My research examine how estuarine carbon sequestration can be enhanced by saltmarsh restoration and if the derived ecosystem service benefits could provide a conservation subsidy to encourage restoration activities whilst enhancing climate change mitigation services.

Research outline

Coastal saltmarshes have experienced high levels of loss in the past, and are estimated to be declining at approximately 2% per year (Duarte et al., 2008). Losses have resulted from coastal squeeze and altered land use, such as conversion of saltmarshes to agricultural land. Modern day threats are increasing and arise from the impacts of climate change and associated altered environmental dynamics (Pendleton et al., 2012). Saltmarshes provide an array of ecosystem services, such as climate change mitigation through carbon sequestration, storing more carbon per unit area than equivalent terrestrial wetlands; estimated to be 430 ± 30 Tg C (Chmura et al., 2003). There is a growing need to restore these habitats to address their physical loss and the loss of services they provide. The way in which these services are enhanced through restoration should be better understood to best appreciate their added value.

My work addresses the potential additional carbon storage benefit realised through saltmarsh restoration and quantifies how this could translate into subsidisation through payments for ecosystem services.

The research focuses on the Eden estuary, Fife, Scotland where saltmarsh replanting has been taking place since 2000 (Maynard et al., 2011). Restoration has been achieved through direct planting of translocated sprigs from within the estuary. This is relatively labour intensive in terms of area restored, but doesn't rely upon the sacrifice of currently 'claimed' land and is, perhaps, more efficient in its success. The quantification of carbon benefit requires assessment of the sedimentary and vegetative carbon pools and how they differ between 'natural' or 'business-as-usual' areas and those that have undergone restoration.

At present a full annual cycle of sediment deposition and settlement trends in the different areas has been measured, assessing the influence of season and tide. Further to this, these processes have been related to the accretion of sediments and thus the potential sequestration of carbon. Additionally, various accompanying data were collected, such as vegetative structure (density and cover) and elevation that will provide a clearer understanding of major factors influencing carbon sequestration. A better understanding of such factors is important for consideration in future planning and optimisation of restoration for carbon storage benefit.

I will also be conducting sedimentary core surveys to ascertain current carbon storage and historical rates of sequestration. The cores will also be used to quantify additional external benefits of restoration through emission avoidance, or reduced saltmarsh cliff erosion due to enhanced protection from restored fronting marsh.

It is hoped these data can be used estimate the potential ecosystem service benefits, and so monetary value, of restoration activities. Thus, facilitating restoration efforts through the offset of initial capital investment with accurately estimated financial returns. The result of which is to alleviate ecosystem decline and mitigate climate change through continued expansion of carbon sequestration capacity in the coastal zone.

Use of funds

This application is for partial funding to attend the EGU General Assembly 2017 in Vienna, Austria; at which I have been accepted to present in the 'Coastal Sedimentary Carbon' session. I will present data from a study into the seasonal variation of sediment dynamics within different areas of the Eden estuary, evaluating differences between restoration and business-as-usual settings. These data

include, deposition rates and the relationship with ‘deposition potential’ and their carbon contents at each site.

Attendance to this conference will be highly beneficial to me at this present time of my PhD. Through-out the coming year I will be conducting final experiments, including sedimentary core assessments and laboratory flume studies. The conference will provide an invaluable opportunity to discuss and obtain input from others in the field, taking advantage of the extensive experience that will be present.

References

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