TROPICAL PEATLAND HYDROLOGY

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There is little relevant data on the topic of peat-hydrology relationships in tropical wetlands. Most peat data are from northern temperate areas, and most hydrologic data are not collected on a scale relevant to peat dynamics; that is, water level fluctuations on the order of 1-2 m and annual durations of inundation.

The relationship of hydrology to peatlands varies according to size of area involved, climate (precipitation, evaporation, temperature), and topography. In colder more northern areas, the cooler temperatures reduce water losses and microbial activity. This permits formation of peatlands on a wider variety of sites than is possible in tropical or subtropical areas, such as South Florida. In these warmer areas, peatlands tend to be more restricted to depressions on fairly level terrain, such as sinkholes, floodplains, or along coasts. In flowways, peat accumulation tends to raise water levels by damming, and thus further increase the depth and width of the peat deposit.

In South Florida, the existence of peat is a function of the duration of inundation and the depth of the water table during dry periods. The annual fluctuation of the water table is about

1-1.5 m with wet season water depths varying from about 75 cm in the deepest areas with emergent vegetation to just at the ground surface in "upland" habitats, which will have at least saturated soils during the wet season, and all but a few deep ponds are dry during some part of the dry season. Mineral substrates are typically sands, and organic soils are only found in areas with a hydroperiod in excess of approximately 8 months. This coincides with the approximate "dry edge" of the cypress forests at Corkscrew Swamp. The "wet edge" of the cypress occurs at an approximate ten month hydroperiod. Similar hydroperiods were observed at the Okefenokee Swamp. However, peat depths in excess of approximately 2 m generally do not support extensive cypress forests. Our best guess at the moment is that cypress root systems, which we found extended down to about 2 m below the ground surface, are not sufficient in peat substrates to support large trees.

Peatlands in Florida are frequently reported to exist on sites with a perched water table over an impermeable subsurface clay layer. However, most sites I have examined are the result of inundation by the regional water table, irrespective of the presence or absence of an impermeable subsurface layer.

Peat deposits at Corkscrew Swamp are about 2 m deep. The basal peats were C-14 dated at 5000-6000 years, and additional dates in the profile indicate a regular accumulation of about 3 cm per century. C-14 dates for other deposits in South Florida also indicate basal ages of 5000-6000 years B.P., which coincides

with a rapid rise in sea level to approximately present elevations at this time.

Peat accumulation depends on a combination of above ground litter and below ground root inputs.. We measured decomposition of ground surface litter in fine mesh bags, which indicated annual decomposition rates of only about 15-35%. in the spectrum of "upland" to aquatic habitats at Corkscrew Swamp. One part of the experiment examined decomposition rates at different hydroperiods in one habitat and found no correlation. These data suggest much greater accumulations of organic matter than are indicated by C-14 dates of the peat profile. The best explanation to account for this discrepancy is the frequent occurrence of fires that remove most of the accumulated litter. The regular occurrence of fussinite throughout the peat profile would further support this. While fires may occasionally burn peat to significant depths, these appear to be very localized events and are probably not significant over extensive areas, since we are not aware of any widespread ash deposits in peat profiles.

The amount of carbon (% moisture free) in several Corkscrew Swamp peat profiles was about 50% in the fibrous surface peat and about 40% in the mucky basal 5000-year-old peat.

Productivity of cypress, based on ring-width measurements, was characteristically 2-3 times higher toward the center of Corkscrew Swamp compared to the forest edge. Whether this is related to the

deeper peats (edge - 0 m center - 2 m) or wetter conditions (8 month hydroperiod; center - 10 months), we were uncertain. However, it could also be associated with stresses caused by the more frequent and severe fires as one moves from the forest center to its edge.

Man's greatest impacts on hydrology-peatland relationships have to do with drainage. Drainage results in rapid organic soil losses, at one site amounting to about 50-75 cm in 10-15 years. However, there was still approximately 1-2 m of peat remaining and it appeared that the peat surface had stabilized in conjunction with the new water table level. The swamp forest at this site was still intact and in reasonably good condition despite the loss of organic soil. Drainage can be purposeful, such as for agriculture or grazing, or it can be an accidental byproduct of other types of development, such as oil exploration and/or extraction or pond construction. Some efforts are now being made in South Florida to minimize peat losses associated with drainage by at least seasonal reflooding. Shallow impoundment of wetlands leads to fairly rapid organic accumulations. Organic slurries up to about 30 cm deep can develop within about 20-30 years and compact to about 1.5-3.0 cm when the impoundments are allowed to dry out.