# Markens mikrober i odlingsystemet – kväveomsättning och lustgas

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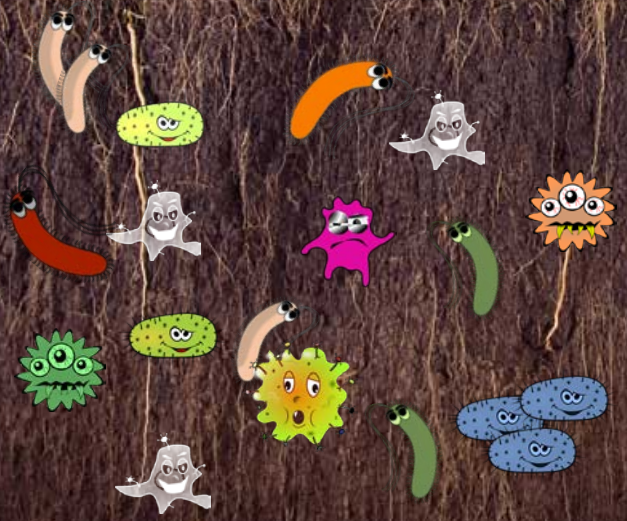
# « mikrobiologiskt zoo »



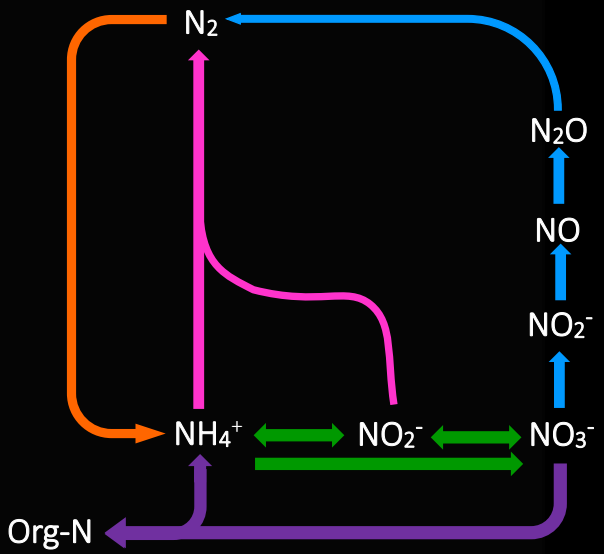
**Biomassa in jorden: 10 ton/ha**

- **Bakterier 1-2 ton**

**svamp: 10 – 100 m/g jord**

**Bakterieceller: $10^7$ – $10^{10}$/g jord**

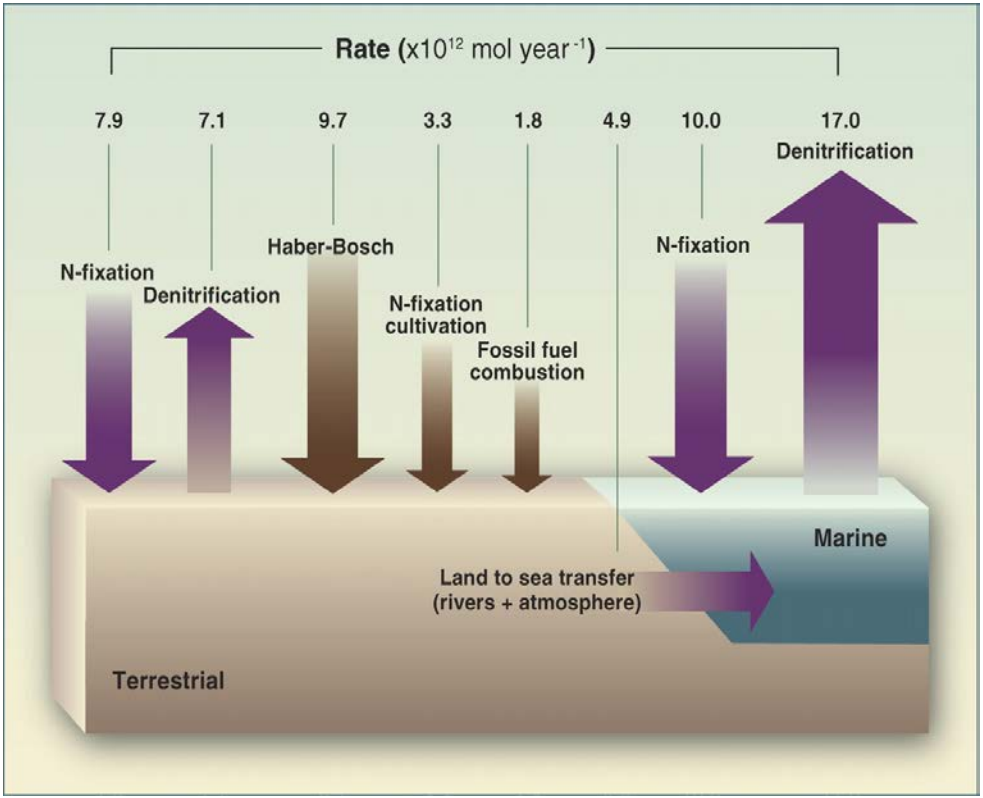
**”Arter”: $10^3$ – $10^4$/g jord**


$N_2$
$N_2O$
NO
$NO_2^-$
$NH_4^+$
$NO_2^-$
$NO_3^-$
Org-N


NO N
WITH N


N

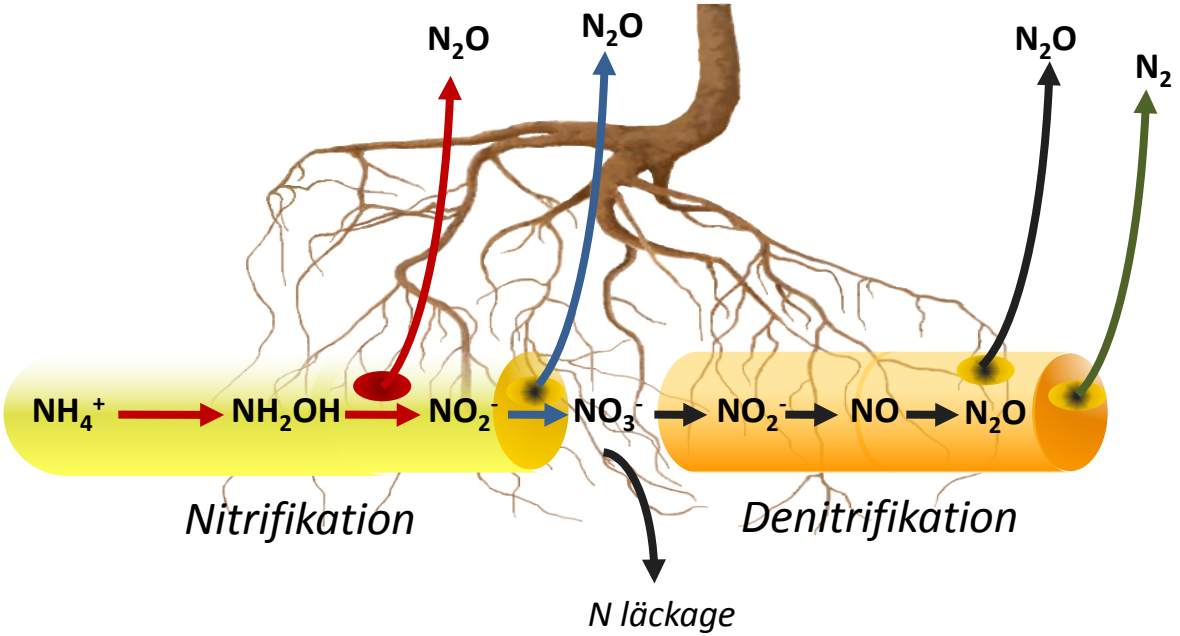
# Globala kvävefluxer:




Bruna pilar visar mänsklig påverkan.

