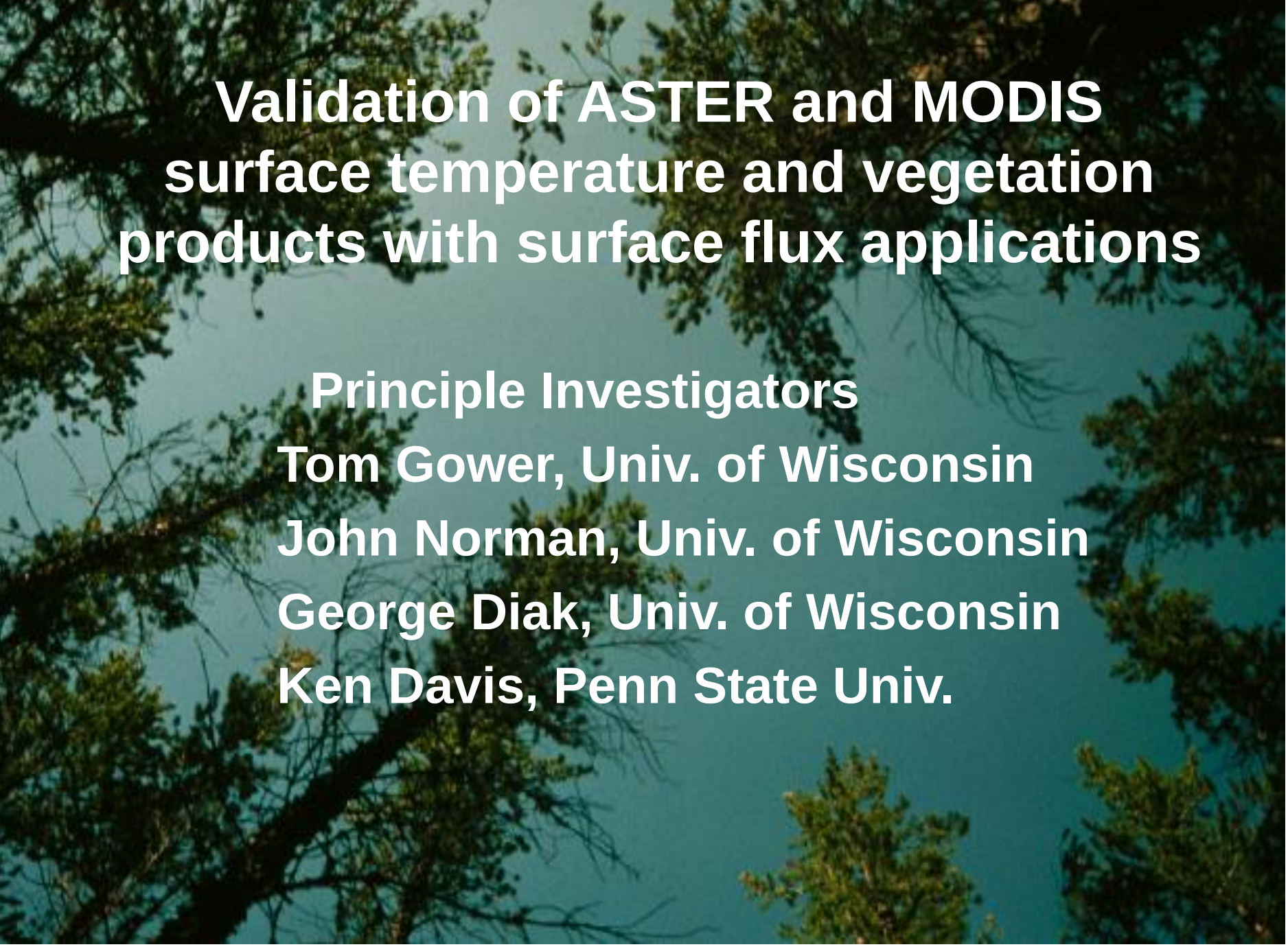


Validation of ASTER and MODIS surface temperature and vegetation products with surface flux applications

Principle Investigators

Tom Gower, Univ. of Wisconsin

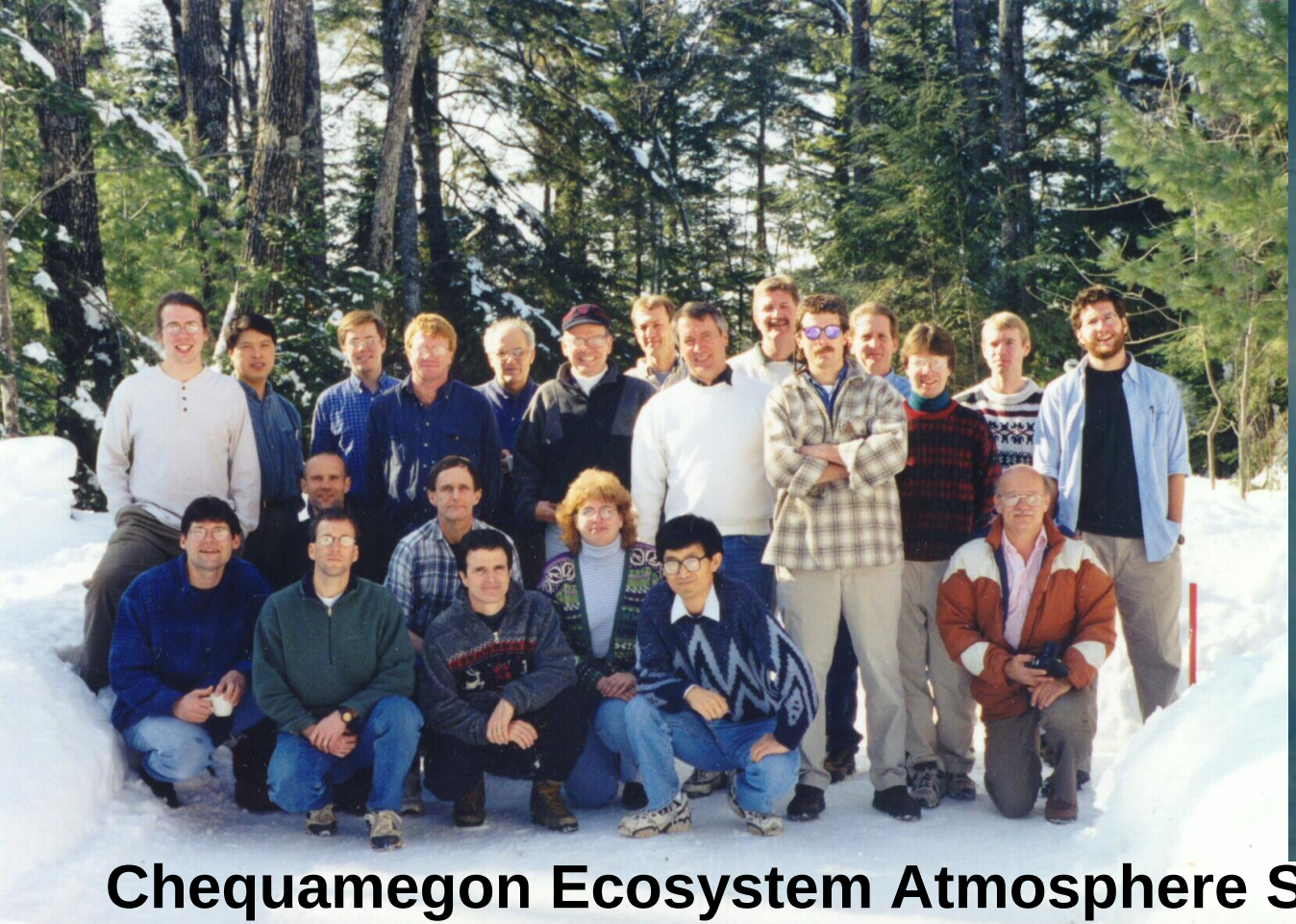
John Norman, Univ. of Wisconsin

George Diak, Univ. of Wisconsin

Ken Davis, Penn State Univ.

