



# Impacts of afforestation on non-CO<sub>2</sub> greenhouse gas emissions

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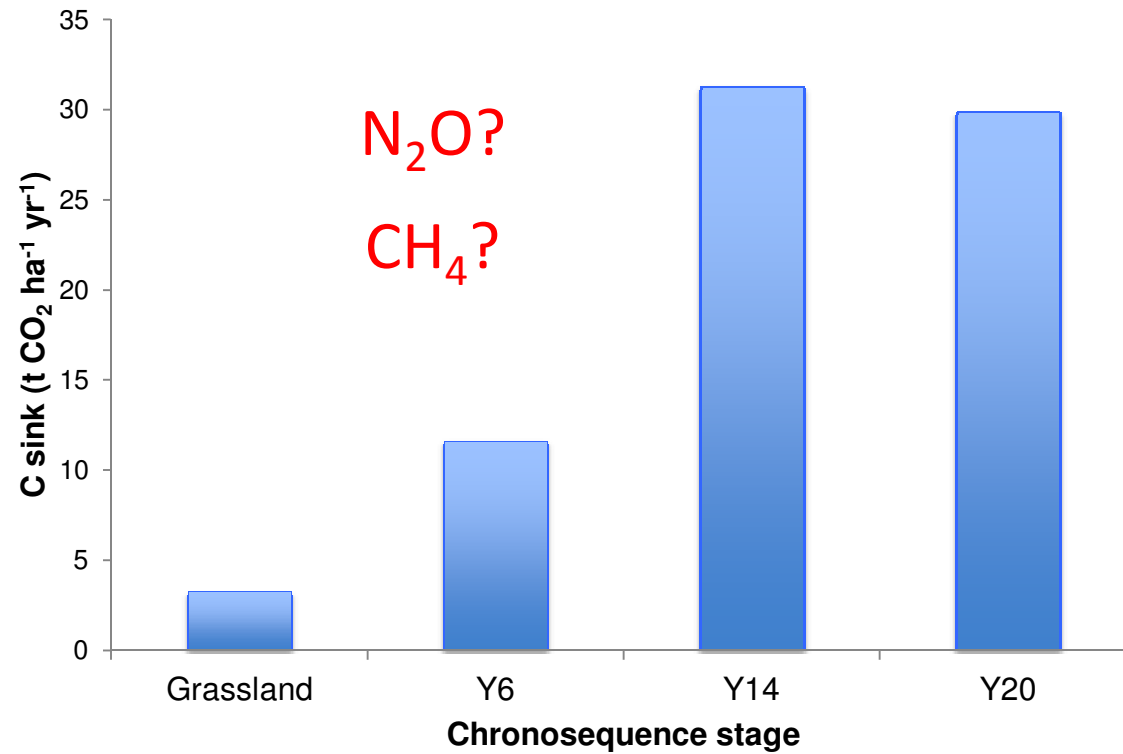
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# AIMS



Total C sink, *Picea sitchensis* chronosequence



Data provided by Dr. M. Saunders



# AIMS



- Assessment of the impacts of coniferous and deciduous afforestation and tree-age on  $N_2O$  and  $CH_4$  emissions for various soil types in Ireland
- Production of field-based estimates of annual non- $CO_2$  GHG budgets for the ecosystems under investigation

# The coniferous chronosequence



- 4 sites on mineral gley soil, Co. Laois
  - Grassland; wet, *Juncus*-dominated, unfertilized
  - 6 year old *Picea sitchensis* (Sitka spruce) forest
  - 14 year old *Picea sitchensis* forest
  - 20 year old *Picea sitchensis* forest

