The Carbon Institute



International Advisory Panel Recommendations and Advice

March 2017

Supported by:



Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety



based on a decision of the German Bundestag



The Carbon Institute partners are:









The **Greenhouse Gas Management Institute (GHGMI)** was founded in response to the current and future needs for qualified professionals to actively engage reversing the causes of climate change. GHGMI develops technically rigorous GHG training curricula authored and instructed by leading experts and delivered globally via a "low carbon" e-learning portal, combined with onsite workshops, and other special programs such as The Carbon Institute.

The **Centre for Climate Risk and Opportunity Management for Southeast Asia and Pacific** (CCROM-SEAP) has been an important academic asset for Indonesia, providing support for national GHG inventories, REDD+ reference levels, training, and policy-science interface. As a centre within Bogor Agricultural University (IPB), CCROM has experience in integrating academic programs with national and sub-national REDD+.

The Forest Carbon Accounting and Monitoring Centre of the State Forestry Administration (SFA) develops personnel and products to inform and assist the People's Republic of China (PRC) to implement forest greenhouse gas inventories and provide REDD+ technical components. FCAMC conducts TCArelated training programs, on subjects including forest ecosystem inventory methods and the IPCC Guidelines for National Greenhouse Gas Inventories, among many other subjects.

The **Regional Center of Special Training in Agriculture, Forestry and Wood (CRESA Forêt-Bois)** is a Central African regional institute for masters-level education in environmental fields, including natural resource management and climate change. CRESA is the focal partner for The Carbon Institute's pioneering regional hub model for excellence in terrestrial carbon accounting in Africa. CRESA is housed in the Faculty of Agronomy and Agricultural Sciences, of the University of Dschang, Cameroon.



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Dear Colleagues,

As an atmospheric scientist and the director of the Scripps CO_2 program, I am acutely aware of how countries need more specific, higher-resolution data on their greenhouse gas emissions to be able to participate in the fight against climate change.

My professional life has been defined by the measurement of atmospheric gases, particularly the continuation of my father's work monitoring the steady increase of carbon dioxide (CO₂) in the atmosphere, captured in the "Keeling Curve." Our atmosphere now contains more than 400 parts per million of carbon dioxide, against preindustrial level of about 280 parts per million. To successfully mitigate climate change, we need to "bend" this curve to slow or stop the growth.

The CO₂ rise is a simple objective truth. Bending the curve, in contrast, is a complex task, requiring human decision-making via policy tools such as countries' greenhouse gas inventories that enable planning and development decisions to reduce greenhouse gas emissions.

An important sector for emissions reductions is forestry and land use, which has the greatest uncertainty of any aspect of the global carbon cycle. To reduce emissions in this sector, it will be critical to expand the workforce of skilled professionals who are trained to maintain high data standards in land use metrics, perform key analyses such as establishing baselines, and effectively communicate results to decision makers. This need must be addressed at national and subnational levels.

The Carbon Institute is designed to fulfill this need via the development of cooperative training for government and academics to reduce the uncertainty in the land use sector. The Carbon Institute envisions catalyzing this process by creating professional development courses that offer Certificates in Terrestrial Carbon Accounting, tailored to the countries in which they are run, while maintaining world class teaching standards

As a first step, The Carbon Institute convened an International Advisory Panel in September 2016, which I was proud to chair. This panel included individuals with high-level government experience, capacity-building experts, and forest carbon technicians from seven different countries.

The panel's main charge was to answer the following questions: How can these Certificate programs address practical government needs and priorities in their training? What are the components of a world-class terrestrial carbon accounting training program that adds value for governments beyond existing the existing carbon accounting academic offerings? How can carbon accounting be taught to help reconcile the global carbon budget reconcile with the realities of development on the ground?

This report contains our recommendations, which we offer with the hope of spearheading a process to develop world-class academic programs that can empower stronger climate change decision-making in China, Indonesia, and worldwide.

