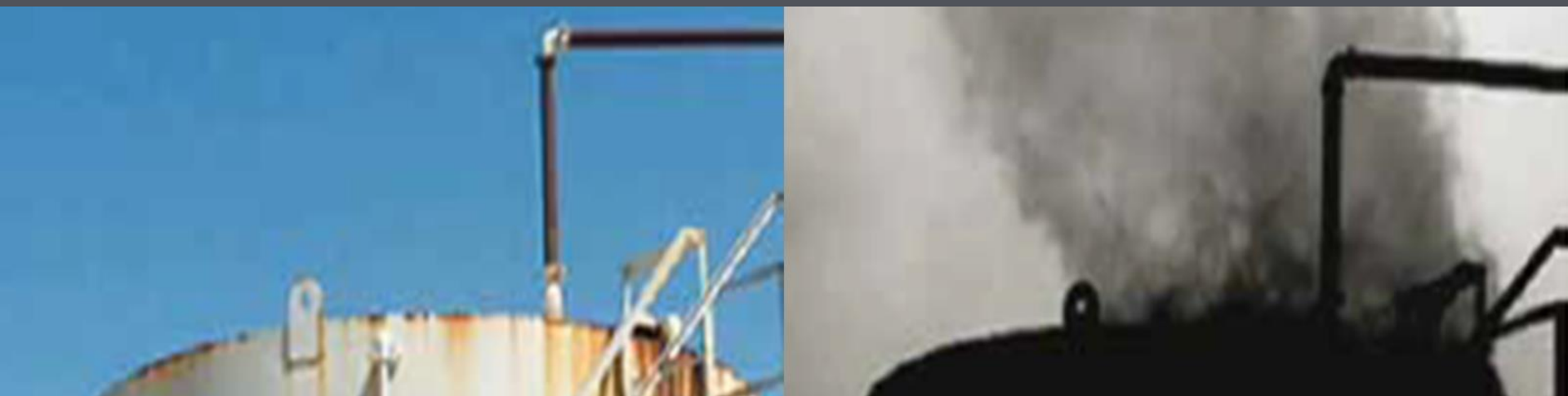


# BENEFITS OF METHANE MITIGATIONS



## **Methane, Ozone and the Carbon Budget for 1.5 degrees (MOC1.5)**

Bill Collins, Chris Webber, Peter Cox, Stephen Sitch, Jason Lowe, Chris Huntingford

Sarah Chadburn, Edward Comyn-Platt, Anna Harper, Garry Hayman, Tom Powell

# Cutting methane emissions can make a major contribution to the goal of limiting climate change

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Methane gas emissions from human activities have made a sizeable contribution to the changes in climate observed so far. This new scientific study finds that the benefits from reducing methane emissions are larger than many previous studies have estimated.

