INTERNATIONAL BLUE CARBON INITIATIVE SCIENTIFIC WORKING GROUP

Fifth Workshop
15-17 May 2013
Sydney, Australia

REPORT

member organizations:

workshop partner organizations:

thewaterloofoundation

Workshop Overview

The University of Technology, Sydney (UTS) hosted the fifth workshop of the International Blue Carbon Scientific Working Group, part of the Blue Carbon Initiative, in Sydney, Australia. Australia is home to the world's largest distribution of seagrass, as well as extensive areas of mangrove and salt marsh. The Coastal Carbon Cluster – a collaboration of eight Australian research institutes – was recently launched with the aim of compiling data and understanding processes controlling Australia's blue carbon resources. The workshop focused on blue carbon science and policy opportunities in Australia and the Coral Triangle region.

Key outcomes are presented for each of the four workshop themes.

- Theme 1. Carbon distribution mapping and modelling: Challenges and priorities

The importance of mapping and modelling of blue carbon habitats at a range of spatial scales was discussed. Whilst there have been advances in mapping and modelling efforts, global distribution maps of seagrass and salt marsh do not exist. Quantification of the contribution of coastal habitats to carbon stocks also remains a major priority.

- Theme 2. Recent research and developments: Challenges using proxies

A session on ecological proxies (indirect measures of environmental conditions) highlighted the potential of proxies in terms of calculating carbon storage, showing disturbance over time, and indicating the permanence of carbon sequestration.

- Theme 3 – International and Australian blue carbon initiatives

Updates were provided on international blue carbon initiatives, including the work by the Intergovernmental Panel on Climate Change (IPCC) to develop new guidance for GHG national inventories for wetlands and the available mechanisms for blue carbon under the United Nations Framework Convention on Climate Change (UNFCCC). Discussions highlighted the science and policy opportunities within Australia, with recommendations made for the implementation of strategic demonstration projects which showcase blue carbon benefits.

- Theme 4 – Blue carbon in the Coral Triangle

Discussions of the Coral Triangle focused on the extent and diversity of the region's blue carbon habitats, opportunities to leverage blue carbon for coastal conservation and the gaps in scientific knowledge which need to be addressed and communicated to policy makers.

Dr. Peter Ralph and Dr. Neil Saintilan led field tours of Towra Point Nature Reserve and Silvers Beach in Botany Bay and presented an overview of the region's mangrove, salt marsh and seagrass areas. Working Group members and guests were also given demonstrations of UTS laboratory facilities for blue carbon research. The meeting concluded with a discussion of the progress and protocols for the review of the Draft Blue

Carbon Field Manual. Resources from the Meeting, including speakers' presentations can be found at the workshop web site: http://thebluecarboninitiative.org/australia-may-2013/

Coordinators

Herr, Dorothée – Global Marine and Polar Program, International Union for Conservation of Nature (IUCN)
Hoyt, Sarah – Global Marine Division, Conservation International
Isensee, Kirsten – Intergovernmental Oceanographic Commission, United Nations Educational, Cultural and Social Organization (IOC-UNESCO)
Lawrence, Anissa – Tierramar Consulting
Pidgeon, Emily – Global Marine Division, Conservation International
Ralph, Peter – Plant Functional Biology & Climate Change Cluster (C3), University of Technology, Sydney (UTS)

Working Group Members

Cifuentes, Miguel – Tropical Agriculture Research and Higher Education Center (CATIE)
Copertino, Margareth – FURG
Crooks, Stephen – Climate Change Services, ESA-PWA
Emmett-Mattox, Stephen – Restore America's Estuaries (RAE)
Fortes, Miguel – University of the Philippines
Giri, Chandra – United States Geological Survey (USGS)
Hutahaean, Andreas – Indonesian Center for Marine & Coastal Resources, Agency for Marine & Fisheries Research, Indonesia
Johnson, Beverly – Geology Department, Bates College
Kairo, James – Kenya Marine and Fisheries Research Institute (KMFRI)
Kennedy, Hilary – University of Bangor
Marbà, Núria – Research Council of Spain at the Mediterranean Institute for Advanced Studies
Morris, James – University of South Carolina
Quesada, Marco – Conservation International, Costa Rica
Saintilan, Neil – CSIRO and NSW Office of Environment and Heritage
Simard, Marc – Jet Propulsion Laboratory, NASA
Telszewski, Maciej – Independent Consultant
Wagey, Tonny – Arafura and Timor Seas Ecosystem Action (ATSEA)

