

The Impacts of Biochar on Soil Nutrient Leaching in the Context of Extreme Hydrological Processes

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Biochar application to agriculture soil:

- carbon sequestration
- reducing greenhouse gas
- improving soil quality, soil structure, nutrient availability for plants

Biochar

Climate Change

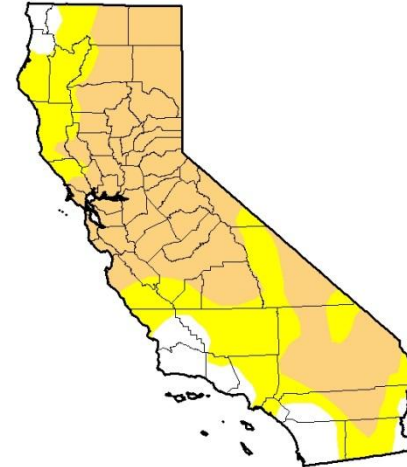
Extreme Hydrological Processes:

- long term drought
- higher frequency of wet-dry cycle
- flooding

North American Drought 2011-2014

U.S. Drought Monitor
California

January 31, 2012
(Released Thursday, Feb. 2, 2012)
Valid 7 a.m. EST



Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
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U.S. Department of Agriculture

USDA   
<http://droughtmonitor.unl.edu/>

February 4, 2014
(Released Thursday, Feb. 6, 2014)
Valid 7 a.m. EST



Intensity:

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- D1 Moderate Drought
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Author:
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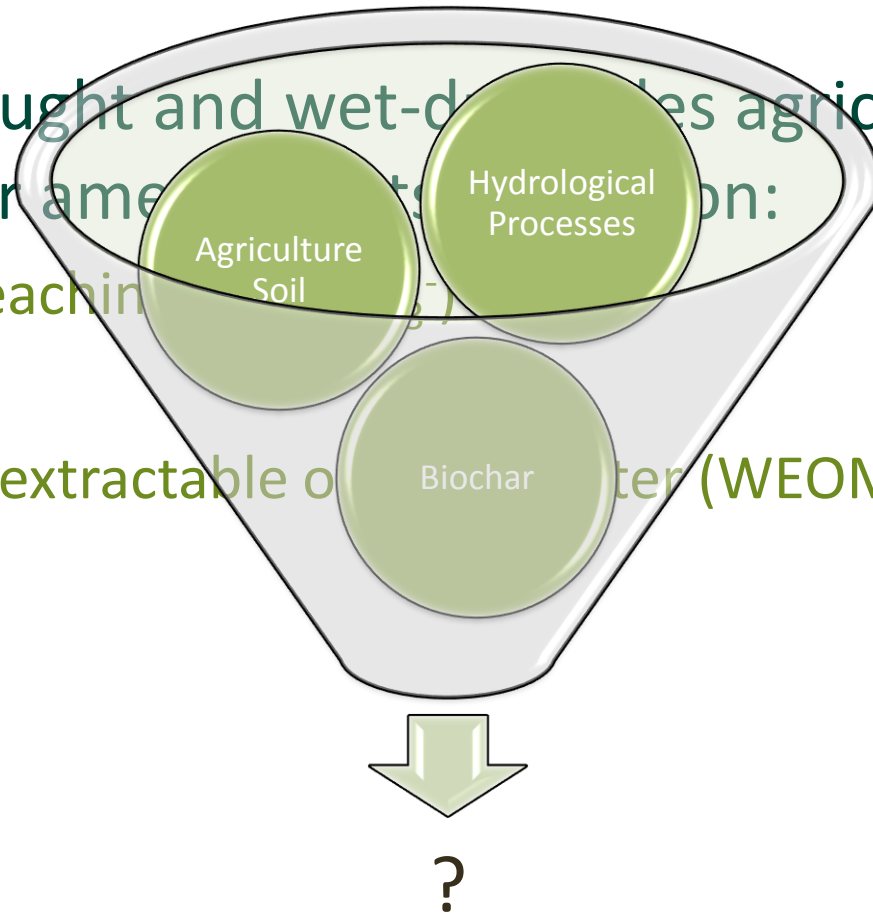
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Research questions

- How do drought and wet-droughts affect agriculture soils with biochar amendment? Hydrological Processes
- Nutrient leaching (N, P, K)
- Soil pH
- Soil water extractable organic matter (WEOM)



