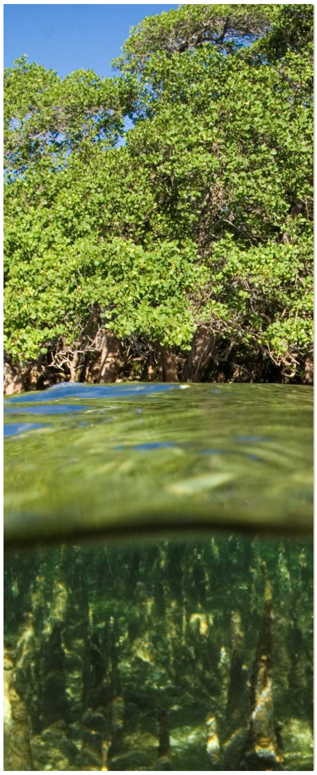

Sequestration of Carbon Along Our Coasts: Important Sinks and Sources

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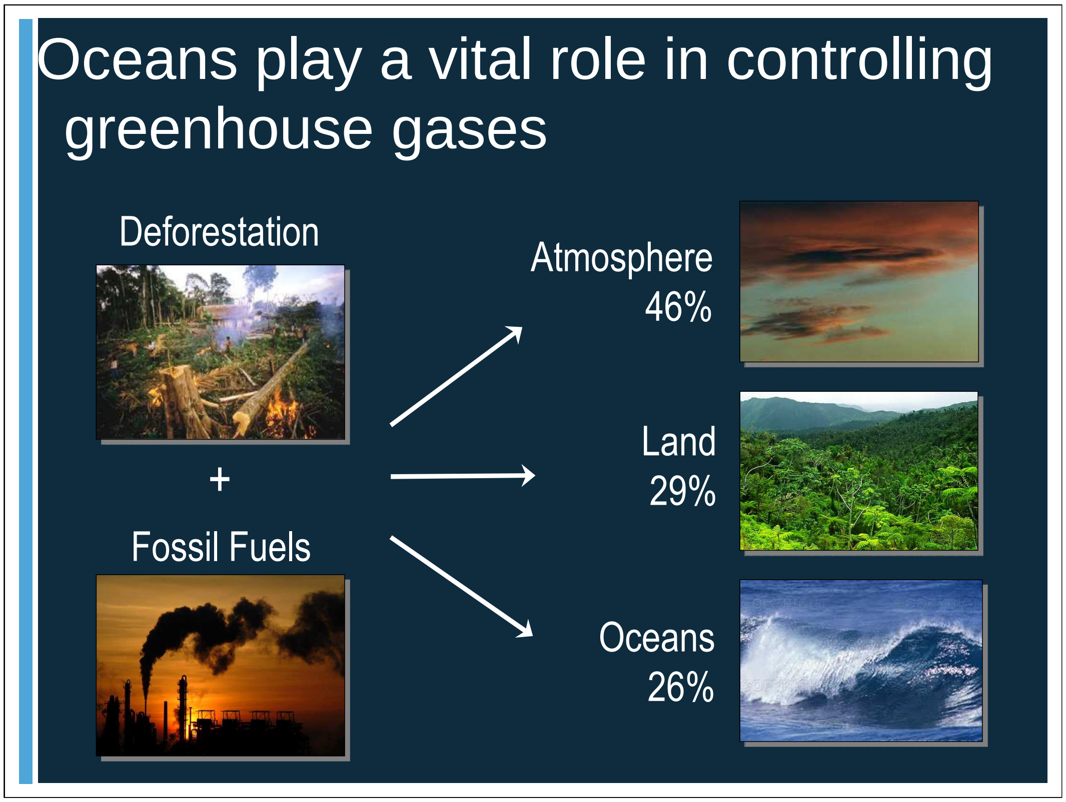
•Marine Conservation Community has watched the development of incentive agreements and mechanisms such as REDD with some puzzlement.
•The worlds oceans contain approximately 90% of the global carbon budget. It is therefore natural that the oceans should be included in any incentive scheme for natural C sequestration and storage.
•A number of groups have been looking at carbon sequestration in certain marine ecosystems, particularly coastal systems. High carbon sequestration capacity and storage rates strongly suggest that conservation of these key coastal marine systems may be a very cost-effective tool in mitigating climate change, potentially one of the very few low-cost options for removing carbon dioxide(CO_2) already in the atmosphere.
•However, there are also major challenges. We are not going to be able to simply apply REDD to the ocean.



