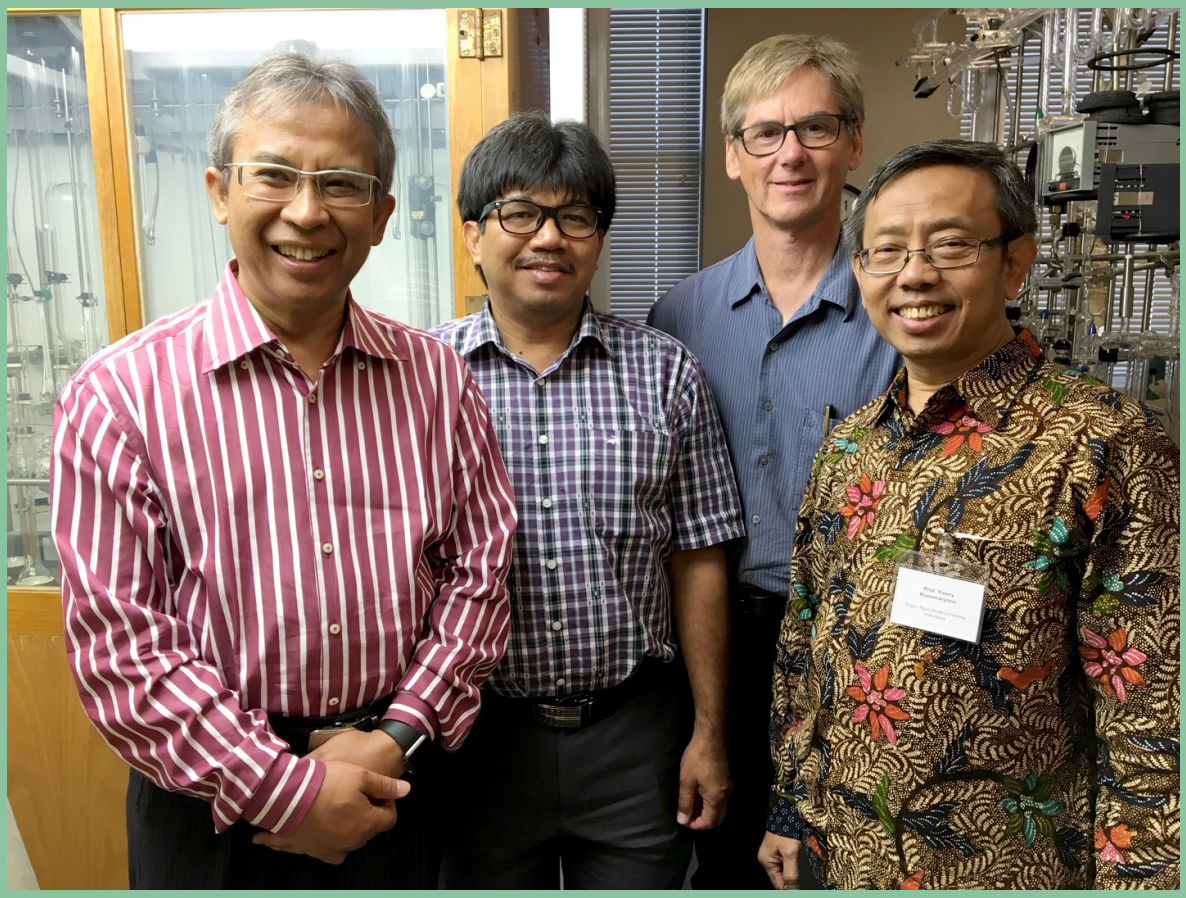
TCA Program Proposal:

A Certificate Program in Advanced Terrestrial Carbon Accounting at Bogor Agricultural University, Indonesia



(Left to right, Dr. Rizaldi Boer, Dr. Muhammad Ardiansyah, Dr. Ralph Keeling, Dr. Yonny Koesmaryono)

Supported by:

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

based on a decision of the German Bundestag

August 2017

Executive Summary:

The Carbon Institute is an international academic partnership to train the next generation of carbon workers, comprised of the Centre for Climate Risk and Opportunity Management in Southeast Asia and the Pacific (CCROM) in Indonesia, the GHG Management Institute (GHGMI) in the United States, and other partners. Together, we propose a new Terrestrial Carbon Accounting (TCA) Certificate program to be run by CCROM in conjunction with national and international partners.

The primary goal of the TCA Certificate program is to train Indonesian professionals in forest carbon accounting so that they may implement policies, projects, and market-based programs to reduce greenhouse gas (GHG) emissions and increase carbon sequestration. A second and equally important goal is to enhance the teaching faculties for advanced TCA in Indonesia.

Partnership Background (Chapter 1): TCA Certificate programs are under development by The Carbon Institute. TCA Certificate programs focus on developing comprehensive competencies, aligning curriculum with government priorities, and using real data to address government needs.

Research and Stakeholder Consultations (Chapter 2): Two studies form the basis of this program proposal. First, CCROM conducted a scoping study on existing academic capacity for TCA instruction in Indonesia. Then, to build certificates tailored to government needs, CCROM conducted comprehensive consultations and interviews with stakeholders.

