



ENGLISH HERITAGE

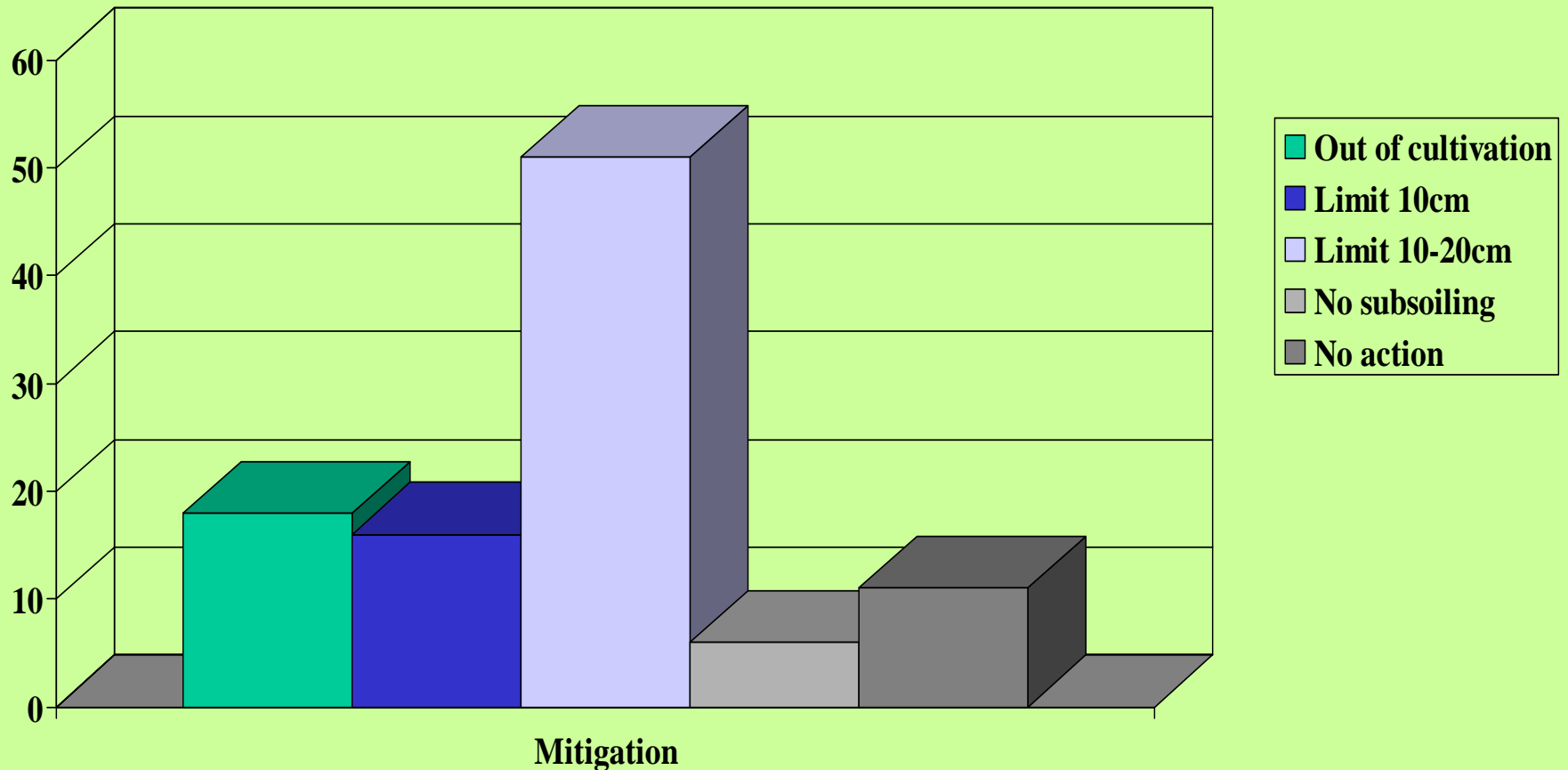
**Putting plough damage in the lab:  
the results of the English Heritage,  
Defra and Cranfield University  
cultivation and archaeology project**