Soil and biochar for incubation

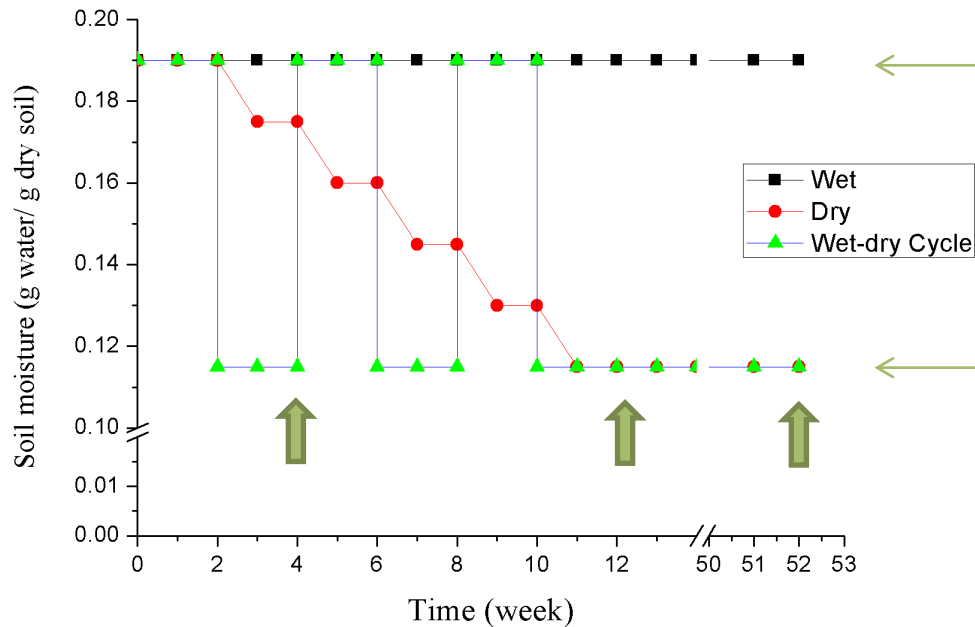
- Soil from conventionally managed, irrigated, unfertilized wheat/fallow treatment plots at **Russell Ranch Sustainable Agricultural Research Facility** in University of California, Davis.

- Biochar was obtained from Dixon Ridge Farms.



Soil type	Inut Shell
Organic Matter	Inut shell
Percent Clay	
Percent Sand	950
USDA Soil Text	3.1
pH (1:1 H ₂ O)	40.4
Ksat (mm/h)	227.1

Incubation experiment setup

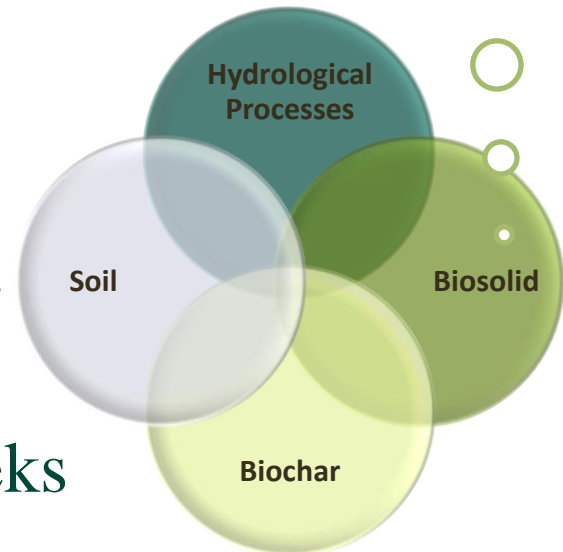


80% water holding capacity

wilting point

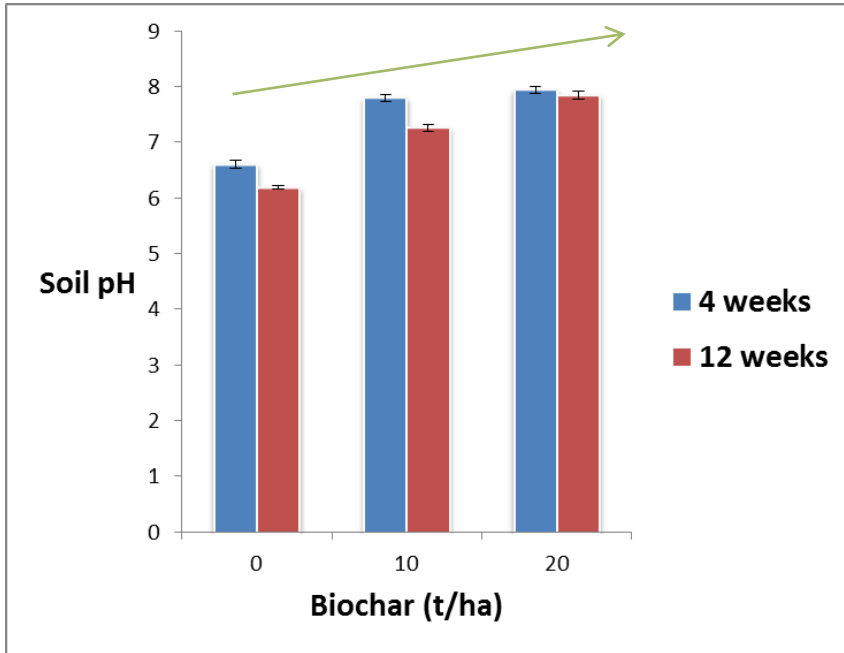
I am nutrients.

- **Biochar:** 0, 10, 20 t/ha walnut biochar
- **Biosolid:** 0, 10 t/ha biosolid
- **Sampling:** 4 weeks, 12 weeks, 52 weeks
- Each treatment has three replicates.