Sincerely,

Julyla J. Neelins

Dr. Ralph Keeling Program Director, Scripps CO₂ Program



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Background

Countries have stated ambitions to reduce greenhouse gas emissions. Yet most countries lack the capacity to aggressively implement and track emissions reductions. Quality reporting under the Paris Agreement will require an exponential increase in human capacity to measure carbon fluxes, carbon stocks, and the effectiveness of mitigation actions. The forest and land-use change sector has the highest degree of carbon accounting uncertainty of all sectors, due to the inherent complexities of ecosystem-based storage, emissions and sequestration.

The Carbon Institute seeks to bridge the gap between country ambitions and the technical capacities for reducing emissions in the forestry sector. The Carbon Institute is an international partnership developing high-quality academic programs in advanced, applied Terrestrial Carbon Accounting (TCA) with government input, for government purposes. The Carbon Institute is a partnership between the Greenhouse Gas Management Institute (GHGMI) in the United States, the Forest Carbon Accounting and Monitoring Center (FCAMC) in China, and the Centre for Climate Risk and Opportunity Management for Southeast Asia and Pacific (CCROM-SEAP) in Indonesia, and CRESA Forêt-Bois in Cameron. The goal of The Carbon Institute is to empower countries with the human capital and tools needed to fulfill mitigation pledges, reduce uncertainty estimates, access results-based finance, and increase mitigation ambition.

Under a generous grant from the German Federal Ministry for the Environment, Nature Conservation, Building, and Nuclear Safety (BMUB), The Carbon Institute is building TCA programs in China and Indonesia. Under a separate grant, the United States Forest Service is helping The Carbon Institute build a West African regional hub of excellence for TCA in Cameroon.

In September 2016, The Carbon Institute convened a ten-person International Advisory Panel to provide advice on how to build and teach the highest quality curriculum that is tailored to national circumstances. Advice was also sought on how to leverage the strength of international academic partnerships to achieve the biggest possible impact.

The panel provided recommendations in four broad categories:

- 1. Endorsement and blessing
- 2. Curriculum recommendations
- 3. Program design and recruitment
- 4. Implementation of the Paris Agreement

The eleven specific recommendations and guidance are articulated in the pages below.



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Abbreviations

AFIP	Academy of Forest Inventory and Planning, China
AFOLU	Agriculture, Forestry, and Other Land Use
BMUB	German Federal Ministry for the Environment, Nature Conservation, Building, and Nuclear Safety
CCROM-SEAP	Centre for Climate Risk and Opportunity Management for Southeast Asia and Pacific (also known as CCROM), Indonesia
CO ₂	Carbon dioxide
СОР	Conference of the Parties (referring to UNFCCC COPs)
CRESA	Regional Center of Special Training in Agriculture, Forestry and Wood, Cameroon
EFDB	Emission Factor Database
EIA	Environmental Impact Assessments
EP(GHG)	The Environmental Professional Certification on Greenhouse Gases
FCAMC	Forest Carbon Accounting and Monitoring Center, China
FREL	Forest Reference Emission Level
GHG	Greenhouse gas
GHGMI	Greenhouse Gas Management Institute, United States
GIS	Geographic Information Systems
IAP	International Advisory Panel
IKI	International Climate Initiative
INDC	Intended Nationally Determined Contributions
IPB	Institut Pertanian Bogor ("Bogor Agricultural University" in English), Indonesia
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
LULUCF	Land Use, Land Use Change, and Forestry
MRV	Measurement, reporting, and verification
NDC	Nationally Determined Contributions
NGO	Non-governmental organization
PRC	People's Republic of China
REDD+	"Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries," an international policy framework to reduce forest carbon and land-use emissions, particularly through financial incentives
SFA	State Forestry Administration, China
ТСА	Terrestrial Carbon Accounting
ΤCAIAP	Terrestrial Carbon Accounting International Academic Partnership (also known as "The Carbon Institute")
ТСІ	The Carbon Institute
UNFCCC	The United Nations Framework Convention on Climate Change



About The Carbon Institute

The Carbon Institute develops world-class, evidence-based carbon accounting certificate programs with pre-eminent national partners. The aim of The Carbon Institute is to train carbon accounting professionals in government agencies and universities, to ultimately achieve significant and measurable changes in land use related carbon emissions.