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English Heritage

# Conservation Of Scheduled Monuments In Cultivation (COSMIC)



# COSMIC Results

- COSMIC developed a cost effective, reliable risk assessment model
- Indicated that in most cases reversion to grassland is not necessary in order to reduce damage
- If we were to implement, needed to know more about depth-limited tillage and direct drilling in comparison to normal ploughing

# **Trials to Identify Soil Cultivation Practices to Minimise the Impact on Archaeological Sites**

- To determine the effects of differing agricultural and soil management techniques on surface and sub-surface archaeological remains
- To develop practical, cost-effective methods of monitoring compliance following the implementation of such techniques
- To provide general recommendations on how farming systems and soil management techniques can be adapted to reduce damage to archaeological sites

# Pressure at depth



DD Rings



Dual tractor tyres



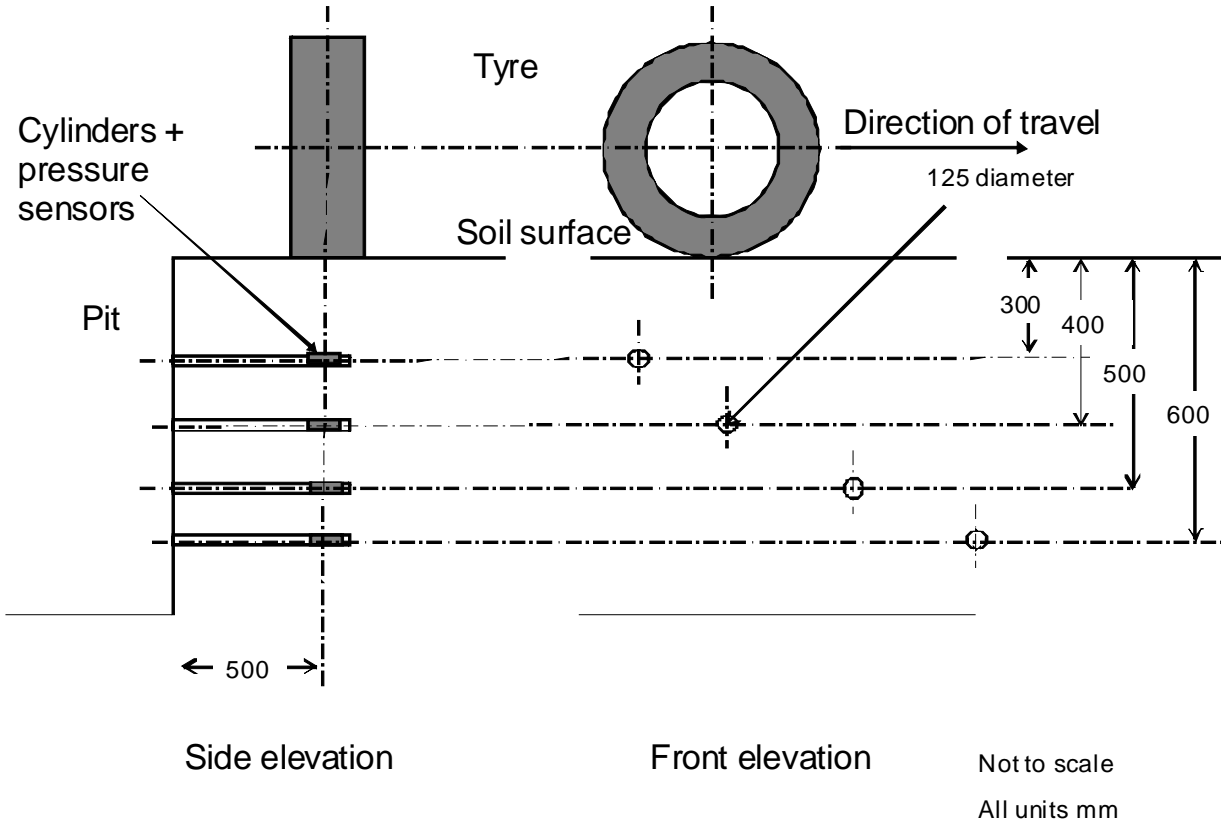
Direct Drill tines

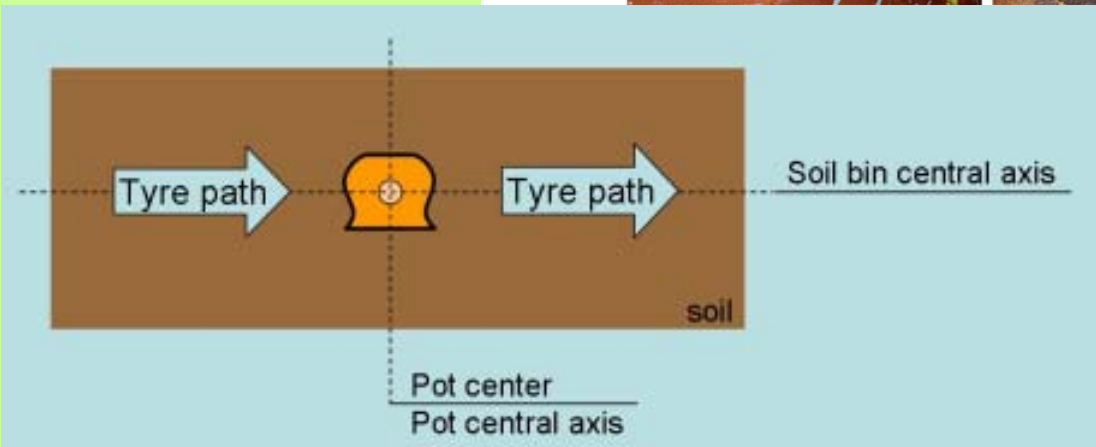
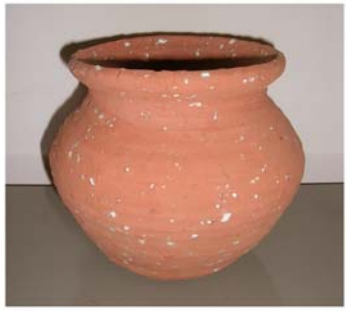


Direct drill (coulters)

