The Management of Natural Coastal Carbon Sinks

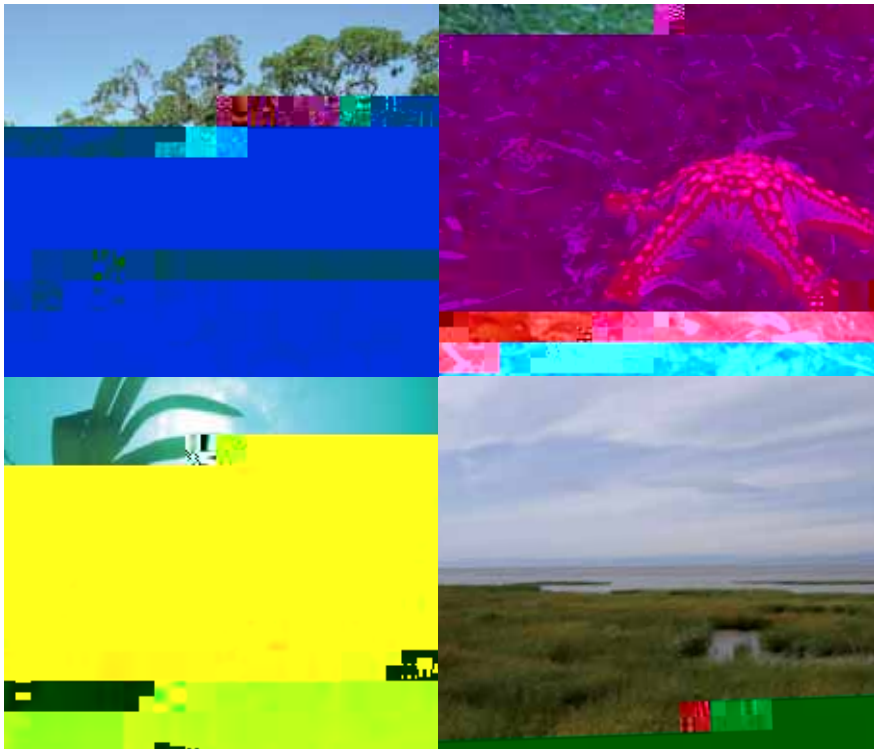
A short summary

November 2009

Introducing coastal marine carbon sink

Climate change is arguably one of the biggest issues facing humanity. World leaders now recognise that urgent and significant reduc ons in our emissions of greenhouse gases are needed if we are to avoid future dangerous climate change. Alongside such measures is an increasingly strong recogni on that there is a need to properly manage par cular habitats that act as cri cal natural carbon sinks.

The produc on of the report has been s mulated by an apparent lack of recogni on and focus on coastal marine ecosystems. There is an urgent need to complement ac vi es already well advanced on land to address the best prac ce management of terrestrial carbon sinks such as forests and peatland. This report is therefore mely as a number of Governments are now introducing legisla on to tackle climate change and quan fy carbon sinks. Interest in and ac ons to address the underlying causes of climate change are also growing– regula on of anthropogenic emissions of greenhouse gases into the atmosphere, avoiding deforesta on, management and protec on of other natural terrestrial carbon sinks, and the development of fiscal measures that place a value on carbon and therefore provide an economic incen ve to reduce emissions.



(from top le to bo on right): Mangroves, New Caledonia © Dan La oley; Close up of seagrass © Jerker Tamelander; Temperate water kelp forest © JNCC; Saltmarsh on the St Lawrence, Canada © Sarah Knox

It is important that such quan fica- ons and processes work with the latest science and evidence.

To construct the report we asked leading scien sts for their views on the carbon management poten al of a number of coastal marine ecosystems: dal salt marshes, mangroves, seagrass meadows, kelp forests and coral reefs. These ecosystems were selected because of the ini al belief that they should be good at sequestering carbon, and are located in situa ons where management ac ons could secure the carbon sinks. If evidence substan ated this claim then this could expand the range of global op ons for carbon management, unlocking new possibili es for financing and protec ng the coastal marine environment.

