Changing Minds Changing Coasts
100 Years of Coastal Change on Mersea Island, Essex

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Abstract

This paper outlines a novel approach to mapping localised coastal change using private image archives and oral histories held within the coastal community of Mersea Island, Essex. A methodology was developed, part of a pilot study the influence of natural forces and human interaction on coastal environments. It used archaeological features exposed on the foreshore as a baseline for observing physical and ecological changes. Six indicators of coastal change were developed with the community and their presence/absence observed in the dataset of images and memories. A series of five maps were created at twenty-year intervals to highlight morphological changes to the coastline coastal, producing a timeline of events against which the impact of natural and human influenced events on the island's coastline could be assessed. The pilot study revealed the impact of human activity on coastal change and the ecological health of the foreshore. It proposes a model that can easily be applied to other coastal communities and offers a solution to mapping such change remotely with few barriers to participation within a community.

Keywords: Coastal change, climate change, archaeology, oral history

1. INTRODUCTION

Climate change represents the greatest challenge to our species in its history. The impact of global warming is already being felt and limiting its impact on the future of our planet is one of the most pressing issues facing scientists, governments and the public today. Scientific consensus states that humans are altering the systems that govern the earth's environment and that action must now be taken to limit the impacts of these changes on global society (IPCC 2021). Coastal communities will bear the greatest burden of these impacts as weather patterns change, bringing more frequent extreme weather events such as storms and flooding, both responsible for the erosion of our coastline. In the longer-term, sea-level rise will begin to submerge coastal cities, towns, and villages around the world, affecting the lives and livelihoods of millions.

The problems associated with climate change are often reported at a global scale, for example how the burning of fossil fuels contributes to a global rise in temperatures. Connecting people to issues on these scales is difficult, it can feel overwhelming or even abstract, and individuals often struggle to see how changing their behaviours can make a difference. Finding a means of communicating these impacts on a personal, local or community level is a challenge scientists and science communicators have faced for decades. The emotive power of sharing stories

may prove to be the most effective method in this crucial movement (Roeser 2012, Rockman and Maase 2017).

Changing Minds, Changing Coasts (CMCC) was developed in response to this issue in an unlikely scenario. Answering a funding call from the National Environment Research Council (NERC), the Coastal and Intertidal Zone Archaeological Network (CITiZAN) created a pilot project which facilitated *'public participation in environmental science while understanding, addressing or mitigating the impacts of the COVID-19 pandemic'* (NERC website 2020). The project built on five years of work by CITiZAN documenting the archaeological remains exposed on our nation's foreshore, in part to better understand historic and contemporary coastal change. This paper outlines the novel approach developed to map these changes on a local level by working with hitherto unseen datasets that exist within the coastal community of Mersea Island, Essex.

2. BACKGROUND

CITiZAN is a community archaeology project developed to preserve by record England's fragile coastal heritage before it is lost for good, destroyed or buried by the forces of nature (www.citizan.org.uk). An award-winning National Lottery Heritage Funded citizen science initiative, the project trains local people to identify, record and monitor archaeological remains exposed on the foreshore using a custom-built app to capture important details and images. It also conducts high precision site surveys to establish relative sea level positions at each site and corresponding point in time. This data supports wider research into sea level, climate, and coastal change. It is comprised of five Discovery Programmes across England, one of which is Mersea Island, Essex *(fig 1.)*. The project runs survey days, foreshore workshops, and targeted public engagement within each discovery programme and provides digital resources and events nationally.

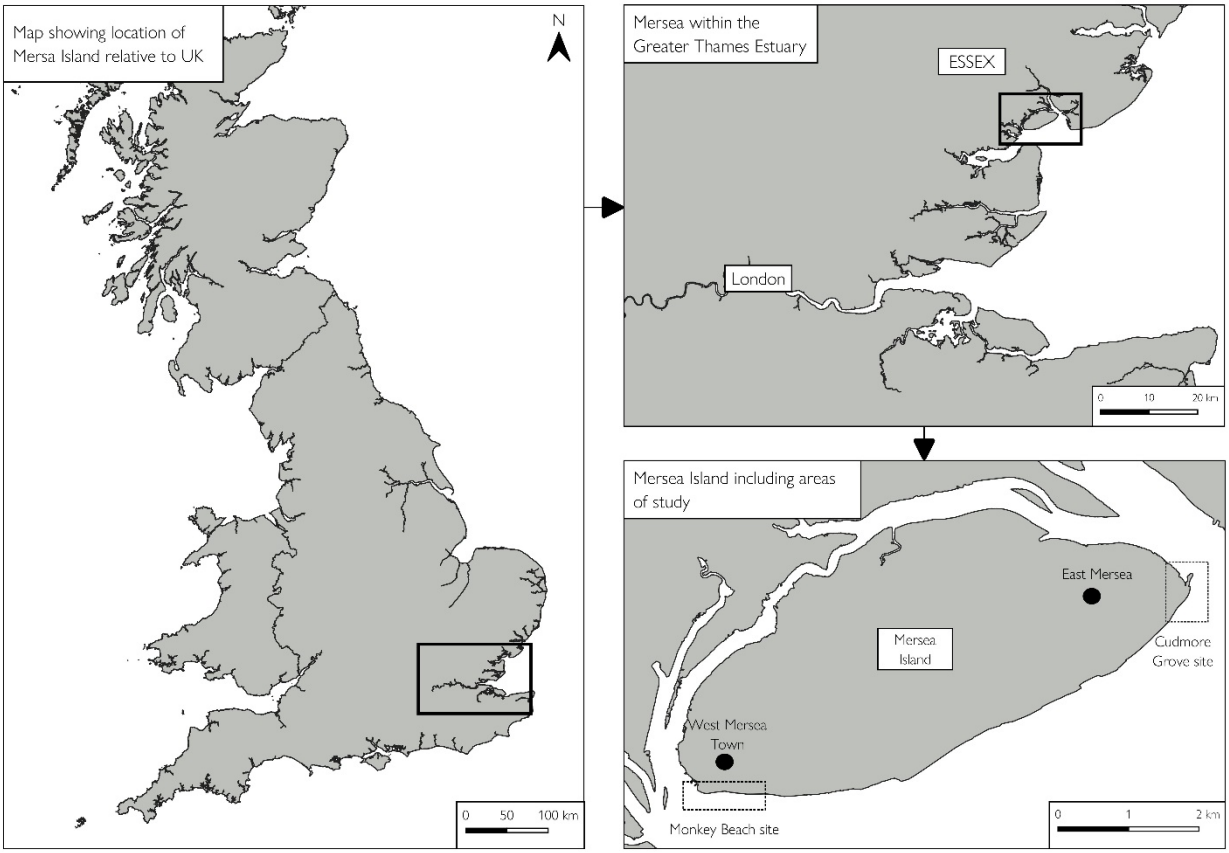


Figure 1. Map locating Mersea Island and boundaries of study areas

Since 2016 CITiZAN has been working with the community of Mersea Island to observe, record and monitor archaeological features exposed on the foreshore. The project has surveyed numerous archaeological sites and features exposed on the extensive mudflats that make up its considerable foreshore. A range of archaeological evidence of settlement on the island spanning the Bronze Age to late Medieval periods has been observed, the majority of which is captured by local volunteers surveying the foreshore autonomously at low tide. Using archaeology as a proxy, the team of dedicated volunteers has created a photographic record of coastal change since 2016, documenting its impacts on the exposed archaeology, and preserving over 130 newly observed archaeological features by record before they are lost for good *(fig. 2)*. It has proven to be a fruitful

