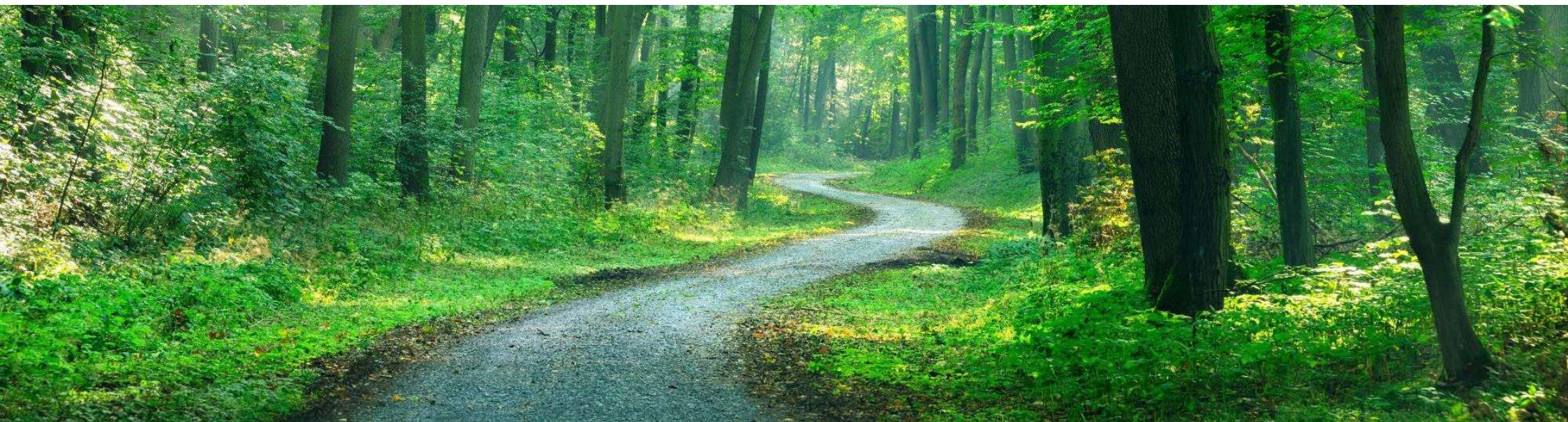


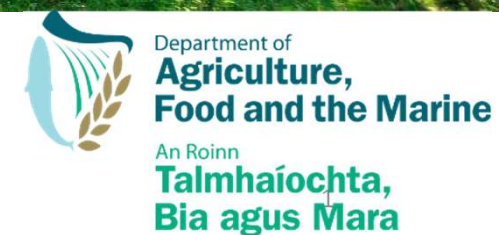


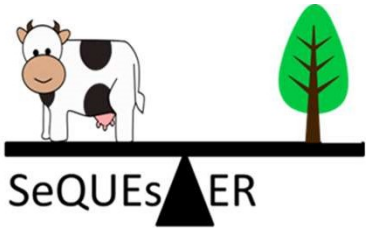
# SeQUEsTER: Pathways to carbon neutrality post 2030