Guests

Albert, Joelle – WorldFish
Apichanangkool, Pemika – University of Technology, Sydney
Baird, Mark – CSIRO
Cameron, Clint – Charles Darwin University
Chotikarn, Ponlachart – University of Technology, Sydney
Copeland, Craig – Department of Primary Industries, NSW
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Ong, Stacey – University of Technology, Sydney
Prathep, Anchana – Prince of Songkla University
Primavera, Jurgen – Pew Fellow in Marine Conservation, Philippines
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Rasheed, Michael – James Cook University
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Roelfsema, Chrisopher – University of Queensland
Rogers, Kerrylee – University of Wollongong
Roy, Jessica – University of Technology, Sydney
Saunders, Megan – University of Queensland
Schliep, Martin – University of Technology, Sydney
Serrano, Oscar – Edith Cowan University
Sidik, Frida – University of Queensland
Spalding, Mark – The Nature Conservancy
Thomson, Alex – University of Technology, Sydney
Trevathan-Tackett, Stacey – University of Technology, Sydney
van Bochove, Jan-Willem – United Nations Environment Programme, World Conservation Monitoring Programme

Funding and Supporting Organizations

Walton Family Foundation, NASA, Waterloo Foundation, AusAid, UTS, Government of NSW (OEH), WWF Australia, Fondation Total, Conservation International, IUCN, IOC-UNESCO

The International Blue Carbon Initiative Scientific Workshop participants at the University of Technology, Sydney. May 15, 2013. Photo courtesy of CI.

Theme 1 – Carbon distribution mapping and modelling: Challenges and priorities

Presentations:

Introduction to carbon in Australian seagrasses
Dr. Peter Ralph (*University of Technology Sydney*) provided an overview of Australia's blue carbon resources, which include the most extensive area of seagrasses globally, as well as extensive mangrove and salt marsh. Dr. Ralph also introduced the Coastal Carbon Cluster - a collaboration of eight Australian research institutes – which aims to draw together new and existing data and insights of Australia's blue carbon resources.

Remote sensing of seagrass using multiple data sources
Dr. Chris Roelfsema (*University of Queensland*) presented an overview of seagrass mapping approaches, including field methods (e.g. georeferenced photo transects; Automated Underwater Video; snorkelling) and a range of remote sensing tools, including case studies from Moreton Bay (Australia), Solomon Islands and Indonesia.

Seagrass distribution across Brazilian coast
Dr. Margareth da Silva Copertino (*Fundaçao Universidade Federal do Rio Grande*) described the distribution of blue carbon habitats throughout South America, with a focus on the seagrass distribution of Brazil. A literature reviews calculated a seagrass area of >170,000 ha around the continent, with over 30,000 ha in Brazil alone. Further studies are required to improve these estimations and promote seagrass protection.

Mapping carbon stocks in salt marshes of Maine, USA
Dr. Beverly Johnson (*Bates College*) described a project investigating carbon density across a tidal marsh using a combination of simple stratigraphy, field data and GIS interpolation. This study has allowed for the first estimates of salt marsh blue carbon stocks in Maine to be quantified.

Northern Australia seagrass – how to estimate mobile small species over massive areas
Dr. Michael Rasheed (*James Cook University*) described the seagrass of the Australian tropics, deriving information from a combination of broad- and fine- scale mapping projects. The region represents a globally significant seagrass extent, however little is currently known of the fate of seagrass production or the extent of seagrass in neighbouring countries such as Papua New Guinea.