Consider the main drivers of climate change: Burning fossil fuels and deforestation releasing CO2 and other Greenhouse Gases into the atmosphere.

Estimates vary, but between 30 and 50% of this human caused CO2 has been absorbed by the oceans. The oceans have therefore been critical as a buffer against climate change and makes the oceans more important than forests as a buffer against Climate change. (Forests absorb approximately 20% of anthropogenic CO2 emissions).

Most of the carbon absorbed in the open ocean stays near the surface

Open Ocean Carbon Sequestration

Surface primary production

↓

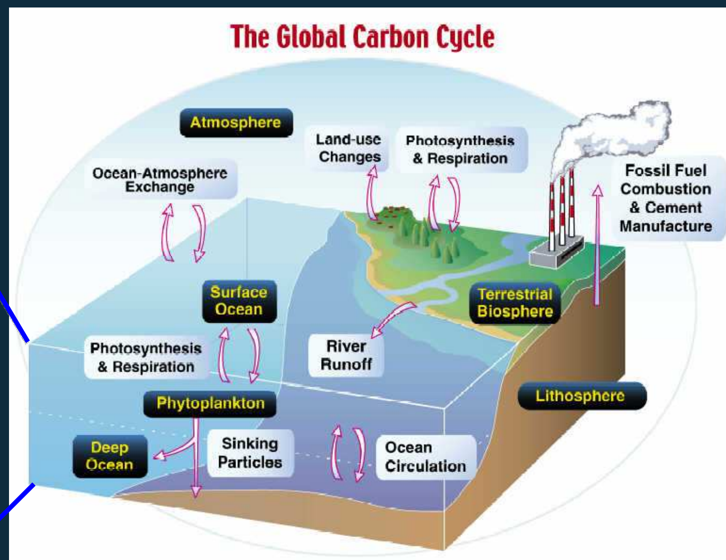
100m
<5-15% (decades)

↓

1000m
~1% (centuries)

↓

Burial in deep sediments
~0.1% (millennia)

