

Ecological Forecasting Biogeochemistry Group

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Biogeochemistry Group Focus

Overarching goal:

To assess how **climatic variability** and climate change interact with **land use/land cover** patterns to influence biogeochemical cycling in Central Plains grasslands and at the grassland/forest ecotone.

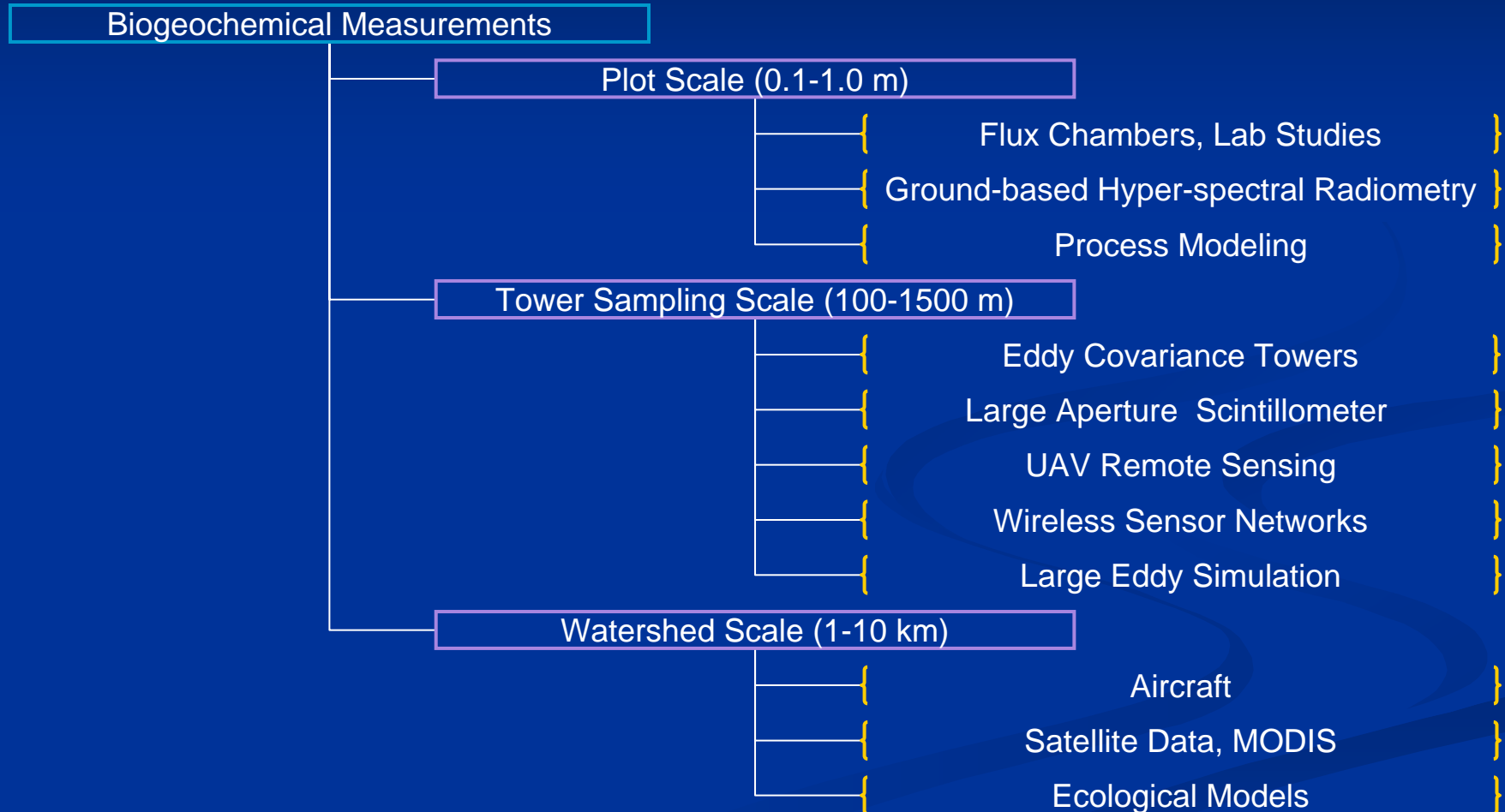


Research Topics

- Climatic Variability
- Land Management / Use
- Carbon cycle and hydrology linkages
- Scale / Spatial Variation
- Instrumentation and Informatics
- Climate Change

