What are the success stories in agricultural mitigation?

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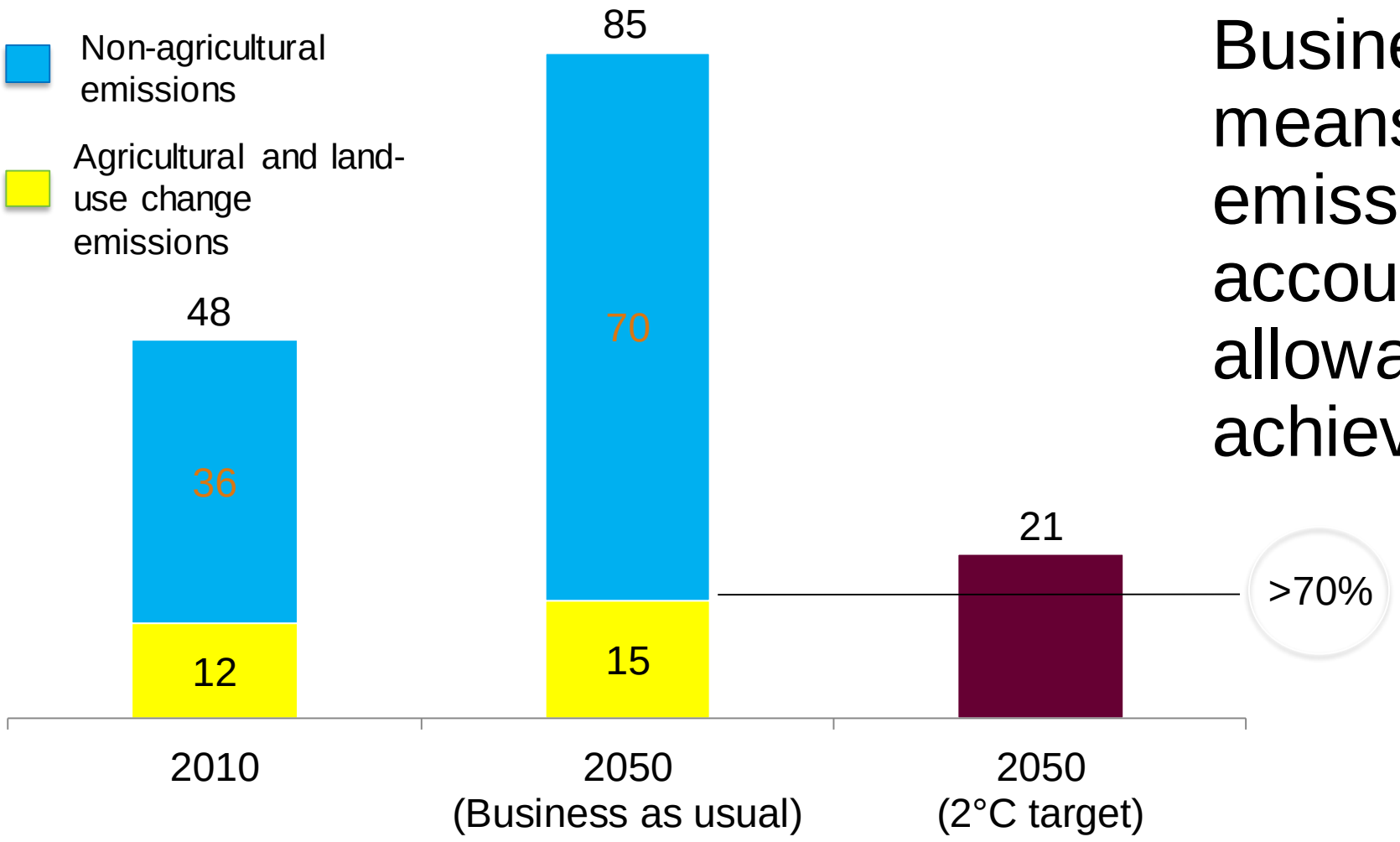
Why is GHG mitigation in agriculture important?