**(Canfield et al. 2010 *Science*)**

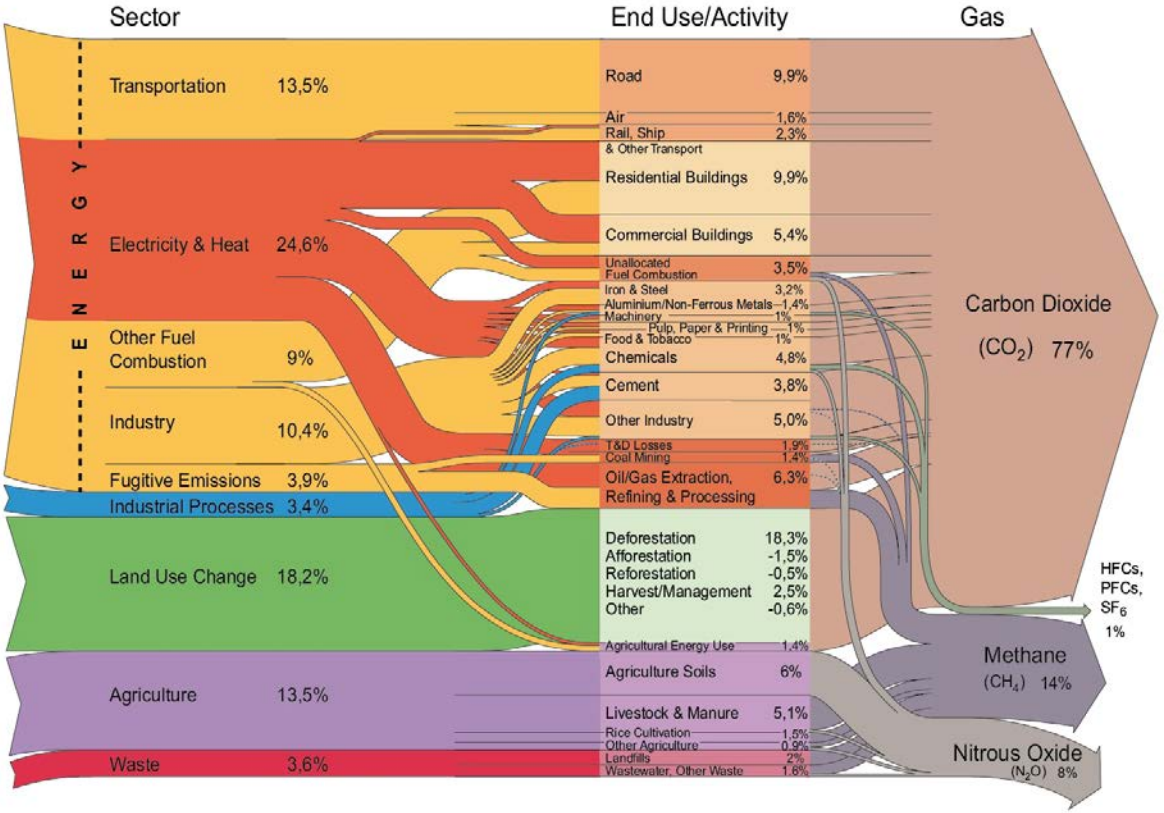
# Förluster av kväve från mark



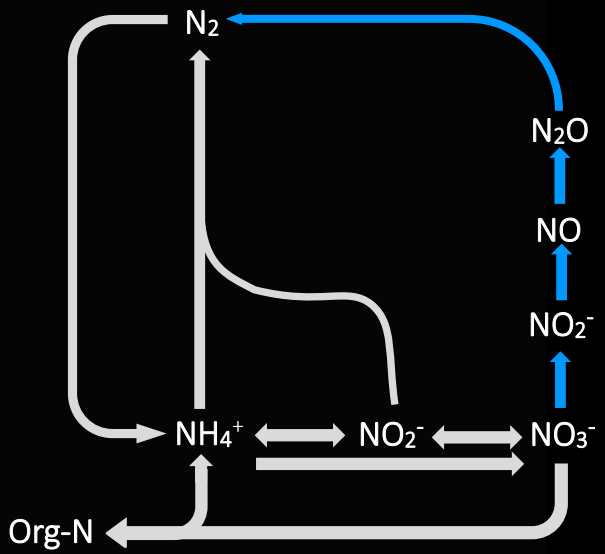

(Philippot & Hallin 2011, Trends Plant Sci.)


$N_2O$

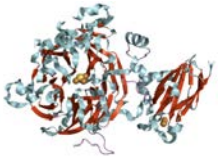
# Växthusgaser från olika sektorer i samhället:



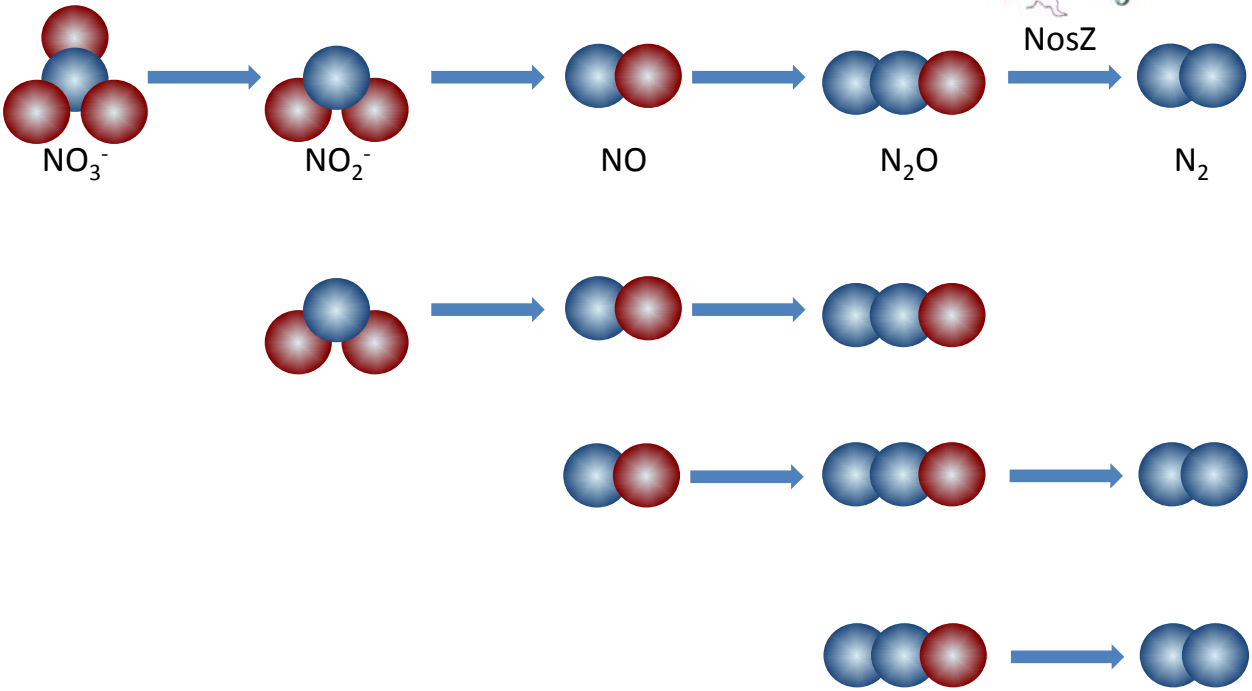

All data is for 2000. All calculations are based on $CO_2$ equivalents, using 100-year global warming potentials from the IPCC (1996), based on a total global estimate of 41 755 $MtCO_2$ equivalent. Land use change includes both emissions and absorptions. Dotted lines represent flows of less than 0.1% percent of total GHG emissions.

