Heavy rainfall and riparian soil conditions: potential impacts on a critical N cycling process

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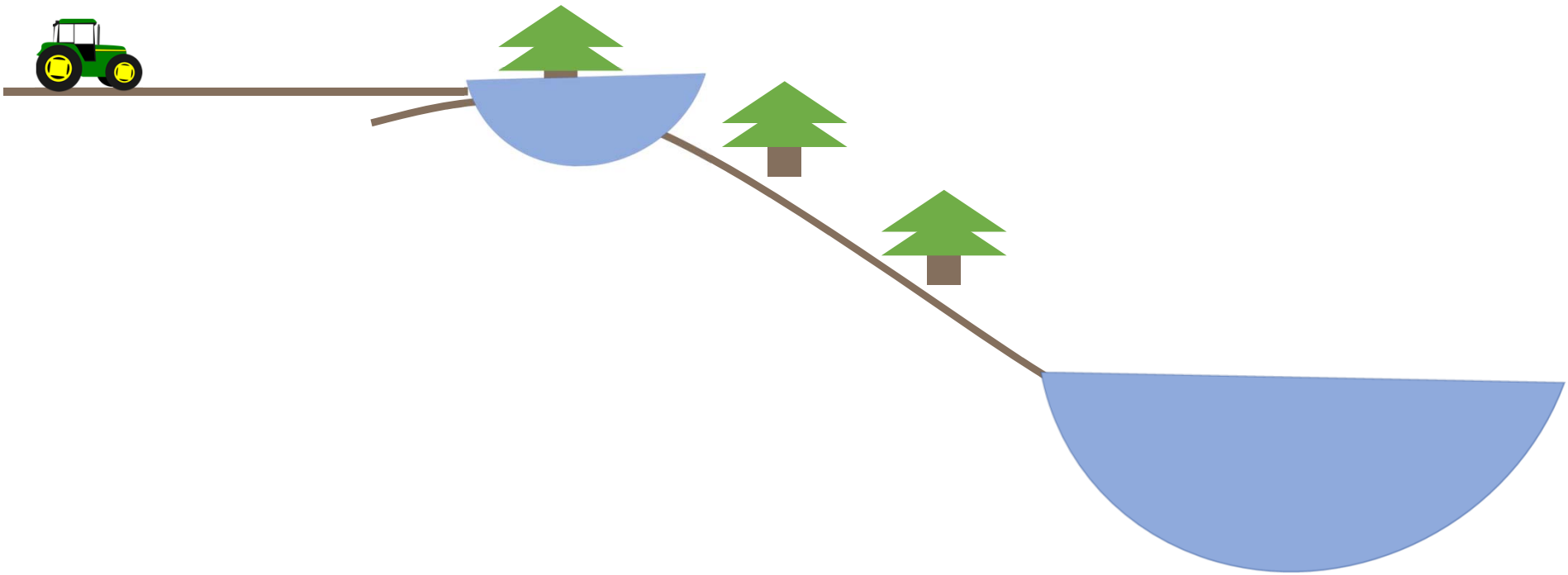
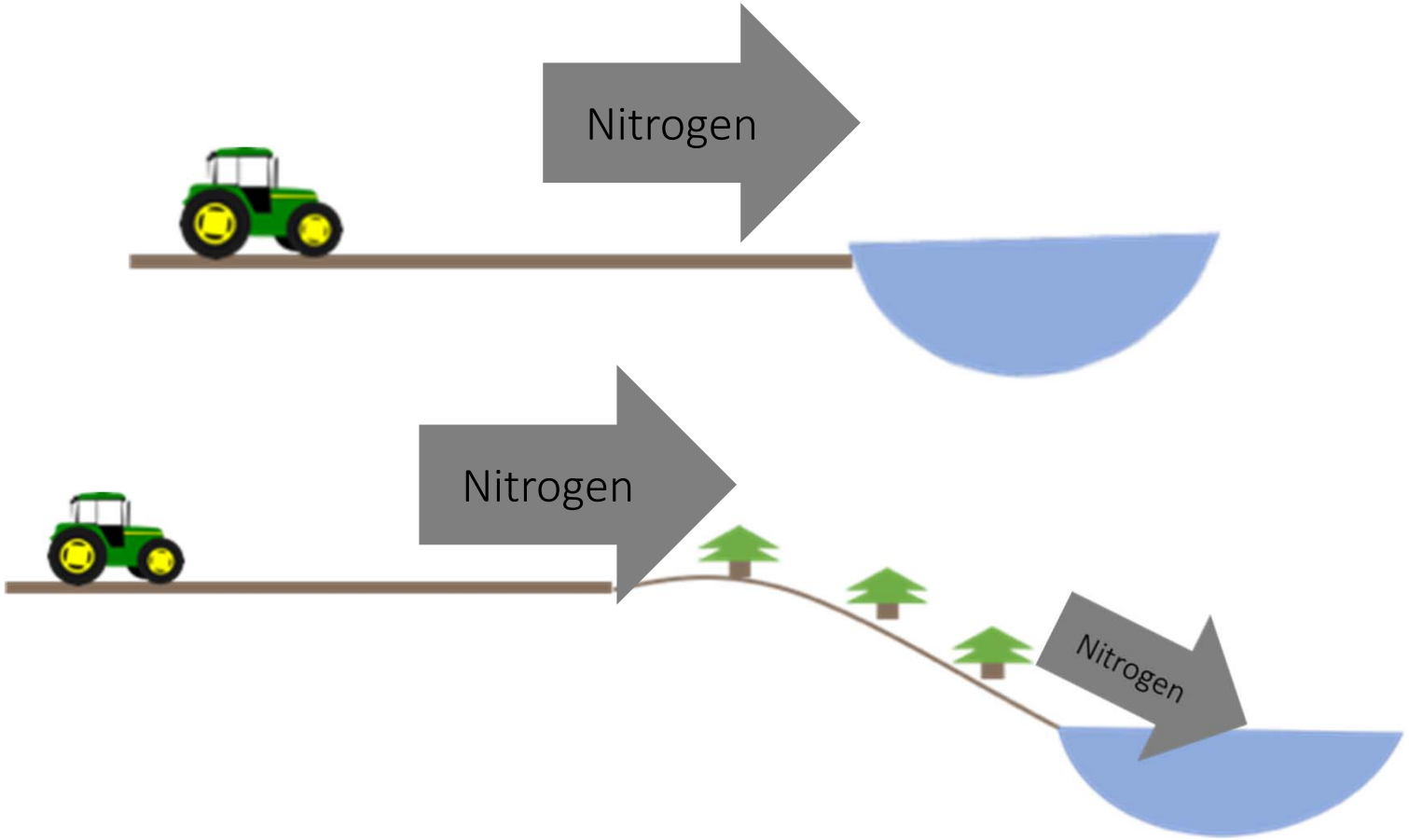
Riparian ecosystems:
'hot spots' for **biological soil denitrification**