Business-as-usual means that agriculture emissions would account for >70% of allowable emissions to achieve a 2°C world

Technical mitigation options

Numerous mitigation options available in agriculture

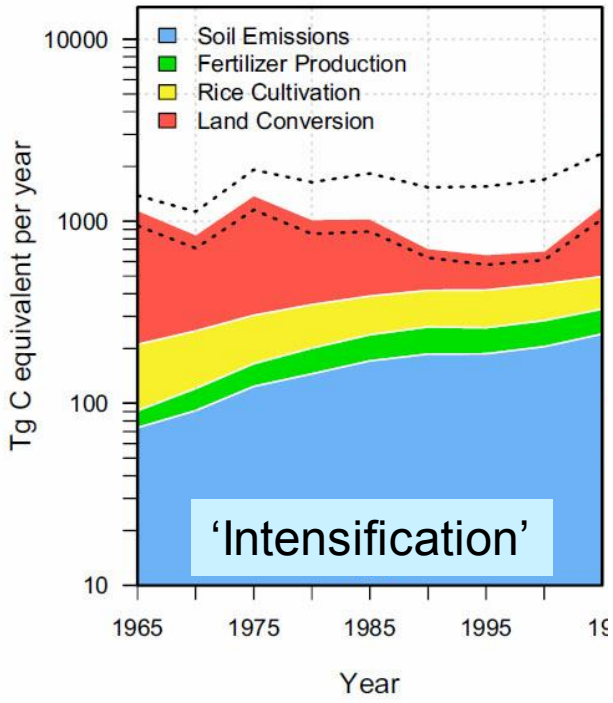
Mitigation options:

- **cropland management**
  - Nutrient management (timing, placement, source, rate),
  - water management (irrigation, drainage)
  - rice management (AWD),
  - agroforestry,
  - land use change.
- **grazing land management**
  - pasture improvement,
  - grazing intensity, I
  - increased productivity (e.g. fertilization),
  - nutrient management,
  - fire management,
  - species introduction (including legumes)
- **restoration of degraded lands**
  - erosion control,
  - organic amendments,
  - nutrient amendments
- **livestock and manure management**
  - improved feeding practices
  - specific agents and dietary additives
  - longer term structural and management changes and animal breeding
  - manure/biosolid management
  - improved storage and handling
  - anaerobic digestion - more efficient use as nutrient source
- **bioenergy energy crops, solid, liquid,**
  Energy crops, biogas, residues

Source: Smith et al., (2008).

Mitigation at scale: improved crop yields

Net effect on GHG emissions of historical intensification (1961-2005)