Six-Course Framework Includes:

- 1. Science and Policy Context
- 2. Field Methods (developing emission factors)
- 3. 2006 IPCC Guidelines and Land Classification
- 4. Remote Sensing/GIS (generating activity data)
- 5. Statistics for Terrestrial Carbon Accounting
- 6. Analysis and Communication of Results

The Carbon Institute is committed to change making. Using a tested six-course framework, we build certified training programs by partnering with the best agents in national governments and universities. We work in high-impact countries, with the highest potential to reduce emissions from land use change, the most to gain from improved land management under the Paris Agreement, and the political will to use science to change policy. Through respectful engagement throughout the process, we help our partners operate and own their Terrestrial Carbon Accounting Certificate programs to achieve measurable results. The Carbon Institute integrates iterative improvement cycles and impact assessments into all aspects of the programs (curriculum, institutional design, etc.).

Partnerships between China, Indonesia, and the United States

Under a grant provided by the German Federal Ministry for the Environment, Nature Conservation, Building, and Nuclear Safety (BMUB), The Carbon Institute is building strong sustainable academic capacity to teach quality TCA in Indonesia and China. The Carbon Institute leverages a pilot Advanced Certificate in TCA, accredited initially at the University of California



San Diego in 2013, to guide development of new professional certificate programs in China and Indonesia. The first certificate courses in China and Indonesia will be run in 2018. The Carbon Institute partnership will generate 240 Terrestrial Carbon Accounting course-certificates in China and Indonesia before 2020.



Recommendations

The International Advisory Panel Mandate

In September 2016, The Carbon Institute convened ten advisory panel members from seven countries, along with ten staff from Carbon Institute organizations in China, Indonesia, and the United States. The panel met with the mandate to provide high-level guidance to The Carbon Institute on:

- 1. Ensuring the highest quality Terrestrial Carbon Accounting (TCA) certificate curriculums.
- 2. Thinking creatively so these TCA certificates have the biggest impact in the real world.
- 3. Developing new ideas for working together across national borders.
- **4.** Providing advice on academic-government partnerships, knowledge sharing, and measuring our impacts.

The panel was encouraged to provide specific recommendations and to challenge The Carbon Institute partners to achieve a new level of quality in measuring to manage terrestrial carbon. The key recommendations of the panel are summarized in the pages that follow.



1. Endorsement and Blessing

Recommendation 1: Engage government at multiple levels in course design

From the outset, our discussion for building strong academic programs in TCA programs reiterated the importance of designing carbon accounting certificates that address government needs

and are developed with iterative government input. Panel members noted that the ultimate task of carbon accounting is to meet the government demand, and this requires engaging with and circling back to key government decision makers.

This type of iterative engagement with government includes:

- **1.** Tailoring curriculum to government needs and priorities
- 2. Building programs to fit government scheduling and budgetary constraints
- **3.** Ensuring that issues with government data are known and addressed
- **4.** Developing useful case studies and projects appropriate for government audiences
- 5. Having a clear and evolving picture of the target audience
- 6. Government financing for the course



The Carbon Institute Knowledge Manager, Molly White, in the recently burned Big Sur Land Trust Mitteldorf property.

Beyond engagement with the most obvious national government ministry (e.g., ministries of the environment and forestry), the panel advised engaging other ministries (ministries of agriculture, ministries of planning, ministries of education), as well as local and provincial governments. Developing strong relationships with staff currently doing forest carbon accounting will be beneficial, as well as working with higher-level decision makers who oversee the carbon accounting outputs.