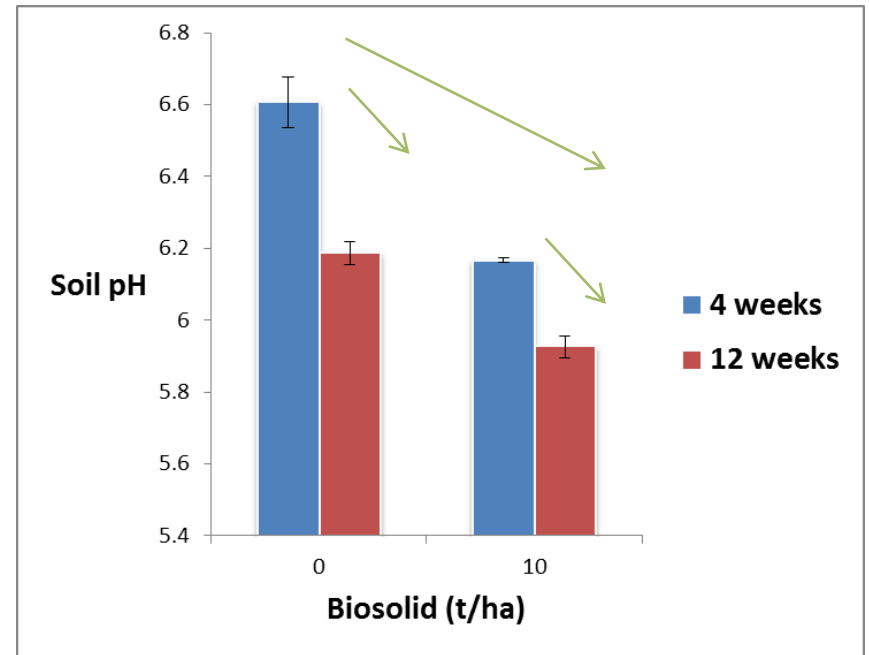


Impact of biochar & biosolid on soil pH

Wet, no biosolid



Wet, no biochar

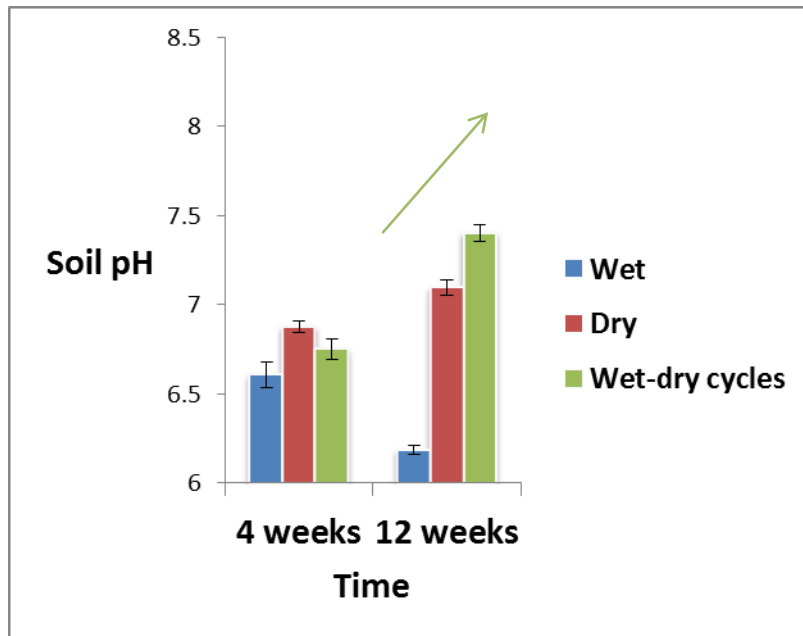


- 4 weeks: biochar increases pH for 1.28 units
- 12 weeks: biochar increases pH for 1.00 units

- Biosolid amendment reduces soil pH for 1.09 units in average.

Impact of hydrological process on soil pH

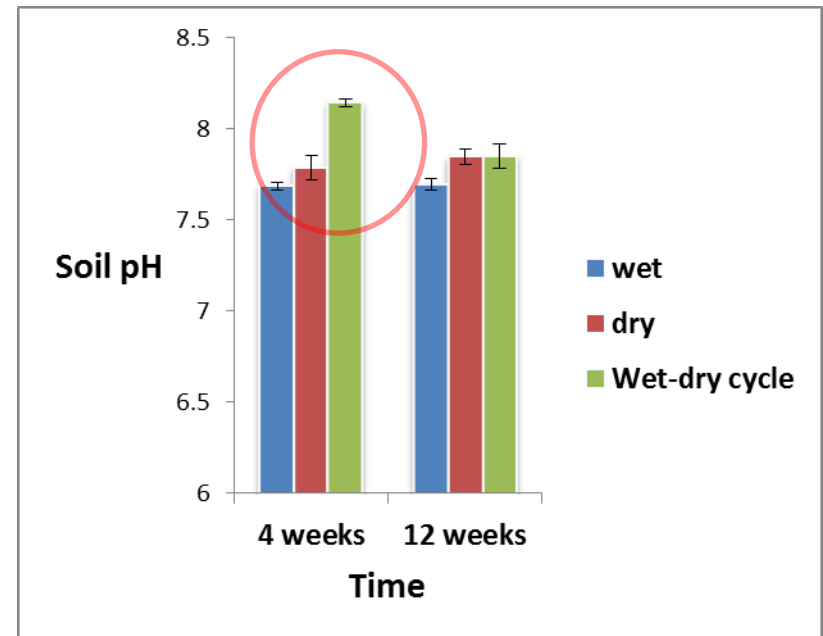
No biochar, no biosolid



- Long term drought and wet-dry cycles increases soil pH.