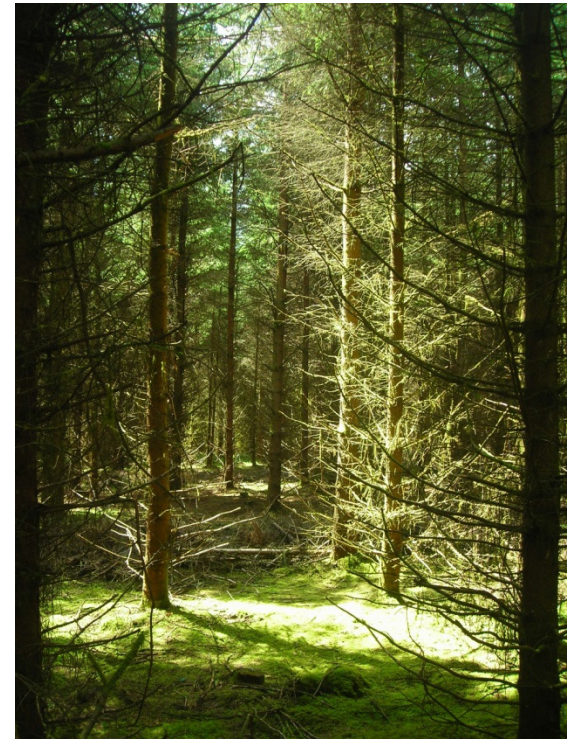
# The coniferous chronosequence



○ Grassland



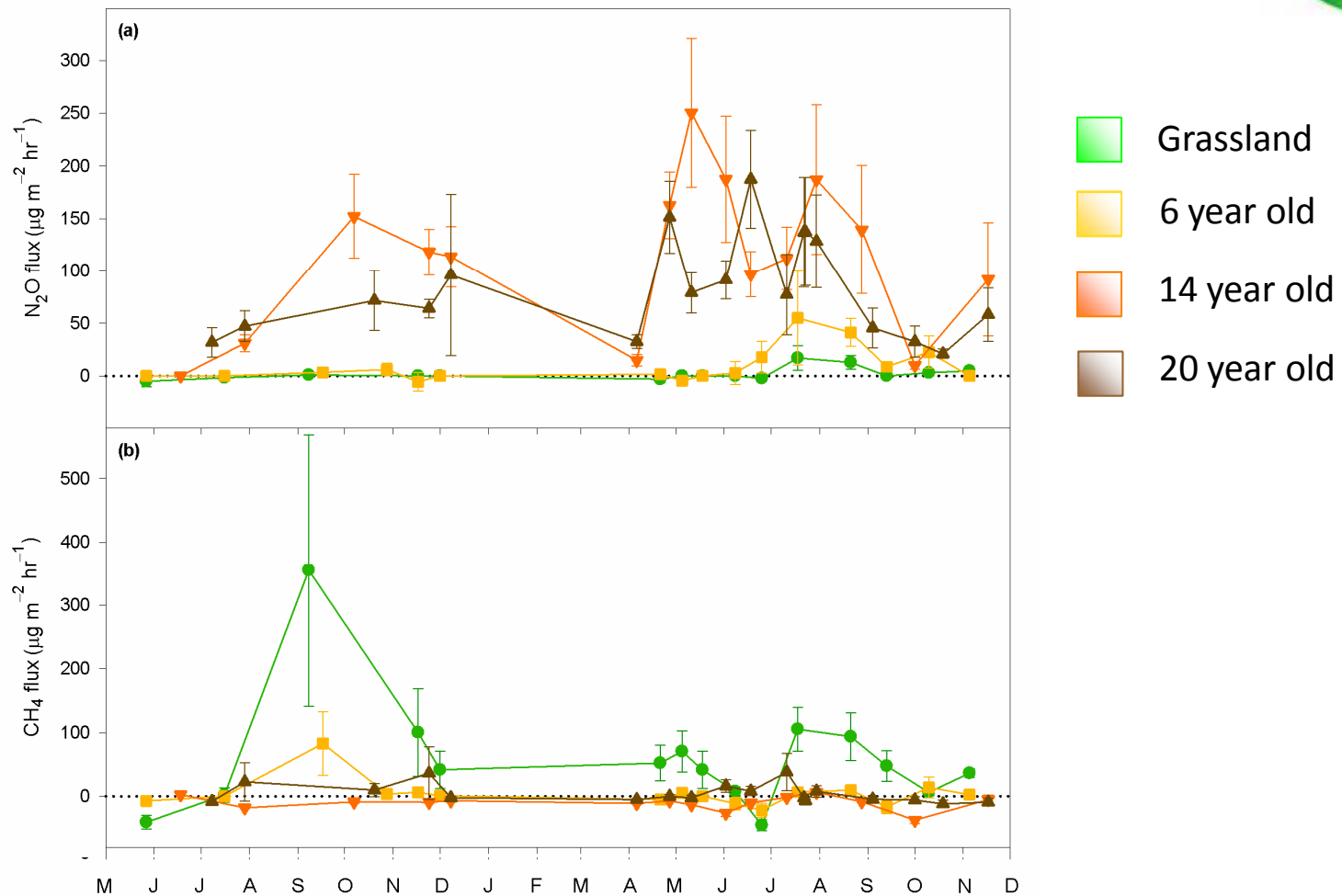
