

CIDA Project -- "Confronting Global Warming: Enhancing Carbon Sequestration in China" Launched in Summer 2002

A University of Toronto partnership between the Institute for Environmental Studies (IES), the Department of Geography and the Faculty of Forestry has been awarded a \$2.3 million grant from the Canadian International Development Agency (CIDA) to apply Canadian modelling and remote sensing technology to understand the role of land-use change in China's carbon cycle. The goal of the project is to contribute to the global effort of reducing net greenhouse gas emissions by enhancing China's capacity to sequester carbon in natural sinks, thereby supporting environmentally sustainable development in China. The anticipated result is that China will possess enhanced ability to increase ecosystem carbon stocks through the development of technical and human resources and more effective land-use and afforestation planning and policies.

The project director and the principal investigator is Jing Chen of the Department of Geography. University of Toronto research team members include: Rorke Bryan, Sean Thomas and John Caspersen of the Faculty of Forestry; Virginia Maclaren, Danny Harvey and Mingzhen Chen of Geography, and Rodney White of Geography and IES. Julia Pan of IES/OISE serves as the project manager. Other partners in Canada include the Adaptation and Impacts Research Group of Environment Canada, the Canadian Centre for Remote Sensing, and the Canadian Forestry Service.

The Chinese network, led by the Institute of Geography & Natural Resources Research of the Chinese Academy of Sciences, includes Centre for Remote Sensing of Beijing Normal University, Earth System Research Centre of Nanjing University, Nanjing Forestry University, Nanjing Agriculture University, Chinese Academy of Sciences Institute of Soil Science in Nanjing, and the Cold and Arid Regions Environmental and Engineering Research Institute in Lanzhou (northwest China).

After CIDA's approval of the Project Implementation Plan, the project kick-off meeting was held in Beijing, Institute of Geographical Sciences & Natural Resource Research (IGSNRR) on August 2nd, 2002. The meeting was co-chaired by the Canadian and the Chinese project directors Profs. Jing Chen and Liu Jiyuan, and attended by four Canadian members from the University of Toronto, and representatives from all the Chinese participating institutions. The CIDA Development Councilor Ms. Cecilia Leung and the Environmental Development Officer Dr. Zhizhong Si from Canadian Embassy in Beijing, Mr. Liu Xiang from the Ministry of Foreign Trade & Economic Cooperation, and Professor Fu Bojie, Director General, Bureau of Resources and Environment, Chinese Academy of Sciences, also attended the meeting and made speeches of support. After reviewing the Project Implementation Plan (PIP), especially the clear identification of the goals and purposes of the project, the chief coordinators of each institution presented their current research projects which were relevant to the carbon sequestration project and their workplans in the coming year. All participants expressed their confidence in this significant collaborative project and hoped the results would provide positive references to the environmental policy making in both countries.

The first round of project activities conducted this summer were four technical training workshops (facilitated jointly by Canadian and Chinese experts in carbon modeling, remote sensing, forestry assessment & ground truthing, and integrated assessment) in all three localities in China, followed by forestry field work in Baoying, southeast China; Liping, of southwest China, and Heihe of northwest China.

1. The Training Workshop on Remote Sensing Methods and Carbon Modeling was delivered by Prof. Jing Chen in Beijing on July 29-31. The focus of workshop was on methods for retrieving biophysical parameters using remote sensing data and carbon cycle models developed in Canada and to be used in the CIDA project. Over 50 trainees attended the workshop from all participating institutions in Beijing and Nanjing. On the second and the third day of the workshop, scientists from the Institute of Atmospheric Physics and the Institute of Remote Sensing Applications also joined the workshop. This workshop lay the foundation for using existing Canadian methods, models and instruments for the CIDA project. Following the workshop, the participants spent one day for presentations from various project participating institutions to improve mutual understanding of the various project components.

In addition, another five days' technical training workshop on the operation of the 'Geocomp-n' software was conducted jointly by Mr. Robert Keeping, the Technical Service Manager of Toronto PCI Geomatics Co., and Dr. Mingzhen Chen of Department of Geography, University of Toronto. The training contents included **Day 1**: The overall introduction of the Geo-comp system and its function, plus the installation of the system. **Day 2**: Data-entry, geocoding inter-phase establishment, the concept of image chip and its processing. **Day 3**: Introduction of Composite inter-phase including missing line, calibration, browse image, definition of product types, and Geocomp-n code establishment. **Day 4**: GCP data collecting and editing, PCI OrthoEngine package, with some demonstration on Canadian database. **Day 5**: Demonstration of PCI processing with Aster 1A Image – emphasizing on trainees' hands-on participation. The 11 participants from Beijing and Nanjing all regarded this training workshop as an "extremely rewarding and eye-opening experience" which facilitated their future participation in the carbon project research.