Our Proposal (Chapter 3): As a result of our research and interviews, The Carbon Institute partners propose a Certificate that meets the following parameters:

- ***Schedule***: *The program will occur 1-2 times per year, beginning in 2018. Each session will be 2 weeks (12 instructional days) of length during summer break (July and August).*
- ***Trainees***: *The target audience for the training are forestry professionals from local and provincial governments enrolled at Bogor Agricultural University (IPB). The program will train about 20-30 people per year.*
- ***Registration Fees and Payment***: *Training will be financed by the Ministry of the Environment and Forestry, as well as other funding sources. The program will cost about 10 to 15 million Rupiah per student.*
- ***Management:*** *The program will be organized and managed by CCROM.*
- ***Location***: *The program will be hosted and run at Bogor Agricultural University (IPB) in Bogor, West Java.*
- ***Certification***: *We anticipate certificates will be jointly accredited by the Bogor Agricultural University, the GHG Management Institute, and The Carbon Institute partnership accreditation panel.*

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The Carbon Institute Partners

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 in Southeast Asia and the Pacific** (CCROM-SEAP, CCROM) of Bogor Agricultural University 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 TCA-related 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.

Chapter 1: Overview of The Carbon Institute Partnership

The Carbon Institute is a global partnership created to build strong and sustainable terrestrial carbon accounting (TCA) academic certificate programs that are of the highest academic and professional standards. Founding members of The Carbon Institute ran the first accredited Advanced TCA Certificate at University of California San Diego in 2013. Over 150 applicants competed for 24 course positions, and the evaluations from the first advanced certificate in TCA were extremely positive.

The Carbon Institute partner in Indonesia, the Centre for Climate Risk and Opportunity Management in Southeast Asia and the Pacific (CCROM) is a centre within Bogor Agricultural University (IPB) that will run the accredited TCA Certificate.

CCROM and other Carbon Institute partners have completed the work of convening an international advisory panel for best practice TCA recommendations, developing and sharing curriculum, developing an administrative support toolbox, and organizing and preparing two initial scoping studies, summarized in chapter 2.

This program proposal is the final scoping study in the three-part series. This proposal provides an overview of the program, summarizes stakeholder consultations and programmatic assessment efforts, highlights the opportunity to increase Indonesia's forest carbon workforce by developing a TCA program, and proposes the specific details for such a program.

TCA Applications under the Paris Agreement

Terrestrial Carbon Accounting is the measurement and monitoring of terrestrial (land-based) carbon stocks and carbon stock changes (fluxes, such as emissions and removals). TCA is carbon accounting for the land use, land use, change and forestry (LULUCF) sector. TCA is a technical discipline intended to support policy outcomes and enhance the efforts of decisionmakers.

What are all the things TCA is useful for?

- Developing and assessing Forest Reference Emission Levels
- Accounting for emissions/removals to access results-based REDD+ finance
- Providing increasingly accurate land area data, including land use changes
- Evidence-based policymaking, including low-emission land-use planning
- Developing, implementing, and tracking land-use mitigation actions
- Tracking Nationally Determined Contributions
- GHG Inventories of Emissions by Sources and Removals by Sinks
- National Communications and Biennial Update Reports to the UNFCCC (as well as Transparency of Action under the Enhanced Transparency Framework)
- Preparedness for the Global Stocktake

- Enhancing the capacity of policy makers and technical staff to estimate emission reductions by national and sub-national mitigation measures

Building Comprehensive TCA Competencies

The Carbon Institute partners have identified 6 common-core skill areas needed for advanced policy applications of TCA. These are:

1. International and domestic policy contexts and climate science
2. Carbon modeling through GIS and remote sensing (developing geospatially-referenced activity data)
3. IPCC guidelines and land classification
4. Forestry field methods and data collection (developing country-specific emission factors)
5. Statistics and uncertainty analysis
6. Analysis of results and the communication of these analyses to decision makers

These six areas correspond to the six courses taught in the TCA Certificate program. The exact content and specifications of these six areas vary by national circumstances and government priorities.

Work completed thus far

As of August 2017, substantial groundwork to develop an Indonesian TCA Certificate program has already been completed by the partnership.

Scoping study conducted on academic capacity and caps for TCA instruction in Indonesia: CCROM conducted research to understand the existing academic capacities for TCA in each of the 6 core skill areas. For more information about the status of TCA instruction in Indonesia, consult “Scoping Study 1” in chapter 2.

Stakeholder consultations conducted about government capacity needs and priorities for TCA: To develop a rigorous understanding of government TCA needs and priorities, CCROM conducted interviews with 154 stakeholders. Key outcomes include determining the ideal candidates for the course (government forestry staff enrolled at IPB), weighting the course content, and answering key logistical questions about the course. For more information, consult “Scoping Study 2” in chapter 2.

International Advisory Panel provides best practice recommendations for TCA instruction: In September 2016, The Carbon Institute partners from China, Indonesia, and the United States convened an advisory panel of 12 advisors from 6 countries, including two advisors from Indonesia, Dr. Nur Masripatin of the Ministry of the Environment and Forestry and Dr. Yonny Koesmaryono of Bogor Agricultural University. This panel provided best practice

recommendations for building the TCA Certificates. These recommendations have been published in a report and made available online at: http://carboninstitute.org/the-carbon-institute-international-advisory-report-published/.

