A3 Foresight Program

CarboEastAsia

from CARBON SCIENCE to REGIONAL STEWARDSHIP

Capacity building among ChinaFlux, JapanFlux and KoFlux to cope with climate change protocols by synthesizing measurement, theory and modeling in quantifying and understanding of carbon fluxes and storages in East Asia

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CarboEastAsia

BACKGROUND

AsiaFlux (www.asiaflux.org) is the Asian arm of FLUXNET, the worldwide research network of flux monitoring towers for carbon, water, and energy cycles in terrestrial ecosystems. We are like the watchmen on the towers, working and taking care of ecosystems on our planet! The monitoring sites are all over the continents, ranging from tropical forests near the equator to tundra in the Arctic and from wetlands near sea level to prairies on the Tibetan Plateau.

Why do we observe carbon and water cycles? Profoundly, the very existence of such cycles makes life possible on earth, acting as the maestro of nature's diversity and harmony. These cycles and their variability are the hands that weave the fabric of rich life on our planet, yet we are carelessly altering them in an unprecedented way.

CarboEastAsia (www.carboeastasia.org) is a visionary program in AsiaFlux, which provides scientific leadership and information of the Asian ecosystems to guide community to a sustainable pathway during rapid global change.

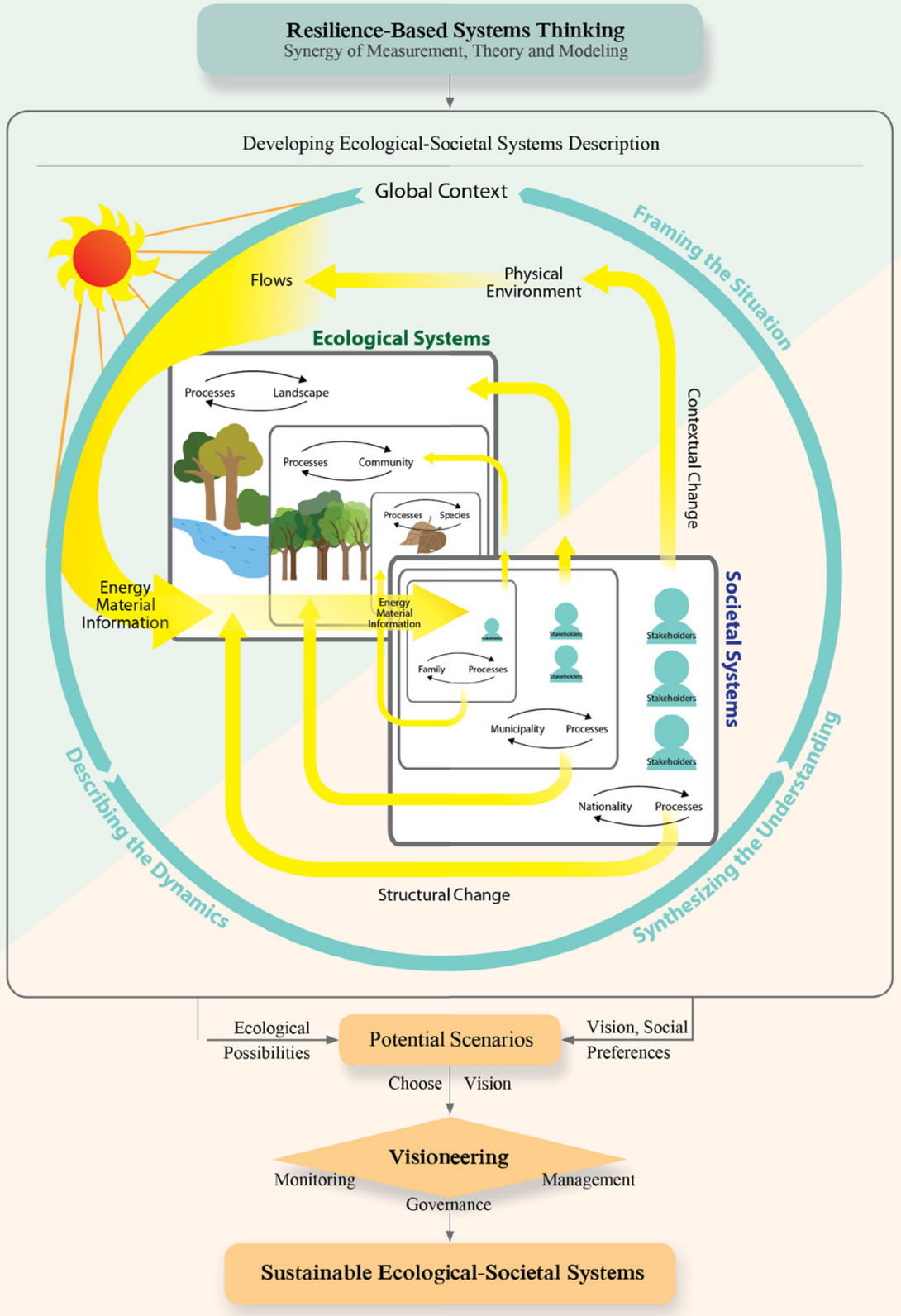
MISSON

CarboEastAsia is the core program of AsiaFlux and we pursue its mission to bring Asia's key ecosystems under observation to ensure quality and sustainability of life on earth.

VISION

Under the AsiaFlux motto, "thinking community, learning frontier," our vision is to (1) develop forward-looking collaborative researches and data sets on carbon, water and energy cycles in key ecosystems in Asia; (2) provide workshops and training on current and future challenges posed by global change; and (3) cultivate the next generation of scientists with skills and perspectives so that they are prepared to engage in regional sustainability challenges in Asia as informed leaders and stewards through ecosystem approach with resilience-based systems thinking and visioneering.

PHASE I and II



THE WAY AHEAD

RESEARCH THRUSTS

Main objectives are to (1) identify key mechanisms driving carbon cycle, (2) quantify strength and variability of carbon sink/source, (3) ascertain the role of ecosystem structure and function, (4) develop ecosystem models suitable to East Asia, (5) evaluate the impacts of disturbance, (6) establish the database for regional synthesis, (7) provide scientific insights on ecological possibilities in Asia, and (8) assess the role of Asian carbon cycle in a global context.