20 t/ha biochar

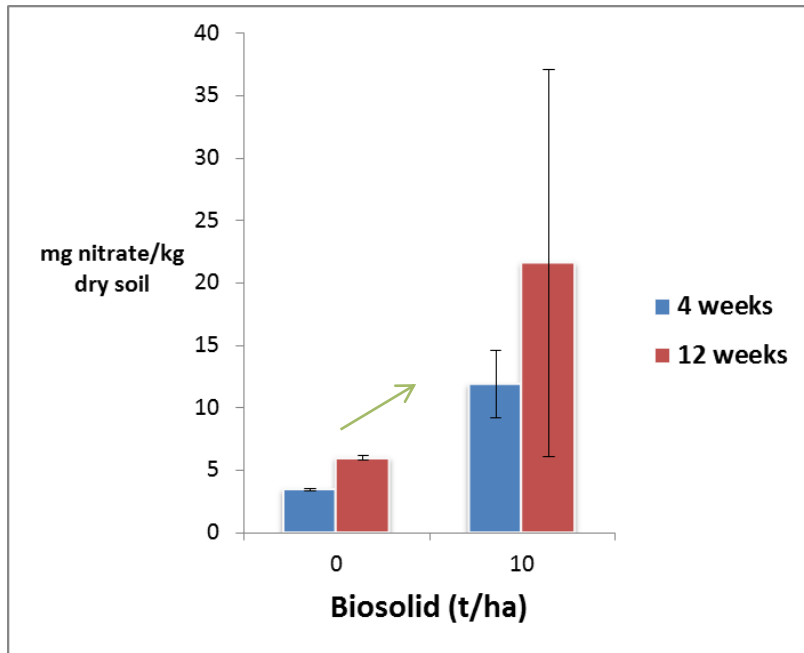
10 t/ha biosolid



- Short term soil pH increase in wet-dry cycle treatment is observed.

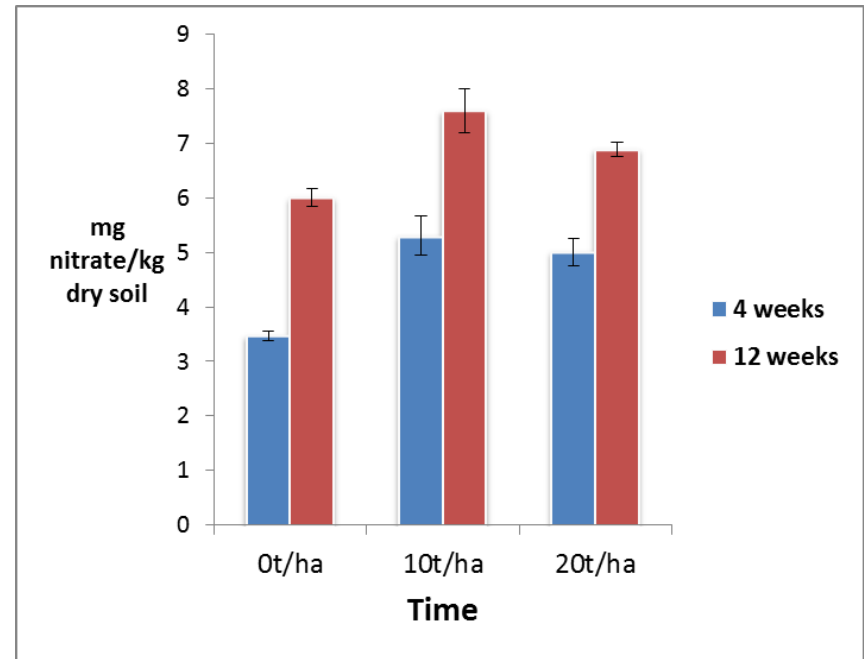
Impact of biosolid & biochar on water extractable nitrate

Wet, no biochar



- Higher labile N observed in all biosolid amended treatments.

