

**Improving our understanding of connections between the catchment and sediment dynamics (quality and quantity) in UK estuaries.**

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**Talk structure**

- Catchment sediment issues
- Catchment controls on estuarine sedimentation
- Effects on estuarine habitats
- Quantifying effects
- Food For Thought

# Human activities known to adversely effect sediment supply to estuaries

- Land use changes
- Impoundments
- Flow regulation
- Flood risk infrastructure



# Water abstraction and freshwater flow inputs to estuaries

- Flow regulation and abstraction have been demonstrated to have large effects on the capacity of fluvial systems to do geomorphic work;
- Role of freshwater in estuarine function is well-known (e.g. Boynton and Kemp, 2000);
- Freshwater strongly influences the physical dynamics of estuaries
- Changes in the timing, frequency and magnitude of freshwater input critically effect estuarine biotic productivity (Flemer and Champ, 2006)
- It is for these reasons that ‘freshwater flow alteration’ is a hydromorphological metric in WFD.

# Impacts on estuarine sediments .... Are variable

- Sediment is often disconnected by human alterations in rivers - this can lead to a reduction in sediment availability in rivers;
- Yet, flow reductions and other fluvial alterations have often led to large increases in estuarine sedimentation



- Freshwater flow impacts on estuaries tend to focus on biotic and physico-chemical responses
- Yet, there have been and continue to be large-scale effects on estuarine sediment dynamics

Saltmarshes are areas vegetated principally by halophytic herbs, grasses or low shrubs, bordering saline water bodies (Allen and Pye, 1992)



