Raising the REDD+ Bar:

Report on the Inaugural Certificate in Terrestrial Carbon Accounting

The 24 members of the 2013 inaugural class earning a Specialized Certificate in Terrestrial Carbon Accounting at the University of California, San Diego with Frances Seymour (in purple dress), former director general of the Center for International Forestry Research (CIFOR).

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Overview

In many countries the destruction of forests is the leading cause of global climate pollution. Recognizing this, many developing countries have set ambitious targets and begun large scale efforts to reduce forest loss and degradation, lowering associated carbon emissions. To support these changes, donor governments have pledged over $6 billion to help developing countries protect tropical forests and rapidly reduce greenhouse gas (GHG) emissions. This unprecedented opportunity to safeguard imperiled tropical forests and fight climate change is collectively known as REDD+[1]. An increasing portion of REDD+ funds are ear-marked for "pay-for-performance" approaches, where *the amount of conservation finance* is pegged to *the amount of reduced carbon emissions*. However, many REDD+ funds remain unspent. One reason for this delay is a worldwide lack of capacity to account for changes in terrestrial carbon with scientific rigor.

With this in mind, the World Wildlife Fund (WWF), the University of California, San Diego (UCSD) Extension, the Tropical Forest Group, and the Sustainability Solutions Institute at UCSD launched a Specialized Certificate in Terrestrial Carbon Accounting ("TCA Certificate") in 2013. This report assesses the program's first year and describes lessons learned and plans for new international partnerships.

TCA Certificate students improving their skills in field measurements, plot design, and sampling procedures for terrestrial carbon

The TCA Certificate is the first academic program dedicated to advanced carbon accounting in terrestrial ecosystems. The course design was guided by a range of stakeholders, built to be academically rigorous, and oriented toward improving gaps in core skills needed to implement REDD+. An extensive recruiting effort resulted in 150 applicants for the first year, of which 24 of the most qualified professionals from 19 countries enrolled and completed the program. Members of the first class included REDD+ country government officials, non-profit managers, academics, and representatives from the private sector. In the first year, the TCA Certificate ran for four weeks (12 August – 6 September 2013) at the University of California, San Diego. Internationally-renowned instructors, including Dr. Thelma Krug, Peter Graham, and Frances Seymour joined other distinguished faculty to teach the first TCA Certificate. Course surveys showed high levels of satisfaction and clear gains in the technical REDD+ skills of participants. The second phase of the TCA Certificate has begun, focused on fine-tuning the academic instruction, partnering with other nations and Universities to internationalize the course, and placing some materials online.

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[1] REDD+ refers to the United Nations Framework Convention on Climate Change (UNFCCC) negotiations, and related initiatives, on reducing emissions from deforestation and degradation in developing countries.

Terrestrial Carbon Accounting Certificate's Theory of Change

REDD+ is at an inflection point. Since 2005, there has been growing international recognition that safeguarding tropical forests and their stored carbon must be part of any successful international

> *"The course was very helpful not just because of the high quality content, but because of the contact that we had with people from all over the world, speakers and students, struggling with the same issues and highly motivated to move REDD+ forward".*
>
> 2013 TCA Certificate Student

response to climate change. And while UN negotiations on a new climate change treaty are struggling to find clear traction, REDD+ has inspired innovative work to reduce deforestation and greenhouse gas emissions. Donor funds in excess of USD $6 billion have been pledged to developing countries that can credibly reduce greenhouse gas emissions associated with land use change. A major roadblock preventing REDD+ from realizing its full potential is the lack of trained professionals with robust carbon accounting skills. There are simply *not enough professionals who can credibly measure and model changes in terrestrial carbon stocks and flows*. One seminal study[2] estimated that 89 out of 99 countries had medium to very large capacity gaps in the basic REDD+ monitoring requirements.

To remove this roadblock and help forest countries take advantage of REDD+ finance, the TCA Certificate was designed and built. The first TCA Certificate was taught at the University of California, San Diego in 2013. Discussions are underway with a number of partners to teach the TCA Certificate in other countries while maintaining high academic standards.