Figure 3. CITiZAN volunteers record a typical feature of the Mersea foreshore - a section of wattle hurdle trackway

working relationship with a community of just over 6000 people, over 700 of whom have attended various events, lectures, and foreshore surveys. During that time, conversations with the community alluded to a variety of alternative data sets that the project would be wise to capture. They revealed the volume and quality of relevant source material held within the community that researchers may otherwise overlook or not have the time or capacity to seek out and incorporate in their studies. Stories of foreshore walks, and discoveries on the mudflats were by far the most prevalent resource encountered, a factor of many members of Mersea's community being lifelong residents who enjoy frequent access to the foreshore. Stories generally centred on memories of archaeological features encountered on walks around the island's coast, but many others were tales handed down or heard second hand from now deceased residents. Of course, memory and oral history as a research resource has its drawbacks, and these are discussed below (see Oral History section in methodology below).

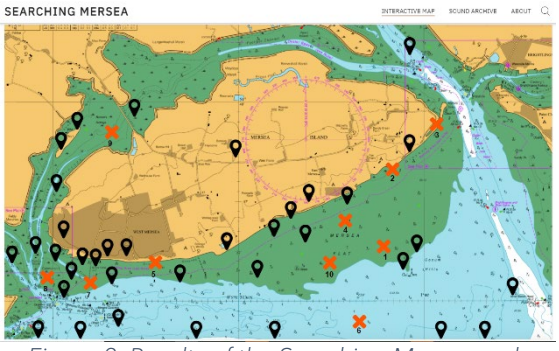


Figure 2. Results of the Searching Mersea oral history project mapped on the Mersea foreshore

A small pilot project, Searching Mersea *(Hutchinson and Northall forthcoming)*, was developed in 2017 to map archaeological remains using these alternative data sets, particularly oral histories (see www.searchingmersea.com). The exercise was intended to narrow down physical search windows on the vast Essex mudflats, highlighting areas in which to focus future physical survey. Participants were asked a series of questions relating to their encounters with archaeological remains and the locations of these were referenced on a map of the area *(fig. 3)*. The resulting points of interest were then corroborated by ground truthing or cross referencing with the locations of known finds. The results indicated that memories, even over the course of a 50-year lifespan, were still reliable when identifying areas of archaeological interest, on occasion including detailed descriptions of the finds. They also hinted at the scale of coastal change that had taken place on the island, particularly where large features that had been identified were no longer present.

In addition to oral histories, a great many historical images were brought by members of the public to events held on the island. These included photographs from personal archives and postcard collections dating back to the late 19th century. Of note were those images of sites that CITiZAN were actively investigating. They often showed a landscape far removed from the foreshore of today, one in which the topography of the site was almost unrecognisable to the authors. Aside from providing context for archaeological interpretation, combining images and oral histories began to tell stories about Mersea's foreshore that detailed much more than just the exposure and destruction its archaeological resource. These experiences, and hitherto untapped data, sets laid the groundwork for the methodology used in CMCC.

3. METHODOLOGY

3.1 Research aims

The main aim of CMCC was to establish and map the nature and scale of coastal change on Mersea Island over a 100-year period using a community generated data set i.e., lived experience. Archaeological features provided the proxy for understanding when these changes occurred whilst providing a baseline for the pace of change from that point forwards. The resulting timeline would then be compared to obvious social, technological, and industrial developments on a local level to establish any connection between action and consequence that may have influenced coastal change. In short, can a community map the impacts of human interaction with the environment on a local level and can we use that story to positively influence future actions to preserve our environment.

CMCC was designed to work almost entirely remotely and provide opportunities for anyone within an interest to participate. To achieve this, the project was structured into three work packages focussing on different media; the first focussed on gathering image data from the volunteer team. The second on gathering new oral history recordings and revisiting older ones from the Searching Mersea project. The third focussed on mapping the interpretation of the combined data sets. Given the relatively small budget (£10,000), two sites on the island were chosen to focus the study. As Mersea Island is divided into two parishes, a site from each was selected: Cudmore Grove Country Park in East Mersea and Monkey Beach in West Mersea. Both lie at the very geographical tips of the island. Site selections were based on the presence of already surveyed archaeological sites, the initial exposure of which would provide a baseline for measuring the scale and pace of coastal change from that point onwards. Sites were also chosen based on their popularity with locals and tourists as places to visit for walks, swimming etc. in the hope that they would generate the biggest possible image record.

Meaningful organisation of the data to support research questions required categorisation using five-time periods; 1920 – 40, 1940 – 60, 1960 – 80, 1980 – 00 and 2000 – 20. Twenty-year intervals were chosen to produce snapshots of coastal change to make comparisons easier, and to accommodate for difficulties in establishing exact dates for some of the archive material. They also roughly correlated with the publishing of new editions of Ordnance Survey mapping to be used baseline maps for each interval study (see below).

When designing the methodology for the project a degree of flexibility was required due to ongoing COVID-19 regulations. Research aims were divided into primary i.e., those which could be achieved remotely and secondary, those which required visits to Mersea Island.

The primary aims of this project were as follows:

1. To trial new methods in collaboratively looking at coastal change on Mersea Island. To source images and photographs from the community relating to the sites.

2. To conduct new oral histories and revisit archive material from the Searching Mersea project to draw out relevant information.

The secondary aims were:

1. To conduct in person open house days to encourage people to drop in to see the images found and record an oral history. This would mitigate the dependency on technology to participate in the project.

2. To install fixed point photography stands at each site to monitor coastal change over a period of six months. This would allow more public participation in the project and provide information on seasonal change.