STRATEGIES

During Phase I and II, CarboEastAsia consisted of five working groups to focus mainly on 'framing the situation by generating a systems description' and 'describing the dynamics of the situation.' The next step involves synthesizing the understanding into narratives (scenarios). Ecological-societal systems are combined systems of ecological and social components and drivers that interact and give rise to results, which cannot be understood based on ecological or social considerations alone. The "visioneering" emphasizes the integration of ecological possibilities and social preferences into scenarios (narrative description), thereby resolving a shared community vision. In CarboEastAsia, students and researchers are encouraged to learn how to design heuristic forward-looking projects for the realization of the vision through the adaptive triad of governance, management and monitoring.

OUTCOMES

At the completion of the 5-year collaboration program, we have (1) identified unique mechanisms causing different carbon dynamics associated with the monsoon variability, (2) quantified the strength and variability of carbon sink/source for 21 forests, 3 grasslands and 3 croplands in 7 countries in Asia, (3) ascertained the different roles of diverse ecosystem structure and functional types, (4) tested and identified the strengths and weaknesses of various terrestrial biosphere models in simulating the ecosystem carbon budgets over East Asia, (5) evaluated the impacts of natural and human disturbances on carbon and water cycles, (6) established the standardized database for 27 sites with total site-years of 71 years for regional synthesis, and (7) found supporting evidence on ecological possibilities through feedback loops, hierarchically nested processes and structures, and self-organization. We were not able to assess the role of Asian carbon cycle in a global context.

Forward-Looking Collaborations & Progresses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Phase I 2007-2010

Kickoff Meeting and 1st Seminar of CarboEastAsia [1]
30 Nov. – 1 Dec. 2007
Beijing, China
Strategic planning and establishment of sub-programs: SP1. Interdisciplinary joint field investigation; SP2. Networking flux measurements; SP3. Model development, validation, scaling and integration; and SP4. Seminar and science meetings.