Throughout this process, the advisory panel reiterated the importance getting formal endorsements from governments. Many panel members underscored that this is the single most essential step to make TCA capacity building sustainable and practically useful. They emphasized intentional approaches, encouraging The Carbon Institute to build government involvement and buy-in as a central aspect of the program design.



Partners: Government Input in Context

Partners and panel members from China and Indonesia had specific thoughts on how to apply advice on government input to their national context.

Partners with the State Forestry Administration in China emphasized that it may be best to begin by focusing on forestry and secondarily wetlands, rather than moving into all sectors and landuse types at once. This is a critical moment in time for becoming involved in training, they noted, due to the launching of the Chinese carbon markets and the government's effort to establish carbon accounting rules. As such, there is broad government need for understanding greenhouse gas (GHG) estimation and reporting concepts. There is particular need with regards to the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories.

Partners with CCROM in Indonesia emphasized the importance of gaining input from sectors beyond forestry, as different islands have different sectors that are the most important to work with (e.g., agriculture in Java). Alongside the Ministry of Environment and Forestry and the Ministry of Agriculture this includes government units such as the National Planning Commission and the Centre for Education and Training. Collaboration with local, provincial, and state governments is equally important. Engaging with subnational government entities should include explanations that emphasize how the TCA certificate will help them with reporting requirements for Nationally Determined Contributions (NDCs) and Forest Reference Emission Levels (FRELs).

In articulating the academic-government relationship, the panel framed the TCA certificate programs as "applied academic initiatives" that get government and universities to better work together. The courses in Policy Context and the Communication and Analysis of Results were identified as being central to this collaboration. Further, government involvement in the design of the Communication of Results course was seen as being particularly important.

Recommendation 2: Broadening stakeholder involvement

While governments are the main "client" of the TCA programs, most panel members felt consultations with non-governmental organizations and the private sector to be essential.

Reasons for broadening stakeholder involvement:

- Enhance capacities across an entire country
- Expand potential audience and the impact of the TCA program
- Independent market which is supplementary to a government market

Panel members expressed opinions on how heavily to get input from and train individuals in NGOs, civil society, and the private sector. Some members felt broad stakeholder involvement is key to push mitigation. Some panel members felt engaging multiple universities might reduce territoriality between institutions. Some panel members emphasized the need to hone in on one target audience specifically, focusing on the most important training-of-trainer learners within government institutions.



2. Curriculum Recommendations

Recommendation 3: Comprehensively address TCA competencies

In 2013, The Carbon Institute developed a course framework for comprehensive instruction in TCA, drawing on input from global experts across the REDD+ space.

These six subjects identified by the global experts as key to *comprehensive* training were:

- 1. Science and Policy Context
- 2. Field methods (developing emission factors)
- 3. 2006 IPCC Guidelines and Land Classification
- 4. Remote sensing/GIS (generating activity data)
- 5. Statistics for Terrestrial Carbon Accounting
- 6. Analysis and Communication of Results

The Carbon Institute is now adapting this comprehensive TCA curriculum to national contexts and priorities. By co-developing the courses with government stakeholders, the national curricula will

establish competencies in learners that directly address government needs.

Across the board, the panel emphasized that the TCA certificates be built with good practice pedagogy and focus on rigorous learning outcomes to ensure learner competencies. The panel encouraged The Carbon Institute to prioritize active learning and project-based structure, as subjects like GIS and statistics require hands-on experience.

The panel members suggested particular curricular emphases within the six-course framework. The course on the



Dr. Ralph Keeling and Mr. Manuel Pulgar-Vidal on the campus of the Scripps Institution of Oceanography, the site of the International Advisory Panel meetings.

Analysis and Communication of Results was given substantial weight by the panel. This skill set is highly important for governments, and a major gap in existing technical capacities. Those panel members involved with academia generally agreed that GIS, field methods, and statistics are already well-taught at the university level. However, they need to be integrated for Terrestrial Carbon Accounting applications. All panel members noted there is minimal instruction in the use of the IPCC Guidelines, particularly the 2006 Guidelines.