○ 6 year old



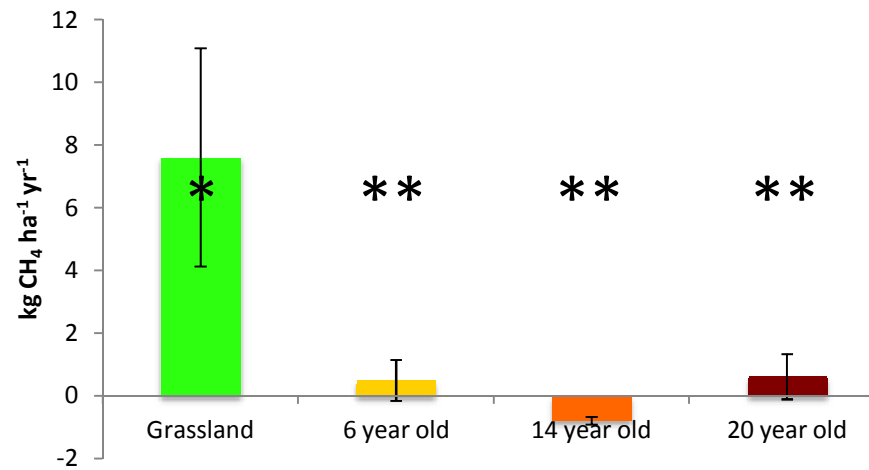
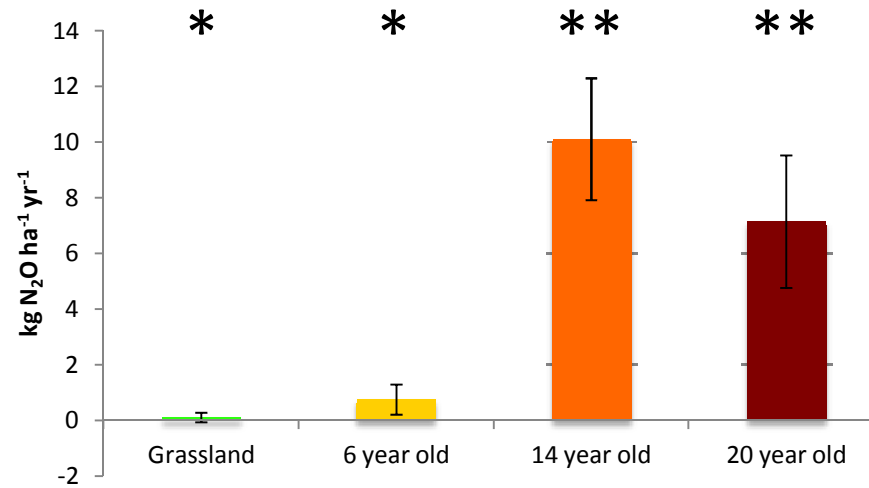
○ 20 year old