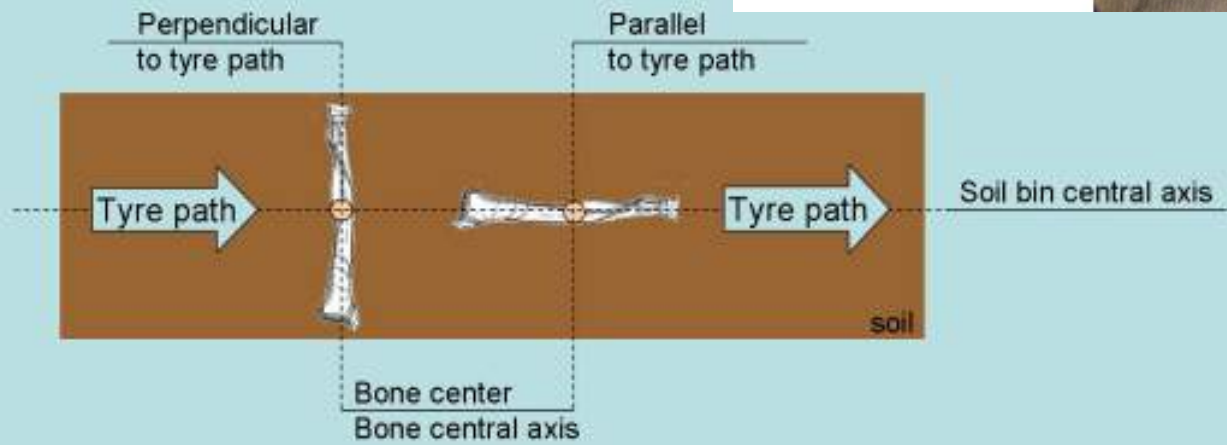


# Pressure at Depth - Clay site

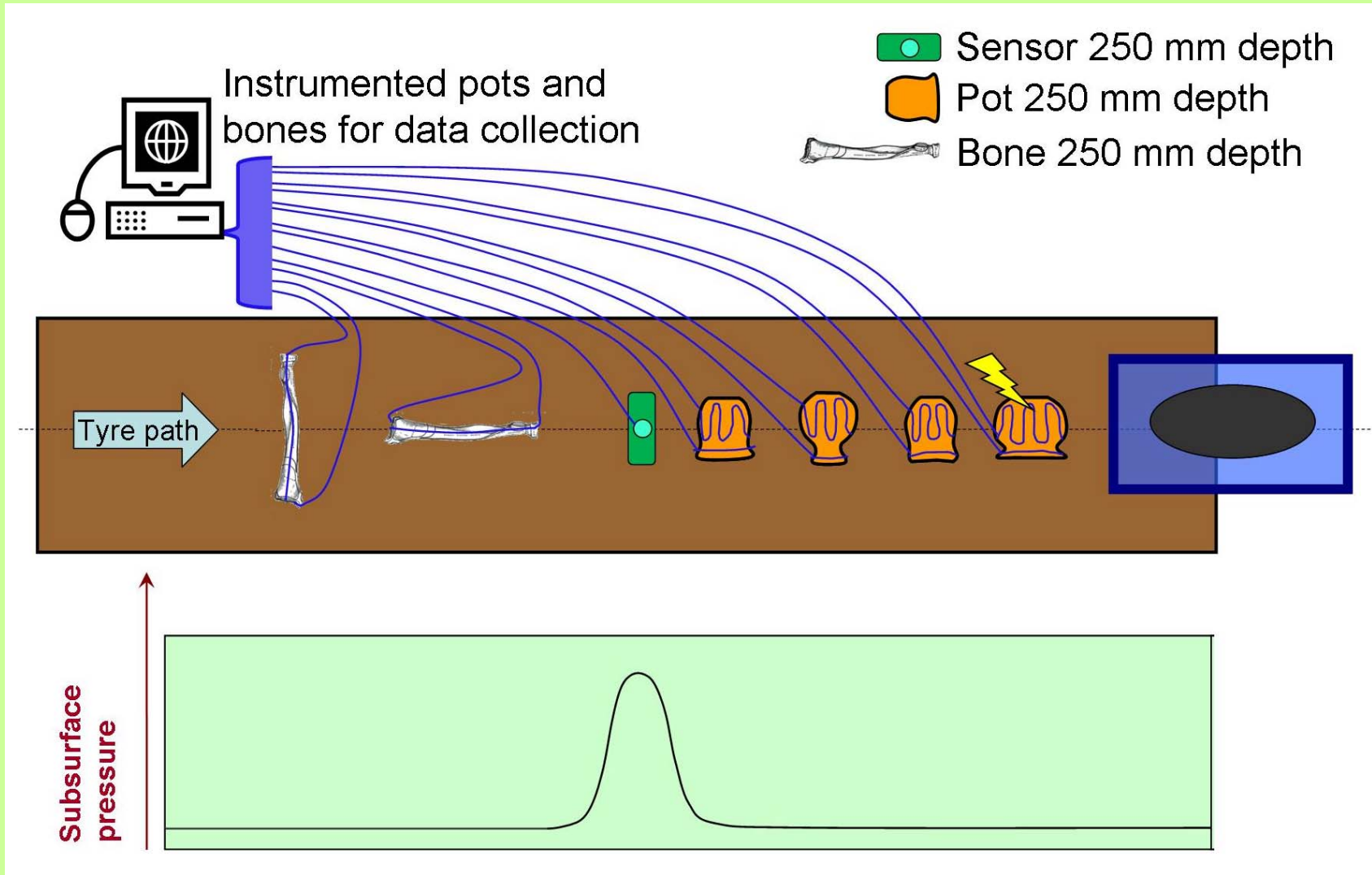




# Artefact Studies



# Artefact Studies



# Field Studies

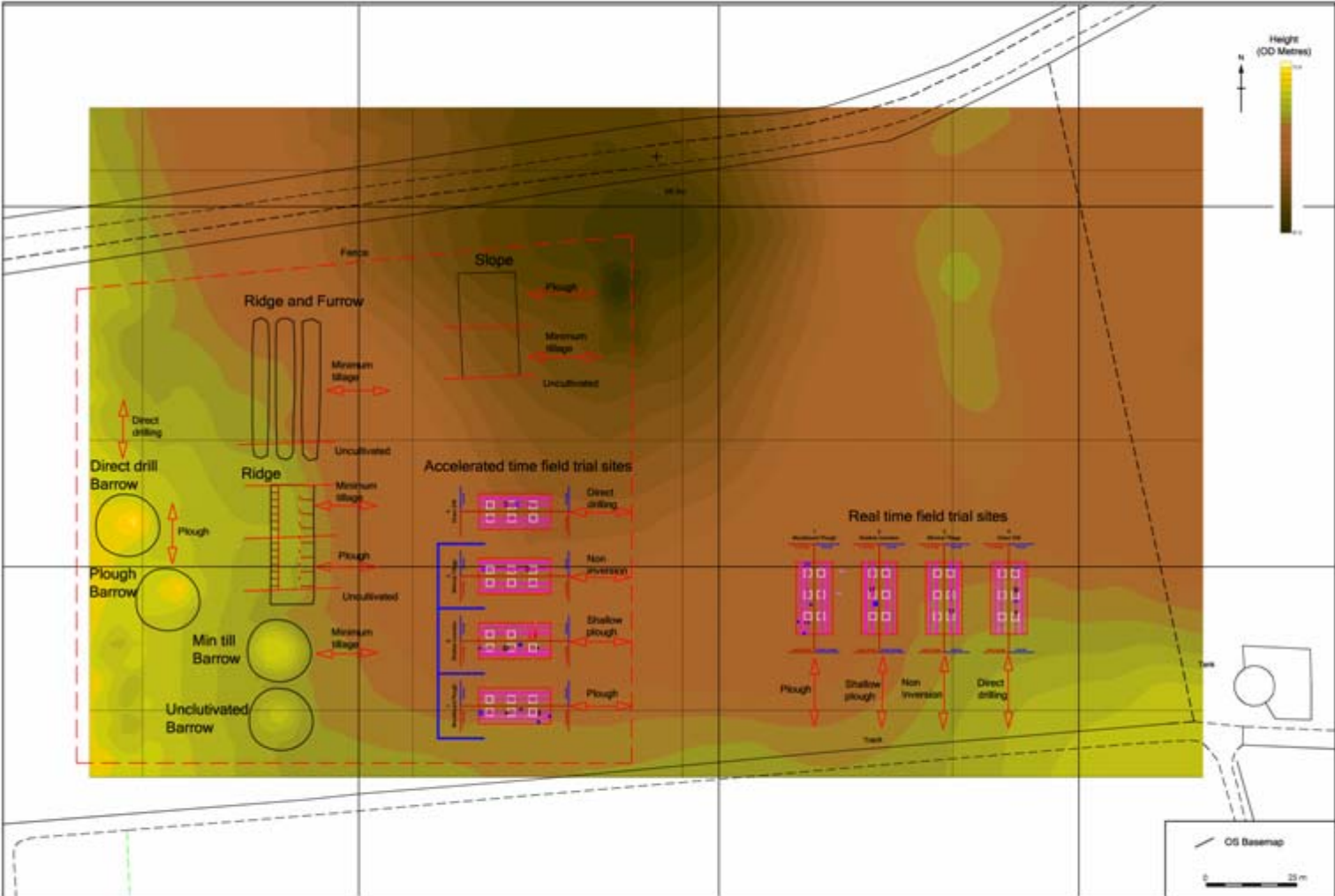


