fields of expertise (Figure 16) and in most cases had very little experience and knowledge of coastal wetlands.

The program delivered an enjoyable, meaningful and immersive experience to corporate staff (Figure 17). Most participants provided positive feedback about their experience and shared their highlights of the event:

- "I enjoyed being able to ask scientists questions as they came up."
- "My favourite part of the day was the fieldwork, getting our hands dirty and contributing to research."

The program established a base knowledge on participants' thoughts and attitudes towards wetlands. It showed a diversity of views from those considering wetlands 'beautiful' and even central to 'life', while others viewed them as 'smelly' and full of annoying 'mosquitoes'. Interestingly, there were also some terms around our responsibility to manage these threatened coastal ecosystem (Figure 18).

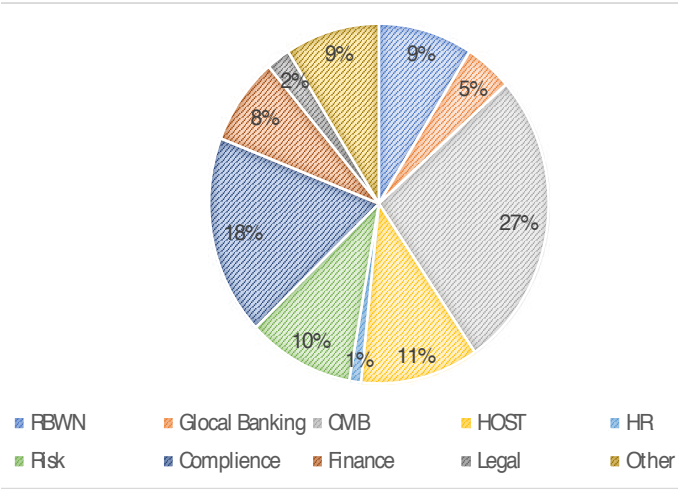

Figure 16. Percentage of HSBC participants per business division that attended the Scientist for a Day Program.

Figure 17. HSBC staff collecting a small soil core from Towra Point Nature Reserve, Sydney.