# Average N<sub>2</sub>O and CH<sub>4</sub> effluxes



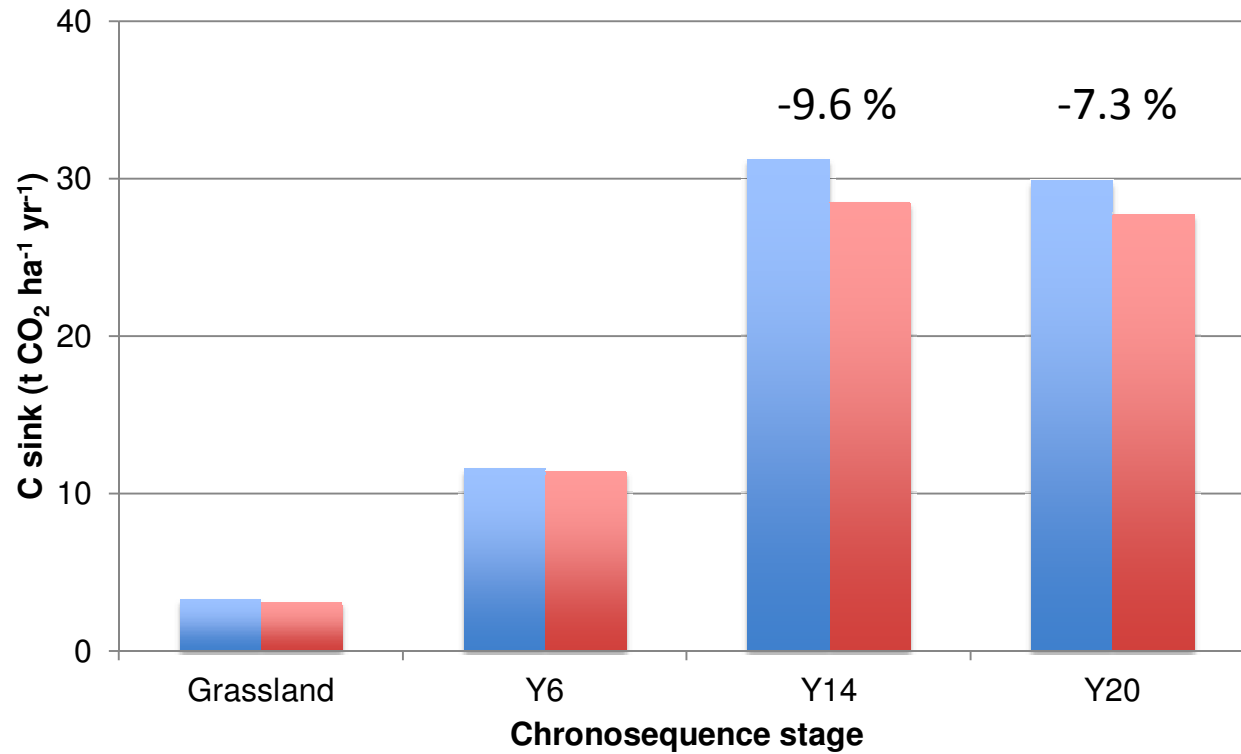
# Annual cumulative fluxes



# Impact of N<sub>2</sub>O and CH<sub>4</sub> on C sink