Figure 3.2: Layout of field

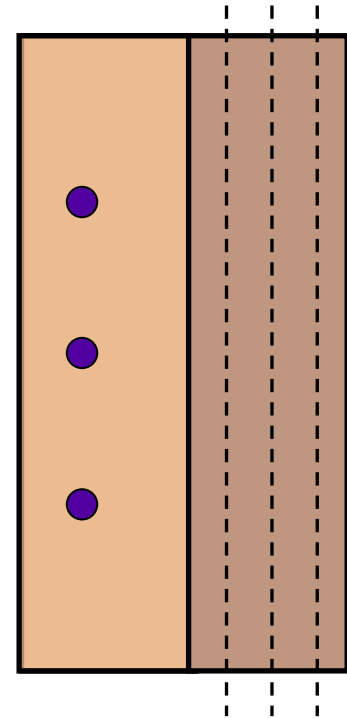
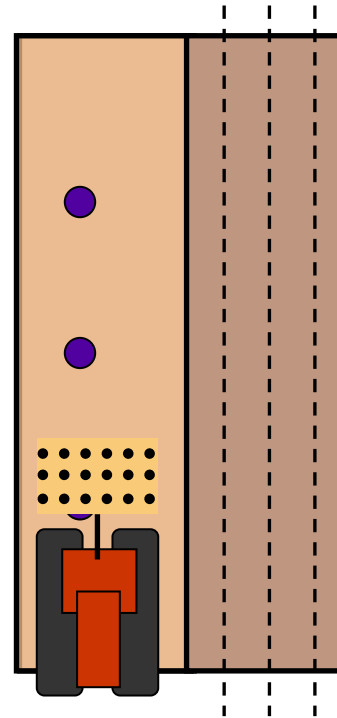
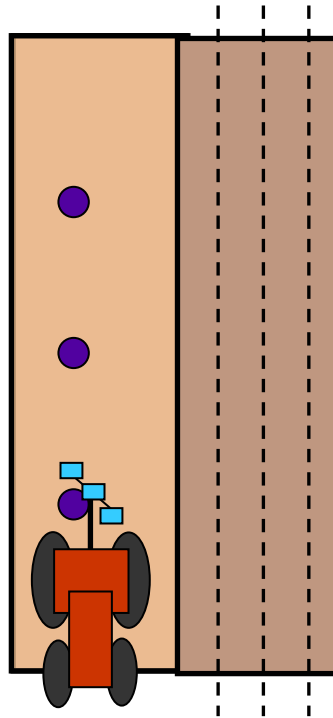
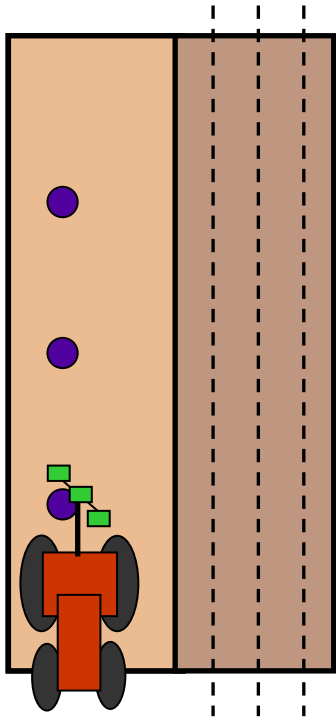
# Field Site - Pressure at Depth

Plough

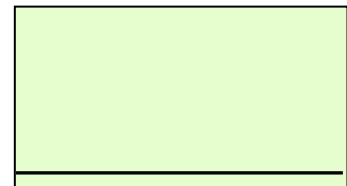
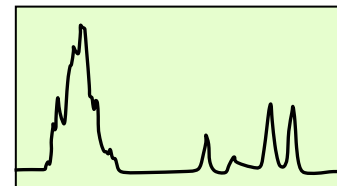
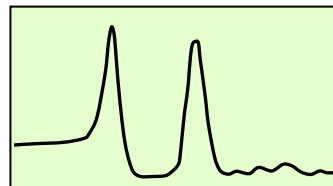
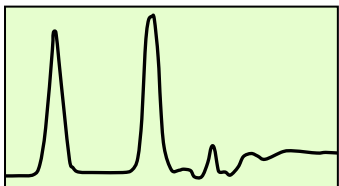
Shallow  
Plough