Outline

I. General Project Background
II. Objectives and Products to be Validated
III. Data Collected and Results
IV. Data Availability and Collaboration
V. Scaling from Plots to MODIS Pixels to Flux Tower Footprints
VI. Communication of Results
VII. YR 2001 Plans



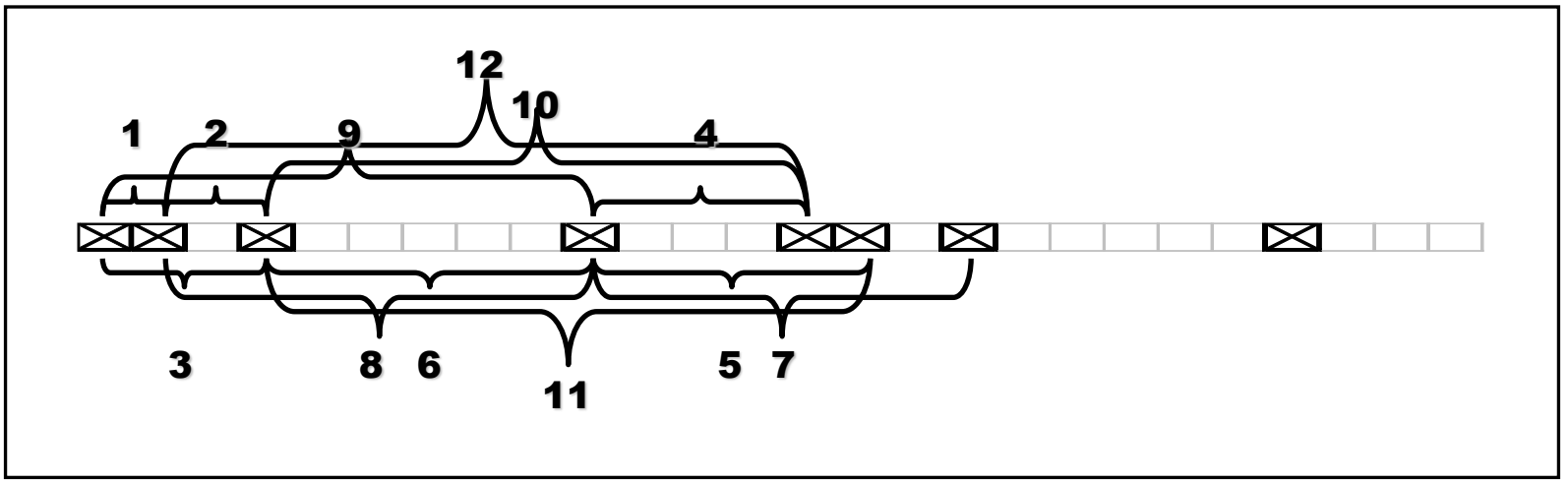
Chequamegon Ecosystem Atmosphere Study (CHEAS)

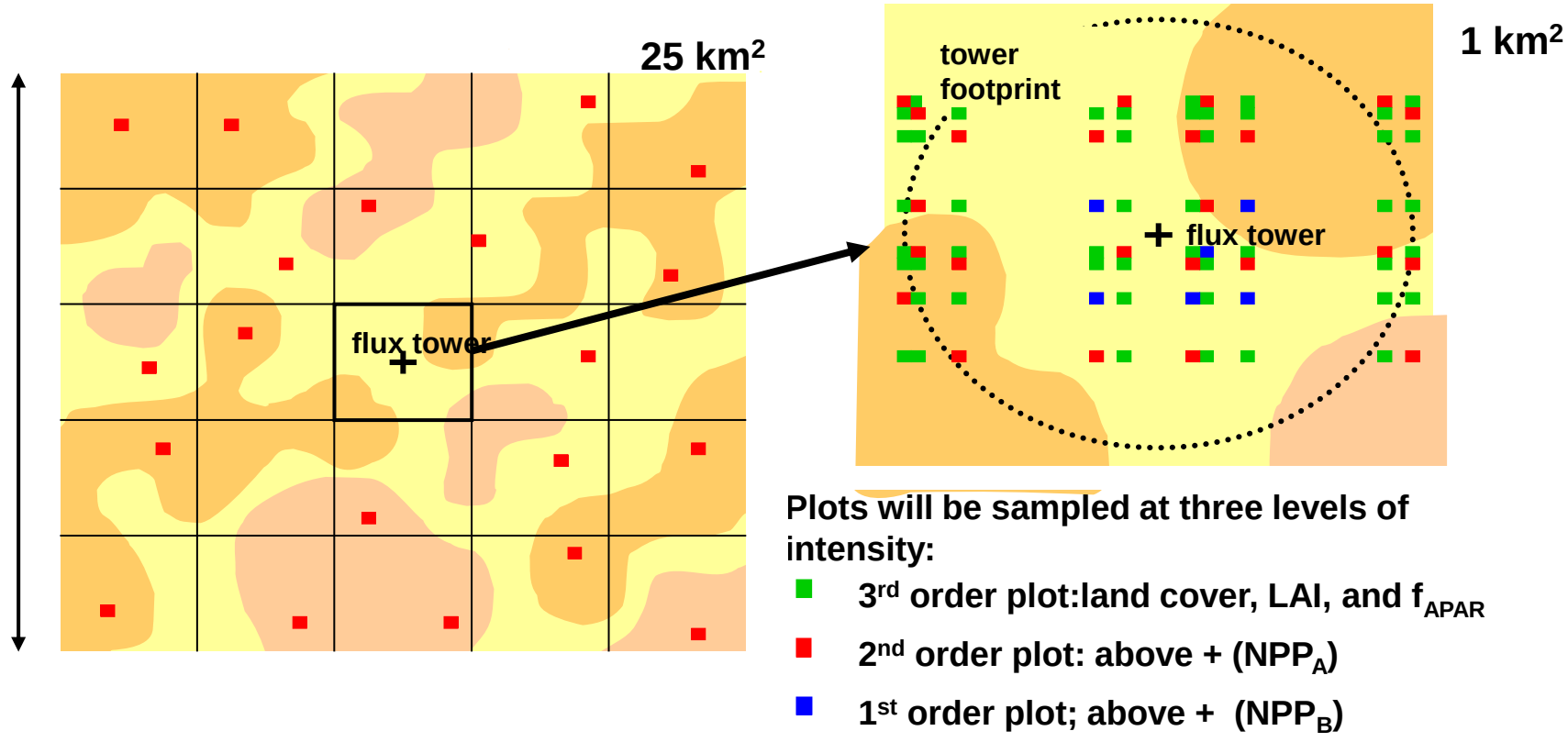
⇒ Multi-disciplinary, collaborative program to quantify carbon, water, and energy exchange between cold-temperate forest/wetland landscape and the atmosphere.