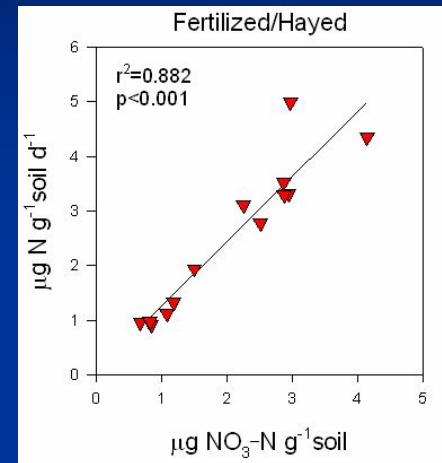


Measurement Scales and Integration



Plot Scale Research

- Soil Respiration
 - Billings, Ham
- Soil Nitrogen Cycling
 - Billings, Blair
- Canopy Respiration and Photosynthesis
 - Ham, Owensby
- Field Spectroscopy
 - Ham

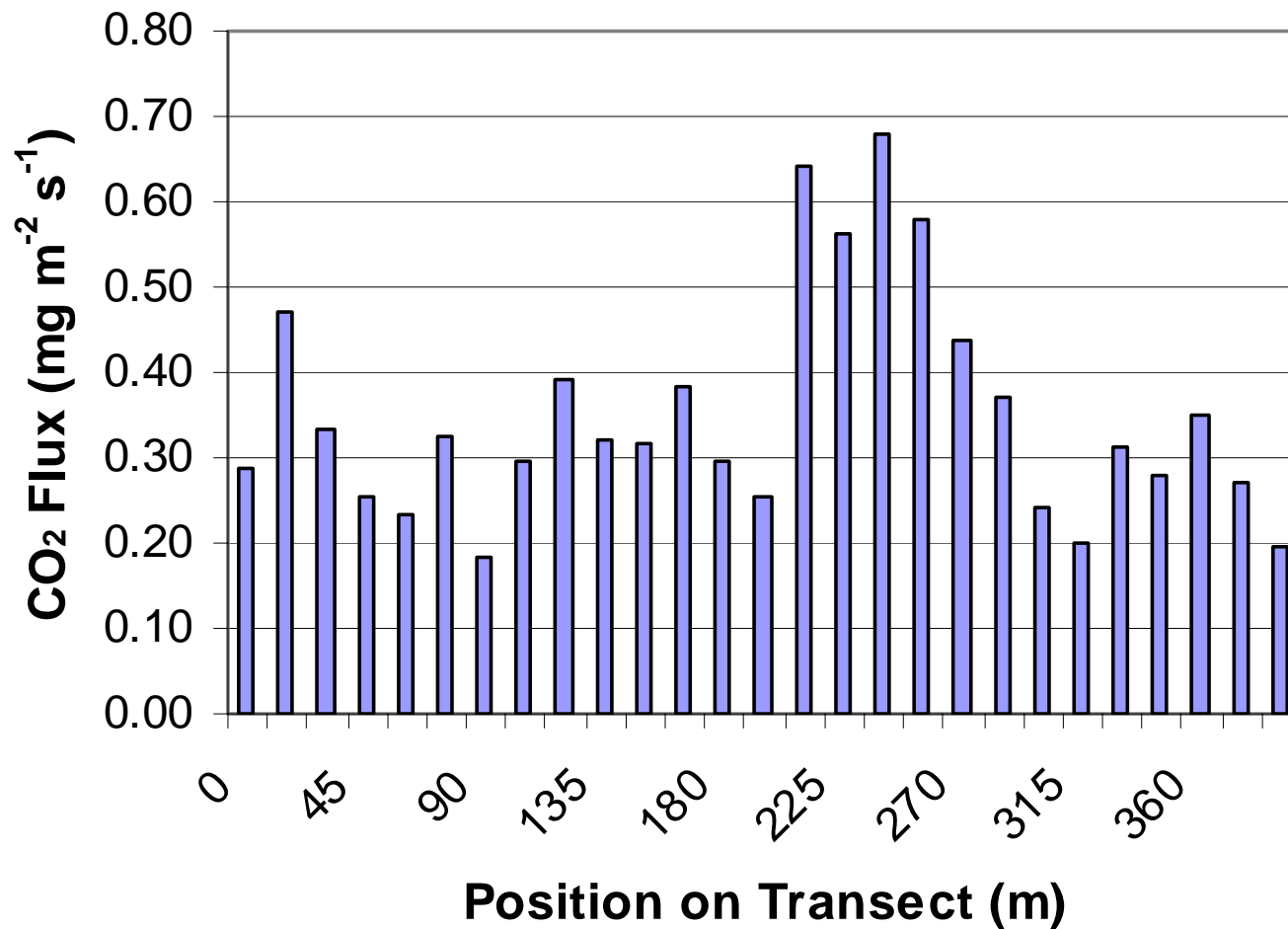


