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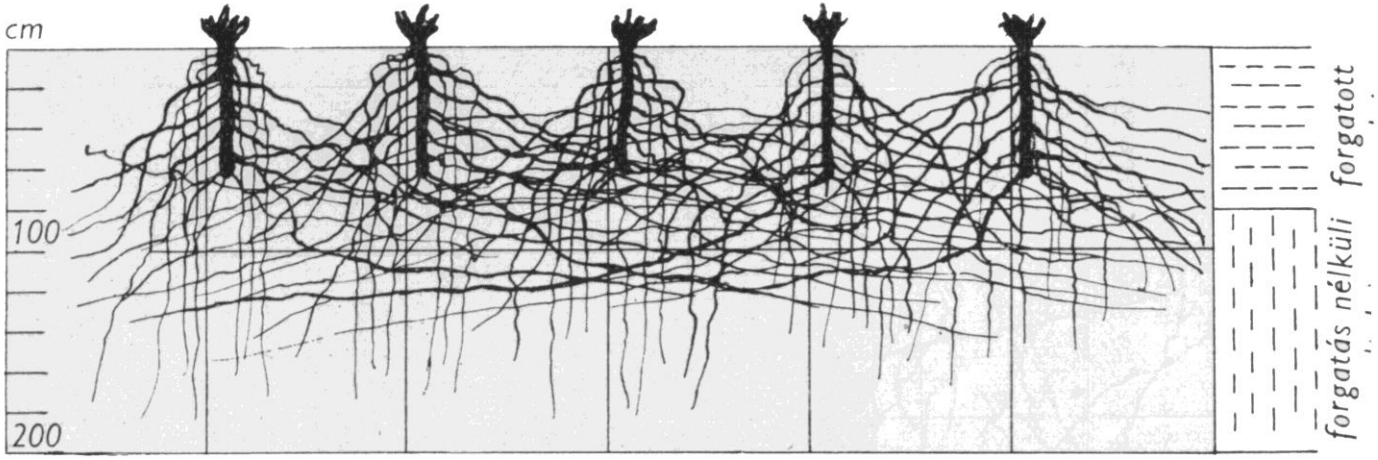
Temporal, Spatial & Genetic Constraints on Vineyard Greenhouse Gas Emissions

David R. Smart and Kate M. Scow