⇒ Located in northern Wisconsin, near Park Falls, WI.

⇒ Dominant ecosystems are: alder wetlands, early successional aspen forests, northern hardwoods, and upland pine forests.

⇒Funding sources are: NASA EOS-VAL, DOE, McIntire-Stennis, NOAA, NASA Hydrology, TECO.

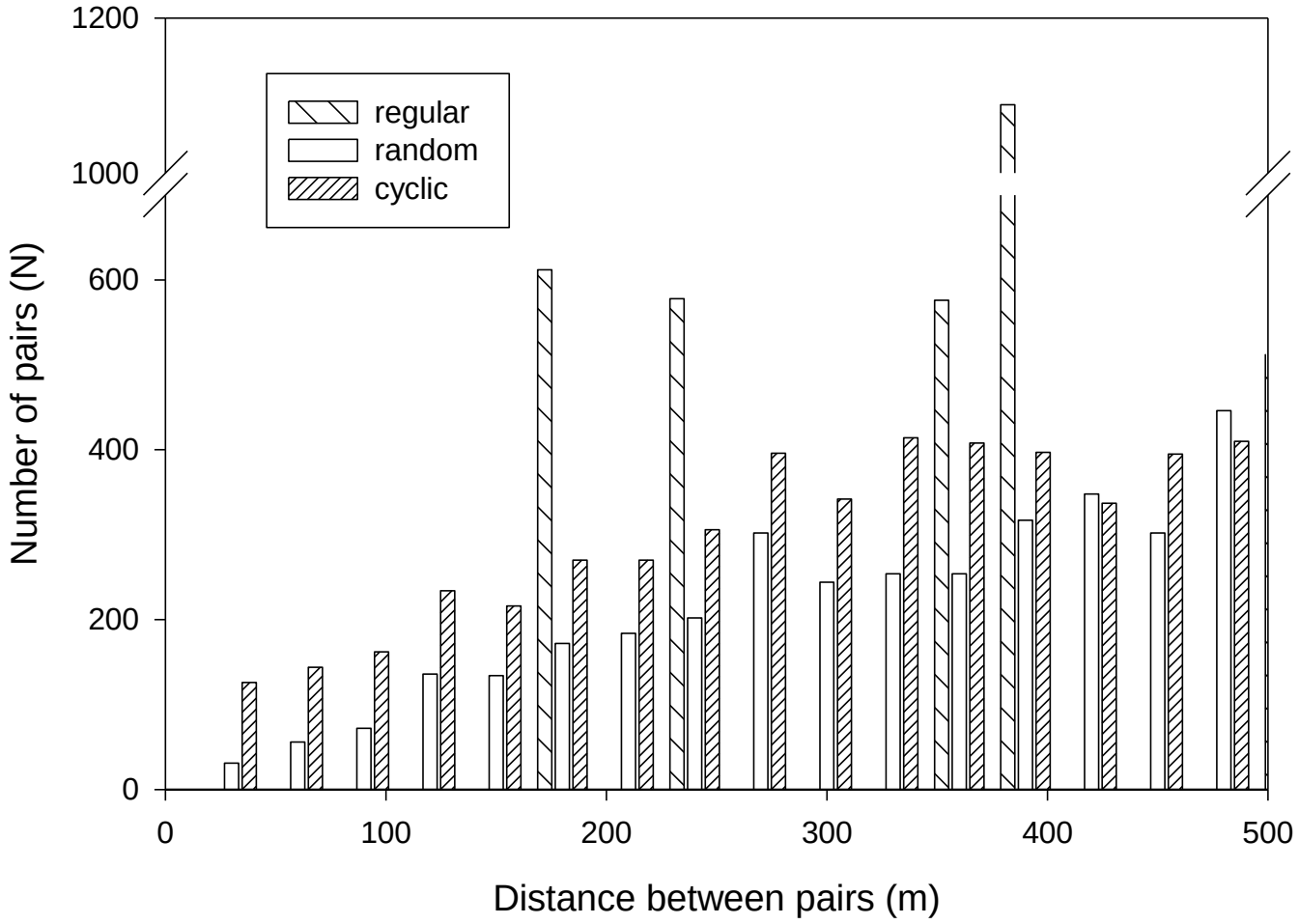




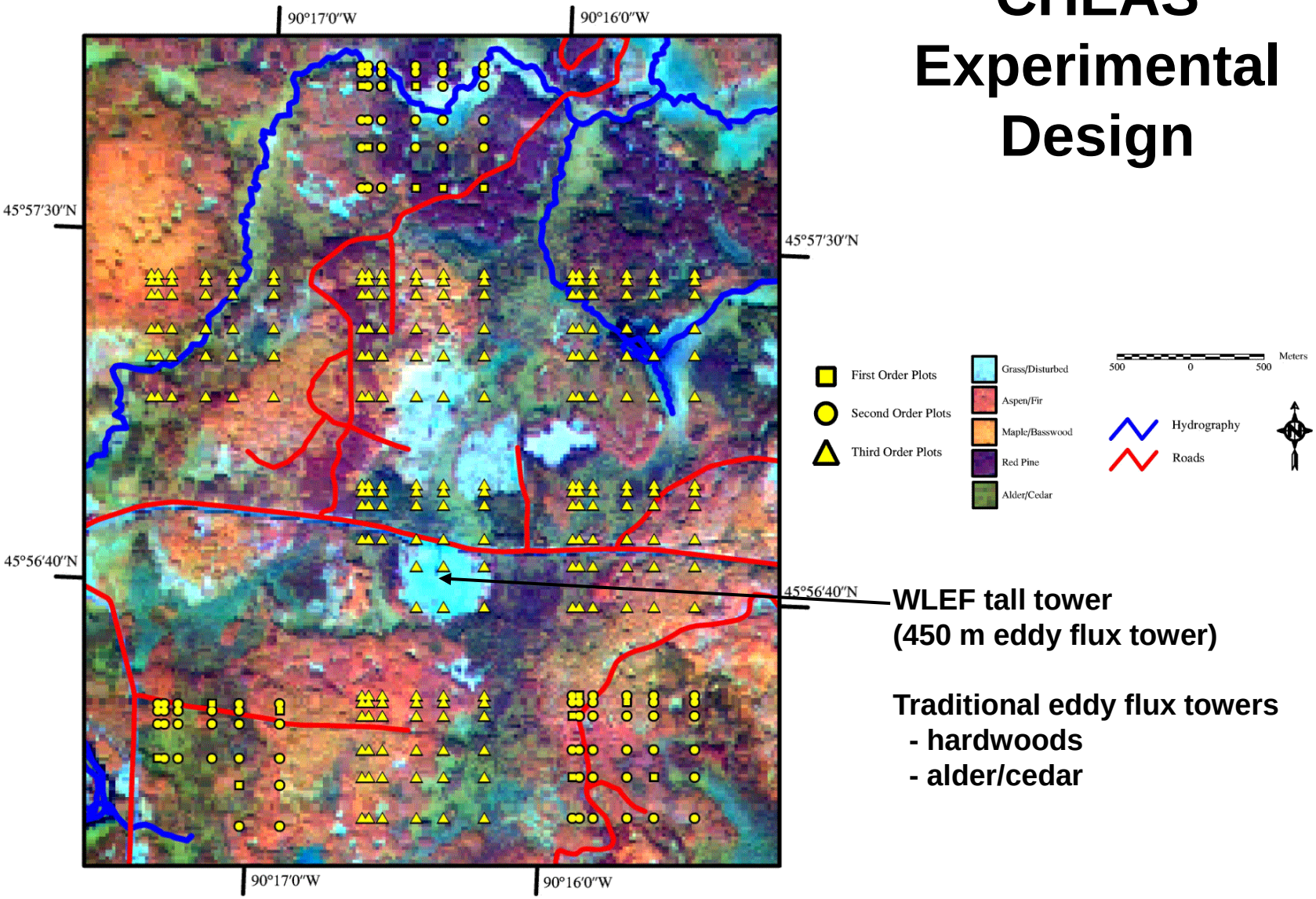
Plots will be sampled at three levels of intensity:

- 3rd order plot:land cover, LAI, and f_{APAR}
- 2nd order plot: above + (NPP_A)
- 1st order plot; above + (NPP_B)

CHEAS Cyclical Sampling Design


1200
1000
600
400
200
0
Number of pairs (N)
regular
random
cyclic
0
100
200
300
400
500
Distance between pairs (m)

CHEAS Experimental Design



Traditional eddy flux towers
- **hardwoods**
- **alder/cedar**



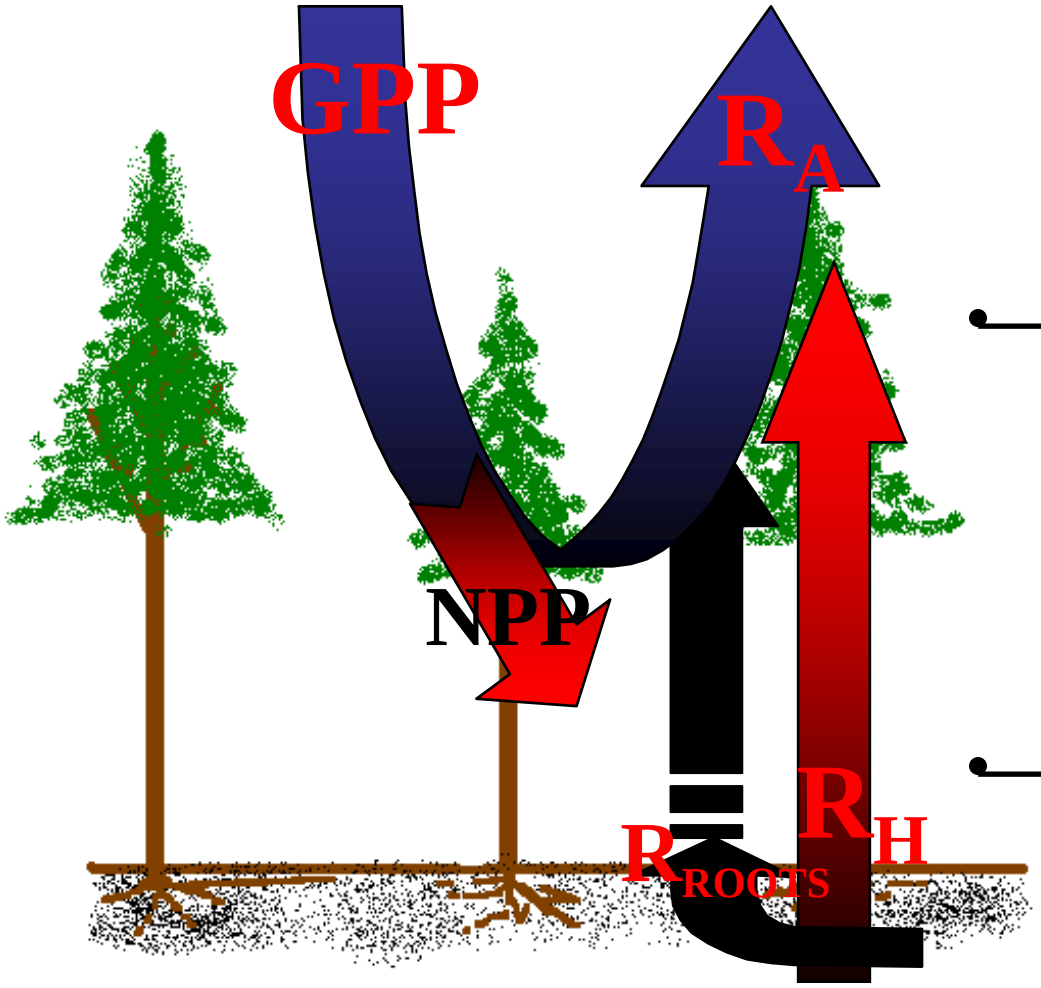
Dominant Vegetation Types

-alder wetland
-upland pine
-aspen
-northern hardwoods

II. Products to be measured and Validated

- **Land surface temperature (LST) and emissivity at the scale of ASTER and MODIS pixels**
- **Leaf Area Index (LAI)**
- **Fraction Intercepted Photosynthetic Active Radiation (FIPAR)**
- **Aboveground and Total Net Primary Production (NPP_A and NPP_T)**
- **Net Ecosystem Production (NEP)**