Curriculum refined, shared, and undergoing the process of national customization:
The Carbon Institute has developed a core template curriculum for the Terrestrial Carbon Accounting Certificate programs. This curriculum comprehensively covers the skills needed for advanced TCA. This includes 6 fundamental courses: science and policy context, field methods and data collection, the 2006 IPCC Guidelines and land classification, GIS/remote sensing, TCA statistics, and analysis and communication of results. These courses are now being customized for the Indonesian context.

Toolbook to support TCA Certificates program in Indonesia:
A TCA Toolbook is under development that will provide institutional support and guidance to efficiently build sustainable TCA Certificate programs. The toolbook will establish systems for continuous course improvement. The toolbook contains lessons learned based on the 2013 course. This toolbook is really an online "toolbox," a collection of resources and guidance to be directly applied by the TCA Certificate program hosts.

Online portal and TCA Help Desk launched:
The Carbon Institute has launched an online portal at http://carboninstitute.org/tcahelpdesk/ to share the successes of The Carbon Institute partners, to host curriculum, and to provide information about the courses as they are developed. The website includes a TCA Help Desk, where learners can ask a technical question about TCA and receive a response within 48 hours.

Chapter 2: Summary of Research and Stakeholder Consultations for the TCA Certificate Program

CCROM conducted a scoping study to determine academic baselines for terrestrial carbon accounting instruction in Indonesia and stakeholder consultations to determine current government needs and priorities for TCA instruction. The results of these studies are summarized below and full copies of the studies are available online at: http://carboninstitute.org/resources-and-media/country-context/.

Scoping Study 1: Understanding Current TCA Instruction in Indonesia

The first scoping study was conducted to determine current baselines for TCA instruction in Indonesia. This scoping study was done to help CCROM understand:

1. Existing capacity building at IPB
2. Existing courses in TCA at other universities

3. What similar TCA capacity building initiatives, if any, have been done or are ongoing outside of IPB and other universities (e.g., under other capacity building grants, through civil society, run by government, etc.)

The high level results are summarized below. The full baselines scoping study is available online.

Existing Capacities

CCROM surveyed 9 universities and other training institutions and programs in Indonesia, and ranked the number of courses offered in each subject. All institutions and programs surveyed had significant gaps in comprehensive TCA instruction, and nearly some significant instruction gap within each of the core 6 areas for TCA instruction. In particular, virtually no programs have instruction on the Communication of TCA Results. In general courses tend to be heavy on policy context and light on technical skills.

In particular, CCROM conducted a deep dive into the study programs and course offerings at Bogor Agriculture University (IPB), which has been identified as the institutional home of the TCA Certificate program.

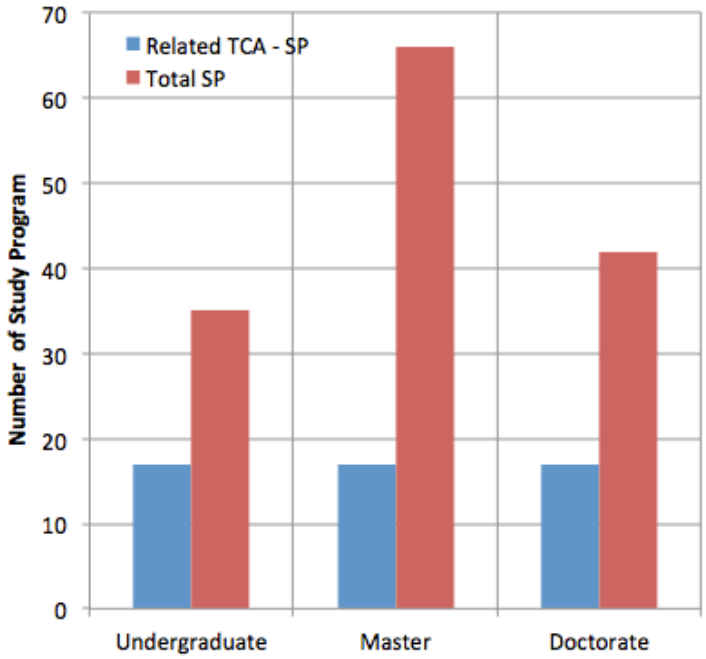

Figure 1. The number of TCA-related study programs compared against the total number of study programs for three levels of study at IPB.

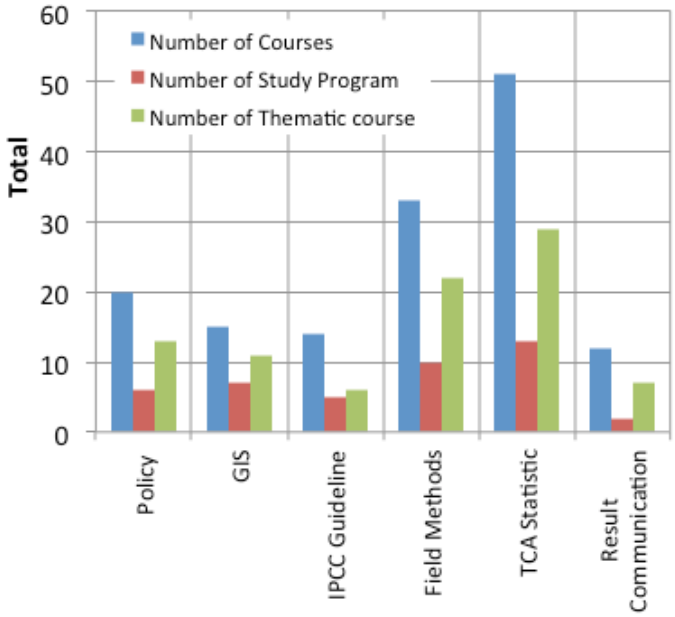

Figure 2. The number of TCA-related courses in each of the comprehensive TCA course areas in the study programs at IPB.