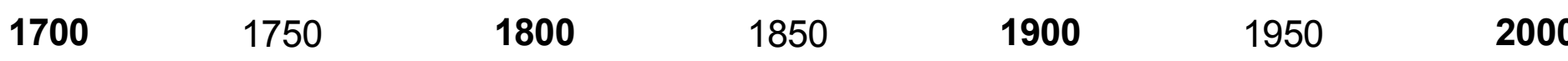
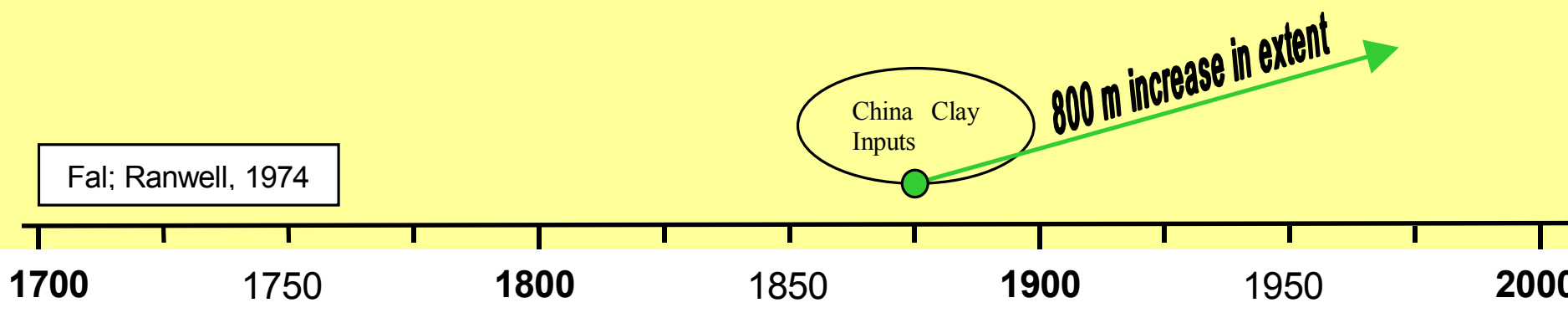
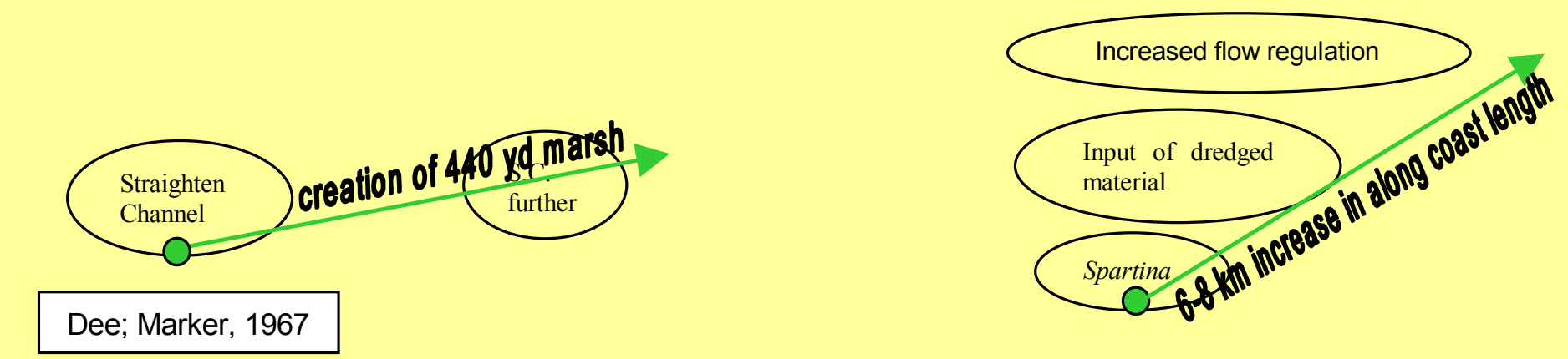
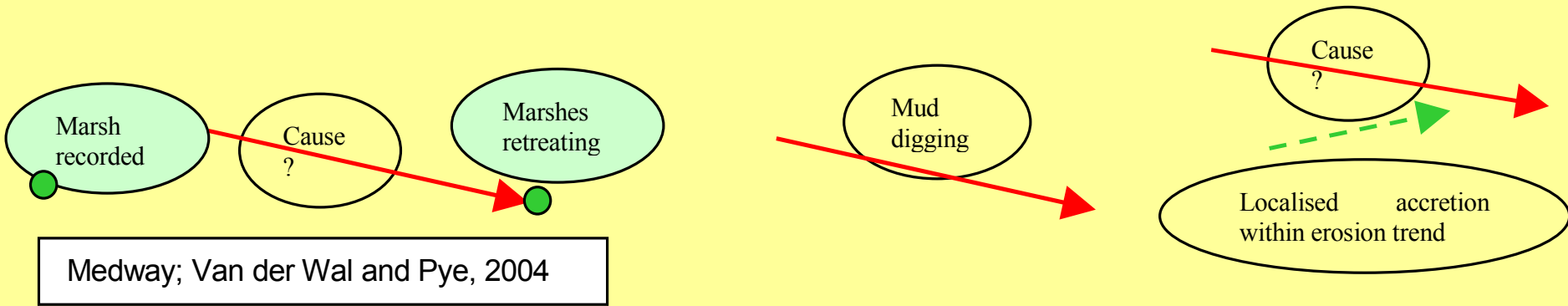
# Ecosystem Services

1. Wildlife Habitat (e.g. Wolters et al., 2005)
2. Fishery Nursery Sites (e.g. Colclough et al., 2005)
3. Water Quality Improvement (e.g. Adam, 2002)
4. Social and Recreational Benefits (e.g. Rawson et al, 2004)
5. Carbon storage (e.g. Chumra et al., 2003)
6. Flood Risk Management (e.g. Spratt et al., 2005)
7. Nutrient/Contaminant storage (e.g. Cundy)

Estimated economic value of tidal marshes is US\$ 10,000/ha/yr (Costanza et al., 1997)



*Lagoon of Venice, from RAMSAR Convention of Wetlands*



# Scale issues for monitoring and assessing condition

- Scale is critical when assessing erosion and accretion trends
- In Morecombe Bay, UK, a localised geomorphological study shows erosion and accretion cycles with a general erosional trend.
- Yet, at a larger spatial scale the overall estuary is accretionary.
- Cross-disciplinary literature reviews are important in historical analysis