Distribution and dynamics of mangrove forests of the world using earth observation satellite data
Dr. Chandra Giri (*United States Geological Surve*y) described the methods and results of satellite mapping of global mangrove distribution. Results show that over 75% of the world's mangrove is located within the top 15 ranked countries. Regular mapping (every five years) and a historical analysis of mangrove distribution going back to the 1970s are planned as a continuation of the global mangrove mapping project.

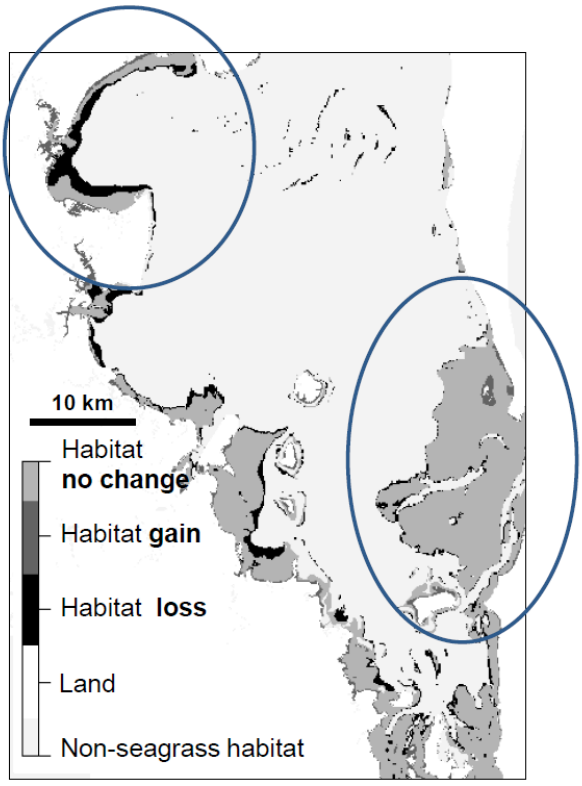
Global-scale modelling of blue carbon in mangroves

Mark Spalding (*The Nature Conservancy*) described the methods and results of a global scale modelling approach to quantify blue carbon in mangrove forests. The model combines above-ground biomass data from over 90 studies with a global climate model (BIOCLIM) to identify mangrove hotspots.

Seagrass distribution and carbon budget using a process-driven model
Dr. Mark Baird (*CSIRO*) presented an overview of a modelling platform incorporating hydrodynamic, sediment and biogeochemical models which has been adapted to determine seagrass distribution and benthic ecology.

Carbon accretion/movement within the river estuary system; where does all the carbon end up?
Dr. Barbara Robson (*CSIRO*) described the important processes of rivers and estuaries in the carbon cycle. A case study of the Ord River of north-western Australia was used to highlight the importance of different functional zones within the river-estuarine continuum.

Modelling of seagrass distributions with sea level rise
Dr Megan Saunders (*University of Queensland)* presented the findings of a study which combined a seagrass distribution model (informed by field data) and an inundation model. Results suggest up to 17% of seagrass would be lost within the study area under a 1.1m sea-level rise scenario. The study also identified the opportunity to mitigate local stressors (e.g. water quality) in order to offset such loses.



Effect of predicted 1.1 m sea level rise by 2100 on distribution and abundance of seagrass in Moreton Bay, Southeast Queensland, Australia. Change in distribution of seagrass suitable habitat, indicating areas of seagrass habitat present in 2000 at risk of loss by 2100, new habitat gained in 2100, and areas of no change between 2000 and 2100.

(Adapted from: Saunders MI, Leon J, Phinn SR, Callaghan DP, O'Brien KR, Roelfsema CM, Lovelock CE, Lyons MB, Mumby PJ (2013) Coastal retreat and improved water quality mitigate losses of seagrass from sea level rise. Global Change Biology
DOI: 10.1111/gcb.12218)

Update on salt marsh accretion model
Dr. James Morris (*University of South Carolina*) updated the working group on a methane emissions sub-model for American salt marshes, utilising TOPEX tidal data. A key conclusion from the model is the importance of methane emissions in microtidal estuaries,

where methane emissions are expected to surpass carbon sequestration with accelerating sea-level rise over the next century.