Alongside the information above, CCROM also quantified the percentage of TCA-relevant material in the key courses that are graphed above in Figure 2, depicted as "thematic course."

Capacity Gaps

As a synthesis of Indonesian university and program offerings, we rank each subject on where there are the fewest courses available (and greatest need) to the most courses available. These are: (1) analysis and communication of results, (2) 2006 IPCC Guidelines and land classification, (3) GIS/remote sensing, (4) science and policy context, (5) field methods and data collection, and (6) TCA statistics.

Scoping Study 2: Stakeholder Consultations with Agencies and Experts

Stakeholder consultations were conducted to determine current government TCA capacity gaps and priorities. This is essential for determining instructional and logistical elements of a TCA Certificate program in Indonesia. CCROM interviewed 154 stakeholders including bureaucrats, academics, practitioners, and students from three levels, S1 (bachelor), S2 (magister) and S3 (doctor). The results are summarized below. The full stakeholder consultation summary (gaps scoping study) is available online, including appendices.

Ideal Candidates

Respondents agreed that the key target audience for are professionals from national ministries and agencies, as well as professionals in agencies at the province level, focusing on key early mover provinces in Indonesia that are already moving forward faster than other provinces. Most interview respondents felt that their ministry or agency would want to send between 1 and 5 people to the TCA Certificate program each year.

Most respondents felt that TCA Certificate program participants could be from any level of study, as long as they have completed their undergraduate degree. The large majority of those interviewed felt that course participants should have a forestry background. Most respondents also felt that basic statistics and GIS skills would be an essential prerequisite for the TCA Certificate program.

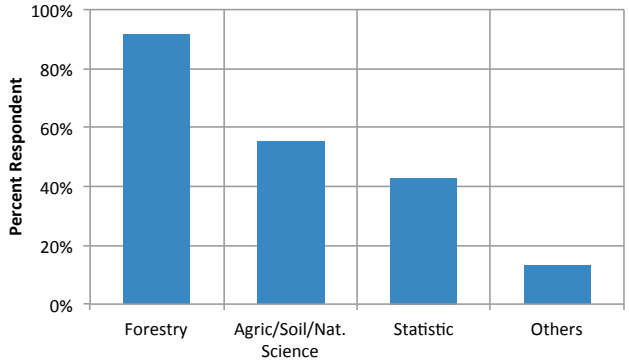

Figure 3. Responses on the ideal educational background of participants in the TCA Training.

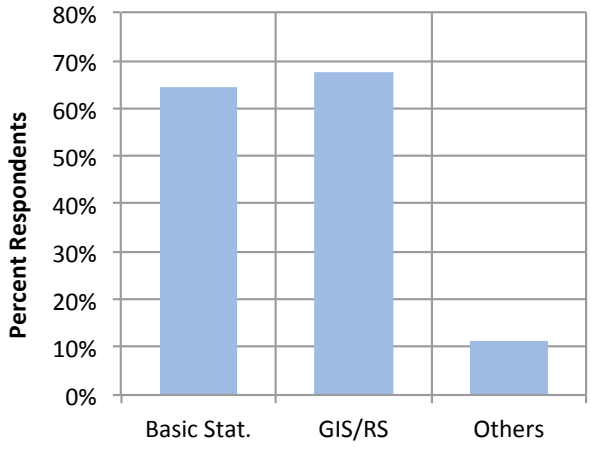

Figure 4. Respondents views on the ideal prerequisites for the TCA Certificate program.

Course Content

The interviewed stakeholders identified the amount of time that should be spent on each course. Averaging their responses, these are ranked from the greatest amount of time to the least amount of time: (1) GIS and remote sensing, (2) field methods and data collection, (3) TCA statistics, (4) 2006 IPCC Guidelines and land classification, (5) science and policy context, and (6) communication of results.