A series of six indicators of change were co-created with volunteers to be used as proxies to measure coastal change. These would provide fixed points of conversation for the oral histories and a simple presence/absence analysis for the image archive. It should be noted that none of the authors is expert in coastal morphology, marine biology etc. A geographer, for example, might choose very different indicators relevant to their expertise, but the focus of CMCC was to establish a way for the community to tell its own story of change using indicators memorable and meaningful to them. The resulting six indicators were thus.

1. *Presence of archaeological (or considered to be) features*
   This related to anything evidently human made on the foreshore of which there is considerable variety in period and type on Mersea. Upright timbers, posts, stakes, and pottery fragments were/are common.

2. *Presence and character of saltmarsh*
   Saltmarsh, marshland that occupies the upper intertidal zone between land and open saltwater, is a common feature of the wider Blackwater estuary and once ringed the island. It is topographically obvious and therefore changes in its shape and composition are generally memorable to coastal communities.

3. *Range of foreshore biodiversity*
   A wide-ranging topic here reduced to include the presence or absence of shellfish, seaweed, and seagrasses (particularly common eelgrass *(fig 4.)* on the foreshore. Their presence indicating a healthy marine and intertidal environment.

Figure 4. Common eelgrass (Zostera marinas). Copyright wikicommons

4. *Sedimentary makeup of the foreshore*
   A description of the sediments and topography of the foreshore e.g., muddy, sandy, shingle, clay.

5. *Location of the high and low water lines*
   Quite simply the position of the highest and lowest tide lines.

6. *Cultural use of the foreshore*
   Concerned the human activities undertaken on site such as fishing, winkling, recreation etc. Included as a marker of how coastal change can directly affect the lives of those living in coastal communities and the jobs they rely on.

These six indicators were chosen based on conversations with members of Mersea's community during previous years of

archaeological survey undertaken by the CITiZAN programme. They were developed without prompt from the project team, but in collaboration with participants. They are indicative of the naturally holistic view of the landscape that the volunteers developed as part of their understanding of place, life, and upbringing on the island. They set a relatable baseline to measure the subtle changes that have played a prominent role in the lives of volunteers.

In total, 20 volunteers took part in the pilot study. Of these 12 took a more active role, a manageable number based on the timeframes and resource involved. The team comprised regular CITiZAN volunteers, oystermen, an expert on saltmarsh ecology, an engineer, an amateur historian, a schoolteacher, and staff members from the Mersea Island Museum *(fig. 5)*. They ranged in

Figure 5. L-R Lawrence Northall, Danielle Newman, Oliver Hutchinson of CMCC meet David Cooper and Joanne Godfrey of Mersea Island Museum for a socially distanced project meeting

age from 45 to 75 years old and all were lifelong residents on the island. Calls for volunteers were put out over social media groups active on the island, via email and word of mouth, the latter being an important medium in a tight community such as Mersea.

3.2 Images

The final image database combined 55 collections and includes a total of 322 images from private and museum collections. The database was created and stored on a google drive to allow each member of the team access and ability to edit the data. Each entry was categorised as follows:

1. Thumbnail of image.
2. Plan- to keep track of which images have been used within the project.
3. Top Ten- used to highlight an image of note to other project members.
4. Viewshed description-Has one been created? The viewsheds are sections of map used to illustrate what is visible in each picture.
5. Date of Image- what is the date of the image and how has that been determined.
6. Quiz- was the image included in a quiz and which quiz number that was.
7. Replicate- An image to be replicated by volunteers or when the team can reach Mersea Island.
8. Team Check- An image that we need some more local information from, usually related to location
9. Map Used- Which interval map is associated with this image.
10. Indicator boxes for Archaeology, Cultural, Salt Marsh, Biodiversity, High Water Line, Mud. If these were present in the photographs the box was checked.
11. Notes- These include both notes from the Mersea Museum website, if they exist, as well as team notes from meetings and notes of responses from the image quiz.
12. Collection- what collection does the image belong to and the Mersea Museum database number, if applicable.

Initial consultations with volunteers and oral history participants confirmed that the majority of postcard and photograph collections from residents had been donated to the museum. As such, the Mersea Island

Museum were contacted early in the process and brought on as supporting partners. This enabled the project to gain access to many images. The museum database is available online and permitted searches using both key words and browsing by tagged posts. For this pilot study, the following search terms were used; Blackwater hidden, Mersea aerial views, Mersea creeks, fleets, channels, Mersea houseboats, Mersea coast road, Mersea east, Mersea natural history, and Mersea oysters. Specific searches were conducted for Monkey Beach, Cudmore Grove, pillboxes, archaeology, and images related to major weather events.

Dating of postcards is notoriously difficult because of their long period of circulation. Often the best indicator of age is a postmark, but this can only give a minimum age. Postmarks were used where possible, but a variety of other indicators were required to improve the accuracy of some date. The style of the postcard, clothing depicted, models of cars, and absence or occurrence of known features helped narrow the date of the image. When we could not establish a date, the images were flagged. From these 18 flagged images a quiz was created *(fig. 6)* to seek help from oral history participants, local volunteers, and an expert in historical fashion. The content of the quiz (https://gbettinson.typeform.com/to/nnNSulyz) built on the results of the oral histories by asking participants to not only date the image, but also to reflect on a certain aspect where information was lacking. As well as being circulated by email, the quiz was posted to the Facebook group *Mersea Island in Years gone* to test what the public response would be. A total of 10 people completed this quiz, and the results suggest this is an excellent way to gather more specific personal histories relating to the images and reach out to the community. One example of how the quiz achieved its aims concerns the discovery that a white railing shown in one postcard indicated that the image dates to sometime after the 1930's, on the basis that one respondent's father helped install them during that time. Of the 18 images included in the quiz, 7 were ultimately selected for inclusion in the pilot study.

The two-decade intervals provided a sufficient bracket for the dating methods applied to postcards, particularly when they were paired with images from a known date. Once these processes had been completed a final selection of images was made that complemented and augmented the oral history indicators. Two representative images were selected for each location per decade grouping, representing a mix of known dated photographs, drawings, and more generally dated postcards. *Fig 7* is an example of the analysis that was applied to the image database. A simple presence/absence method was applied to biological indicators such as seaweeds, marsh grasses etc. Higher

14 → Could you guess when this image was captured?