Tiemann and Billings,
unpublished data
KU Field Station





Soil Respiration on 400-m long Transect



Tower-Based Research

- Eddy Covariance Towers

- Konza Towers (3)

- Ham, Brunsell, Blair

- Rannells Towers (3)

- Owensby, Ham, Coyne

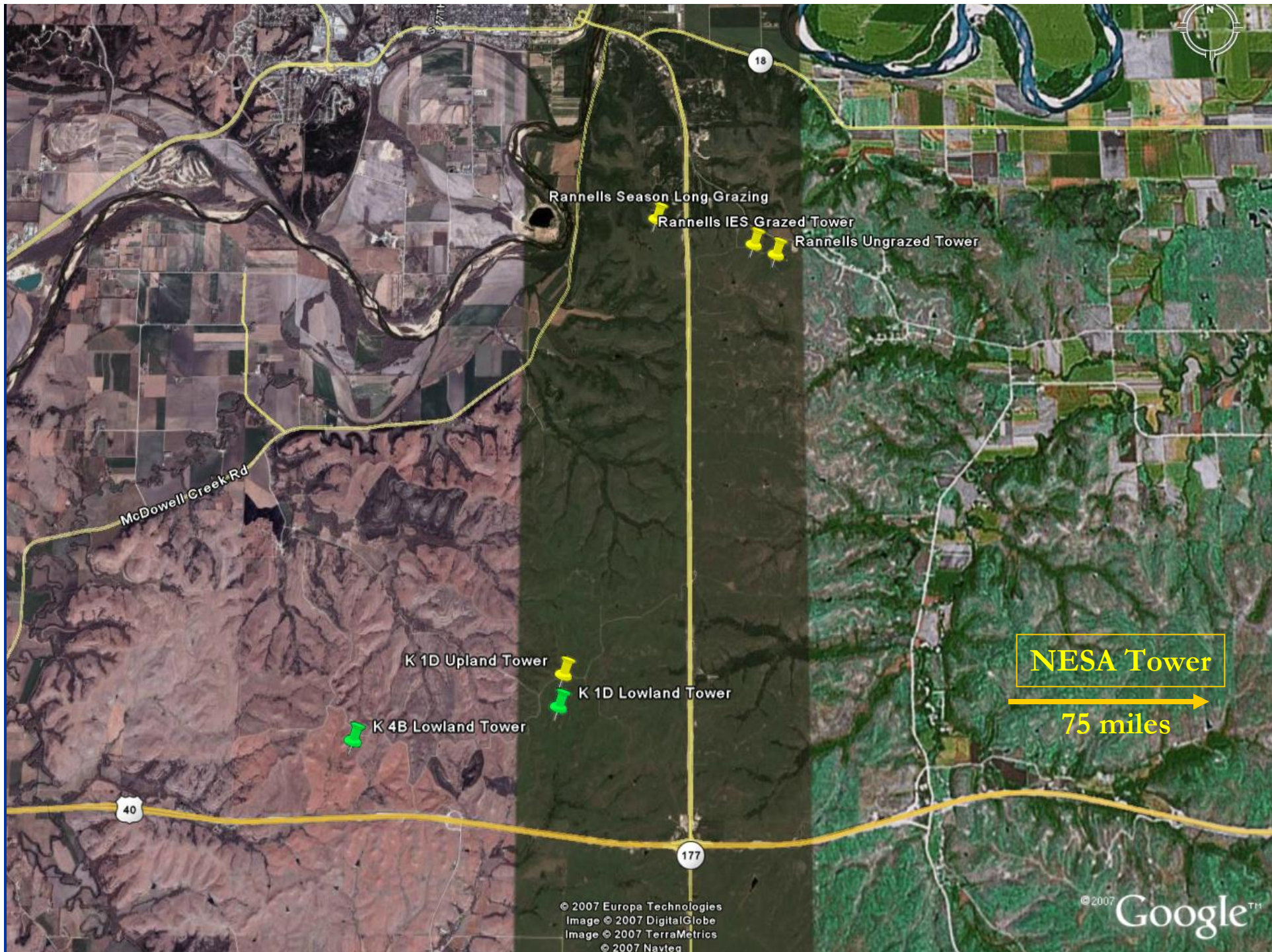
- NESAs, KU Tower (1)