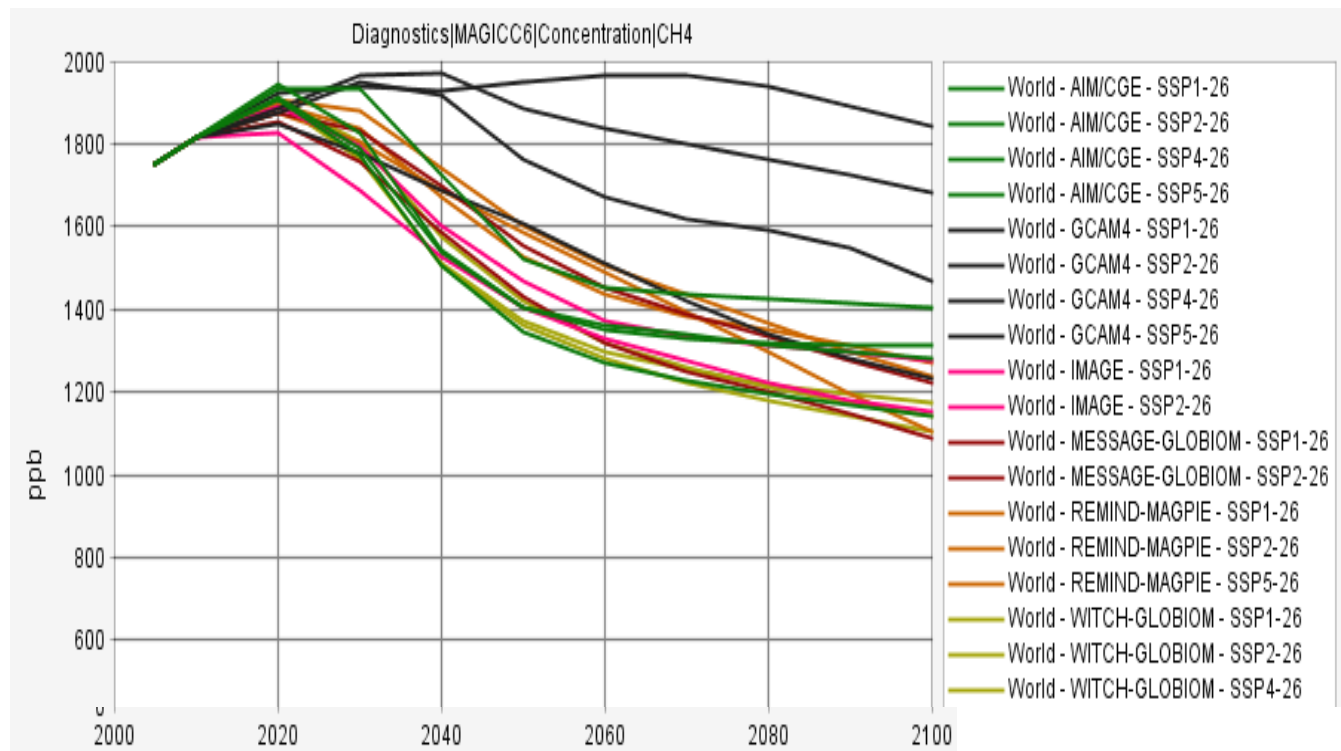
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**Rapidly reducing methane emissions means that it becomes more feasible to limit warming to lower levels.**