Colm Duffy, Remi Prudhomme, Mary Ryan, Cathal O'Donoghue, David Styles

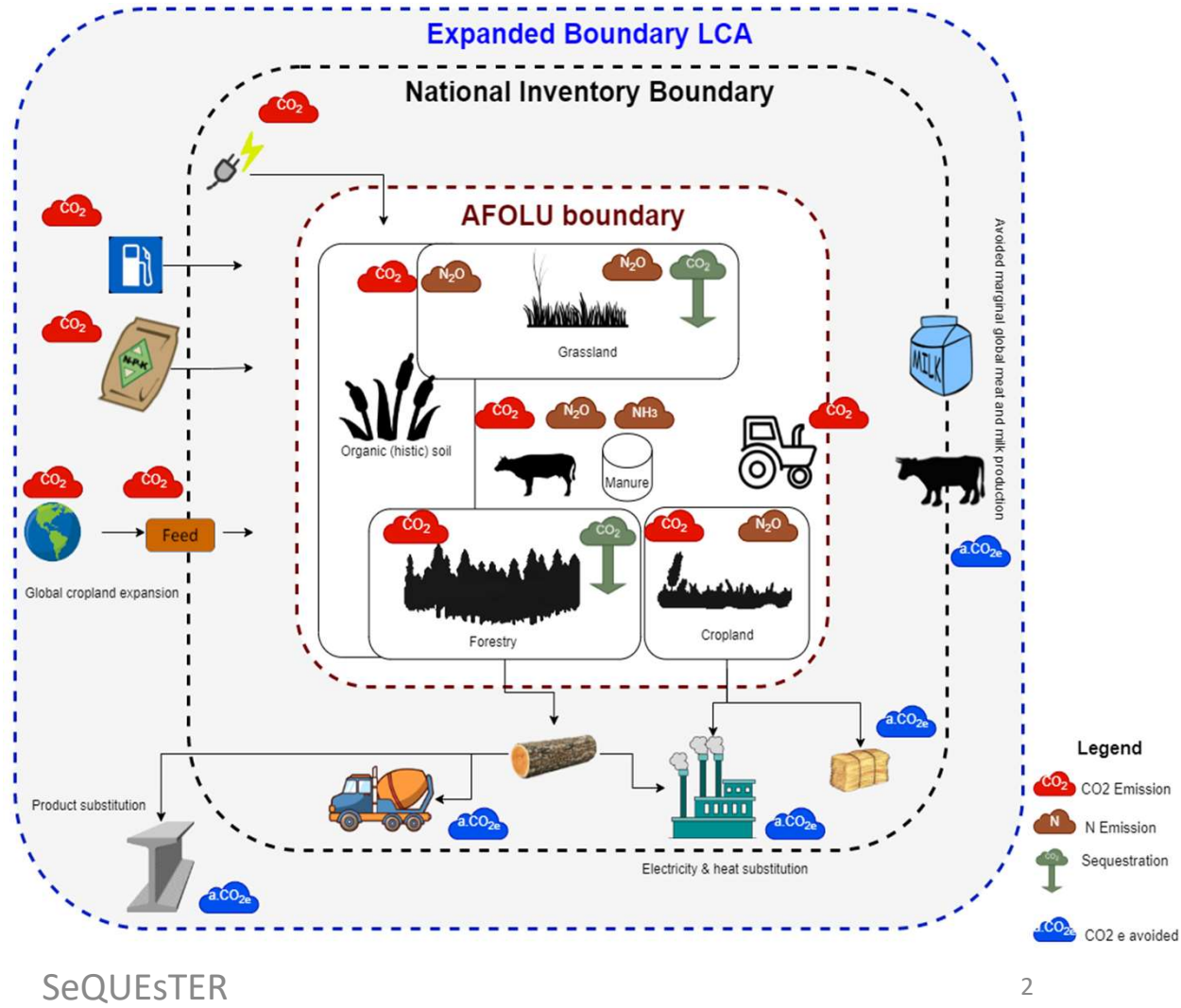
CCAC April 2020

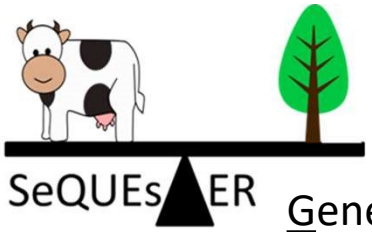