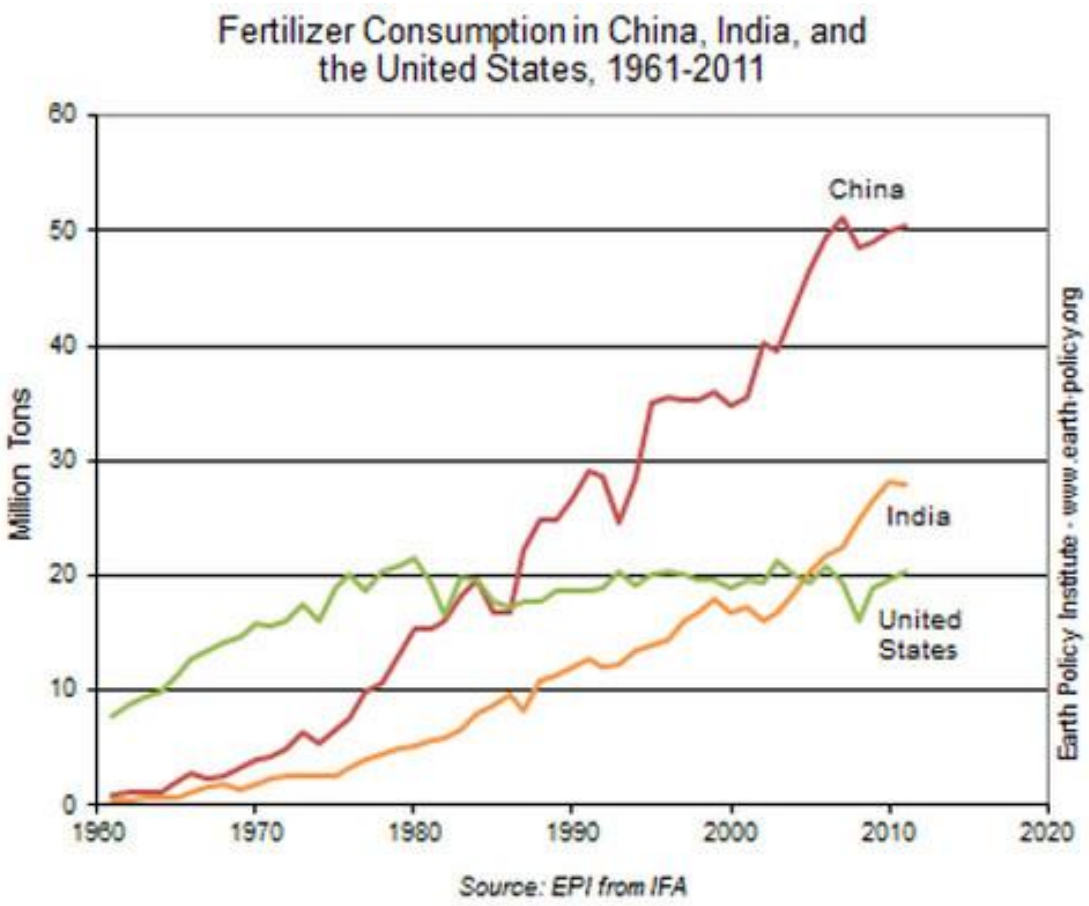


Source: Burney et al., 2009 PNAS

Agricultural Intensification:

- Investment in yield improvement has saved 590 Gt CO_2e since 1961.

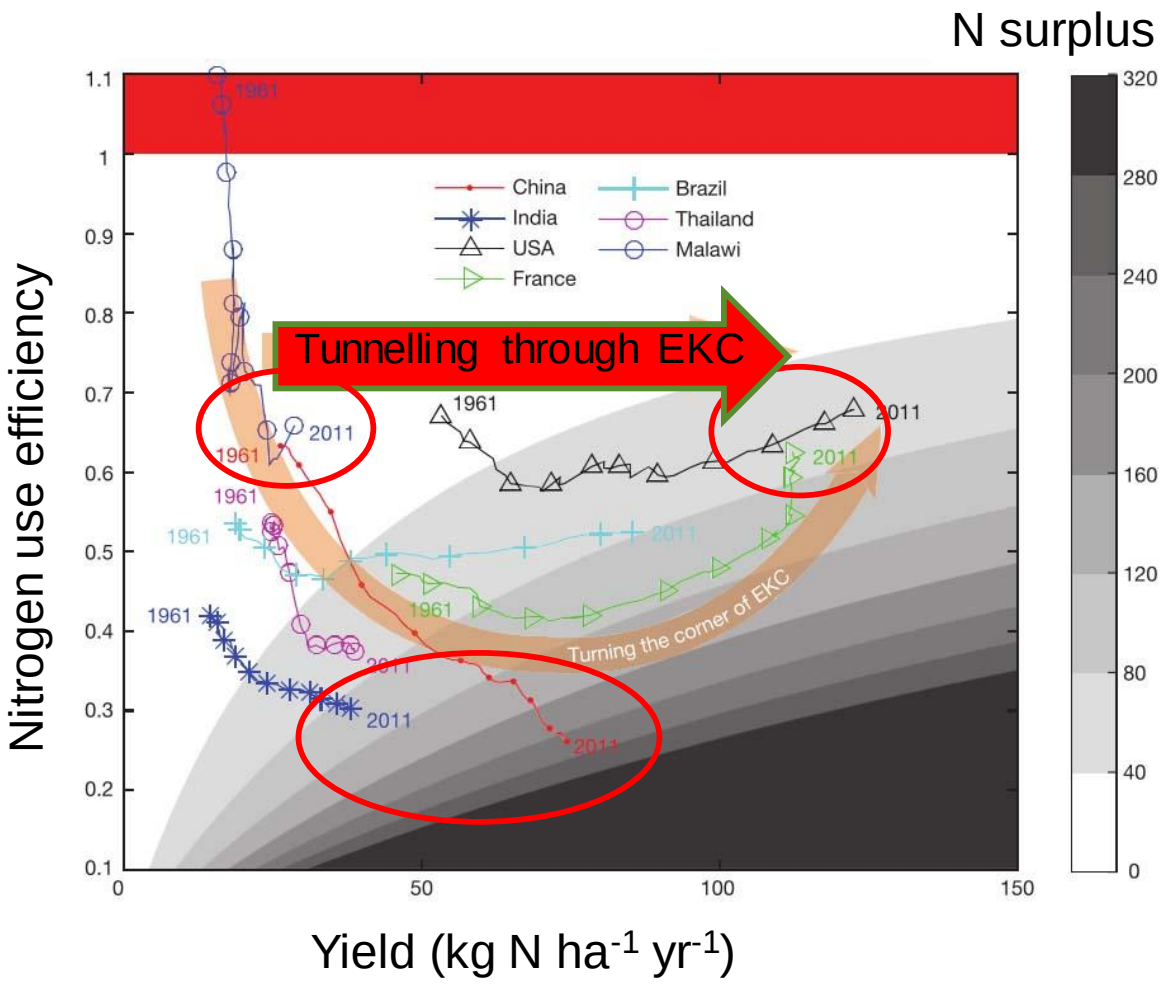
Mitigation at scale: improved fertiliser use efficiencies