Presentations by the partners emphasized the importance of particular subject areas within their institutions. Partners in China and Indonesia emphasized that while statistics is already taught, existing statistics courses do not use GHG applications, and that existing carbon accounting tends to be weak in uncertainty analysis methods.



In the discussions that followed, several distinct emphases arose for China and Indonesia. In China, existing statistics educational capacity should be supplemented with a focus on TCA uncertainty analysis and error propagation of uncertainties. Insofar as the IPCC and field methods curriculum focus on particular land use categories, it is best to focus primarily on forest and wetlands, and to later expand this to other land uses such as the agricultural sector. It was also noted that requiring prerequisites for the TCA certificate will allow more advanced trainings in statistics and IPCC methods.

In Indonesia, documenting the learning outcomes is crucial to attract clients. The TCA training should be based on expected competencies and skills that will be developed. Incorporating specific local contexts will convince local stakeholders to send more trainees. Including standardized formats needed for reporting to the UNFCCC or to national agencies (e.g., institutional arrangements), as part of the curriculum will increase the perceived value of the TCA program, especially for subnational government institutions.

Recommendation 4: Leverage existing materials and structures

The panel advised using existing curricula, complementing and extrapolating from existing courses, rather than replicating what already exists. Several panel members agreed that the TCA-relevant training available tends to be either very basic or very specific. The challenge is to create a comprehensive program that fits the suite of government needs for LULUCF carbon accounting.

The panel concurred that existing materials by GHGMI, CCROM, and FCAMC should be leveraged. Discussions highlighted GHGMI's development of the onOline courses on the 2006 IPCC Guidelines and the extensive member network services for professional development. A strong suggestion was to combine on-line and in-class "hybrid" training, especially for IPCC methods. The panel emphasized that learners could employ the GHGMI IPCC courses as a possible textbook or tool. The panel encouraged The Carbon Institute to build off existing GHGMI curriculum on the fundamentals of good data management systems, quality assurance/quality control, and existing exercises on how to use the IPCC Emission Factor Database (EFDB). Similarly, panel members suggested that member services already offered by GHGMI should be leveraged for The Carbon Institute (e.g., alumni networks).

The panel advised mapping programming onto structures and programs at IPB and SFA to build the strongest program with existing resources. For example, Indonesia's environmental impact assessment training and China's annual monitoring training were identified as good case studies for integrating training sustainably into an academic-government partnership.



Recommendation 5: Adapt to national priorities and the changing international context

The panel advised The Carbon Institute to ensure all curricula are adaptable, in order to remain useful to governments. Because international climate change policy negotiations are ongoing, TCA curriculum must keep pace with the changes to maintain relevance.

Course Area	Expected Cause of Updates
Policy Context	Subject matter will develop and change nationally and internationally, based on changes within the UNFCCC and in national and subnational policies.
Remote Sensing/GIS	Remote sensing guidance will be included in the 2019 refinement of the 2006 IPCC guidelines. New technologies and tools will emerge.
2006 IPCC Guidelines	2019 Refinement of the 2006 IPCC Guidelines.
Analysis and Communication of Results	Dependent on the progress of international negotiations, requirements for tracking NDCs, using carbon accounting to attract finance, other reporting around LULUCF mitigation.

Examples of expected updates required within the six course areas:

The panel members provided advice for how to best adapt the comprehensive TCA curriculum to be nationally specific. Case studies are an essential means of capturing local, national, and regional context. These cases should be integrated throughout the course materials, and should include context, decision-making processes, and the pros and cons of these approaches.

To ensure that the TCA programs are the most relevant for a country's context, the panel emphasized that they must be *immediately useful* to governments. This includes national policy applications as well as the international context of the Paris Agreement's reporting, Global Stocktake, and higher mitigation ambitions for future Nationally Determined Contributions. The use of real data for learner projects was described as top objective, as this allows government data to get processed essentially for free by participants.