# OBJECTIVE

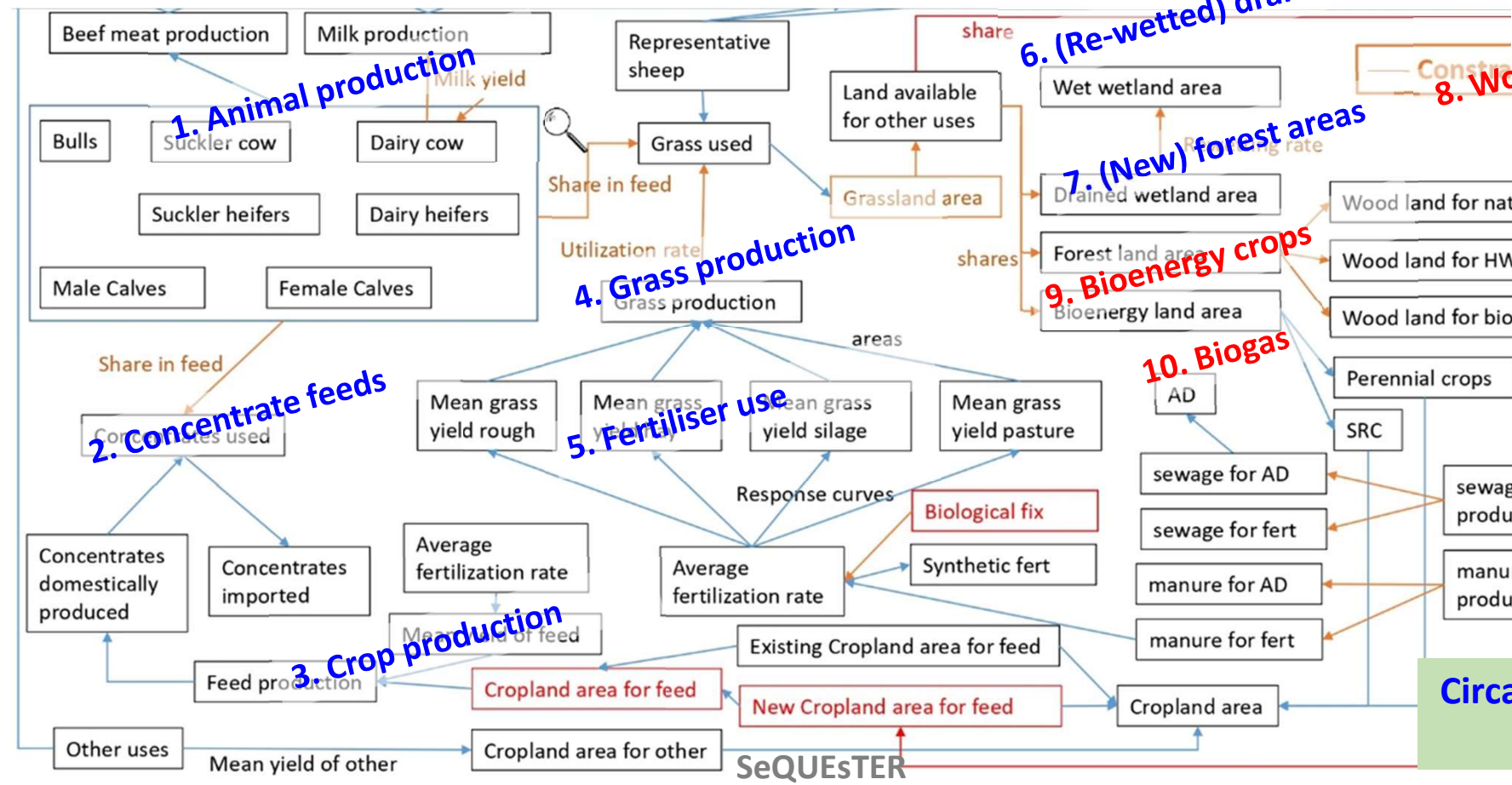
- Identify pathways to a climate neutral AFOLU sector by 2050
- Initial boundary: AFOLU
- Subsequent work: Upstream & downstream consequences



