Soil recommendations after the largest oil spill in US History-The Tioga Experience

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Soil and Soil-Water Workshop

NDSU Extension

Fargo, ND

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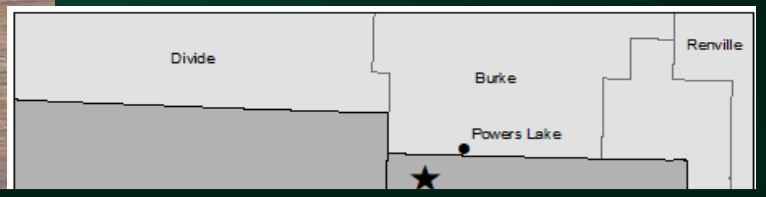
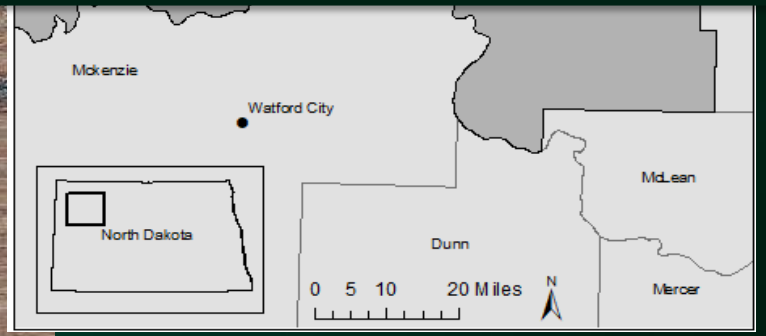
Problem

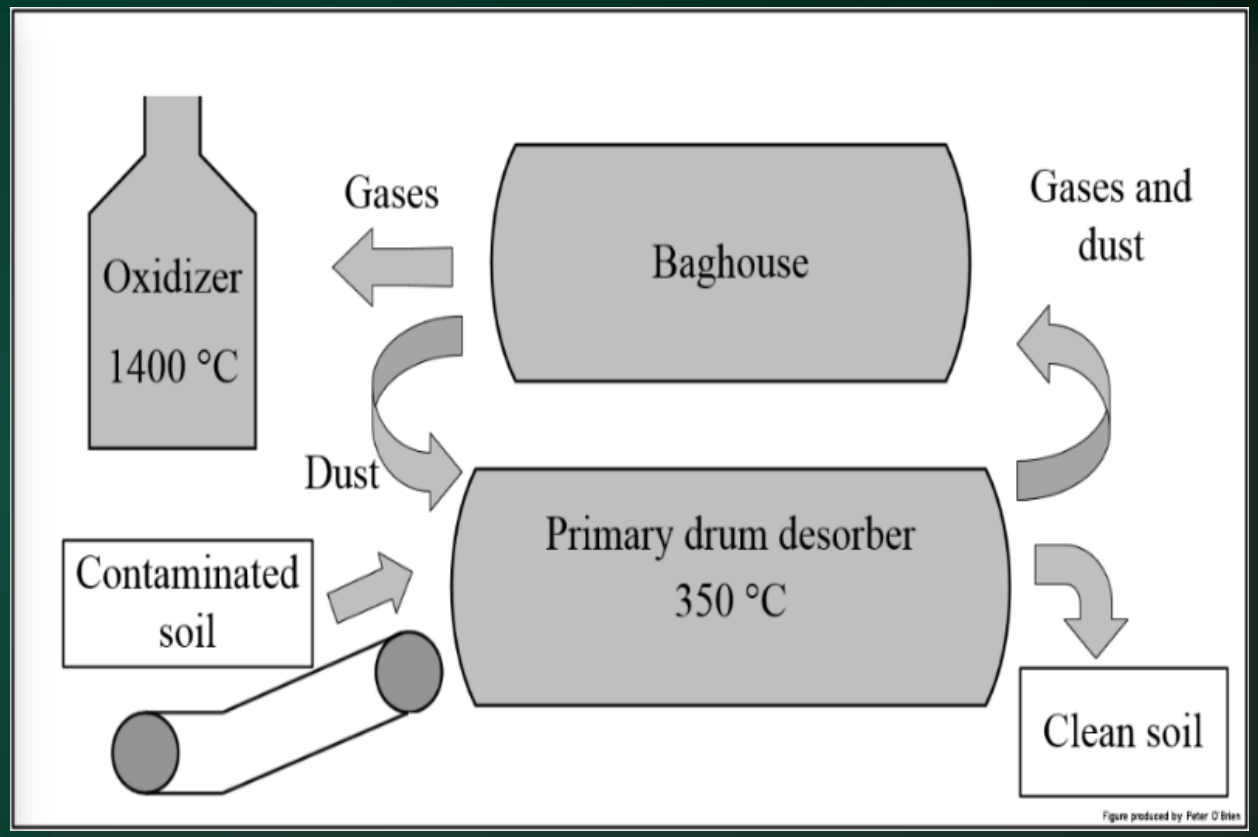


Goal: Bring soils back to agricultural production.