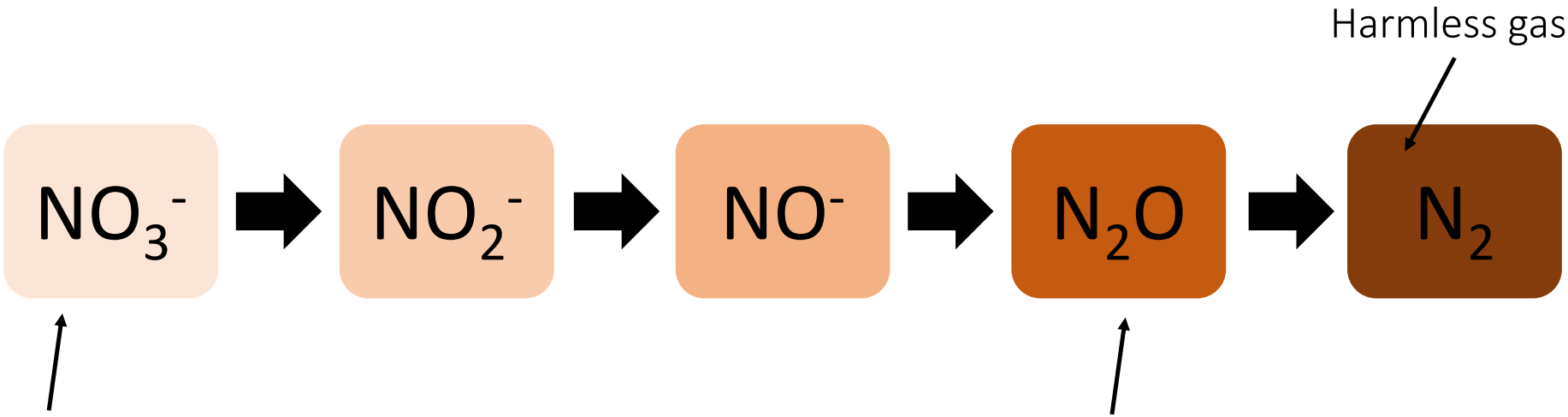
Riparian ecosystems: reduce nitrogen inputs from adjacent land to



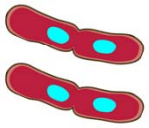
Riparian buffers reduce nitrogen inputs to nearby rivers and streams



Denitrification removes nitrogen from the soil environment



Denitrification can remove nitrogen from the soil environment

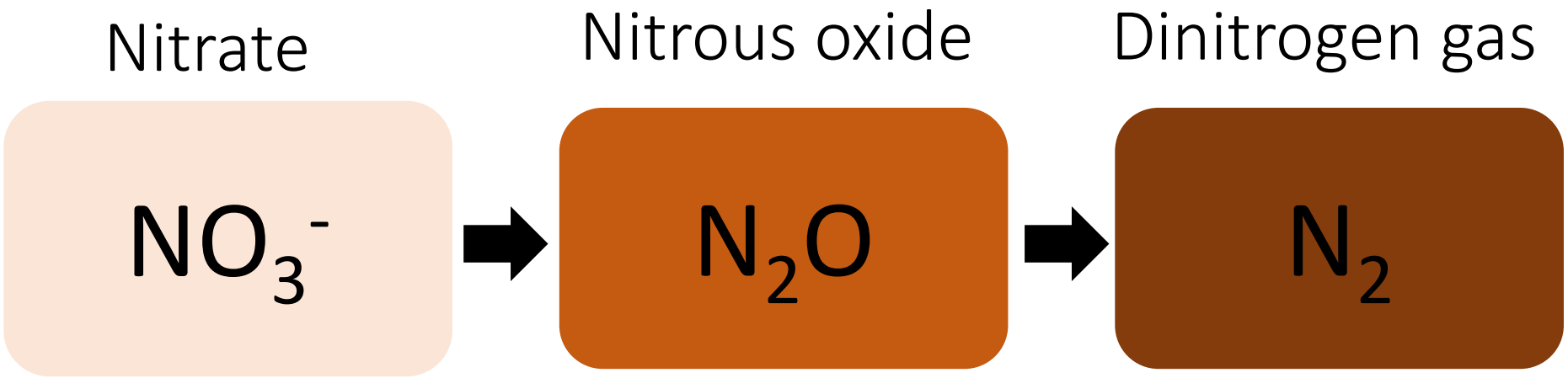


Performed by soil microbes

Fuel for cyanobacteria (NO_3^-)

Gaseous nitrogen (N_2O or N_2)