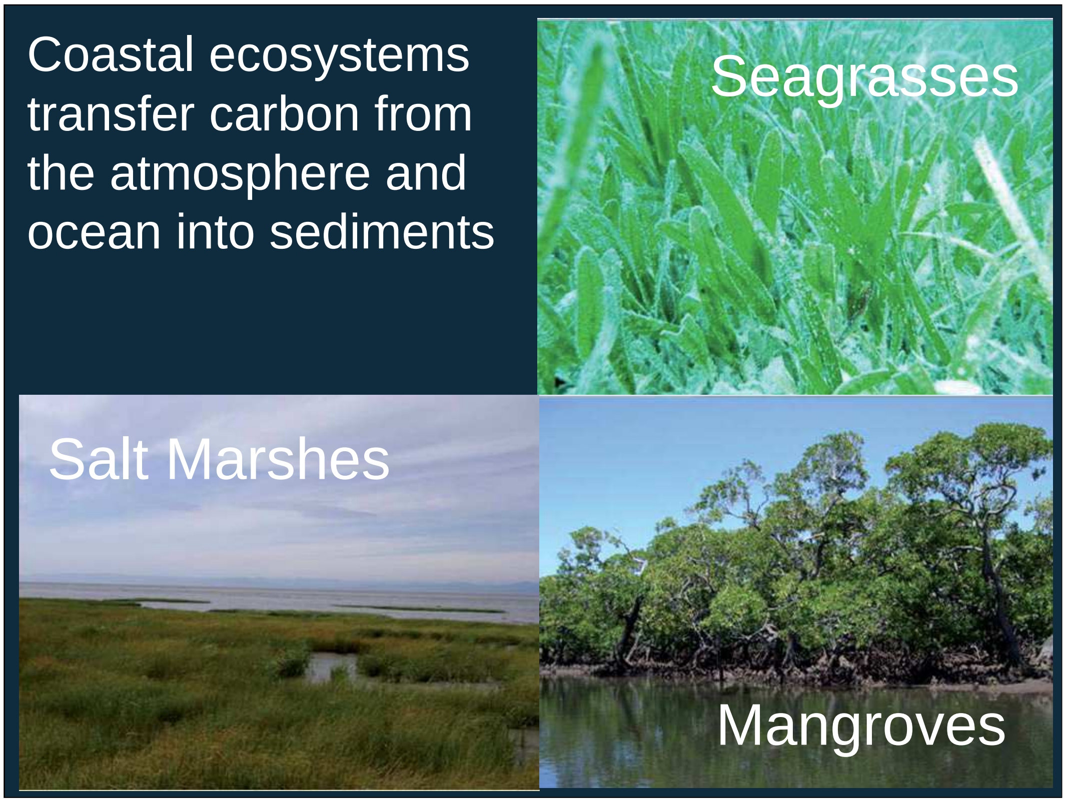


Nearly half of the global primary productivity occurs in the open ocean – dominantly very near the surface. CO2 is transferred from the atmosphere to the surface of the oceans, and microscopic plants called phytoplankton (that make the ocean look green) consume carbon from the ocean around them.

This process is completely analogous to terrestrial consumption of CO2 by trees and plants. However, the very dynamic nature of the oceans – the currents and waves – make understanding where and for how long the carbon is sequestered in the ocean a very challenging problem.

We do know that only approx 10% of the CO2 absorbed at the surface sinks to 100m, where it might be held for a few decades. However, only approx 0.1% of the CO2 is truly sequestered at the bottom of the ocean.

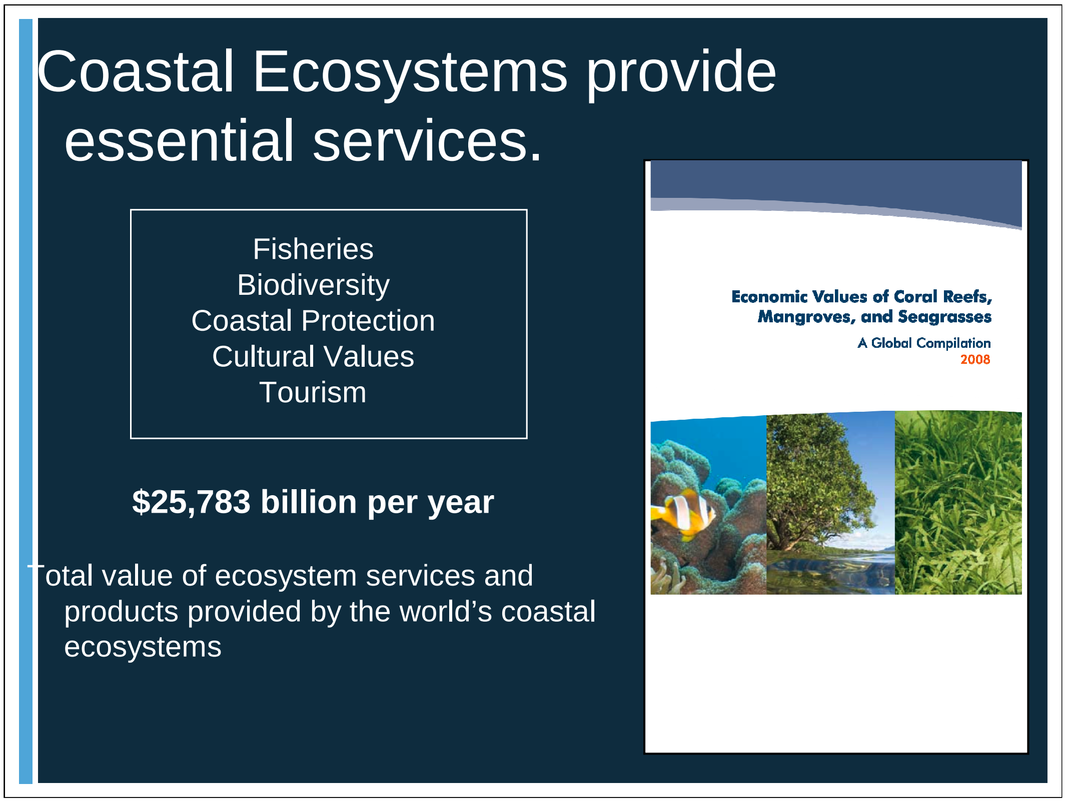
Tracing the fate of the open ocean carbon presents a huge challenge to developing incentive mechanisms for open ocean carbon sequestration.