- A 19th century
- B 1900 - 1919
- C 1920 - 1939
- D 1940 - 1959
- E 1960 - 1979
- F 1980 - 1999
- G 2000 - 2020
- H Wouldn't want to guess ✓

Figure 6. An example of a quiz question trialled as a means of refining the date range of certain images in the data set

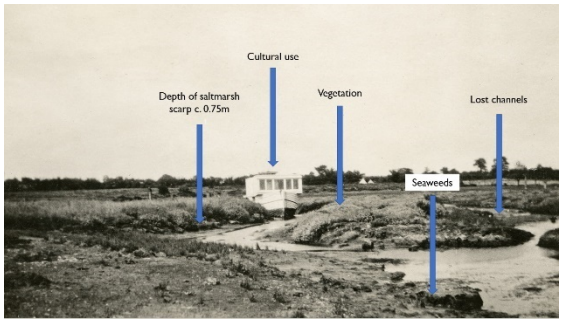


Figure 8. Example of indicators of change as applied to images

resolution scans of some of the images would permit, in future, possible species identification of some plant life, but this is of course dependent on the quality of the original image. Estimations of the depth of the saltmarsh scarps that bound the creeks and channels were made to support ongoing analysis of sediment loss across the foreshore, with the aim of estimating total sediment loss between each interval and over the 100-year period.

The project design originally included the installation of two fixed point photography stations, one at each site, from which members of the public could provide almost identical images of the same location. Again, the long-term analysis of these images could be used to monitor changes on a more frequent basis to document, for example, the immediate impact of severe weather events on the condition of the foreshore. Unfortunately, COVID-19 restrictions did not allow for this to take place. To mitigate this, volunteers were asked to recreate some of the historical images selected to help illustrate the high degree of change between across the study period. Volunteers were provided with viewshed documents *(fig 8)* to aid them in the process. This aspect of the project was completed by both volunteers and project officers in the spring of 2021. The resulting comparison images that were created have proven one of

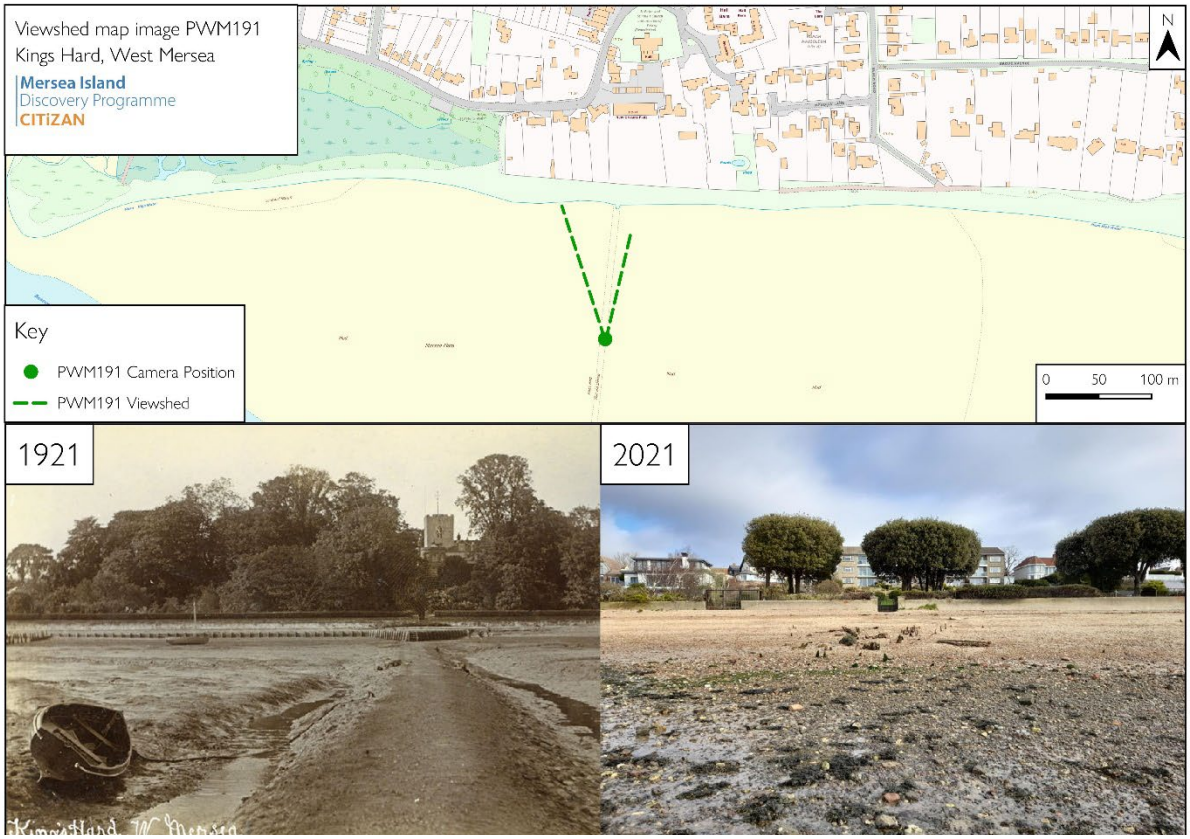


Figure 7. Upper section - Example of viewshed map for image replication.
Lower section - Replica image displayed alongside original taken c.100 years apart.
The images clearly show the loss of a creek network set into thick muds that supported leisure and fishing boats mooring by the beach. The eroded remains of the triangular jetty structure are visible centre image in 2021

the most impactful outputs of the project when sharing the results of the study with the wider public. They offer the starkest examples of how much the island foreshore has changed, providing a high impact, poignant statement of loss.

3.3 Oral Histories

Around 5 hours of oral history material was drawn on for identifying indicators of coastal change in the time periods of study. Of this, 2.5 hours was new material recorded for the project on Mersea during a window in lockdown restrictions when three volunteers were interviewed. 2.5 was drawn from oral history archives from Searching Mersea. Archive material was explored, and extracts chosen according to the research questions of the project. New interviewees were selected through existing community relationships as well as by recommendation from members of the Mersea Museum. New candidates were primarily chosen based on their understanding and experience of coastal change on Mersea. This included their levels of local knowledge, past interaction with the foreshore in areas relevant to the project and association with the foreshore in specific periods (either directly or through previous generations). The oral histories were recorded in settings chosen by the interviewees and deemed suitable by the interviewer according to the technical requirements of the recording process (using handheld microphones). Questions were prepared to encourage conversation towards research interests, e.g., 'can you tell me what the Monkey Beach looked like when you were a child?'. Questions were kept consistent across interviews to enable comparison of information and minimise unconscious bias produced through variations in phrasing. They included enquiries relevant to time-period, location, processes, and factors of change as well as regarding the specific indicators where these had been established. Recordings were then transferred onto audio software and processed and edited into thematic extracts relevant to research. They were coded and organised into an archive using Soundcloud.com (not yet publicly available). Each extract was transcribed, and a data matrix was created that associated the content of an extract with its relevant chronological interval, site and indicators discussed. These were accompanied by a brief description of what the extract could tell the project, supported by verbatim quotes. Finally, a general summary was drawn up summarising the oral histories as a whole and describing coastal change through the relevant indicators. Form this some conclusions about the processes of change and impacts of local factors was established.