Total C sink, *Picea sitchensis* chronosequence



C sink Data provided by Dr. M. Saunders







# Microbial sources of N<sub>2</sub>O

H<sub>2</sub>O

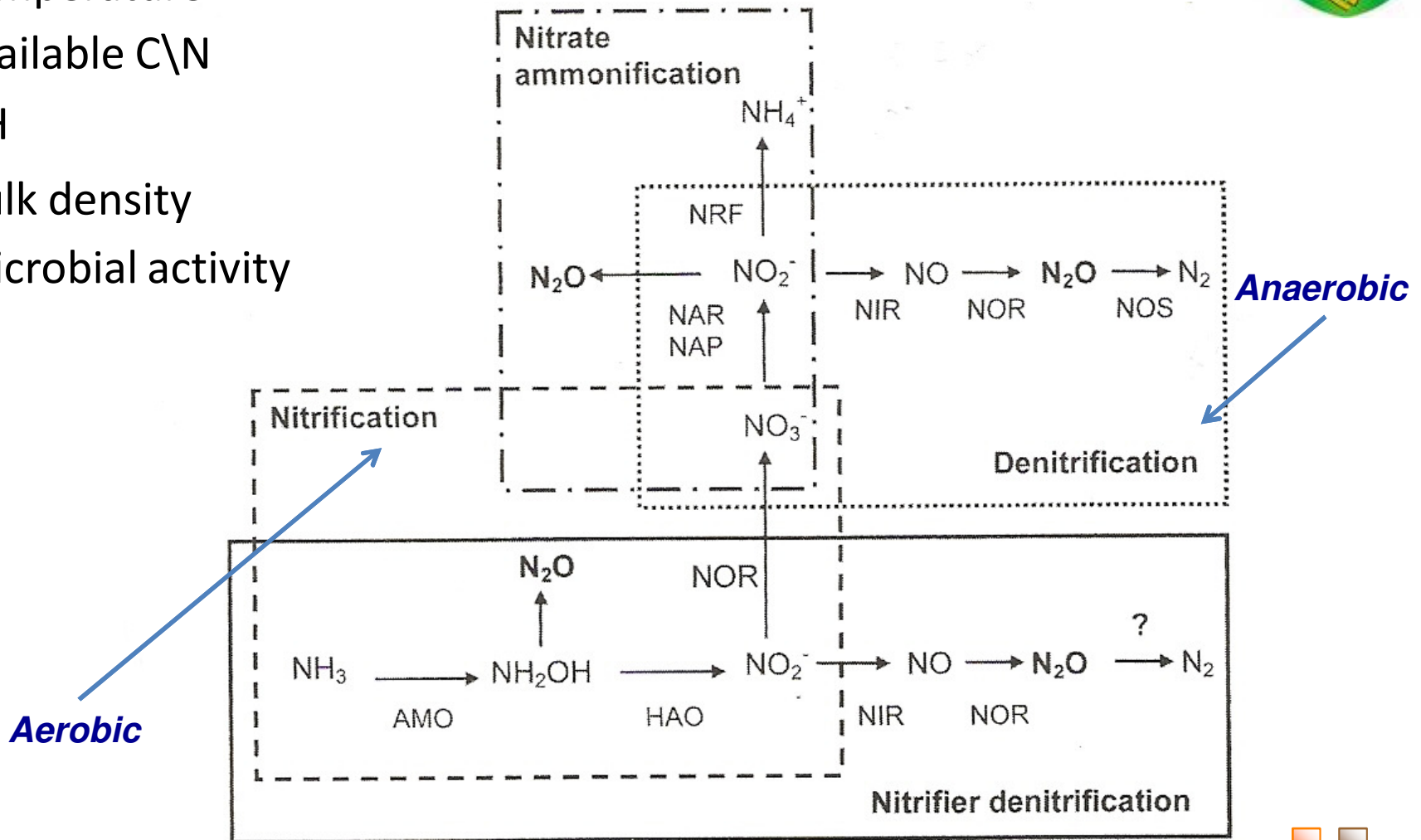