However, in coastal environments we now have strong evidence that a significant fraction of CO2 is sequestered for centuries by certain coastal habitats

-seagrasses
-mangroves
-salt marshes

Further, there is real potential to verify and monitor the O2 sequestered by these systems. These systems are therefore present the best starting point for developing management, conservation and incentive approaches for carbon sequestration by marine systems



We have known for sometime that coastal habitats provide essential ecosystem services to billions of people globally.

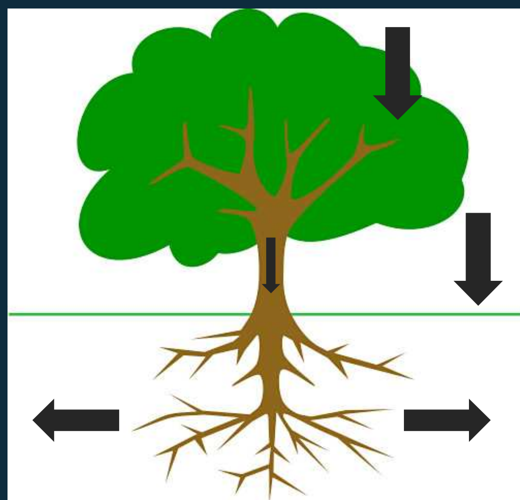
Ecosystem services and products provided by the world's coastal have been valued at
$25,783 billion per year.
Wetlands have been valued to be worth over $2,800 per hectare on average globally.

More specifically, mangrove forests provide at least US $1.6 billion each year in ecosystem services and support coastal livelihoods worldwide.
It is estimated that almost 80% of global fish catches are directly or indirectly dependant on mangroves

We clearly need to be sustainably managing, conserving and restoring these systems.

The extremely efficient carbon sequestration and storage capacity of these systems further magnifies their value. This addition ecosystem service may provide a basis for incentive agreements or other payment mechanisms that could be transformative in our ability to support such effective management and conservation.