University of California, Davis



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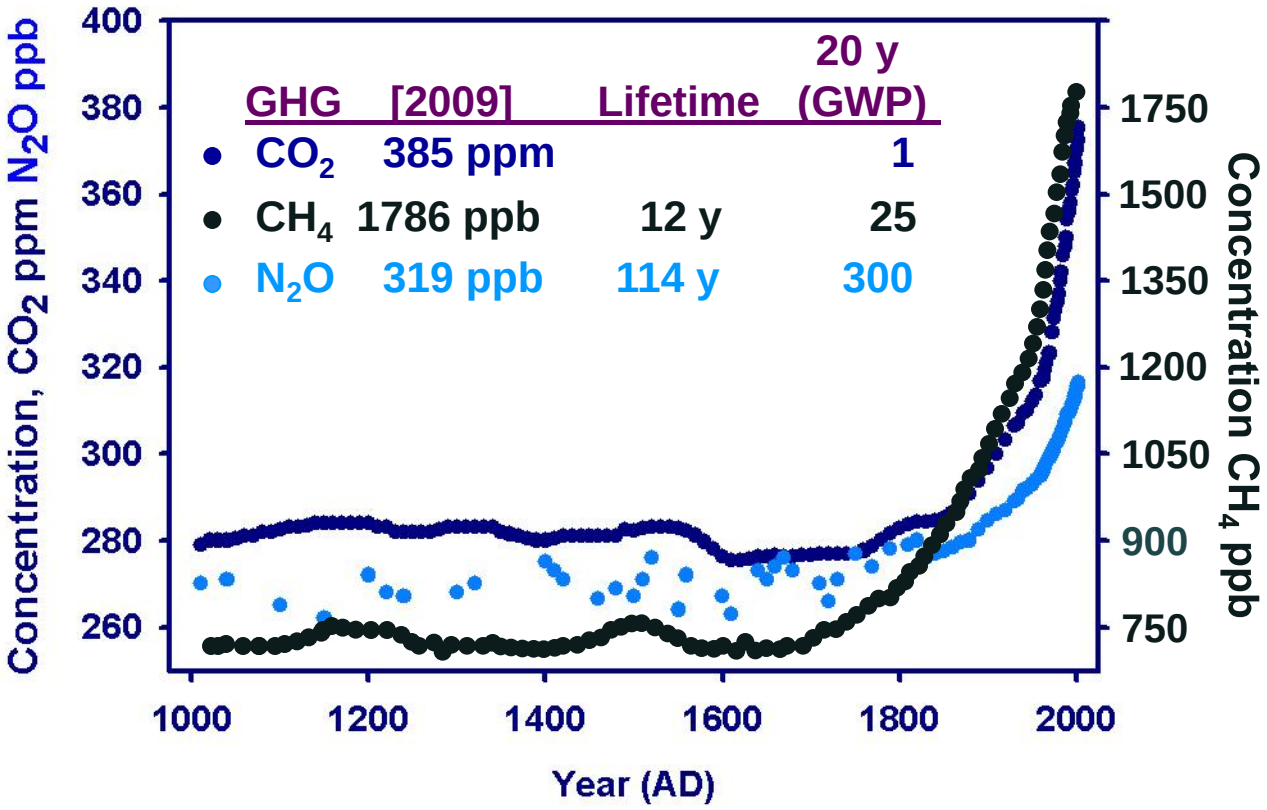
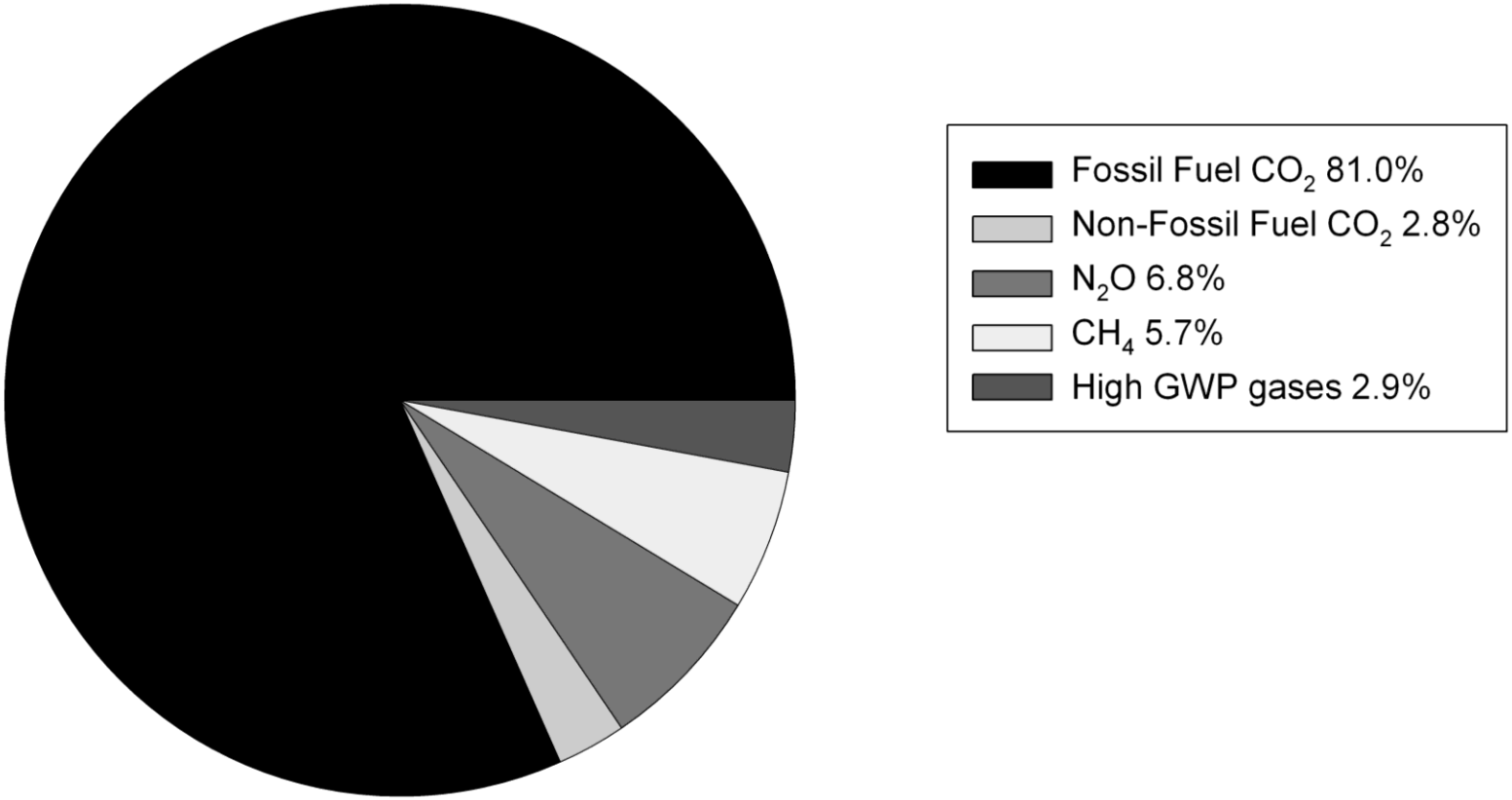
Greenhouse Gas Footprint