Fertiliser consumption

80% of the global increase in N fertilizer consumption in the last decade (2000-2009) came from China & India.

Mitigation at scale: improved fertiliser efficiencies

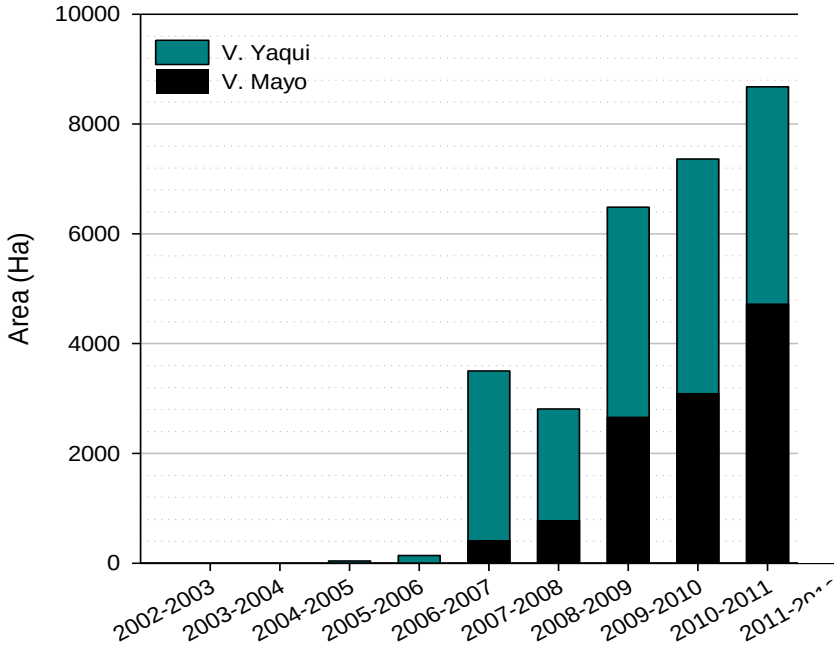


Analysed 50 years data (1961-2011) on national-level N use, crop yield and GDP for 113 countries:

- **USA & France:** evidence of 'turning the corner' and now operating within global limit for N surplus.
- **China & India:** no turning point yet and much ground to make up to reduce N surplus once the corner is turned.
- **Malawi:** on a classic downward trajectory of NUE – although in recent years this decline may have reversed.