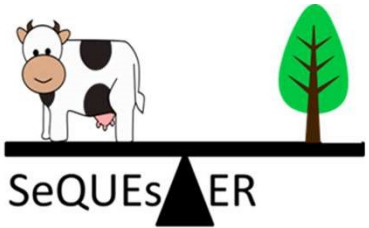


# GOBLIN

General Overview for a Back-casting approach of Livestock Intensification (& land use)



Circa 30,000 lines code!



# DRIVERS: ANIMAL PRODUCTION



X



CH<sub>4</sub>, N<sub>2</sub>O, NH<sub>3</sub>, CO<sub>2</sub> (N & P to water)



X



=

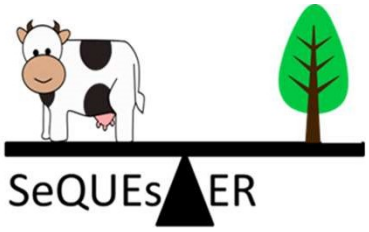


X



SeQUEsTER





# DRIVERS: GRASS PRODUCTION



/

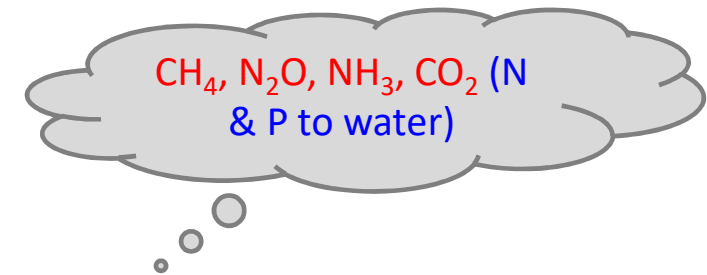


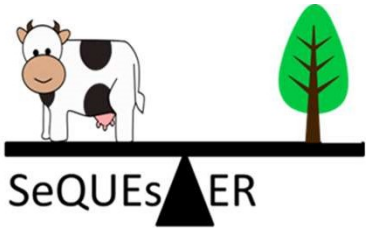
x



use efficiency

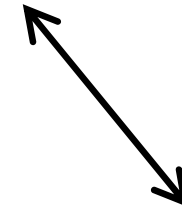
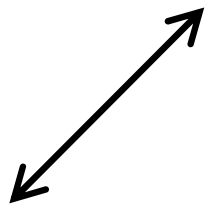
= m<sup>2</sup> (or million ha)! +