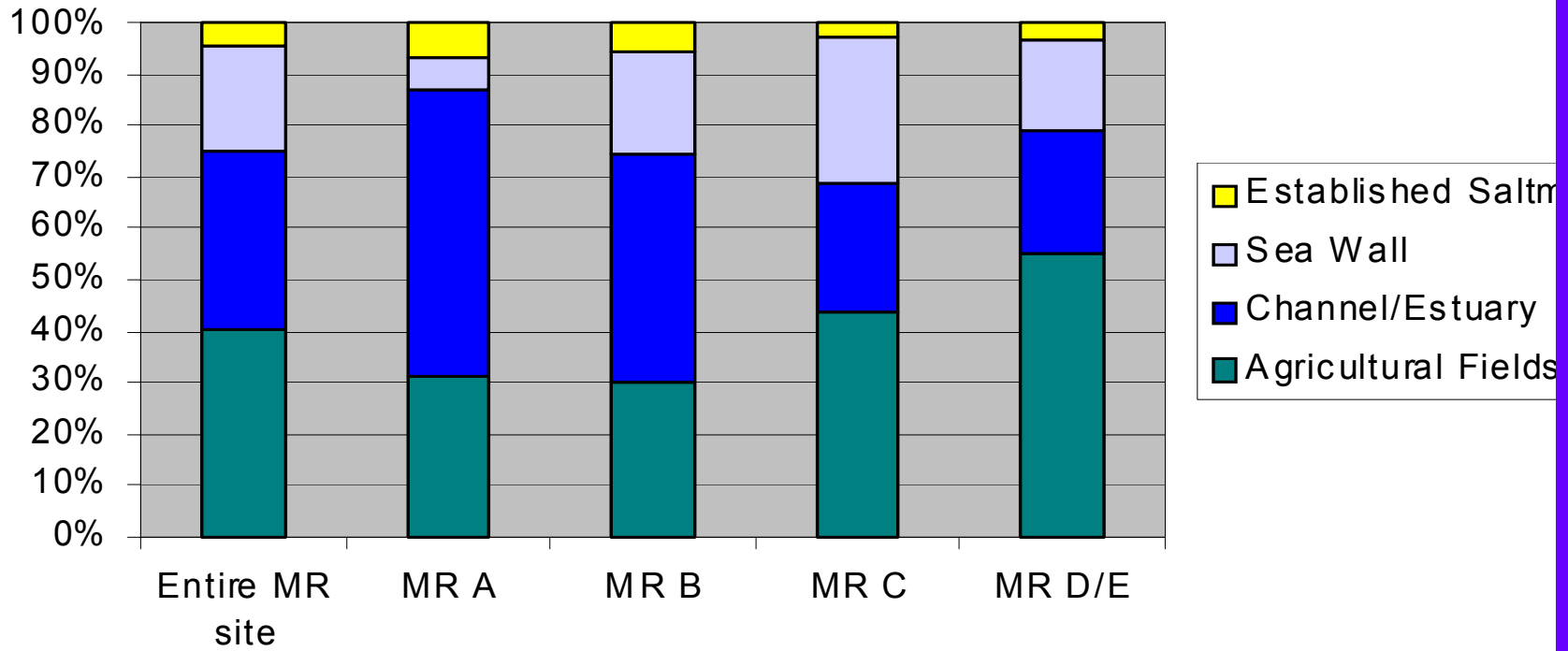
# Testing tools in new locales....

....sediment fingerprinting in estuaries?