Validation of MODIS Products



Products

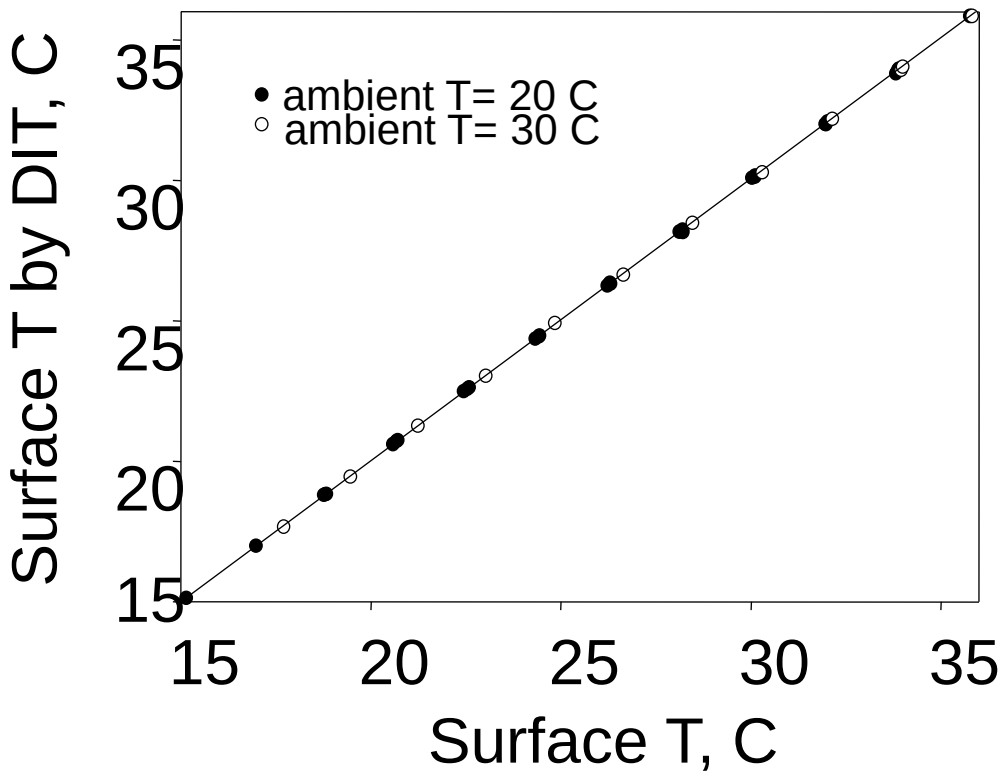
I. Landcover [1,2]
II. LAI [1,2]
III. fIPAR [1,2]
IV. NPP [1,2]
V. GPP [1,3,4]
VI. NEP [1,3,4]

1 = MODIS
2 = field measure
3 = simulated (IBIS)
4 = eddy flux

GPP = Gross Primary Production
NPP = Net primary Production
NEP = Net Ecosystem Production

R_H = Heterotrophic Respiration
R_A = Autotrophic Respiration

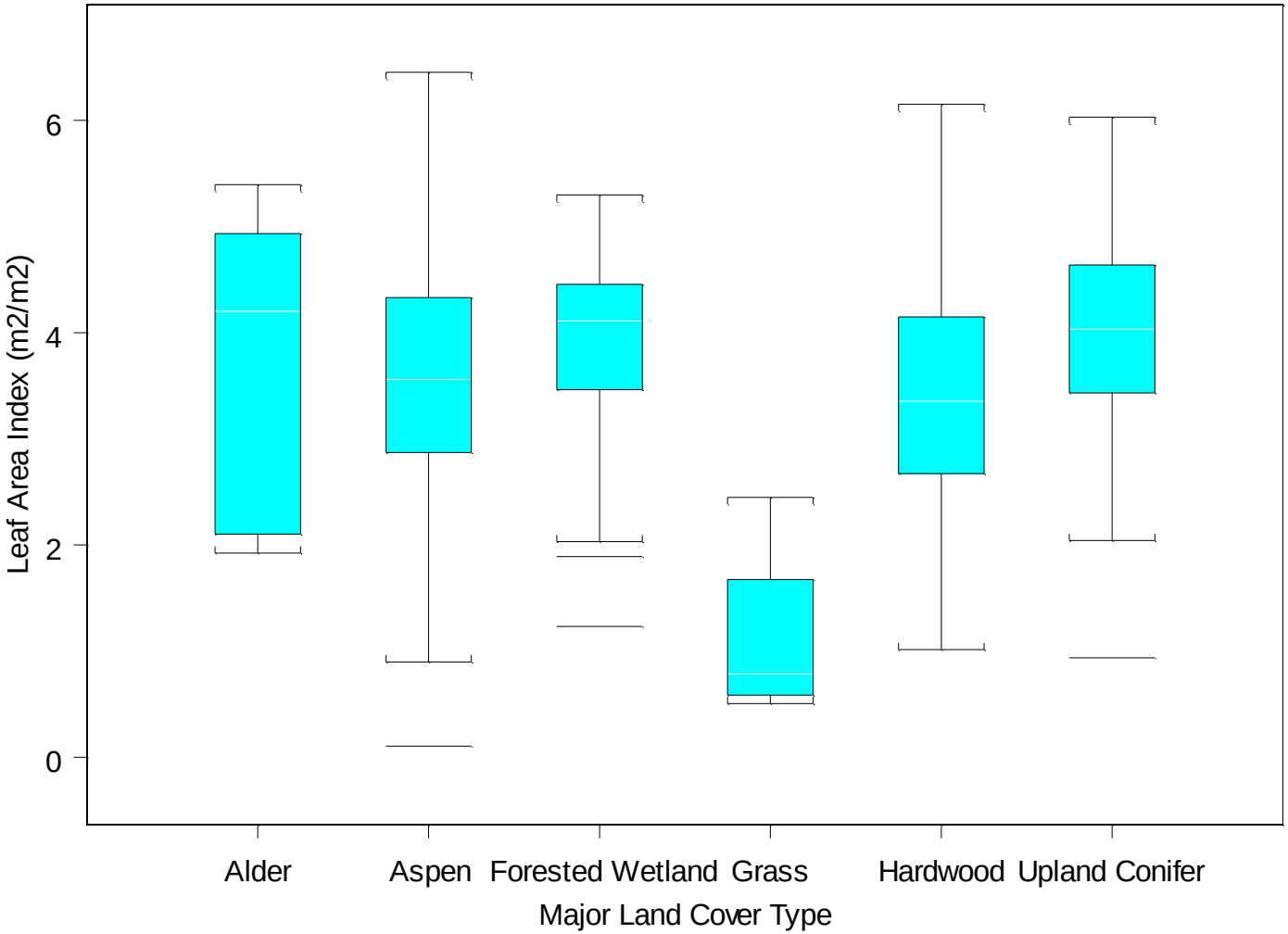
Calibration of Differential Infrared Thermometer (DIT) to be used to Validate Aster Vegetation Temperature Product



