Improving the sustainability of agriculturally exploited peatlands through water regime management

Quentin Dawson

National Soil Resources Institute, Cranfield University, Silsoe, UK

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Rationale

In Britain, 77% of soil organic carbon is contained in peatlands, which themselves account for only 12% of the total British soil resource (National Soil Resources Institute, unpublished).

Soil aeration status (water management) is a significant factor governing the rate of organic matter decomposition in peat soils (Bellisario, 1999 and Schreader, 1998).

Aim

- To monitor the effect of water management on the sustainability of lowland agricultural peat soils under different land uses.

Research sites

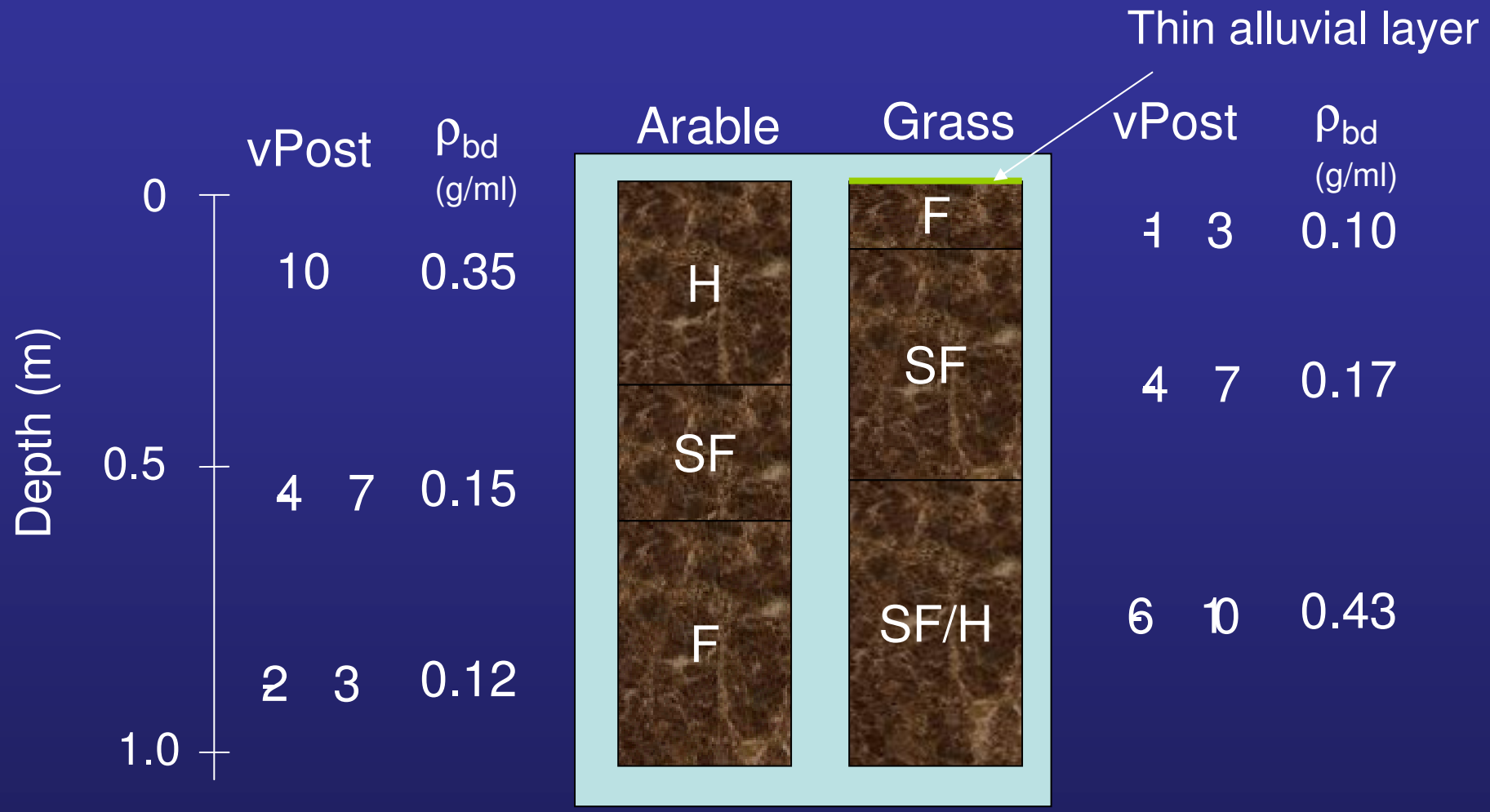
Lowland sites were selected because of similarity in soil type (once classified within the same soil group) but difference in land use.