Abbotts Hall Managed Realignment Site, Essex, UK

*Estimated sediment provenance of the entire Abbotts Hall MR site and of zones A, B, C and D/E.*

**Sediment Provenance of the Abbotts Hall Managed Realignment Site**



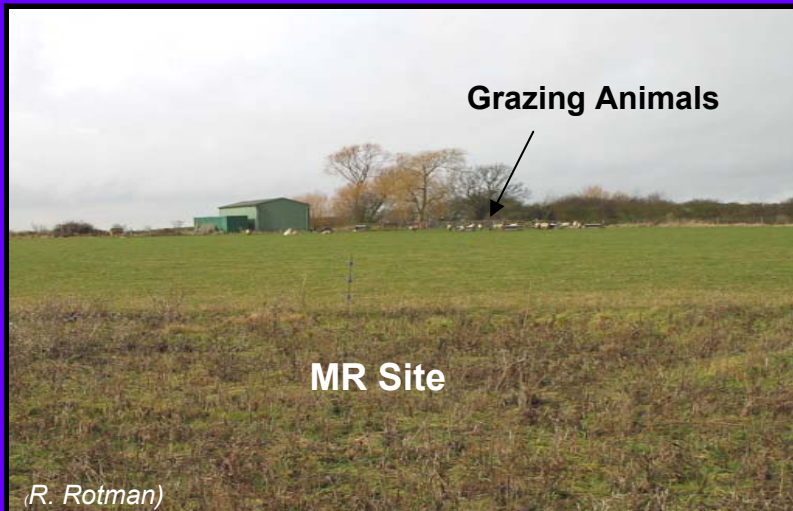
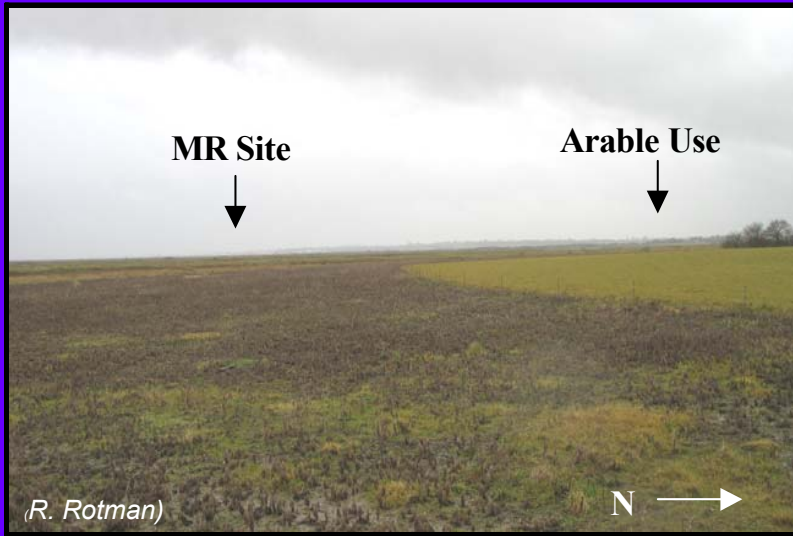
# Quantifying sediment transport pathways

## Assumptions/Qualitative Observations

- Agricultural run-off is not monitored at Abbots Hall
- The presence of fields upslope and immediately adjacent to the realignment area could serve as sediment source
- Some fields in Abotts Hall are ploughed each January
- Sampling took place in early February
- The Met Office reported heavy rains in the intervening period, therefore field - MR transport seems probable.

**Results of the sediment fingerprinting work provide quantitative evidence of the role of agricultural sediment in an MR site**

# *Abotts Hall vs. Freiston sites and adjacent agricultural land*



**Due to the flood risk embankment behind the managed realignment site, there was no contribution from agricultural land at Freiston, UK**

# Where do we need to go from here?

## Policy and Management

- Further testing of 'new' tools to quantify sediment sources or apply such tools in new environments (e.g. estuaries);
- Science to underpin policies on sediment and freshwater flow needs of estuaries
- Policy decision about the dealing with temporal lag-effects of human impacts on estuarine sediments and habitats.



# Where do we need to go from here?

## Research Questions

- Sensitivity analyses - disturbance responses and restoration potential
- Biogeomorphological approaches - e.g. sediment (quantity & quality) - ecology relationships
- Riparian impacts and in-channel sediment modelling
- How will sediment transport and capacity for geomorphic work vary under different climate change scenarios

Collaborative, European research teams