The theory of change behind the TCA Certificate is that a shared international carbon accounting academic curriculum will provide REDD+ the necessary technical foundation to succeed. A shared academic platform will ensure that the technical basis for REDD+ is nationally owned and internationally harmonized. This in turn will foster a network of professionals with the skills and human ingenuity to credibly track terrestrial carbon. In turn, this will facilitate the overarching goal of REDD+, compensating developing countries with payments based on credible reductions in greenhouse gases.

Box 1. Specialized Certificate in Terrestrial Carbon Accounting By the Numbers

- 150 applications, 55 professionals accepted, 24 professionals enrolled (full capacity)
- 3,480 student learning hours
- Students representing 19 countries
- 50% of graduating class women
- Geographic diversity of students:
  - Asia (38%)
  - Latin America (29%)
  - North America/Europe (17%)
  - Africa (17%)
- 20 scholarships offered
- Course development cost: $100,000
- Average Instructor rating (4.4) out of 5.0
- Overall satisfaction with:
  - Academic Program: 100%
  - University of California: 100%
  - Lead instructor: 100%

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[2] Romijn, E., M. Herold, L. Kooistra, D. Murdiyarso, L. Verchot. 2012. Assessing Capacities of Non-Annex 1 Countries for National Forest Monitoring in the Context of REDD+. *Environmental Science and Policy* (19-20), pp 33-48.

Academic Curriculum

The TCA Certificate was designed based on a review of other GHG training programs, interviews with REDD+ technical experts (to identify their perceived training gaps), and informal market research which showed significant demand for advanced terrestrial carbon training. Preliminary academic materials were developed and shared with a range of experts, government officials, multinational organizations and academics who guided the refinement of the TCA curriculum. The consultation and development process was led by an Advisory Board (see Appendix I) and complemented by additional discussions with REDD+ donors, practitioners, experts, and academics.

The TCA Certificate is comprised of six separate academic classes (Table 1), which were approved by UCSD Extension's Academic Committee in early 2013. To receive the specialized TCA Certificate, participants are required to pass all six classes with a satisfactory grade.

Table 1. TCA Certificate: Class Names, Academic Units, Hours of Instruction

Class Name	Academic Units	Hours of Instruction
Policy Contexts for Terrestrial Carbon *(BIOL-40285)*	2	22
Measuring Terrestrial Carbon Change, Modeling Using GIS, Remote Sensing, and Activity Data *(BIOL-40286)*	3	30
Classifying Forest and Land Cover *(BIOL-40287)*	2	22
Terrestrial Carbon Accounting Data Collection & Evaluation *(BIOL-40288)*	2	18
Statistics for Terrestrial Carbon: Data Aggregation, Uncertainty Analyses & Error Propagation *(BIOL-40289)*	3.5	32
Applying and Communicating Analysis Results *(BIOL-40290)*	2	21
Totals	14.5	145

The TCA Certificate focuses on the technical elements of REDD+ carbon accounting, while putting these technical issues in the broader policy context. Technical instruction in remote sensing, GIS, land use classification, change detection, inventories, and statistics are organized around the Intergovernmental Panel on Climate Change's (IPCC) guidance on greenhouse gas inventories. Statistical methods prescribed by the guidance (e.g., developing robust mathematical carbon models, error propagation, Monte Carlos simulations) are allocated the most teaching time. The TCA Certificate requires participants to develop their own carbon accounting models and evaluate preliminary REDD+ carbon models (e.g., REDD+ reference levels) proposed internationally. By combining advanced technical practice with training in the policy/funding contexts for REDD+, the course was grounded in "*real world science and conservation*". Participants take several exams and presented their course work in group presentations and reports.

TCA Certificate Program Participants

The 150 applicants to the TCA Certificate exceeded the perceived demand for an advanced, four-week intensive training program. From the large pool of applicants, 85 were considered qualified based on their applications. Twenty-four professionals were admitted and completed the entry requirements, including successful visa applications, financial support, and four weeks of leave to participate in the program. Program participants were evenly split between men and women and there was good geographic diversity (see Box 1 on page 2). Program participants came from government (30%), non-profits (45%), and the private sector and academics (25%). This first TCA Certificate cohort included many REDD+ government officials and experts who are developing the technical accounting work that is the basis for REDD+ in their countries.