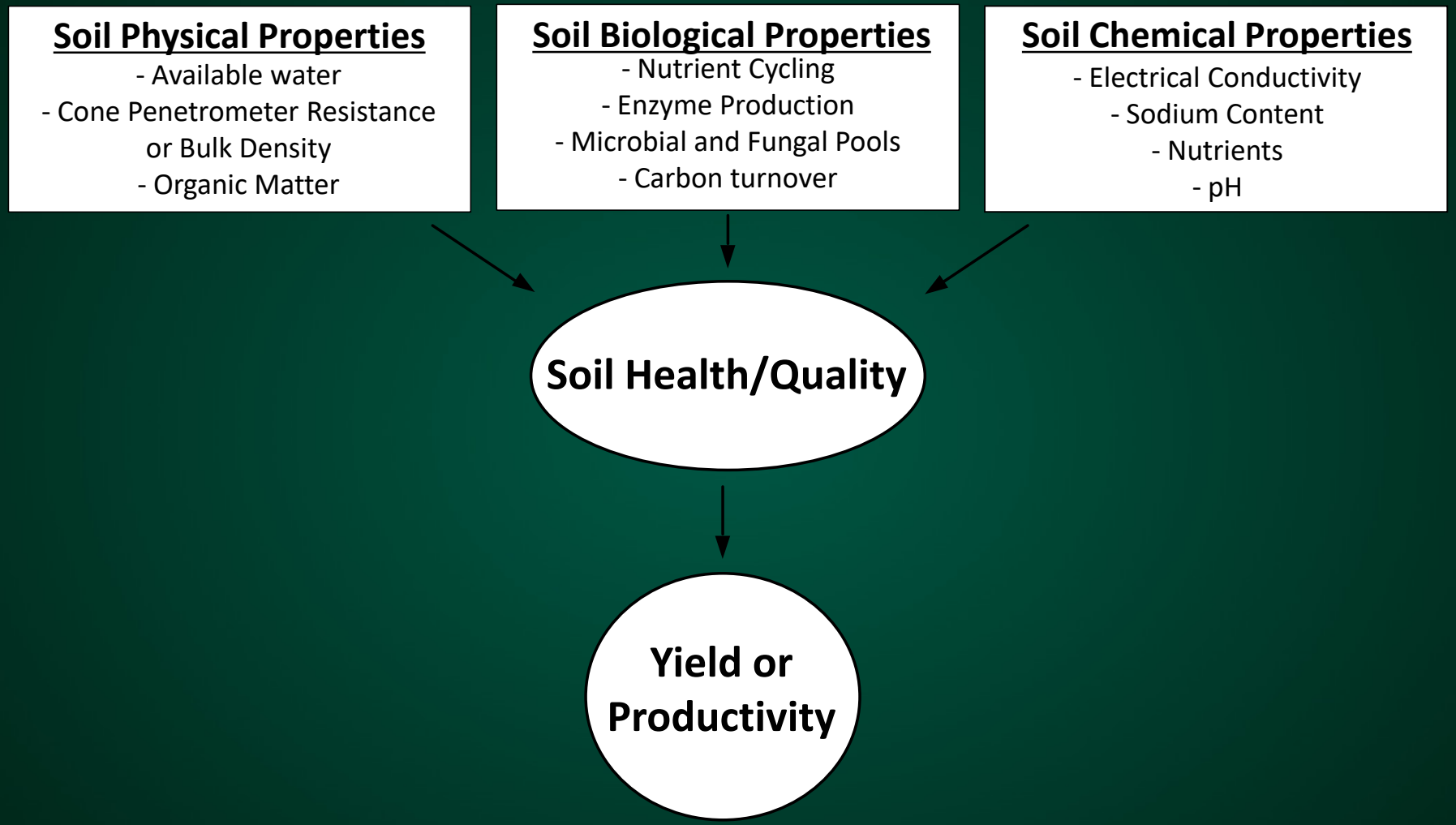
30 rail cars

Solution: Thermal Desorption



…but some unknowns

Holistic Approach to the Remediation/Reclamation/Restoration of Soils



Can TD-treated soil be used for agricultural productivity?

C270A

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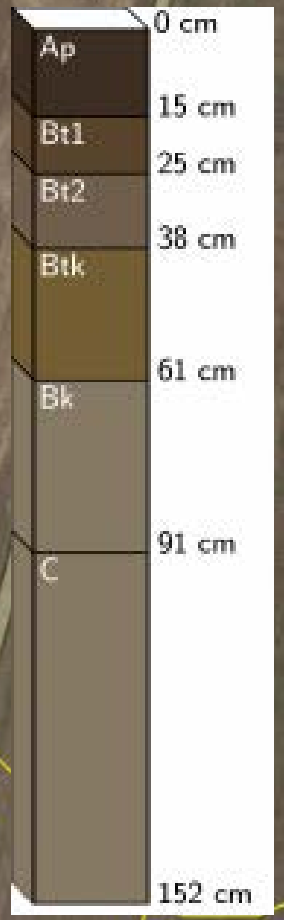
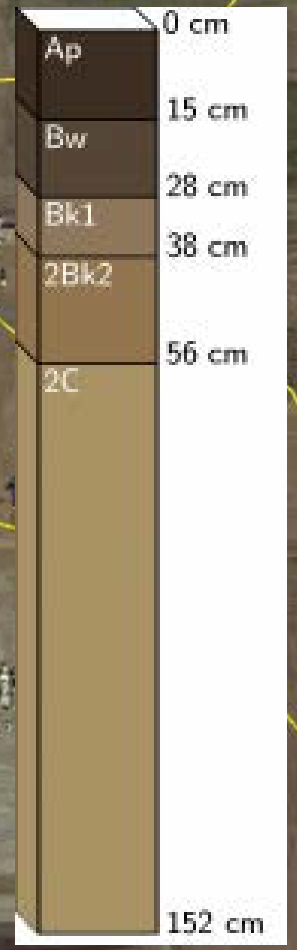
Williams-Zahl loams, 3 to 6 percent slopes, 2e and 3e