- Site 1: A grassland where fen peat underlies a thin alluvium in the South West of England (51°01.00'N 2°56.15'W).
- Site 2: An exposed fen peat under intensive horticultural and arable farming in Eastern England (52°31.52'N 0°28.16'E).


WEST SEDGEMOOR
South West England

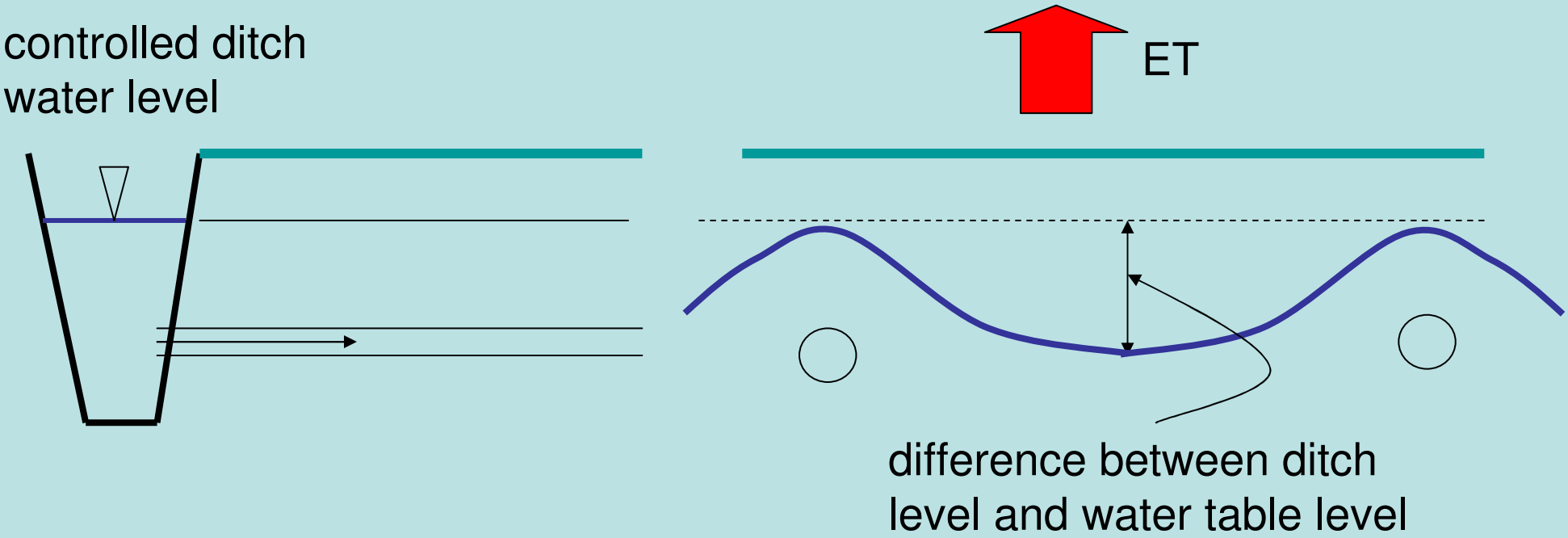