> "*The technical content was delivered in an extremely intuitive manner by specialists in their fields. Supporting lecturers and discussions framed the technical content in the wider context of an evolving UNFCCC and multilateral REDD+ architecture. I fully recommend the course to professionals engaged in forestry and REDD+.*"
>
> 2013 TCA Certificate Student

TCA Certificate Instructors and Lecturers

Three instructors approved by the University of California, San Diego taught 70% of the coursework. John Niles was the overall lead course instructor and Dr. Stuart Sandin and Dr. Anup Joshi taught terrestrial carbon statistics and remote sensing, respectively. The instructors were aided by world renowned guest lecturers, chosen for their knowledge and teaching credentials (see Table 2). Dr. Thelma Krug, an icon in the field of carbon accounting, taught the IPCC guidelines for two days. Peter Graham, the UNFCCC co-chair of the technical REDD+ negotiations led discussions on the history of the UNFCCC technical decision making. Frances Seymour, former Director General of CIFOR, presented a day of materials on Indonesia's REDD+ experiences and salient issues surrounding palm oil and certification.

Table 2. Terrestrial Carbon Accounting Certificate Instructors and Lecturers

Name	Title & Organization	Course Topics
John Niles	Director of Climate and Forest (WWF) & Visiting Scholar (UCSD)	Lead Instructor, Policy Contexts, Land Use Classification
Dr. Thelma Krug	Head of International Cooperation & Senior Researcher, National Institute for Space Research (Brazil)	Intergovernmental Panel on Climate Change Good Practices Guidelines, Greenhouse Gas Inventories
Peter Graham	Senior Economist, Canadian Forest Service	United Nations Framework Convention on Climate Change
Frances Seymour	Former Director General of the Center for International Forest Research	Indonesia and Palm Oil Case Studies
Dr. Anup Joshi	Research Associate & Program Coordinator, University of Minnesota	Remote Sensing, GIS, Activity Data, Classifications, Change Detection
Dr. Stuart Sandin	Assistant Professor, Scripps Institute of Oceanography & UCSD	Statistics, Monte Carlo simulations, linear regression, error propagation
Dr. Scott Rifkin	Assistant Professor, UCSD	Statistics, linear regression, R Coding
Dr. Jordan Golinkoff	Forest Carbon Analyst, The Conservation Fund	Field measurements, inventory design, sampling, quality assurance

Evaluations

Pre-course surveys completed by incoming TCA students gauged their up-front abilities and perceived technical gaps. Incoming students were asked to score themselves on 50+ specific carbon accounting skills. Based on these surveys, minor academic adjustments were made to focus instruction on technical gaps (topics students felt were both important and in which they were not yet proficient). Surveys after the course showed the academic topics where participants had the least and the most improvements. These findings will be used to improve subsequent iterations of the TCA Certificate.

As shown in Table 3, by comparing the before and after surveys, students showed substantial gains in all major academic classes and coursework. The most technical components received the highest improvements (remote sensing, GIS, data collection and evaluation, and statistics) while softer skills (related to policy context and communicating results) showed substantial, but smaller improvements. Land cover classification, a central aspect of high quality carbon accounting, showed intermediate gains.

Table 3. TCA Certificate Classes, Self-Assessments and Improvements

Class Name	Average Pre-Course Self Score	Average Post-Course Self Score	Improvement
Policy Contexts for Terrestrial Carbon *(BIOL-40285)*	3.13	4.00	0.87
Measuring Terrestrial Carbon Change, Modeling Using GIS, Remote Sensing, and Activity Data *(BIOL-40286)*	2.17	3.69	1.52
Classifying Forest and Land Cover *(BIOL-40287)*	2.57	3.60	1.03
Terrestrial Carbon Accounting Data Collection & Evaluation *(BIOL-40288)*	2.57	3.88	1.31
Statistics for Terrestrial Carbon: Data Aggregation, Uncertainty Analyses & Error Propagation *(BIOL-40289)*	2.22	3.63	1.41
Applying and Communicating Analysis Results *(BIOL-40290)*	2.83	3.75	0.92

General course evaluations (completed by 85% of the students) showed 100% satisfaction with the course content, the lead course director, and their University of California experience. Areas for improvement included suggestions for better organizing the materials, improving logistics, and having some course work done on-line before classroom instruction. Program participants also rated the TCA Certificate instructors and lecturers with very high marks, giving the combined 8 teachers an average score of 4.4 out of 5.0 (with 5.0 representing highest satisfaction).