Denitrification can remove nitrogen from the soil environment

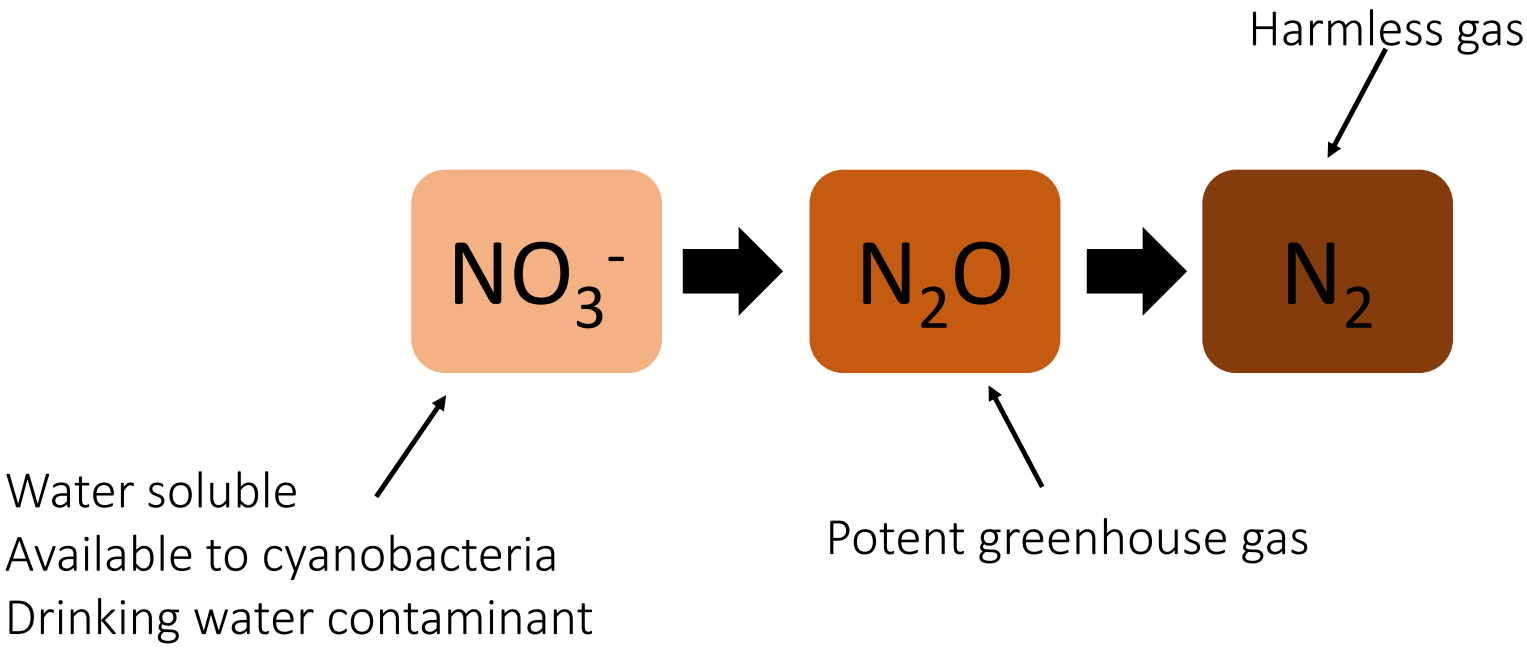


- Water soluble
- Fuel for cyanobacteria

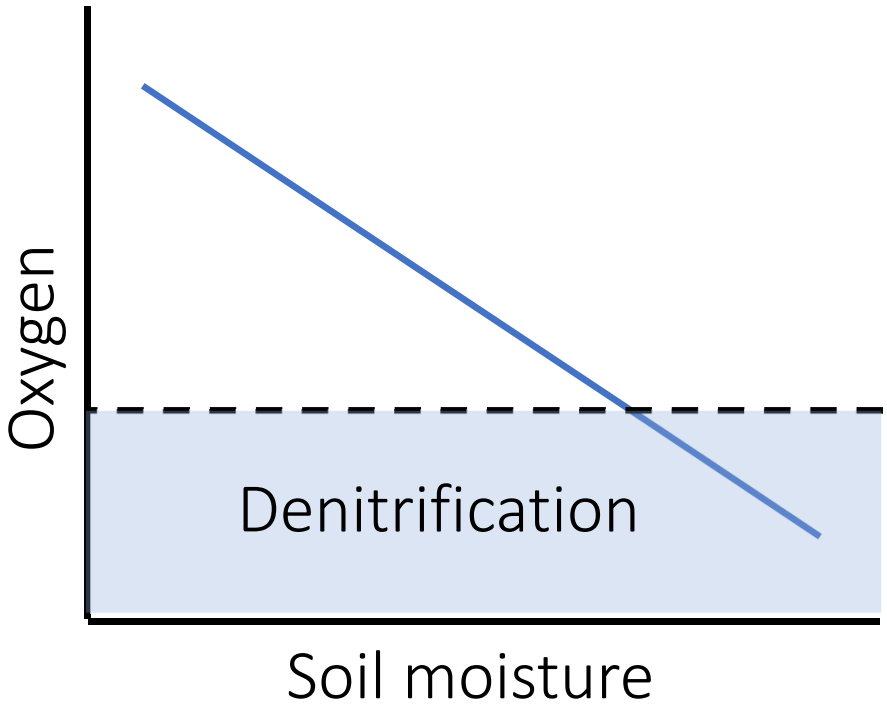
- Potent greenhouse gas

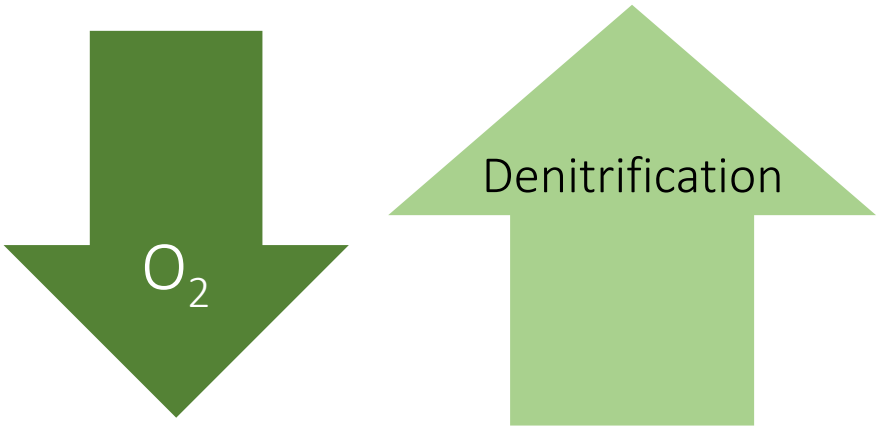
- 78.09 % of atmosphere
- Harmless

Denitrification can remove nitrogen from the soil environment



Denitrification requires a **low oxygen** environment