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The overall take home message from the evidence and new analysis presented in this report is the globally significant role these coastal marine ecosystems (but not coral reefs – for reasons described in the main report) play in carbon fixa on, complementing the already widely recognised terrestrial carbon sinks. Individual chapters set out the contribu on each selected coastal marine habitat makes.

Overall, these coastal marine habitats have a far greater capacity (per unit of surface area) than land habitats to achieve long-term carbon sequestra- on in sediments, arising in part from the extensive belowground biomass of the dominant vegeta on. The rate of carbon storage in the sediment by dal salt marshes, mangroves and seagrass meadows is approximately 10 mes the rate observed in temperate forests and 50 mes the rate observed in tropical forests per unit area. Combined with the par cular ways in which such habitats trap carbon, this means that they are cri - cal components to include in future carbon management discussions and strategies.

These coastal habitats are under signifi

Tidal Salt Marshes — at a glance

• Inter dal ecosystems dominated by vascular plants.

• Occur on sheltered marine and estuarine coastlines from the sub-arc c to the tropics, but most extensive in temperate climates.

• Their soils store 210 g C $m^{-2}yr^{-1}$. This is a substan al rate and the carbon stored in dal salt marsh soils of the USA comprises 1-2% of its total carbon sink.

• Each molecule of CO_2 sequestered in soils of dal salt marshes and their tropical equivalents, mangrove

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swamps, probably has greater value
than that stored in any other natural
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Some of the main ndings of this report

• These key coastal marine ecosystems are of high importance because of the significant goods and services they already provide, as well as (but not for coral reefs) the carbon management poten al recognised in this report, thus providing new convergent opportuni es to achieve many poli cal goals from few management ac ons.

• The carbon management poten al of these selected coastal marine ecosystems compares favourably with and, in some respects, may exceed the poten al of carbon sinks on land. Coral reefs, which rather than act as 'carbon sinks' are found to be slight 'carbon sources' due to their e ect on local ocean chemistry, thus heightening the need for strict controls on carbon dioxide emissions.

Mangroves — at a glance

• Salt-tolerant, mainly arboreal, flowering plants growing in the inter- dal zone of tropical and sub-tropical shores.

• Global area of 157,000 km^2 - 160,000 km^2.

• Global carbon burial of ~18.4 Tg C yr^{-1}.

• Mangrove forests are es mated to

Some of the main ndings of this report

• The chemistry of some specific coastal marine sediments (for example dal salt marshes) suggests that whilst such habitats may be of limited geographical extent, the absolute compara ve value of the carbon sequestered per unit area may well outweigh the importance of equivalent processes on land. This is due to the high sediment accre on rates with associated organic ma er, o en under anoxic condi ons, coupled with a lower poten al for the emission of other powerful greenhouse gases such as methane.

Seagrass Meadows — at a glance

• Flowering marine plants that form extensive meadows and are globally distributed. Found in shallow waters of all con nents except the Antarc c.

• Responsible for about 15% of total carbon storage in the ocean.

• Global extent of seagrass now es - mated to be about 0.3 million km^2

• Alongside the carbon management poten al of these ecosystems, another key finding is the lack of distribu onal data for some coastal marine habitat types. Having comprehensive habitat inventories is cri cally important. This research highlights the urgent need, alongside recognising the carbon role of such ecosystems, to ensure that such inventories are completed for salt marsh and kelp forests, and then all such inventories are e ec vely maintained over me.

• These coastal marine ecosystems are also vital for the food security of coastal communi es in developing countries, providing nurseries and fishing grounds for ar sanal fisheries. Furthermore, they provide natural coastal defences that mi gate erosion and storm ac on. Therefore, be er protec on of these ecosystems will not only make carbon sense, but environmental sense as the co-benefits from ecosystem goods and services are clear.

