Carbon Sequestration by Grasslands and Forests

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Introduction Much R and D funding is invested in forestry development in an endeavour to increase terrestrial C storage . However , it is not generally acknowledged that grasslands , including sown pastures and rangelands , are equally as important for the storage of C as forests (t Mannetje , 2008) .

Grasslands Fisher *et al* . (1994) measured soil C storage of 237 t/ha under a 6-year-old *Andropogon gayanus-Stylosanthes capitata* pasture , with about half of it in the 40-100 cm deep soil layer , compared with 186 t/ha under unimproved savanna in Colombia . At another site , the soil under unimproved savanna held 197 t/ha C , compared with 223 t/ha under *Brachiaria humidicola* alone and 268 t/ha under a *B . humidicola-Arachis pintoi* pasture .

Recent research in Colombia and Costa Rica (t Mannetje *et al* ., 2008) showed that : 1) Mean soil C stored in native forests and in long-established improved pastures were about the same (157 vs 160 t ha^{-1}) . However , mean total C (in soil and above ground biomass) in forest was 40 % more than in grasslands (261 vs 162 t ha .) 2) In the humid tropical region of Costa Rica improved pastures and silvopastoral systems had higher soil C sequestration than degraded pasture and native forest , indicating that well managed pastures have an important role in mitigating green house gas emissions .

Forests Forests accumulate C mostly in roots , trunks , leaves and litter . However , once trees are mature and have little or no growth , they will assimilate only as much CO_2 as they lose in respiration . Old-growth neo-tropical forests do not accumulate substantial amounts of C in the form of net biomass increases (Clark 2002) . Mature trees in temperate forests do not contribute significantly to C sequestration . Current atmospheric C levels limit photosynthesis and growth and thus do not add to C storage . During spring , when deciduous trees develop new leaves , they rely heavily on C reservoirs of sugars , starches and fats , because atmospheric C is insufficient (Hoch *et al* ., 2003) . Furthermore , limited supplies of other nutrients , particularly N and P , may limit assimilation and growth . Nevertheless , clearing forest leads to a great loss of C in the biomass to the atmosphere , which cannot be replaced by grassland C sequestration in the short term .

Considerable C emissions to the atmosphere take place in forest systems in the humid tropics as a result of decaying litter and decomposing soil organic C and that rivers in humid forested ecosystems , like Amazonia , are C-saturated and add to atmospheric C (Richey *et al* ., 2002) . Mayorga *et al* . (2005) concluded that Amazonia was , at best , in equilibrium with the atmosphere regarding C , and possibly even added to atmospheric C .

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