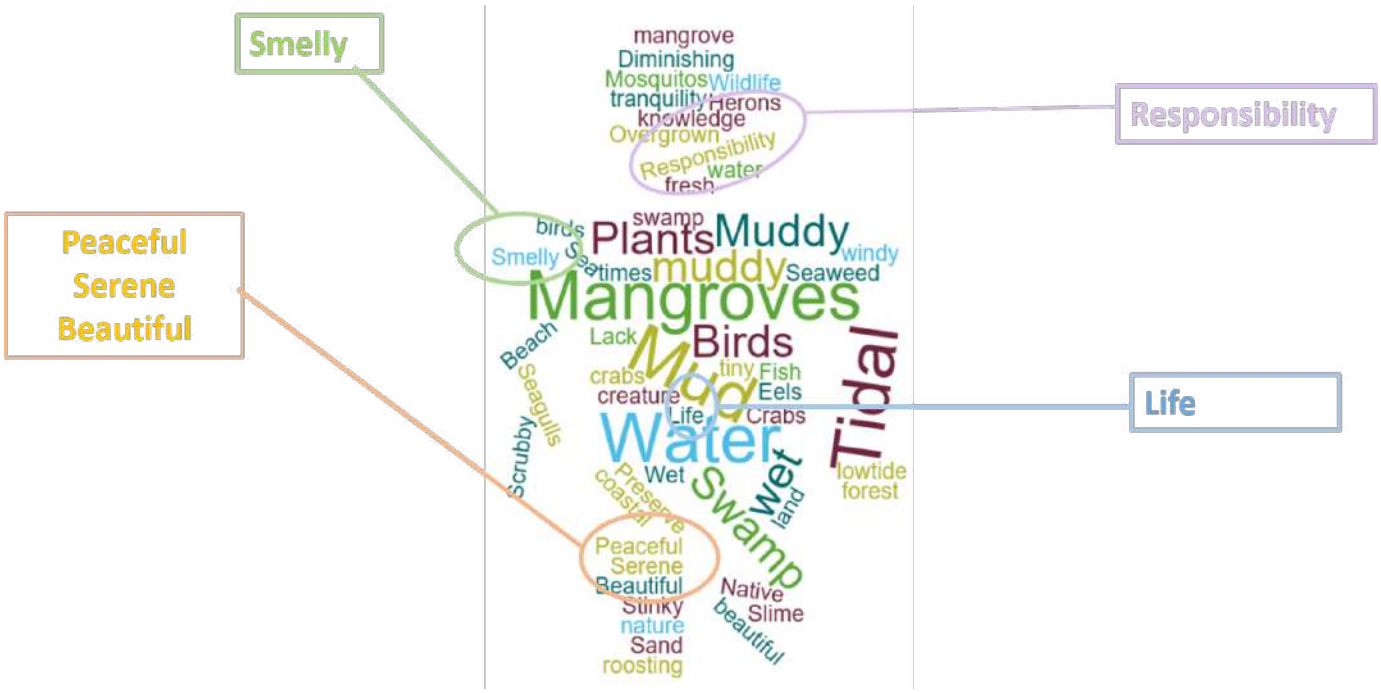

Figure 18. Participants' baseline knowledge on wetland ecosystems before joining the HSBC Scientist for a Day program. The word cloud includes the first three words that come to mind when defining a 'coastal wetland'.

After partaking in the program, most people better understood the role and importance of wetlands in relation to recreation, tourism, coastal protection, habitat for biodiversity, health and well-being, natural landscapes, nursery for fish, pollination, environmental education, carbon storage, protect coastal erosion, and mitigate waste, pollution and climate change. Participants also were more committed to living and working more sustainable (Figure 19).

Improved health & wellbeing

Participants benefited from the program by having the opportunity to reconnect and engage with nature. Research has shown that people who have greater contact with nature during their workday report significantly less stress-related health complaints, improved levels of comfort, pleasure and wellbeing, as well as job satisfaction and performance (Plan 2015).

Ninety-four percent of the citizen scientists felt the program contributed to their health and wellbeing as an escape from the daily work routine and a fulfillment from contributing to scientific research. Further, this Citizen Science program provided an opportunity to strengthen participants´ teamwork skills by working with colleagues and external staff to achieve a common goal.

HOW LIKELY ARE YOU TO ADOPT MORE SUSTAINABLE PRACTICES?

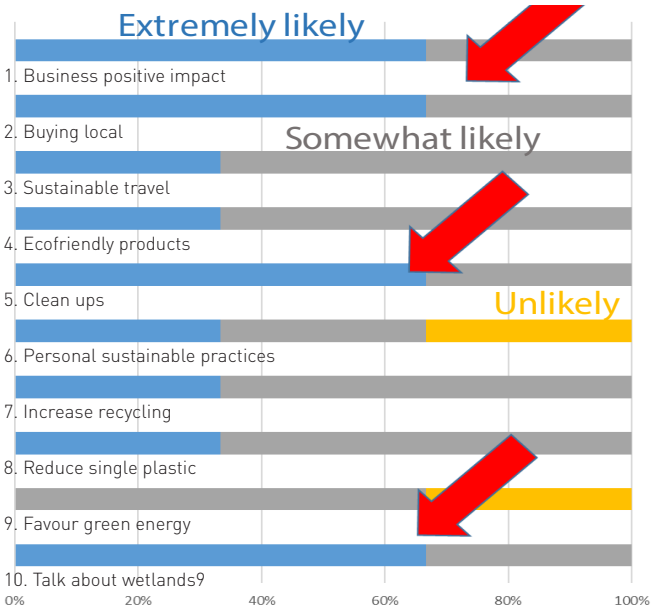

Figure 19. Participants' likelihood of adopting sustainable practices after participating in the HSBC Scientist for a Day program. Results from the social research questionnaires.

PROJECT OUTREACH

The educational and scientific success of the HSBC Scientist for a Day program was recognised through the 2019 AFR Higher Education award for Industry engagement. The program was also showcased externally in several conferences, newspapers, blogs, social media (#BlueCarbonArmy) and a news report.

AUSTRALIAN FINANCIAL REVIEW INDUSTRY ENGAGEMENT AWARD

The HSBC Citizen Science program was awarded the 2019 AFR Higher Education award for Industry engagement. The award recognises Higher Education institutions working with industry in a way that goes beyond standard commercial relationships and is genuinely reciprocal, mutually beneficial, and highly valued by both partners.