Coral Reefs — at a glance

• Management approaches already exist that could secure the carbon storage poten al of these ecosystems, and most governments have commitments to put such measures in place for other reasons. These include biodiversity protec on and achieving sustainable development. Agreed management ac ons that would be e ec ve include Marine Protected Areas, Marine Spa al Planning, area-based fisheries management approaches, bu er zones to allow inland migra on of coastal carbon sinks, regulated coastal develop-

About the report

The origin of this report lies back in 2006 with IUCN's World Commission on Protected Areas and Natural England in the UK, and a joint enthusiasm to address this novel issue. This ini al enthusiasm sparked the interest of many global partners and scien sts when it became apparent that evidence is available that could change the emphasis on the management of carbon sinks.

Over the past three years we have sought out and worked with leading scien sts to document the carbon management poten al of par cular marine ecosystems. This report documents the latest evidence from these leading scien sts on these important coastal habitats.

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For a copy of the full report go to publica ons at:
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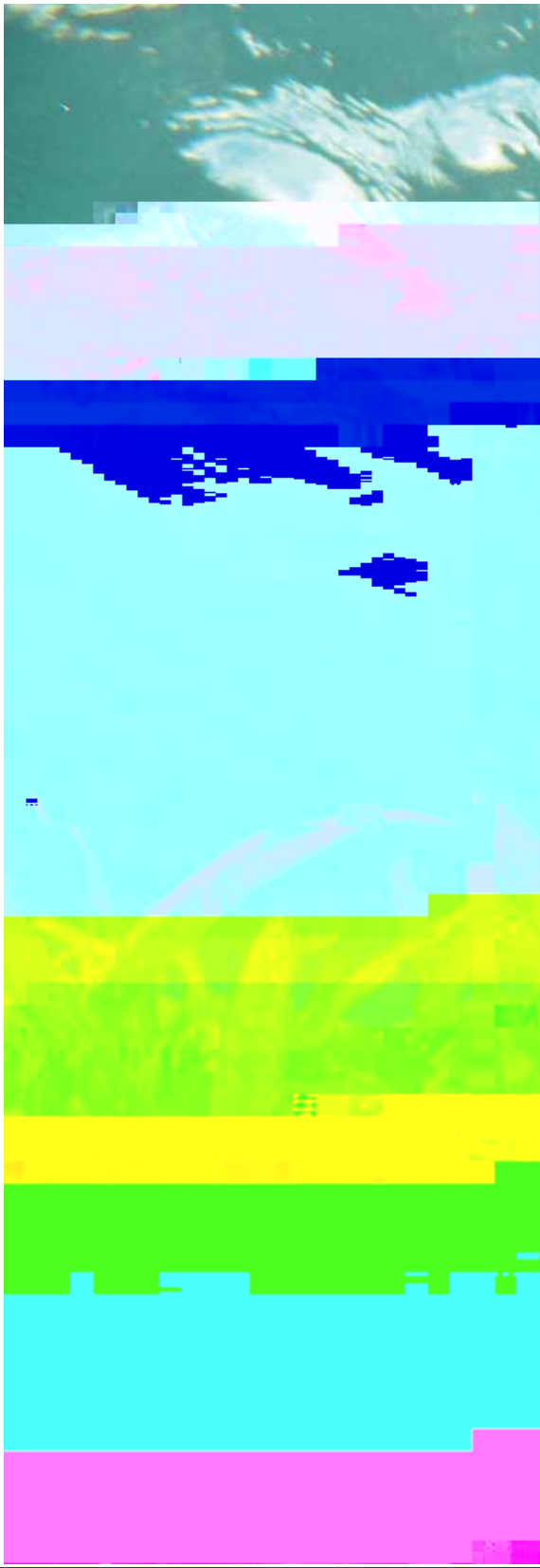

Thalassia hemprichii at Paje lagoon, Zanzibar Tanzania