Source: Zhang et al., 2015 Nature

Mitigation at scale (modest): Scaling of precision N management tools in Mexico



Greenseeker:

- Optical sensors - reduced N use by 30-40% with no loss of yield.

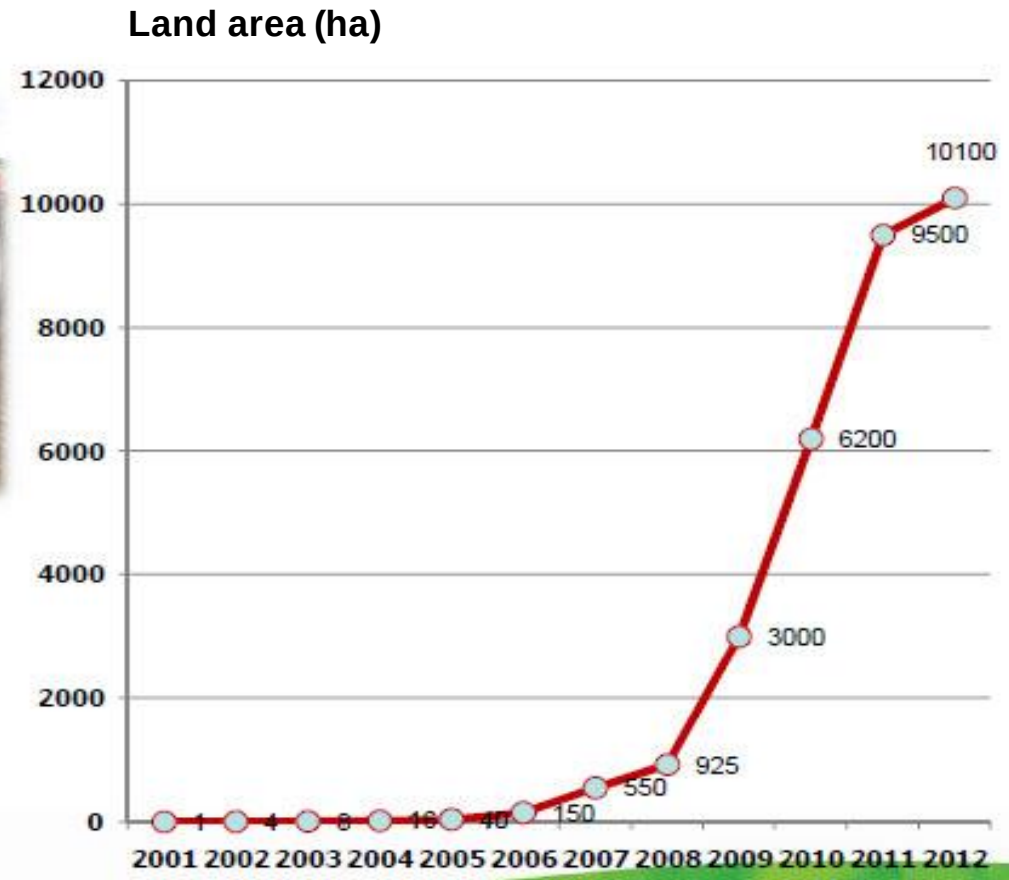
GreenSat:

- Mexican government (SAGARPA) is now hosting GreenSat.

