

TCA Scoping study in China: baseline, gap and opportunity

1. Background

Funded by the International Climate Initiative (IKI), The Carbon Institute is a collaboration of the Greenhouse Gas Management Institute (GHGMI), the Forest Carbon Accounting and Monitoring Centre (FCAMC) of the State Forestry Administration (SFA) in China and the Centre for Climate Risk and Opportunity Management (CCROM) at Bogor Agricultural University (IPB) in Indonesia. The Carbon Institute partners will develop robust Terrestrial Carbon Accounting (TCA) certificates that address national needs and fulfill international standards. By developing academic courses and teaching capacities in China and Indonesia on TCA, The Carbon Institute will help create the human capacity for countries to account for, and implement, their Nationally Determined Contributions (NDCs) and receive performance-based payments for REDD+.

One of the first work packages that must be completed by The Carbon Institute as part of the IKI grant, SFA and IPB (especially FCAMC and CCROM) will prepare three baseline studies on: 1) existing in-country academic TCA instruction, 2) gaps based on country needs, and 3) opportunities for new academic TCA Certificate programs. With the support from GHGMI, FCAMC conducted these three scoping studies to first understand what TCA courses and programs are already being taught in China; second, understand what government needs are for comprehensive TCA instructions; and third, develop a proposal for using existing TCA academic programs and filling unmet government TCA training needs with a new TCA certificate, led by SFA.

2. Materials and Methods

As show in the guidelines from GHGMI, TCA training covers six thematic areas: policy context, GIS and RS, IPCC guidelines/land classification, field methods, TCA

statistics, communication of results.

We invented 12 universities, academies and institutions in China. (1) Four universities that are first- and second-class universities in China: Beijing Forestry University, Beijing Normal University, Peking University, Xiamen University; (2) Two academies that leded by SFA: Academy of Forest Inventory and Planning, Personal Exchange and Development Center; (3) Six institutions that present research capacity at country and province level: Institute of Geographic Science and Natural Resources Research (CAS), Institute of Botany (CAS), South China Botanical Garden (CAS), Chinese Academy of Agricultural Sciences, Chinese Academy of forestry, Beijing Academy of Agricultural Sciences.

We collected the curriculums of the universities, the training schedules of SFA, the presentations and reports of the institutions from websites and by personal communication. Then, we divided all these information into the six thematic areas and other areas that isn't related to TCA area.

3 Baseline

3.1 Curriculum at the university

Curriculum: The professor carries on the specialized courses to students. The purpose of students is to learn knowledge and basic skills. Evaluation of course is test and score. Curriculum usually has strong theoretical and general adaptability.

Generally, the course of TCA has not been set up at the university. The related courses focus on forestry remote sensing, measurement, environmental monitoring, statistical analysis and other basic direction.

Table 1 Curriculum at the university in China

Thematic area	Curriculum
RS, GIS	1. Advanced geographic information system

	2. Progress in Geographic Information Science
	3. Digital earth and digital city
	4. Spatial Database
	5. GIS algorithm and application development
	6. Spatial data mining and knowledge discovery
	7. Measurement and Cartography
	8. Earth science data: the key to understanding the earth
	9. Photographic surveying
	10. Remote sensing physics
	11. Thermal infrared remote sensing
	12. Microwave remote sensing
	13. Advanced seminar of remote sensing and mapping
	14. Disaster remote sensing and emergency management
	15. Hyperspectral remote sensing
	16. Principles and methods of remote sensing image interpretation
	17. Remote sensing thematic information extraction and analysis
	18. Remote sensing image analysis
	19. Introduction to airborne remote sensing system
	20. Advanced remote sensing digital image processing
	21. Measurement and remote sensing
	22. Forestry remote sensing and geographic information system
	23. Remote sensing of resources and environment
	24. 3S theory and technology
	25. The principle and application of geographic information system
	26. Special topics on Vegetation Quantitative Remote Sensing Technology
	27. Spatial analysis of geographic information system and industry application
	28. Geographic information system
	29. Research progress of 3S Technology