The process faced several challenges, firstly the nature of the island's history, the time periods of interest and the demographics associated with foreshore usage limited the diversity of participation considerably (e.g., most people regularly using/working the foreshore in 1950's Mersea are now men of a certain age). Secondly, the data created by oral histories is necessarily a product of memory and passed down accounts, often recounted by interviewees at an age associated with memory decline. Thirdly were issues of subjectivity, which is an inherent limitation of oral histories in general. To mitigate these challenges identical questions were cross compared against multiple subjects to identify a range of perspectives and to create more rigorous accounts. In a project with more resources recent time periods would be addressed according to interviews with a younger and greater range of subjects to help balance the diversity of participants. A further challenge was found in the interconnectedness of the foreshore environment and the inseparability of its various elements as both producers and products of change, which didn't always lend itself easily to a distinct identification of different types of indicators.

3.4 Mapping

A collection of georeferenced Ordnance Survey maps was used to create the baseline mapping for the project. Publication dates were used to link them as closely as possible to the twenty-year mapping intervals chosen. Direct correlations to each decade were not always possible, therefore maps published as close to the beginning of each interval as possible were used where necessary. They correlate as follows.

Interval Period	Map
1920 - 1940	County Series 1st Revision published 1923
1940 - 1960	National Grid 1:10 560 1st Imperial Edition published 1953
1960 - 1980	National Grid 1:10 000 1st Revision published 1966
1980 - 2000	National Grid 1:2500 2nd Revision published 1981
2000 - 2020	Ordnance Survey 1:1000 Mastermap published 2016

Camera positions and viewsheds were established for each image using local knowledge and the authors' experience of the island and its environs. For each of the 20 images chosen, the camera positions identified on the map are accurate to within c.10m, with only a handful being more difficult to locate. Viewsheds were represented on each map as a field of vision identified by two lines. With this established, the presence or absence of the six indicators identified in section 2 were noted and, where possible, plotted as a georeferenced polygon onto a map unique to each of the chosen images *(fig. 9)*. This required a degree of interpretation and a small element of artistic licence, but the intention was to bring colour to the maps by highlighting the presence of features not usually captured in traditional cartography. To this end the approach worked well. Black and white images naturally presented problems, and in those cases the form of plants and the shapes within the landscape were used to identify seaweed, saltmarsh grasses etc. Again, this was difficult, but for a pilot study showed that important details can be extracted from old images with a trained eye and with enough certainty to indicate the presence or absence of the chosen indicators of change within the landscape.

The data (images, maps, and identified indicators) were displayed side by side for ease of reference, with arrows used to highlight points of interest and oral history recollections. An interpretation was provided for each image and conclusions drawn as to the state of the coast at that point in time. The oral histories served to bring both images and maps to life, sometimes in exquisite detail.

The result was a series of maps that show a detailed chronology of change across the range of indicators *(fig 10)*. For example, it is now possible to measure the impact of erosion on the shape and position of the coastline not only in terms of the lateral retreat, as identified through straightforward mapping, but also in terms of the depth and structure of established saltmarsh, the loss of marshland environment, reductions in the quantity of shellfish and so on. Whilst any measurement or indicator identified in the images is given with a margin of error, the results make for more educated estimations of, for example, total volume of sediment loss that has occurred at each site between throughout the century. Where archaeological remains are