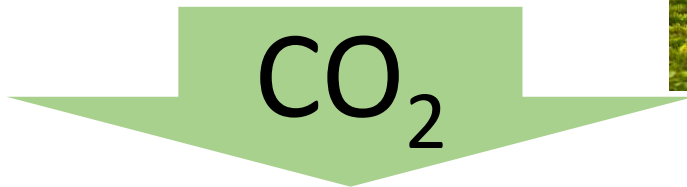


# OFFSET POTENTIAL

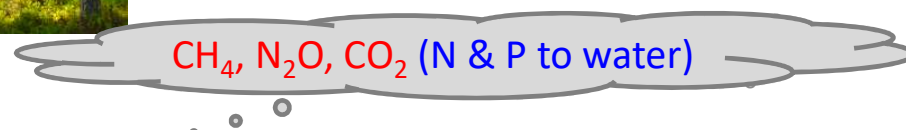
$\Delta m^2$  (million ha) grass

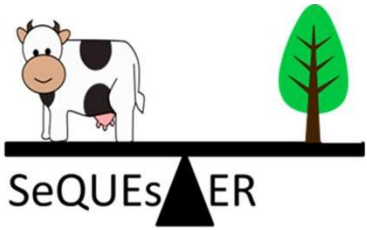


=



+

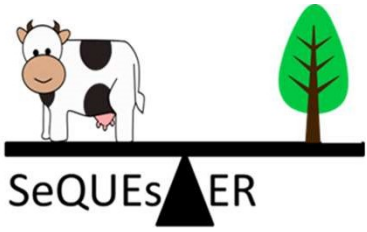




# OUTPUTS (2015-2050)

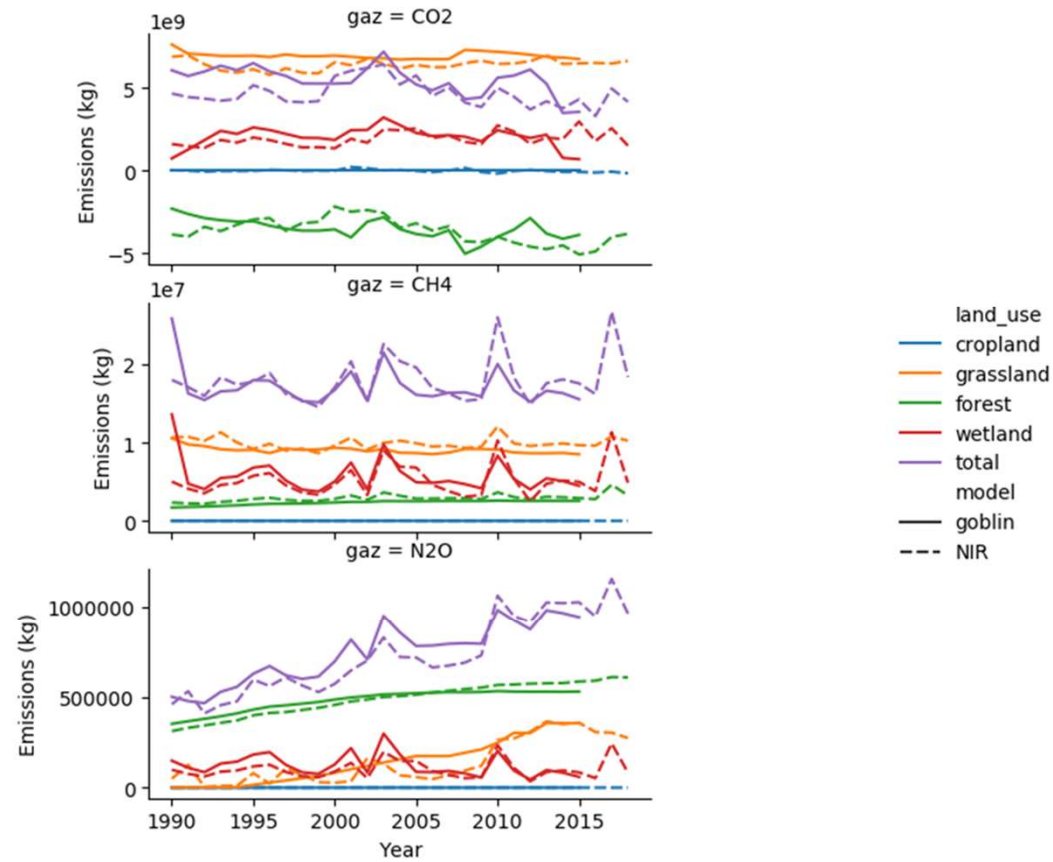
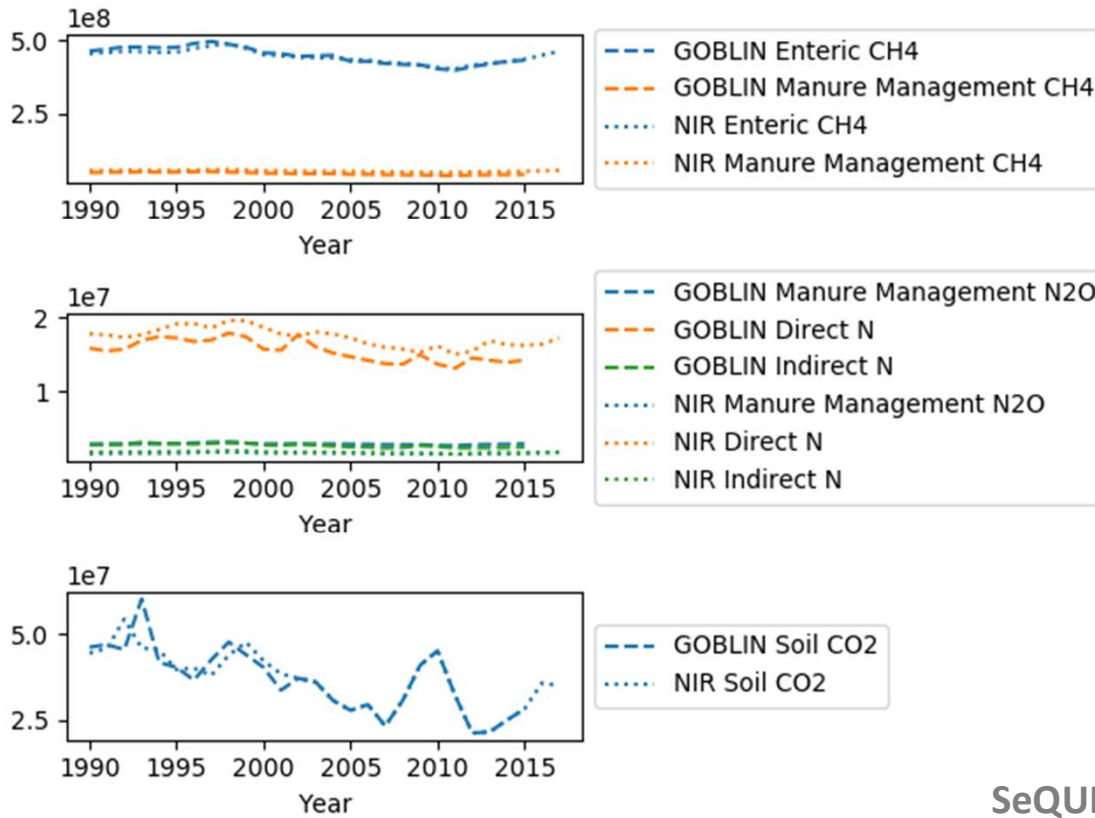
- Agriculture
  - Emissions ( $\text{CH}_4$ ,  $\text{N}_2\text{O}$ ,  $\text{CO}_2$ ,  $\text{NH}_3$ , N & P losses to water)
  - Production
  - Utilised area
- AFOLU
  - Areas & area changes
  - Emissions (organic soils, LUC, biomass removals)
  - Sinks (forestry growth, wetlands, LUC)
- Emissions balance ( $\text{GWP}_{100}$ ,  $\text{GWP}^*$ )
- Randomised scenarios within biophysical constraints (aligned with NIR accounting)  
Filter by emissions balance

