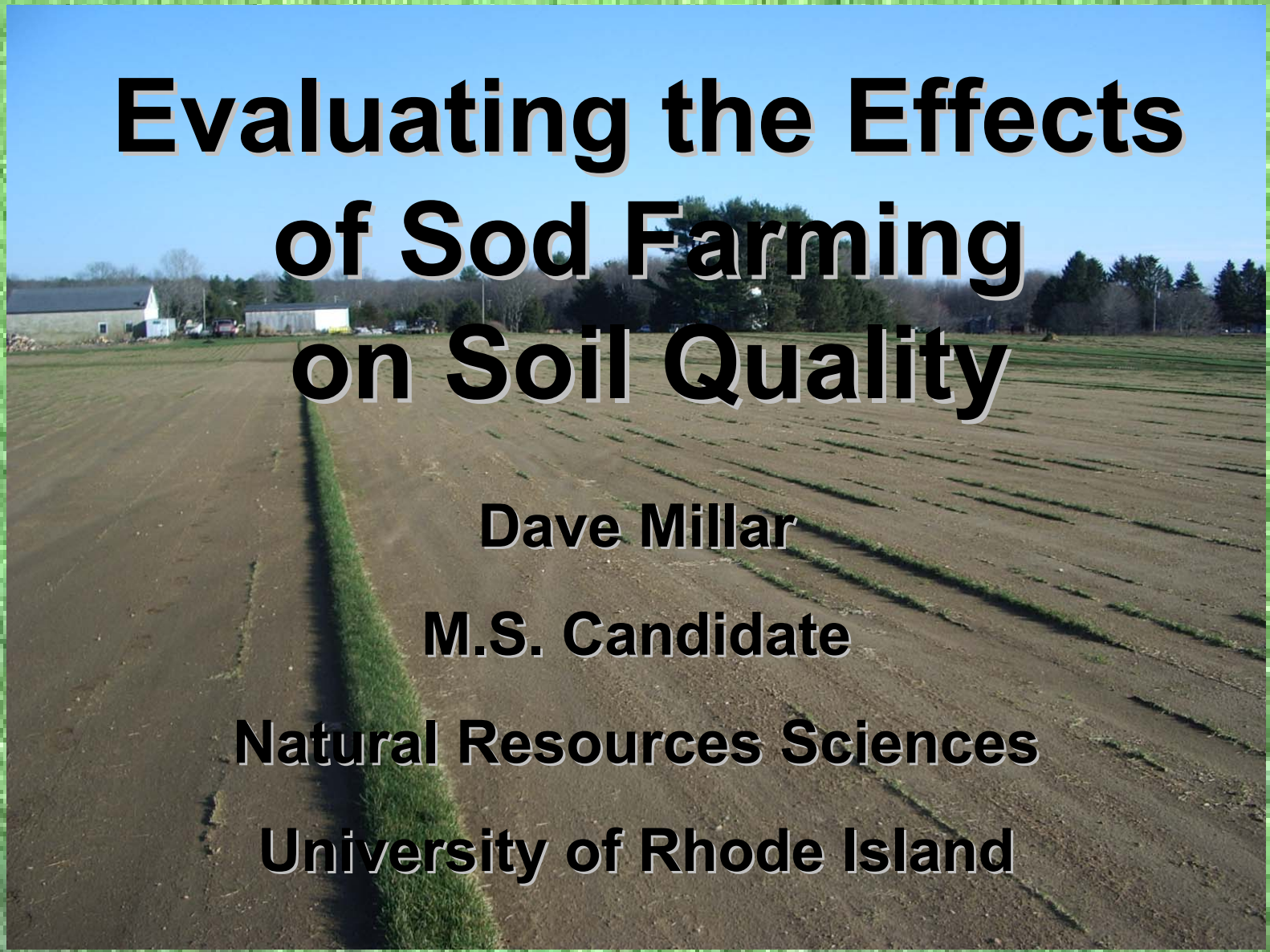


Evaluating the Effects of Sod Farming on Soil Quality

Dave Millar

M.S. Candidate

Natural Resources Sciences

University of Rhode Island

Outline

- Brief overview
- Discuss methods
- Initial results
- Upcoming research plans

Introduction

- Sod farming is one of the largest agricultural enterprises in RI
- Most located in So. County on the most productive agricultural soils in RI
- Continuing increase of development pressure on this part of RI

http://www.sodco.net

John S. Allen photo

Open Space Preservation

- In southern RI there is a lot of interest in preserving open space

- Ensures the land is being used sustainably

- Purchasing the development rights of land is one way to protect open spaces

- Funding from land trusts, private & government organizations, etc.

- **USDA-NRCS is interested in using funds from the Farm and Ranchland Protection Program (FRPP) for purchasing of development rights of RI sod farms using**
- **Some criteria of the FRPP are to "protect topsoil from conversion to non-agricultural uses, and ensure that the agricultural capacity of the soils remain viable for future generations"**

Soil Loss on Sod Farms

- Each time sod is harvested, a layer of soil is removed
- The amount of soil removed during harvest varies depending on farming practices, soil type, etc.
- A few studies have made attempts to quantify this loss of soil

http://www.elitesodfarms.com/sodpix/sodstack.jpg

Is that much soil really being removed?

- RI sod producers feel they are increasing the soil quality of their land, outweighing any soil loss occurring during harvest

- Perhaps methods used to quantify soil loss are inadequate or antiquated for use on modern sod farms - biosolids

- Other factors affect soil quality other than loss

What is soil quality?

"The capacity of a soil to function within ecosystem boundaries to sustain biological productivity, maintain environmental quality, and promote plant and animal health"

- Doran et. al. 1994

- **Dynamic Properties**

Dynamic Soil Properties

- Describes condition of soil due to relatively recent land use
- Includes soil quality indicators
- Composed of physical, biological, and chemical soil properties

Objectives

- To determine appropriate soil quality indicators to be used for assessing the sustainability of land used for sod production

- To establish reference guidelines to be used for future soil quality assessment on sod farming operations