METHWOLD FEN
Eastern England

Peat Profiles

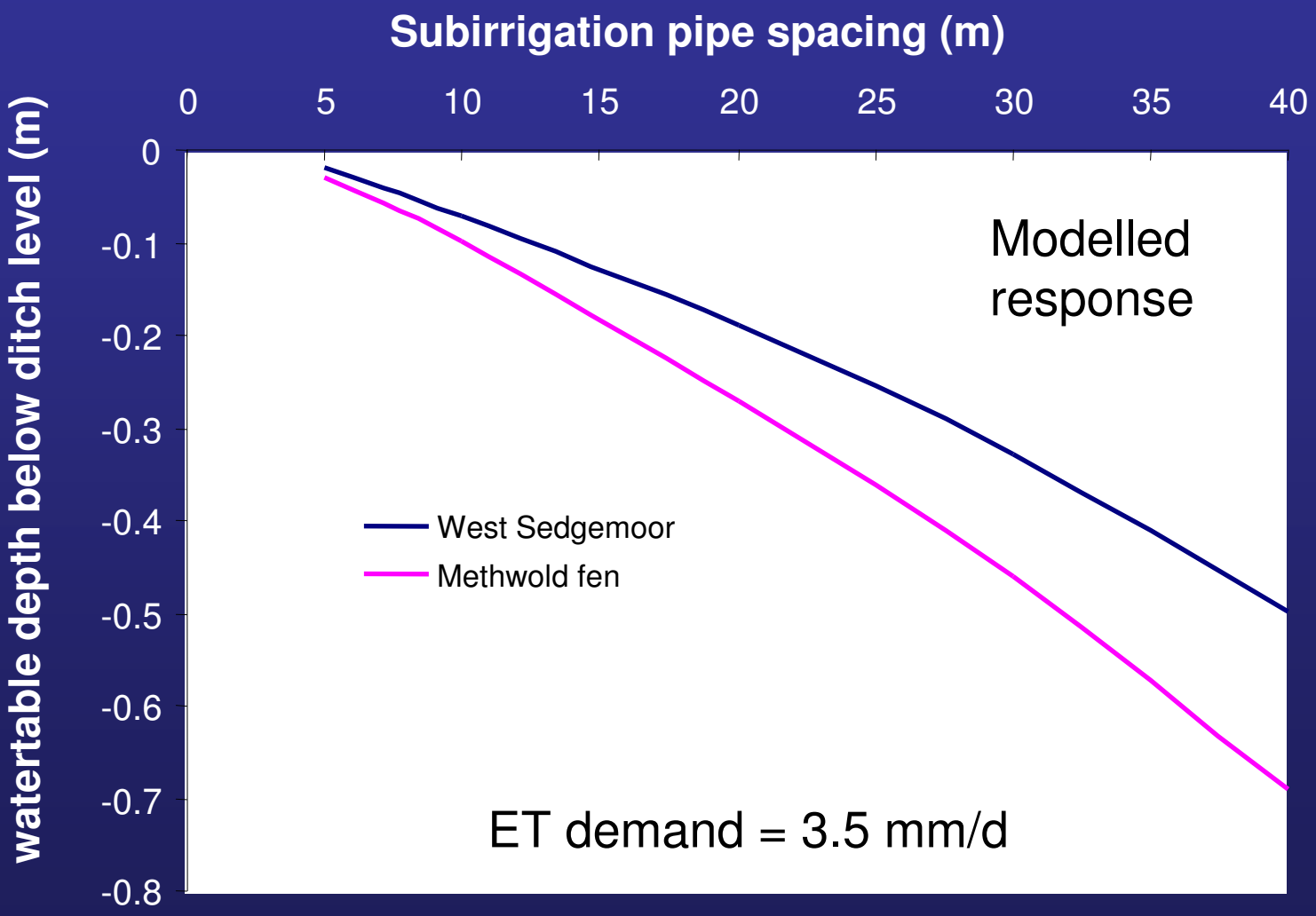


Water table control

Sub-irrigation Control



Effect of pipe spacing on water table depression



Pipe Installation

West Sedgemoor

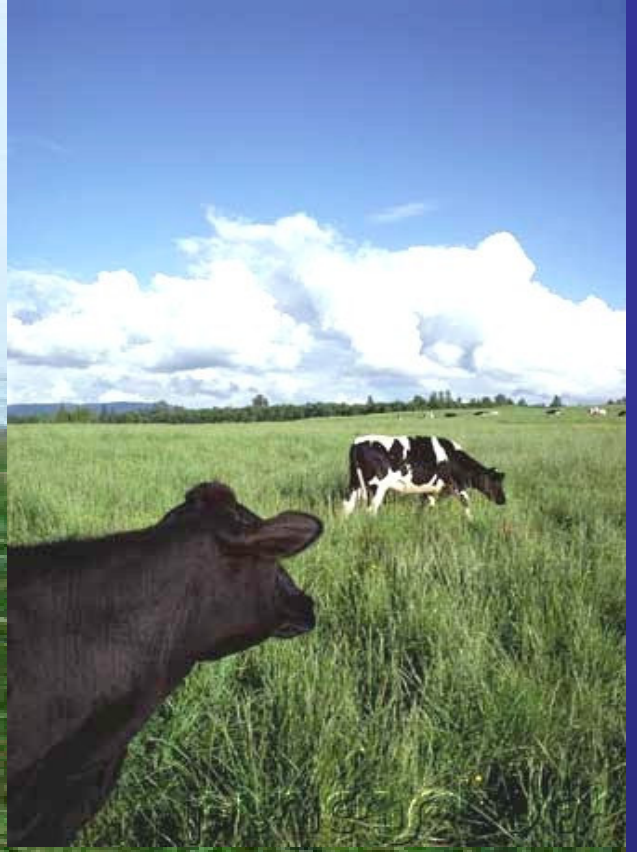
Subirrigation pipe spacings at 10, 25 and 40 m