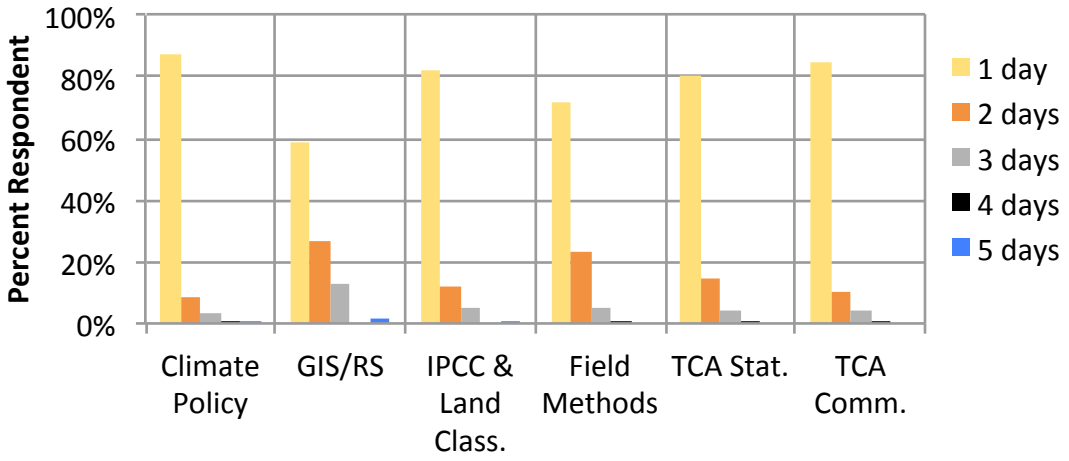

Figure 5. Respondents views on the ideal amount of time for each TCA course area

Respondents self-evaluated how knowledgeable they are in each TCA course area. Based on this self-evaluation, the areas with the least knowledge to the areas with the most knowledge are: (1) communication of results, (2) TCA statistics, (3) 2006 IPCC Guidelines and land classification, (4) data collection and field methods, (5) policy context, and (6) GIS and remote sensing. This can be used to determine the relative complexity of each subject.

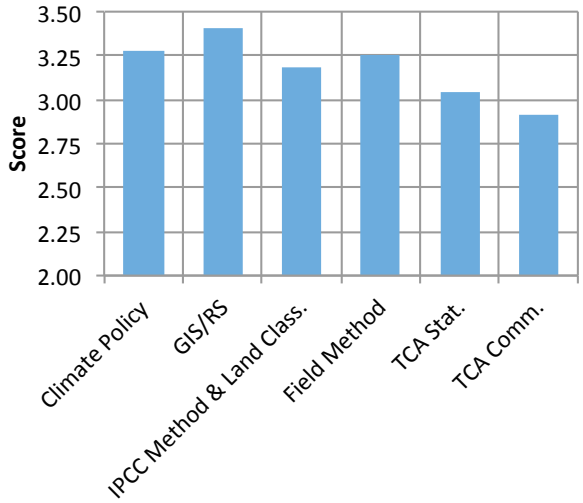

Figure 6. Score on depth of knowledge of respondents on the 6 TCA course areas

Respondents also identified the key topics and learning objectives within each course.

Sixty one percent (61%) of respondents interested in the course stated that they could bring real data for the training. This includes statistical data, spatial data, and forest carbon data. Most of these respondents require permission from their supervisors, which takes one to two weeks, on average.

Logistical Considerations

Generally, respondents favor a course duration of two weeks. Most respondents suggested that one TCA Certificate program be run per year in July or August. There is interest among potential students in having the government (in order of preference): pay for the course, provide resource people for the courses, and recommend learners to the course.

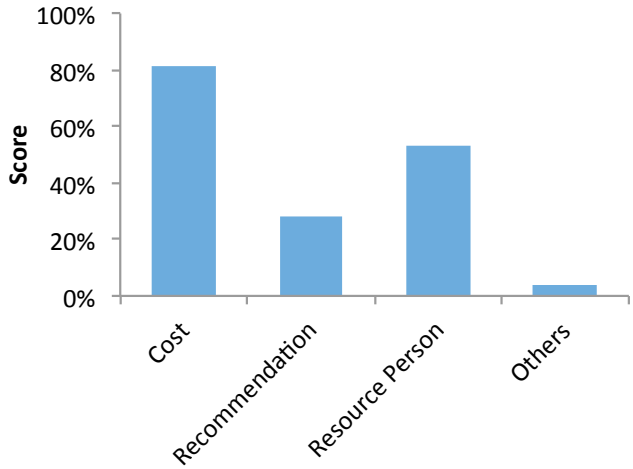

Figure 7. Respondent preferences for the role of government in the TCA Certificate program

Chapter 3: A New Opportunity: Terrestrial Carbon Accounting Certificate Run by CCROM of IPB

A Clear and Present Opportunity

Based on our findings to date, we conclude there is a clear need and opportunity to run a new TCA Certificate program in Indonesia under the auspices of IPB. This program will help government and other institutions understand carbon stocks and fluxes, enable government to better mitigate climate change, and support regional, national and international climate change policies. Per the recommendations of the International Advisory Panel (report online), these programs will be nationally owned and operated, adapted to Indonesian needs, iteratively

updated, internationally accredited, and developed in close relationship with numerous government agencies.

Principles

Nationally owned, operated, and financed

The Carbon Institute is an international partnership. However, the TCA programs are designed to be country-owned and operated. CCROM is developing nationally-specific curriculum in the 6 common-core skill areas for terrestrial carbon accounting. All courses are designed according to the specifications of the Indonesia forest carbon accounting systems, policies, and initiatives. The Bogor Agricultural University (IPB) will host the TCA Certificate program. The program will be open for enrollment by graduate students at IPB, a significant number of which are forestry professionals from the national, provincial, and local levels. Enrollment fees will be paid primarily by the Ministry of the Environment and Forestry and local governments, as well as other funding sources.

World-class instruction that meets Indonesian needs

The Carbon Institute and The Greenhouse Gas Management Institute have committed to ensure that the TCA Certificates issued in Indonesia are recognized as world-class, comprehensive training programs. The TCA Certificates will benefit from GHGMI's decade of experience teaching GHG management and accounting to over 3,500 professionals from more than 160 countries. The TCA Certificate programs will also benefit from the work developing, accrediting and running successful TCA Certificates at the University of California, San Diego and in Central Africa.