- To determine the overall effect commercial sod production has on soil quality

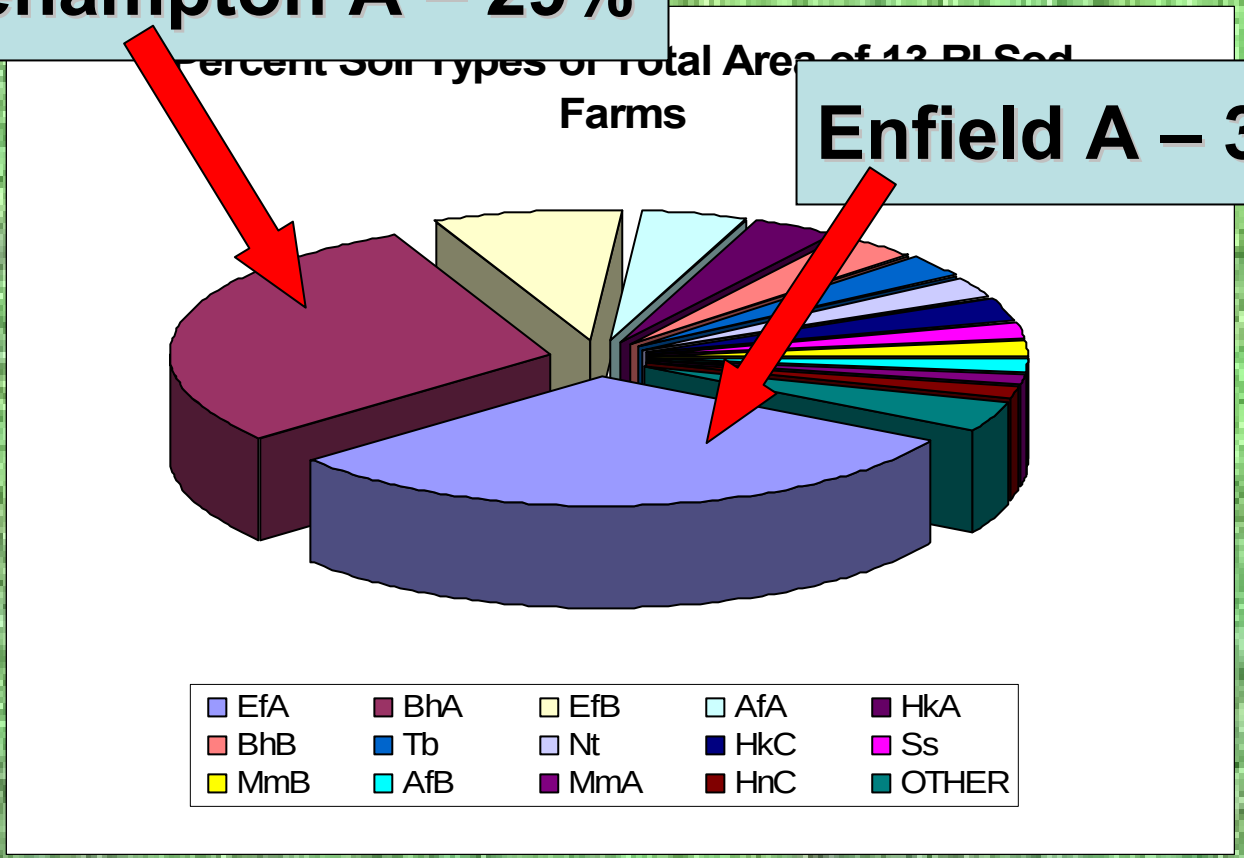
Methods

- Sites
  - 5 sod farms, 3 control sites (corn field, turf plot (no harvest), and forest
  - All 8 sites stratified by soil type
    - Agawam, Enfield, Bridgehampton

Soil Types

Bridgehampton A – 29%

Enfield A – 31%



Parent Material for RI sod farm soils

http://www.nesoil.com/images/enfield.htm

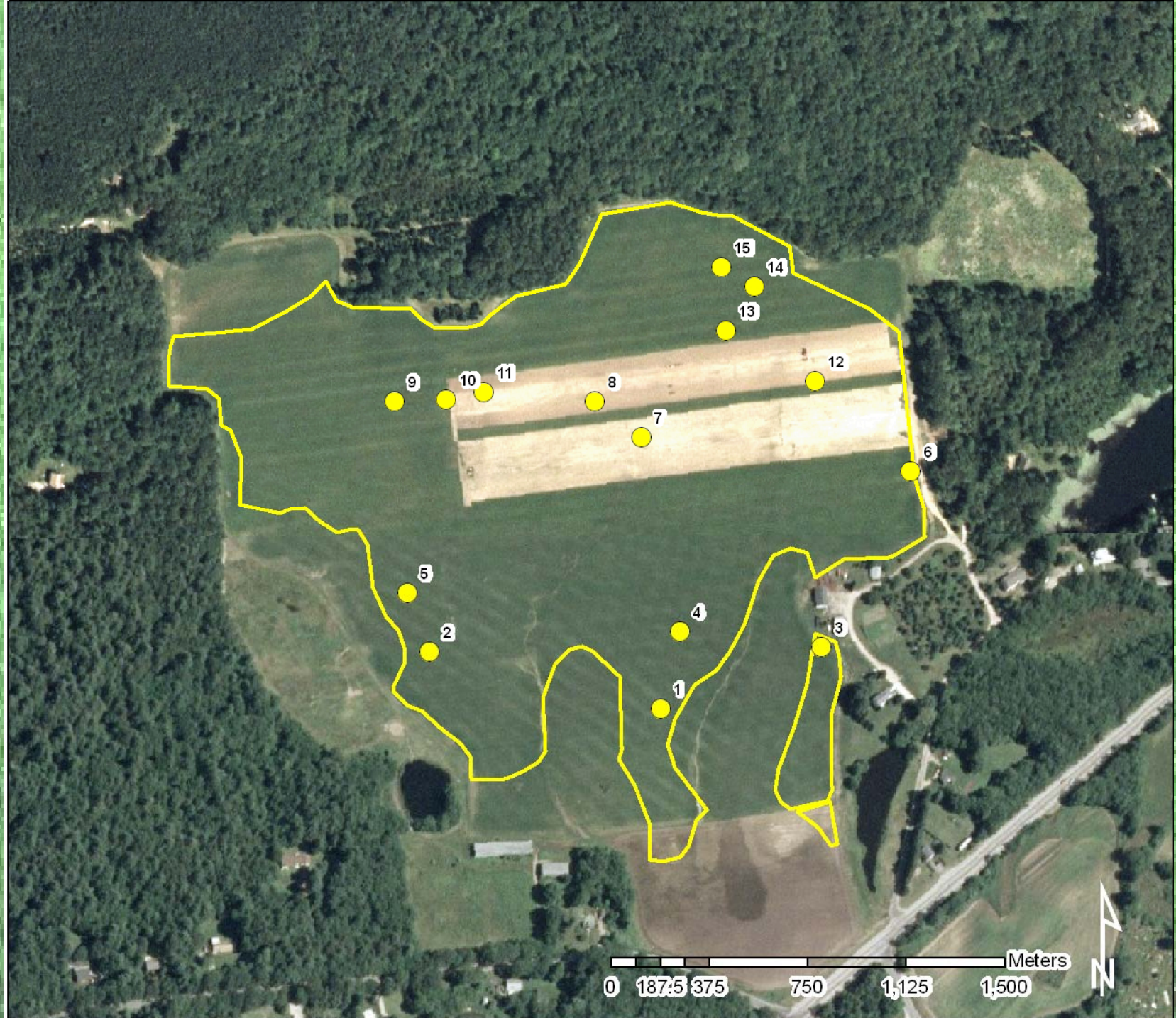
Loess or loamy material – fine, silty material

