NACP Midcontinental Intensive Draft Science Plan
outline

• Who wrote the science plan?
• Overall science plan structure
• Atmospheric inversions (top-down)
• Ecosystem-based approaches (bottom-up)
warning

• This is not LBA.
• Project is shared among NASA, DOE, USDA, NOAA, NSF, others?
• No central, single requests for proposals.
• Coordination in timing of projects is weak.
• Collaboration and synthesis will be a challenge!
Objectives of the MCI Task Force

The Task Force (TF) provides guidance to PIs (the science team members) and feedback to the NACP Scientific Steering Group (SSG) and program managers. The TF will oversee campaign-wide issues, including implementation of the science plan and coordination of the synthesis.
Task Force Members

- Stephen Ogle (co-ord.) – ecosystem modeling
- Ken Davis (co-ord.) – tower measurements, upscaling, regional syntheses
- Bob Cook – data management support for Intensive
- Shashi Verma – EC flux towers in agricultural systems
- Arlyn Andrews – long term atmospheric monitoring (tall towers, aircraft), atmospheric inversions
- Kevin Gurney – atmospheric inversions and fossil fuel emissions
- Steve Wofsy – aircraft measurements, regional syntheses
- Tris West – ecosystem modeling
- Tim Parkin – EC flux towers in agricultural systems
- Jeff Morisette – remote sensing
- Pieter Tans – ex officio
MCI Objectives

• Provide “top-down” and “bottom-up” flux estimates and associated uncertainties for the MC Intensive study region at seasonal to annual time scales, including a separate analysis for the fossil fuel component

• Provide independent validation data and error analysis for both approaches, evaluate discrepancies between the two approaches, and diagnose problems,

• Iteratively improve estimates for both approaches,

• Provide the basis for optimization of field, satellite and atmospheric sampling schemes,

• Provide methods for determining mechanistic explanations for regional net fluxes patterns across seasonal to decadal time spans, and

• Provide guidance to future intensives.
Hypotheses

- Increased spatial and temporal coverage of atmospheric trace gas measurements and improved simulation of atmospheric transport and mixing processes will enable regional, weekly to annual net carbon fluxes to be determined to within 10% using “top-down,” or atmospheric budget, techniques.

- A hierarchy of field and remote sensing observations will enable further process model development and/or data assimilation techniques that reduce uncertainties in “bottom-up” flux estimates.

- Comparison of “top-down” and “bottom-up” results from daily to annual time scales will lead to iterative improvement of each independent regional approach, leading to estimates of seasonal and annual fluxes and stock changes that are consistent among the approaches.

- The “bottom-up” methods, including carbon flux and stock measurements and models, will yield a quantitative understanding of the environmental conditions, agricultural management, and ecosystem processes responsible for the observed regional CO2 and CH4 flux estimates.
Structure - Nested spatial scales

- Whole mid-continental region
  - Annual to daily focus, high spatial resolution. Independent top-down and bottom-up approaches.
- Sub-regional intensive domains
  - Evaluate bottom-up approaches within coherent MLRAs/ecoregions. Seasonal to daily focus, very high spatial resolution. Independent top-down fluxes.
  - E.g. Bondville, Mead-NB, SMEX05/Iowa-USDA, ARM-CART
- Stand-level studies
  - Flux towers, ‘tier 3 and tier 2’ plots, etc. Used to calibrate ecosystem models for up-scaling.
  - Annual to daily focus. Single points in space.
Region-wide “top-down” flux estimates
- multiple independent approaches

Region-wide “bottom-up” flux estimates
- multiple independent approaches

Syntheses:
- within clusters
- across clusters
- between whole region and clusters
- across methods

Sub-domain intensives/clusters
- develop and evaluate bottom-up approaches
- develop and evaluate top-down approaches
Project deliverables

1. Mid Continent Regional Flux and Stock Change Estimates
   - Maps of fluxes/stock changes from the sub-region and whole regions studies.
   - Both “top-down” and “bottom-up” approaches, as well as syntheses of the two approaches

2. Validated Methods

3. Mechanistic Explanation of Patterns
   - Weather patterns, soils and land use and management
   - Fossil fuel consumption
   - Livestock management
   - Waste Management
   - Industrial Processes
   - Commodity production and use

4. Guidance for Future Intensives
   - Synthesis reports with a summary of research findings, unresolved research issues and data needs
   - Discussion of operational strengths and weaknesses of campaign
Coordination/Management

1. **NACP Website**
   - Information dissemination for intensive
   - Map server to provide information about ongoing experiments

2. **Workshops**
   - MCI investigators workshops
     - Present Science Plan
     - Determine Role of Participants
     - Identify Gaps
   - Whole-NACP workshop in the fall.
     - Compare results from summer 06 among MC PIs
     - Integrate MCI with NACP-wide activities
   - Regional methods workshop
     - Summer 2007
     - Invite representatives from regional studies across N. America and globe
     - Special focus on grad student and postdoc education

3. **Session on regional carbon cycle studies at Fall AGU Meeting(s)**
   - Present science to a broad audience
   - Repeat 2005 session in 2006, 2007?

4. **Data management plan**
5. **Funding for future workshops, research collaboration**
   - NSF research collaboration network proposal?

6. **Coordinated special issues, synthesis papers**
7. **Calls for synthesis research, research to fill gaps in the MCI science team.**