On behalf of HSBC and Earthwatch, the award was received on Aug 27, 2019 by the Blue Carbon Lab team (Dr Peter Macreadie and Dr Maria Palacios) in Brisbane (Figure 20). Photos, a short description of the program and the names of HSBC, Earthwatch and Deakin were included in an article in the Financial Review newspaper and their website.

Figure 20. 2019 Australian Financial Review awards ceremony in Brisbane.

"PEOPLE FOR NATURE" WEBINAR

The program was showcased in the "**People for Nature" webinar** hosted by Victoria's State Wide Integrated Flora and Fauna Teams (SWIFFT) on July 25 2019. The event was aimed at highlighting Citizen Science programs engaging communities around the topic of climate change. The presentation was delivered by Dr Maria Garcia (Earthwatch Australia) and thee event was sponsored by the Department of Environment, Land Water and Planning (Victoria), Federation University Australia, Helen Macpherson Smith Trust and Zoos Victoria.

OCEANIA ECOSYSTEM SERVICES FORUM

Results from this Citizen Science program were presented in the Oceania Ecosystem Services Forum on the 5th September in Christchurch, New Zealand. The presentation titled "Wetlands: Should they stay or should they go" was delivered by Dr Maria Garcia (Earthwatch Australia) in the session "Public and private investment in ecosystem services".

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Healthy Ecosystems for Resilient Communities

TV, NEWSPAPER & SOCIAL MEDIA

- Reporters from the Sunday Star Times in Auckland joined the trip to Bayswater and interviewed participants, including Auckland's HSBC's CEO Chris Russell. The article titled **"Climate's future can be read in tea leaves"** (Figure 21 top) was published on 16 Dec 2018 and highlighted the fact that innovative approaches such as finding volunteers to bury teabags in our mangrove swamps, are required to tackle climate change.

- ABC's 730 film crew joined one of the Melbourne trips to Jawbone Reserve. The 5 min video report titled **"Push to protect Blue Carbon sites"** was aired on the 22 Jan 2019 on ABC 730 Australia. It highlighted Dr Peter Macreadie' Blue Carbon Lab, as well as the importance of citizen scientists in the data collection process (Figure 21 bottom).

- The **HSBC Citizen Science program** has a dedicated website including a short description of the science plan, recaps from the 21 field trips, and outreach material. External outreach of the program also includes over 100 posts on social media under the hashtag **#BlueCarbonArmy** and five newsletters delivered to over 900 external stakeholders (e.g. NGOs, corporates, government) showcasing the program achievements (e.g. Sept edition 2019).

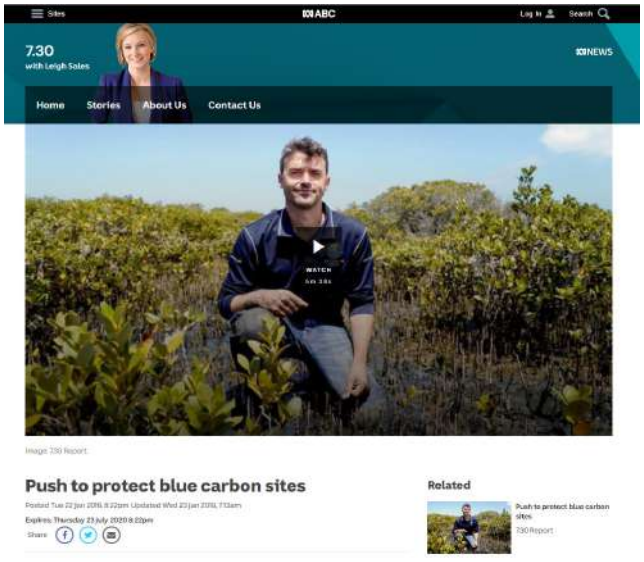

Figure 21. Top: Newspaper story in Auckland's Sunday Star featuring HSBC New Zealand's CEO Chris Russell. Bottom: ABC's 730 film "Push to protect Blue Carbon sites" aired on the 22 Jan 2019.

ACKNOWLEDGEMENTS

Earthwatch Australia and the Blue Carbon Lab at Deakin University are indebted to the financial contribution from HSBC and all citizen scientists that joined us both in the field and in the classroom to collect key data to advance coastal Blue Carbon research.

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