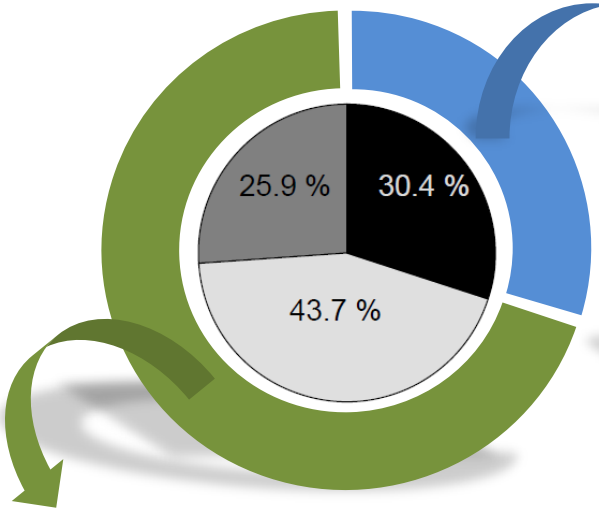



Denitrifikation



NosZ






- 24% har bara *nosZ* – en $N_2O$ sänka
- 6% har *nosZ* för att få bort NO (och $N_2O$)

NosZ II

70% of alla genom med *nosZ* har $N_2O$ reduktion via fullständig denitrifikation