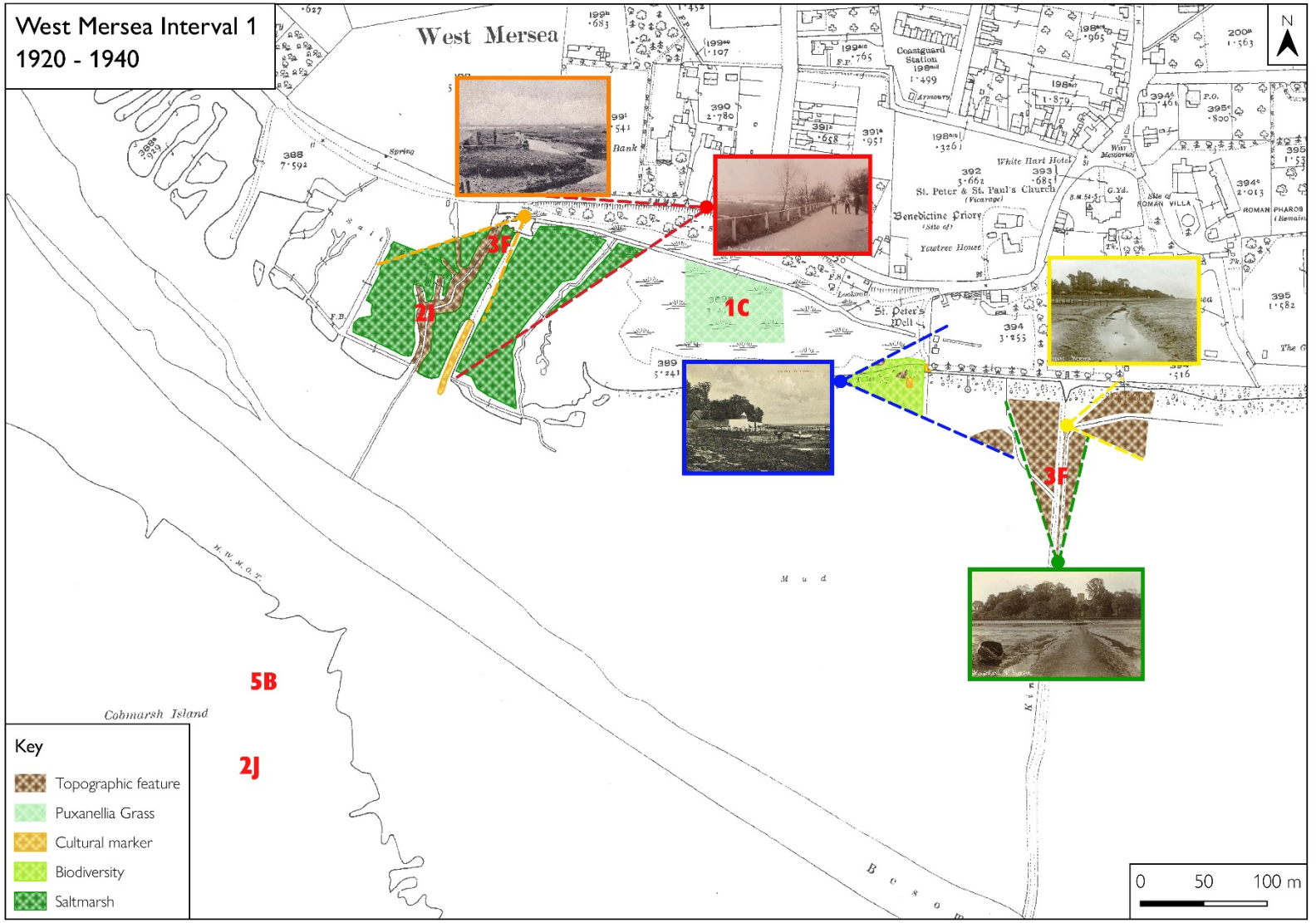
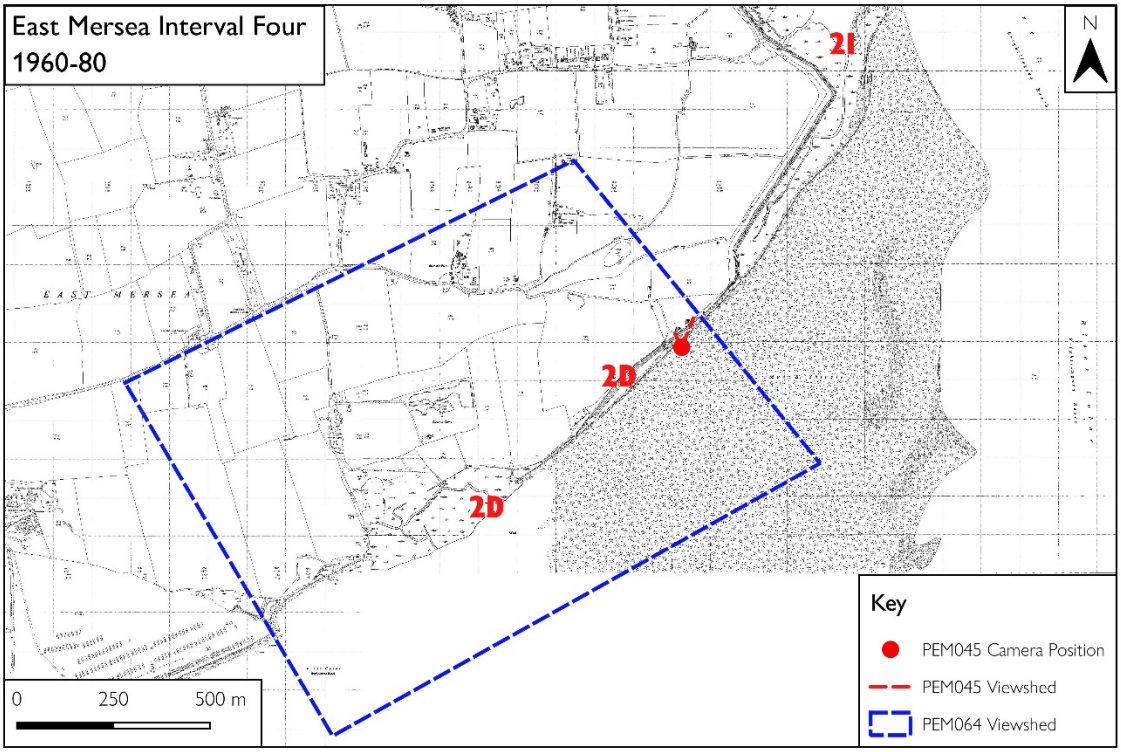


Figure 9. Images and their viewsheds mapped on an early edition OS for the West Mersea site. The alphanumeric codes relate to oral history recordings



Key to oral histories

2I "Coming around East Mersea Stone there used to be a lattice tower sticking out of the water, which marked the wreck of the SS Lowlands...as a child I can remember peering over the side of the boat & seeing the wreck...but now the mud has accreted & it's completely disappeared...it must have been the late 60's it completely disappeared" (OH2I)

2D "I think they were pretty close to the edge but they hadn't gone over, I guess it's 1970 we're talking about...but they were all in tact...I would say about 6 ft from the edge" (OH2D)

2D "I can remember as a child it always being deep & fast running... when the tide went it out it always carved a nice channel through the beach...but I can't remember the creek...I certainly can't remember the creek, only the drain off of the marsh through the beach" (OH2D)

Figure 10. An interval map for East Mersea showing ground and aerial based photography. The alphanumeric codes are referenced as quotes from oral history recordings at the bottom of the image

concerned, the maps provide valuable information on their context, namely in the depth of sediment that had accumulated above them. Whilst this stratigraphy is now long gone, details of the sedimentary architecture can be used to make comparisons with known sequences elsewhere on the Blackwater estuary to estimate probable relative dating of the lost features.

4. DISCUSSION

The results of the study produced a broad and complex story of change on Mersea Island. The impact of human action is identified with some degree of clarity, and its exacerbating relationship with natural events laid bare. The findings of the oral histories indicate a complex and gradual picture of change between 1920-2020 with erosion increasing exponentially throughout the period. They show that a balanced foreshore environment provided a defence against erosion and that a decline in foreshore biodiversity, combined with the impacts of other factors, events and natural processes accounts for an acceleration in coastal erosion. The following is a shortened summary of these findings, a more interactive version of which has been converted into an online story using Arc GISs' Storymapper software (https://storymaps.arcgis.com/stories/bf480b2db6864b2091f3639eea058741) and is populated with the voices of the community who created it.

4.1 Mersea Islands' Climate Story

In the 1920's the foreshore environment of both east and west zones was radically different from that today. Marshland "saltings" (a local term for saltmarsh) and topographically dynamic mudscapes reached far into what is now the intertidal zone. They were substantial enough to support entire creek systems that ran the length of the island between. In some places they were deep and wide enough for use by Thames barges and fishing smacks. Areas including the "cricket pitch" and the "bowling green" were terrestrial in their grasses and parts of Cudmore's foreshore were used for grazing cattle. The structure of the foreshore environment was protected by a complex system of natural barriers. While the roots of eel grass *zostera* helped hold the mud together, the plant also dissipated wave action breaking on the edge of the marshland. By the late 1920's eel grass had started to rapidly disappear, in part a naturally occurring slime mould the main culprit, but some interviewees cited the onset of phosphate and nitrate from agricultural use entering the estuary as playing a significant role. Most of this period has been recounted by inherited stories from older generations and is therefore less reliable than later decades.