- Brunsell

- Large Aperture Scintillometer

- Brunsell





NESA

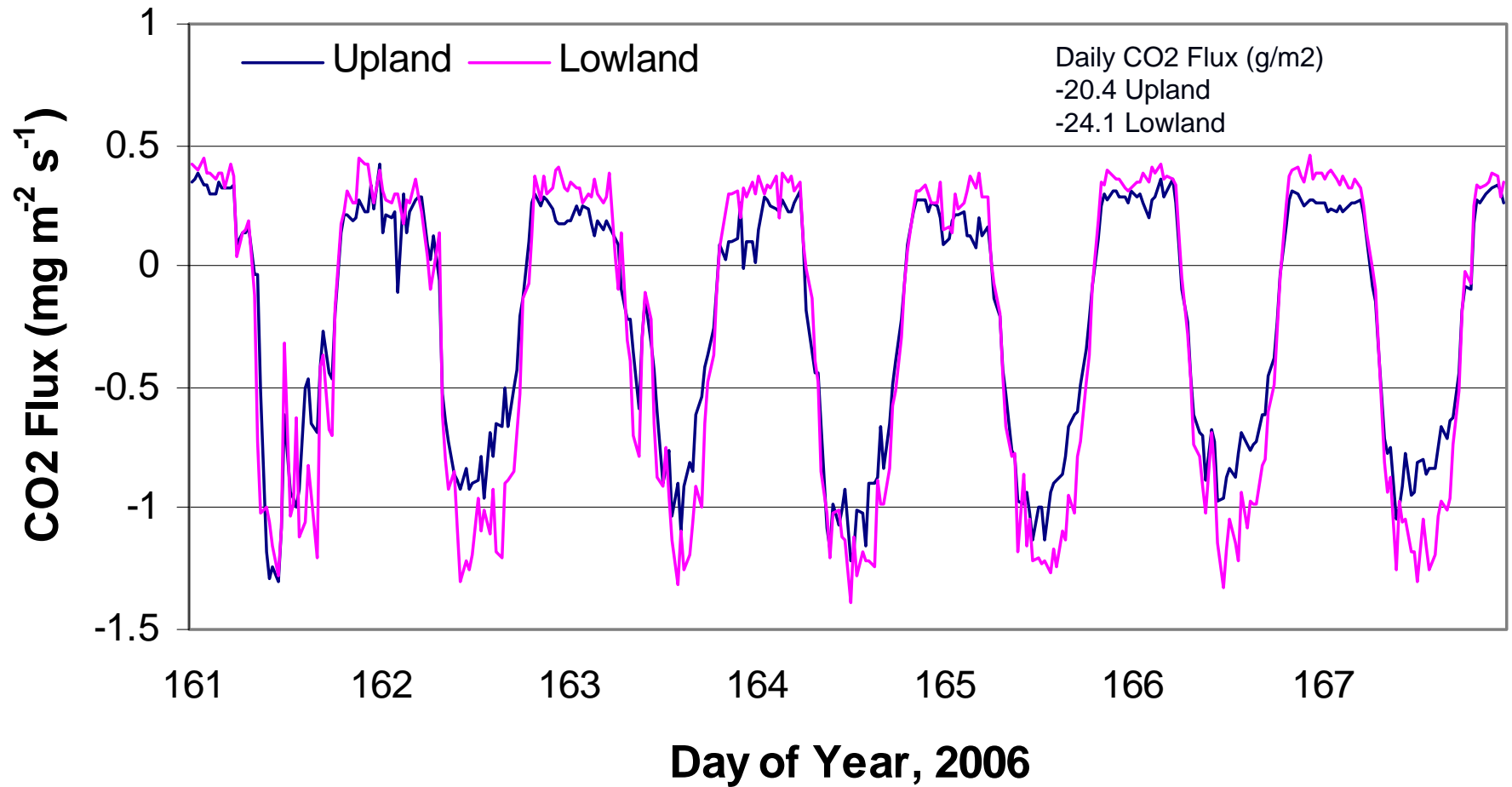
- Eddy covariance
 - soil moisture
 - precipitation
 - fluxes of water, carbon and heat
- Remote Sensing
- Transects of precipitation gradient, urbanization and land cover change (Konza-> KC)