1st Workshop on Data Processing & Synthetic Analysis
19-21 Feb. 2008
Seoul, Korea
CarboEastAsia data requirement and database establishment, Collaboration with other A3 "Ecology" program. Call for research proposal for 1st CarboEastAsia special issue

1st Field Campaign [2, 3]
7-11 July 2008
Fujiyoshida, Japan
Inter-comparison of eddy flux calculation and QC/QA procedures of three flux networks. Inter-comparison experiment of soil respiration measurement at Fujihokuroku site.

2nd Seminar on ACTS with 7th AsiaFlux Workshop [4, 5]
17-19 Nov. 2008
Seoul, Korea
"Re-thinking Global Change Science: From Knowledge to Policy" AsiaFlux Workshop's CarboEastAsia special session: Asian Carbon Trackers' Society (ACTS) – From Implications to Applications. Preparation of 1st special issue.

2nd Workshop on Integrating Field Observations, Remote Sensing, and Modeling [6, 7]
18-20 Feb. 2009
Tsukuba, Japan
Focused on SP2 (Net-working flux measurements) and SP3 (Model development, validation, scaling and integration)

2nd Field Campaign & ChinaFLUX Training Course [8, 9]
27 July-1 Aug. 2009
Xining, China
Capacity building and promoting the communications among young scientists: field excursion to Haibei Station, training on long-term flux observation & data processing

3rd Seminar with 8th AsiaFlux workshop [10, 11]
27-29 Oct. 2009
Sapporo, Japan
"Integrating Cross-scale Ecosystem Knowledge: Bridges and Barriers" AsiaFlux Workshop's CarboEastAsia special sessions: Bridges between ecosystem observation and remote sensing; Barriers in Flux measurements; Global biogeochemical cycle; Interfaces between carbon science and society.

3rd Workshop on Upscaling and Synthetic Assessment of Carbon Cycling in Asia [12, 13]
12-13 Jan. 2010
Beijing, China
Presenting research progress by SP2 and SP3 on two major themes: (1) Inter-comparison of carbon fluxes in different ecosystems in East Asia and (2) Upscaling and synthetic assessment of carbon fluxes in East Asia.

3rd Field Campaign on Soil CO_2 & Non-CO_2 Trace Gases [14]
3 June 2010
Seoul, Korea
Evaluating sub-programs. Establishing new sub-programs (SP4. Networking of Soil Respiration measurement; SP5. Networking flux measurements for Non-CO_2 trace gases). Report on 1st special issue in Biogeosciences. Improving fair-use policy of CarboEastAsia database. Planning for the 2nd Phase.

Joint Symposium with HESSS II
22-25 June 2010
Tokyo, Japan
CarboEastAsia sessions with 2nd International Conference on Hydrology Delivers Earth System Science to Society (HESSS II), AsiaFlux/FLUXNET, GSWP/GLASS, and LandFlux-EVAL Establishing practical protocols and frameworks to promote effective collaborations among research communities of hydrological modeling, field observations, remote sensing in the framework of sustainability science.

1st CarboEastAsia Special Issue in Biogeosciences (BG)

Our efforts on interdisciplinary approach for understanding biogeochemical-ecological interactions have produced a special issue in BG. The two-stage publication process enabled every discussion paper and interactive comments to remain permanently archived and individually citable (www.biogeosciences.net).

During Phase I, a total of 42 papers were published in Biogeosciences (18), Asia-Pacific Journal of Atmospheric Sciences (4), Ecological Research (2), Remote Sensing of Environment (1), Journal of Geophysical Research (1), Nonlinear Process in Geophysics (1), Acta Ecologica Sinica (1), Journal of Plant Research (1), and others (13).