Compiling global salt marsh distributions
Jan-Willem van Bochove (*UNEP-WCMC*) provided an overview of efforts to compile a global salt marsh distribution map, bringing together and validating diverse datasets. The UNEP project also aims to provide a tablet-based tool for contributing new data to the map, an expert forum for discussion and to make information available online (http://data.unep-wcmc.org).

Discussion: Carbon distribution mapping and modelling challenges and priorities

Discussion focused on the needs and challenges of mapping. It was identified that different scales of mapping may be appropriate for different purposes. Policy makers are more likely to need a broader picture of how much carbon is stored, and what that might mean in financial terms across a large area. Market-based tools are likely to need very fine-scale information.

At the broad scale the quantification of salt marsh, seagrass and mangrove habitat, and their contribution to carbon stores are a major priority despite the challenges involved. There is also a need to translate the science of mapping and modelling science of blue carbon habitat to policy makers. Tools to monitor and map habitats need to be established, and may need to be simplified, to make the data more accessible and easier to understand.

Opportunities for incorporating or stacking blue carbon financial values, along with associated ecosystem service values into maps and models will make the argument for conservation of these habitats more clear and exciting.

The Blue Carbon Scientific Working Group at Towra Point Nature Reserve in Botany Bay, Australia. ©CI/photo by Sarah Hoyt.

Theme 2 – Recent research and developments: Challenges using proxies

Presentations:

Restoration of seagrass carbon sinks
Dr. Núria Marbà (*Research Council of Spain at the Mediterranean Institute for Advanced Studies*) presented the methods and results of a modelling study which was validated with data from a long-term seagrass revegetation site in Western Australia. The results showed that seagrass may revegetate areas rapidly, and that significant amounts of carbon can be sequestered by revegetation.

Coring dating of seagrass sediments; strengths and weaknesses
Dr. Oscar Serrano (*Edith Cowan University*) described seagrass soils, with an emphasis on mat-like substrates which are high in organic matter. A variety of coring methods, and their relative strengths and weaknesses were also presented. Comparison of accretion and plant decay rates across a number of species highlighted the variability of the carbon dynamics of seagrass meadows.

Advances in paleo proxy of seagrass blue carbon
Dr. Peter Macreadie (*University of Technology Sydney*) outlined the importance of paleoecological methods to blue carbon research and provided an overview of relevant geomorphological, lithological and biological proxies. Case studies from the New South Wales coast highlighted the use of such proxies to demonstrate the influence of human impact and climate change on blue carbon resources.

Discussion: Challenges with using proxies

The importance of proxies was discussed in terms of calculating carbon storage, showing disturbance over time, and indicating the permanence of C. Geomorphological information and proxies are important for choosing coring sites, as well as in interpreting processes and variability and are an important compliment to biological proxies, including biomass measurements. Defining an appropriate depth to sample to is a challenge and will depend upon the time frame the research is looking at. A one metre depth has been used as a guideline to include the carbon which may be most susceptible to loss.

The fate of seagrass wrack and its relative importance to stored carbon across different systems was also discussed.

Theme 3 – International and Australian blue carbon initiatives

Presentations:

Carbon in coastal ecosystems: Scientific overview
Dr. Stephen Crooks (*ESA-PWA)* presented an overview of the current needs of blue carbon science. Case studies highlighted the significance of emissions from drained and degraded wetlands. The priorities identified for science are data collection, methodologies and reference levels for monitoring emissions and demonstrations / pilot policy projects.

International Blue Carbon Initiative
Dr. Emily Pidgeon (*Conservation International*) provided a history of the Blue Carbon Initiative and an outline of the challenges facing coastal ecosystems. The Initiative aims to increase recognition of the mitigation value of blue carbon habitats, improve their management and regulation and provide the basis for conservation and restoration incentives.