NosZ I

**(Graf et al, 2014 *PLOS ONE*)**

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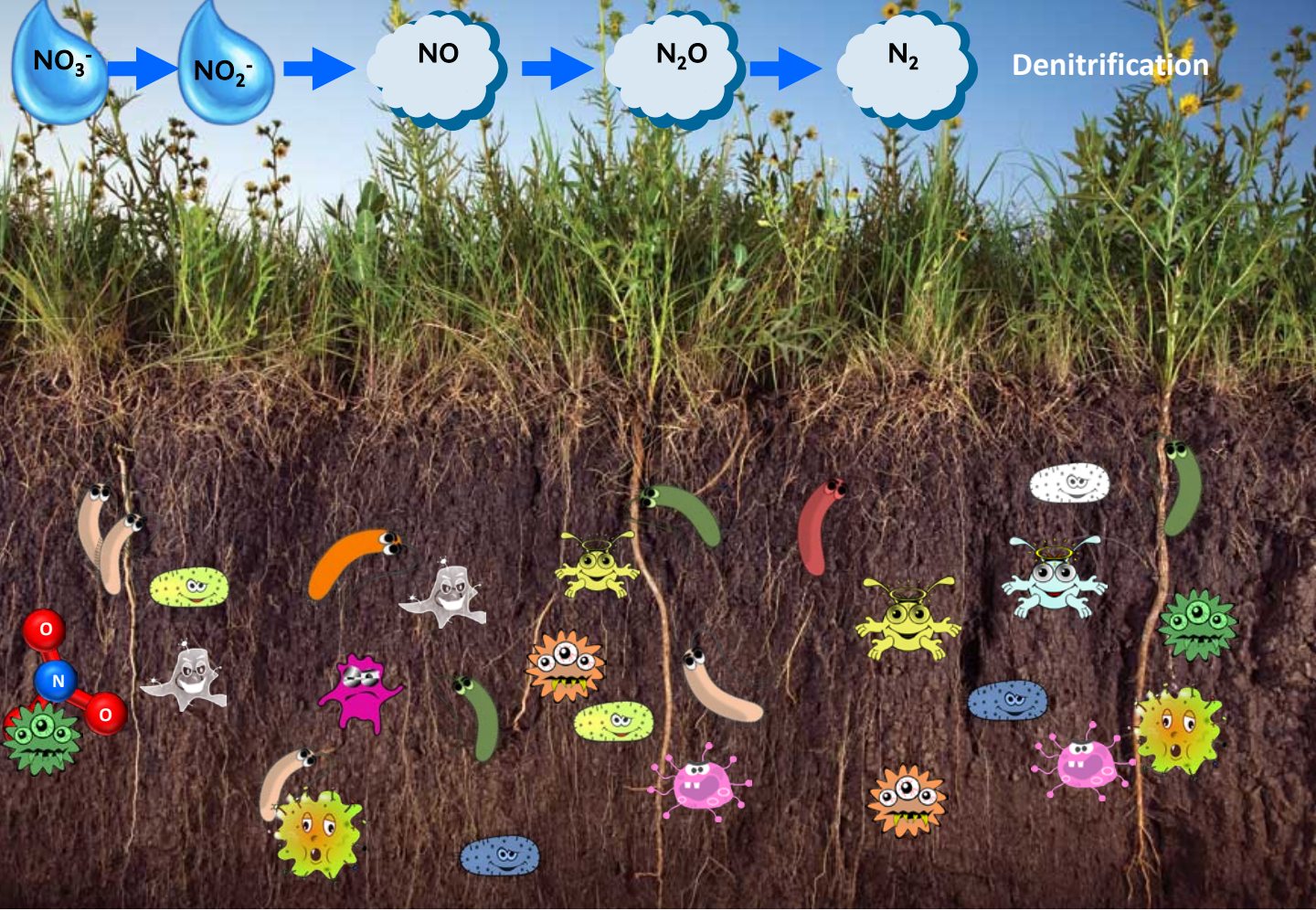
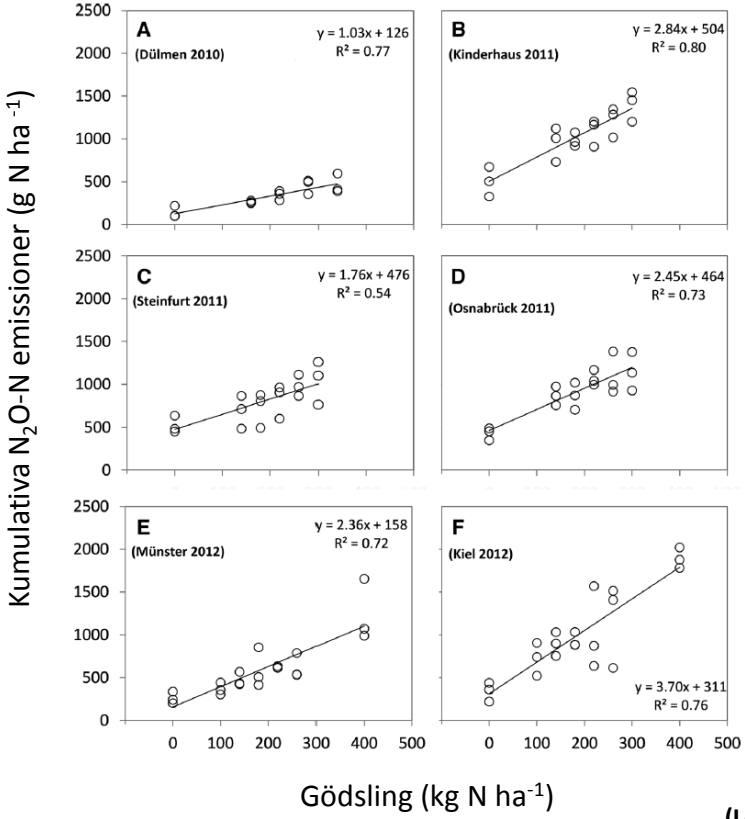
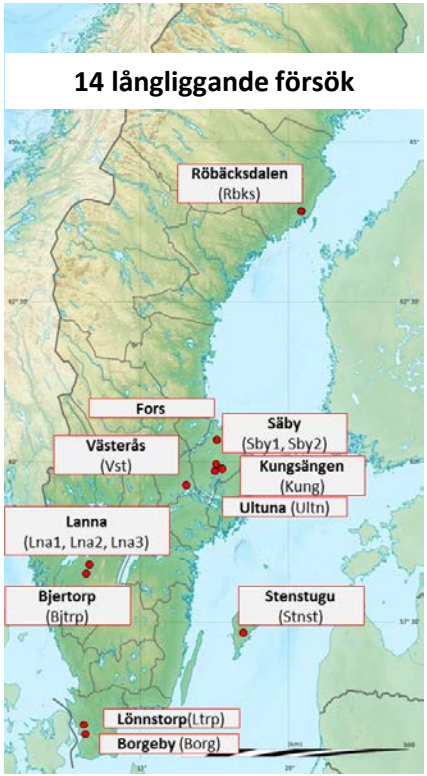