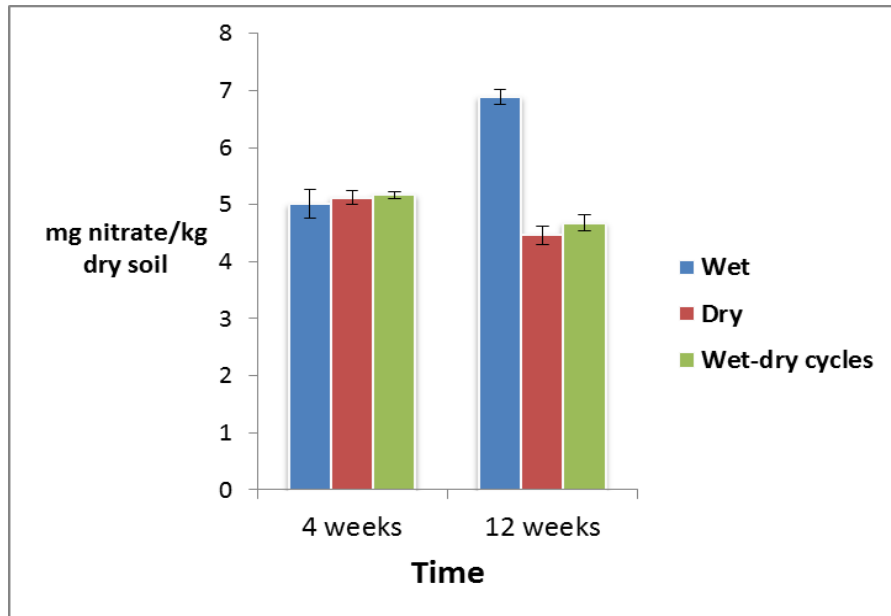
Wet, no biosolid



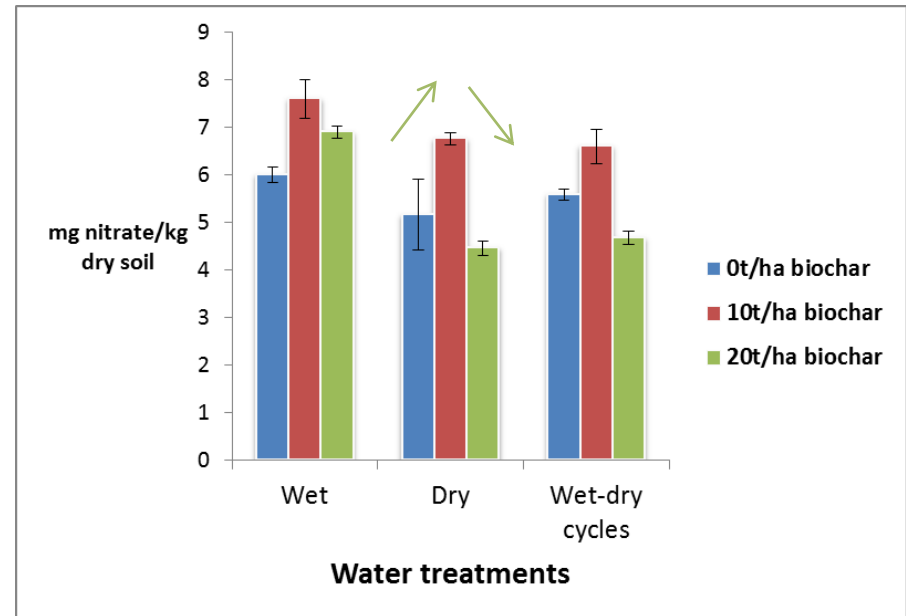
- Biochar amendment increases labile N.