temperature

available C\N

pH

bulk density

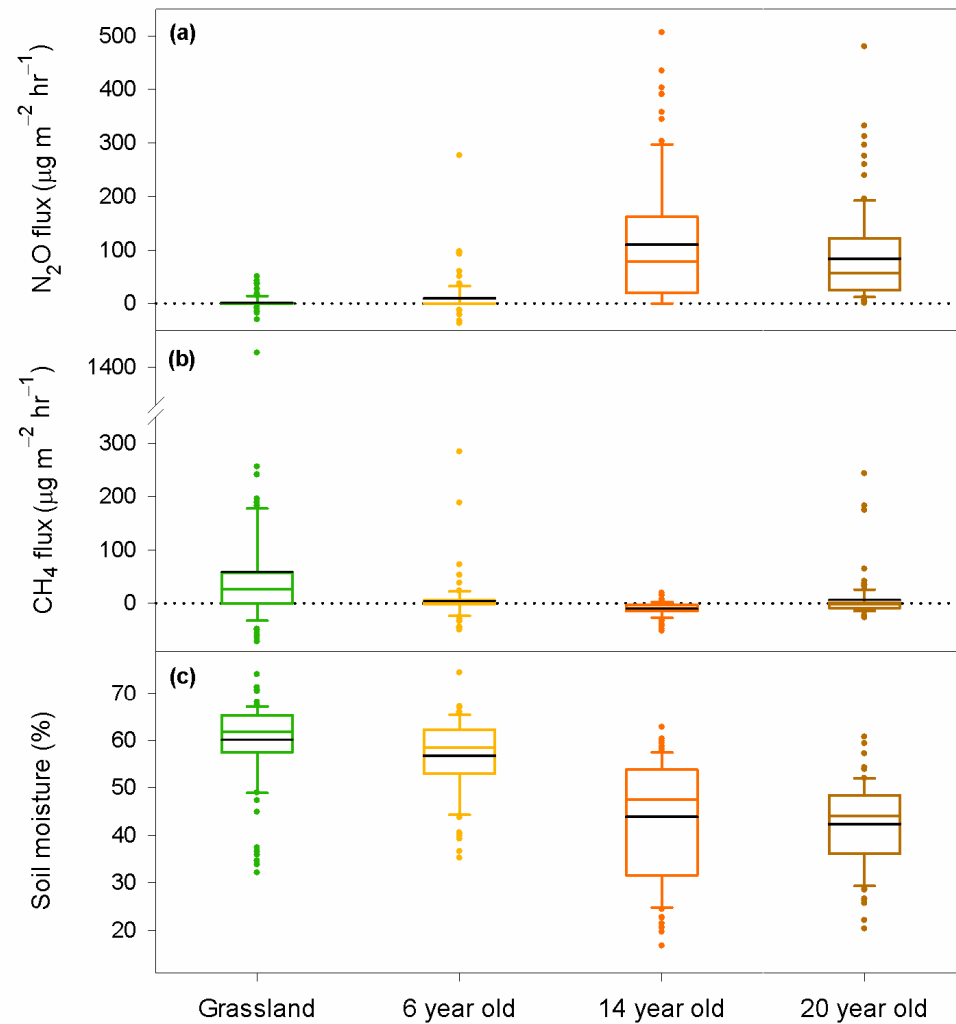
microbial activity



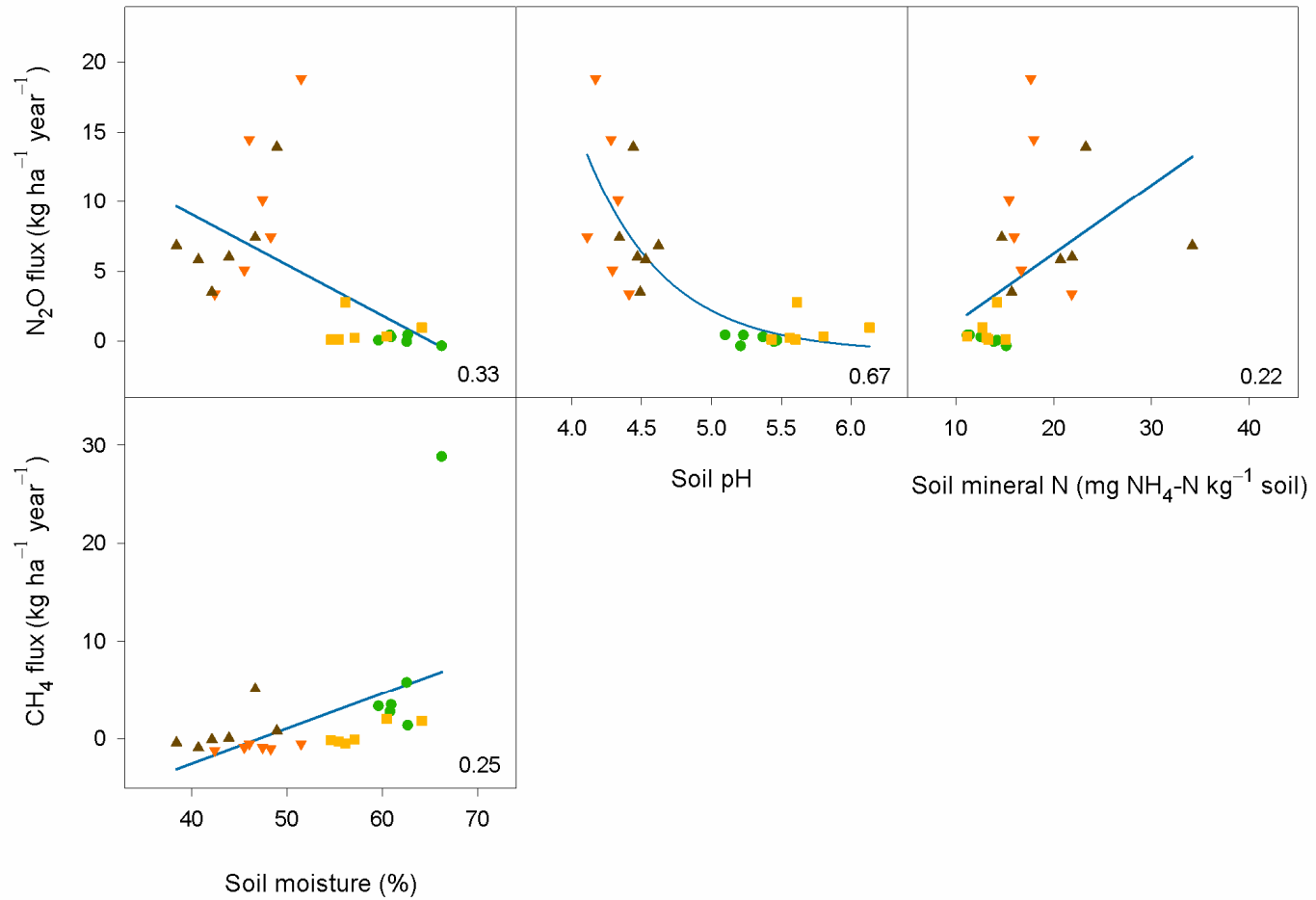
Source: Baggs & Philippot, 2010.



