CONTRIBUTIONS FROM A DECIDUOUS FOREST AND SHRUB WETLAND TO REGIONAL CARBON FLUXES IN NORTHERN WISCONSIN

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SUMMARY

Long-term observations of CO₂ exchange and surface-atmosphere exchange are currently being conducted in the upland deciduous forest and alder-willow wetland. Fluxes measured in these ecosystems are substantially smaller and respiration slightly greater than the deciduous upland forest. Lower photosynthetic rates appear to be associated less productive areas such as shrub wetlands, and perhaps recently logged or thinned forests. There was not much variability in soil temperature among the sites, and lower respiration rates appeared to be associated with lower temperature sensors or in situ measurements. Differences in net ecosystem uptake are higher when respiration is lower in the region as a whole. By combining measurements at the tower sites with additional field measurements, a more complete understanding of environmental processes controlling net primary productivity may be achieved.

REGIONAL OBSERVATIONS

WLEF 450 m flux tower

UPLAND FOREST CONTRIBUTION

WLEF and Willow Creek, 2000

CONDITIONS

CONTROLLING RESPIRATION

WETLAND vs. UPLAND FLUX

Lost Creek and Willow Creek, 2001

FLUX TOWER SITES AND VEGETATION

STAND-SCALE FLUXES

Lost Creek Wetland
Alder-Willow-Sedge
Willow Creek Upland
Maple-Basswood-Ash

MICROMET STATIONS

Alder Wetland
Alder-Cedar-Sphagnum
Mixed Upland
Maple-Fir-Ash

Soil temperature:
> Soil T variability between all sites was small
> Regional respiration rates increased rapidly during the growing season
> Respiration rates at Willow Creek were not strongly influenced by surface soil T

Wetland Fluxes:
> NEE during the winter was small and nearly identical at the sites
> Nighttime NEE (respiration) rates were lower than the upland forest
> Daytime NEE (photosynthesis) rates were lower than the upland forest

FUTURE PLANS

To Resolve Scaling Issues

1) Additional field measurements:
   - roving flux towers
   - additional soil measurements

2) Analysis of WLEF observations:
   - isolate distinct forest stands
   - compare respiration during drought periods

3) Continue flux measurements to understand processes controlling stand-scale variability.

4) Contrast measurements from re-growing, managed forests and old growth communities.

Annual NEE observations:
> Region is a slight annual C source
> Upland site is a large annual C sink
> In winter, upland respiration rate is greater

Apparent respiration/photosynthesis rates:
> Regional respiration is greater from May-Sept
> Upland photosynthesis is substantially greater

Soil moisture and surface water depth:
> Soil moisture retention was greater at Willow Creek than the upland site near WLEF
> Soil moisture contents remained high all year at Willow Creek
> Wetland surface water was lowest when both soil T and respiration were higher

Carbon flux (g C m⁻² d⁻¹)

Cumulative NEE (g C m⁻²)

Net Ecosystem Exchange

Respiration

Photosynthesis

Wetland Fluxes: 2000-2001

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