>What could climate neutrality look like (what's POSSIBLE)?



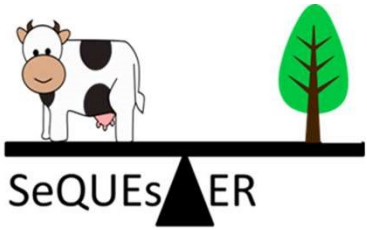
# VALIDATION

NIR activity data IN = NIR emissions OUT



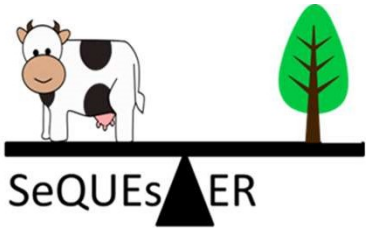
SeQUEsTER



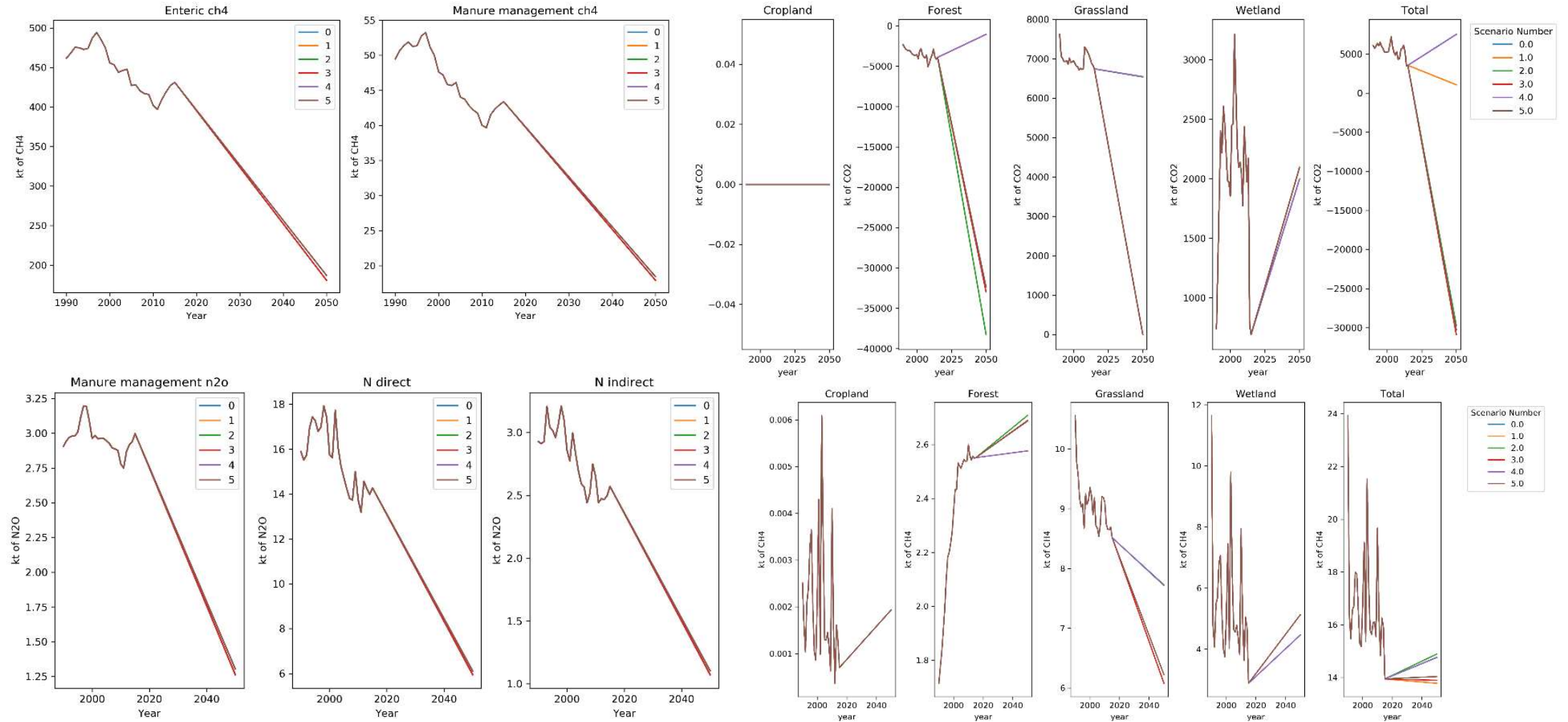


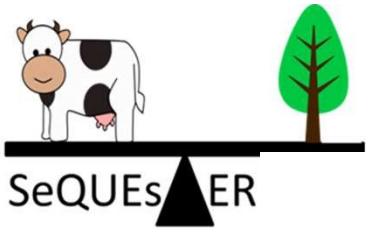
# PRELIM SCENARIOS (2015 baseline)

Scenario	Name	Animal numbers	Productivity	Re-wetting	Forest
		Head/yr	kg/head/yr	ha/yr	ha/yr
0	Animal numbers only	-1.66%	Static	0	0
1	+Grassland rewetting	-1.66%	Static	9,698	0
2	+Afforest.	-1.66%	Static	0	68,432
3	+Rewetting +Afforest.	-1.66%	Static	9,698	58,733
4	+Product.	-1.66%	+0.43% (milk)	0	0
5	+Product. +Rewetting +Afforest	-1.66%	+0.43% (milk)	9,698	57,591