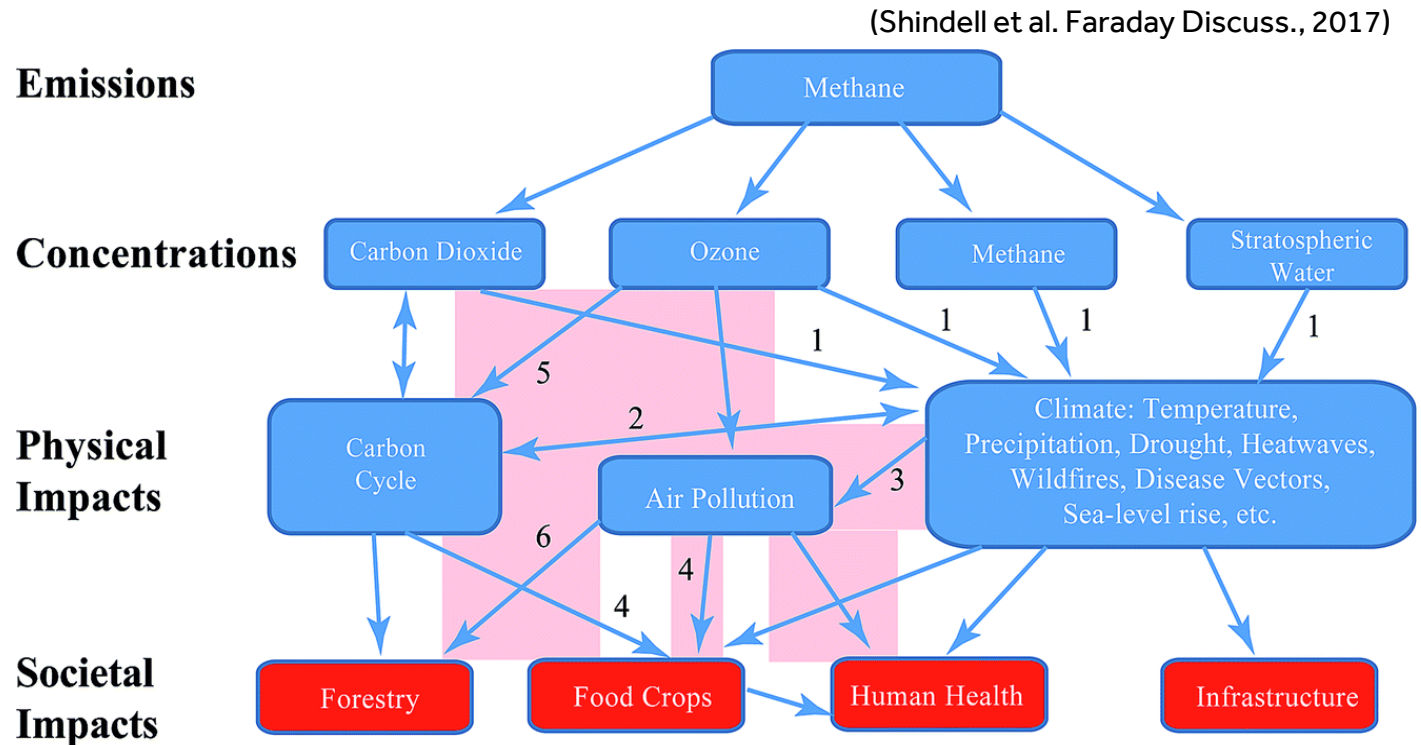
# MITIGATION

- Latest IPCC scenarios:-
- Even for a 2°C target:
  - Wide spread of possible methane concentrations
- Based on assumptions of marginal abatement costs vs CO<sub>2</sub>
  - Different models include different suites of abatement measures



# SOCIAL COST OF METHANE

- Current scenarios from IAMs don't include the social costs of methane
- This can double benefit of abatement

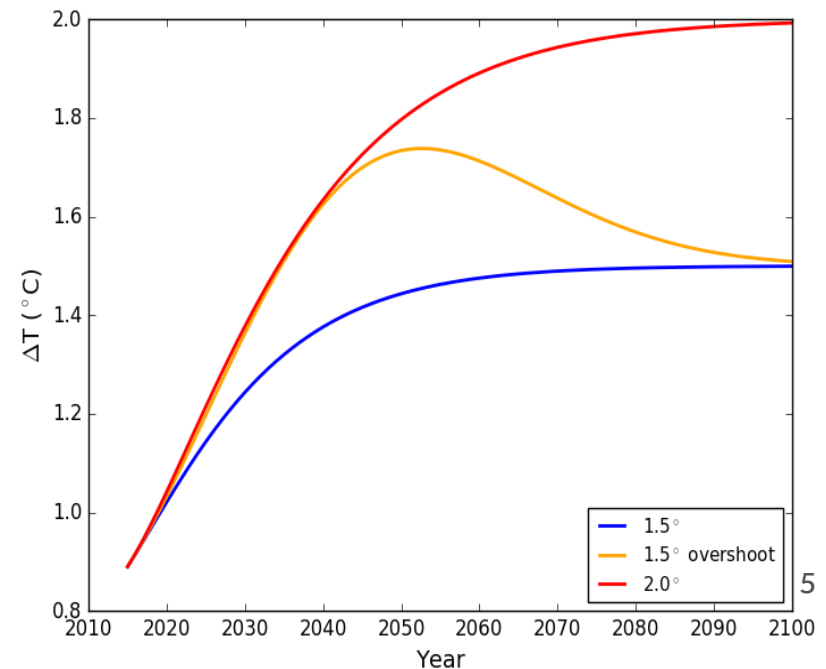
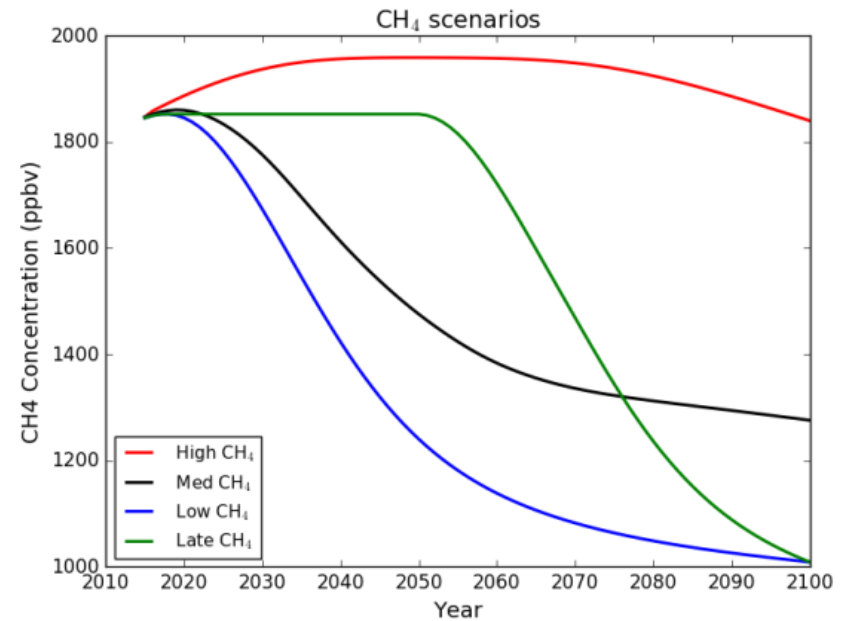