Non-  
inversion

Zero till

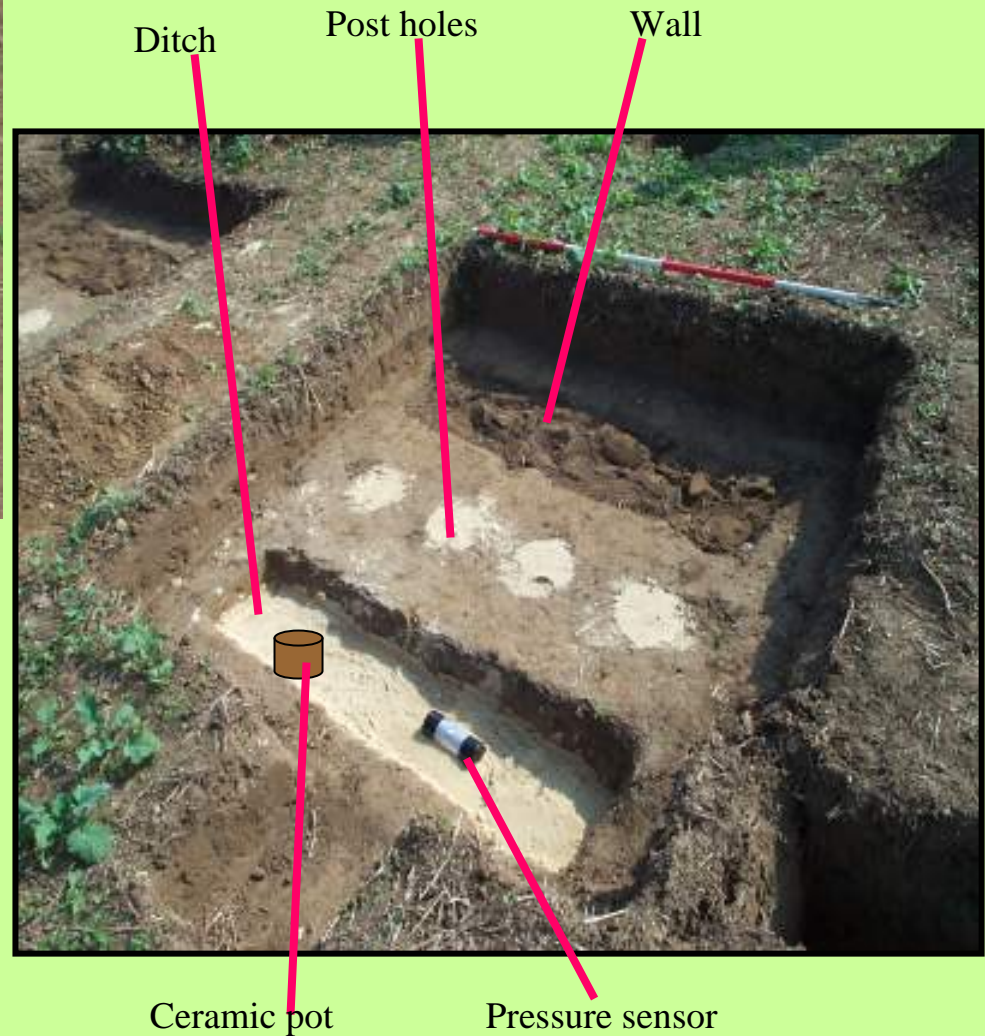


Subsurface  
pressure ↑





# Flat Sites



Ditch

Post holes

Wall

Ceramic pot

Pressure sensor

# Primary Tillage Operations



Mould board plough



Shallow  
plough



Non-inversion tillage



Direct drill

# Secondary cultivation systems



Subsoiler



Spray



Rolls



Zig Zag



Harvester



Tractor and Trailer

Direct Drill



# Re-excavation of archaeological sites post-cultivation



# Earthwork Construction



# Primary Cultivation over the earthworks



Non inversion tillage over the ridge and furrow



Ploughing over ridge



Non-inversion Tillage over the barrow



Direct drill over the barrow



Ploughing on the barrow

# Management Recommendations I

Avoid normal or shallow inversion ploughing over archaeological sites. If unavoidable do not operate with the tractor wheels in the furrow bottom

Do not undertake deep tillage and subsoiling operations which can damage buried archaeology by direct impact

Use non-inversion tillage and direct drilling operations with tractors equipped with wide section tyres, low ground pressure or dual tyres or rubber tracks.

Where possible use harvesters, tractors and trailers equipped with rubber belted tracks or the largest possible tyre diameters and section widths and/or dual tyres or tandem/ triple axles to reduce the load per tyre

# Management Recommendations II

Operate all field going equipment with the safest low inflation pressure for the required load and field/road speed duty cycle

Reduce the load size for harvesting trailers

Prevent road going trucks with high inflation pressures from traversing fields

Where possible avoid field operations in high moisture content conditions with weak soils

# Recommendations III - earthworks

Do not plough earthworks

Non-inversion tillage does not protect earthworks over the time

Direct drilling (no/zero tillage) and managed pasture are the only feasible options, but even then soil type, slope and water run-off need to be taken into consideration.

## Recommendations IV

Overall farmers and land managers should practice the principles of good soil management which in addition to preserving archaeology should also support good agricultural practices, minimizing compaction and assisting in crop production.