The main topics included in these publications are: advection, Asian monsoon, biosphere models, carbon and water cycle, catchment water balance, cloud effect, drought, ecosystem production and respiration, eddy covariance technique, evapotranspiration, ecohydrology, heterogeneity, leaf nutrient, litter decomposition, mapping, methane exchange, modeling, MODIS, net radiation, nocturnal bou ndary layer, organic carbon sequestration, parameter optimization, quality control, remote sensing, scale-dependency, uncertainty, and understorey ET.

Phase II 2010-2012

4th Workshop with 9th AsiaFlux Workshop [15, 16]
1-3 Dec. 2010
Guangzhou, China
"New Challenges of FLUXNET Community to Resilient Carbon/Water Management" AsiaFlux Workshop's CarboEastAsia session: Progress reports from sub-programs & Planning for the 2nd special issue.

5th Workshop on Data-Model Synthesis for Quantifying Carbon Budget in East Asia
22-23 Feb. 2011
Tokyo, Japan
Presentations on research progress with SP2 and SP3 & Proposal for the 2nd special issue. Planning for 5th seminar and AsiaFlux Short Courses in Seoul, Korea.

5th Seminar and AsiaFlux Short Courses [17, 18]
11-15 July 2011
Seoul, Korea
Progress report from sub-programs and for the 2nd special issue in Journal of Forest Research. Short courses (on eddy covariance measurements and data processing) to support AsiaFlux motto, "thinking community, learning frontier"

3rd ASIAHORCs Joint Symposium
25-26 Oct. 2011
Beijing, China
Asian Heads of Research Councils (ASIAHORCs) symposium on Global Change in Asia: a Perspective of Land Use Change

Special Symposium with 5th EAFES [19, 20]
21 March 2012
Shiga , Japan
Symposium on Carbon Cycle of East Asian during the 5th East Asian Federation of Ecological Societies (EAFES) International Congress: Presenting research progress with SP4 (Exchanges of various gas components between the atmosphere and terrestrial ecosystems) and SP5 (Integrated Studies on Carbon Balance of East Asian Terrestrial Ecosystems)

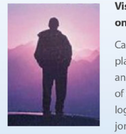
Synthesis of CarboEastAisa & the Way Forward
26-28 July 2012
Mokpo, Korea
CarboEastAsia and AsiaFlux special sessions at International Association of Vegetation Sciences (IAVS) 2012. Celebrating the success of CarboEastAsia and envisioning the future of post-CarboEastAsia collaborations.

2nd CarboEastAsia Special Issue in Journal of Forest Research

We are finalizing the publication of 2nd special issue. During Phase II, additional 30 scientific papers were published in Journal of Forest Research (7), Hydrological Research Letters (2), Global Change Biology(1), Journal of Environmental Management (1), Journal of Hydrometeorology (1), Journal of Meteorological Society of Japan (1), Meteorology and Atmospheric Physics (1), Plant Soil and Environment (1), Tellus B (1), Theoretical and Applied Climatology (1), and others (13).

The additional topics included in the Phase II papers are: CarboEastAsia dataset, ecosystem structure and function, error assessment, interception storage, inter-comparison, isotope analyses, isoprene emission, modeling implications, process network, sensitivity analysis, synthesis, uncertainty analysis, water use efficiency, wavelet analysis, wet canopy evaporation.

The Way Ahead



Vision: foresight with insight based on hindsight

CarboEastAsia has been a landmark platform in presenting, discussing and providing better understanding of carbon and water dynamics of ecological systems in Asia. One of the major outcomes is the refined vision with inspiration and thus CarboEastAsia will continue as a flagship program of AsiaFlux. However, a much more integrated and participatory collaborations are still needed to address all aspects of the proposed ecosystem approach.

Opportunities and Challenges

The continuation of CarboEastAsia is an opportunity to implement some key elements of AsiaFlux science for regional sustainability. The exciting challenges explicitly involve the dynamics of integrated ecological-societal systems, which is the focus of the Phase III of CarboEastAsia. The true challenge is to grasp this opportunity and transform our actions to achieve sustainable stewardship of ecological-societal systems.