2. A forest Carbon Survey Methods Workshop was conducted in Nanjing, China from August 5-9, 2002, followed by a field site visit and data collection in various forest types in Liping county of Guizhou Province. The workshop consisted of a series of lectures given by Professors Sean Thomas and John Caspersen at Nanjing Forestry University, followed by a field practical course on forest carbon assessment and ground truthing methods, conducted at a field site in Baoyin, Jiangsu, China. In addition to Drs. Thomas and Caspersen, two Canadian graduate students from University of Toronto, Yuan-ying Peng and Shayna Stott, participated in the workshop.

Topics covered during the workshop included the following: (1) an overview of large-scale carbon processes and a survey of current efforts at national forest carbon inventories conducted to date by a variety of countries; (2) Survey methods for rapid estimation of carbon in woody vegetation, with particular emphasis on efficient plotless sampling methods for stand basal area, volume, and diameter distributions; (3) Allometric and related survey techniques for converting from forest biomass to carbon; (4) Survey methods for carbon in woody debris, litter, and top-soil components were introduced; (5) Approaches to estimating forest carbon flux using

dendrochronological (tree ring) methods were introduced. Finally, (6) techniques for measuring leaf and canopy spectral reflectance and transmittance using a field-portable spectrophotometer were also demonstrated.

The workshop and field site visits exceeded initial expectations in many respects. Chinese participants rapidly grasped new field techniques, and were efficient and enthusiastic in carrying out pilot forest inventory and ground-truthing exercises. Stand carbon inventories with matching data on leaf and canopy optical parameters were collected in young and mid-aged forest stands dominated by hybrid poplar (*Populus trichocarpa*) cultivars, chinese fir (*Cunninghamia lanceolata*), and native evergreen broadleaf forest (8 additional species), with more limited stand assessments also conducted in mason pine (*Pinus masoniana*). Field exercises also enabled testing of the TRAC instrument and hemispherical canopy photograph methods under a variety of field conditions.

Data collected was shared among all interested project participants. We anticipate that these data will provide much of the basis for 2-3 collaborative research papers.

3. The Workshop on Development and Application of Integrated Assessment Methods in China was held in Lanzhou, China, August 26 - 30, 2002. Dr. Yongyuan Yin of the Adaptation and Impacts Research Group of Environment Canada served as the principal resource person. The workshop was well attended by 45 participants from the three Chinese research partners (of Lanzhou, Beijing and Nanjing) and cross the Heihe region. Key researchers and stakeholders from CAREERI, IGSNRR, ESSI, provincial government departments, municipalities, communities, and NGOs with expertise in the areas of land uses, and people with a vested interest in natural resources and the impacts that land use change may have on the region attended the workshop. The diverse Chinese participation indicated a strong interest in the research project.

A principal goal of the IA Training Course was to bring together researchers and stakeholders to build a team of interested parties to develop an integrated assessment framework. The primary purposes of the workshop was to achieve a common understanding regarding the IA methods, and deliverables of this IA component among the Chinese, international investigating partners, and the stakeholders. The training course was 4 days to enable local scientists and stakeholders through training to conduct research on integrated impact assessment and policy evaluation. Main contents covered in the training course included IA methodologies, economic analysis methods, multi-criteria decision making techniques, multi-stakeholder consultation, sustainable development, and gender and equality issues. One of the results of the IA training course was to establish detailed research approaches for integrated assessments of the three study sites of Liping (in southwest China), Changbaishan (in northeast China) and Heihe (in northwest China).

In particular, the IA research team accomplished the follows:

- Build a team of researchers and stakeholders for the IA component;
- Design a conceptual research framework to link climate change, carbon sequestration, land use and regional sustainability;
- Identify major problems and key concerns related to resource use in the region;
- Enable local scientists through training courses to conduct research on integrated assessment and land use policy evaluation;
- Review data availability of the study sites for integrated assessment;
- Highlight various methods for environmental and economic impact analyses;
- Improve Chinese decision makers' knowledge on the environmental, social and economic risks and impacts caused by land use change associated with potential C sequestration policies and regional development; and
- Enhance female and minority people participation in the study.

Through presentations, the first day gave an overview of the IA component in the carbon sequestration project and highlight the broad issues of climate change and carbon sequestration, the land use change options and regional sustainability issues. Prof. Cheng Guodong, Director General of the Lanzhou Branch/CAS welcome all the participants to the workshop. Dr. Julia Pan explained the management structure and budget of the project and Dr. Yongyuan Yin provided a brief picture of the IA component in the context of CIDA Carbon Sequestration project. Dr. Souquan Zhou of ESSI/Nanjing University reported the IA activities conducted by Dr. Yin and himself in Liping site to provide some guidelines of the IA research. The workshop then had breakout group discussion aimed to improve understanding of the project objectives. It was followed by stakeholder presentations outlining major problems and key concerns related to resource use in the region.

Day 2 was mainly for presentations by representatives of stakeholders to identify environmental and socio-economic problems and concerns in natural resource management in the region. The third day was covered by course work on concepts and methods of environmental and economic assessment. Day 4 focused on hands-on training of step-by-step methodological design for the IA component. The conceptual IA framework could link climate change, carbon sequestration, land use and regional sustainability.

We were delighted to see that there were about one third women participants in all three workshops!