Outwash – coarse sands and gravels

2006 Sampling

- 15 points were randomly selected at all sites using GIS
  - at each point soil cores were taken at depths of 0-10, 10-20, and 20-30 cm
  - these samples were measured for pH, SOM, NH_4^+ & NO_3^-, and microbial biomass C

- 6 points were randomly selected in the field
  - stratified to areas with established turf on sod farms sites, random at control sites
  - used for measuring soil respiration and infiltration rates


15
14
13
12
9
10
11
8
7
6
5
2
4
3
1
Meters
0
187.5
375
750
1,125
1,500
N


0m
0 10
20°C
0 20
0 30


0m


0m
0 10
20°C

SQ Indicators used in this study

Chemical:

- Organic Matter
- NH_4^+ & NO_3^-
- pH

Biological:

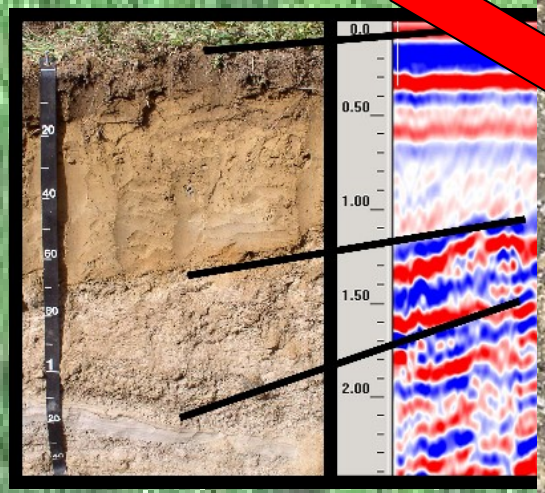
- Microbial biomass C
- Soil Re

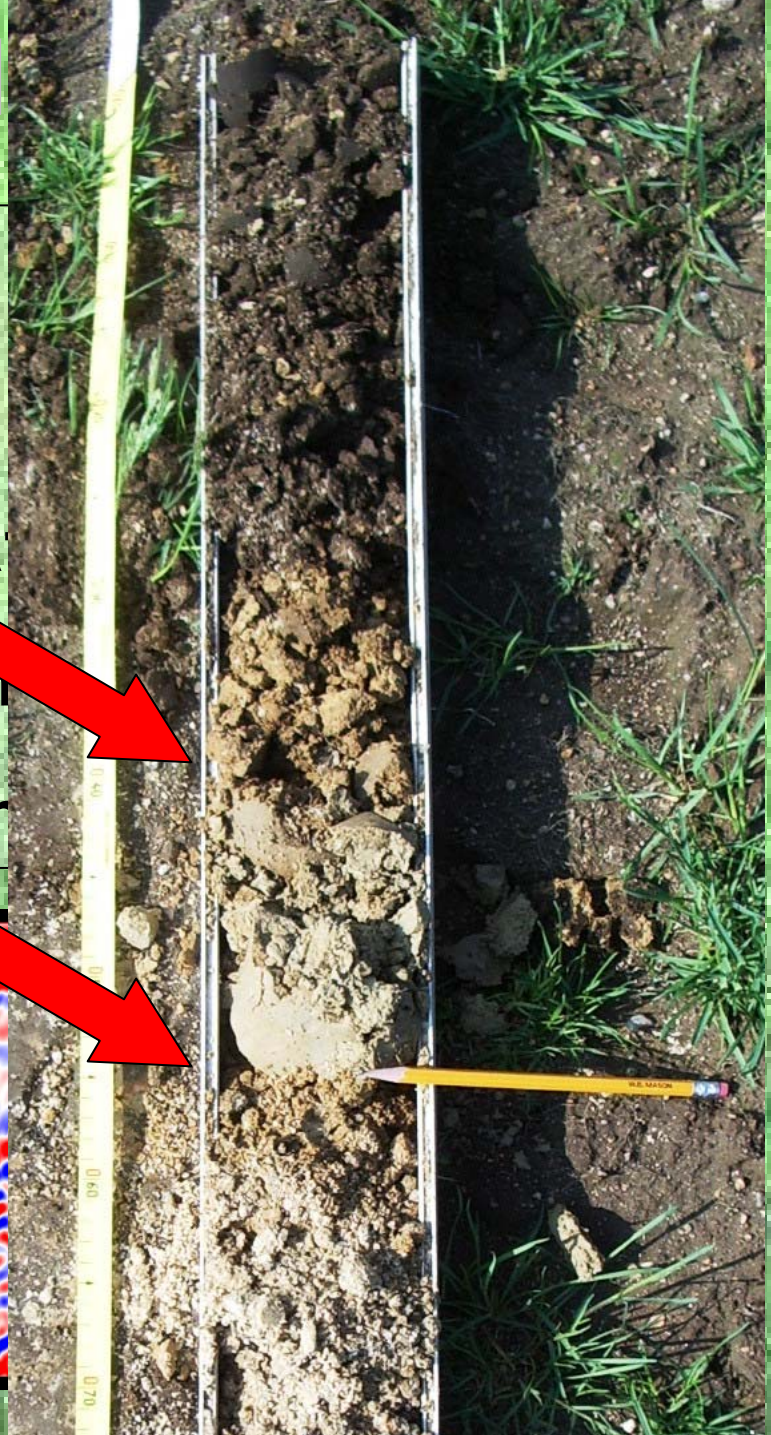
SQ Ind

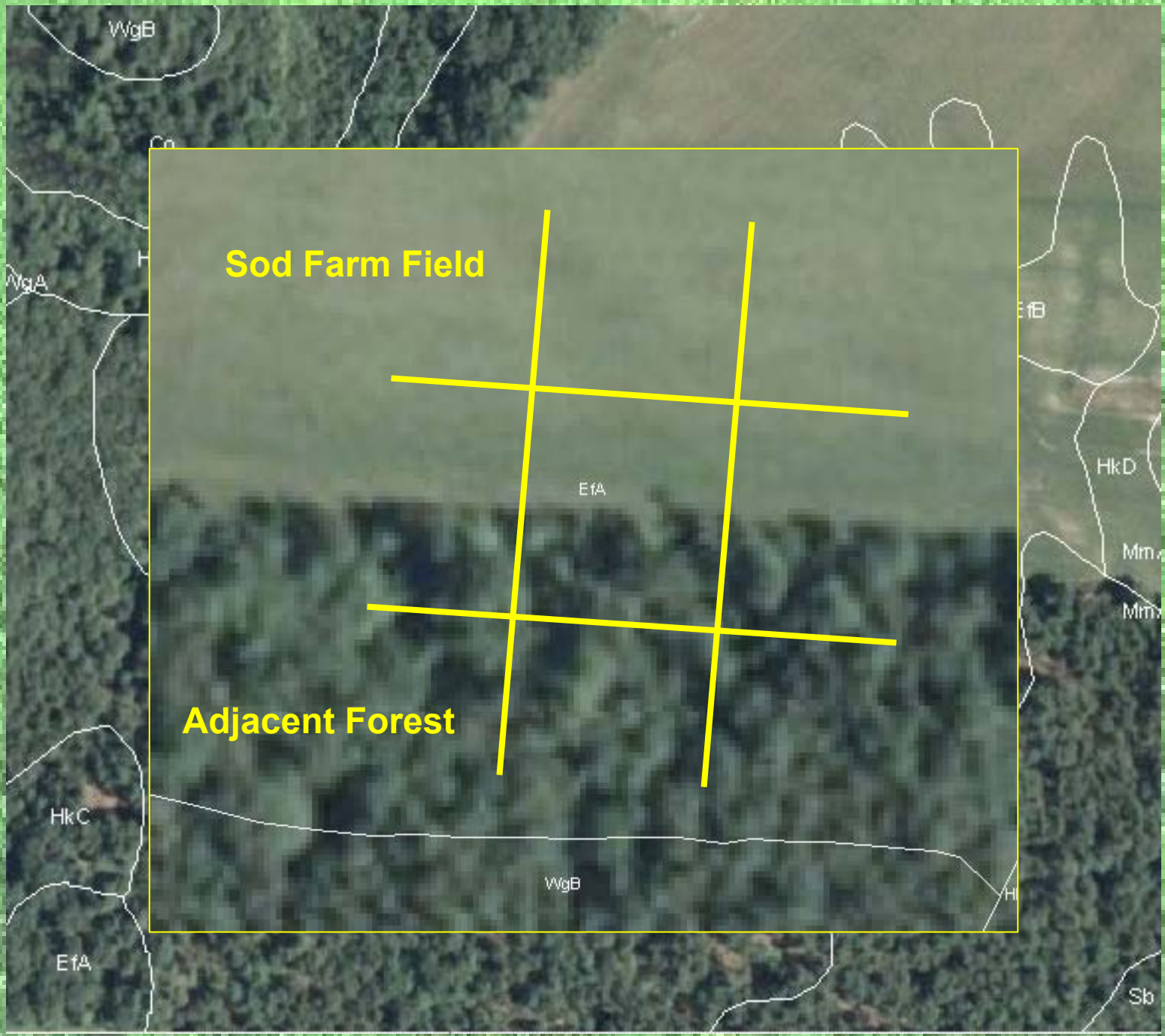
this study

Physical:

- Bulk density
- Infiltration ra
- Solum thickn
- Loess Thickn

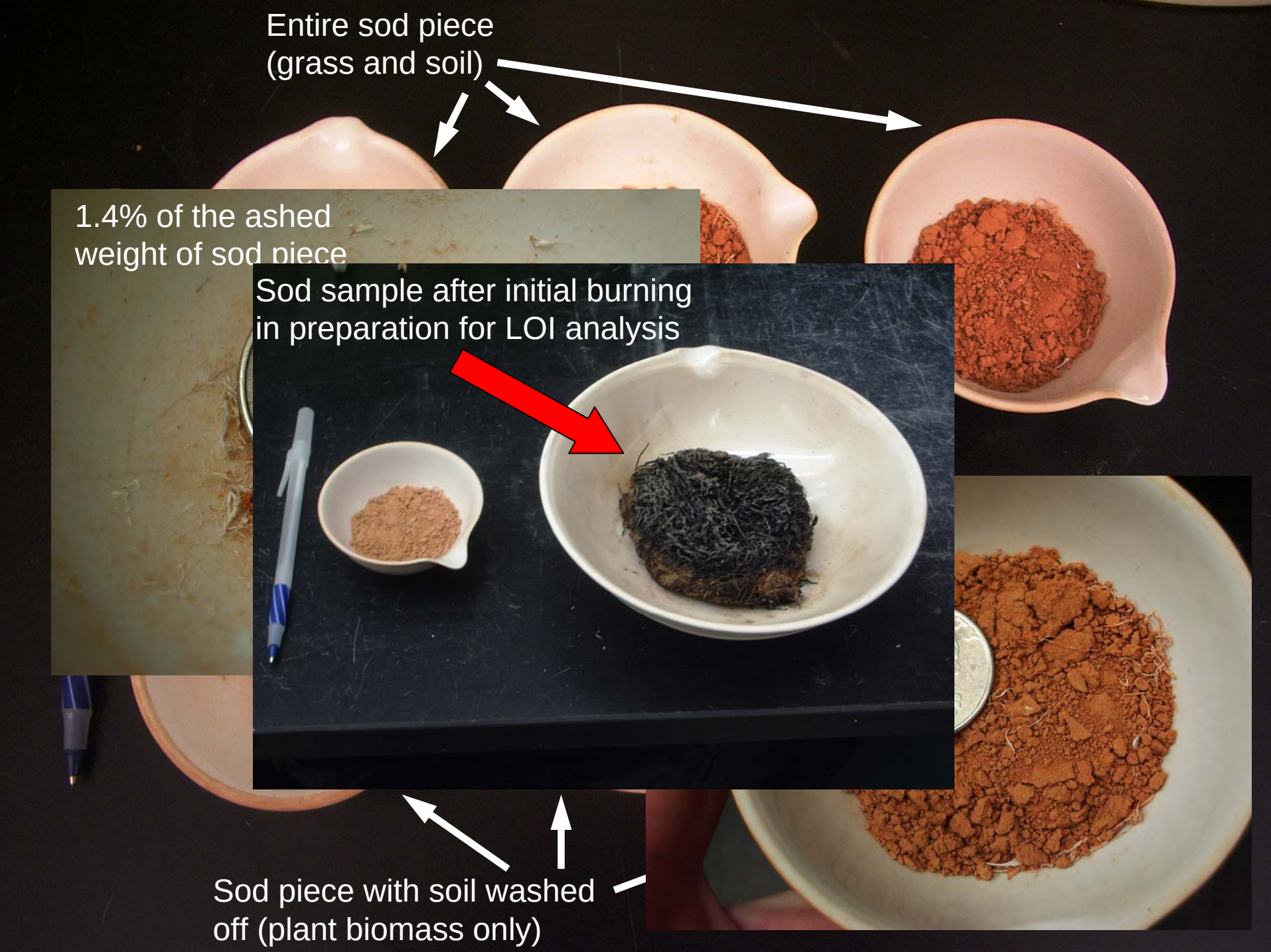




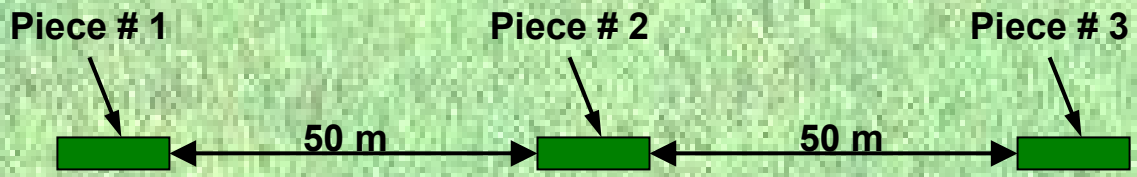

Sod Farm Field
Adjacent Forest
WgB
WgA
EfB
HkD
EfA
Mm
Mm
HkC
WgB
EfA
Sb

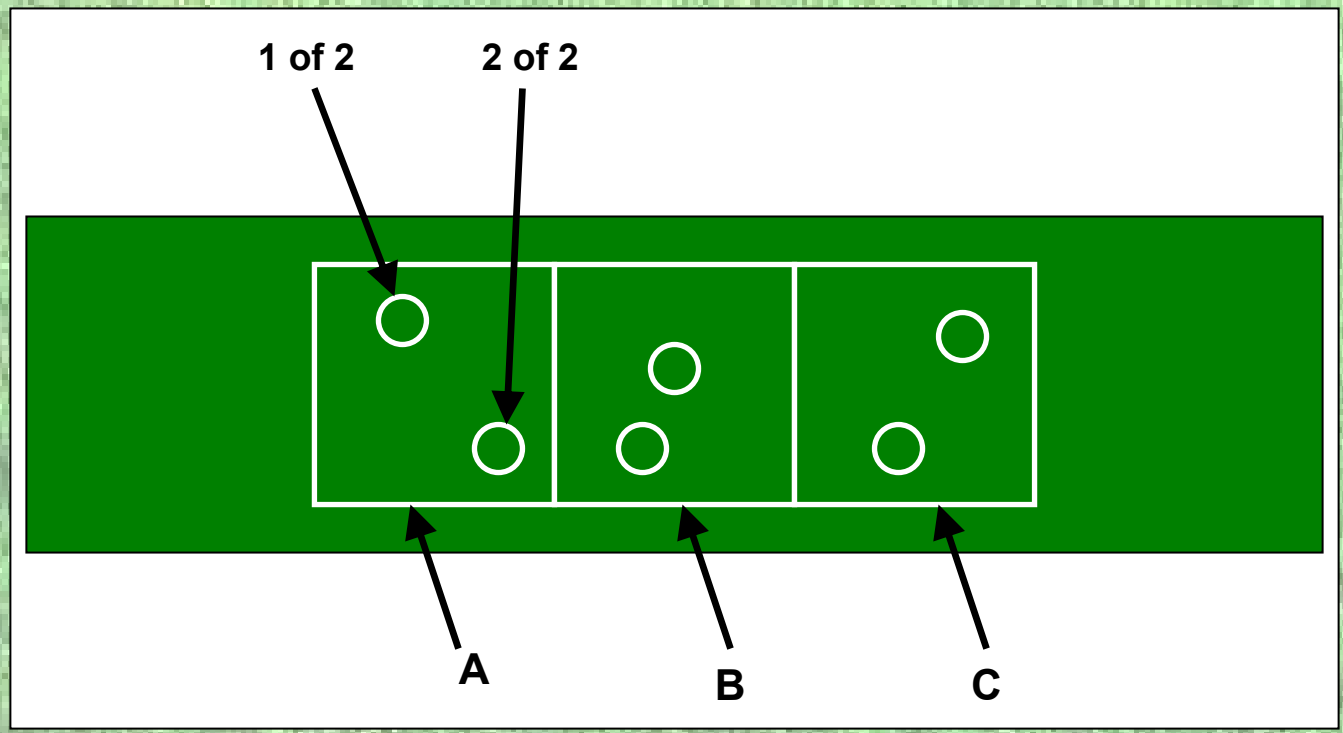
Sampling harvested sod

- Harvested sod was collected from 4 sites, on the same day
  - in an effort to ensure similar soil moisture conditions during
  - sod strips were collected straight from the harvester to avoid soil loss during handling
  - samples taken from the strips were frozen until ready for analysis


Entire sod piece
(grass and soil)
1.4% of the ashed
weight of sod piece
Sod sample after initial burning
in preparation for LOI analysis
Sod piece with soil washed
off (plant biomass only)