# SCENARIOS

- We test the effect of 4 methane scenarios
  - High (highest of SSP2-2.6)
  - Medium (lowest of SSP2-2.6)
  - Low (lower still)
  - Late (starts at 2050)

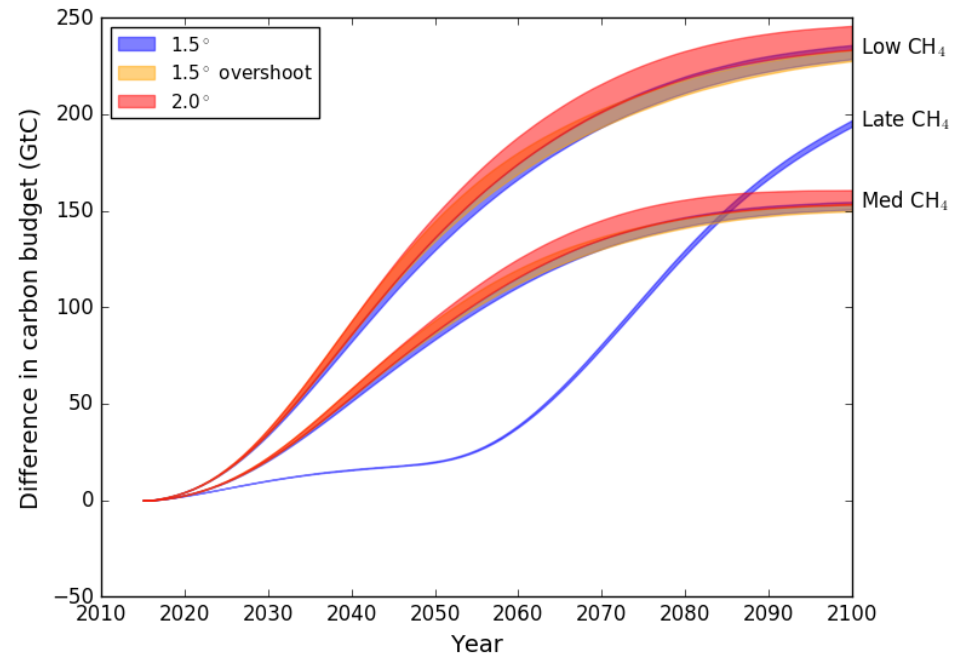
## Inverse modelling

- Calculate CO<sub>2</sub> emissions consistent with three temperature profiles
  - 1.5°
  - 1.5° with overshoot
  - 2.0°
- Using IMOGEN-JULES to simulate 35 climate models