Informatics and Data Collection

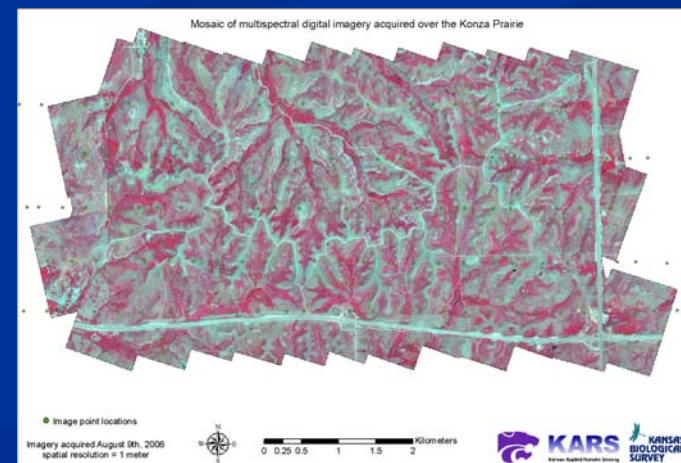
- Towers collect turbulent time series data
- $U_x, U_y, U_z, T_s, CO_2, H_2O, P$, diagnostics
- 10 variables at 20 Hz = 720,000 number / hour
- $(4 \text{ towers}) * (720,000 \text{ num/hr}) * (24 \text{ h/ day}) = 69.1 \text{ million numbers per day}$
- All of these data are collected and temporarily stored on- site and then transferred via wireless internet to our ecoforecast server at KSU
- Weekly processing routine and report generation