• 3 sod strips were collected 50 m apart along a transect at each site

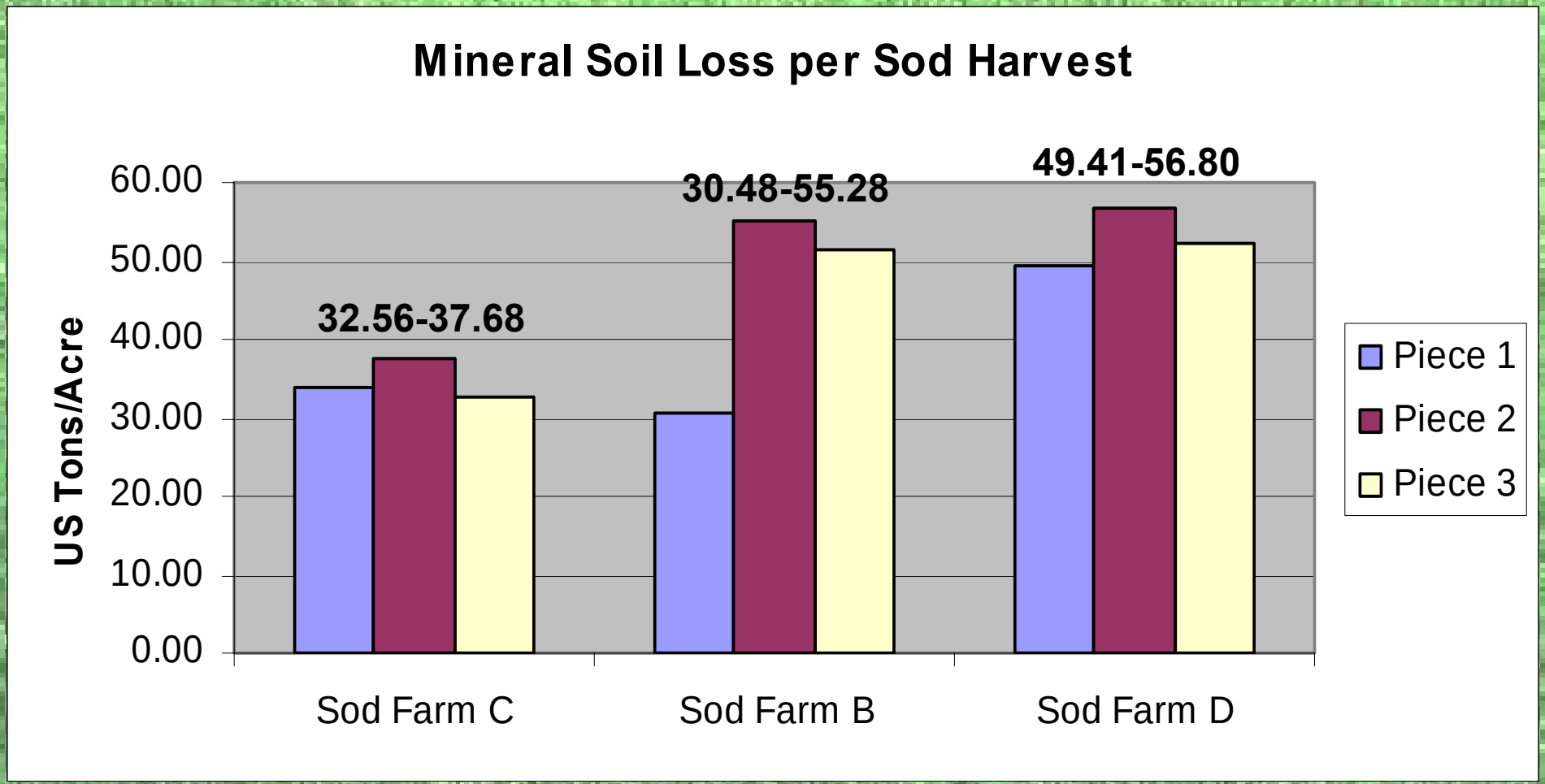




• For each sod strip, 3 1’ x 1’ adjoining squares were traced out

• a 10cm diameter cup cutter was used to take 2 random samples from each 1’ x 1’ square

Results


Mineral Soil Loss per Sod Harvest
US Tons/Acre
60.00
50.00
40.00
30.00
20.00
10.00
0.00
32.56-37.68
30.48-55.28
49.41-56.80
Sod Farm C
Sod Farm B
Sod Farm D
Piece 1
Piece 2
Piece 3