Mitigation at scale: Laser land-leveller in NW India

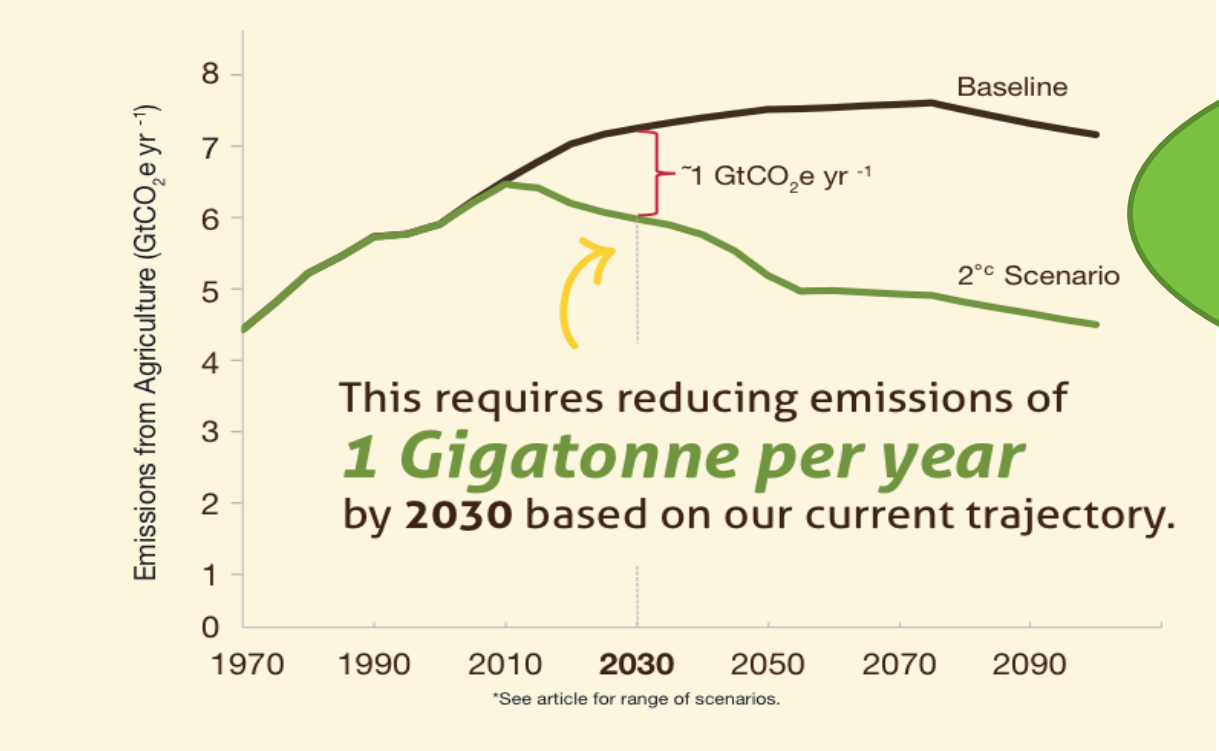
Farm level benefits in RWCS of IGP

- ~7 % gain in crop productivity
- ~20 % (18 ha-cm yr^{-1}) saving in irrigation water,
- US$ 113 to 175 ha^{-1} higher system profitability
- 10-13 % higher agronomic efficiency of nitrogen



Source: Jat et al, 2005, 2006, 2009a,b,2011

2ºC warmer planet: 1 $GtCO_2e$ mitigation needed annually in agriculture by 2030 (11-18% reduction)