Plants naturally sequester carbon and transfer it into the sediment



Carbon from the atmosphere or ocean is fixed by photosynthesis

Carbon is stored in the branches, leaves and roots

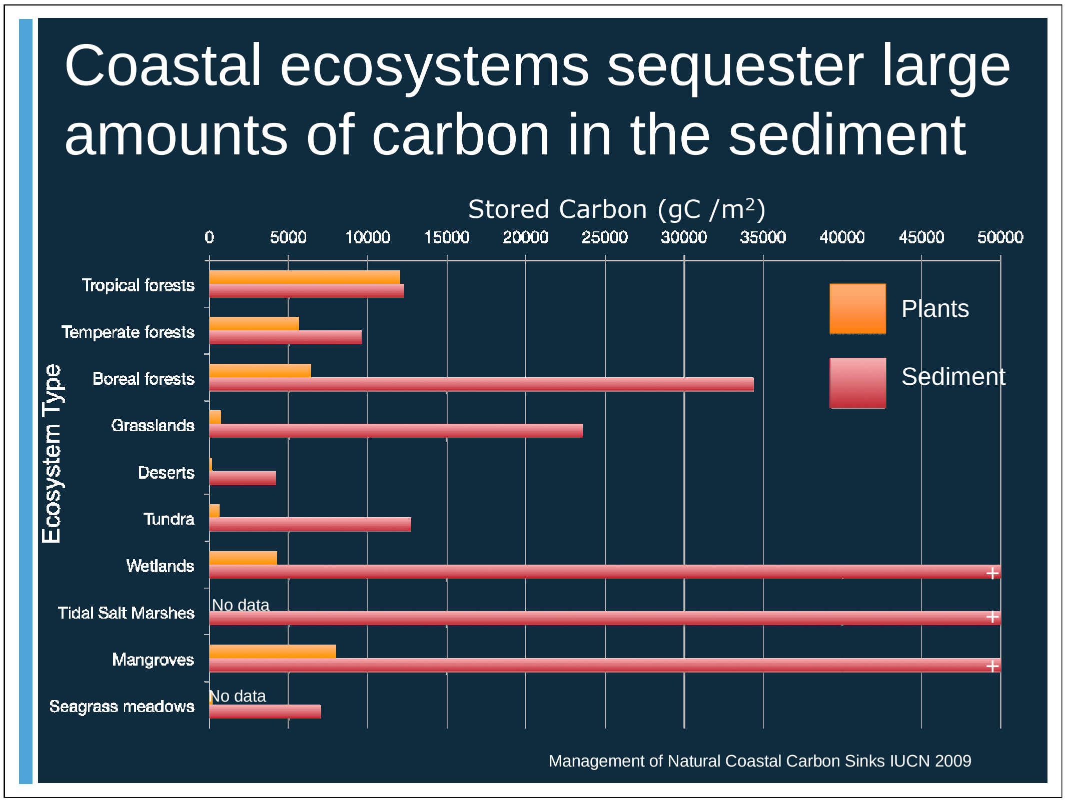
Carbon is transferred through the plant, into the roots and into the sediment

Fallen leaves, branches and add carbon to the sediment

In most plant based ecosystems – on land or in the ocean – carbon dioxide is taken in from the surrounding air or water by the plant and either stored or sequestered. This is a complex process but in this instance we are interested in 2 specific destinations for the carbon.

1.Carbon is stored in the plant – in the foliage, branches, trunks
  - This is the carbon storage accounted for through the REDD mechanism
  - Carbon is emitted from this store of carbon through deforestation and degradation of the plants –e.g. clearing and burning a forest (Amazon or mangrove)

2. Most plants also continuously sequester (or bury) carbon in the sediment below them through their root systems and other mechanisms



Now if we consider the amount of carbon stored in various plant systems. Here we show the carbon stored in the plants and in the sediment below them for a number of terrestrial and marine ecosystems

Carbon in the Plants

Forests present some of the best opportunities for REDD type financing schemes because they have large banks of carbon stored in the plant systems – think of the great forests of the Amazon or Indonesia.

[These forests are also relatively easy to verify the amount of carbon stored in the trees and monitor that it is not being lost (including satellite and other remote sensing methods).]