The core TCA curriculum has been developed by and in consultation with world experts, and addresses all the skills needed for advanced terrestrial carbon accounting. All courses are designed with rigorous pedagogy, applying active learning approaches based on the latest research to ensure strong learner outcomes. Teaching styles and curricular content are both adapted to Indonesian needs and instructional culture. The level of each course is carefully honed in for the best impact according to CCROM's understanding of the background of candidates and the nature of Indonesia's systems for forest carbon accounting and relevant regulations.

Close relationships with government agencies and international partners

The TCA program should be managed by CCROM to ensure longevity, quality, and close cooperation with the IPB Graduate School. CCROM will also continue to serve as the primary Indonesian partner in collaborating with The Carbon Institute partners around the world.

To ensure that the program is delivering learning that is current, up to date, and relevant to current knowledge and decisions related to REDD+, the TCA program is supported by an advisory board, where the member is from IPB and Indonesian agencies, such as the Ministry of Environment and Forestry.

The International Accreditation Panel of The Carbon Institute will invite the TCA Certificate program in Indonesia to be considered for accreditation. Further, as with all partners of The Carbon Institute, Indonesia will be invited to nominate two members to this panel. This panel will ensure that all TCA Certificate programs meet the highest quality standards. Some key areas considered in the accreditation process include curricular comprehensiveness, national suitability of the curriculum, faculty development, opportunities for hybrid learning (in class combined with on-line learning), and learner support through active alumni networks and mentoring.

Proposed Program Details

As a synthesis of our stakeholder consultations, research, and discussions as a partnership, we believe the program should be structured in the following way:

INSTITUTIONAL HOME AND MANAGEMENT TEAM:
The TCA certificate program will be hosted in the Graduate School of Bogor Agricultural University (IPB). CCROM will organize and manage the training sessions.

PROGRAM SERVICES:
The following services will be offered to students enrolled in the TCA Certificate program:

- In-person 2-week training session
- Instruction and examinations in the 6 core course areas and examinations (detailed below)
- About 25% of the course focused on fieldwork to develop hands-on skills
- Alumni support resources (e.g., professional network, career services)
- TCA Help Desk service to respond to technical questions within 48 hours
- TCA Certificate (upon successful demonstration of competency)

The Carbon Institute partners will offer the following services to the TCA Certificate program hosts:

- Development of student products and services above
- Nationally-specific curriculum in the 6 core course areas, iteratively updated
- Faculty recommendations, mentoring, and support resources (e.g., best practice pedagogy materials)
- Administrative toolbook and interactive “toolbox”

- Accreditation process support
- Direct and indirect marketing materials
- Systems for iterative program improvement

COURSE LENGTH AND TIMING:
The program will be run for 12 training days across 2 continuous weeks. The technical training will total about 58.5 hours of classroom instruction and practical exercises and 26 hours of fieldwork, alongside homework assignments. The first two days of the technical program will provide a high-level survey, and be open for enrollment by current and future policy makers. The program will typically run during summer break, in July or August. The course will be run once a year in 2018 and 2019. The course may be run one or two times a year in 2020 and beyond.

COURSE SUBJECTS:
Six (6) courses will be taught, covering the key competencies of terrestrial carbon accounting. These courses are: (1) TCA Science and Policy Context, (2) carbon modeling through GIS and remote sensing, (3) 2006 IPCC Guidelines and land classification, (4) forestry field methods and data collection, (5) TCA statistics and uncertainty assessment, and (6) analysis and communication of results to decision makers. These courses will be tailored to national context and government needs, and provide case studies in the Indonesia national context.

Course	**Approximate Course Hours Allocated**
Science and Policy Context	5.5
GIS/Remote Sensing	14
2006 IPCC Guidelines and Land Classification	8.25
Field Methods and Data Collection	14
TCA Statistics	14
Analysis and Communication of Results	2.75
Fieldwork (spans multiple technical areas)	26

COURSE STRUCTURE:
The proposed TCA Certificate program will be structured to allow a broader range of participants and to become more complex and exercise-driven over the course of the program. The first two days of the twelve-day program will focus on policy context, communication of results, and high-level surveys of each of the four technical areas. This will allow policymaking staff to participate, who do not need the in-depth technical skills, but need an essential understanding of the technical aspects behind terrestrial carbon accounting for future policy design, budgeting, and monitoring and evaluation efforts.

The first nine days of the course will be classroom-based lectures and exercises. The final three days of the program will be integrated fieldwork exercises. The advanced exercises during these

first nine days of classroom instruction will use the forest plots from the fieldwork section as an example. The final fieldwork section will then integrate all of the technical skills that students have learned. For example, the GIS classroom section may conduct a land-cover analysis, which will be subjected to calibration and uncertainty assessment during the fieldwork portion. Final capstone presentations will summarize the work of the participants, and develop experience communicating results. This integrated approach to the fieldwork allows program participants to gain hands-on experience with smaller-scale version of the same work that they will conduct as terrestrial carbon accounting professionals.

The tentative program schedule, including specific lecture titles, is detailed below.