# RESULTS

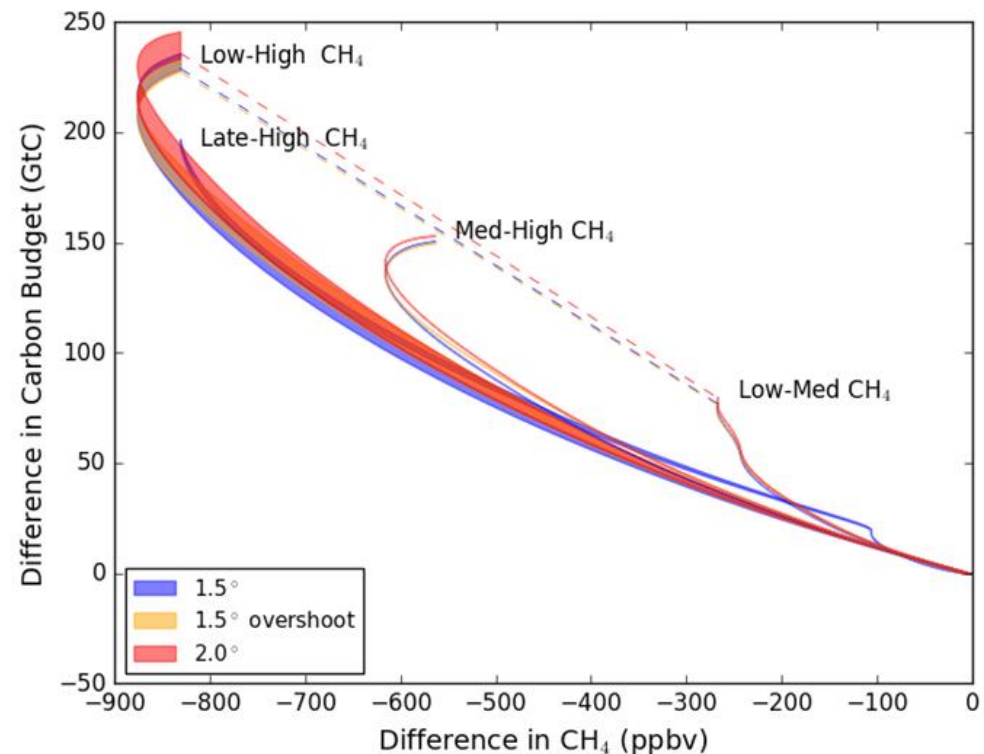
- Methane mitigation does increase the allowable carbon budget
- Doesn't seem to depend on temperature profile or climate model
- “Med” methane scenario allows extra 155 GtC budget compared to “High”
- “Low” methane scenario allows extra 235 GtC budget compared to “High”
- “Late” mitigation has 40 GtC less benefit than “Low”





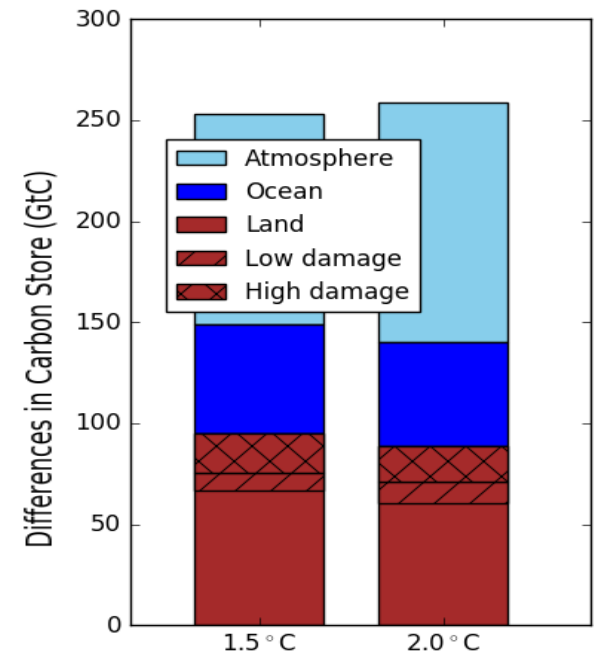
# RELATING METHANE TO CO<sub>2</sub>

- Simple relationship between CH<sub>4</sub> concentration and carbon budget
  - 0.27 – 0.28 Gt(C)/ppb(CH<sub>4</sub>)
  - (assuming mitigation is early enough)