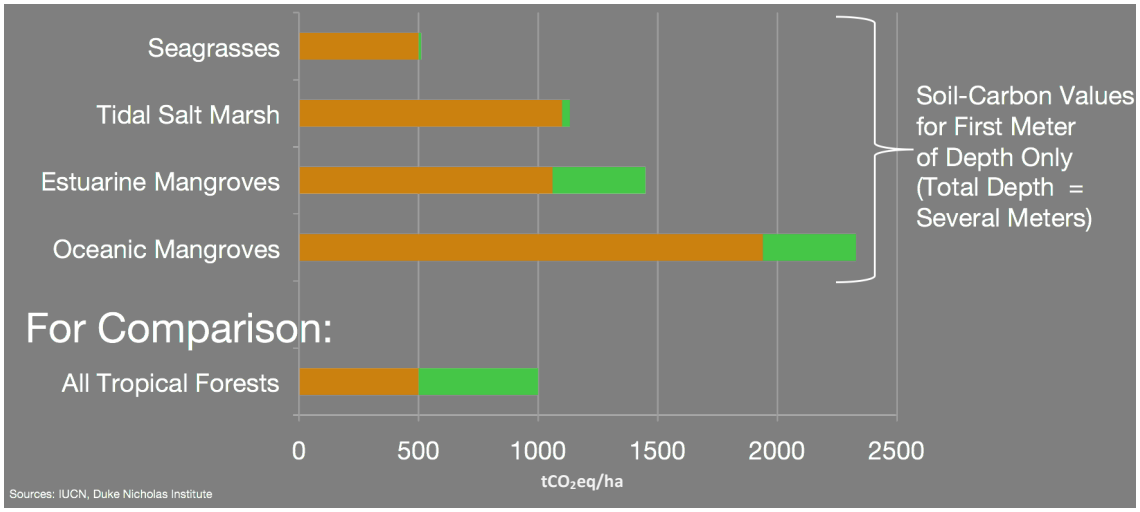
Blue Carbon and the Intergovernmental Panel on Climate Change (IPCC)
Dr. Hilary Kennedy (*University of Bangor)* outlined the importance of greenhouse gas emission inventories and the increasing attention given to wetlands under IPCC guidelines. A new draft supplement specific to wetlands provides guidelines for wetland emissions, which will likely be adopted by the IPCC in October 2013. Representatives of the Blue Carbon Scientific Working Group form part of the authorship of the draft supplement.

The economics of blue carbon
Dr. Brian Murray (*Duke University)* provided a remote presentation explaining the economics of blue carbon. While estimates of ecosystem service values of coastal habitats have been recognised, the problem is that schemes and institutions to administer such incentives are not full considering carbon from coastal systems or other ecosystems services. Payments, or incentives, for blue carbon may come from UNFCCC, voluntary carbon markets or corporate social responsibility.

Overview of blue carbon in the United Nations Framework Convention on Climate Change (UNFCCC)

Dorothée Herr (*International Union for Conservation of Nature*) outlined the role of UNFCCC in the sustainable management, conservation and enhancement of sinks and reservoirs of greenhouse gases. The opportunities to link blue carbon to existing policy and finance mechanisms (including UNFCCC mechanisms such as REDD+) were discussed in the context of global strategies, national implementation and ongoing technical discussions.

Opportunities for blue carbon in Australian coastal policy and management
Anissa Lawrence (*Tierramar Consulting*) presented an overview of the diversity and extent of blue carbon habitats in Australia and the opportunities for their management through on-ground efforts and policy mechanisms. Key recommendations include the prioritisation of restoration opportunities, engagement of recreational and corporate sectors and setting a timetable for integrating blue carbon ecosystems into national climate initiatives, such as the Carbon Farming Initiative.