INSTRUCTION:
CCROM proposes the following teams serve as instructors for each of the 6 courses:

Course	Instructor
Science and Policy Context	Rizaldi Boer (coordinator) Nur Masripatin Upik Rosalina Tania June
Carbon Modeling through GIS/Remote Sensing	Lilik Budi Prasetyo (coordinator) M. Ardiansyah Bambang Dwi Dasanto I Putu Santikayasa Adi Rakhman
2006 IPCC Guidelines and Land Classification	M. Ardiansyah (coordinator) I Wayan Susi Dharmawan Teddy Rusolono Gito Sugih Immanuel Rizaldi Boer
Field Methods and Data Collection	Teddy Rusolono (coordinator) Tatang Tiryana Lailan Syaufina Fahmuddin Agus Muhdin I Wayan Susi Dharmawan
TCA Statistics	Paian Sianturi (coordinator) Tatang Tiryana Teddy Rusolono Rizaldi Boer
Analysis and Communication of Results	Rizaldi Boer (coordinator) Hari Wibowo Belinda Margono M. Ardiansyah Ratna Patriatna

For the initial years (2018 and 2019), instructors will be paid partially under the TCAIAP grant and partially by course tuition. For 2020 and beyond, instructor costs will be covered by course tuition.

EXPENSE:
We expect a price of 10 to 15 million rupiah per student for a two-week course that concludes with examinations and a certificate for qualified students. This price will allow for program self-sufficiency and guarantee the long-term sustainability of the program. This price would cover: lecturer, administrative personnel and guest lecturer costs, costs associated with field work, literature & printing, renting meeting rooms and A/V equipment, and administrative expenses. This will not cover: participant travel costs, accommodations, meals and catering. Program tuition expenses will most likely be paid by government ministries and agencies, particularly the Ministry of the Environment and Forestry (MoEF). The price of the program may be bundled together with Master's degrees as an additional, optional competency.

TARGET AUDIENCE AND ENROLLMENT:
The key target audience is local, provincial, and national government staff enrolled at IPB. The course would be open to, masters, PhD, and qualified undergraduate students at IPB, many of who are already forestry professionals. There is a total expected training enrollment of about 20 to 30 students per year. The primary target audience members are current and future technical staff, with policymaking staff able to enroll in the first two days for a shorter survey of Terrestrial Carbon Accounting.

CERTIFICATION AND ACCREDITATION:
Students who complete the entire program and demonstrate proficiency will receive TCA Certificates. The TCA Certificate program will go through IPB's formal accreditation process. Pending accreditation, it is anticipated that the TCA Certificate will be issued by IPB, and jointly issued by The Carbon Institute and The Greenhouse Gas Management Institute. Accreditation through The Carbon Institute will occur through The Carbon Institute's International Accreditation Panel, which involves representation by multiple international partners of The Carbon Institute.

RECRUITMENT AND MARKETING:
The Carbon Institute partners will work together to design effective marketing materials for direct marketing to potential students. The Carbon Institute partners will also develop the necessary materials to engage sponsoring government ministries and agencies (e.g., MoEF, Ministry of Education). The partners will develop the necessary material for including the Terrestrial Carbon Accounting program within the course portfolio of IPB.

REAL DATA:
Our research shows that many learners will be able to bring real data to use in the course. Stakeholders and potential learners estimate it will take about two weeks to get approval to

bring data to the course. Beforehand, there will be communications between the program and the students to ensure the real data is formatted in a way that can be used in the course.

FACULTY SUPPORT:
All faculty that are chosen to teach the TCA Certificate in Indonesia will have access to The Carbon Institute and The Greenhouse Gas Management Institute "faculty success" support. This will include access to curriculum, teaching materials, information on successful past TCA instruction, tools for how to prepare lectures and examinations based on strong pedagogy, as well as in person and remote support for modifying and delivering course materials.

STUDENT SUPPORT:
All students who take the course will be given access to "learner success" support offered by The Carbon Institute and The Greenhouse Gas Management institute. This learner success support will include supplementary materials, on-line courses as agreed by the partners, the "TCA Help Desk," and alumni network and mentoring.

TENTATIVE COURSE SCHEDULE:
Below is the current tentative schedule for the TCA Certificate program in Indonesia. The first two days will be open to policymaking staff as well, and will cover policy context, communication, and a survey of the technical material. The first nine days include classroom instruction and practical exercises, and the course culminates in integrated fieldwork exercises for the final three days:

Day	Time			Duration	Topic
1	08:00	-	09:45	1:45	**Lecture 1**: Introduction to Climate Change, Terrestrial Carbon, and International Convention
	09:45	-	10:00	0:15	*Short-break*
	10:00	-	12:00	2:00	**Lecture 2**: REDD and LULUCF in the Paris Agreement
	12:00	-	13:00	1:00	*Lunch-break*
	13:00	-	14:45	1:45	**Lecture 3**: REDD and LULUCF in NDC
	14:45	-	15:00	0:15	*Short-break*
	15:00	-	16:00	1:00	**Lecture 4**: Communication result of Terrestrial Carbon Accounting under UNFCCC
2	08:00	-	09:45	1:45	**Lecture 5**: IPCC methodology for Accounting Terrestrial Carbon (REDD and LULUCF)
	09:45	-	10:00	0:15	*Short-break*
	10:00	-	12:00	2:00	**Lecture 6**: Generating activity data and emission factor for Accounting Terrestrial Carbon
	12:00	-	13:00	1:00	*Lunch-break*
	13:00	-	14:00	1:00	**Lecture 7**: IPCC Uncertainty Assessment
	14:00	-	14:15	0:15	*Short-break*
	14:15	-	16:00	1:45	**Exercise 2**: Homework Presentation
3	08:00	-	09:45	1:45	**Lecture 8**: Classifying Lands and Land Use Changes