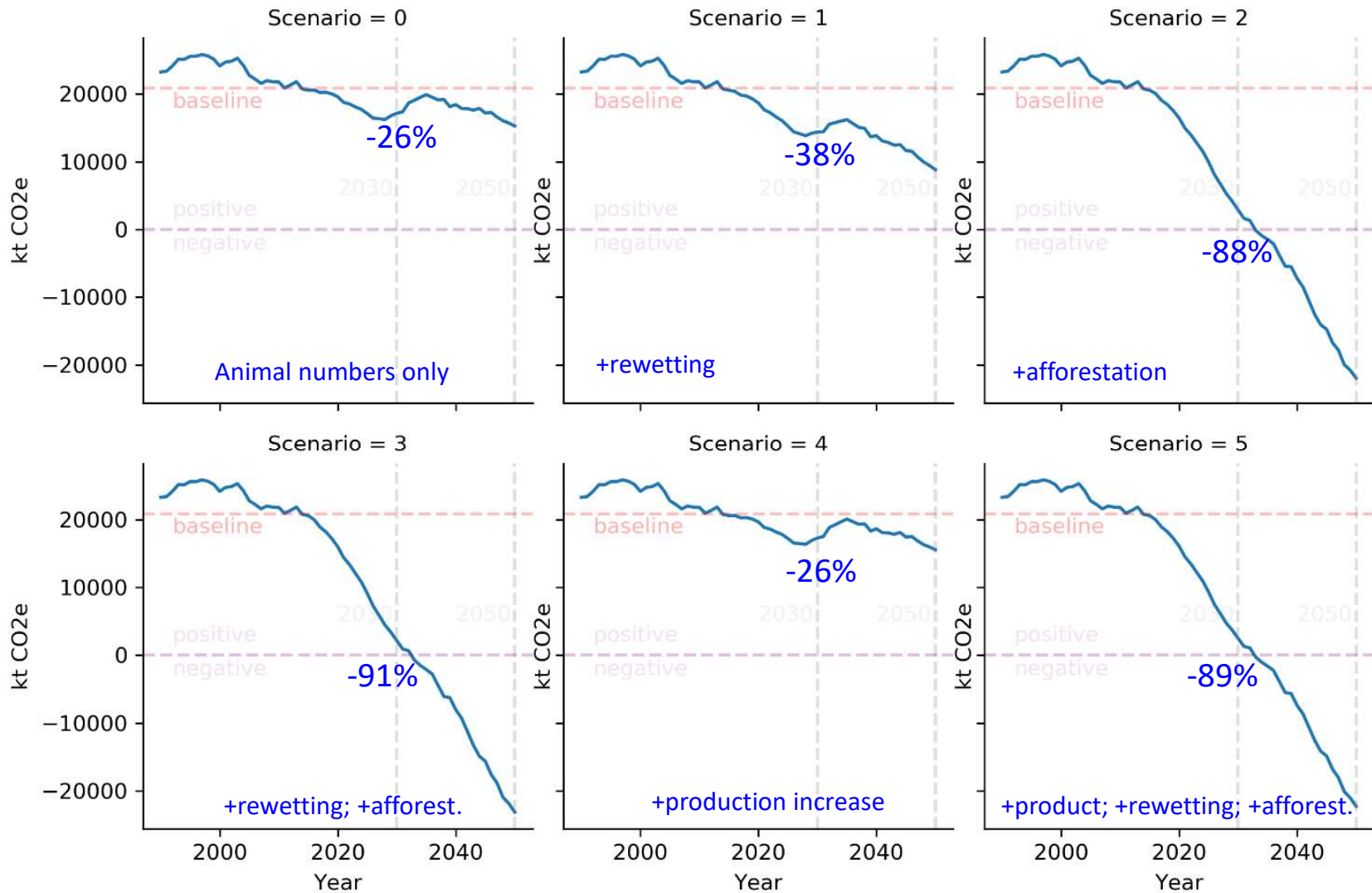


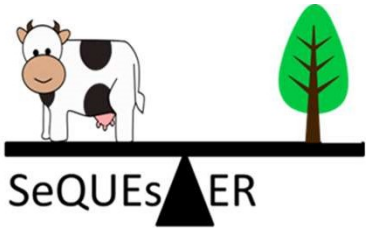
# PRELIM RESULTS (SNAP SHOTS)





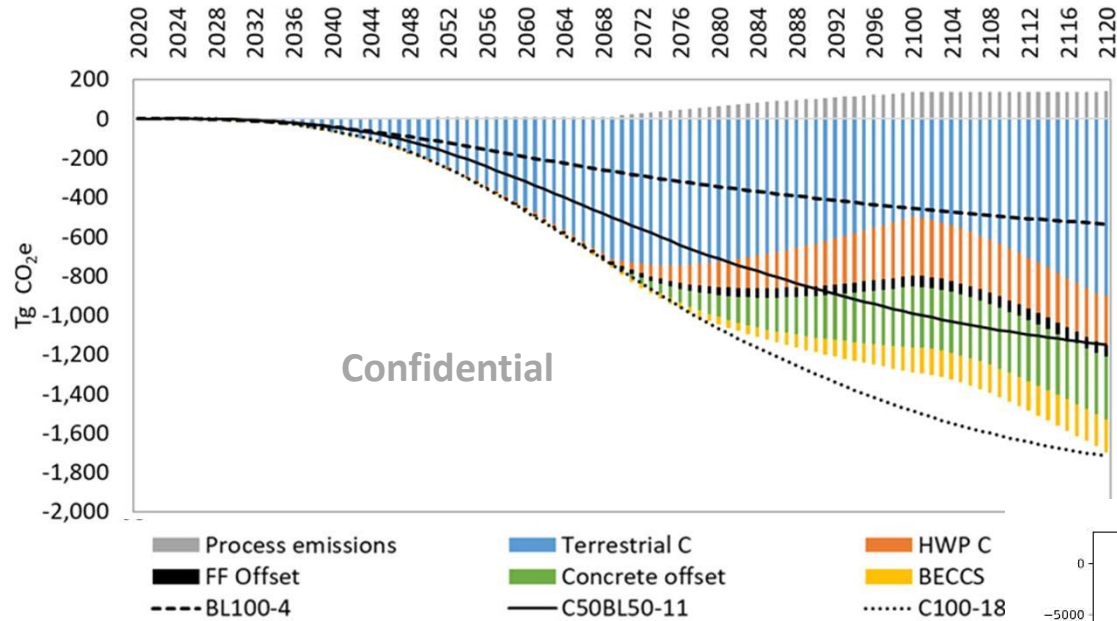
# PRELIM RESULTS (SUMMARY)