Skogley and Hesseltine 1978

- Removal: 27 – 47 tons/acre/harvest

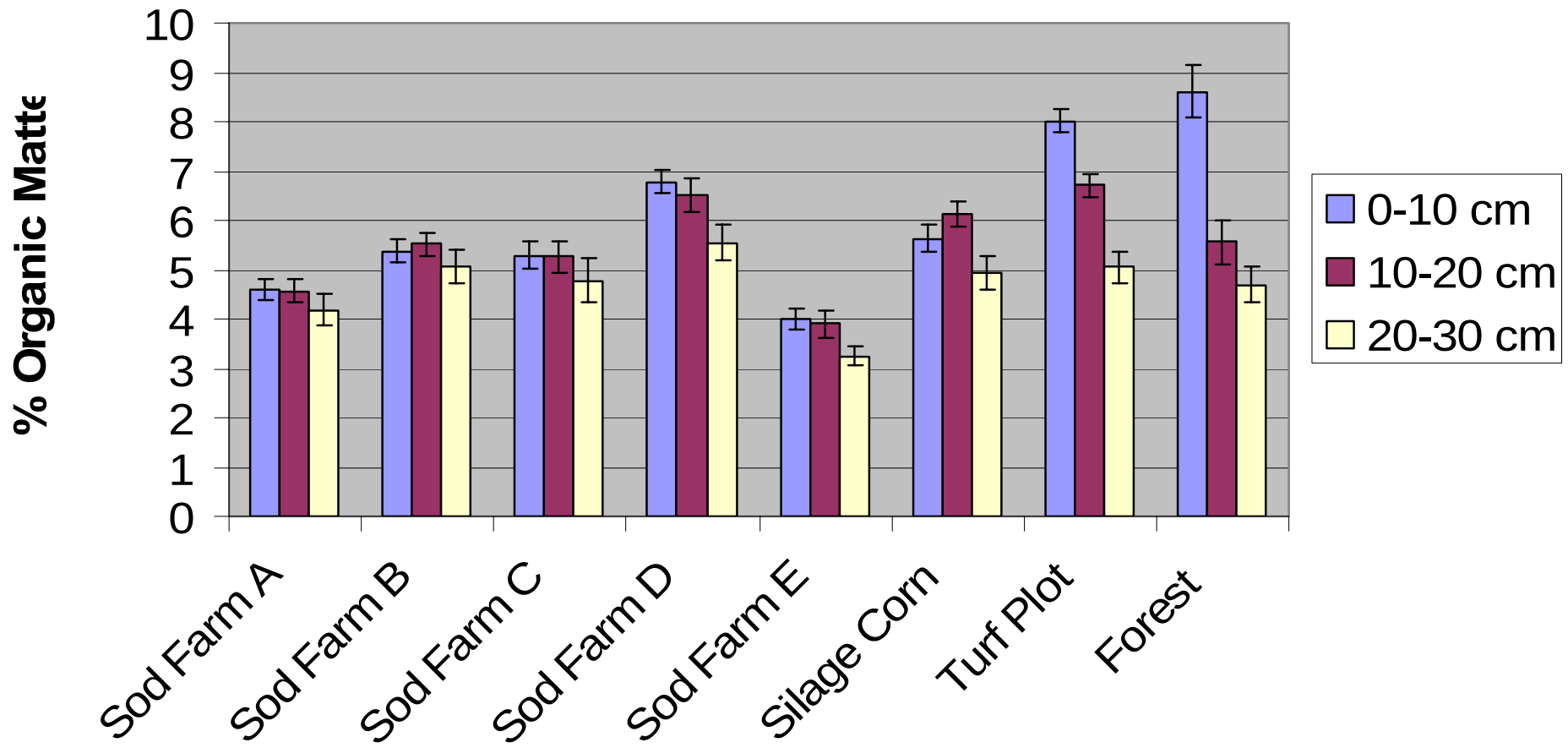
Carr 1996

- Removal: 34 – 45 tons/acre/harvest

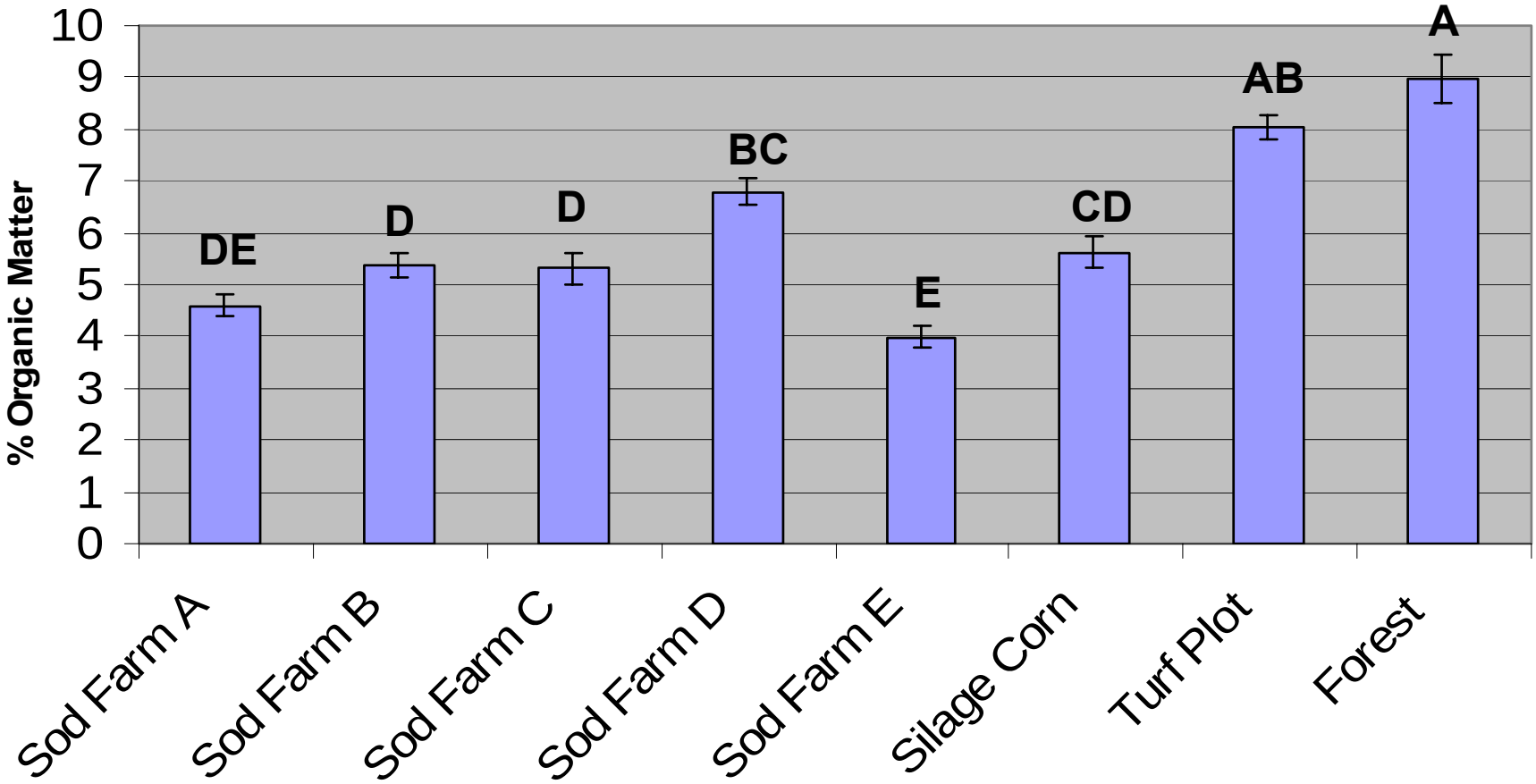