Recommendation 6: Develop expert judgment by including principles and meta-guidance

Some panel members emphasized that subject matter should include principles and general guidance in addition to hard and fast methods.

The panel noted that GHG inventories are ultimately a human-built policy endeavor, rather than purely scientific. As such, TCA also involves sometimes less scientific approaches, such as adjustment factors in REDD+ reference level accounting. To prepare learners for these realities, a comprehensive TCA program should teach principles and rules about how to deal with policy assumptions and qualitative information in contrast to "measured" information.

In general, the panel emphasized, it is important to teach not only the techniques but also the guidance that will train the learners to "think" like carbon accountants. This includes guidance in: representing data, data sources and data quality, the concept of effort expended versus government needs, and how to make results change behavior, among other areas.

Because carbon accounting is a policy practice that occurs under practical constraints, learners should be taught to identify the benchmarks of "good enough" TCA, addressing questions such as:

> How to ensure sufficient participation and transparency in TCA?

Need for subjective guidance in TCA programs Example: natural disturbances in LULUCF accounting

GHG inventories are not supposed to sum to the full emissions entering the atmosphere but only anthropogenic emissions. This means that emissions from natural disturbances, such as naturally-occurring forest fires or drought, are not always counted towards a country's emissions under IPCC Guidelines for National Greenhouse Gas Inventories. In practice, this requires some degree of subjective decision making or "expert judgment." To teach learners how to adequately estimate emissions from disturbances, and develop this sense of expertise, the curriculum should provide general approaches for taking into account human-induced disturbances and excluding natural disturbances. There is existing guidance development under the Kyoto Protocol for when to include extreme events. This is particularly relevant around questions such as how to conduct accounting for avoided forest fires in Indonesia.

- What level of accuracy is sufficient for different categories?
- What level of precision is needed at minimum to make judgments on differences over time?
- What minimum amount of documentation is needed to make carbon estimates reproducible?

As an example, one panel member explored how integrating *environmental integrity guidance* into Terrestrial Carbon Accounting involves questions that require critical thinking or expert judgment:

- How to avoid negative impacts of mitigation measures on other targets like biodiversity (i.e., considerations of non-carbon benefits)?
- How can mitigation planning be better integrated into land use planning?
- What can be taught about avoiding double counting between project-based and country accounting?



3. Program design and recruitment

Recommendation 7: Consider trainee motivations and professional development

The panel advised The Carbon Institute to carefully consider the varying motivations of potential participants during both course design and marketing. Panel members agreed that the key motivation for most students enrolling in an applied academic certificate course is a desire to advance their careers. As such, participants enrolling in should understand that they have the opportunity to acquire capacities that they cannot gain elsewhere.

The panel encouraged The Carbon Institute to provide resources for learner support beyond the core curriculum. They approved of initial plans for learner support, including the development of alumni and faculty networks to share knowledge. The Carbon Institute "help desk" and a curriculum library are just some ways of sharing knowledge. A brainstorming discussion revolved around additional services that could be provided.

Examples of potential learner support services:

- Career resources such as job listings and resume services
- Market information for alumni (i.e., global market status report)
- Resources to track requirements of industries
- Skill maps
- Internships
- Mentoring services
- Networking events
- Capstone projects
- Professional certification exams similar to Certified Public Accounting or Master of Business Administration where knowledge, competency and work logs are required
- Seek additional funding resources to engage these areas if needed

Panel members and partners stressed the importance of marketing the comparative advantage of The Carbon Institute, such as flexibility in the TCA instruction, nationally tailored curriculum, strong pedagogy, and an international network of instructors. A mapping exercise around the needs and motivations of different stakeholder groups in different countries could be beneficial. A map could form the basis of a marketing action plan. Down the line, several years into the program, the panel predicted, The Carbon Institute may wish to diversify focus depending on government audience and tailor instruction to distinct professions and management.