Day	Time			Duration	Topic
	09:45	-	10:00	0:15	*Short-break*
	10:00	-	12:00	2:00	**Lecture 9**: Land Use Sector and Biomass Emissions
	12:00	-	13:00	1:00	*Lunch-break*
	13:00	-	14:15	1:15	**Lecture 10**: Soils DOM and Biomass Burning Emissions (incl. Peat Fire Emission)
	14:15	-	14:30	0:15	*Short-break*
	14:30	-	16:00	1:30	**Lecture 11**: Techniques and Tools
4	08:00	-	10:00	2:00	**Lecture 12**: GIS for TCA
	10:00	-	10:15	0:15	*Short-break*
	10:15	-	12:00	1:45	**Exercise 3:** QGIS-Lab 1 Getting data into QGIS
	12:00	-	13:00	1:00	*Lunch-break*
	13:00	-	14:15	1:15	**Exercise 4**: QGIS-Lab 2 Basic functions in QGIS
	14:15	-	14:30	0:15	*Short-break*
	14:30	-	16:00	1:30	**Exercise 4**: QGIS-Lab 2 Basic functions in QGIS
5	08:00	-	10:00	2:00	**Lecture 13**: Remote Sensing and Forest Classification for TCA
	10:00	-	10:15	0:15	*Short-break*
	10:15	-	12:00	1:45	**Exercise 5:** Remote Sensing: Classification Accuracy
	12:00	-	13:00	1:00	*Lunch-break*
	13:00	-	14:30	1:30	**Exercise 6**: QGIS-Lab 3 Supervise classification, Accuracy assessment data
	14:30	-	14:45	0:15	*Short-break*
	14:45	-	16:00	1:15	**Exercise 6**: QGIS-Lab 3 Supervise classification, Accuracy assessment data
6	08:00	-	10:00	2:00	**Lecture 15**: Sampling forests for carbon measurements
	10:00	-	10:15	0:15	*Short-break*
	10:15	-	12:00	1:45	**Exercise 7**: Sampling design for carbon measurements
	12:00	-	13:00	1:00	*Lunch-break*
	13:00	-	14:30	1:30	**Lecture 16**: Forest measurements for estimating carbon stocks
	14:30	-	14:45	0:15	*Short-break*
	14:45	-	16:00	1:15	**Lecture 16**: Forest measurements for estimating carbon stocks
7	08:00	-	10:00	2:00	**Exercise 8**: Tree measurements
	10:00	-	10:15	0:15	*Short-break*
	10:15	-	12:00	1:45	**Exercise 9**: Plot level data analysis of forest carbon measurements
	12:00	-	13:00	1:00	*Lunch-break*
	13:00	-	14:30	1:30	**Exercise 10**: Estimating forest carbon stocks at strata and population level
	14:30	-	14:45	0:15	*Short-break*

Day	Time			Duration	Topic
	14:45	-	16:00	1:15	**Exercise 10**: Estimating forest carbon stocks at strata and population level
8	08:00	-	09:00	1:00	**Lecture 17**: Summary Statistics and Signal noises
	09:00	-	10:30	1:30	**Lecture 18**: Sampling and Statistical Distribution
	10:30	-	10:45	0:15	*Short-break*
	10:45	-	12:00	1:15	**Exercise 11:** Statistical distribution and signal noises with excel
	12:00	-	13:00	1:00	*Lunch-break*
	13:00	-	14:30	1:30	**Exercise 12**: Data Simulation with excel
	14:30	-	14:45	0:15	*Short-break*
	14:45	-	16:00	1:15	**Exercise 13**: Data analysis with R
9	08:00	-	09:30	1:30	**Lecture 19**: Combining Error
	09:30	-	10:30	1:00	**Lecture 20:** Statistics and Uncertainty in the IPCC Guidelines
	10:30	-	10:45	0:15	*Short-break*
	10:45	-	12:00	1:15	**Exercise 14**: Propagating error through analytical and Monte Carlo approaches with R
	12:00	-	13:00	1:00	*Lunch-break*
	13:00	-	14:30	1:30	**Exercise 15**: Case Study
	14:30	-	14:45	0:15	*Short-break*
	14:45	-	16:00	1:15	**Exercise 16**: Case Study (continued)
	19:00	-	22:00	3:00	Travel to a forest area (e.g. *Gunung Walat* University Forest IPB)
10	08:00	-	12:00	4:00	Planning for the field measurements in the study area
	12:00	-	13:00	1:00	*Lunch-break*
	13:00	-	17:00	4:00	Field measurements
	17:00	-	19:00	2:00	*Rest and dinner*
	19:00	-	21:00	2:00	General discussion
11	08:00	-	12:00	4:00	Field measurements
	12:00	-	13:00	1:00	*Lunch-break*
	13:00	-	16:00	3:00	Data analysis of the field measurement results
	16:00	-	19:00	3:00	*Rest and dinner*
	19:00	-	21:00	2:00	Data analysis for quantifying impact of mitigation action
12	08:00	-	12:00	4:00	Report/presentation writing
	12:00	-	13:00	1:00	*Lunch-break*
	13:00	-	16:00	3:00	Group presentation and discussion
	16:00	-	20:00	4:00	Travel back to campus in Bogor

This project is part of the International Climate Initiative (IKI). The Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) supports this initiative on the basis of a decision adopted by the German Bundestag.