Lehr loam, 2 to 6 percent slopes, 3e



C816B

C154C

2B

Soil Samples

- Native Topsoil (TS)
- Native Subsoil (SS)
- Contaminated stockpile (SP)

Thermally Desorbed

- Topsoil (TS-TD)
- Subsoil (SS-TD)
- Stockpile (SP-TD)

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Laboratory/Greenhouse analyses – Physical and Biological

- Aggregate stability
- Saturated hydraulic conductivity
- Soil organic carbon
- Microorganism populations
- Microorganism activity
- Wheat grain quality






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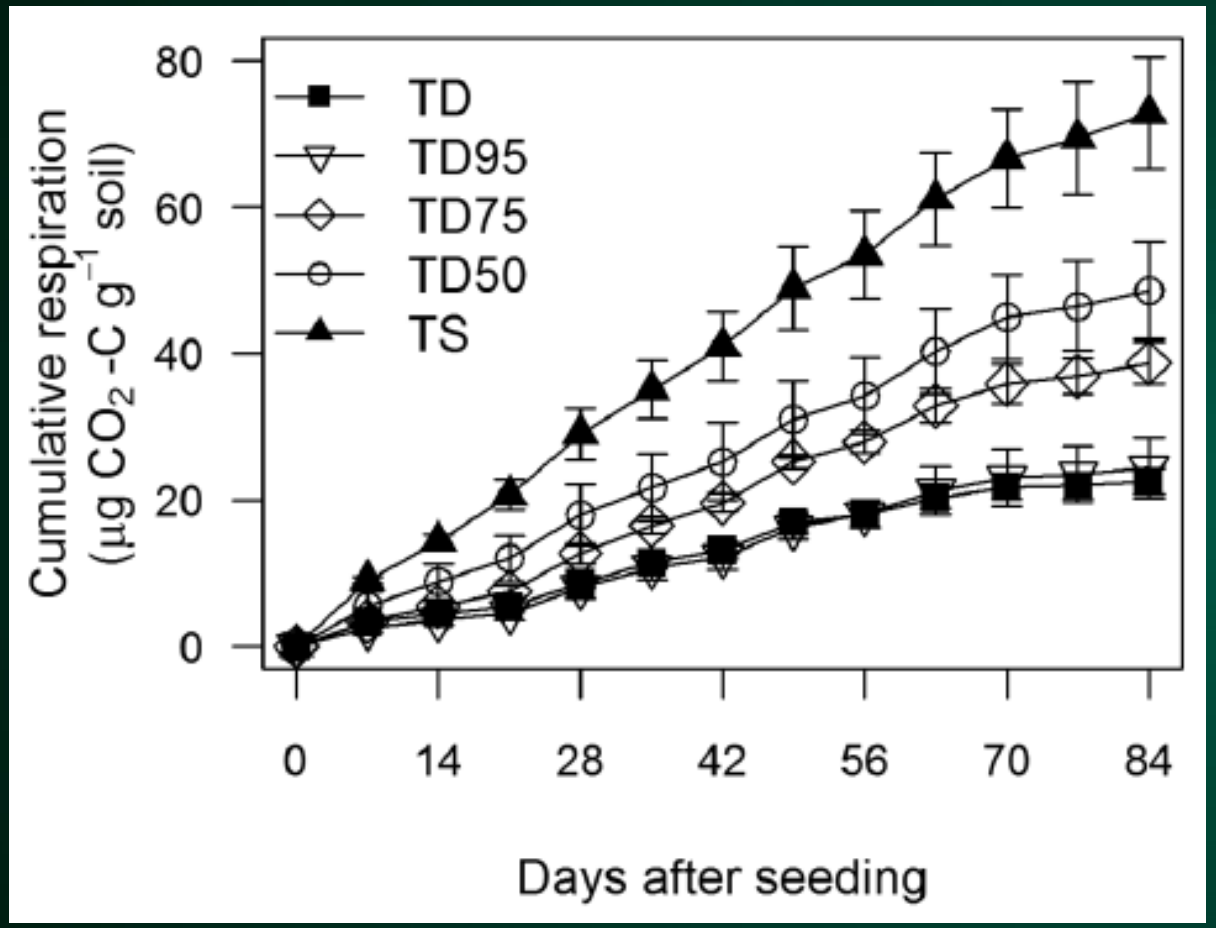