During WW2 large parts of the foreshore were inaccessible, however memories of the 1950's suggests a still biologically diverse foreshore but one with a changing topography. Areas of marshland or mud hillocks still existed as per the previous interval. These supported a broad range of shellfish and seaweed as is evident from the persistence of cultural practices like winkling (for example at the Monkey Beach). Government policies intended to maximise production led to major agricultural changes following the war. Land drainage was improved, the use of chemicals subsidised, and traditionally pastoral farmland made arable. These factors may have negatively impacted foreshore health. Several interviewees remember large pondlike areas called "pans" near Hove Beach that supported the last remnants of eel grass, now generally absent from the foreshore. A considerable level of erosion is also evident from the accretion that was forming, as displaced sediments were settling in more sheltered parts of the island. Similarly, the shells and stones removed by erosion were enlarging beach areas at places like the Monkey Beach causing increased longshore drift.

The picture in the period between 1960 and 1980 is one of accelerating erosion and a downward trajectory for the foreshore environment. Events like the 1963 "big freeze"

wiped out a generation of wildlife and shellfish integral to foreshore health. Erosion in East Mersea had started forming taller cliffs at Cudmore and areas of marshland to the west of the cliffs had almost disappeared. Longshore drift coupled with accretion had made Hove Creek unnavigable by the late 1960's/ early 1970's. With natural barriers gone, erosion was pushing tidal reach inland and turning some areas from terrestrial environments into more saline ones. This was evident from the formation of a transition zone with *phragmites reeds* being joined by saltmarsh varieties like *puccinellia, suaeda maritima,* and *spartina*. A catalyst for foreshore decline has been identified by locals in the use of *tributyltin* as anti-foul on boats, which wasn't banned until the 1980's, after research showed it was highly toxic to aquatic life. The period also saw the disappearance of the last traces of some former creeks including Cumber Gut, which was observed as little more than a shallow drain on an ebbing tide, once a busy fisherman's landing stage.

The period between 1980-2000 saw the end of practices like winkling and cockling at both sites due to the absence of most shellfish *(fig 11)*. Similarly native oysters had left the Monkey Beach by the early 1990's. Cudmore cliffs started receding at an increased rate, partly because of more regular easterly gales and storm surges. Locals also observed the negative effects of actions taken by the council there, through the removal of vegetation, implementation of wooden revetments and polders. In the late 1980's erosion had brought the cliff edge so close to the WW2 military installations that a decision was taken to bulldoze them off. Erosion in the west was seen to be exponentially increasing too, due to the lack of protection provided by natural habitats, easterly storms and increasing tidal reach. One interviewee also noted that a rise in accretion at the mouth of the Colne at East Mersea may have been made worse by the decline in working boats there, as oyster dredging stopped and the number of commercial boats accessing Colchester port was reduced.

By 2000-2020 tidal reach had dramatically increased from earlier decades due to lower, open mudflats. So much material had been eroded from the foreshore (and deposited on other parts of the island as accretion) that ancient land surfaces had started to be revealed in the intertidal zone. Accompanying this was a sudden rise in archaeological remains being revealed by erosion and washed out of the foreshore. Locals found many artefacts and features from a range of epochs spanning from the Bronze Age to the Medieval period. The vacuum created by a relative absence of wildlife had also begun to be filled by specific monocultures (e.g., mussels) and sometimes by hardier incoming species like Japanese weed and *magallana gigus* oysters. By 2020 however a return of the native oyster was being observed at the Monkey Beach, probably due to Essex University's ENORI (Essex Native Oyster Restoration Initiative) project. The general scale of erosion over 100 years on Mersea Island is well illustrated by Cobmarsh Island to the west, which was bought in 1923 at 32 acres and was measured before 2020 at just 16. Erosion continues to increase, and as

Figure 11. Winkling was no longer possible by the 1980's on Mersea. This composite image shows a foreshore rich in shellfish in the 1920's (l). By 2021 the landscape has entirely changed to a brackish grassland (r)

scoured foreshores give rise to greater wave action, seawalls at places like Rewsell's Farm are starting to breach, flooding new areas, and shifting the boundaries of the intertidal zone.

5. PROJECT IMPACT AND LEGACY

The project produced two publicly accessible outputs. The first used ArcGIS Storymap software to create an accessible online archive (https://bit.ly/3mAWsG9). It weaved together the oral histories, images, and maps to create an accessible, visual timeline of change. This output proved a good vehicle for disseminating the results of the study to a wider audience and was ideal given the nature of the funding call and ongoing COVID-19 restrictions on large gatherings, lectures, travel etc. Most importantly, it allowed the story to be told by its participants, bringing the emotional power of the oral histories to the fore, and ensured that Mersea's story was told by its community. The second output was a new exhibit in Mersea Island Museum *(fig 11)*. The exhibit used colour coded picture frames to connect both interpretations and images associated with each 20-year interval to coastal regression maps of each site. It was important to the project to have a physical legacy on the island, particularly when many of the images used came from the Mersea Island Museum archive and all the oral history participants were local. The exhibit was visited by 1274 people over the course of the 2021 season and will remain on display for the summer of 2022.

The project has been presented widely in print form, most notably as a feature in Issue 381 of Current Archaeology. It has also formed the basis of a chapter for the University of Florida publication Citizen Science in Maritime Archaeology (forthcoming). Other articles of note are GEM Case Study 27 and a feature in Historic Environment Forum's 'Taking Positive Action on Climate Change' for COP26 in Glasgow. Results have also been presented at several conferences; CHERISH in May 2021, EAA in September 2021 and NAS in November 2021. An online seminar related to CITiZAN and the CMCC project is also available online (https://attendee.gotowebinar.com/recording/2582811969495027 31).

One of the major impacts of this project was empowering a coastal community to connect with and acknowledge the huge changes to their coastline by using the datasets both as a window on the past and a proxy for the challenges of the present and the future. Through examining anthropogenically driven climate change over the past 100 years, the project has facilitated conversations about climate change, coastal change, and wetland management at a local level, putting residents at the centre of a conversation about the impacts they can have on the future of their community. The project has helped to develop a group of residents more informed about coastal change and the degree to which their actions can exacerbate it. It raised awareness of the value of how the coast is best protected by the natural environment, by saltmarsh, seagrass and the rich mix of marine life that is sustained by it. Where the aim is to share understanding to facilitate positive action to mitigate against climate change, the project has developed a method for delivering that message locally from voices that are known, and potentially more trusted, within the community. It may help to develop communities that are more resilient to climate change, improve knowledge transfer between generations and lead to small, community led projects to manage and protect our coast.

"The whole project has stirred an interest and interaction amongst participants that has been very rewarding. To have been able to contribute to "living" history has been a fascinating journey, it has encouraged collaboration and some deep research in a new and novel way. This in turn has forged new friendships and an appreciation of other talents, personalities and humour that have lifted spirits and prompted debate, a most welcome and enriching manner in these troubled times." (Carol Wyatt, CMCC

participant). A full external evaluation of the project was done in the spring of 2021 (Fredheim 2021) and is available online at https://citizan.org.uk/resources/citizan-reports/

6. LESSONS LEARNED

Upon completion of the pilot project several methodological changes were identified that would improve project outputs. These broadly fell into three categories: connecting outputs from different work packages, benefits of physical access to sites and volunteers, and expanding the age range of participants.