"comprehensive measure of the net amount of greenhouse gases (GHGs) produced and consumed, and provides an indication of whether or not we are contributing to GHG increase in the atmosphere."

IPCC Assessment: Carbon Sequestration Involves Production and Consumption of Three GHGs: CO_2 N_2O & CH_4




Fossil Fuel CO_2 81.0%
Non-Fossil Fuel CO_2 2.8%
N_2O 6.8%
CH_4 5.7%
High GWP gases 2.9%

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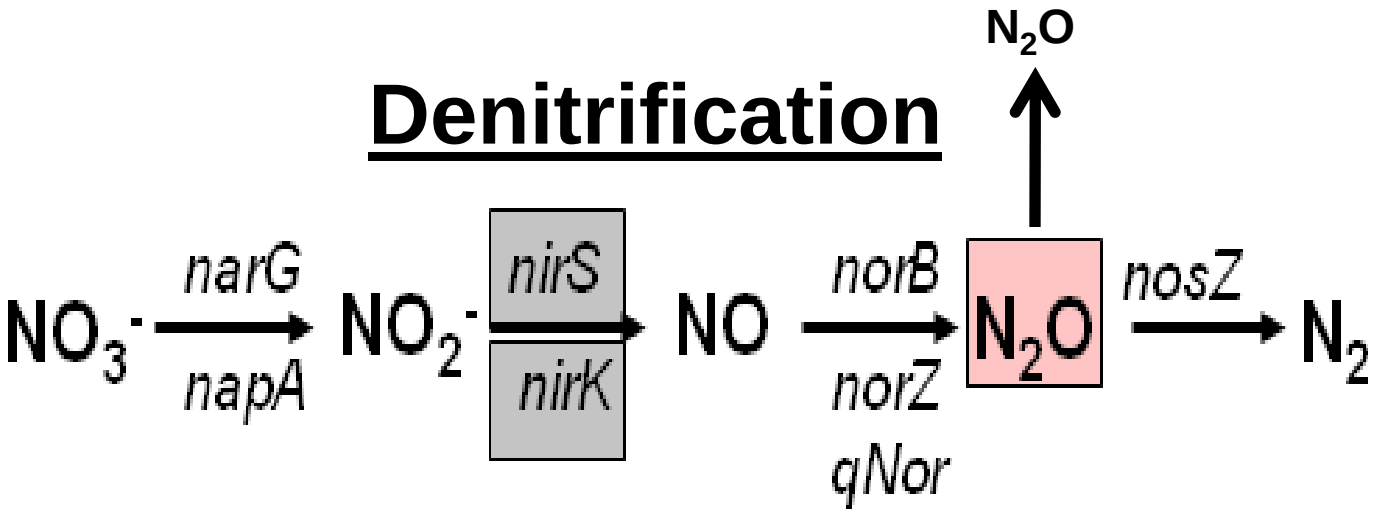
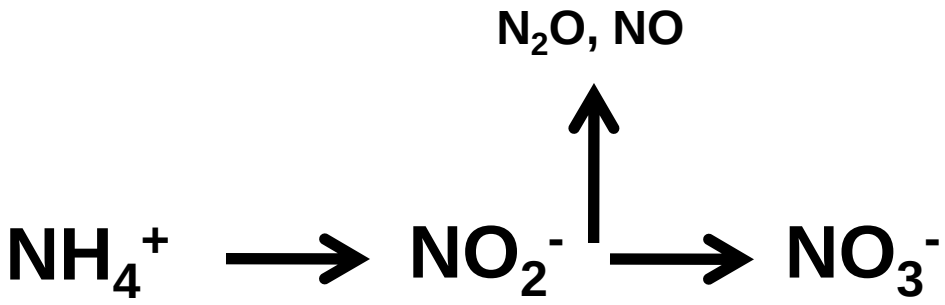
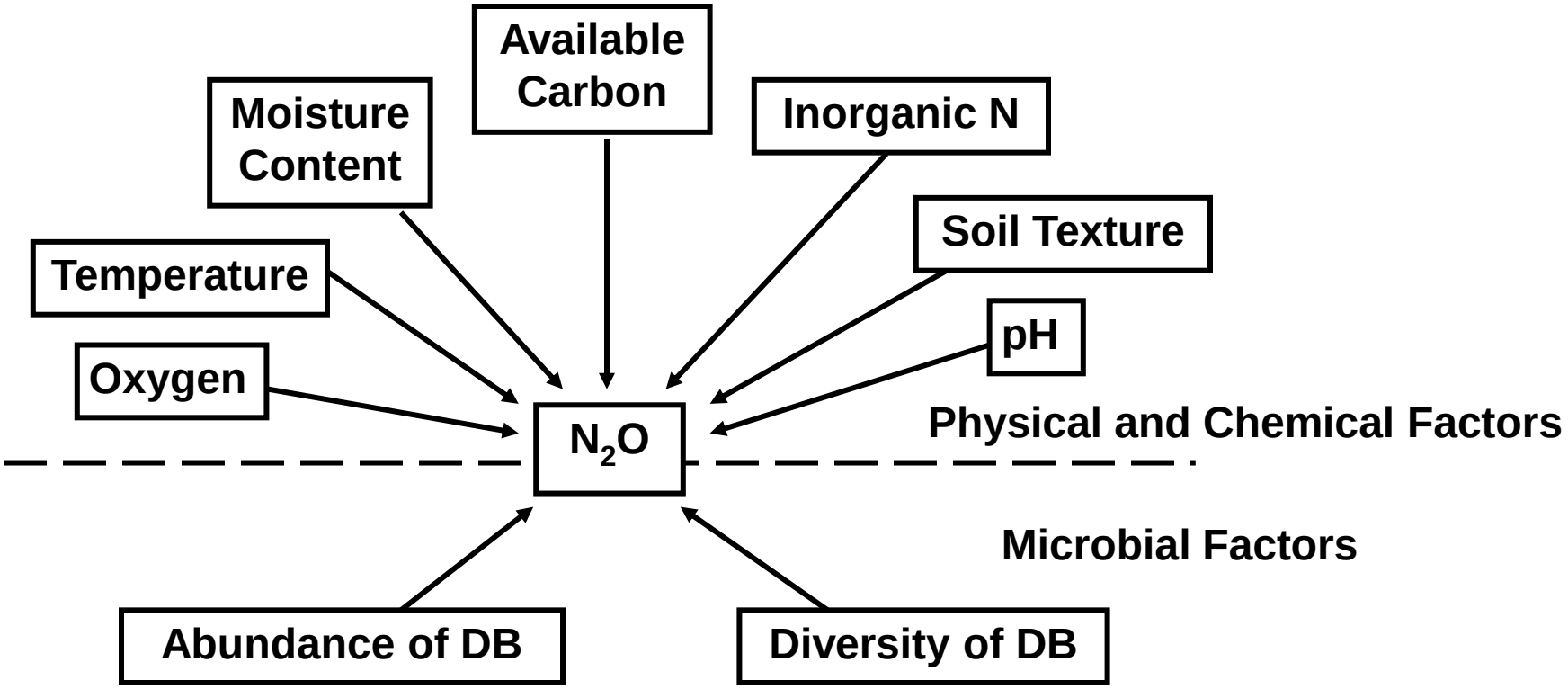
- N_2O Soil Management 47.8%
- N_2O Manure Management: 2.2%
- N_2O Burning Ag Residue: 0.2%
- CH_4 Enteric Fermentation: 17.9%
- CH_4 Manure Management: 14.9%
- CH_4 Rice Fields: 1.5%
- CH_4 Burning Ag Residue: 0.2%
- CO_2 Ag Related Activities: 15.2%