Heavy rainfall

Increased soil moisture

Low oxygen conditions

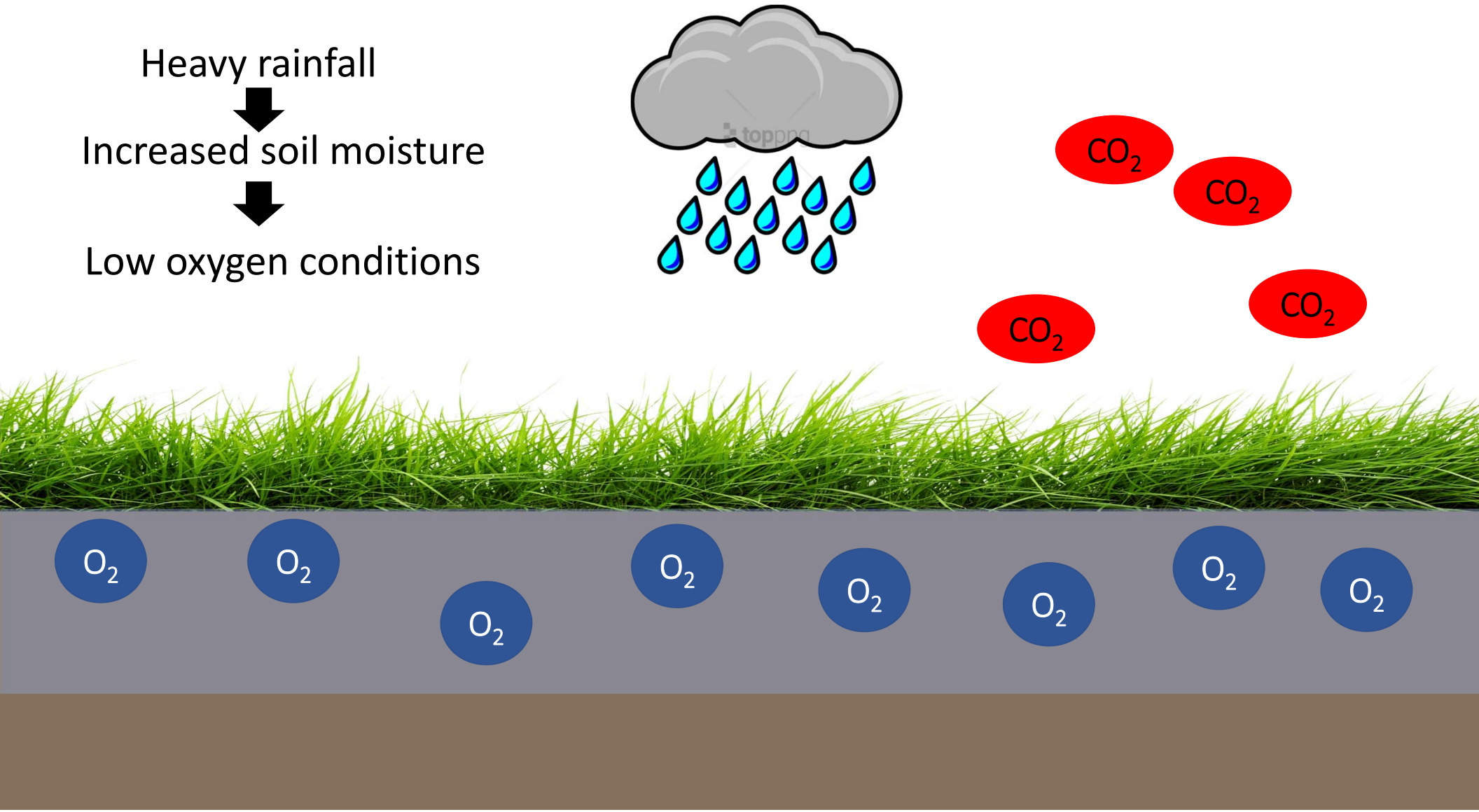
Heavy rainfall

↓

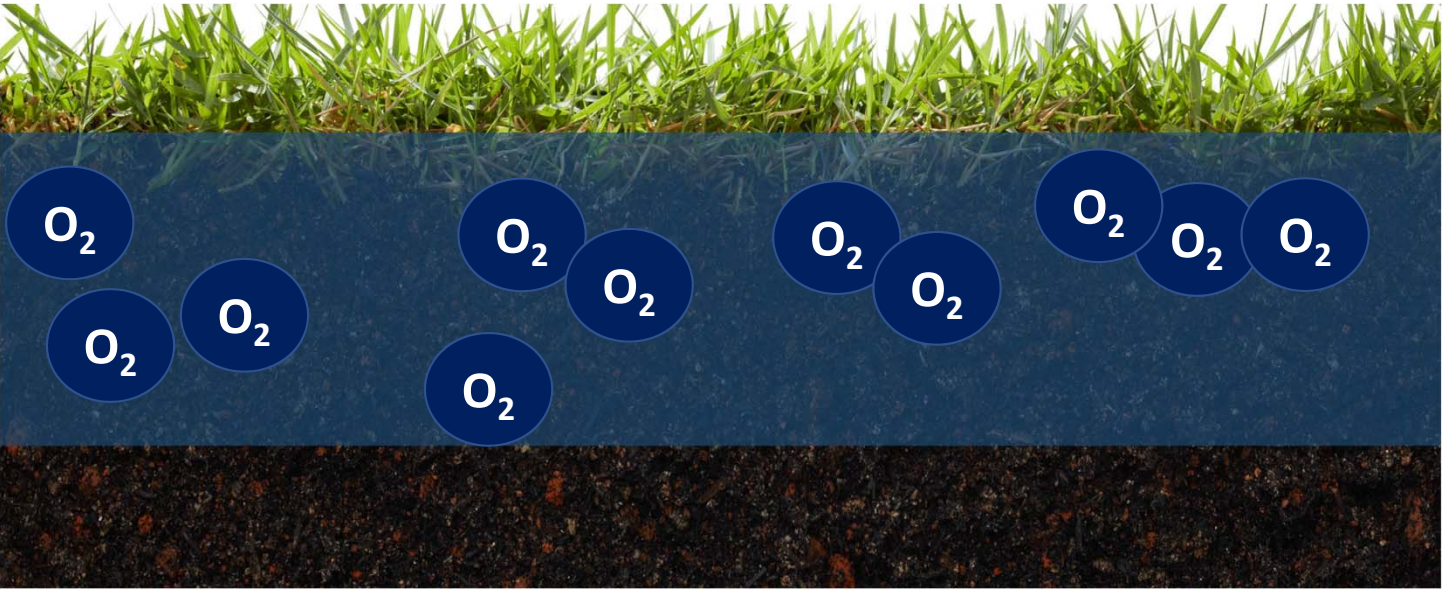
Increased soil moisture

↓

Low oxygen conditions



Overarching hypothesis



Heavy rainfall

↓

Increased soil moisture

↓

Decreased soil oxygen

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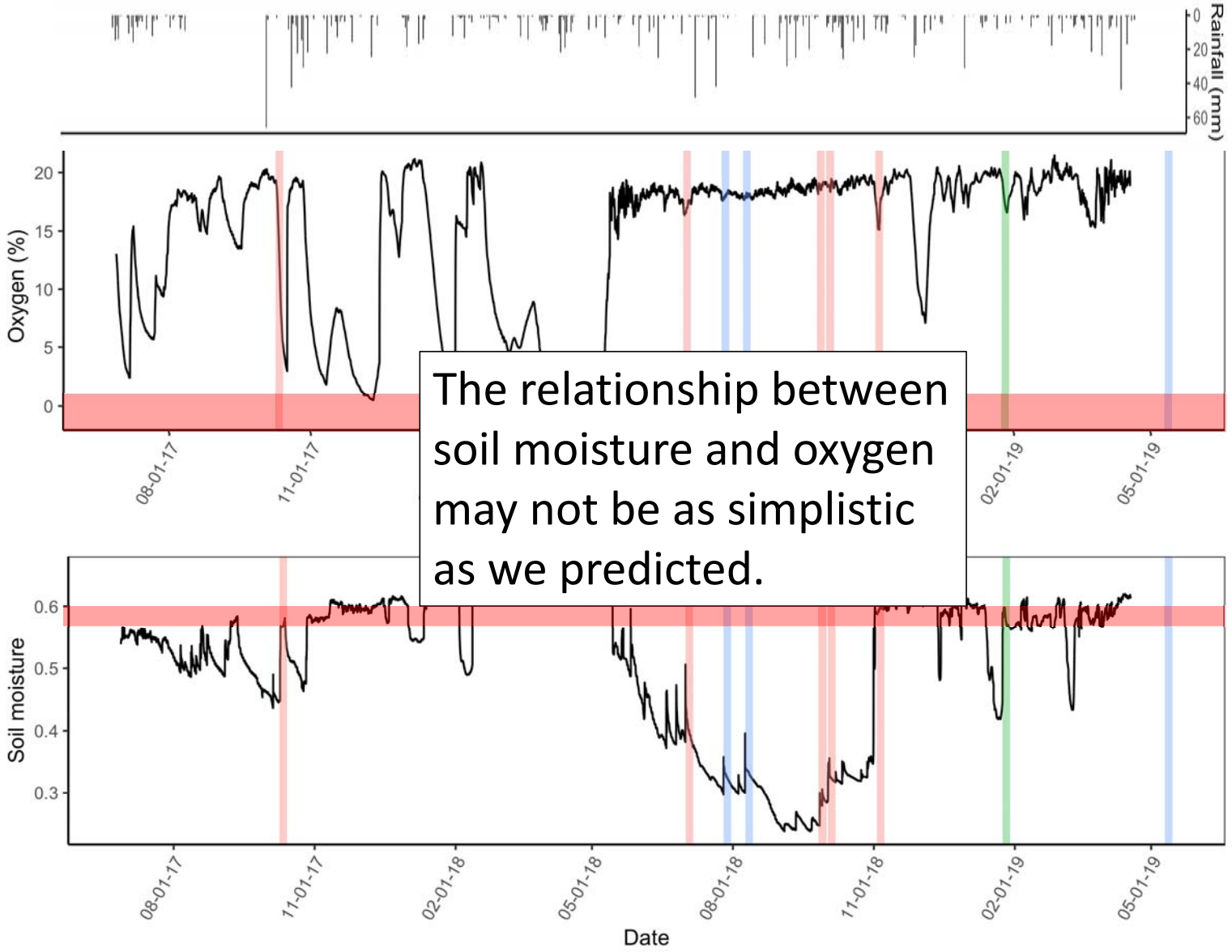