Impact of biosolid & biochar on water extractable nitrate

No biochar, no biosolid



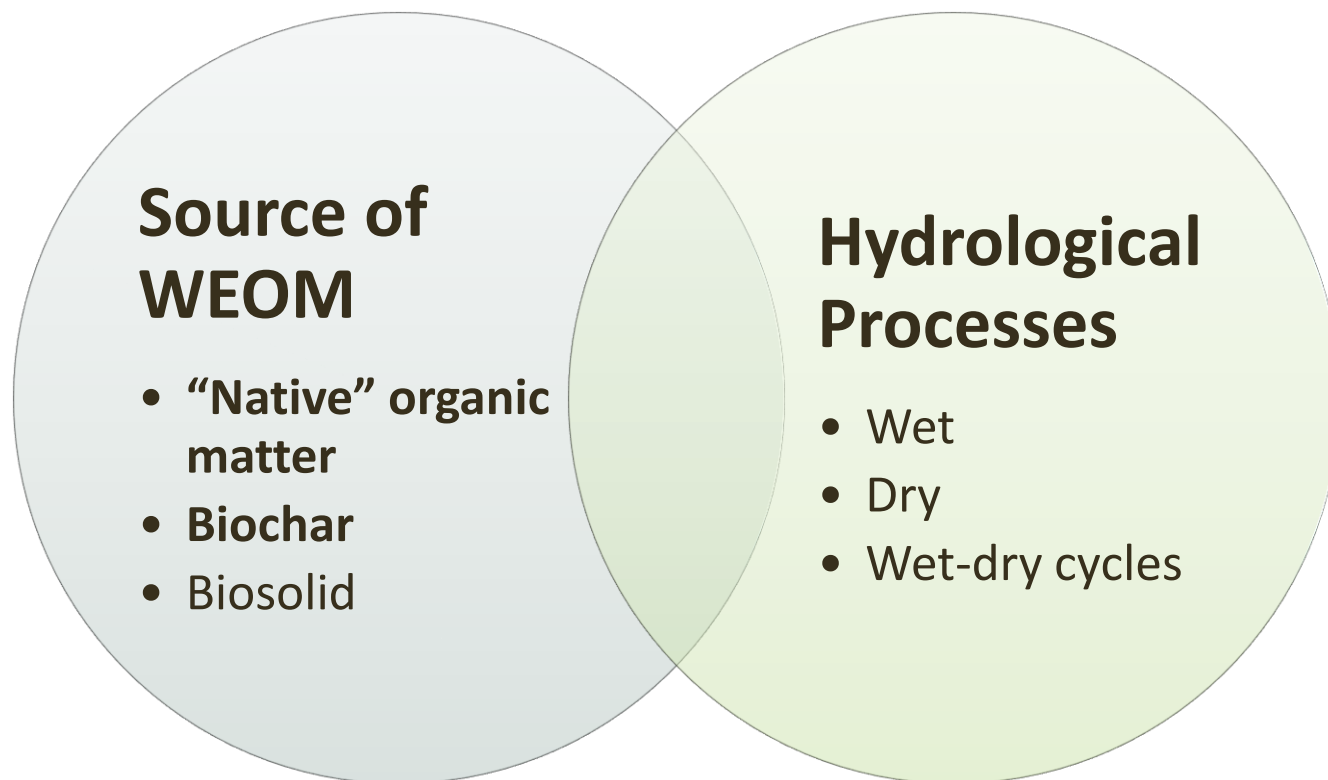
No biosolid



- Similar results also observed in biochar amended treatments.
- There is limited water extractable ammonia.

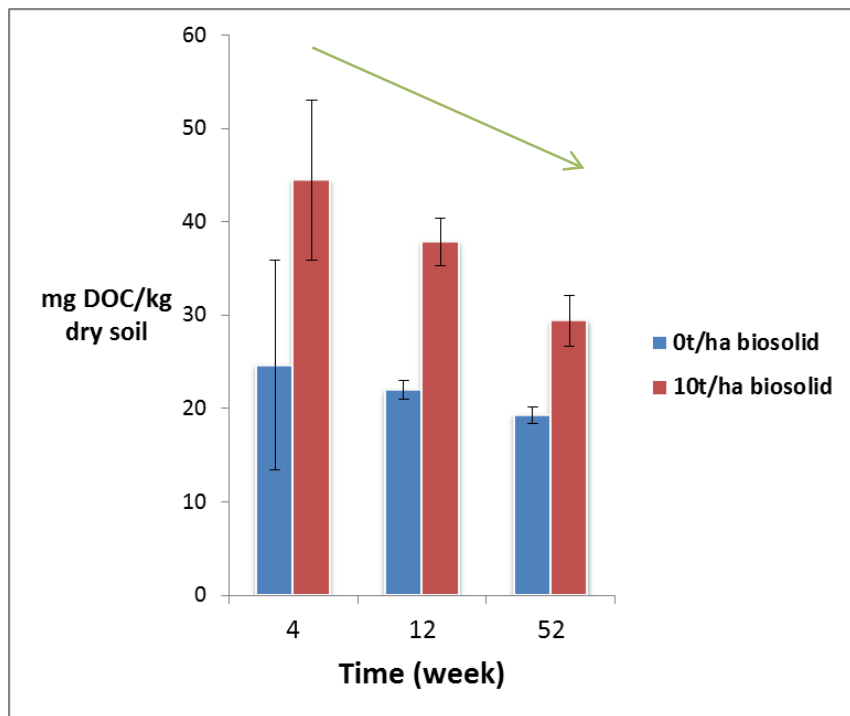
- The impact of biochar on nitrate leaching and TDN is 10 t/ha > 20 t/ha > 0 t/ha

Impact of biochar, biosolid & hydrological processes on soil water extractable organic matter (WEOM)

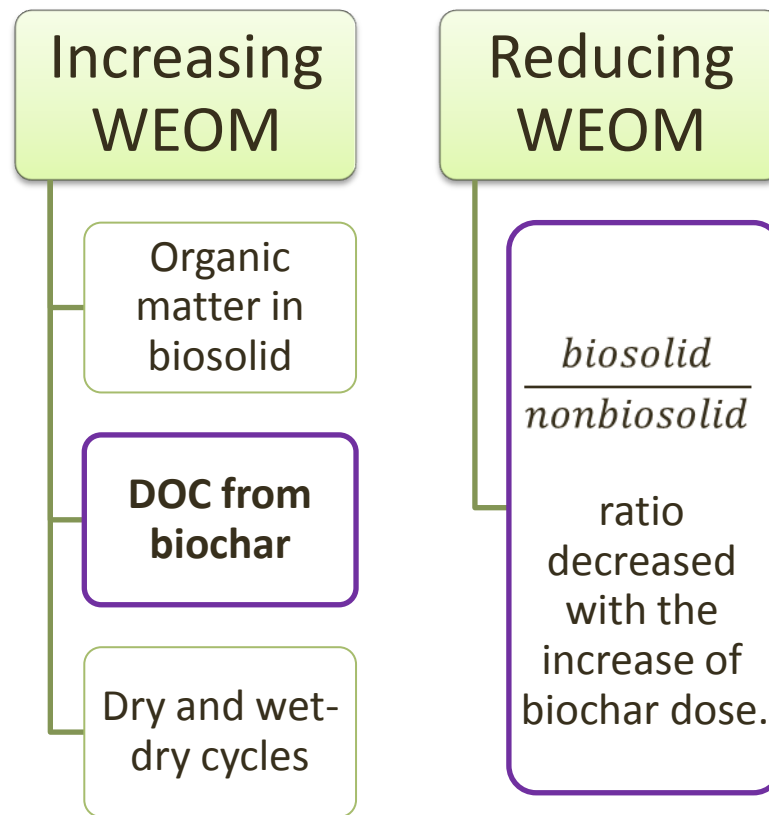


Impact of biosolid & biochar on soil water extractable organic matter (WEOM)