Lessons Learned

The TCA Certificate partner organizations view the first year of the program as a successful new academic certificate and a strong springboard for new directions. In 2014, the original TCA partner organizations are exploring the best ways to "internationalize" the TCA Certificate. Work is underway to identify 3-4 new partner organizations to help offer the TCA Certificate internationally. Through surveys, evaluations, and roundtable sessions with program participants, we have identified several take-away lessons and new directions. These include:

- There is higher than expected demand from REDD+ practitioners for an intensive academic program, even in the face of significant challenges (cost, time commitment, visas, etc.).
- Better recruiting and new partners can attract an even greater number of ideal participants (government technical leads, key civil society experts, etc.)
- Embedding technical training within the evolving REDD+ policy context helped participants better understand existing guidelines to more effectively resolve technical questions.
- The commitment of four weeks and the relatively high costs of the TCA Certificate are significant barriers for some prospective participants.
- Most participants believed that their governments and local academic institutions would be interested in collaborating on international versions of the TCA Certificate, and local program implementation will have a greater impact in advancing country REDD+ capacities.

Next Steps

The partner organizations are pursuing the following next steps:

- Moving the on-site component of the course to southern geographies (specific interest is being explored in multiple countries) through international academic partnerships;
- Migrating approximately 50% of the course content on-line to allow for more preparation before in-class instruction, while lowering the cost and in-person time commitment;
- Enhancing *in situ* field instruction (sampling designs, field measurements);
- Increasing emphasis on applied "real world" challenges, such as developing REDD+ reference levels to meet emerging standards from the World Bank and the United Nations; and
- Creating new partnerships to increase the impact and availability of the TCA Certificate Program within REDD+ countries and funding mechanisms that matter most.

Appendix I. Terrestrial Carbon Accounting Certificate, Board of Advisors

Naikoa Aguilar-Amuchastegui, Ph.D. Lead Forest Carbon Scientist World Wildlife Fund	Holly Gibbs, Ph.D. Assistant Professor University of Wisconsin – Madison	Toby Janson-Smith Senior Director Conservation International
Benoit Bosquet, Ph.D. Sector Manager, Sustainable Development Department, Africa Region The World Bank	Anup Joshi, Ph.D. Research Fellow & Program Coordinator University of Minnesota	Stuart Sandin, Ph.D. Assistant Researcher Marine Ecology Scripps Institution of Oceanography
	John Nickerson Director of Forestry Climate Action Reserve	

Appendix II. Terrestrial Carbon Accounting Certificate, Supporters

The TCA Certificate was made possible with generous support of the following organizations:

- Anonymous Donor
- World Wildlife Fund
- Education Fund for Nature
- The Grantham Foundation for the Protection of the Environment

"I have been working in Climate Change and REDD+ since 2007. Coming face to face with lecturers who were part of the building frameworks for UNFCCC and the IPCC was the first time I fully appreciated the origin, dynamics and responsibilities in moving forward with addressing climate change. I feel more confident now to talk about climate change and carbon accounting, and find myself well placed to contribute to national actions on appropriate mitigation actions such as REDD+".
2013 TCA Certificate Student
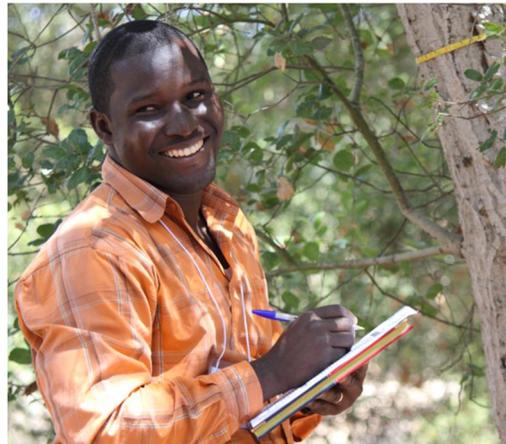
For more information on the Terrestrial Carbon Accounting Certificate, please contact John O. Niles, WWF US Forest and Climate Director and TCA Certificate Lead Instructor.

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