	30. Introduction to geographic information systems
	31. Quantitative Geography
IPCC Guidelines/land classification	1. Seminar on climate change
	2. Meteorology
	3. Soil science and land resources
	4. Air pollution control engineering
	5. Soil plant atmosphere system
	6. Advanced forest soil science
	7. Forest Meteorology
Field methods	1. Experimental design and data analysis
TCA Statistics	1. Data statistical Analysis and practice using SPSS
	2. Mathematical statistics analysis and Practice
	3. Non parametric statistics
	4. Statistics
	5. Statistical principle
	6. Theory and method of statistical data analysis
	7. Statistical software
	8. Application of statistical analysis software
	9. Visualization of statistical data analysis
	10. Forestry Statistics
	11. Statistical calculation
	12. Experimental design and statistical analysis
	13. Introduction to MATLAB
	14. Method of calculation

3.2 Training at SFA

Trainings are short-term, specialized, systematic teaching for practitioners. The purpose is to obtain professional skills. Evaluation of training is professional

certification or certificate. Training usually has stronger advantage of method and operation than curriculum.

The training at SFA teaches policy context, GIS and RS, IPCC guidelines, and field methods. And the topic is mainly focus on forest and land use. They lack specialized statistic courses and GIS and RS for TCA. Communication of results is not mentioned in these training.

Table 2 Curriculum at the university in China

Thematic area	Curriculum
Policy context	<ol style="list-style-type: none"> 1. China's response to climate change policy and action 2. The system design of China's carbon market construction 3. Policy and development of forestry carbon trade in China 4. Progress in international negotiations on climate change and interpretation of forest related issues 5. The situation and task of forestry in China response to climate change 6. Policy and practice of the construction of China's carbon market 7. The situation and task of the forestry carbon trade in China; 8. Development trading guide of forestry carbon project; 9. The approval and certification of forestry carbon sink project transaction; 10. Registered trade procedure of forest carbon sink
GIS and RS	<ol style="list-style-type: none"> 1. LULUCF Technical guide for carbon monitoring: Land classification and data processing method 2. LULUCF Technical guide for carbon monitoring: Measurement and reporting
IPCC Guidelines	<ol style="list-style-type: none"> 1. Methodology of forestry carbon sink project 2. Forestry carbon sink project development and management 3. Afforestation technology procedures for carbon sink 4. Bamboo afforestation project methodology 5. Methodology of the forest carbon sink management

Field methods	<ol style="list-style-type: none"> 1. General situation and experience summary of the national forestry carbon measurement and monitoring system 2. Technical guide for the measurement and monitoring of carbon sink
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3.3 Presentation and report

Presentation and report: Experts familiar with the individual, professional topics, scattered reports. The audience is covered with professional students and researchers. The relationship between the speaker and the audience is more equal, have more opportunities for communication and interaction. No or very difficult to identify the appropriate indicators of the degree of mastery. Focus on the results of the research is accurate, content innovation.

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Table 3 Presentation and report in China

Thematic area	Presentation and report
policy context	1. Carbon sequestration effect assessment of major ecological engineering in China
	2. Perspective of ecological research hotspots in recent years
	3. Ecological big data
IPCC guidelines/land classification	4. International Symposium on the impact of forest carbon sink on Soil and water
field methods	5. Integration of large scale ecological problems in the era of big data: Problems and approaches
	6. Canadian forestry carbon budget model (CBM-CFS3) training

GIS and RS	7. Advances in satellite ocean remote sensing of CO ₂ in China
communication of results	8. International Symposium on carbon cycle in tropical ecosystems
	9. Emissions and increasing carbon sink Symposium
	10. Carbon sequestration of grassland ecosystems, rate mechanism and Potential
	11. USCCC the 13th annual meeting

4. Gap

Many universities have statistics curriculum, but no TCA statistics. There is no training and curriculum of communication of results.

Table 4 Presentation and report in China

	Policy context	GIS and RS	IPCC Guidelines/land classification	Field methods	TCA Statistics	Communication of results
Beijing Forestry University		√				
Beijing Normal University		√				
Peking University		√				
IGSNRR, CAS	Mainly presentation	√	√	√		
Chinese Academy of Agricultural Sciences	Mainly presentation	√	√	Involved in agriculture		
Chinese Academy of forestry		√	Mainly forest	Mainly presentation		
Beijing Academy of Agricultural Sciences		RS training, no curriculum				
Conclusion (Curriculums)	Lack	Lack of activity class data	lack of IPCC courses	Lack	There are statistical courses, there is no TCA statistical courses	Lack

FCAMC, SFA	√	√ forest	√ forest	√ forest		
Personal Exchange and Development Center, SFA	√		√ forest			
Conclusion (Training)	√	√ forest	√ forest	√ forest	Lack	Lack

5 Opportunity