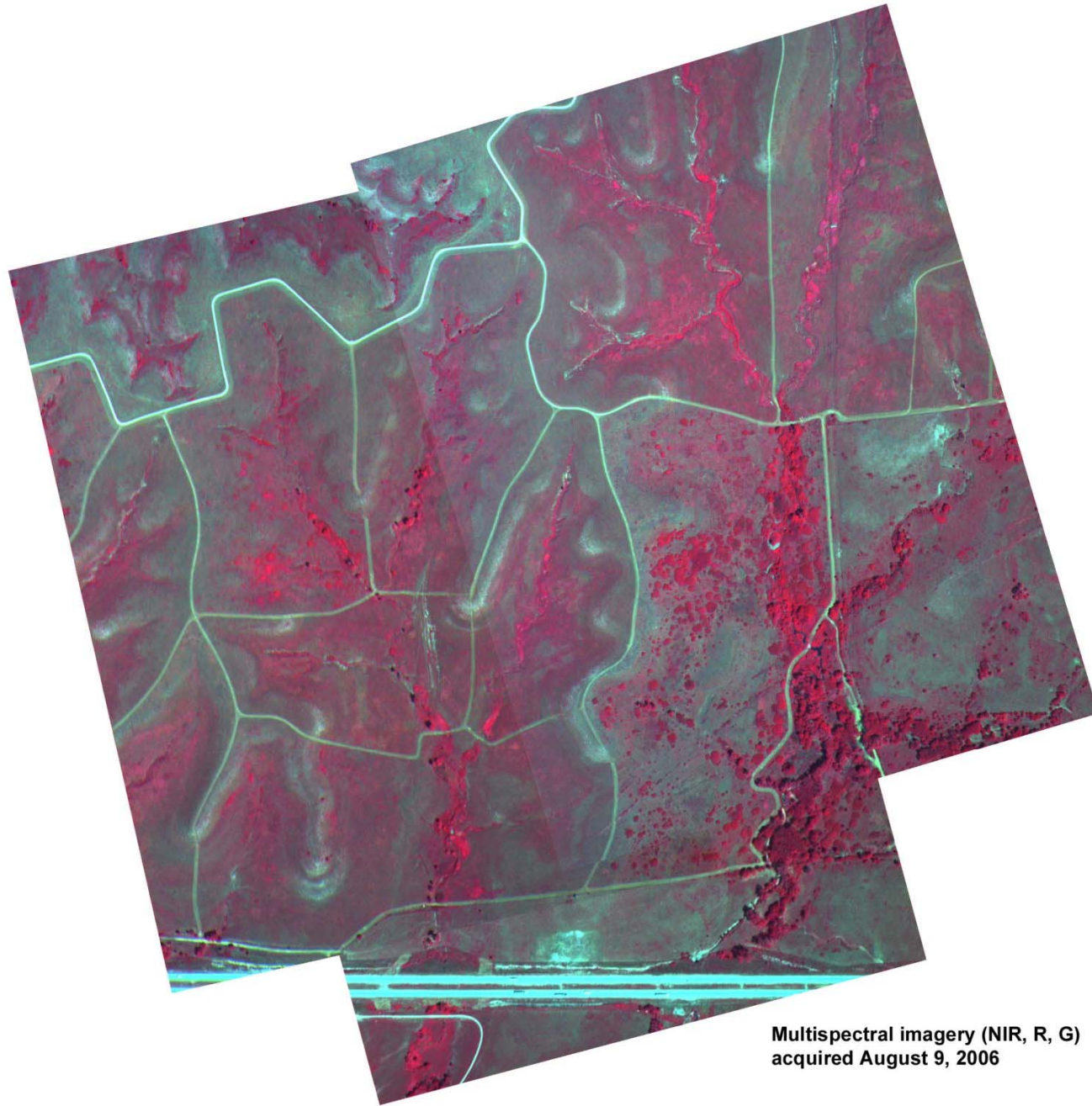
Upland and Lowland CO₂ Fluxes: June 10-16, 2006