A3 Foresight Program CarboEastAsia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CONTRIBUTORS

ChinaFlux

Dr. Guirui Yu
Institute of Geographic Sciences & Natural Resources Research, Chinese Academy of Sciences
yugr@igsnrr.ac.cn

Zhi Chen
Huajun Fang
Yuling Fu
Chao Fu
Yanni Gao
Qun Guo
Shijie Han
Honglin He
Ruixing Hou
Zhongmin Hu
Mei Huang
Weimin Ju
Shenggong Li
Xuanran Li
Shuyong Li
Min Liu
Yingchun Liu
Zhu Ouyang
Wei Ren
Shujie Ren
Xiaoli Ren
Liqing Sha
Wenping Sheng
Hao Shi
Guozheng Song
Xiaomin Sun
Yakun Tang
Huimin Wang
Qiufeng Wang
Shaoqiang Wang
Yafen Wei
Xuefa Wen
Junhua Yan
Guirui Yu
Xiaoyun Zhan
Junhui Zhang
Yiping Zhang
Leiming Zhang
Na Zhang
Li Zhang
Mi Zhang
Caihong Zhang
Fenghua Zhao
Xinquan Zhao
Liang Zhao
Ning Zhao
Lei Zhou
Lei Zhou
Xianjin Zhu

JapanFlux

Prof. Takashi Hirano
Graduate School of Agriculture, Hokkaido University
hirano@env.agr.hokudai.ac.jp

Maricar Morales Aguilos
Jun Asanuma
Yasumi Fujinuma
Seijiro Gotou
Tomohiro Hajima
Kentaro Hayashi
Takashi Hirano
Ryuichi Hirata
Kazuhito Ichii
Takeshi Ise
Tomomichi Katou
Yuji Kominami
Masayuki Kondou
Yoshiko Kosugi
Ayumi Kotani
Naishen Liang
Takashi Machimura
Takahisa Maeda
Masayoshi Mano
Sou Matunaga
Yasunori Mitake
Takafumi Miyama
Akira Miyata
Yasuko Mizoguchi
Tomoki Mochizuki
Ryo Moriwaki
Yuichiro Nakai
Taturou Nakaji
Kazuhiro Nakanishi
Tomohiro Oda
Akiko Ogawa
Hiroyuki Oguma
Keisuke Ono
Takeshi Oota
Yoshikazu Ootani
Nobuko Saigusa
Makoto Saitou
Tooru Saitou
Tomohito Sano
Sundari Siti
Takashi Suzuki
Kentaro Takagi
Kenshi Takahashi
Yoshiyuki Takahasi
Tomomichi Takeda
Kouji Tamai
Sawako Tanaka
Akira Tani
Masahito Ueyama
Tutomu Watanabe
Susumu Yamamoto
Syouichiro Yonemura
Kenichi Yoshimura

KoFlux

Prof. Joon Kim
Complex Systems Science Laboratory, Seoul National University
joon@snu.ac.kr

Kunyoung Byun
Kyuhyun Byun
Chunho Cho
Kyung Moon Choi
Minha Choi
Gwangyoung Choi
Young Jean Choi
Jungryul Choi
Hosu Chun
U ran Chung
Nayoung Do
Jinkyu Hong
Jewoo Hong
Seounghee Hong
Keunchang Jang
Jihyun Jang
Yong Jung
Eunyoung Jung
Minseok Kang
Sinkyu Kang
Sanghyun Kim
Sujin Kim
Sohee Kim
Eunsuk Kim
Daeun Kim
Hyun Woo Kim
Yongseok Kwak
Hyojung Kwon
Taeyoung Lee
Dowon Lee
Dongho Lee
Byonglyol Lee
Bora Lee
Younghee Lee
Eunhye Lee
Jaeseok Lee
Jaeho Lee
Gyoungbin Lee
Jihye Lee
Seungjae Lee
Yunjin Lim
Jong Hwan Lim
Heejeong Lim
Sungbin Park
Sang Ki Moon
Bindu Malla Thakuri
Chanyang Sur
Namchil Woo
Jaeill Yoo
Youngju Yu
Juyeol Yun

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NRF
National Research Foundation of Korea