The panel noted that local government is likely to be a large part of the training audience in both China and Indonesia. As such, the program should be appealing and accessible to local governments. One method for this is developing programs readymade to fit into local government monitoring programs. To scale program reach to local governments a "train-the-trainer" type approach could be explored.

Learner motivations in the Indonesian context: Presidential Regulations Affecting the Provincial and District Levels in Indonesia

For learners in Indonesia, a major motivation to enroll in the TCA program will be Presidential Regulations 62 and 72, and Act 31, which mainline climate action plans and reporting into the work of local governments by requiring all provinces to report.

Because the mandate for preparing the action plan is at the provincial level, not the district level, it is up to the provincial government for knowing how they will implement the action plan. Then, an MRV team at the national level will combine the reports from the provincial level. Local governments will provide much of the basic data. Because of this, local government in GHG inventory preparation will continue increasing each year.

The panel underscored that The Carbon Institute will need to one challenge when training local government. Local government employees frequently change positions and assignments. In Indonesia, when conducting trainings for Environmental Impact Assessments (EIA), if government or private sector actors want to implement an infrastructure project, they must conduct an EIA first. These actors will hire certified consultants to complete the EIAs, who are often selected from rosters of alumni of the certified EIA training programs.

At present, there are differences in how local governments collect data, some following the IPCC methodologies and others using different approaches. At present, the government is developing standardized methodologies for generating activity data (e.g. private-sector peatland regulations). Providing input and teaching standardized methodologies and approaches could lead to universities having the authority to train and even certify participants under the regulations.



Learner motivations in the Chinese context: The Timely Launch of China's National Carbon Market

The Carbon Institute advisory panel meeting included extensive dialogue about the launch of the national Chinese carbon market.

Beginning in 2017, the Chinese government will launch a national carbon market. Currently the forest carbon trade in the provincial markets is quite small, but there is significant potential for growth. In future years, market growth may incentivize professional enrollment in a TCA program.

Until then, the panel recommended focusing primarily on government training but still providing the skills necessary for engaging in the carbon market within curriculum. For example, panel members urged The Carbon Institute to consider how the six comprehensive course areas could be tailored to develop competencies specifically useful for the Chinese carbon market.

As the commercial market develops, the work of the SFA will continue to expand, and there will be an increasing need for government carbon specialists. One panel member noted that the potential target audience for advanced TCA training includes over ten thousand professionals working in forest management with graduate or post-graduate degrees. These individuals are generally familiar with GIS and forest measurement, but will need particular support in statistics and carbon accounting guidance. Other future course participants could include national carbon market verifiers, project developers, landowners, or private-sector professionals looking to broaden their skills.

Recommendation 8: Aim for international recognition and accreditation

Developing international recognition by building excellent nationally tailored certificates with common curriculum and faculty certification will help ensure global best practices. Where possible, the training-of-trainers model may be an effective means of building positive recognition and accreditation.

The panel discussed numerous possibilities for developing an international recognition, which include:

- Expand the geographic coverage of TCA programs to reach a critical mass of countries. If other regions had TCA programs peer-to-peer learning could increase through international exchange among programs. Latin America was suggested as a good place to develop partnerships due to high land use emissions.
- **2.** Explore relationships with reputable international organizations. For example, the UNFCCC, the IPCC, and international development banks.



- **3.** Explore the possibility for international accreditation (e.g. ISO). Accreditation could further formalize recognition that would further encourage programmatic excellence.
- **4.** "Actions speak louder than words." Pursue data-driven approaches to track alumni careers and real-life applications of TCA skills. Additionally, consider whether it is possible to show improvement of GHG inventories and reference levels, declines in uncertainty, declines in emissions, and/or mitigation analysis quality and ambition as a function of TCA training.

The panel members strongly emphasized that TCA programs could demonstrate their efficacy and if the learning outcomes could definitively link to quantitative decreases in the uncertainty of GHG emission estimates.