NRCS standards

- Tolerable Loss: 3 tons/acre/year

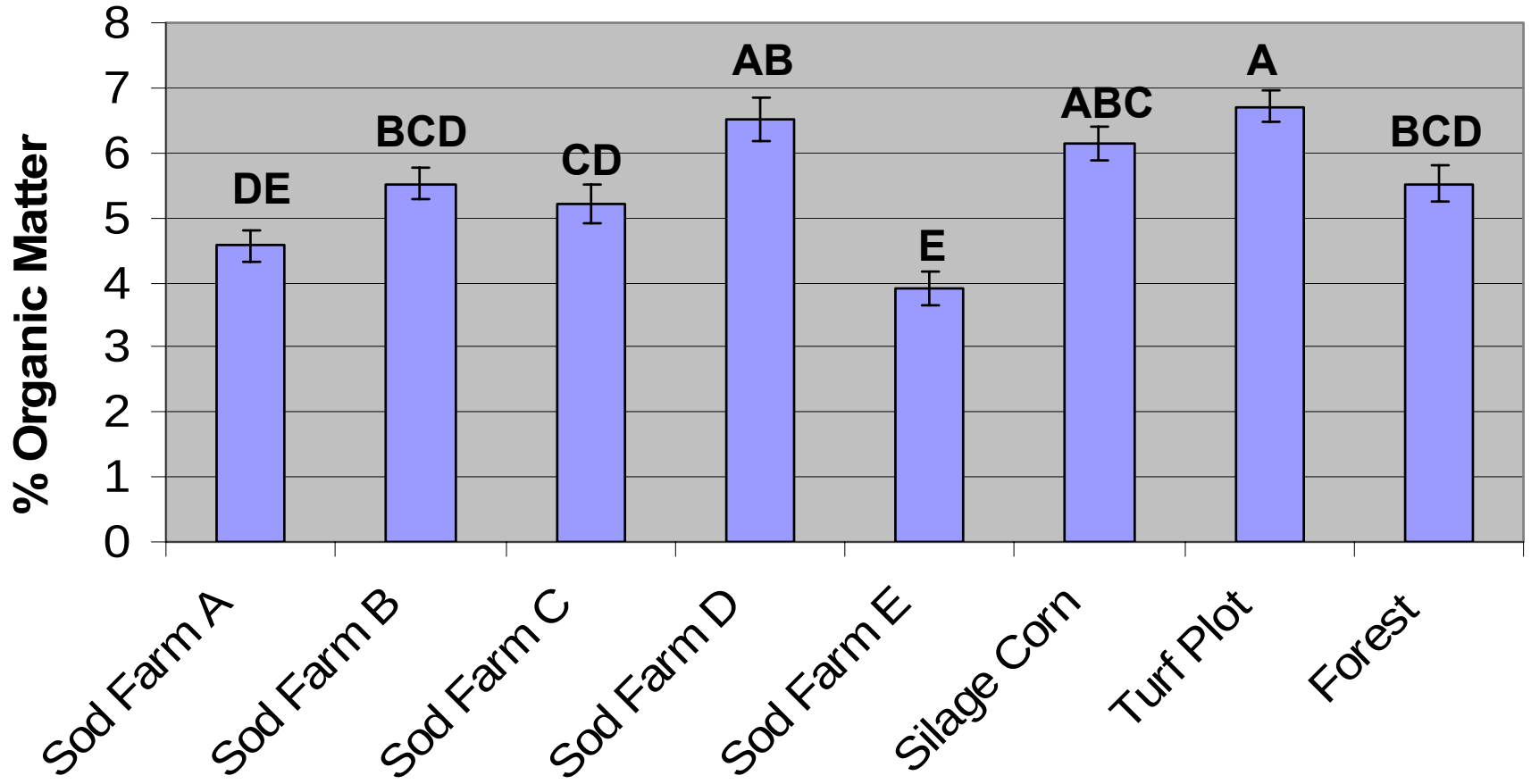
Based on these studies, at least 9-16 times more soil is being removed than allowable by NRCS standards