Wet, no biochar

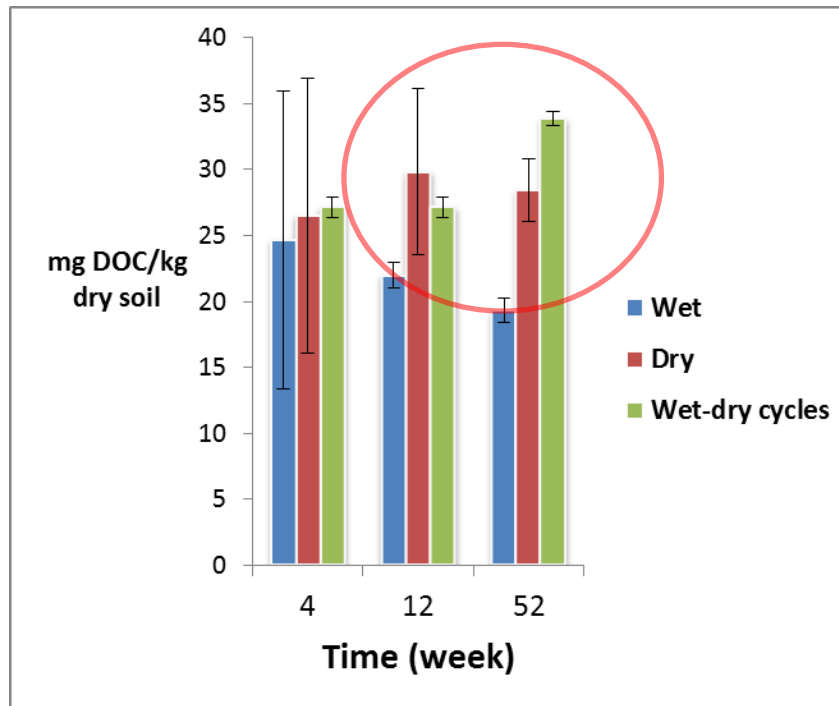


Dual role of biochar in 4 weeks

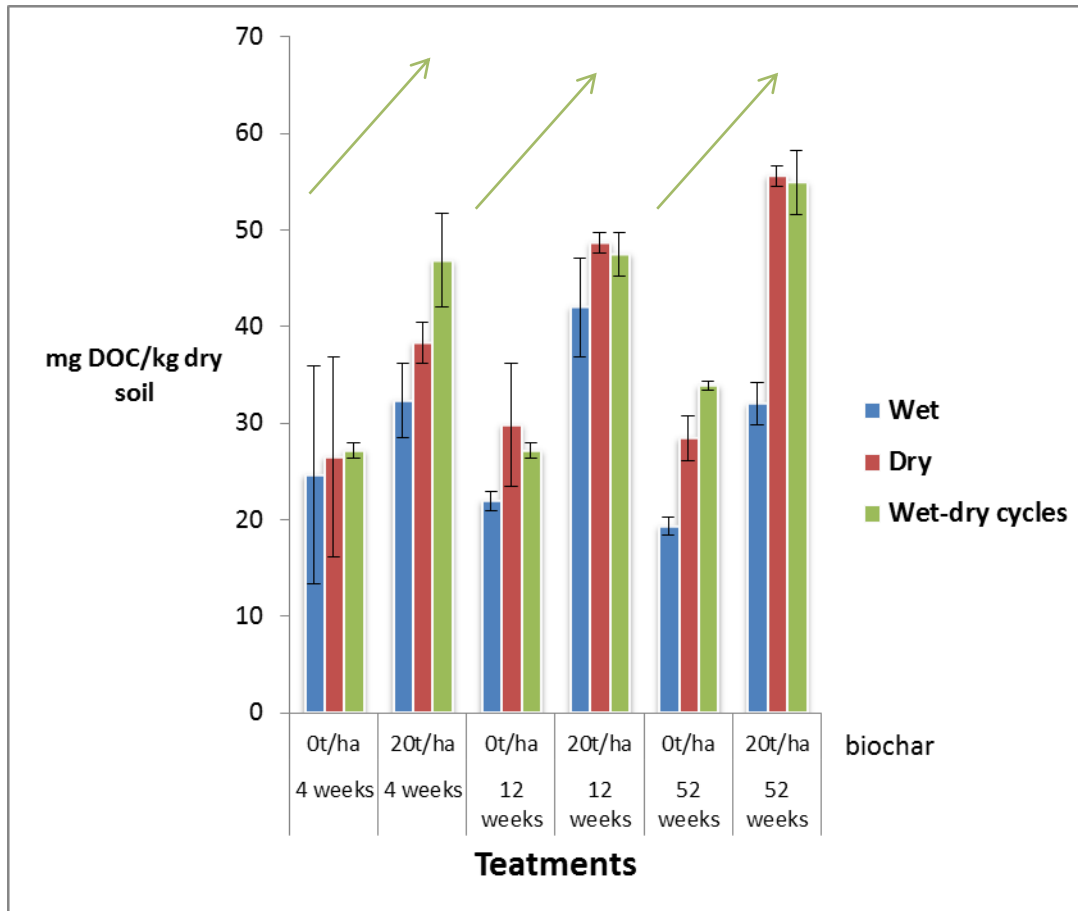


Impact of hydrological processes & biochar on WEOM

No biochar, no biosolid



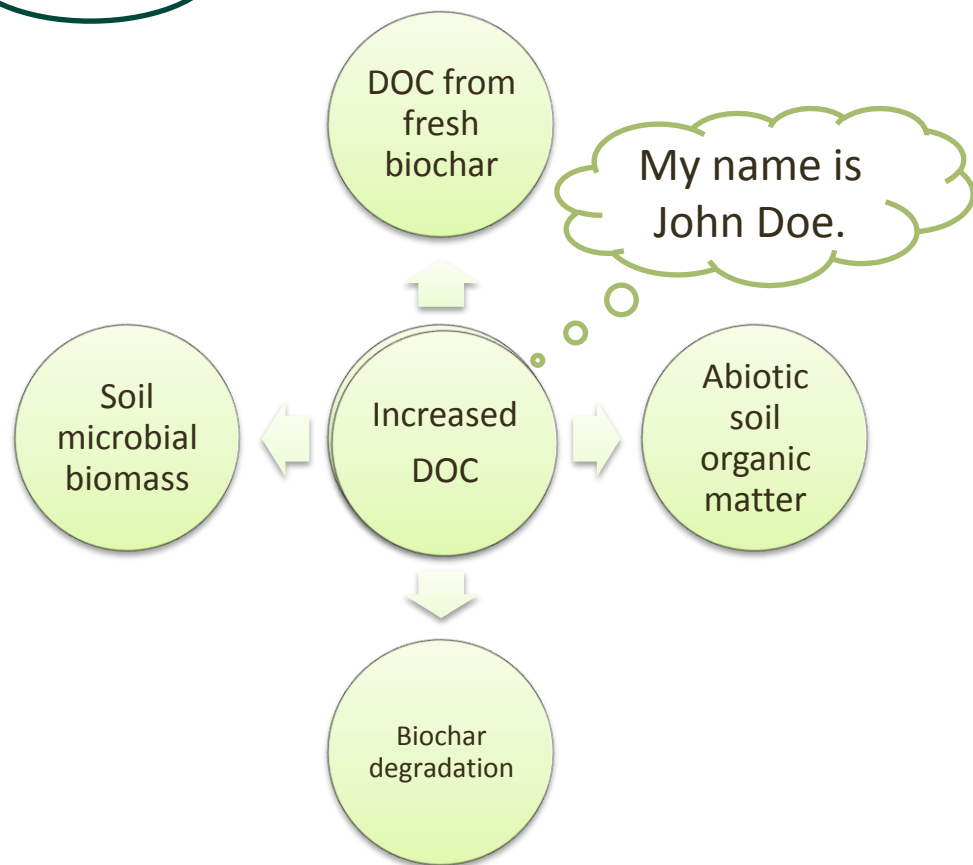
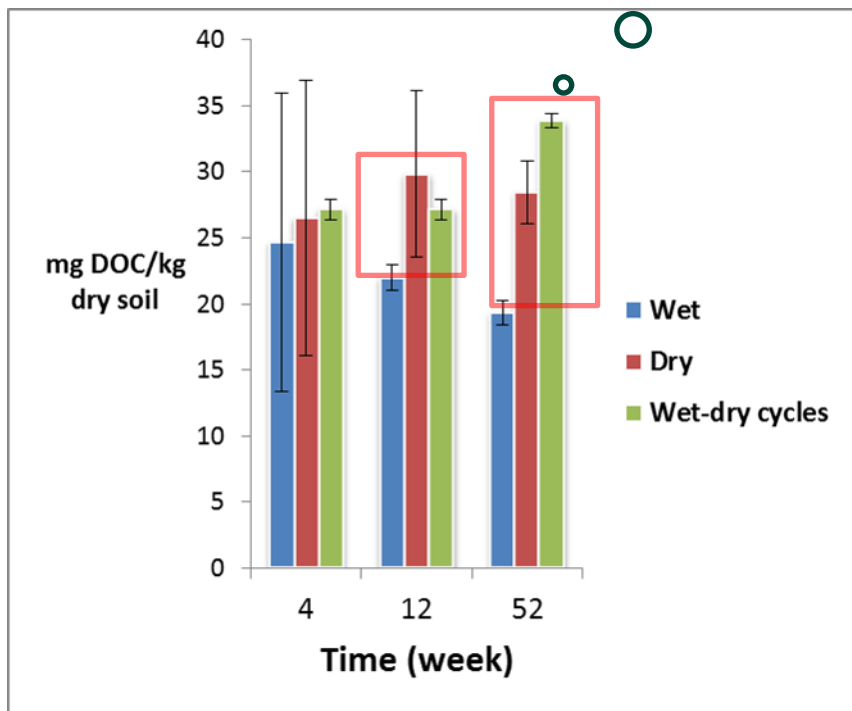
Impact of hydrological processes & biochar on WEOM



- Biochar increases WEOM
- Amount of WEOM:
Wet-dry cycle > dry > wet

Next steps

How do you do, Mr. DOC?
What's your name?



Thank you for your attention!

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