# EFFECT OF OZONE

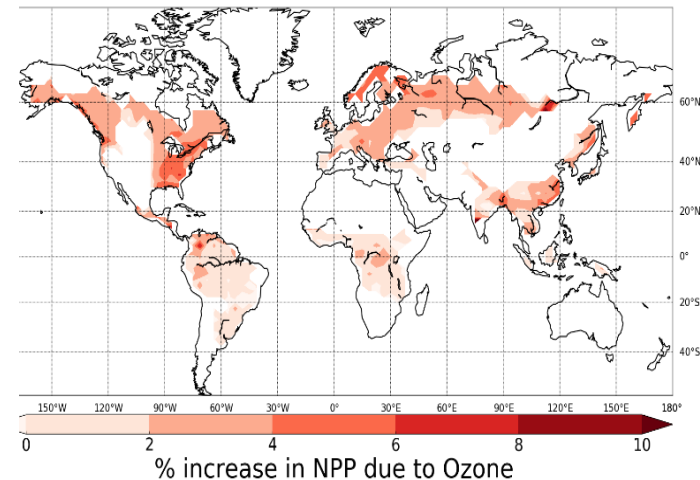
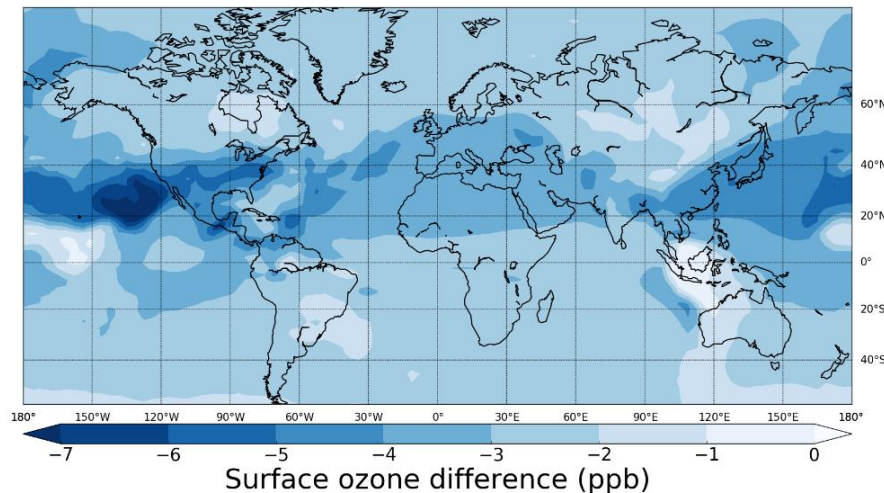
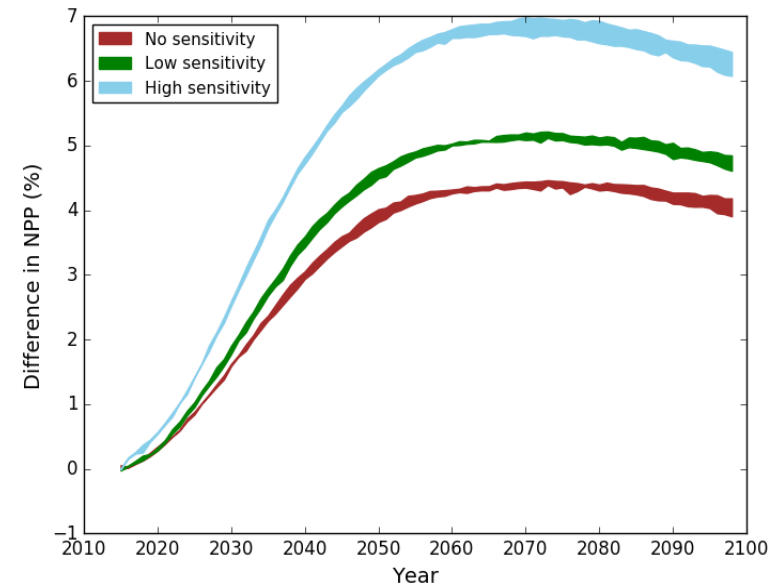
- Impact of ozone damage is to increase the carbon stored on land
  - (remember we are decreasing methane & hence ozone)
- Assuming a higher sensitivity of plants to ozone
  - -> more benefit from methane mitigation