N2O
Denitrification
NO3-
narG
napA
NO2-
nirS
nirK
NO
norB
norZ
qNor
N2O
nosZ
N2


N2O, NO
NH4+
NO2-
NO3-
Nitrification

Envrionment Complexity of N_2O Production



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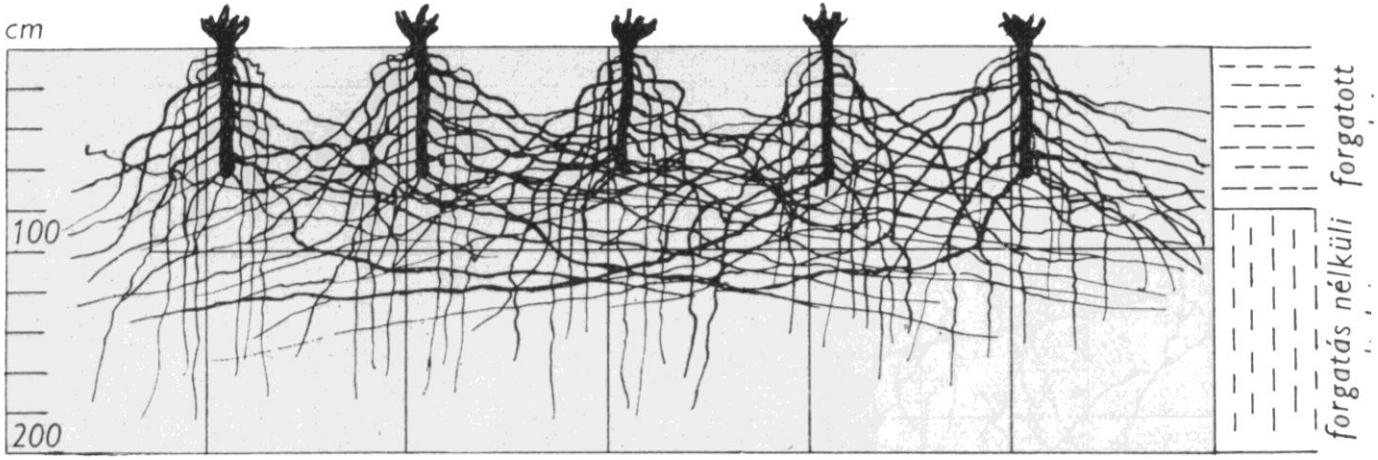
Spatial Variation in N_2O Production

Maria del Mar Alsina, Michael Wolff, Daniel Schellenberg
Christine Stockert & Roger B Boulton



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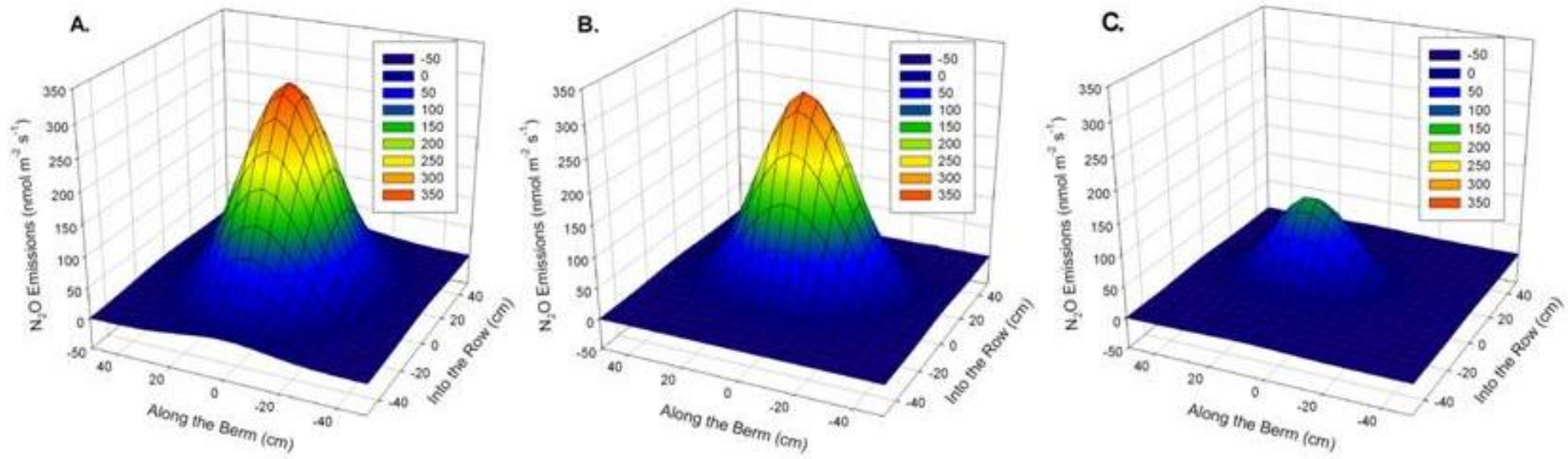
Temporalspatial Variation in N_2O Emissions