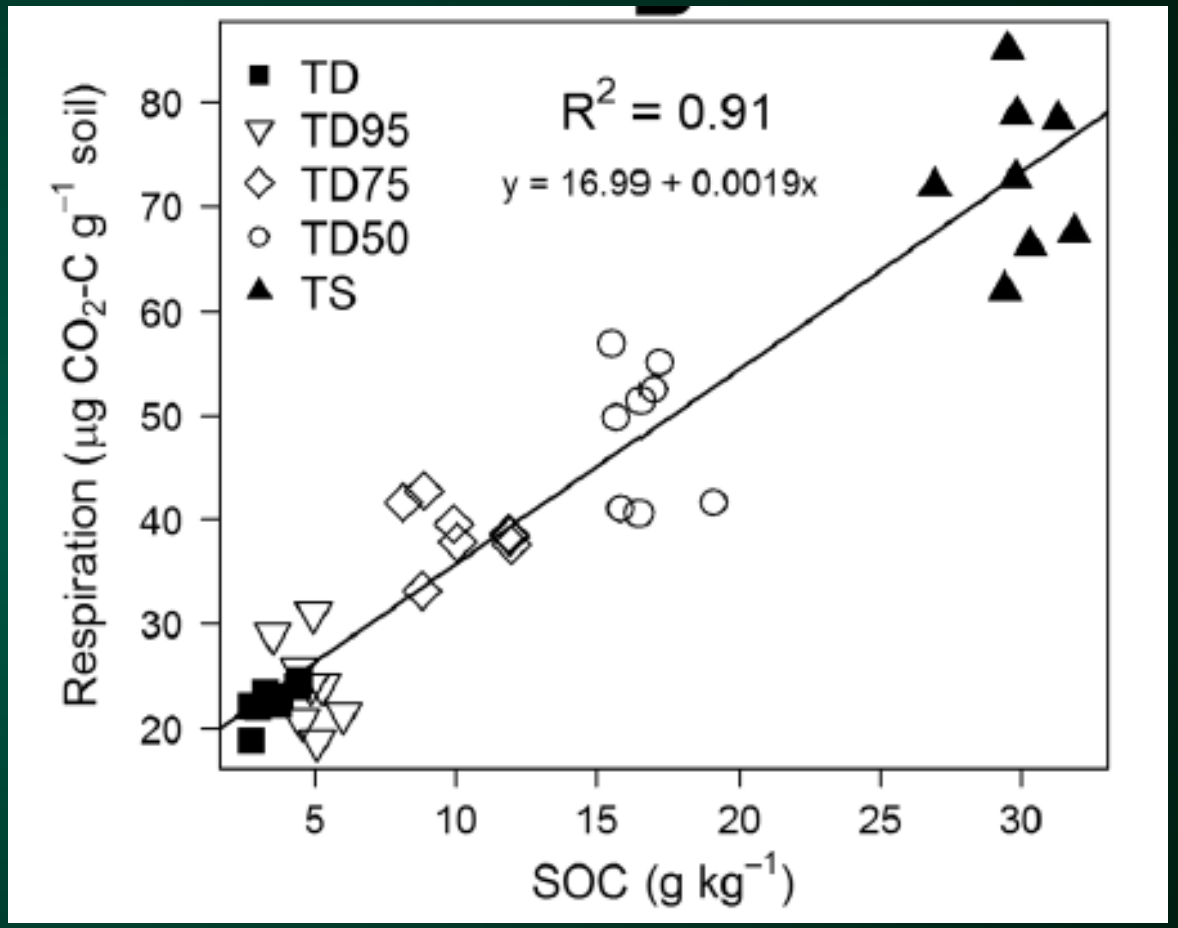

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Laboratory analyses – Chemical

- Cation exchange capacity
- Cation selectivity
- pH
- Phosphorus sorption
- Phosphorus desorption

Field study

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Soil mixes

TDU: contaminated soil that has been treated by TDU
(TPH 229 mg kg^{-1})

A: native, non-contaminated topsoil
(TPH < 5 mg kg^{-1})

SP: contaminated soil that has been excavated and stockpiled, but not yet treated
(TPH 1475 mg kg^{-1})

TDU + A
(TPH 110 mg kg^{-1})

SP + A
(TPH 704 mg kg^{-1})

Composted bedding (manure, m)