$NO_3^-$
$NO_2^-$
NO
$N_2O$
$N_2$
Denitrification
O
N
O

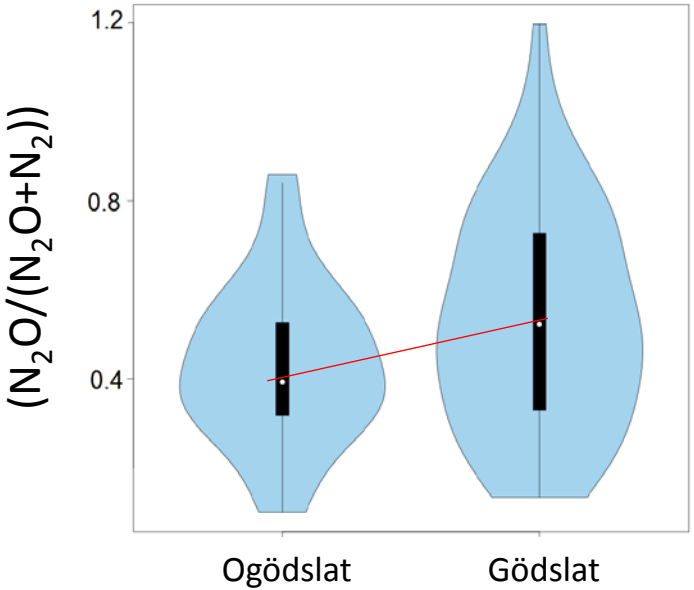
# Gödsling ökar $N_2O$ emissioner




**(Lebender *et al.* 2014)**

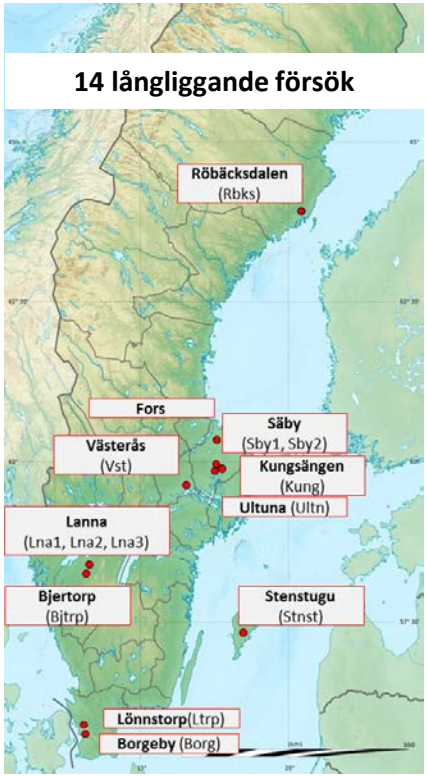
# Effekter av kvävegödsling på $N_2O$ reduktion