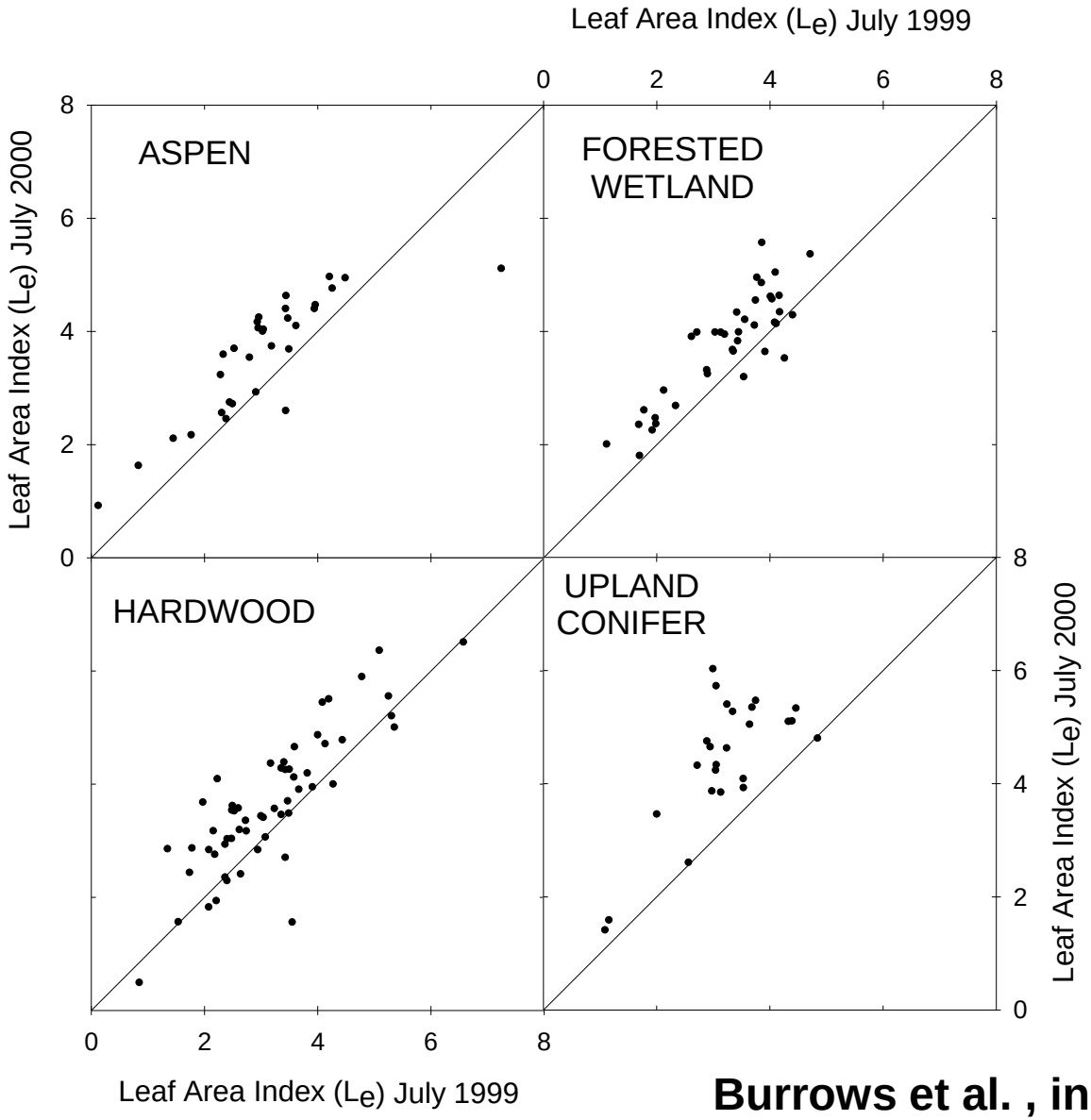
Everest Interscience Infrared thermometer (model 4000)
- measured in 8 - 14 μm wavelength bands
ASTER surface temperature channels are 10.25-10.95 and 10.95-11.65 μm

* Atmospheric Emitted Radiation Interferometer (AERI) emissivity measurements to be compared to the five ASTER thermal bands