10 soil treatments

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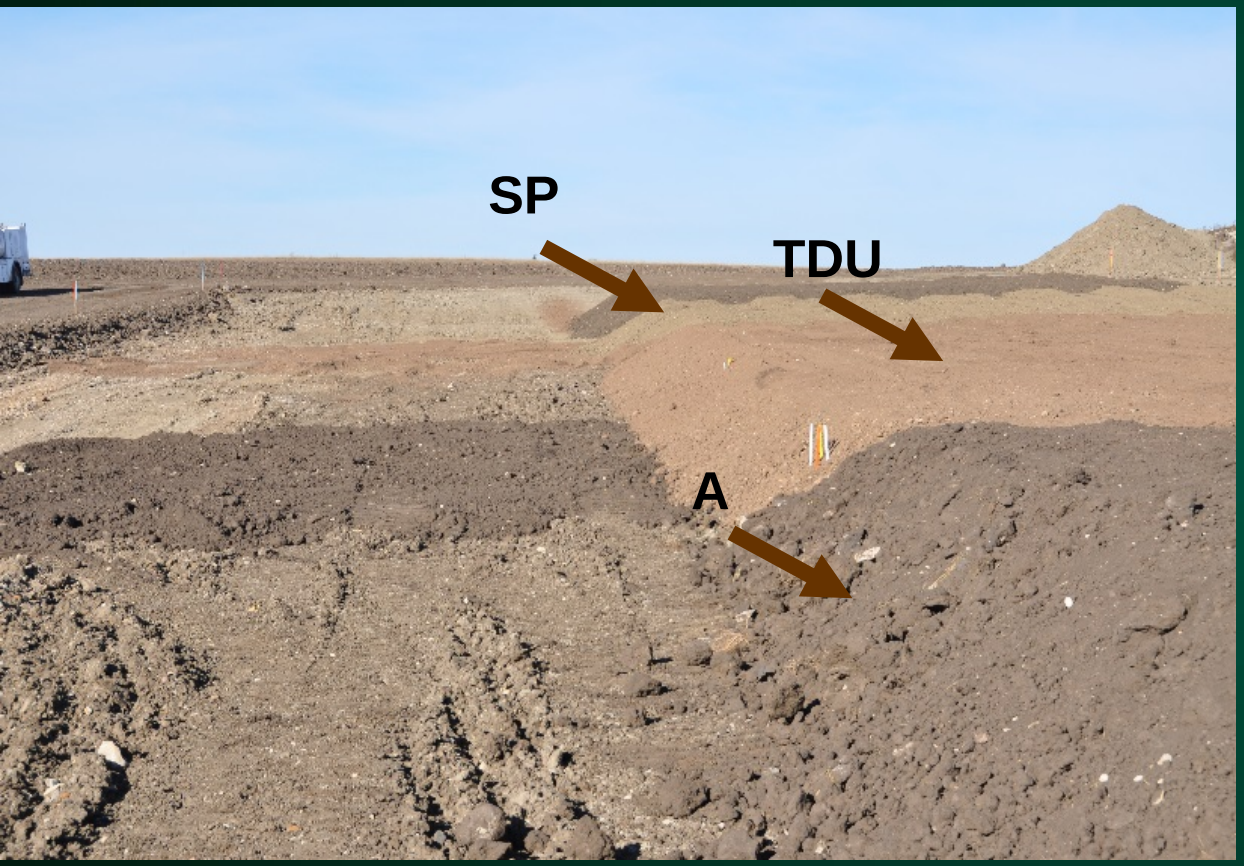
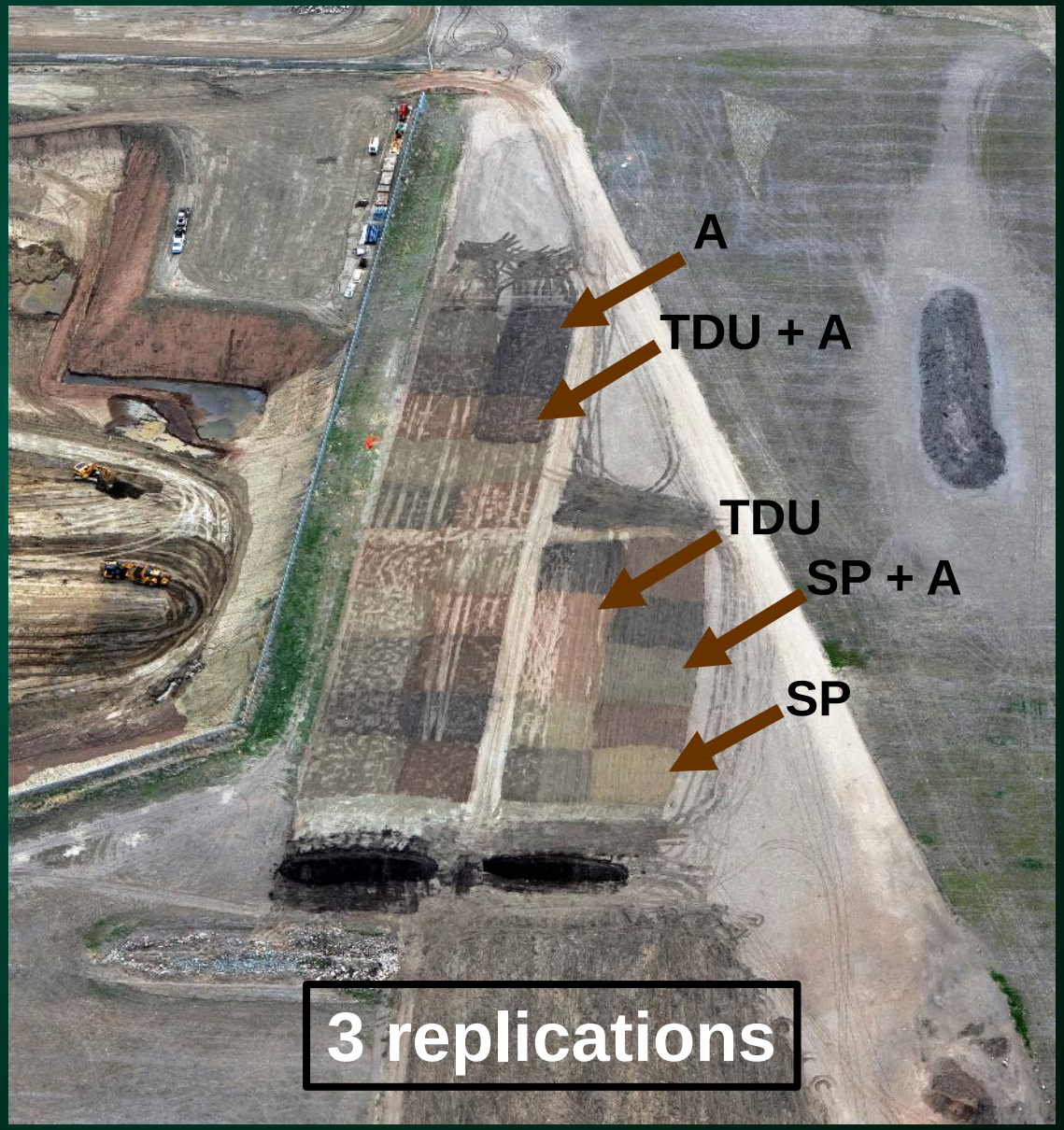
Soil mixes