Conducive environment for dentrification

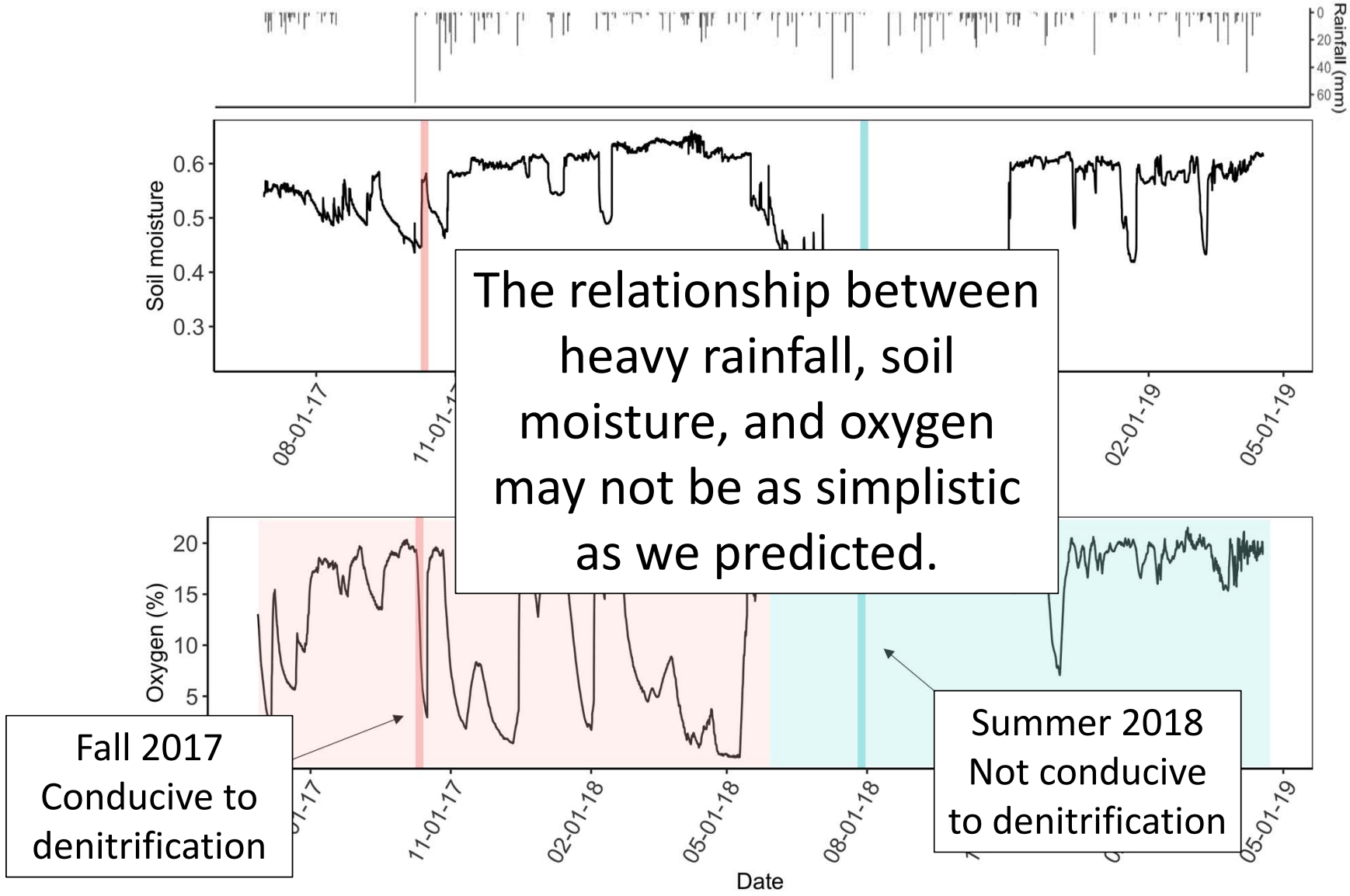
Research question

When (temporally) and *where* (along gradients of land use and landscape position) does soil oxygen content decrease to levels that support denitrification?



The relationship between soil moisture and oxygen may not be as simplistic as we predicted.