Leaf Area Index – Ecosystem Averages

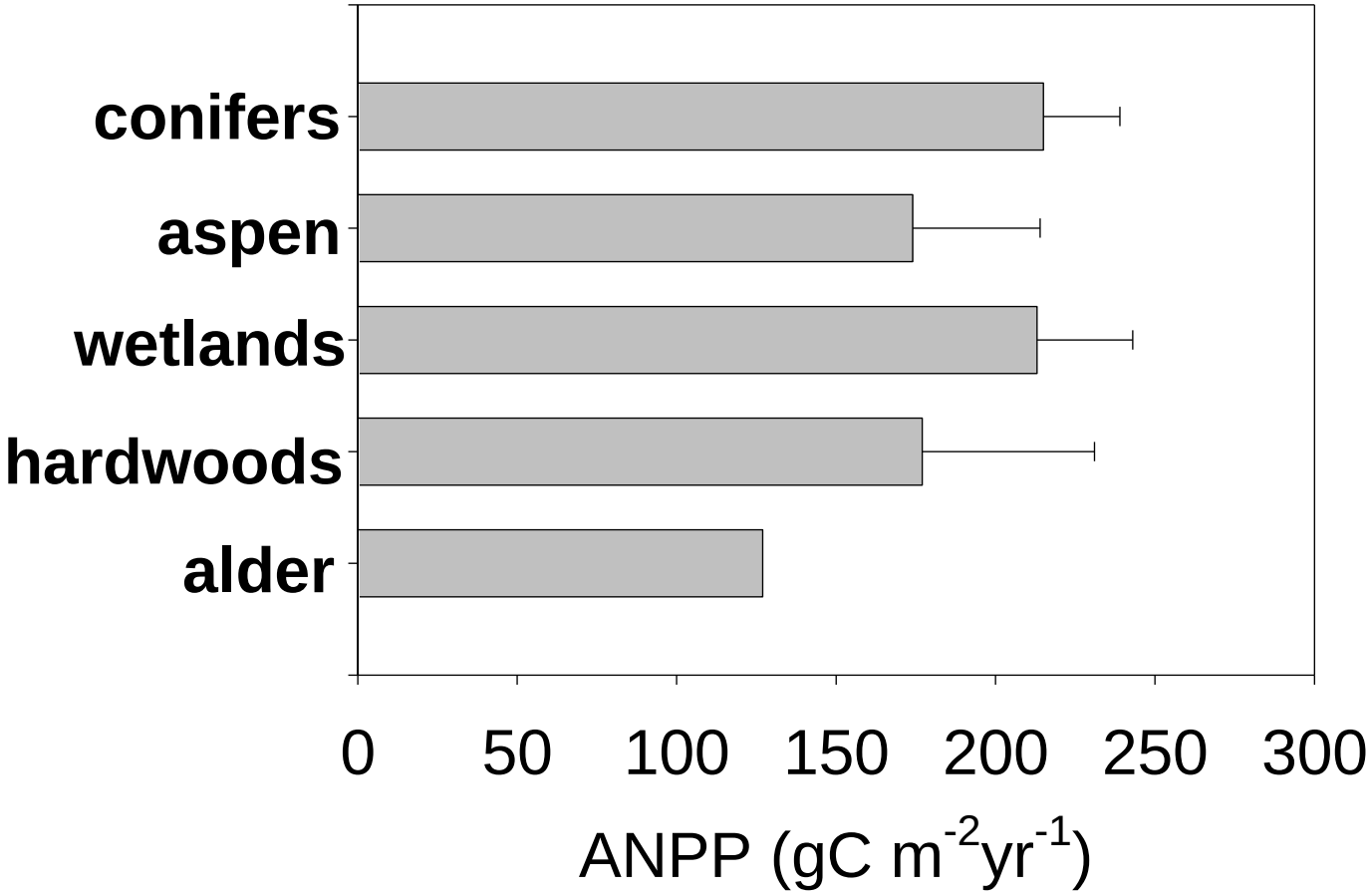


Inter-annual variation in LAI

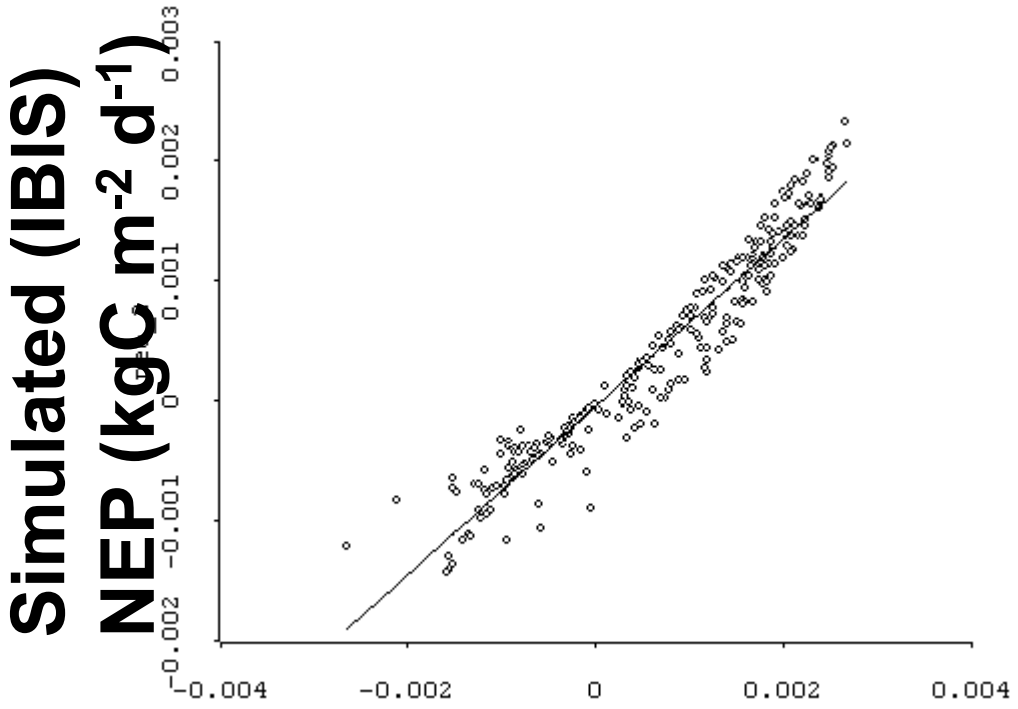


Burrows et al. , in prep.

Aboveground Net Primary Production (NPP_A)



Comparison of Measured (Eddy flux) vs Simulated (IBIS) Net Ecosystem Production



IV. Data Availability and Collaboration

- **All 1999 and 2000 data have been submitted to Mercury**
- **All 1999 and 2000 data are available from the CHEAS webpage:www.cheas.umn.edu**
- **We are anxious to collaborate with MODLAND and other scientists. All that we ask is that users of the data contact appropriate PI for any revisions.**

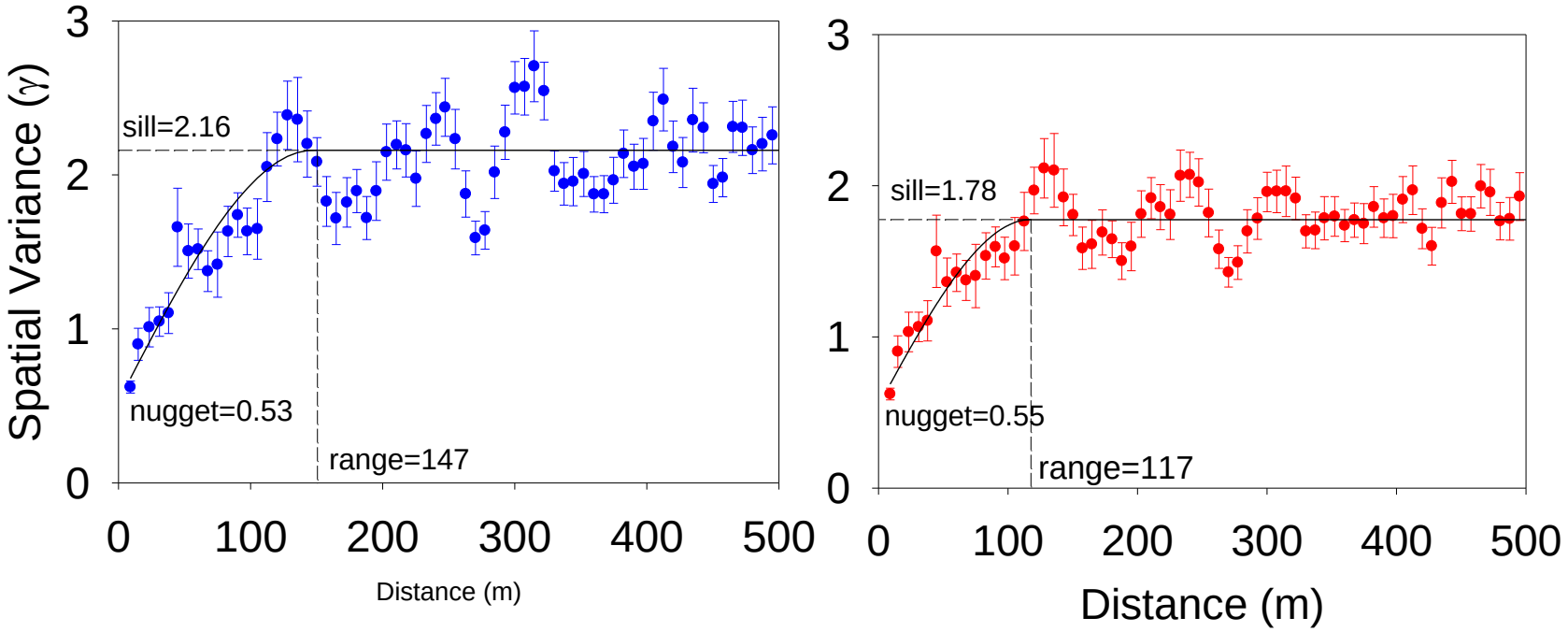
V. Scaling from plots to MODIS pixels to flux tower footprints

- Process-based ecosystem models driven by remotely sensed vegetation cover, LAI, and fIPAR