Both images and oral histories are individually imperfect ways of holistically understanding change. It was difficult to establish a useful date for some postcards, particularly if they were not franked, and people often had flexible accounts within the oral histories of dates. Historical maps proved to be the linchpin in providing context for the community datasets and for providing an accessible means of understanding the data.

It was only by examining the gaps and flaws in both the image and oral history work packages that the quiz format was established. In future, the idea of using targeted images at a midway point during analysis should be central to gather a greater breadth of information and supplement or validate the oral history data. The inclusion of other data sets (news reel footage, archive films etc.) and existing databases in coastal and marine sciences would certainly enrich the outputs of future iterations of the project. Improving the style of questions asked of participants could also lead to more refined results, for example, the creation of visual guides for defining the density or volume of certain indicators. Images of sea grass environments at different stages of health could be shown to volunteers to identify the one closest to their recollection. This could enable us to further validate indicators based on foreshore ecology.

Although the project had been designed to work in a COVID-19 secure way, the ongoing pandemic impacted our ability to maximise the local reach of our project. The secondary aim of delivering in person open house days could not be completed owing to COVID-19 restrictions and the long-term closure of suitable event locations on Mersea Island. Prior to COVID-19, the CITiZAN project was primarily 'hands on' and focused on a physical presence within communities in each Discovery Programme. The challenges of a digital only approach were exposed when attempting to reach out to the community using a project specific social media page. While the project has strong connections and presence within the community, this did not transfer into online connections. This issue was mitigated by connecting through social media with island and area residents in established, locally managed groups. It is almost certain that more participants could be reached had in person, non-restricted events been taking place. Indeed, it was only towards the end of the project that some of the most valuable connections were made, and people felt comfortable sharing both images and stories with us, largely through Find's Identification Days on the island. This suggests that need for both digital and in person participation options to be offered, as indeed the project had originally hoped to do. Personal connection and familiarity between participants and project officers help to create an environment where stories can be more easily shared. While much of the data collection can be done through digital means, it is more inclusive to offer a physical opportunity for participation. Embedding the project within with a local museum or other community hub would enable connections with a wider range of potential participants and try different methods for combining images, maps, and oral histories to draw out local stories of coastal change.

Lastly, expanding the age range of participants would likely increase the impact of the study. Involving local school children and younger generations of residents would provide opportunities for intergenerational discussion about coastal change. Importantly,

the stories of dramatic coastal change within the volunteers' lifetimes could be shared within the community with those who will be faced with its longer-term impacts.

7. CMCC 2.0

The collaborative database created by the CMCC project will continue to be used within the CITiZAN Mersea Island Discovery Programme to augment our future reports and outputs. Indeed, the opportunity provided by this project to examine our sites in a more holistic way has already changed how we work with the community to record sites and deliver new public events.

With another opportunity and more resources, a wider study involving more communities and locations. The results of each community study could be used to develop a more detailed timeline of change across a greater range of indicators at a regional level, for example the Greater Thames Estuary. Alternatively, the indicators used to measure change could be tailored to look at the impact of coastal change on a wider range of coastal communities with differing types of coastlines. Either project would entail collecting and analysing considerably more data, but with a dedicated project team and framework this would be eminently possible. Enlisting partners from the relevant sciences to corroborate aspects of coastal change would also doubtless prove valuable, allowing each specialty the space to produce a more in-depth study with wider ranging results and CITiZAN to focus on archaeological interpretation and community engagement.

In effect, CMCC has developed a framework that can be employed at various scales and within any coastal community to link heritage, change, and the future in a more holistic way. The inputs and indicators used will vary depending on needs of the project and the stories that the community has to tell, and on the scale of any future funding.

8. CONCLUSIONS

Coastal communities are first-hand witnesses to the scale, speed and impacts of coastal change. Each member of a community is a living archive of life by the sea, witnessing the subtle daily, weekly, and yearly changes in the landscape from a unique perspective and level of detail. Lives are played out and memories formed on beaches, cliffs, marshes and coastal paths, the topography, ecology, and biodiversity of which are governed not just by the rhythm of the tides and the shocks of a storm, but by the often-unintended consequences of human interactions with the environment. Combining a community's witness statements of change with a photographic record spanning 100 years provided a framework for the community to create its own climate story.

The co-development of the six indicators of change also provided an insight into how people perceive place, particularly that of a changing coastline. The indicators are representative of changes in the environment that were most pertinent in the memories of eight regular volunteers to the CITIZAN project whose memories and lifetimes span a period of 75+ years. They primarily involve morphological changes in the landscape (changes to saltmarsh, foreshore composition, position of low and high tide lines). Aspects of the foreshore ecology and biodiversity were also key suggestions for indicators made by the volunteers, making up a large part of the visual memory of place and foreshore. The exposure, presence, and loss of archaeological features, or what are considered archaeological or enigmatic features of the foreshore by participants, was found to be a useful prompt for recalling the state of the foreshore around the time of initial exposure. The dating of the first exposures of archaeological features on the coastline proved to be particularly memorable for participants. The idea of a familiar landscape suddenly punctuated by un-natural forms (e.g., rows of wooden posts, the sharp outlines of square pits, sections of wattle hurdle etc.) is

a useful aid-memoire against which to explore other indicators, mainly because their exposure indicates loss or significant change to a foreshore environment that, up until that point (perhaps through childhood and early life) was far more stable in its composition.

The value of this novel methodology and uniquely detailed, community constructed data set could be significant for interdisciplinary study of coastal erosion at a local level. While the issues surrounding memory as a reliable form of information are obvious, when corroborated by scale and against other sources of information they can paint a detailed picture of change that more traditional scientific modes of study may struggle to attain. In the battle against climate change data is vital, and although most of the participants of this study are not experts in the fields of marine biology or geography, they are experienced enough in place and landscape to recognise change and loss. Whilst measurements are not necessarily scientifically precise, the story generated by this project provides detail enough to weigh the impacts of wider changes and to alert the younger members of a community that change is real and can occur at considerable pace. Major weather events such as storms, flooding and deep freezes have measurable impacts. So do the introduction of agrichemicals, increases in shipping, changes in land management and drainage, and waste from industry, polluting and heating the water with lasting effects. This pilot study has proven that communities are an incredibly rich source of data that can be effectively collated to support the most pressing research agenda of our age.

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