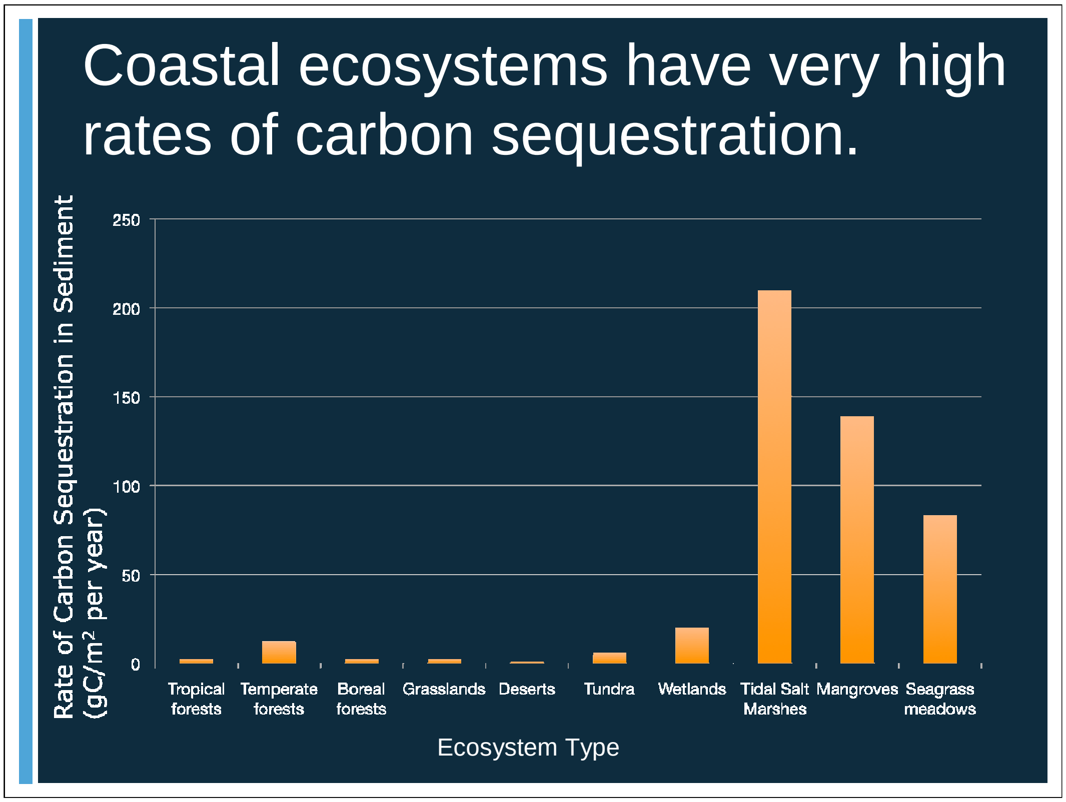
Coastal marine habitats – significantly less is known. However, mangroves store similar amounts of carbon to many terrestrial forest systems. A number of groups are now working on developing protocols for integrating mangroves into REDD.

Carbon in Soil

We know that vast amounts of carbon are stored by these systems in the soil and sediment below them. To date however, this stored carbon has not be accounted for in national inventories of carbon.

[Significantly less is known about of the distribution and variability of soil carbon deposits in almost all coastal marine systems. It is clear however, that marine systems have very comparable levels of soil carbon.]

Destruction and degradation of these systems directly leads to the release of carbon into the atmosphere and ocean.



In addition to storing carbon, plant systems are continuously absorbing carbon from the atmosphere and water and storing it as shown in the previous slide.

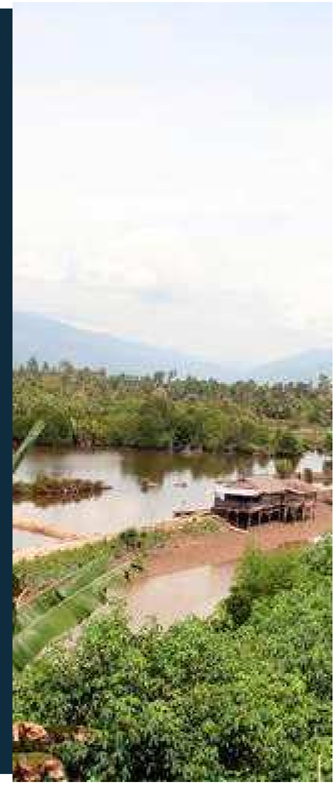
Coastal marine systems are phenomenally efficient at this continuous mitigation of carbon – these systems absorb carbon at rates up to 50 times greater than terrestrial forests. Further, coastal marine systems can maintain these rates for centuries. C sequestration in most forest systems levels off after a few decades.

