

Recirculating aquaculture can reconcile food supply and afforestation in Great Britain



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The UK Sustainable King Prawn Project

- The UK government's plan to remove atmospheric greenhouse gasses (GHG) by planting 30,000 ha/yr of new woodland could displace agriculture, reducing food output;
- We examine if king prawn recirculating aquaculture systems (RAS) can offset food losses by:
 - Assessing the viability of RAS on British farms, with & without capital (CAPEX) subsidies;
 - Quantifying RAS-driven offsets of food losses due to woodland expansion.

Financial assessment & emissions

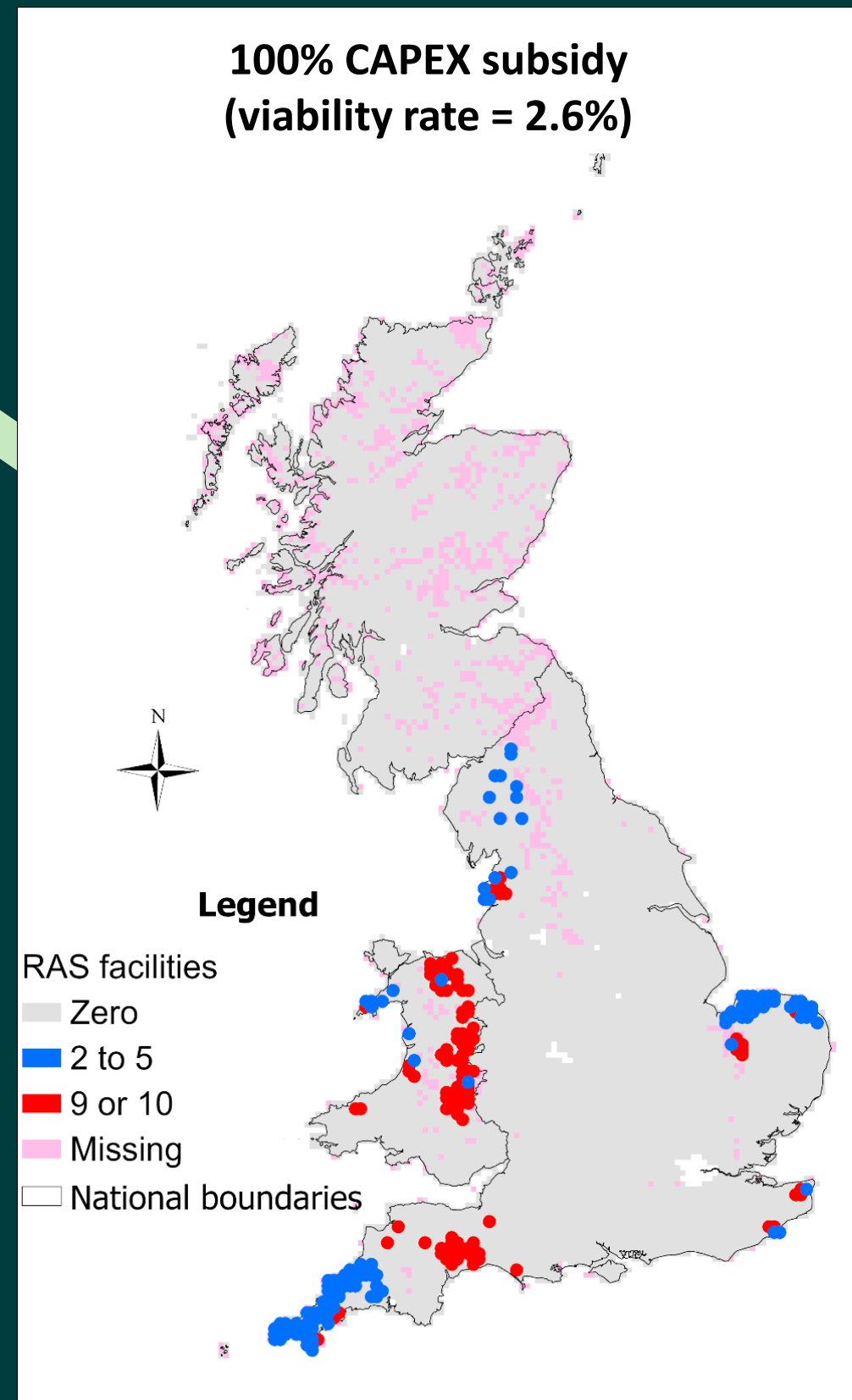
Subsidy level	Policy scenarios				
	No grant	50% CAPEX	100% CAPEX	150% CAPEX	200% CAPEX
Prawn farm-gate price (£/kg)	20.30	20.12	19.92	19.62	19.26
Viability rate (percent of all 5 km ² cells)	1.52%	1.66%	2.63%	3.99%	4.58%
Prawn meat production (kiloton / year)	9.35	10.14	12.21	12.30	12.98
Emissions: prawn import substitution / woodland creation	2.81	3.05	3.67	3.70	3.90
Total emissions avoided as a share of UK's emission reduction target for agric., land use, and imported food (*)	25%	26%	29%	29%	30%

(*) Share of joint target for agriculture & land use, augmented by 50% of the current emissions embodied in food & forestry products (CCC, 2025, ONS, 2024).