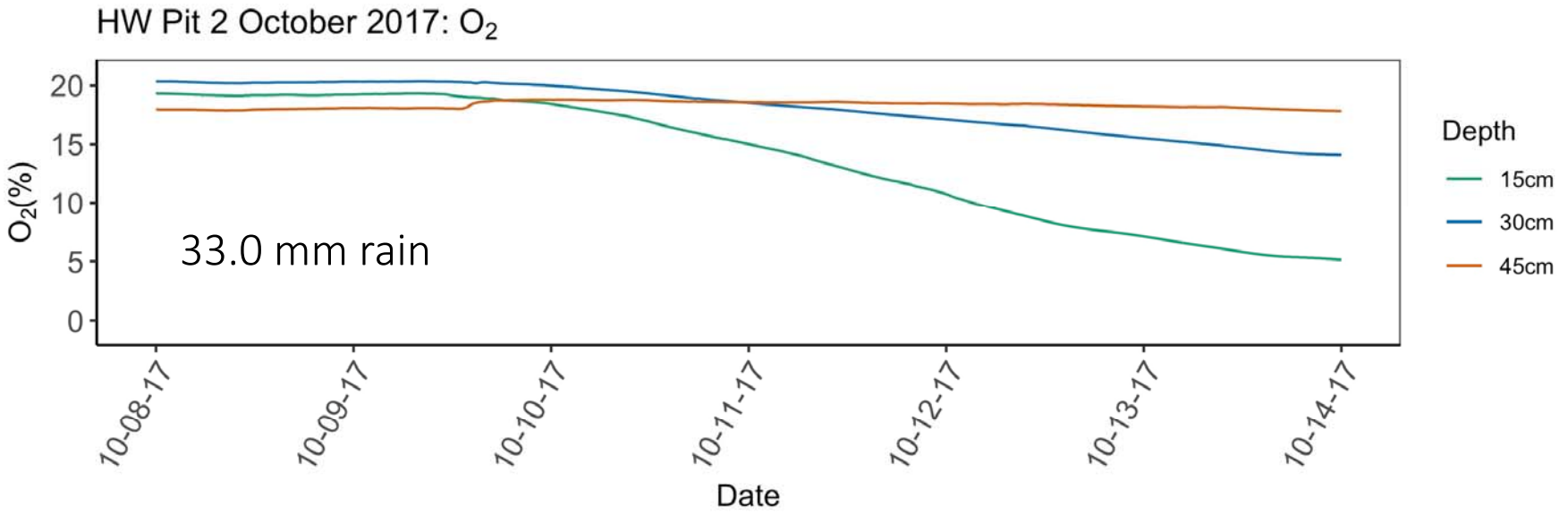
At a glance: identifying when soil oxygen content is low enough for denitrification to occur