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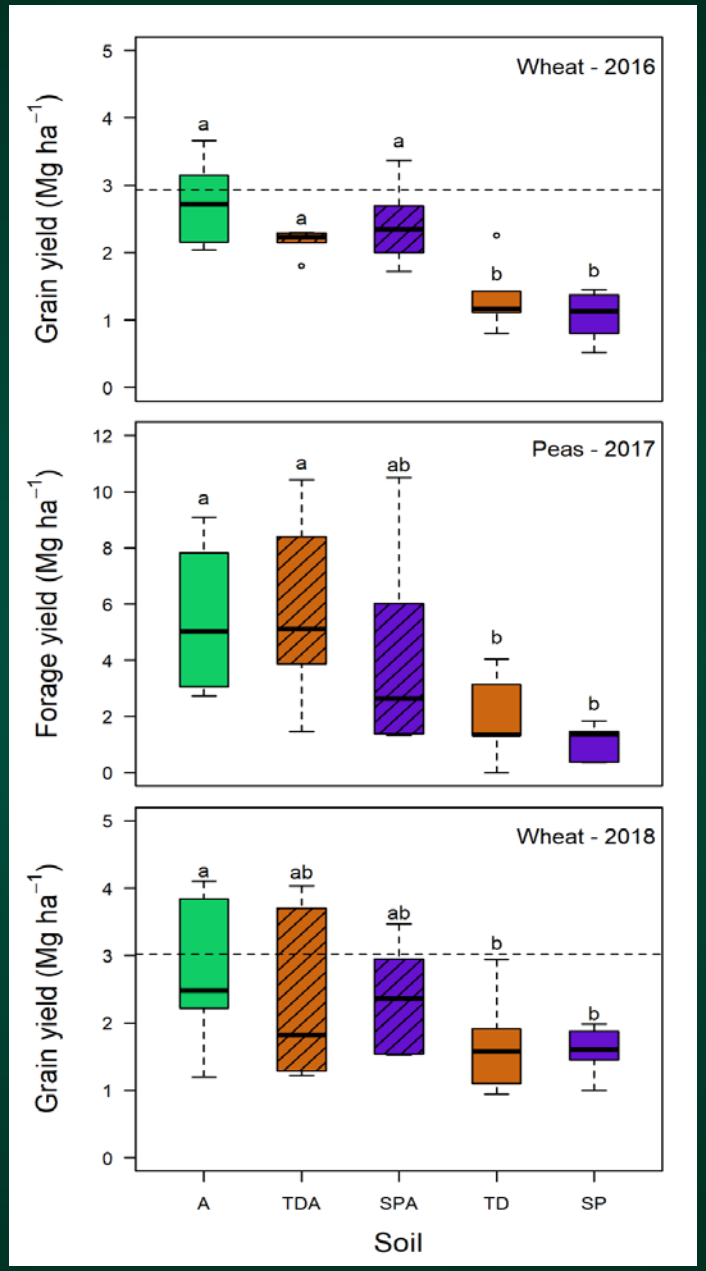
Cropping System

2016

2017

2018

A = topsoil
TDA = 1:1 Thermally desorbed plus A
SPA = 1:1 Stockpile plus A
TD = Thermally desorbed
SP = Stockpile



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Soil	Petroleum hydrocarbons (mg kg^{-1})	
	2015	
	DROMO	GRO
SP	1394 (114)	81 (10)
SPA	678 (62)	26 (5)
TD	229 (9)	nd
TDA	110 (13)	nd