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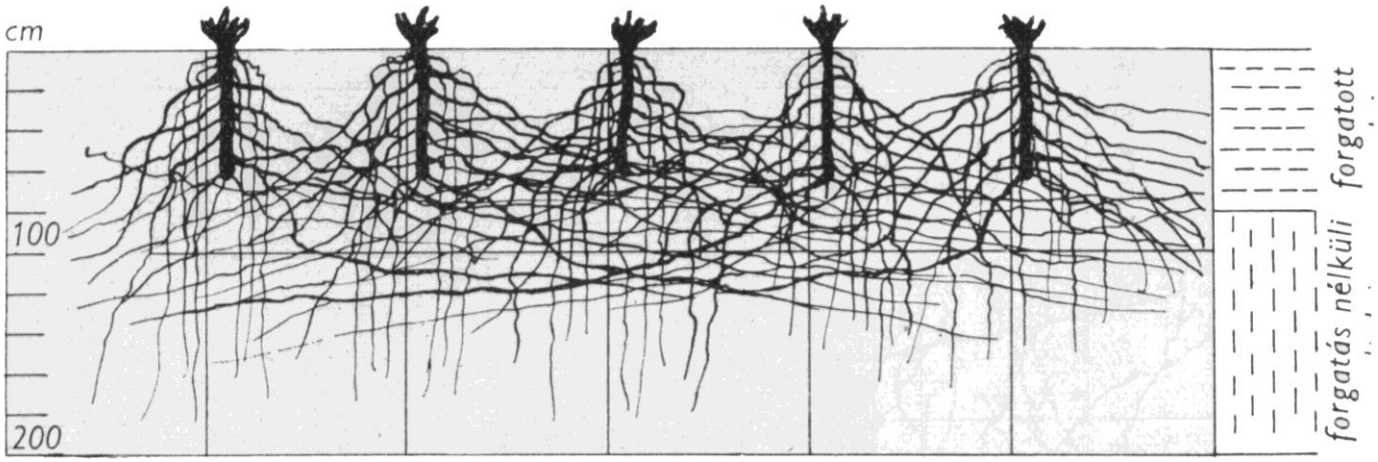
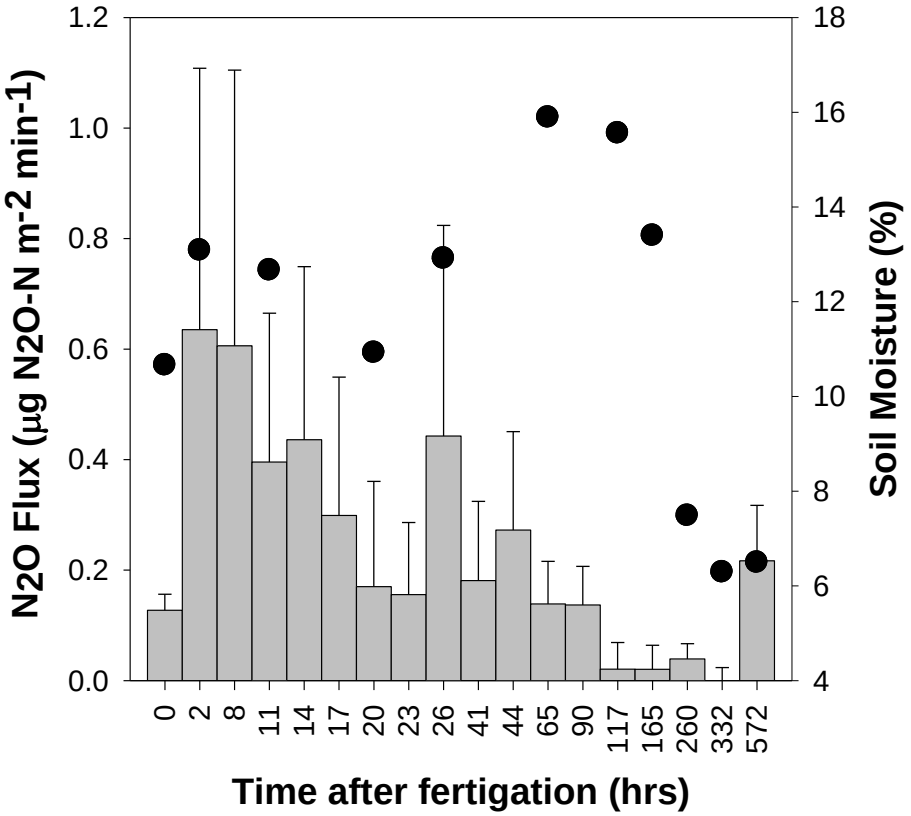
Temporal Variation in N_2O Production




N2O Flux (µg N2O-N m-2 min-1)
Soil Moisture (%)
Time after fertigation (hrs)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
4
6
8
10
12
14
16
18
0
2
8
11
14
17
20
23
26
41
44
65
90
117
165
260
332
572

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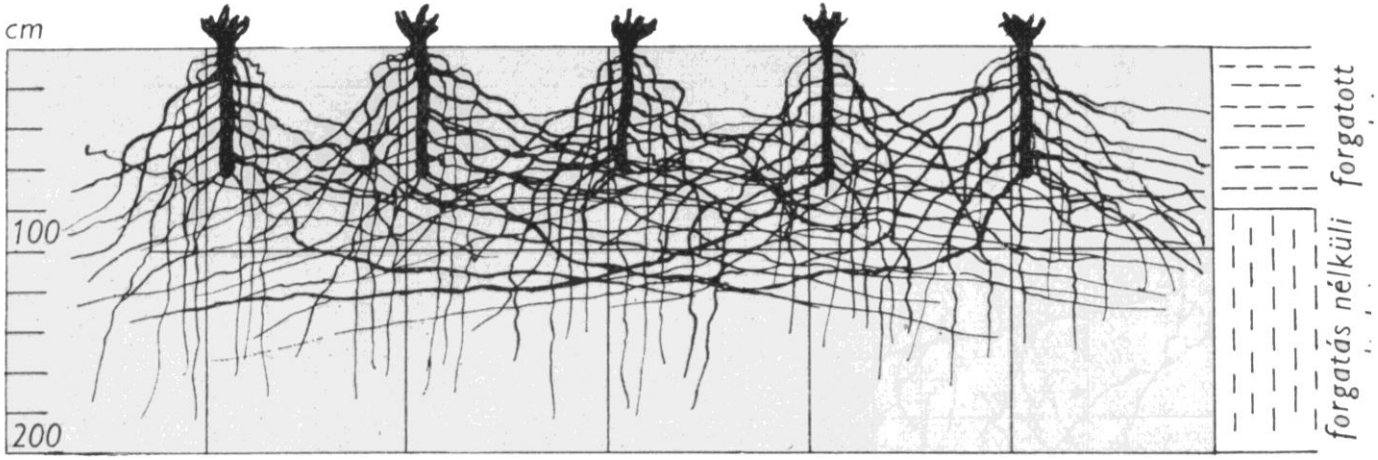
Genetic Variation in N_2O Production

Michael Matiasek / Kate M. Scow
Department of Land Air & Water Resources
University of California at Davis