The panel advised The Carbon Institute to develop not only strong programs for their own sake, but to also engage in work that can set a *de facto* international standard for Terrestrial Carbon Accounting skills.

Partners and Advisors from Bogor Agricultural University in Keeling Lab. From left to right: RIzaldi Boer, Muhammad Ardiansyah, Ralph Keeling, Yonny





4. Implementation of the Paris Agreement

Recommendation 9: Engage in curating data

The panel briefly discussed questions related to curating data. Panel members underscored the use of real data as a means to excel beyond current capacity building programs. This concept describes a program that uses real data within training, so as to provide real outputs useful to governments.

The panel noted that developing and maintaining quality datasets is the first challenge to landuse carbon accounting. As such, the panel brainstormed several ways the program could simultaneously support data management and improvement efforts, including:

- Curate data and management through course examples
- Increase focus on IPCC guidance on data management practices
- Identify examples which could "loop back" to reporting needs of country
- Teach the use of, and provide output to the IPCC Emission Factor Database (EFDB)

Recommendation 10: Consider the role of verification

The panel advised us to thoughtfully consider the role of verification in national and international TCA contexts. The panel noted a growing need for verification internationally under the Paris Agreement. As such, the program should not limit instruction to the measurement and reporting aspects of MRV.

In discussing verification, the panel encouraged The Carbon Institute to consider verification in several aspects, including some that go beyond the standard UNFCCC definition:



- Assess others' reporting (i.e., looking at and analyzing other countries' communication of data)
- Estimate emissions using independent data
- Compare bottom-up estimations against atmospheric data from remote sensing or from station networks as a means of reference

A focus on verification fits the emerging needs for professionals under the Paris Agreement. Focusing on verification should include the ability to assess and reconcile emission estimates by other countries. This is because the Paris Agreement requires significantly more bottom-up review and assessment, and will likely require independent verification across national borders.

Curricular knowledge on verification should aim to develop expert judgment through critical thinking around crosscutting principles. The panel members urged The Carbon Institute to include



information about "independent data sources," distinct from the country mandated data, and to teach general principles that need to be followed to enable verification with independent data. Such curriculum should also keep pace with the atmospheric science, including comparisons against atmospheric data as a means of teaching the policy applications of the science.

Recommendation 11: Plan for the future

Throughout discussions, the panel urged to adopt a forward facing approach in various ways. In line with the Transparency Framework under the Paris Agreement, curricula should focus on building reference levels that are not only accurate, but also transparent through the clear attribution of data. Beyond the basic math, this includes a focus on data quality, source, and means of improvement.

The panel also emphasized continuous course improvements to match national and international technological and policy developments. The panel challenged The Carbon Institute to consider how courses could be structured to take up new developments, and how the process of accounting and stocktaking can help tighten mitigation targets and increase ambition. Moving forward, panel members noted, REDD+ will need to be much better embedded into country NDCs, and this trend should be worked into the curriculum. For the policy-oriented courses, The Carbon Institute should consider which concepts are important for integrating REDD+ with NDCs and other government sectoral policies. The Carbon Institute should consider the technical challenges to ensure environmental consistency, avoid double counting, and constrain uncertainties. These accounting issues will become increasingly prominent as the private sector increasingly sources materials from "deforestation-free" areas of the world and seeks to track these improvements.

The panel pushed The Carbon Institute to adapt courses as REDD+ moves from a national concept to implementation at subnational levels. This includes considering the methods appropriate for emissions reductions at varying jurisdictional scales.

Many panel members heavily supported the idea of expanding The Carbon Institute partnership into other regions and sectors. Panel members said that such expansion, done properly, could enhance both the curriculum and the career potential aspects of The Carbon Institute graduates. Latin America and Central Africa were particularly emphasized as places to explore for new partnerships. The panel advised The Carbon Institute to consider how future funding can expand the capabilities of the grant for China and Indonesia, and beyond to other countries.

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