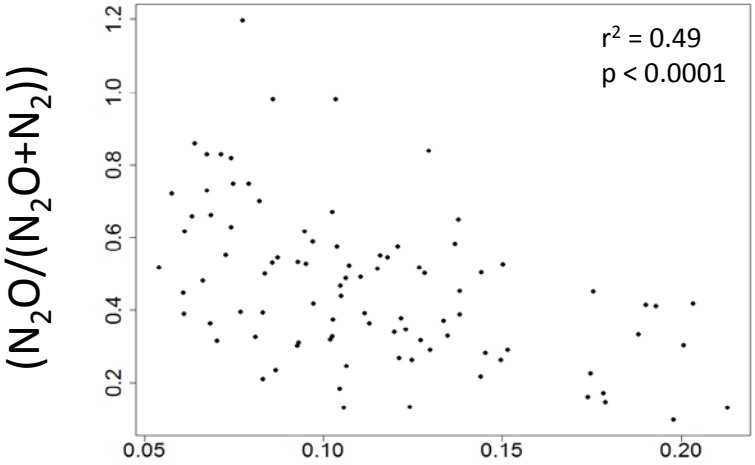



(Putz et al, manuscript)

# Effekter av kvävegödsling på $N_2O$ reducerare



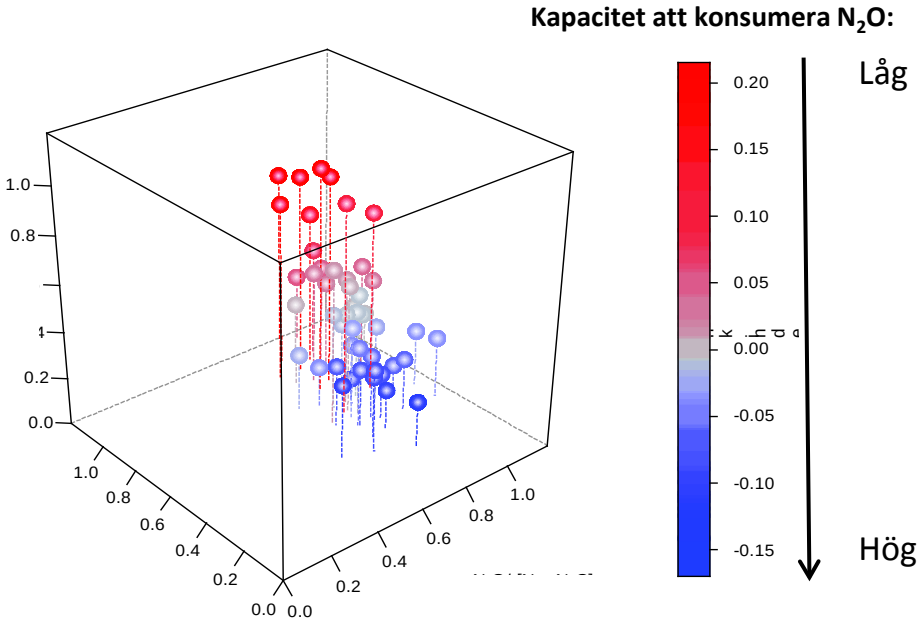




**Antal $N_2O$ reducerare/antal denitrifierare**

- **Gödsling förändrar mikrobsamhället**
- **Fler avger lustgas istället för kvävgas**

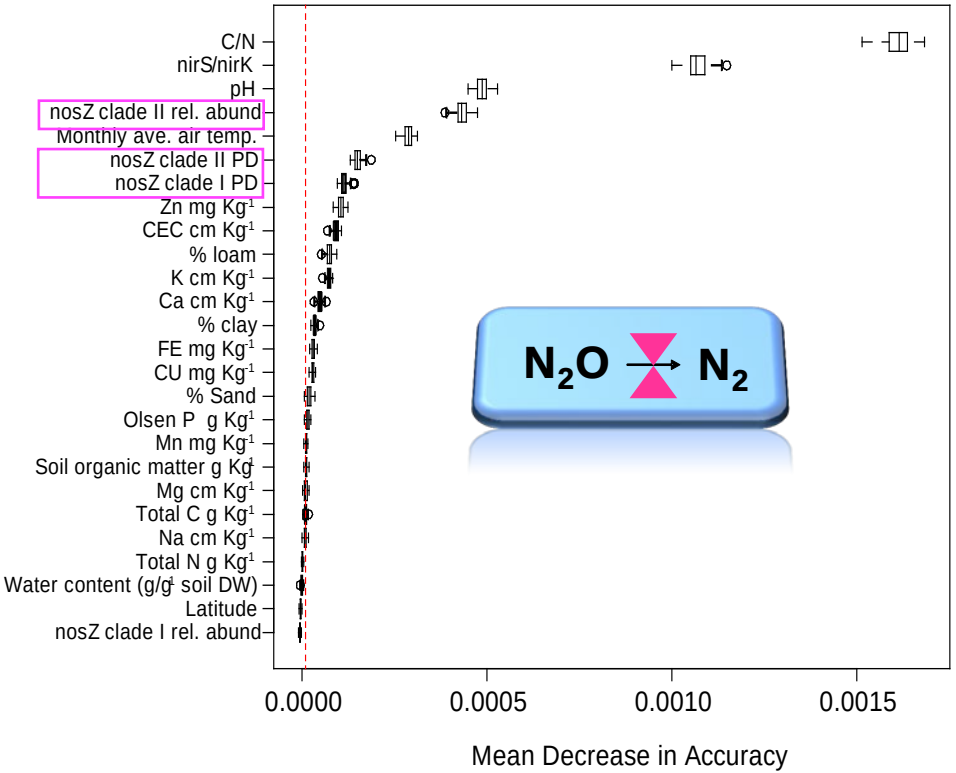
**(Putz et al, manuscript)**

# Potential för $N_2O$ reduktion i 47 olika jordar




(Jones et al, 2014 *Nature Climate Change*)