at 0.7 m depth

Ditch Level control

West Sedgemoor
Flooded November to March

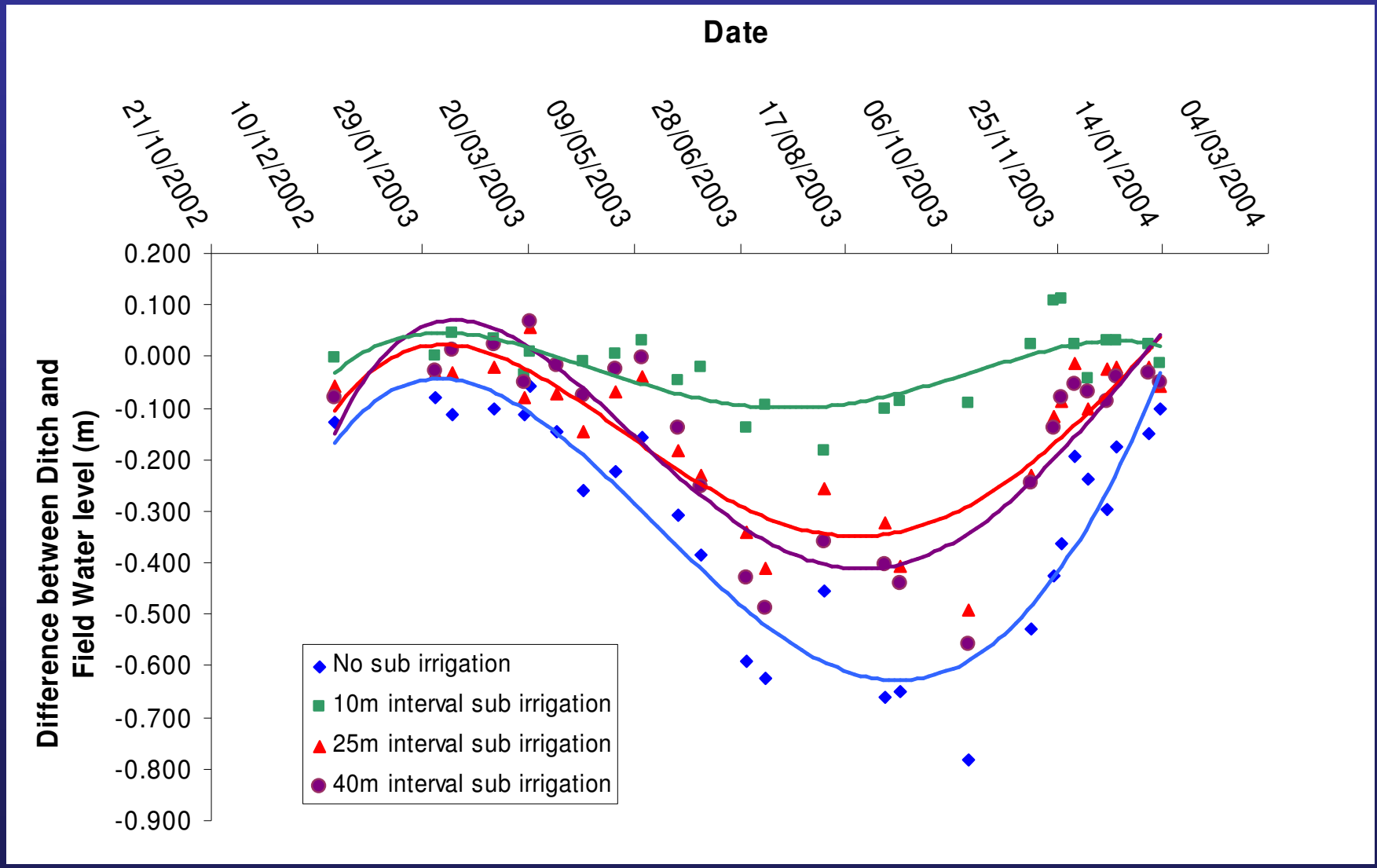
West Sedgemoor
Water level at -0.3 m from surface March to November