Global averages for carbon pools (soil organic carbon and living biomass) of focal coastal habitats. Tropical forests are included for comparison. Only the top meter of soil is included in the soil carbon estimates (Source: Nicholas Institute, 2011. Green Payments for Blue Carbon Economic Incentives for Protecting Threatened Coastal Habitats)

Discussion: What should the State of New South Wales do?

Blue carbon opportunities for the State of New South Wales were discussed across four key areas: science, policy, operations and communications.

The major role identified for science is the implementation of a well-defined restoration demonstration project. Such a project should provide high quality baseline information which can be used to demonstrate carbon benefits over a well-defined time series. Operational considerations include the importance of prioritising potential demonstration sites in order to get the greatest benefit, and the importance of effective communication and patience in the process. Regarding communications, the scientific output of such a project(s) needs to be broadly applicable and communicated globally.

Policy discussions identified the importance of dynamic policy mechanisms (e.g. in relation to coastal squeeze), the need for a risk assessment of the vulnerability of coastal conservation areas to sea-level rise and the issue of mangrove/ salt marsh dynamics in NSW. The importance of policy implementation at the appropriate level (e.g. State versus local government) and the opportunity to incorporate blue carbon into national mechanisms such as Australia's Carbon Farming Initiative were also discussed.

Theme 4 – Blue carbon in the Coral Triangle

Presentations:

Mangrove research and conservation in Coral Triangle countries
Dr. Jurgenne Primavera (*Pew Fellow in Marine Conservation, Philippines*) outlined the recent history of mangrove plantation efforts in the Philippines and the challenges involved, such as species selection and planting within appropriate areas in the tidal range. The importance of engaging local government, communities and students, as well as the role of resources and marketing materials presented in local dialects were discussed.

Blue Carbon in Action: Its potential application as one tool to improve natural resource management at Tanjung Panjang (Gorontalo Province, Sulawesi, Indonesia)
Dr. Clint Cameron (*Charles Darwin University)* discussed the management opportunities in a region where *tambak* (fish/shrimp pond) farming is prevalent and mangrove deforestation for new tambak construction continues. Restoring hydrology was identified as an important first step in restoration, allowing for natural revegetation to occur. The importance of underpinning efforts by capacity building (education) and sustainable livelihoods development was emphasised.

Gaps and challenges in seagrass knowledge and management in Coral Triangle countries
Dr. Miquel Fortes (*University of the Philippines)* presented a 'state of the knowledge' regarding South East Asian seagrass. Despite the accepted importance of the ecosystem, seagrass research remains deficient, and is generally a slow, 'reactive' response to issues and global concerns. Mechanisms required to address the gaps include regional and national inventories, predictions of future change and the communication of research in an effective manner.

Carbon loss from degraded seagrass sites
Pemika Apichanangkool (*University of Technology Sydney*) outlined the methods and preliminary results of a study comparing blue carbon sink capacity in pristine and degraded tropical seagrass sites. A combination of sediment analyses and benthic net production measurements suggest seagrass degradation results in a loss in gross primary production and reduce the capacity of sediment to store organic carbon.

Indonesian Blue Carbon Program
Dr. Tonny Wagey (*Arafura and Timor Seas Ecosystem Action)* presented an overview of blue carbon initiatives in Indonesia, including data collection from focus sites in Banten Bay, Derawan Islands and Bali. Future steps include the development of a National Plan of Action for Blue Carbon, further engagement in national and international programs and an expansion of focus sites across Indonesia.

Mangrove ecosystem services and payments for blue carbon in Solomon Islands
Dr. Joelle Albert (*WorldFish*) presented a study of mangrove ecosystem services, which combined analysis of the governance of mangroves in the Solomon Islands and the goods and services they provide, including a quantification of mangrove C stocks. The future management of mangroves and their ecosystem services requires an emphasis on community awareness and incentive, as well as the role of science.