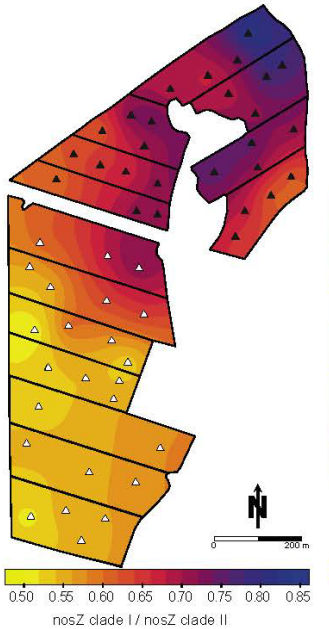
# Vad påverkar markens kapacitet att reducera lustgas allra mest?




**(Jones et al, 2014 *Nature Climate Change*)**

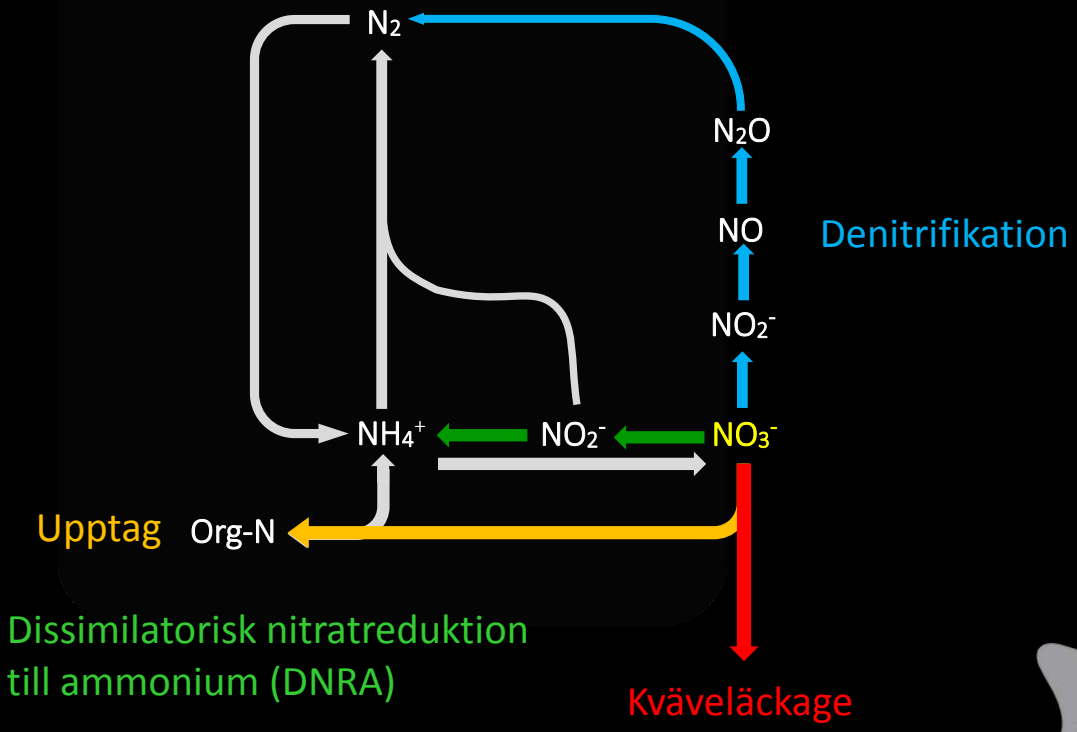
# Vad gynnar vi bakterierna med NosZ I och II?