2006 Soil Organic Matter Content
n = 15
% Organic Matte
10
9
8
7
6
5
4
3
2
1
0
Sod Farm A
Sod Farm B
Sod Farm C
Sod Farm D
Sod Farm E
Silage Corn
Turf Plot
Forest
0-10 cm
10-20 cm
20-30 cm

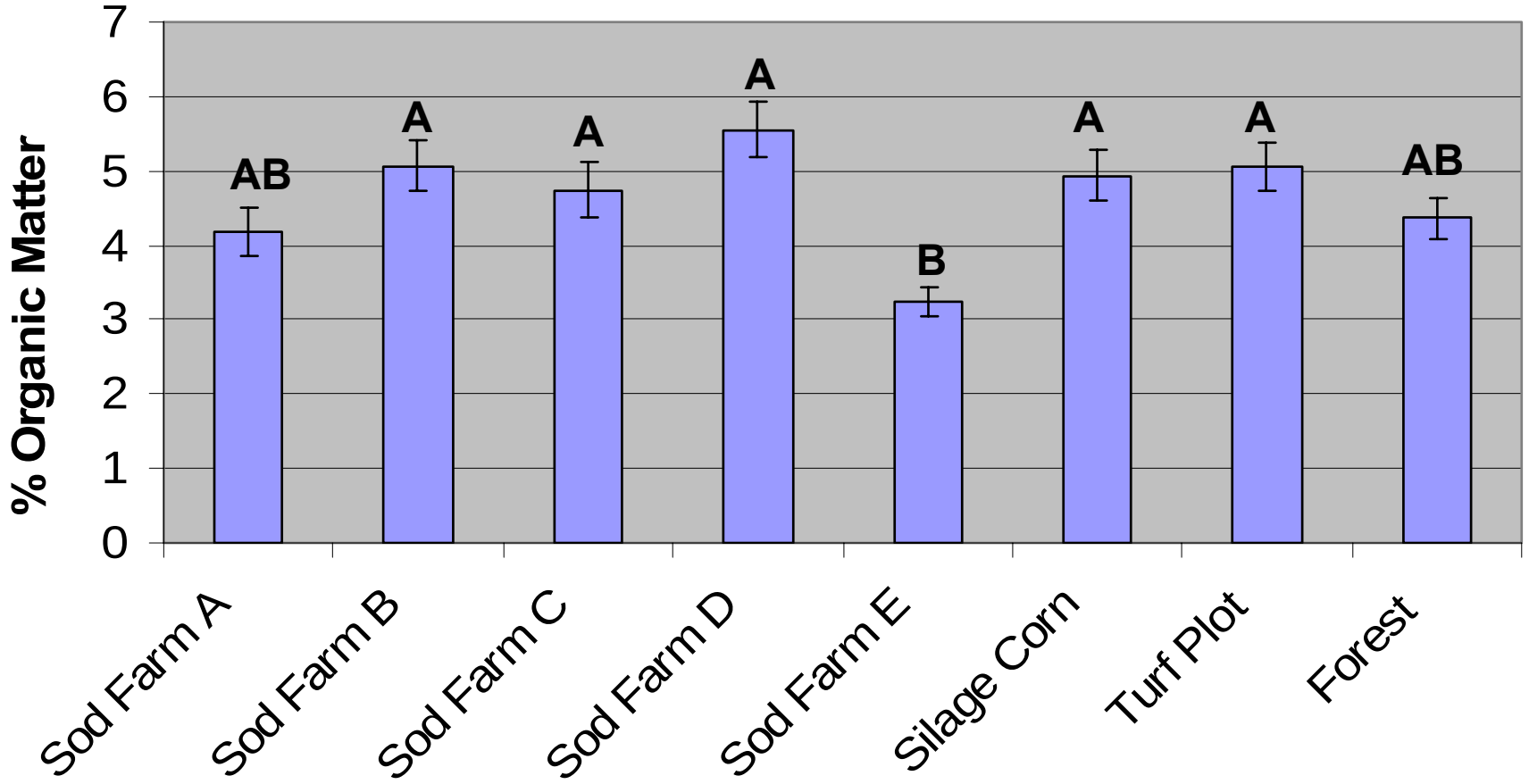
2006 Soil Organic Matter Content (0-10 cm)



2006 Soil Organic Matter Content (10-20 cm)



2006 Soil Organic Matter Content (20-30 cm)



Upcoming research plans

- Run samples for C:N ratios
- Measure δ13C Isotope Signatures
  - Biosolid fertilizer, turf plant tissue, and SOM
- Sample all sod farms within fields ~30 years old
  - SOM, Mineral N
- Finish lab analysis

"Boston Bean" biosolid fertilizer

Acknowledgements

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- Mark Stolt, Jose Amador, Bridget Ruemmele

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NRCS

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Questions?