FACT SHEET 10: CARBON AND WATER FLUXES

New Hampshire's Changing Climate, Land Cover, and Ecosystems

Development pressures and increasing suburbanization in New Hampshire have led to complex patterns of urban, suburban, forested, and agricultural landscapes. Understanding how greenhouse gas and energy fluxes vary over different land cover types will help us better assess the impacts of interactions between climate and land use under future change scenarios.

For instance, the land surface interacts with the atmosphere primarily through movement of greenhouse gases (e.g., CO_2) and energy (e.g., light, heat), and these gas and energy fluxes vary by land use/land cover type. In the simplest terms, these fluxes can be thought of as breathing (respiring CO_2), sweating (water loss through evapotranspiration), and reflecting (albedo). Eddy flux measurement systems use the eddy covariance method to measure CO_2 fluxes and evaporative water loss over a hayfield, cornfield, forest, and parking lot in Durham, NH. These systems provide monitoring capabilities and baseline data that can potentially be used to assess changes over time, and provide information for land managers.

BIOMASS PRODUCTION AND CARBON SEQUESTRATION

By combining both eddy covariance, biomass production, and management (fertilization and harvest data), we have been able to quantify both net carbon sequestration as well as rates of usable biomass production. At the managed (cornfield and hayfield) sites, quantifying carbon added via fertilization and removed by harvest is critical for determining net ecosystem carbon exchange (**Table 1**). The data show there are tradeoffs between biomass production versus net carbon sequestration provided by these different land cover types. The managed cornfield annually provides the largest amount of usable biomass (1382 g/m^2/yr), followed by the hayfield (860 g/m^2/yr) and mixed forest (wood production 275 g/m^2/yr), while net carbon sequestration is highest in the mixed forest (909 g C/m^2/yr), followed by the hayfield (234 g C/m^2/yr), and cornfield (-4 g C/m^2/yr).

CARBON FLUX (g C/m^2/yr)	THOMPSON FOREST	KINGMAN FARM HAYFIELD	MOORE CORNFIELD
Harvest	0	430	691
Fertilization	0	-381	-381
Net Gas Exchange	-909	-283	-306
TOTAL	**-909**	**-234**	**4**

Table 1. Mean carbon fluxes for 2013-2015 for 3 vegetated land cover types in Durham, NH.

Negative values indicate carbon sink (i.e. carbon sequestered); positive values indicate carbon flux to the atmosphere.

CARBON FLUXES AND LAND MANAGEMENT

The eddy flux systems document the decrease of carbon uptake by the land surface after harvesting corn or hay, and an increase in carbon uptake coincident with fertilization, demonstrating the potential effects of farm management (mowing and fertilizing) on carbon fluxes (**Figure 1**). These data can potentially inform farm managers as to optimal times for mowing and/or species to plant.

