

AREAS OF RESEARCH

The Convex Seascape Survey investigates three distinct but interlinked areas.

1

Investigating the origins of seabed carbon stores. Where did carbon come from, and how and when did it get there?

We are exploring the origins of carbon stored on the world's continental shelves and how these stores have changed over time. Our researchers are using geological and sea level data to build models to understand and locate the biggest carbon stores. We're also working to understand where these stores came from, and which are still actively accumulating carbon.

2

Understanding the evolution of human activities and their impact on seabed carbon stores.

Our teams are investigating historic and modern patterns of human activity, such as trawling, on the continental shelves and how it might impact our carbon stores. Our work quantifies the impact of seabed disturbing activities and seeks to identify potential climate mitigation options.

3

The role of life and biodiversity on seabed carbon stores and the benefits of protection.

We are examining the role of marine life and biodiversity in carbon storage. Our team is investigating the net impact of marine life on carbon storage, as well as studying disturbed and pristine seabed worldwide to measure the impact of disturbance and the speed of recovery following protection.

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The Convex Seascape Survey is more than just a research programme; it is a testament to the power of collaboration, innovation, and perseverance in the face of global challenges. I am deeply proud of what we have achieved so far and am excited about the discoveries that lie ahead."

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To find out more about the
Convex Seascape Survey visit
www.convexseascapesurvey.com.

Cover photo Henley Spiers



EXPLORING

the untapped potential of sediment
carbon as a natural carbon store

INTRODUCTION

One of the critical unsolved scientific questions of our time is: How does the ocean support a stable climate? The seabed is the ocean's biggest carbon store and, in a time of climate emergency, could be crucial in slowing global warming.

Convex Insurance, Blue Marine Foundation and the University of Exeter have brought together world experts, pioneering ideas and the latest technology to provide accurate, open-access data on seabed carbon stores. Our survey results help explain the role of marine sediments in the Earth's carbon cycle and guide ocean management decisions.

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As an unprecedented phase of global warming is underway, understanding the carbon storage capability of the ocean is vital. We already know that the seascape is the ultimate sink for carbon emissions and could be an immense ally in slowing climate change—what we're hoping to discover is the extent of that impact.

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Professor Callum Roberts, Convex Seascape Survey Chief Scientist

Our scientists travelled to Canada's Saguenay Fjord to understand how seafloor species affect carbon storage. They hoped to understand whether one or two key species are crucial for carbon storage or whether the overall group of organisms is more important.

Over two weeks, the team collected muddy grab samples from up to 200 metres deep and analysed them in a temporary lab. Using fluorescing carbon, they studied how seabed creatures move carbon within the sediment when they dig and tunnel. The team measured whether carbon was being locked away or simply used up by the animals, and observed whether the combination of species affected the fate of carbon.

University of Exeter researcher, Professor Ceri Lewis, hopes the knowledge gained through this investigation will be valuable on two fronts:

"At the moment, global carbon models don't really look at these processes in the mud, so we are hoping to improve some of the accuracy of those models. But we also want to provide new evidence to be able to manage the ocean floor and protect carbon stores."

Photos Adam Porter



MODELLING & MAPPING

Our researchers created PALTIDE; a unique free web-tool that enables users to visualise, interrogate and download relative sea level and historical tidal data for the northwest European shelf over the past 21,000 years.

Dr Sophie Ward and Dr Zoë Roseby used these models and data to predict the evolution of carbon-rich muddy deposits in three areas; the Fladen Ground, Celtic Deep and the western Irish Sea, and have been able to confirm their predictions using seafloor core samples from these areas.

Their work shows that each mud basin has a distinct history of sediment accumulation. Notably, the muddy deposit in the Fladen Ground was laid down as ice retreated at the end of the last ice age and has been preserved under calm tidal conditions. Today, the rate at which the Fladen ground accumulates new sediment is extremely low, making it unlikely to recover from human disturbance.

The team have now turned their attention to locating and quantifying carbon-rich deposits on other global continental shelves, and hope that by highlighting the differences in age and activity between muddy deposits their work can inform site-specific management decisions.



TESTING TRAWLING

A team from Plymouth Marine Laboratory have been using a converted fishing vessel to simulate the impact of trawling on seafloor biology and chemistry.

The researchers, dragged a beam trawl fitted with weighted chains across the sea floor to investigate how much buried carbon re-enters the water column as a result of trawling. Using an innovative pumping system, they collected water samples from within the plume of stirred up sediment and also extracted seafloor core samples ahead of and behind the trawl to measure chemical and biological changes. Laboratory analyses of these samples is helping us to understand the extent to which trawling affects sea floor carbon storage.

Charles Clover, Co-founder Blue Marine Foundation, says:

"The question of how human activities, like trawling, affect seafloor carbon stores has been much debated and the Convex Seascape Survey is providing valuable new data on this front. We're collecting empirical data through these simulated trawls in Plymouth, as well as studying adjacent disturbed and pristine sediment habitats worldwide. Meanwhile, we're also mapping global historical disturbance against models of carbon rich deposits formed since the last ice age. When combined, this new knowledge is moving the needle on our understanding of the vulnerability of seabed carbon stores."

Photos Sophie Ward, Zoe Roseby and Matt Jarvis



EDUCATION

We're working with education providers to fill knowledge gaps on how the ocean and climate are connected.

We provide award winning teacher resources covering topics like carbon cycles, marine adaptation, biodiversity, and ocean chemistry.

Learners in over 30 countries have joined our free live lessons on topics such as COP, whales and the carbon cycle, and environmental DNA techniques.

We deliver ocean climate themed continued professional development to build teacher knowledge and confidence and provide lesson inspiration.



So informative and inspiring. It really cleared up my misconceptions around climate and has given me ideas about how to incorporate it into the curriculum.



Teacher CPD feedback, Capel Manor Primary School, England

Photo Tim Bryant