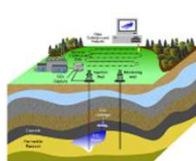
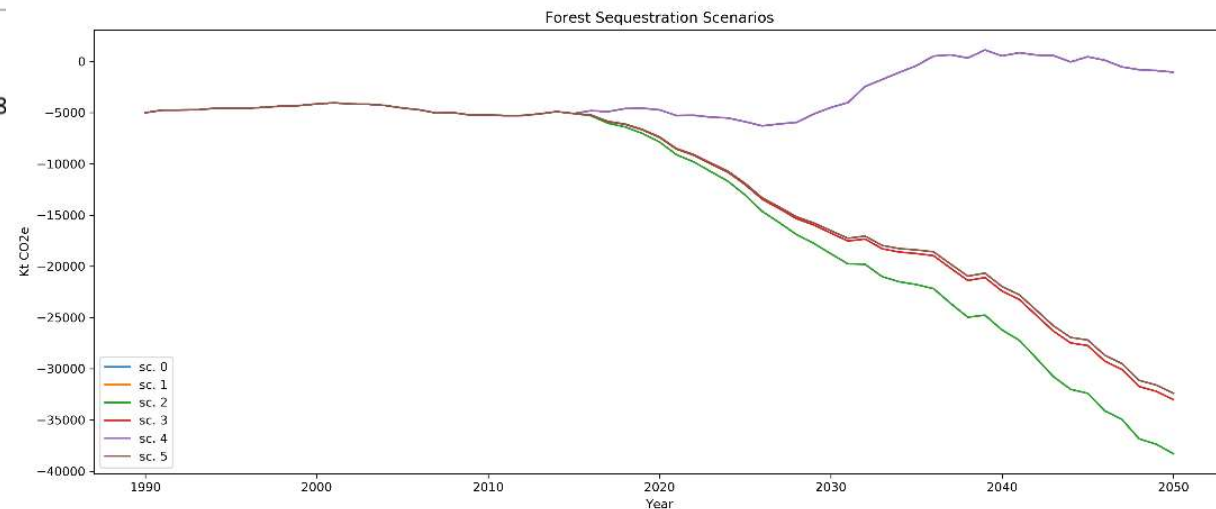


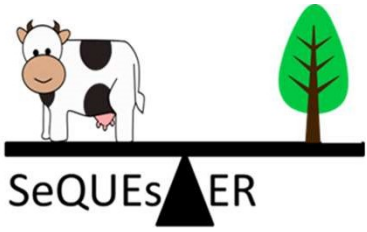
# FORESTRY

- Forestry sink is declining in Ireland
- Commercial forest mitigation *faster & longer* than conservation forests (flexible future uses)
- Rolling planting = just 15% of 100-yr mitigation achieved by 2050!
- Long term, more trees in ground = more headroom for animal production
- Planting needed **NOW!**



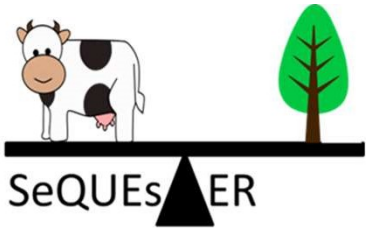
Forster et al. (accepted). Nature Comm.





# CONCLUSIONS

- Climate neutrality = Animal production *interacting* with land use
- GOBLIN identifies *biophysical constraints* to long-term AFOLU climate neutrality
  - Socio-economic-cultural-policy filters can then be applied
- Need to integrate with wider climate neutrality plans
  - Bio-energy/product demand
  - Residual offsetting (i.e. AFOLU > climate neutral?)
- Climate neutrality not a technical challenge; direction of travel clear
  - Plant trees & rewet organic soils
  - How much animal production can these measures support?



# Questions welcome...

David.Styles@ul.ie



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