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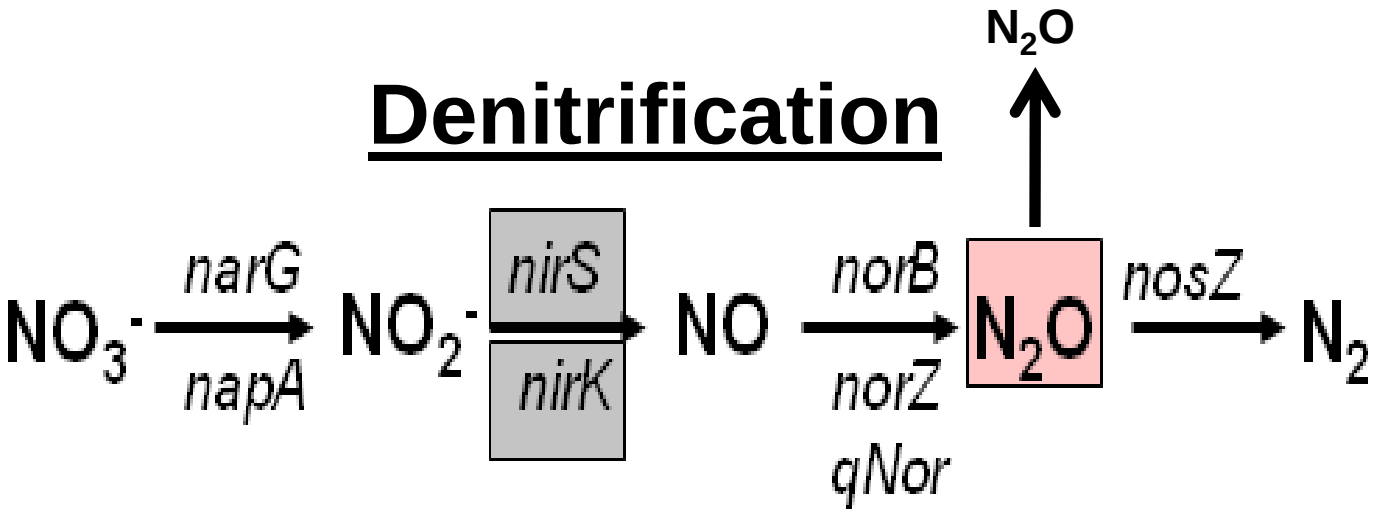
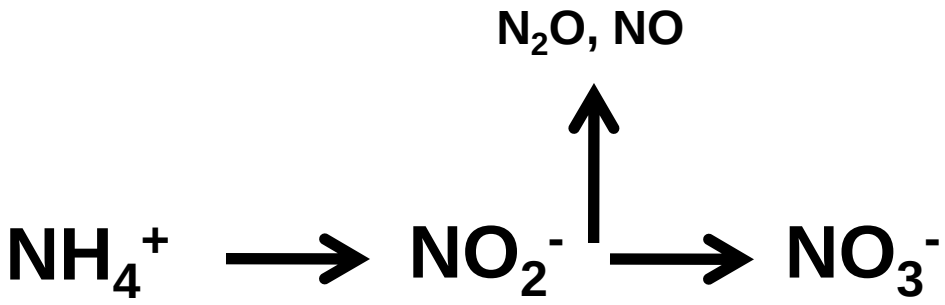
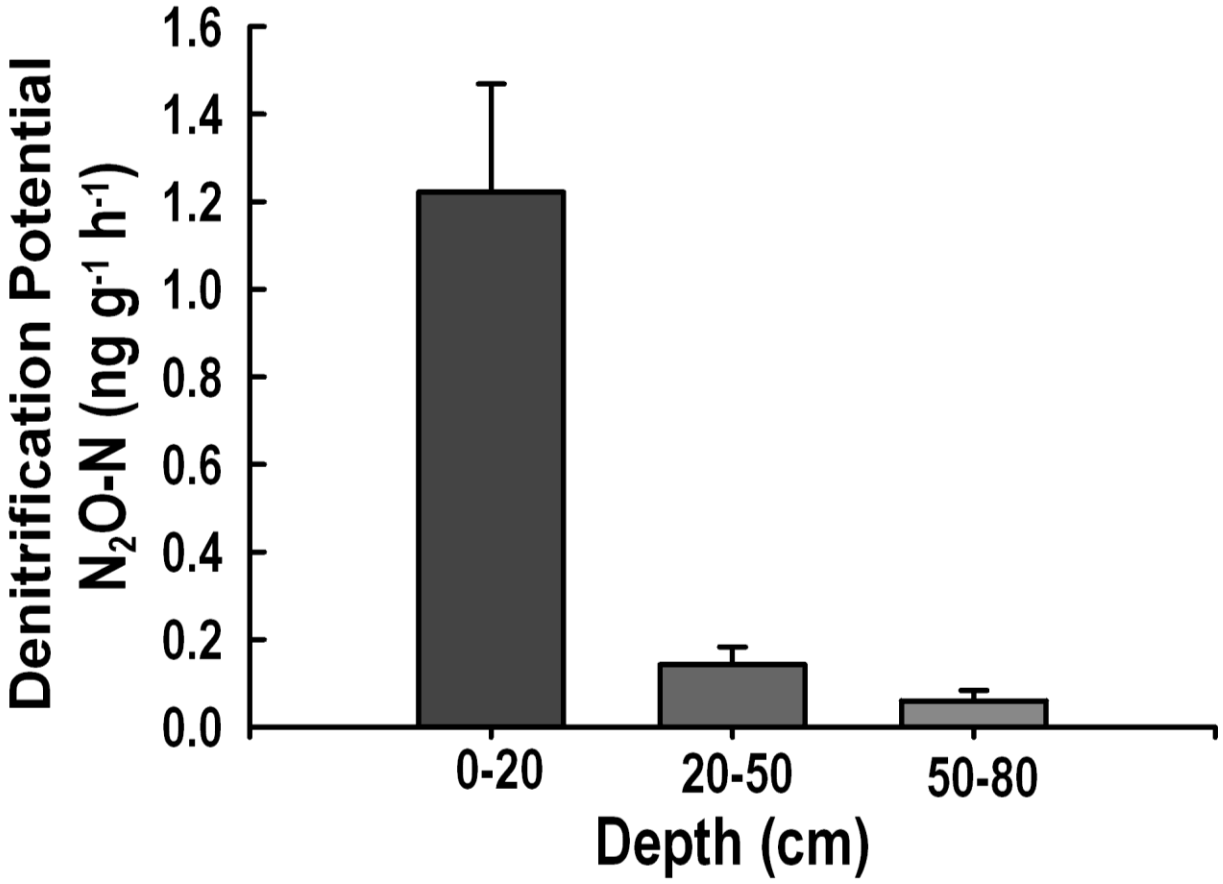