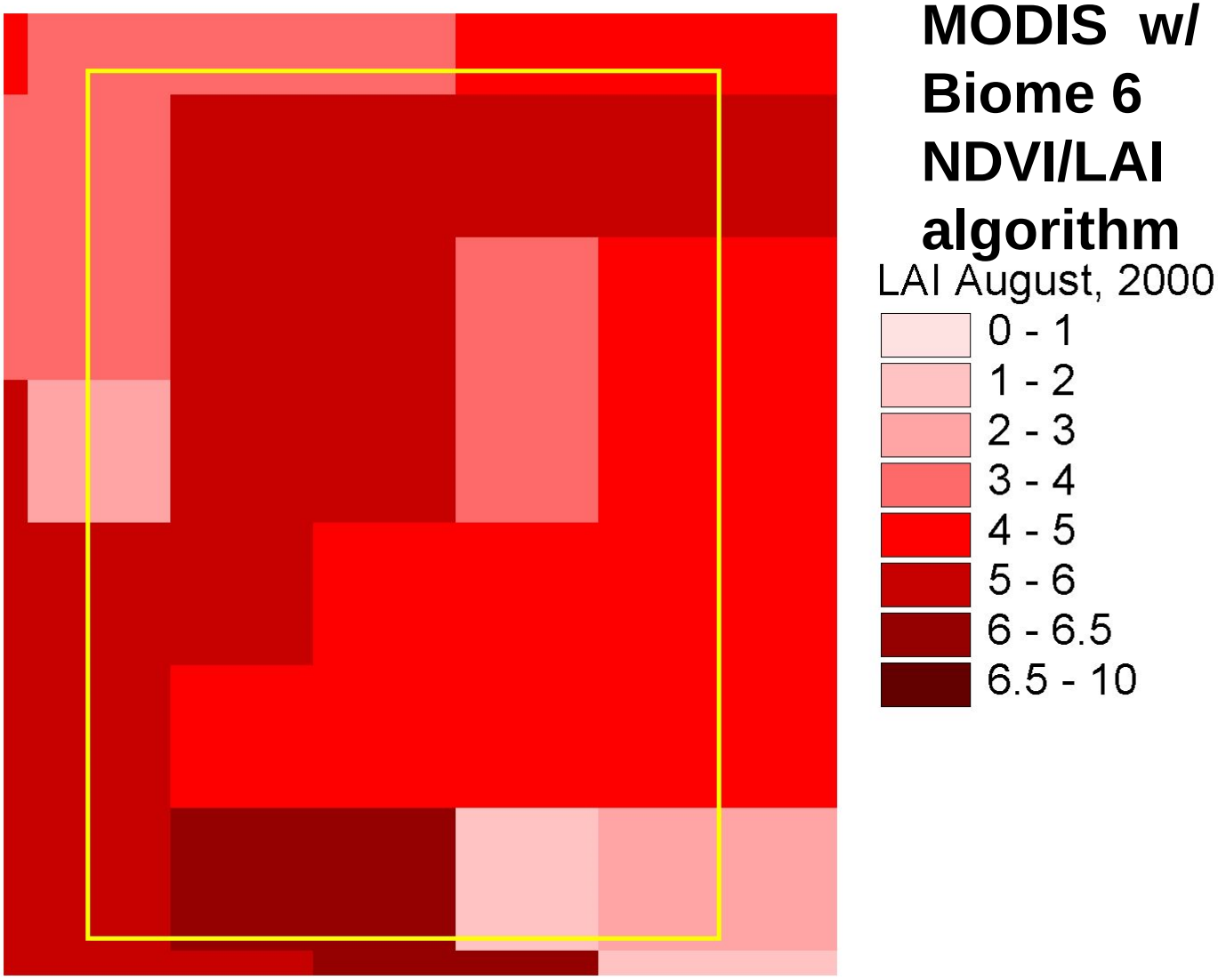
  Atlas, ETM+, MODIS

- Geostatistical models
  - avoids saturation problems
  - quantitative approach to estimate biomass

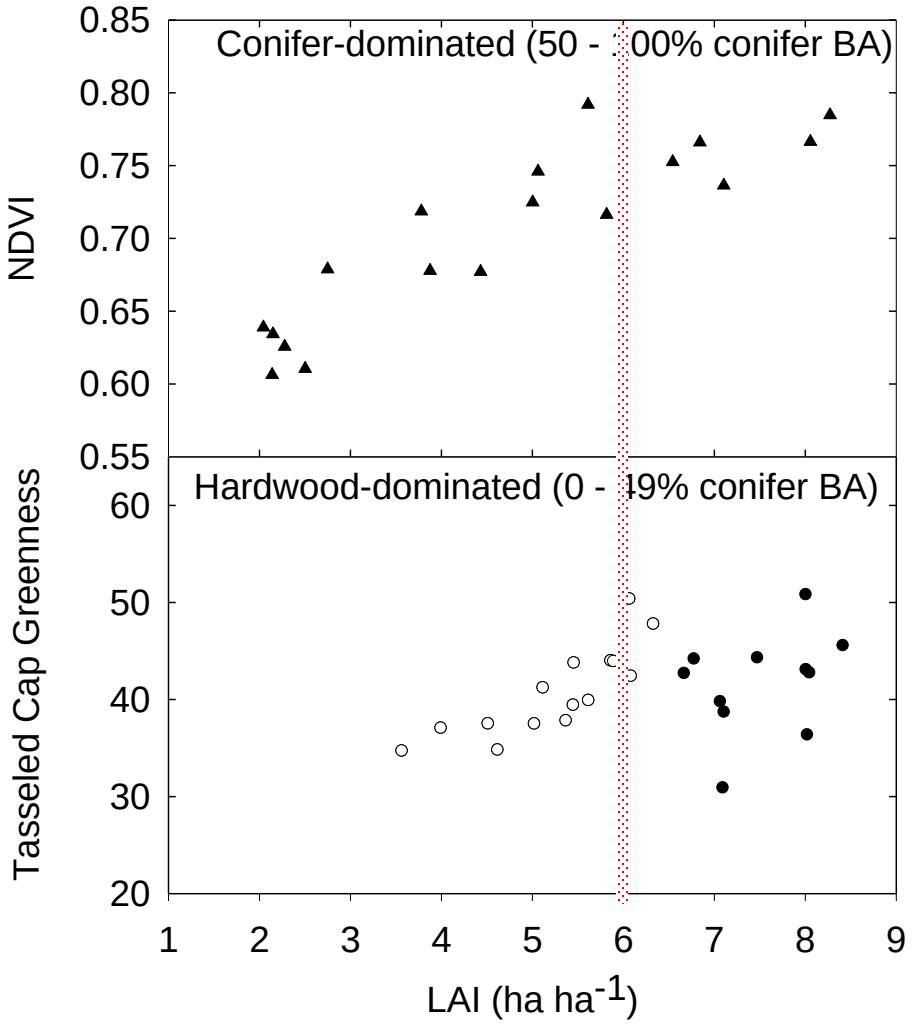
Semivariograms: Quantifying Spatial patterns of LAI and NPP



Comparison of MODIS LAI to Field Measurements



Measured vs Landsat TM5 LAI



VI. Communication of Results

- Global Change Biology special issue for the CHEAS project – manuscript deadline is Feb 1, 20001.
- There is interest within the NASA EOS-VAL science team to contribute to a special MODIS issue??

Field Plans for 2001

1. Measure LAI and fIPAR
   - 1 major field campaign during peak LAI
   - 2 minor field campaigns to capture phenology
2. Measure ANPP
3. Image Acquisitions
   - MODIS, ETM+, AVIRIS, ATLAS?
4. Comparison of NPP, GPP and NEP among MODIS products, IBIS ecosystem model, and eddy flux tower