Strategic breaching of a dike wall in an extensive shrimp pond, Tiwoho Village, North Sulawesi Indonesia. (Source: Yayasan Kelola, MAP-Indonesia and PhD. Rignolda Djamaludin)

Discussion: Priorities and opportunities for blue carbon in the Coral Triangle

The current status of blue carbon initiatives in the region was discussed. It was recognised that the situation and needs varies from country to country in the region. Overall, the Coral Triangle has seen a number of blue carbon success stories, with projects driven by efforts within the country generally being the most successful. The most effective role for outsiders is in providing assistance for the people and organisations within the country.

Discussions of the Indonesian experience highlighted the high-level political support for blue carbon initiatives. Dr. Tonny Wagey introduced the Blue Carbon in the Coral Triangle report, with the recommendation that such a report be translated into local languages, with local flavour, and taken to policy makers.

The prospect of introducing blue carbon through existing initiatives was discussed. There is an opportunity to introduce blue carbon into the Coral Triangle Initiative as part of that group's region-wide action plan and scientific working group members were implored to promote this opportunity through their regional networks. Arguments were also made for the introduction of blue carbon into the UNFCCC REDD framework, and for international scientists to work towards tools which support blue carbon in regions such as the Coral Triangle.

Other Issues Discussed

Blue Carbon Field Manual

Maciej Telszewski described current progress on the working group product: Coastal Blue Carbon Field Manual: Methods for Assessing Carbon Stocks and Emissions Factors in Mangroves, Tidal Marshes and Seagrasses. To date the main authors of the manual have been Boone Kauffman, Cath Lovelock and Dan Alongi, Núria Marbà, Peter Ralph, Jim Fourqurean, Hilary Kennedy, Pat Megonigal, Steve Crooks, Bev Johnson, Neil Saintilan, Chandra Giri, Emily Pidgeon, Sarah Hoyt and Maciej Telszewski. The manual was recently sent to the working group members for review and additions.

The intended audience for the manual is technically able non-specialists including Master's level academics/technicians. The objectives of the manual are to enable the audience to be able to (1) Assess the carbon stock in a Blue Carbon ecosystem and (2) estimate change in carbon over time. The manual is NOT a Blue Carbon textbook or a guidebook to Blue Carbon economic/market evaluation. The main sections of the manual are as follows:

Chapter 1 provides introduction to the document and background knowledge of the blue carbon ecosystems and their importance with regards to climate change mitigation
Chapter 2 provides guidance on the types of carbon pools in blue carbon ecosystems, describes procedures for field sampling and lab analysis (common to all ecosystems)
Chapter 3 provides details of the procedures recommended specifically to assess the carbon stocks in each of the component pools for mangroves, tidal salt marshes and seagrass ecosystems.
Chapter 4 considers methods for determining the change in carbon stocks, including methods for measuring carbon fluxes
Chapter 5 describes the remote sensing methods for estimating ecosystem areas and changes in land cover.
Chapter 6 provides tiered recommendations on specific parameters to be measured and guidance on managing and reporting carbon stock data.
Chapter 7 deals with reporting of the results and basic error analysis.
Chapter 8 discusses emissions factors associated with anthropogenic degradation, removal, restoration and afforestation of coastal marine ecosystems.
Chapter 9 describes methods for assessing methane and nitrous oxide emissions
References
Glossary

All comments and reviews should be submitted by 30th June. Please review for compatibility with other important documents (eg the IPCC guidelines). Colleagues from outside the WG willing to contribute are more than welcome to do so (please send names to us). Full credit and attribution will be given to all authors and contributors. A final working group draft with comments integrated into the text is anticipated by August and we hope to publish the Manual by the end of the year.

Next Working Group meeting: to be hosted by IOC-UNESCO at the UNESCO offices in Paris, France. Dates to be confirmed by late October to early November.

Ponlachart Chotikarn of the University of Technology, Sydney explains the Eddy covariance system to members of the Blue Carbon Initiative Scientific Working Group. (From left to right: Ponlachart Chotikarn, Miguel Fortes, Emily Pidgeon, Mark Spalding, Stephen Crooks, Maciej Telszewski). ©CI/photo by Sarah Hoyt