This mean that, despite their relatively small area, the annual C sequestration by coastal marine ecosystems is comparable to terrestrial systems. Each year 1 km2 of seagrasses absorbs approximately the same CO2 as 50km2 of tropical forest.

[Deep complex root systems are a major factor contributing to the effectiveness of coastal marine systems in sequestering carbon – provide efficient mechanism for burying carbon.]

These coastal systems are being rapidly lost and degraded.

Coastal Habitat	Estimated Global Area (km^2)	Annual Loss	Total Loss
Seagrass	300,000	2%	29%
Salt Marsh	400,000	2%	*
Mangrove	152,000	1.8%	35%



However, these coastal systems are now being lost at an alarming rate.

35% of the worlds mangroves have been lost

29% of the worlds seagrasses have been lost

Approximately 2% of these important coastal systems are lost each year , approximately 4 times estimates of tropical forest loss and with them we are losing a natural, very efficient carbon mitigation mechanism.

Coastal pollution, development and aquaculture are all contributing to the loss of coastal ecosystems.

[The annual loss of mangroves is the equivalent of losing 2 million km2 of tropical forest in terms of the annual CO2 sequestered.]

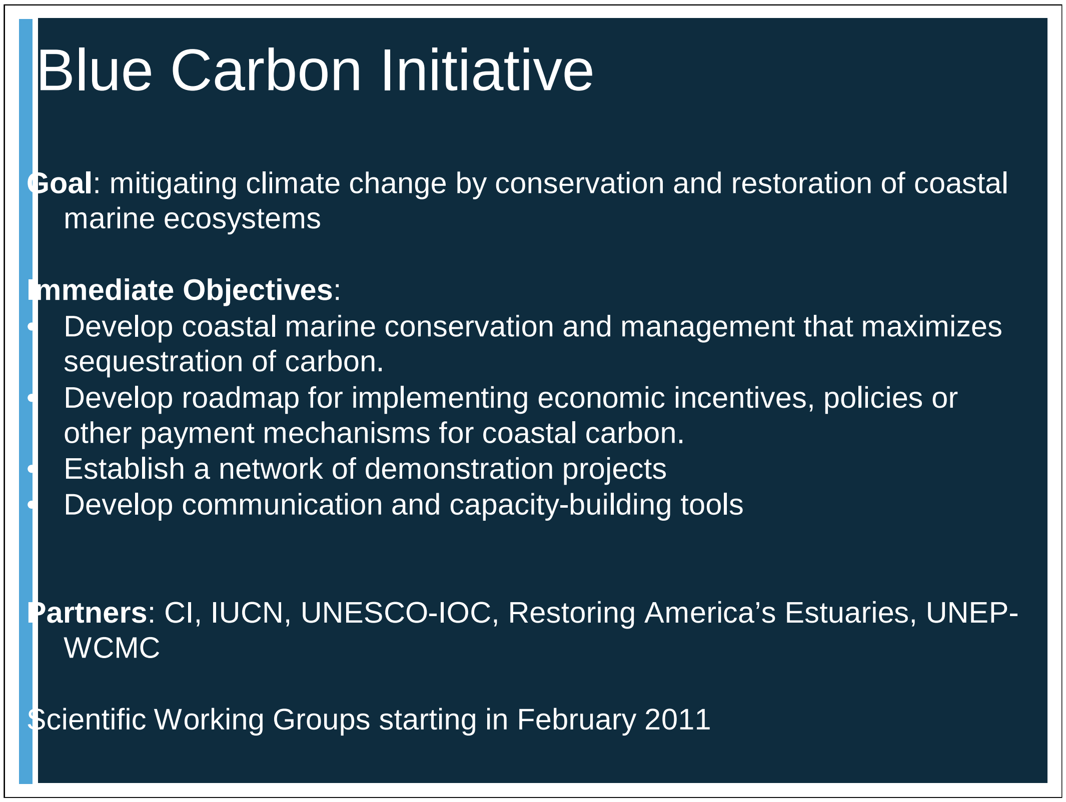
Degradation of these coastal ecosystems results not only in reduced natural sequestration CO2 but also in the rapid emission of large carbon stores that have built up under these ecosystems over centuries. (See Steve's talk)