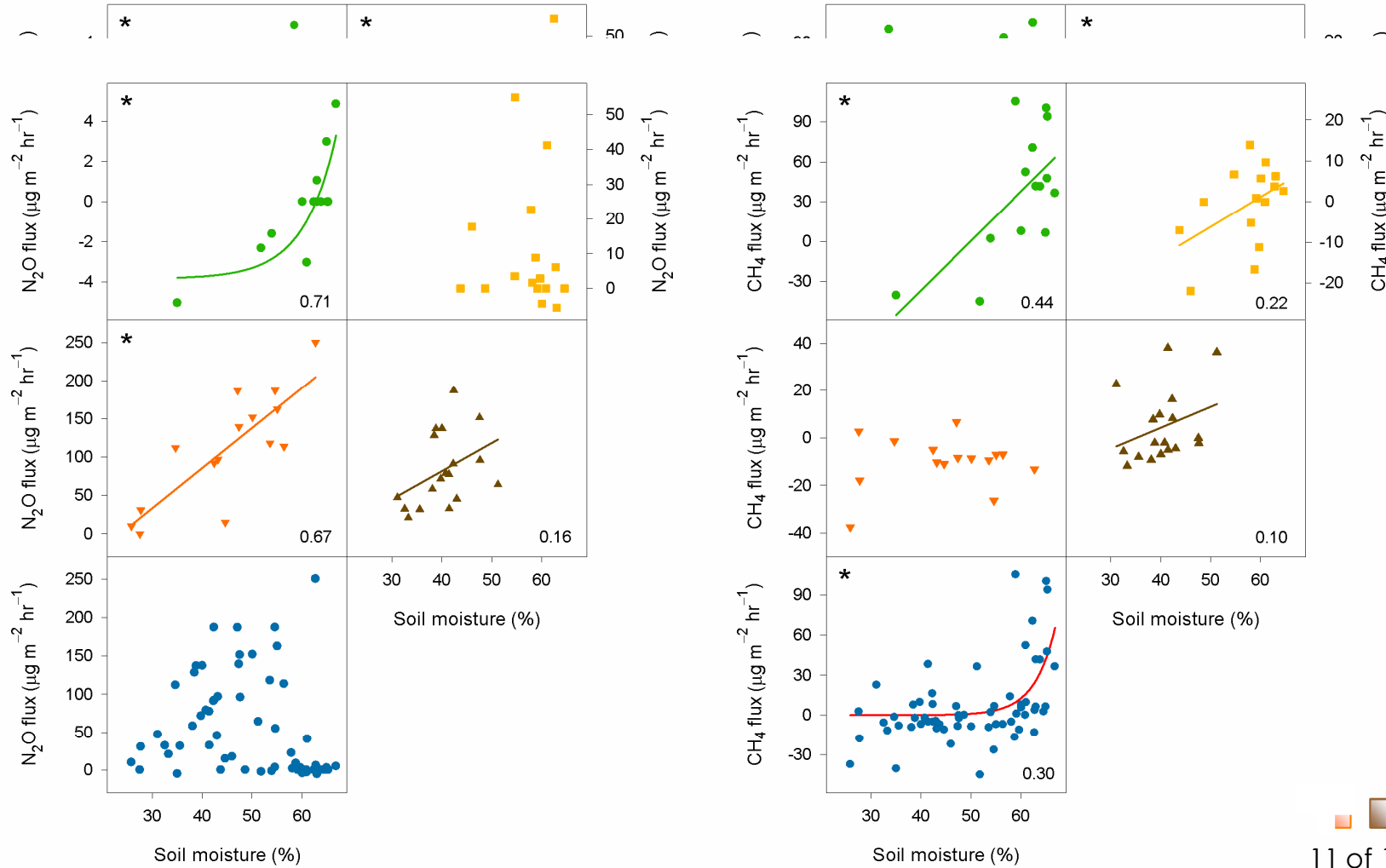
# Possible drivers



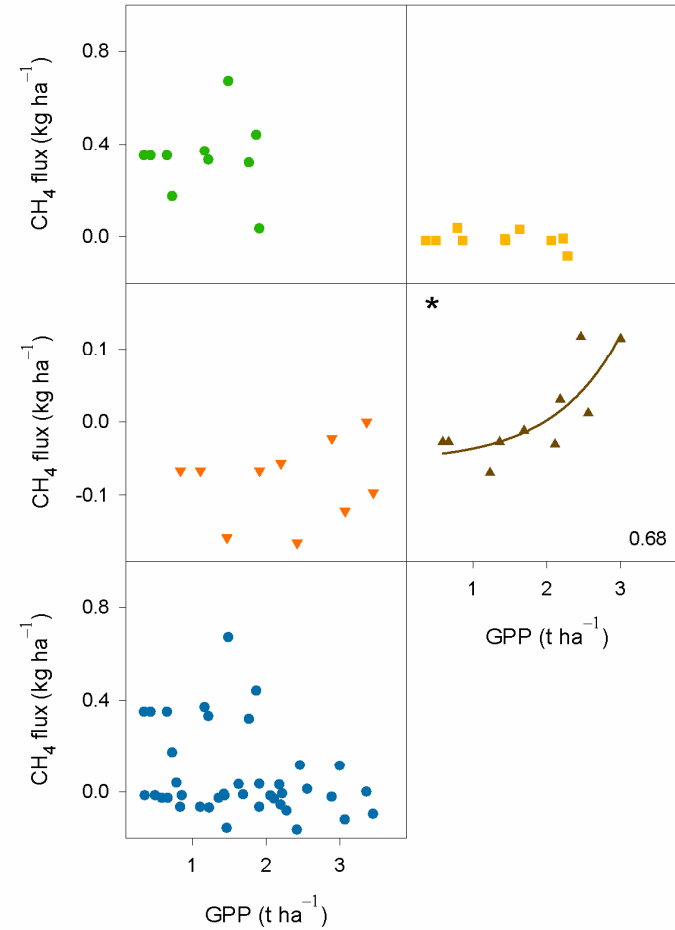
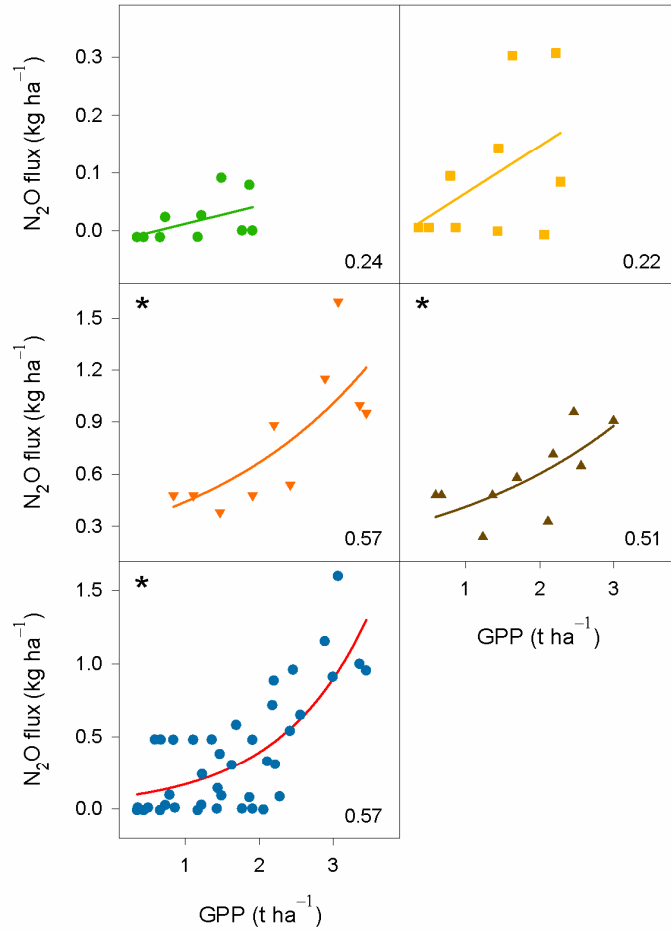
# Possible drivers