Remote Sensing and Sensor Nets

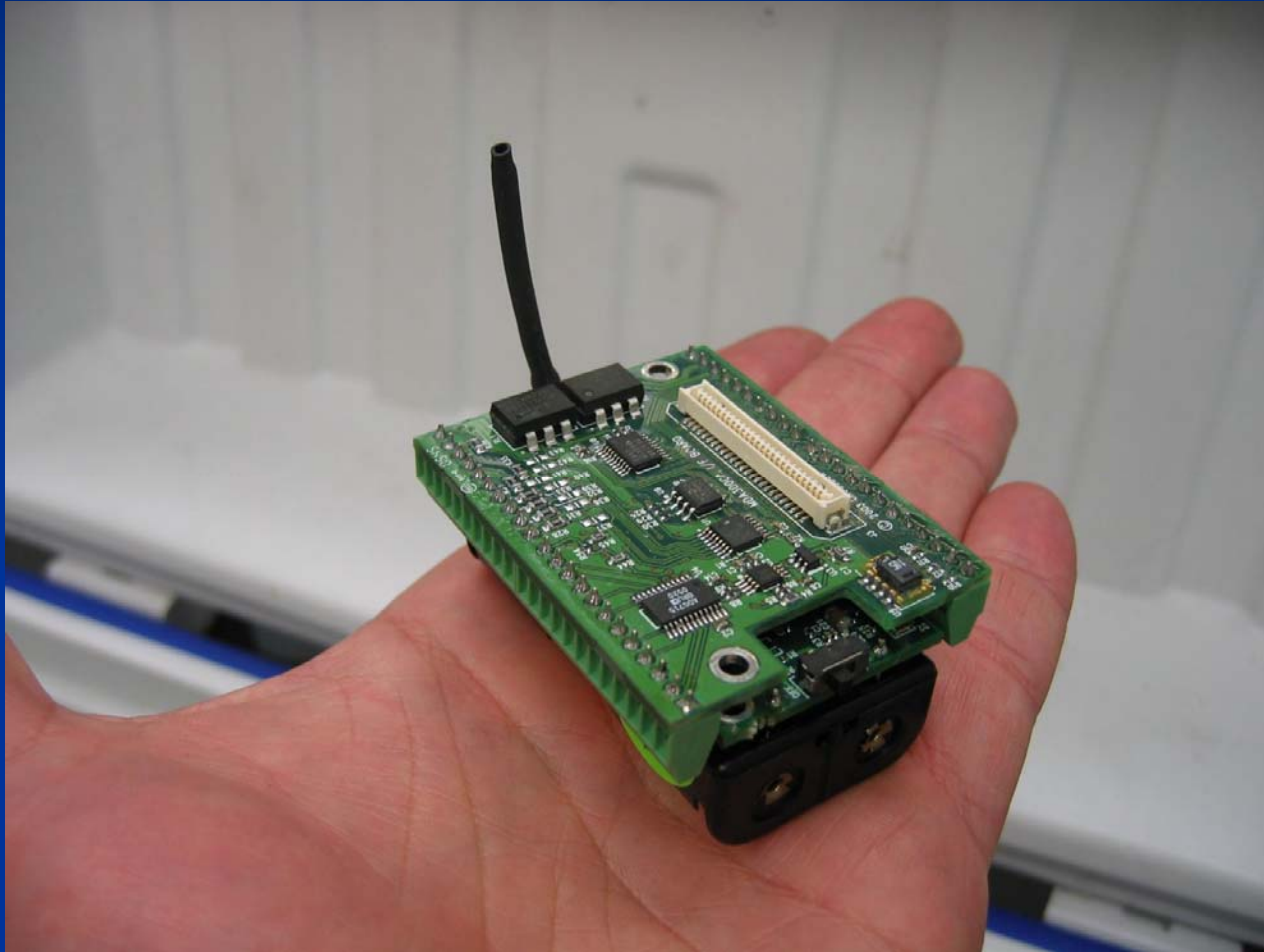
- UAV
 - Ham, Schinstock, Goodin
- Full-Scale Aircraft
 - Price, Houts
- Satellite
 - Brunsell, Price
- Wireless Sensor Networks
 - Ham, Andresen





