susceptibility and biogeochemical processes throughout the Amazon basin.

21.2: Micrometeorology, CO2 and H2O Exchange of a Tropical Rainforest Before and After Selective Logging

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We are using long-term eddy covariance to study the effects of selective logging on the energy and trace gas exchange at km 83 in the Tapajos National Forest, Para, as a component of LBA. In addition to the core flux measurements of carbon dioxide, water vapor, momentum and heat, sensors were installed to measure vertical profiles of CO2, H2O, wind velocity, and temperature within and above the forest. Continuous tower and biometric measurements began a year before logging (June 2000) when the forest was still considered primary. A similar tower in an unlogged area of the same forest (km 67) provides a control for the logged site measurements. Selective logging in fall 2001 was conducted by a local firm using reduced impact procedures, and included ~400-ha of forest that extended ~2-km upwind of the tower. The loggers removed ~6% of the biomass in large trees, left another ~18% of the biomass in large trees as slash, and eliminated ~13% of the canopy on an area basis. Tower and biometric measurements at both sites continued throughout the 3 month logging period and up to the present. After the logging, a second 65 m tall tower was installed in a large gap created by the logging, and similarly instrumented, in order to address the role of gaps in affecting forest atmosphere exchange. Preliminary analysis of the tower observations indicate that canopy photosynthesis declined following logging, and that ecosystem respiration increased in the subsequent wet season.

21.3: Selective Logging Effects on Carbon Budgets at Three Sites in the Brazilian Amazon

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Single tree selection is the predominant approach to logging in the Brazilian Amazon today. While removal of logs (usually less than 40 m^{-3} ha^{-1} on a first entry) off-site has a minor effect on site carbon stocks, collateral damage caused by felling, skidding, and road building results in signficant mortality and canopy opening. Reduction of canopy leaf area should reduce productivity while the increase in necromass should augment ecosystem respiration. We aim to quantify these effects in both conventional (CL) and reduced impact (RIL) harvest management at sites in the municipalities of Paragominas and Santarem in Para State and in Juruena in Mato Grosso state. Canopy gap fraction (Licor, LAI-2000) and both standing and fallen coarse woody debris (line intercept sampling) were measured at logged and unlogged sites. For logging intensities in the range of 20 to 30 m^{-3} ha^{-1}, CL and RIL increased canopy gap fraction to approximately 20% and 10% compared to approximately 3% gap fraction at undisturbed forest sites. Logging also greatly increased necromass stocks. For example,at the sites in Paragominas, necromass stocks increased by 95% and 35% for CL and RIL over a background of about 28 Mg-C ha^{-1} in undisturbed forest. We modeled the effects on carbon flux using stand table models and simple compartment models to estimate post-site carbon balance. Based on simple extrapolation from our limited sites, we estimate that logging leads to a net loss of at least 30 Tg-C y^{-1} from the Brazilian Amazon.

21.4: Biomass and Necromass in Three Undisturbed Forests in the Brazilian Amazon

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Necromass (Coarse Woody Debris [CWD]) is important component of the carbon cycle in tropical forests. The relationship between necromass and biomass may provide interesting insight into the functioning of a forest. Forests with the same biomass but differing necromass pools might have experienced different disturbance and mortality events or have different decomposition histories. This study examined three undisturbed Amazonian forests, Cauaxi, Para (3.75° S, 48.37° W), Tapajos National Forest, Para, Brazil (3.08° S, 54.94° W) and Juruena, Mato Grosso, Brazil (10.48° S, 58.47° W). We compared biomass, DBH distributions, standing necromass, fallen necromass and CWD decay class distributions. Relationships between each of these parameters were used to compare carbon cycling across the sites. At Tapajós, the average mass (+/- S.E.) of fallen CWD was 50.7 (1.1) Mg ha^{-1} for duplicate sites. The average mass of fallen CWD at Juruena was 44.4 (16.3)Mg ha^{-1} for duplicate sites. At Cauaxi, fallen CWD mass average was 55.2 (4.7) Mg ha^{-1}. Small (> 2 cm and < 5 cm dia) and medium sized material (> 5 cm and < 10 cm dia) accounted for 8-18% of the total fallen CWD mass. Standing dead average mass was 33.5 (4.0) Mg ha^{-1} for duplicate sites at Tapajos. At Juruena, the average mass of standing dead was 24.8 (6.5) Mg ha^{-1} for duplicate sites. Standing dead was not measured at Cauaxi. The biomass estimate for > 10 cm DBH for Juruena was 313 Mg ha^{-1}. Cauaxi biomass for trees > 20 cm DBH was 249 Mg ha^{-1}. Tapajos