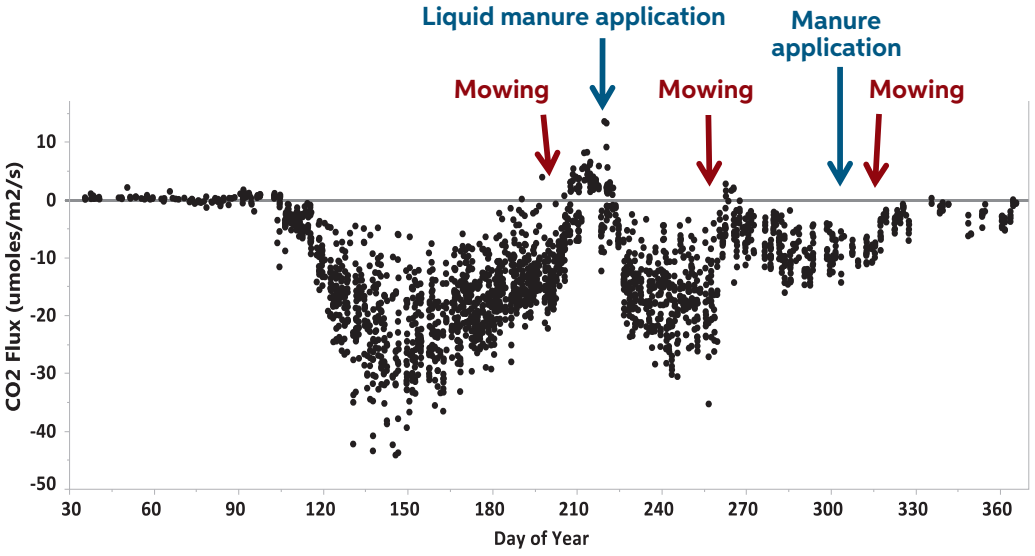

Figure 1. Carbon fluxes at Kingman Hayfield during 2014. Negative values indicate carbon uptake by the land surface (e.g., photosynthesis) while positive values indicate carbon release. Data shown are only for daytime.

WATER FLUXES AND LAND COVER

Forests demonstrate the highest water vapor flux rates among the four land cover types measured, presumably due to the larger leaf area index and deeper rooting depth as compared to hayfields or cornfields. The parking lot has comparatively low evaporative water loss because of its inability to sweat. Low evapotranspiration rates combined with high surface temperatures for non-vegetated surfaces such as the parking lot demonstrate why more development can lead to urban heat-island effects.

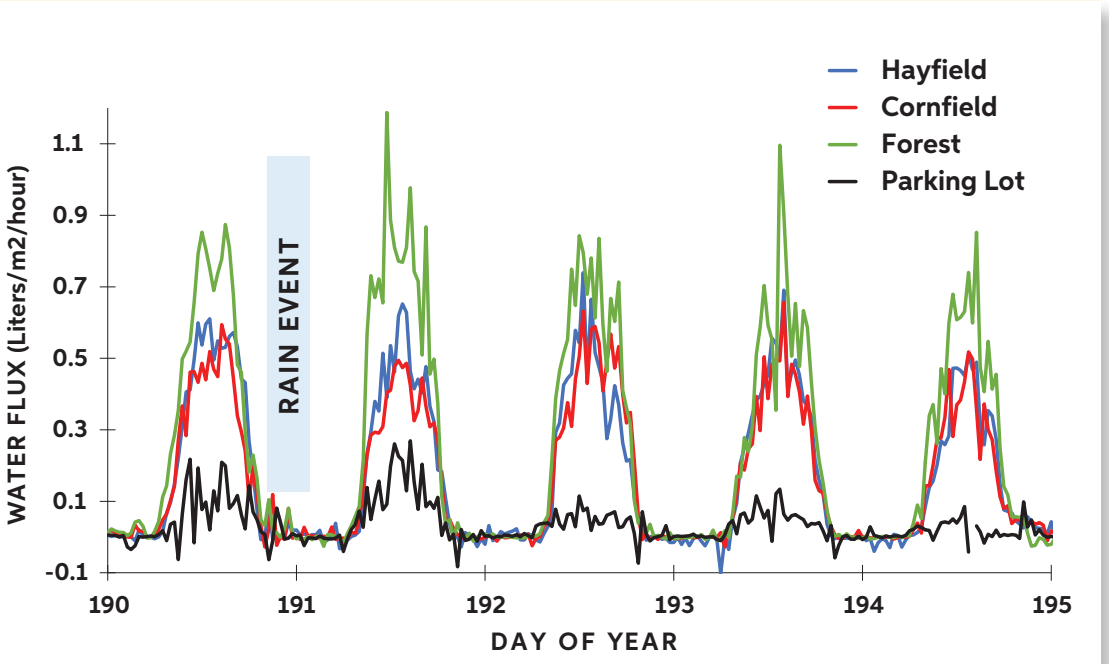

Figure 2. Comparison of evapotranspiration (evaporative water loss) for four land cover types (hayfield, cornfield, forest, parking lot) during mid-summer.

ACCESS TO DATA: **ddc-eddyflux.sr.unh.edu**

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