N2O
Denitrification
NO3-
narG
napA
NO2-
nirS
nirK
NO
norB
norZ
qNor
N2O
nosZ
N2


N2O, NO
NH4+
NO2-
NO3-
Nitrification

Denitrification Enzyme Potential



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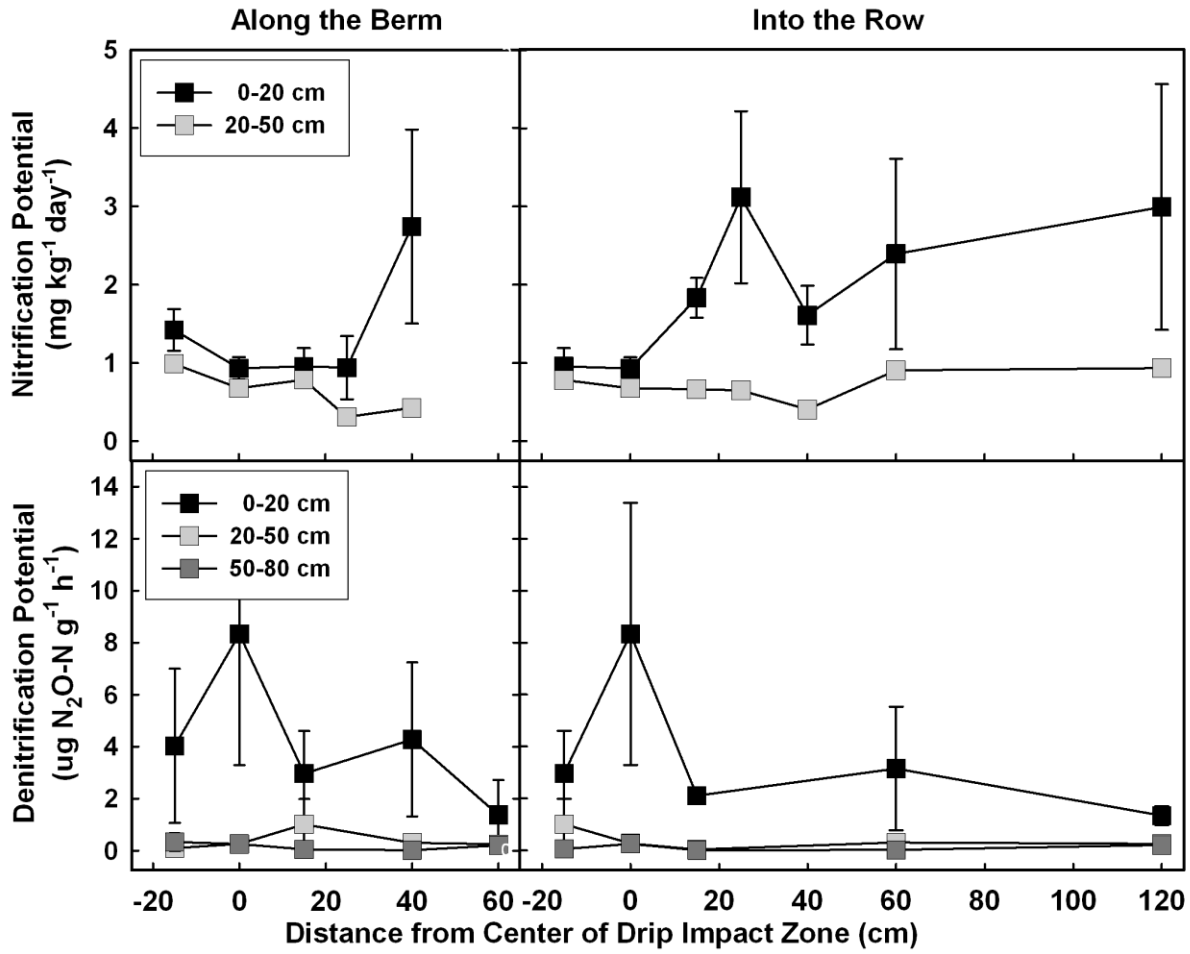
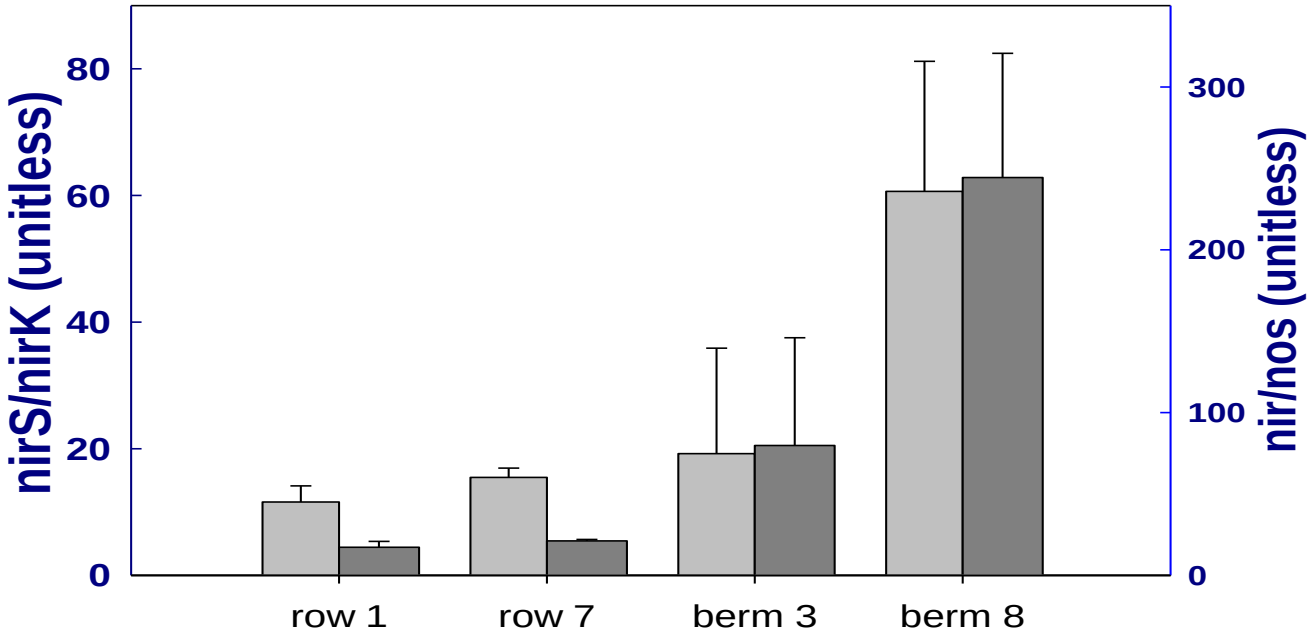
Nitrification & Denitrification Enzyme Potential