For example, draining a typical coastal wetland – such as a marsh or a mangrove – for agriculture releases 0.25 million tons of carbon dioxide per square kilometer for every meter of soil that is lost. Between 1980 and 2005, 35,000 km^2 of mangroves were removed globally - an area the size of the nation of Taiwan. This degraded area continues to release up to 0.175 Gt of carbon dioxide every year – equivalent to the annual emissions of countries such as the Netherlands or Venezuela.

Reversing this loss and degradation of coastal ecosystems is essential to addressing climate change
Effective management and conservation of coastal ecosystems can:

•Prevent release of dense carbon stores
•Maintain high sequestration capacity
•Ensure ecosystem services essential for adaptation (fisheries, coastal protection, etc.)

Conservation and management of coastal marine ecosystems is likely to one of the few efficient but low-cost options for removing carbon dioxide already in the atmosphere. Currently no management or incentive systems, including financial incentives, specifically value the role of marine ecosystems in sequestering and storing greenhouse gases.



Over the last few years scientific work on sequestration and storage of carbon by coastal systems – specifically seagrasses, salt marshes and mangroves, has been rapidly expanding. Important initial work on understanding the feasibility of managing and developing incentives for conserving these systems for their carbon capacity has been undertaken by a number of group, particularly work by a number of our panelists. We now need an internationally supported program to design and implement a framework for systematically valuing carbon sequestration in addition to the many other ecosystem services provided by these systems.

I am therefore able to announce the launch of the Blue Carbon Initiative – supported by a consortium of partners . The goal of the initiative is to provide real mechanisms for mitigating climate change by conservation and restoration of coastal marine ecosystems

The immediate objectives of the initiative are to

•Develop coastal marine conservation and management that maximizes sequestration of carbon.

•Develop roadmap for implementing economic incentives, policies or other payment mechanisms for coastal carbon.

•Establish a network of demonstration projects

•Develop communication and capacity-building tools

Scientific Working Groups starting in February 2011.

We are very excited by the potential of this program and are enthusiastic to talk to others interested in participating.

For more information

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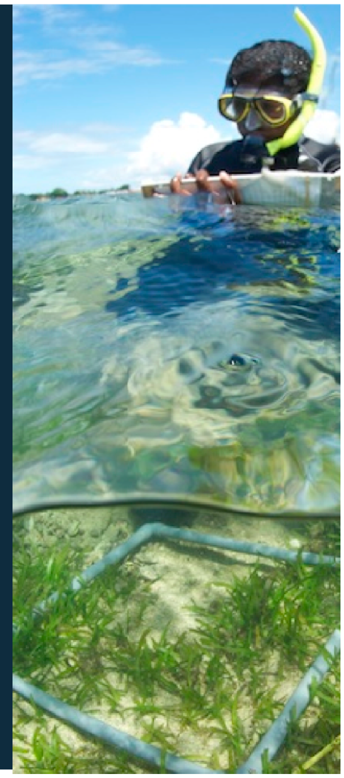

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