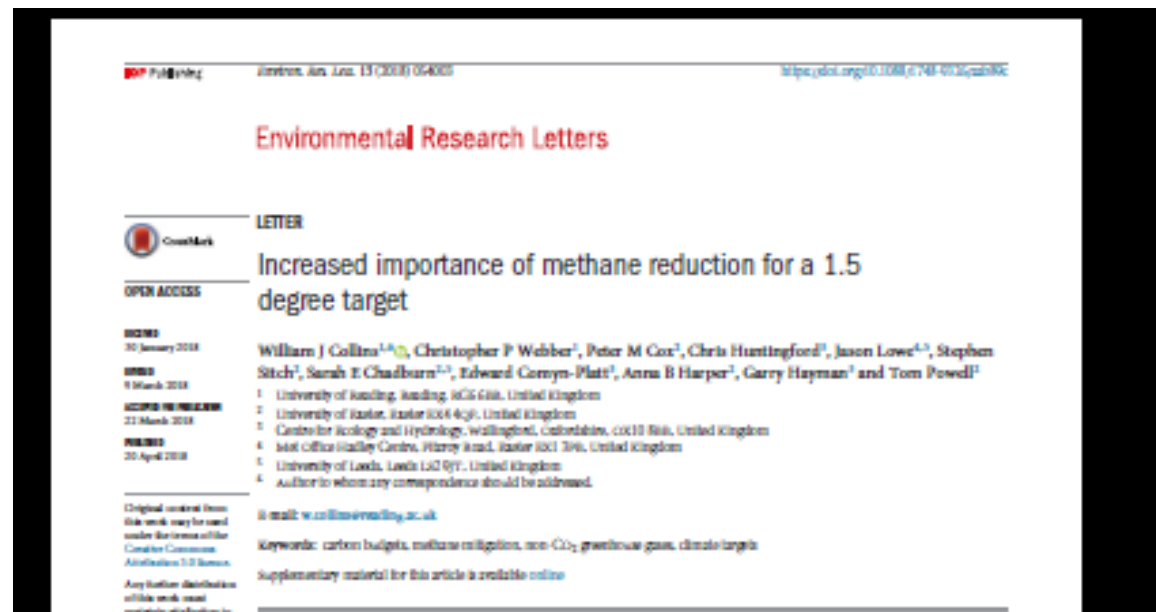
# NON-CLIMATE BENEFITS

- Mitigation of methane is good for plant productivity
  - More CO<sub>2</sub> allowed in the air
  - Less ozone damage
- Good for people
  - Less air pollution



# PAPER

- Published in April
- Cited by IPCC 1.5 Report



# CONCLUSIONS

- Methane mitigation within standard 2° scenarios can lead to substantial increases in allowable carbon emissions
  - Robust relationship  $\Delta E_{\text{CO}_2} = 0.27 \Delta \text{CH}_4$  (GtC per ppb)
  - Equivalent to comparing change in emission *rate* of  $\text{CH}_4$  with change in *cumulative* emission of  $\text{CO}_2$
- Accounting for ozone damage adds 4-12% to the benefit
- Methane mitigation also benefits
  - Increase plant productivity/crop yields
  - Improved human health
- The MOC1.5 project provides motivation for exploration and costing of more ambitious methane reduction potentials