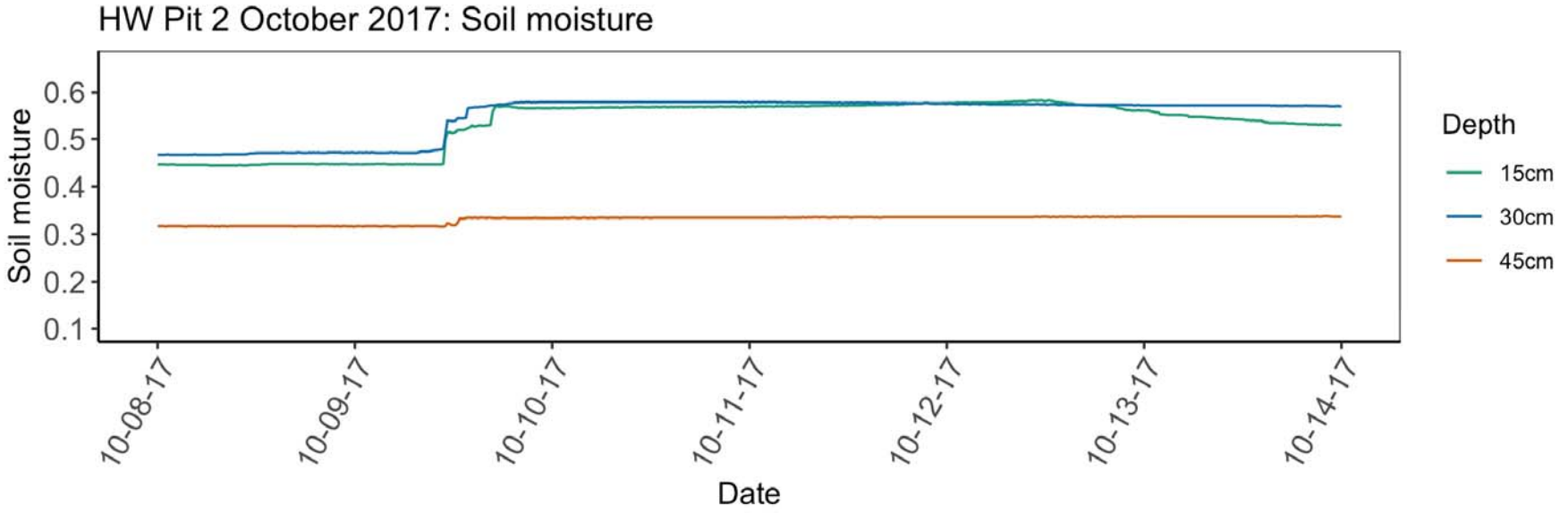


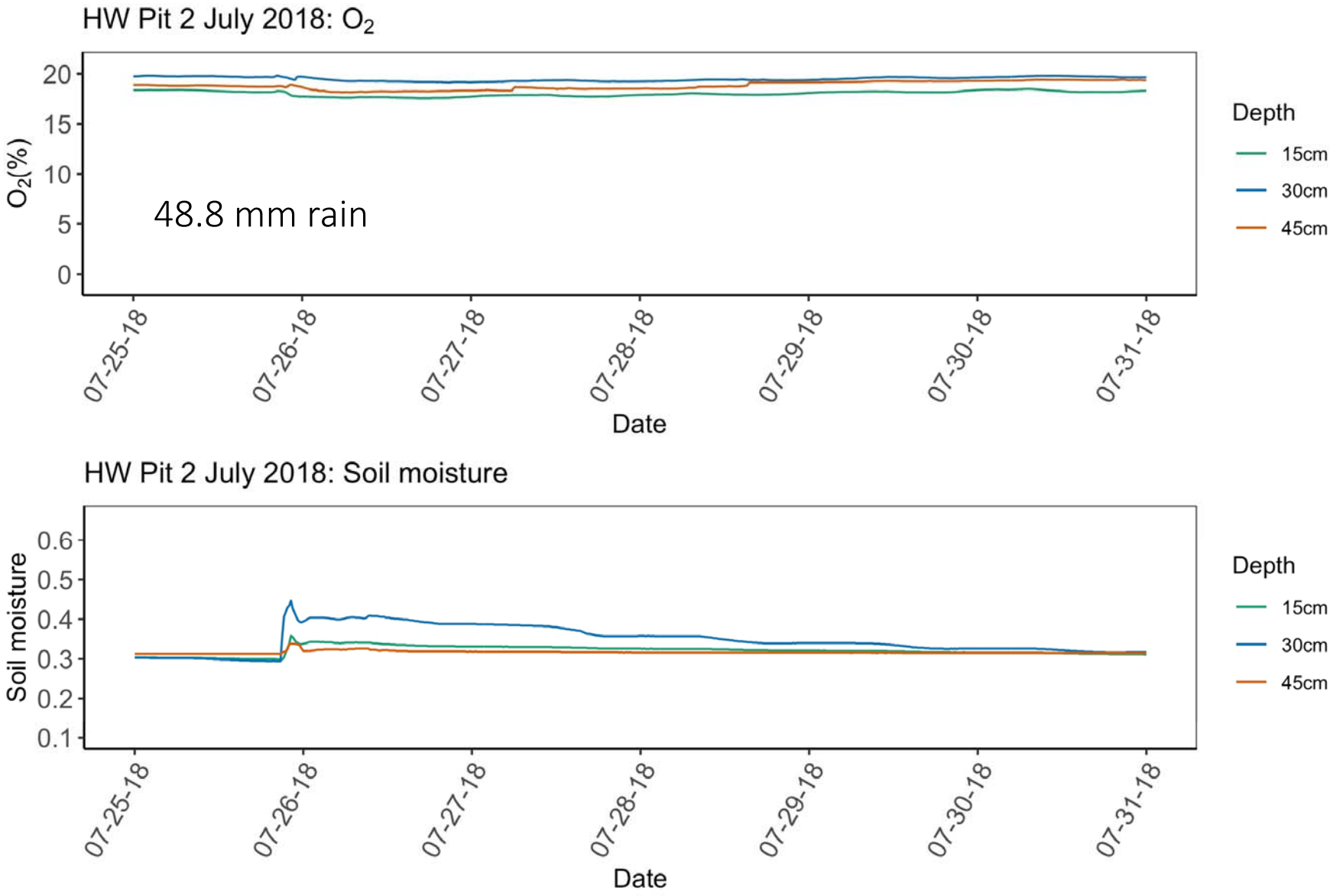
The relationship between heavy rainfall, soil moisture, and oxygen may not be as simplistic as we predicted.