# Possible drivers; water



# Possible drivers; available C



GPP data provided by Dr. M. Saunders



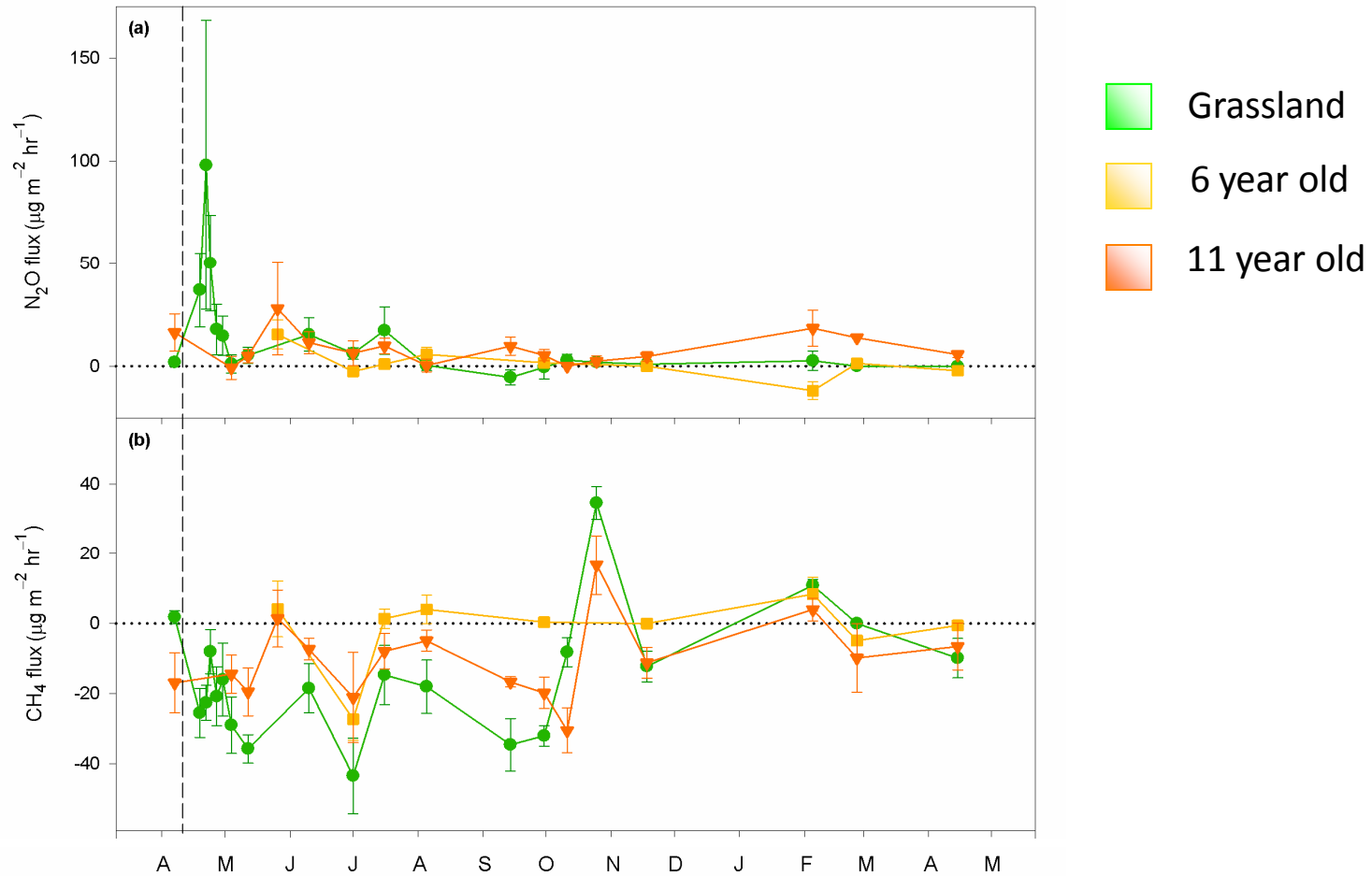
# The deciduous chronosequence



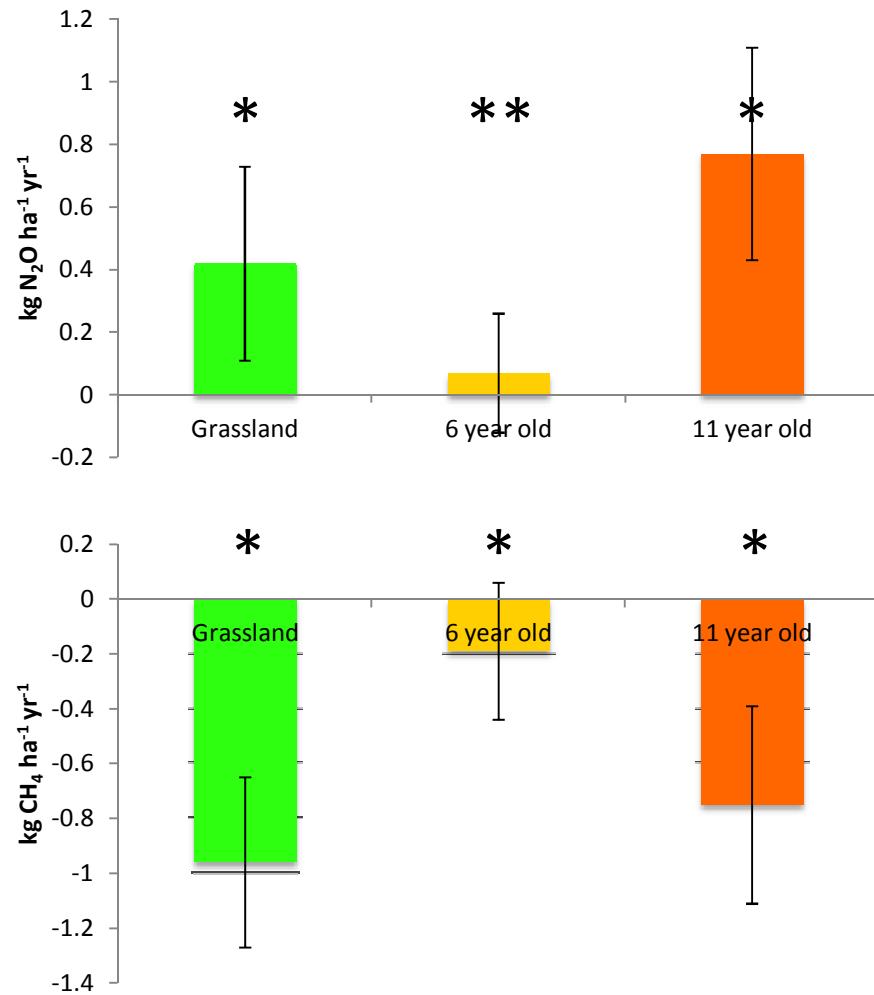
- 3 sites on mineral brown earth soil, Co. Offaly
  - Grassland; fertilized, cut for hay making
  - 6 year old *Fraxinus excelsior* (European ash) forest
  - 11 year old *Fraxinus excelsior* forest



# Average N<sub>2</sub>O and CH<sub>4</sub> effluxes



# Annual cumulative fluxes





# Conclusions



- Land use change (afforestation) impacts on  $N_2O$  and  $CH_4$  emissions are site-specific, depending on site history, changes in management, changes in soil microbial composition and activity linked to transformation in soil properties, maybe changes in rhizospheric competition for available N
- Implications for  $N_2O$  and  $CH_4$  amelioration; coniferous or deciduous? More research is needed, simultaneous sampling, longer time-scale, effects of management (i.e. thinning), analysis of short- and long-term impacts, investigation of root activity on microbial guilds

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