Methwold Fen
Water level at -0.5 m in summer,
lowered in winter for drainage

Water Table Response

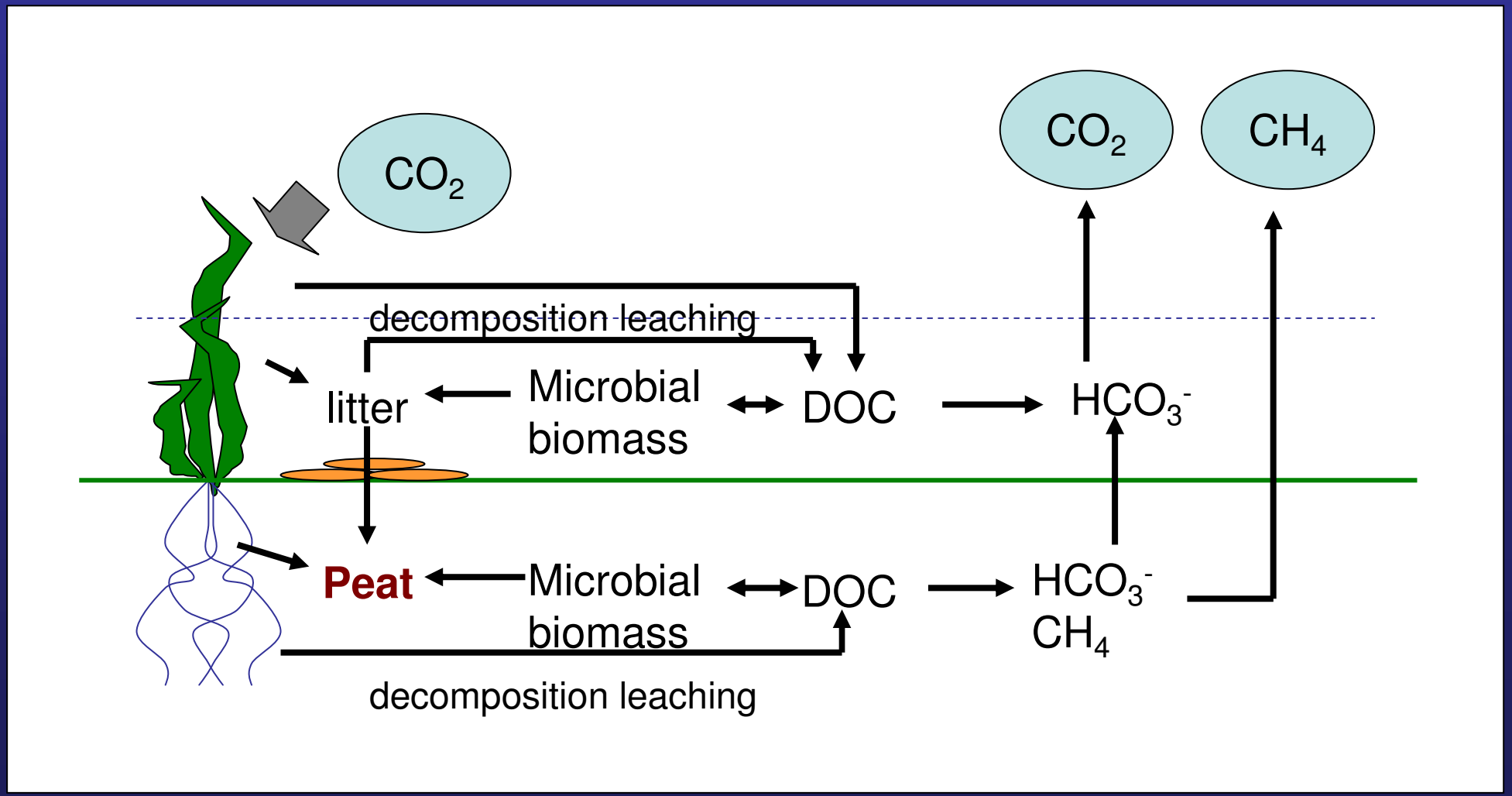
Groundwater levels for peat soils under grass during 2003



CO_2 Release

Laboratory peat cores

Drainage effects on CO_2 evolution



Carbon loss at Methwold fen

- From analysis of soil respiration rates, it is estimated that 22 tonnes of CO_2 per hectare per year is lost to the atmosphere (6 tonnes Carbon) under intensive agricultural use. This rate of loss is more than halved under grassland management.

- Previous research has shown that peat soils under grasslands degrade and subside at 0.5 – 1cm yr, whilst peats under intensive agricultural use degrade much faster, at up to 5 cm yr. Van den Akker (pers comm) has found that upto 30 tonnes of CO2 per hectare per year is lost using conventional ditch water management to irrigate the peat soil (35% more CO2 evolution than found under our initial sub surface irrigation monitoring).

End Note

- Water table management in lowland peats soils is feasible using sub surface irrigation.
- The link between organic carbon loss and water table position has shown interesting results that require further investigation.
- Survey indicates that with the water table maintained at 0.5 m depth on peatlands under intensive agriculture through the summer months, the surface elevation of the peat has continued to fall over the last 20 years at 2cm yr. This is considerably less than general rates of peat soil loss using surface or ditchwater irrigation alone.
- A high proportion of this peat loss is likely due to microbial respiration of the labile organic carbon fraction.