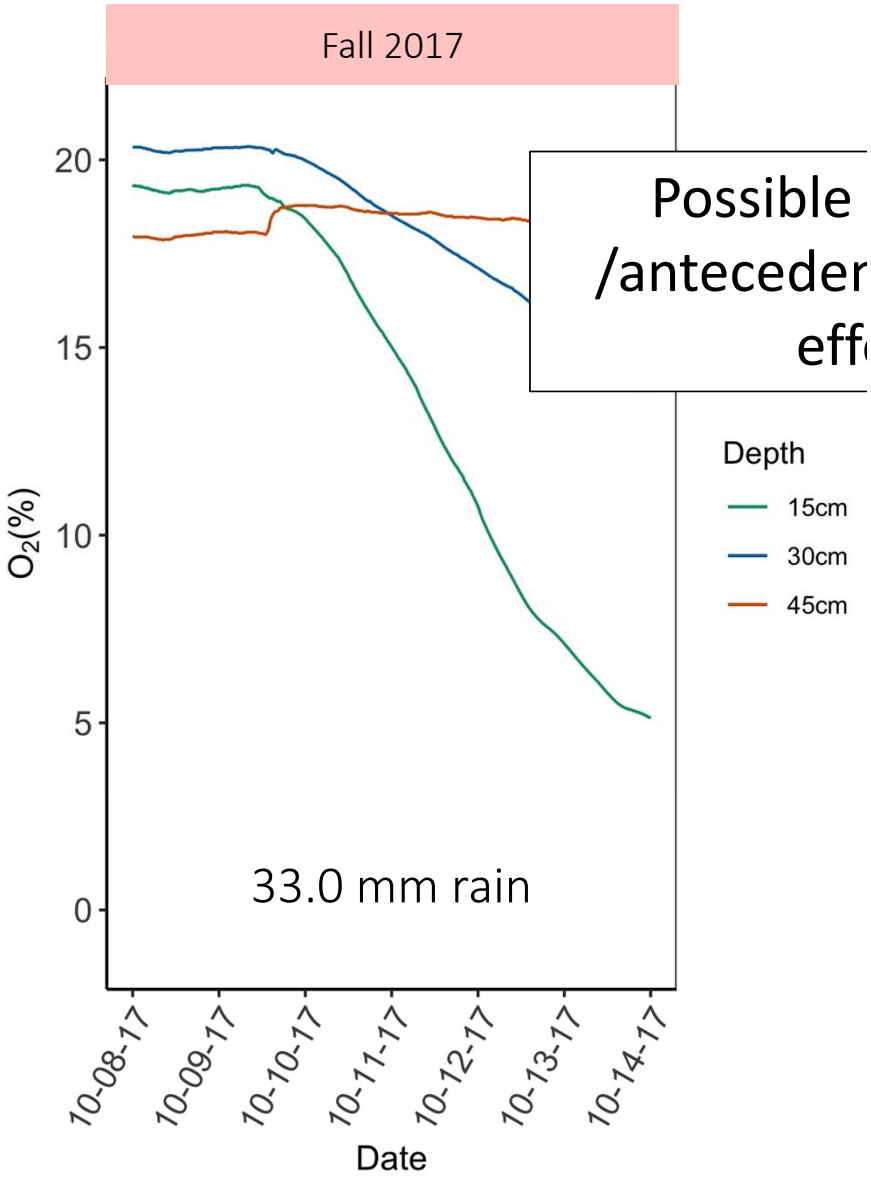
Fall 2017
Conducive to denitrification

Summer 2018
Not conducive to denitrification

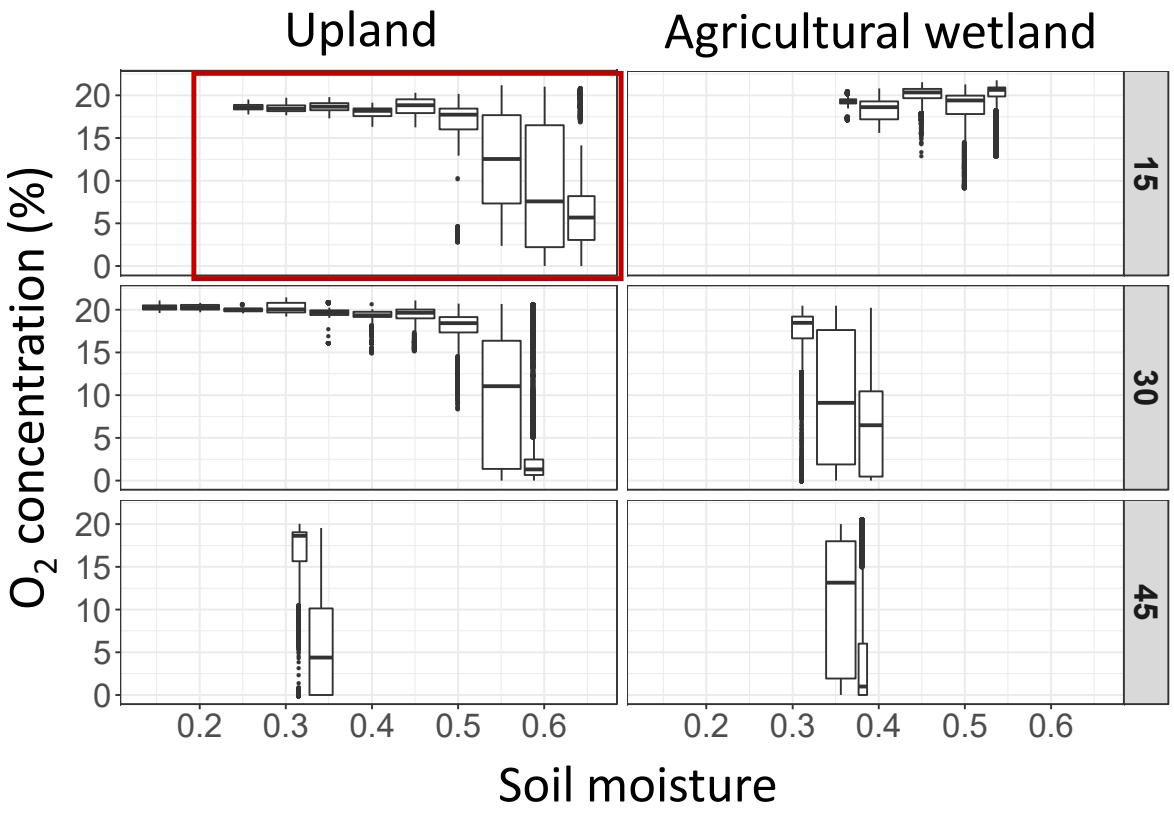

HW Pit 2 October 2017: O_2
O_2(%)
20
15
10
5
0
33.0 mm rain
10-08-17
10-09-17
10-10-17
10-11-17
10-12-17
10-13-17
10-14-17
Date
Depth
15cm
30cm
45cm

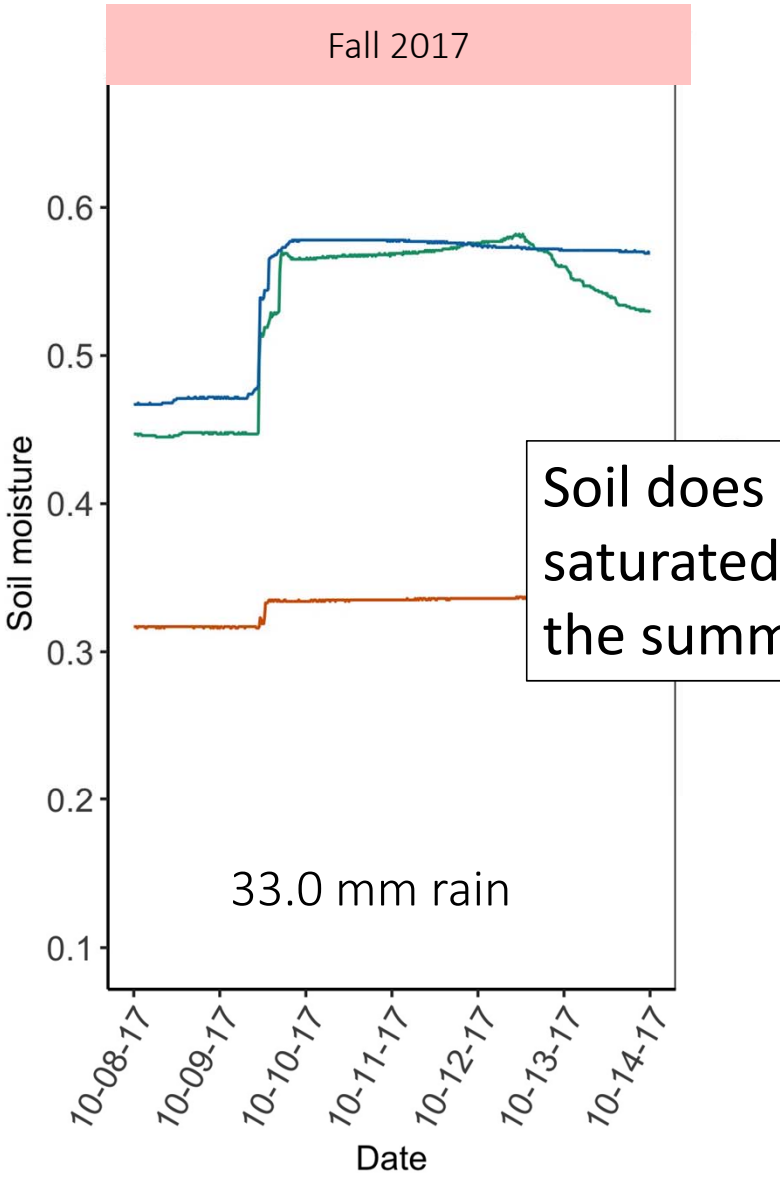

HW Pit 2 October 2017: Soil moisture
Soil moisture
0.6
0.5
0.4
0.3
0.2
0.1
10-08-17
10-09-17
10-10-17
10-11-17
10-12-17
10-13-17
10-14-17
Date
Depth
15cm
30cm
45cm


HW Pit 2 July 2018: O_2
O_2(%)
20
15
10
5
0
48.8 mm rain
07-25-18
07-26-18
07-27-18
07-28-18
07-29-18
07-30-18
07-31-18
Date
Depth
15cm
30cm
45cm
HW Pit 2 July 2018: Soil moisture
Soil moisture
0.6
0.5
0.4
0.3
0.2
0.1
07-25-18
07-26-18
07-27-18
07-28-18
07-29-18
07-30-18
07-31-18
Date
Depth
15cm
30cm
45cm


Fall 2017
Possible
/anteceder
eff
Depth
15cm
30cm
45cm
33.0 mm rain
O_2(%)
20
15
10
5
0
10-08-17
10-09-17
10-10-17
10-11-17
10-12-17
10-13-17
10-14-17
Date

A complicated relationship




Fall 2017
Soil moisture
0.6
0.5
0.4
0.3
0.2
0.1
Soil does
saturated
the summ
33.0 mm rain
10-08-17
10-09-17
10-10-17
10-11-17
10-12-17
10-13-17
10-14-17
Date

What drives differences in the soil's response to heavy rainfall?