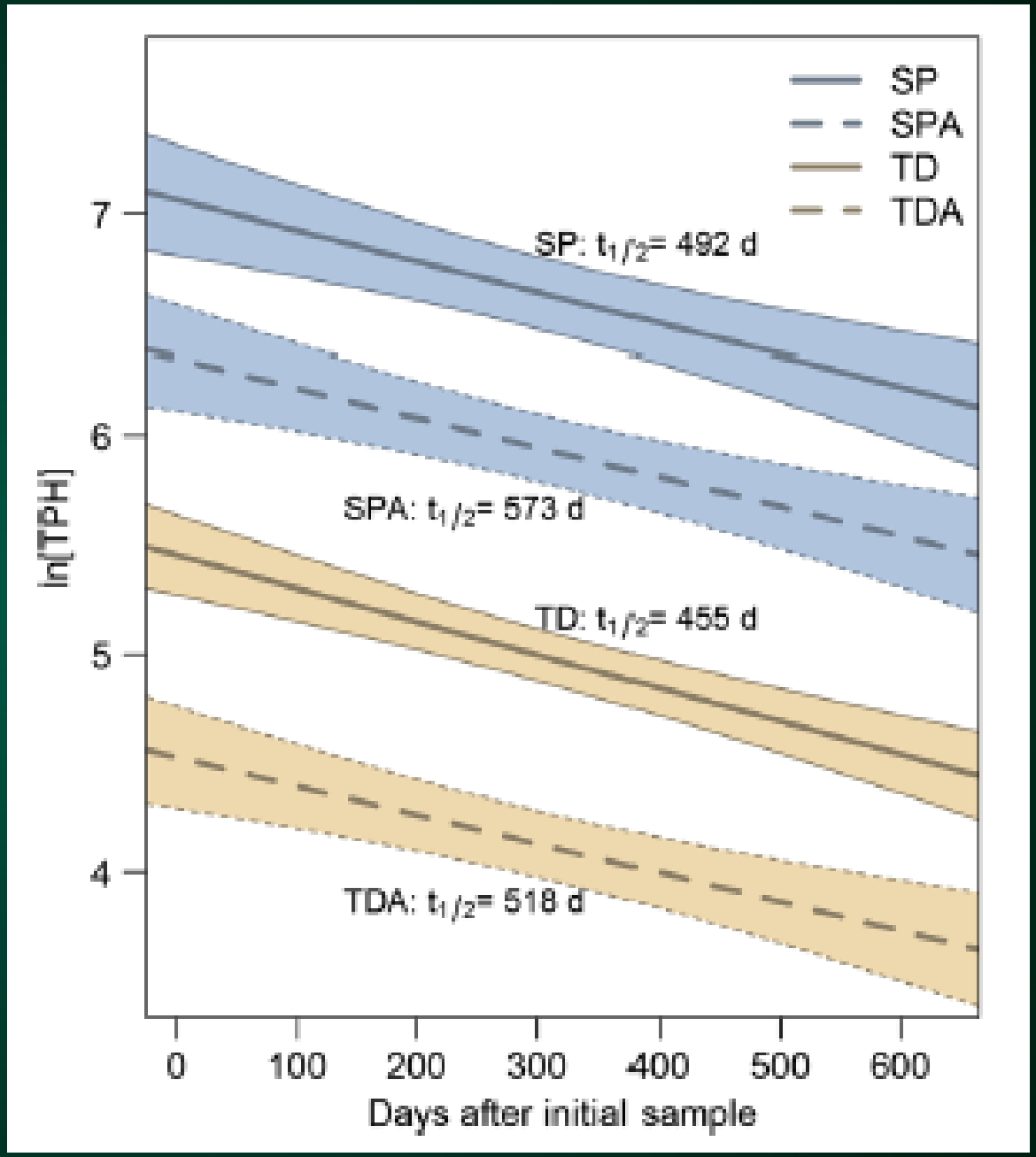

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Table 3 Mean concentration of 16 PAHs (with standard error) in vegetative biomass and grain for wheat and field pea, respectively

Regardless, these levels can be deemed neither suitable nor unsuitable for human consumption because no limits for PAHs in US foods exist (ATSDR 2013),

TDA	110 (40)	7.7 (0.5)	25 (5)	5.0 (0.4)
A	152 (61)	7.5 (1.4)	23 (5)	4.9 (0.5)

Fall 2018

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Fall 2018

	lbs/a
Forage Oats:	20
Slender WG:	7
Forage WRye:	40
YB Clover:	3

Winter
2018

NDS

Spring 2019

Grand Forks Herald

E-PAPER

GOVERNMENT AND POLITICS

Nearly six years after record oil spill, North Dakota landowners see work ahead

Written By: John Hageman | May 25th 2019 - 6am.

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Patty Jensen picks up soil from her and her husband's field near Tioga, N.D., where crews cleaned up a large oil spill after years of work Monday, May 20, 2019. John Hageman / Forum News Service

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Spring 2019

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Spring 2019

Grain sorghum, 8 lbs/ac

Photo courtesy of Patty Jensen

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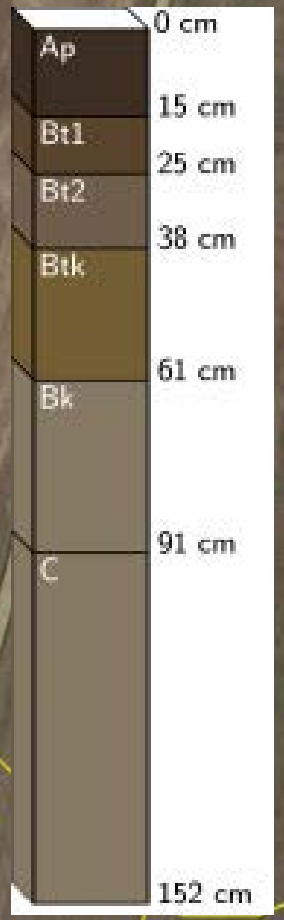
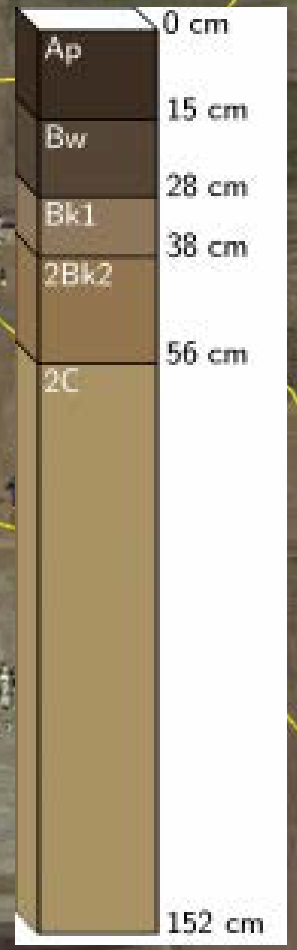
Williams-Zahl loams, 3 to 6 percent slopes, 2e and 3e