*nosZ*I/*nosZ*II

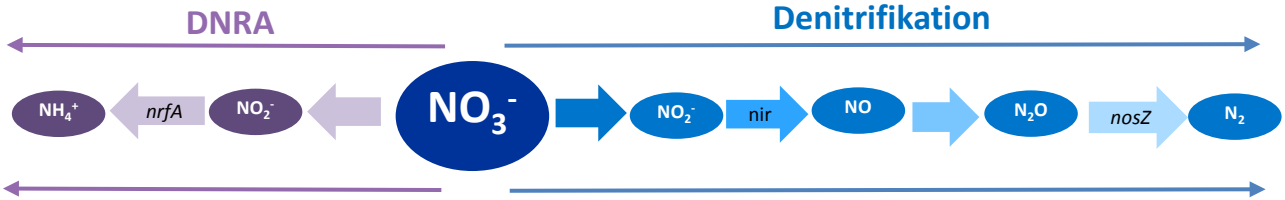



**(Juhanson et al, 2017 *SBB*)**

# Var tar nitratet vägen?

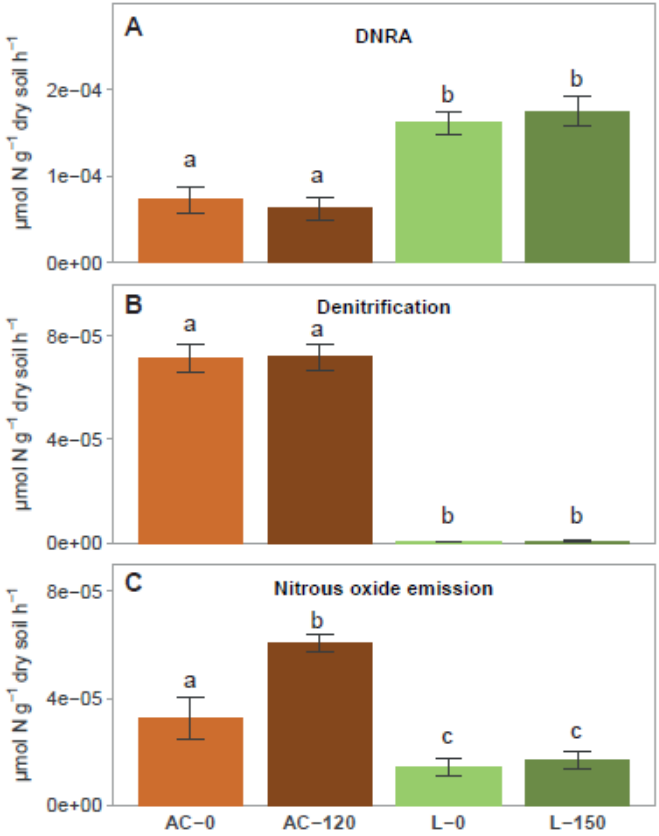


# Effekt av odlingssystem




| **N** kg $ha^{-1}$ $år^{-1}$ | **0** | **150** | **0** | **120** |
|---|---|---|---|---|
| **C:$NO_3^-$** | 4 700[a] | 5 200[a] | 4 100[b] | 3 800[b] |

**(Putz et al, manuscript)**




(Putz et al, manuscript)

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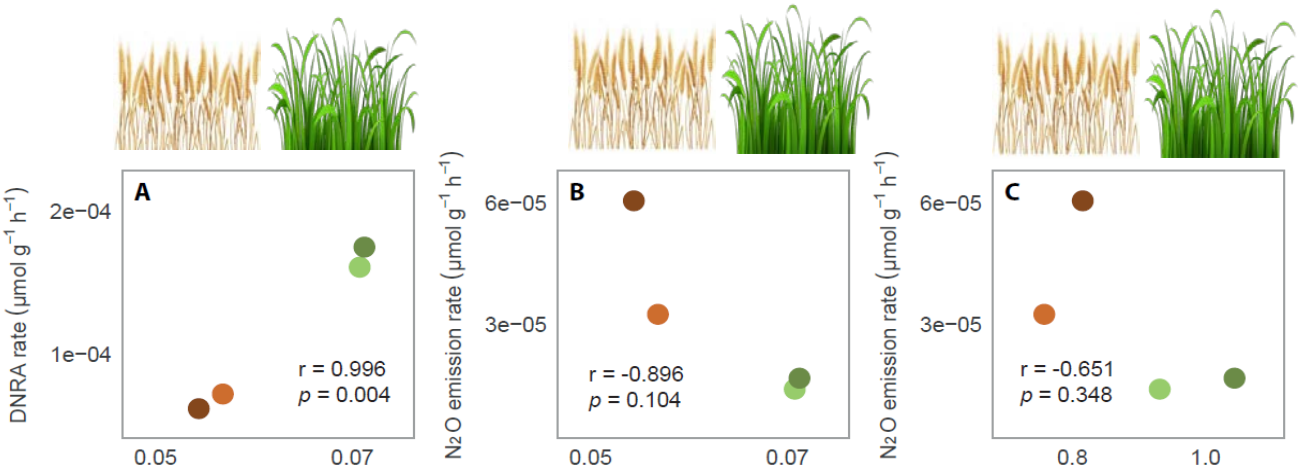


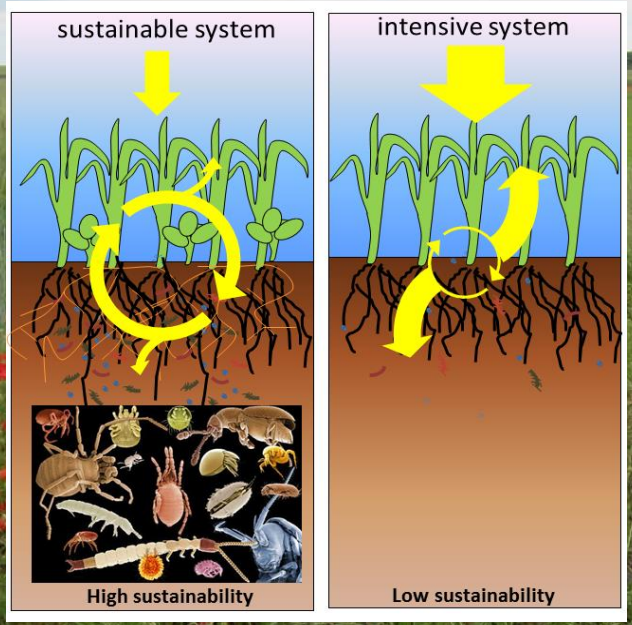

Antal DNRA bakterier/Antal denitrifierare

Antal $N_2O$ reducerare/
Antal denitrifierare

- **Odlingssytemet har större betydelese än gödslingen**
- **Kvoten mellan markkol (C) och nitrat styr skillanden**

**(Putz et al, manuscript)**

# Digging Deeper




biodiversa (2017- 2020)

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