Nitrification & Denitrification DNA Abundance



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Bringing it All Together

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Michael Matiasek / Kate M. Scow
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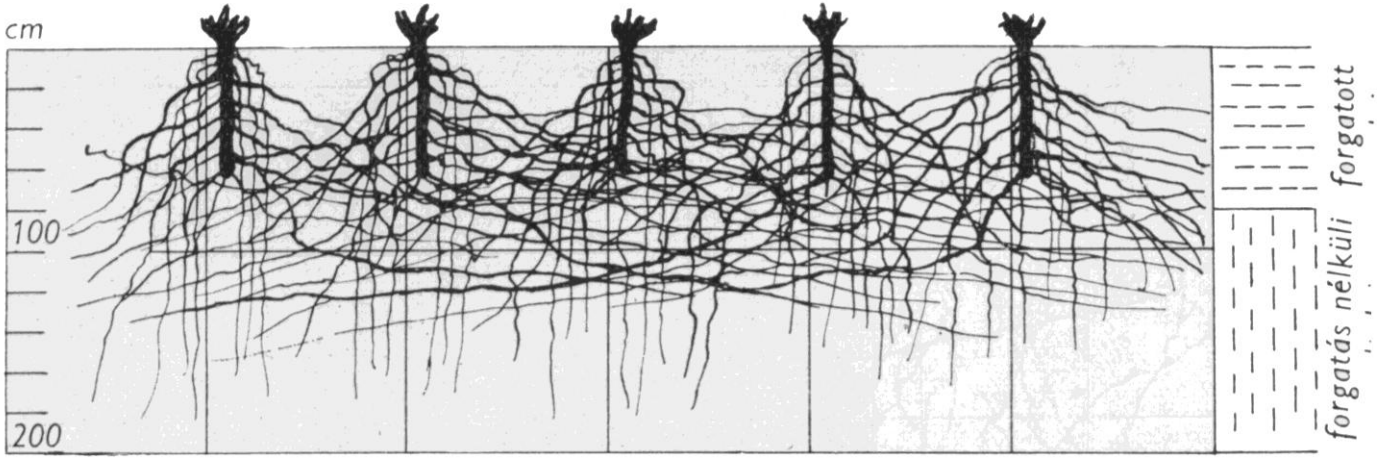
Department of Land Air & Water Resources
University of California at Davis



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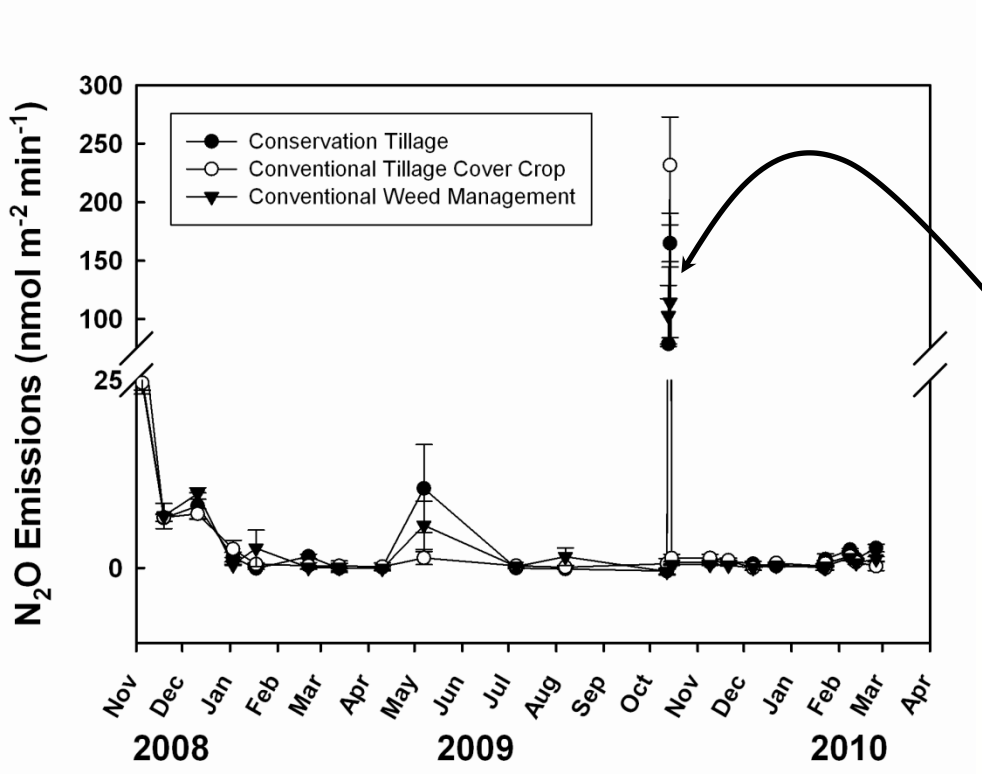

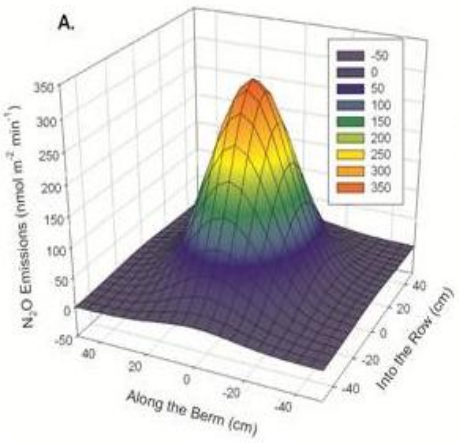

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Conclusions:

Carbon sequestration is much more complex than simply carbon.

Both regular and irregular spatial variation exists at the vineyard/orchard scale.

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Climate Change ● Sustainable Agriculture
Environmental Quality ● Landscape Processes

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Conclusions:

Microbial communities involved in N_2O production seem to be entrained to 'management practices'.

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Environmental Quality ● Landscape Processes