Lehr loam, 2 to 6 percent slopes, 3e



C816B

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2B

Soil recommendations

- Sourcing good topsoil is key
  - 2% OM, loam texture, neutral pH, low EC and %Na, "weed free"
- Compaction may likely occur upon spreading
- Blending topsoil with lower-quality soil may be adequate
- Thermal desorption will decrease OM and soil biology
- Plants grown in "low levels" of hydrocarbons did not pose risk

Publications

- O'Brien, P. L., et al., 2016. Implications of using thermal desorption to remediate contaminated agricultural soil: physical characteristics and hydraulic processes. J. Env. Qual. 45:1430-1436.
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- Croat, S., et al. 2020. Crop production on heavily disturbed soils following crude oil remediation. Agron. J. (in press)

- Croat, S., et al. 20XX. Phosphorus sorption and desorption in soils treated by thermal desorption. (soon to be submitted to Water, Air, and Soil Pollution)

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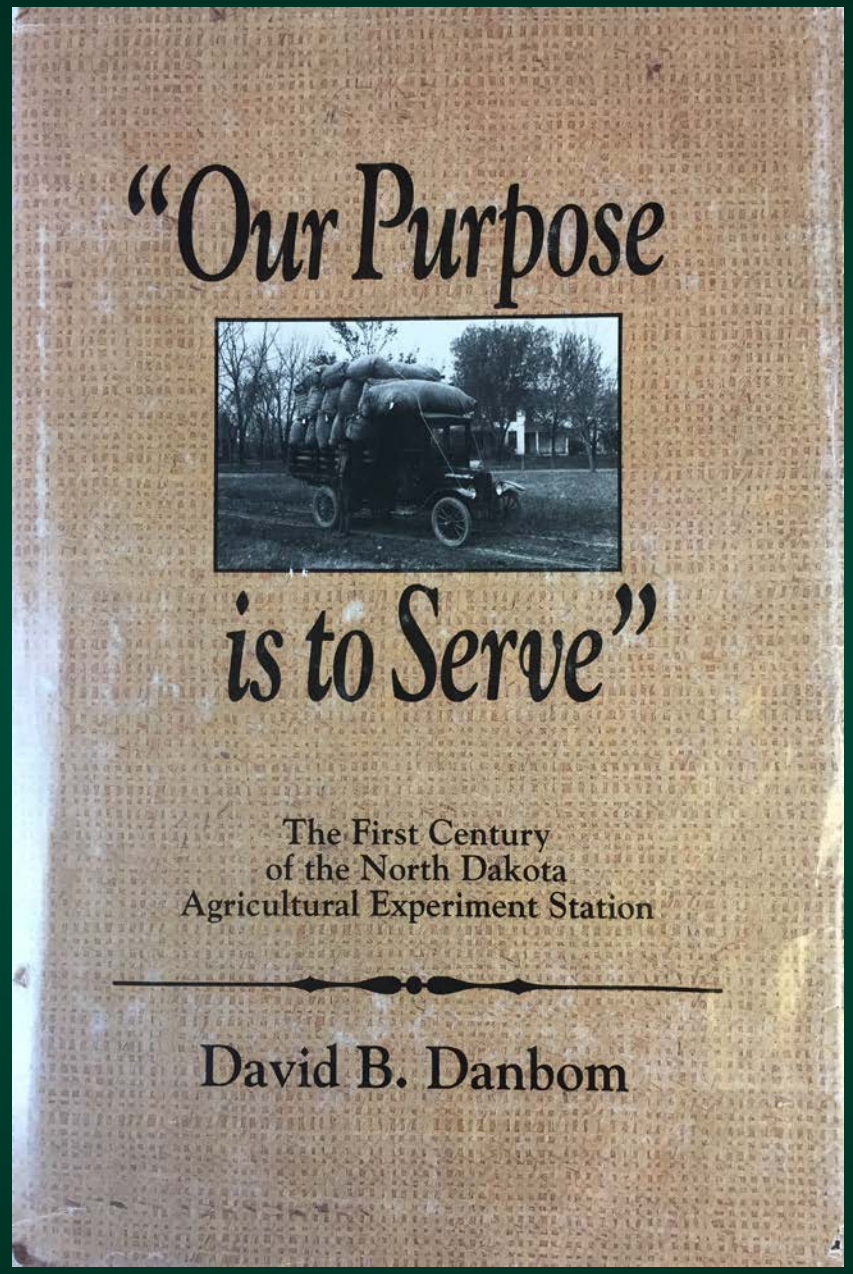
Acknowledgments

Kevin Horsager • Nate Derby • Joel Bell • Aaron Green
Megan Ostrand • Becca Hebron • Zach Bartsch
Steve and Patty Jensen

Hordes of gullies now remind us,
We should build our lands to stay;
And departing leave behind us,
Fields that have not washed away.
Then when our boys assume the mortgage
On the land that's had our toil,
They'll not have to ask the question,
"Here's the farm, but where's the soil?"

—Anonymous
With apologies to Longfellow



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