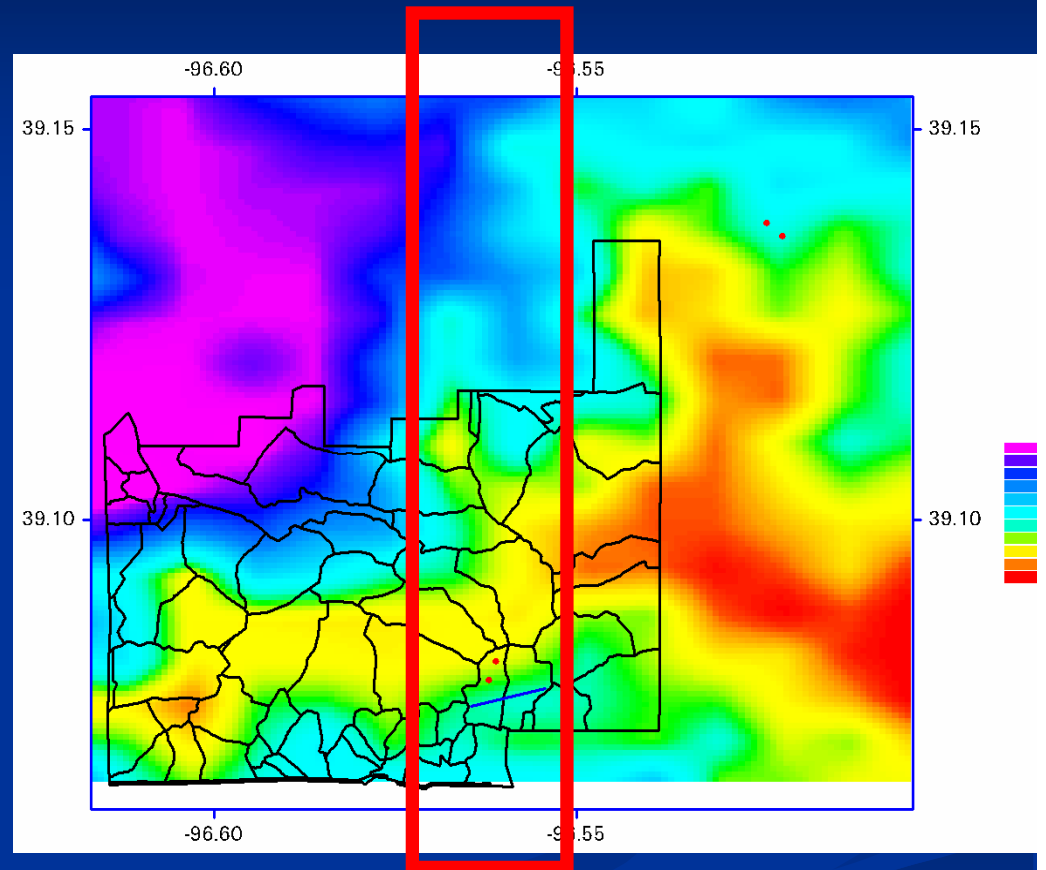
**Multispectral imagery (NIR, R, G)
acquired August 9, 2006**

Wireless Sensor Networks



Modeling

- Process Modeling
 - Billings, Ham
- Energy Balance/ET
 - Ham, Brunsell
- Large Eddy Simulations
 - Brunsell
- Ecosystem Modeling
 - Brunsell, McKane
 - (GEM, SVAT)



(Brunsell)

Air Quality



New Grants and Proposals

- Blair, J.M. 2007-2010. Collaborative Research: Interactive effects of altered rainfall timing and elevated soil temperature on soil communities and ecosystem processes. DOE National Institute for Climate Change Research, \$365,922.
- Blair, J.M. 2007-2010. Grassland structure and function in response to warming and more extreme precipitation patterns. USDA NRI Managed Ecosystems, \$148,108 to KSU.

Plans to Pursue Funding in 2007

- Goodin, Ham, Brunsell and others. Impacts of Land Management with Burning and Grazing on Carbon Dioxide Flux in the Tallgrass Prairie. NASA/USDA Carbon Cycling Program.
- Goodin, Ham and Others. Effect of Flint Hills Burning on Regional Air Quality. USDA NRI Air Quality.
- Billings. Ecosystem function and microbial diversity across seasons in grasslands undergoing forest succession. NSF Ecosystems Program
- Ham, Brunsell and others. Using adaptive wireless sensor networks to quantify spatio-temporal variations in microclimate and soil moisture dynamics in a tall-grass prairie. NSF Instrument Development.
- Brunsell and Ham. Soil moisture dynamics in a tall-grass prairie. NSF Geography and Regional Sciences.
- Brunsell, Ham and others. NASA terrestrial hydrology or land cover
- NSF Critical Zone Observatory, NEON program, LTER Regional Science Initiative