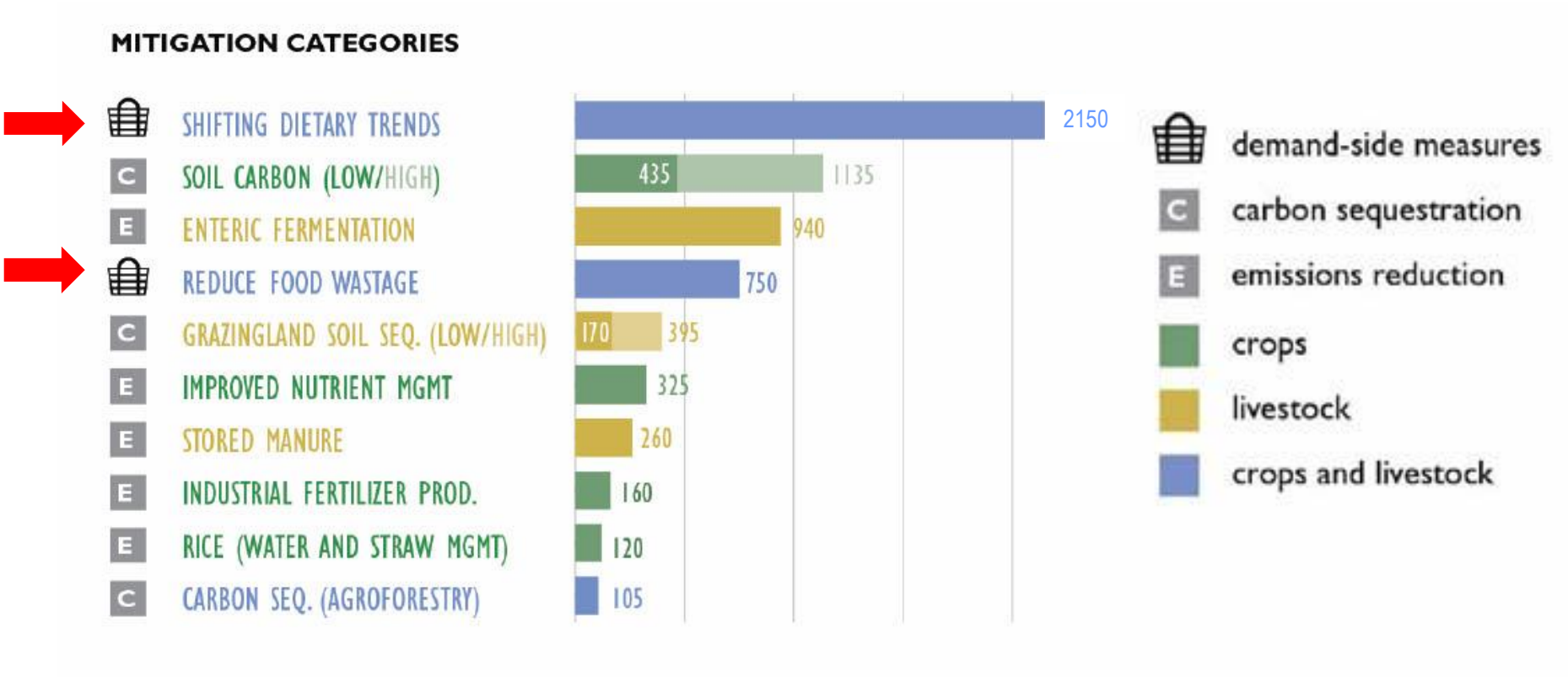
Achieve only 21-40% of mitigation needed in agriculture by 2030 even if implemented at scale

Source: Wollenburg et al, (2016) Global Change Biology, 22, 3859–3864

Increased global commitment to mitigation in agriculture

- 119 countries intend to make emissions reductions in agriculture
- Over 60% are developing countries

Mitigation options - some numbers (2030)



Source: Strategies for Mitigating Climate Change in Agriculture. California Environment Assocs. (2014).

Conclusion

- Many scientifically-proven mitigation options in agriculture but challenge remains to reach scale.

- So far, best examples of GHG mitigation at scale have been achieved on the back of priorities to increase production (improved varieties/breeds) and reduce environmental degradation (e.g. pollution of waterways in Europe).

- In the absence of more transformative measures these are likely to continue to be the major source of emissions savings in agriculture - but will deliver only 20-40% of savings needed.

Conclusion

- There are NO silver bullets.
- We cannot continue to treat GHG emissions from agriculture as solely a problem of poor resource use efficiencies.
- Need to consider a mix of the best mitigation options from both the DEMAND and SUPPLY side of agriculture (e.g. less meat & dairy consumption, better storage/less waste, sustainable intensification, integrated crop-livestock systems, organic farming/local food).
- Need a policy frameworks that aims, at its core, to cycle nutrients through our economy with fewer unwanted effects ('leaks').

Thank you for your interest!