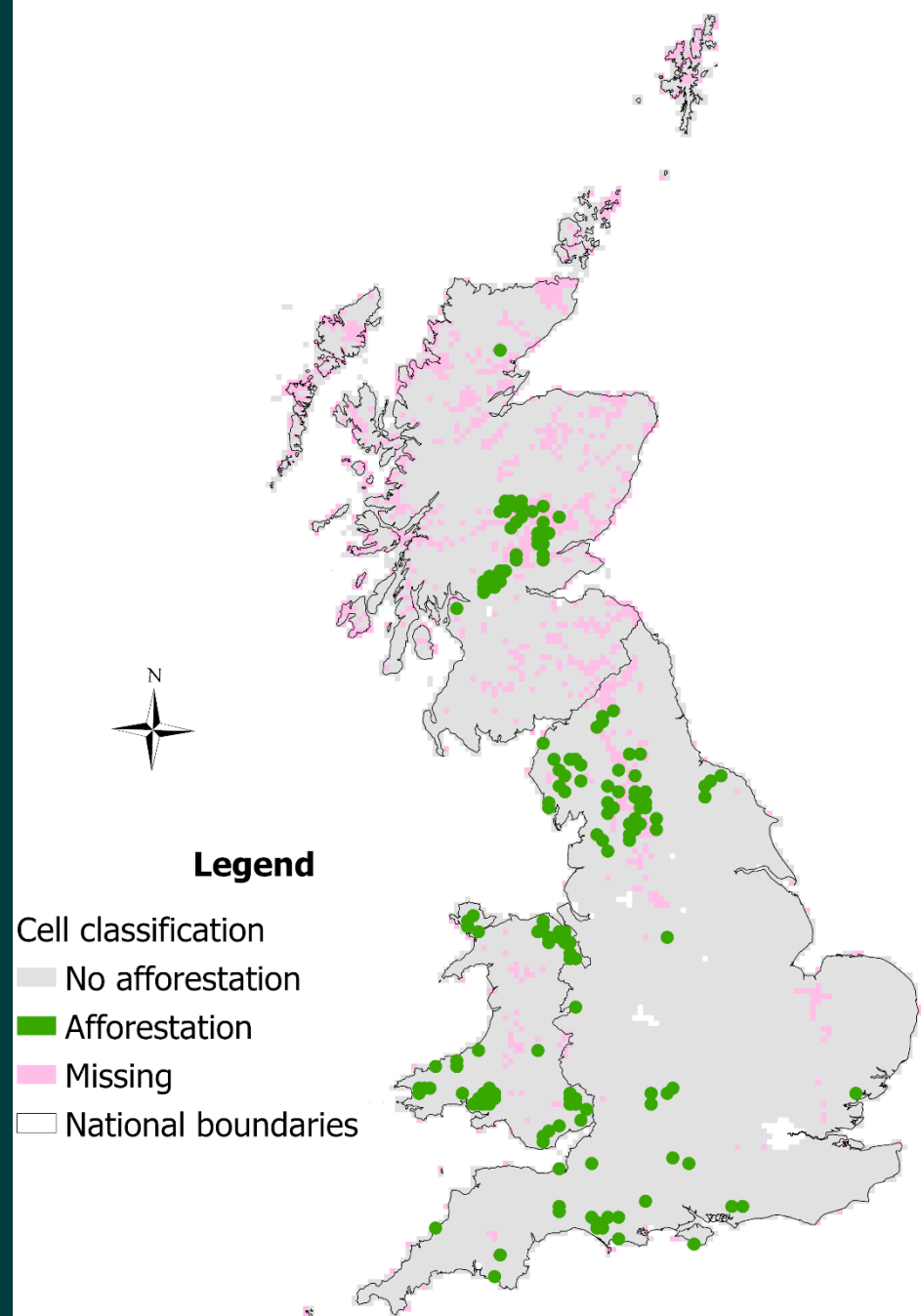
RAS is viable in 1.5% of GB's 5 km² grid cells, rising to 4.6% if subsidised

Viable RAS units offset nearly 80% of the protein loss induced by afforestation on well under 1% of the land area converted into woodland

Viability of RAS across GB



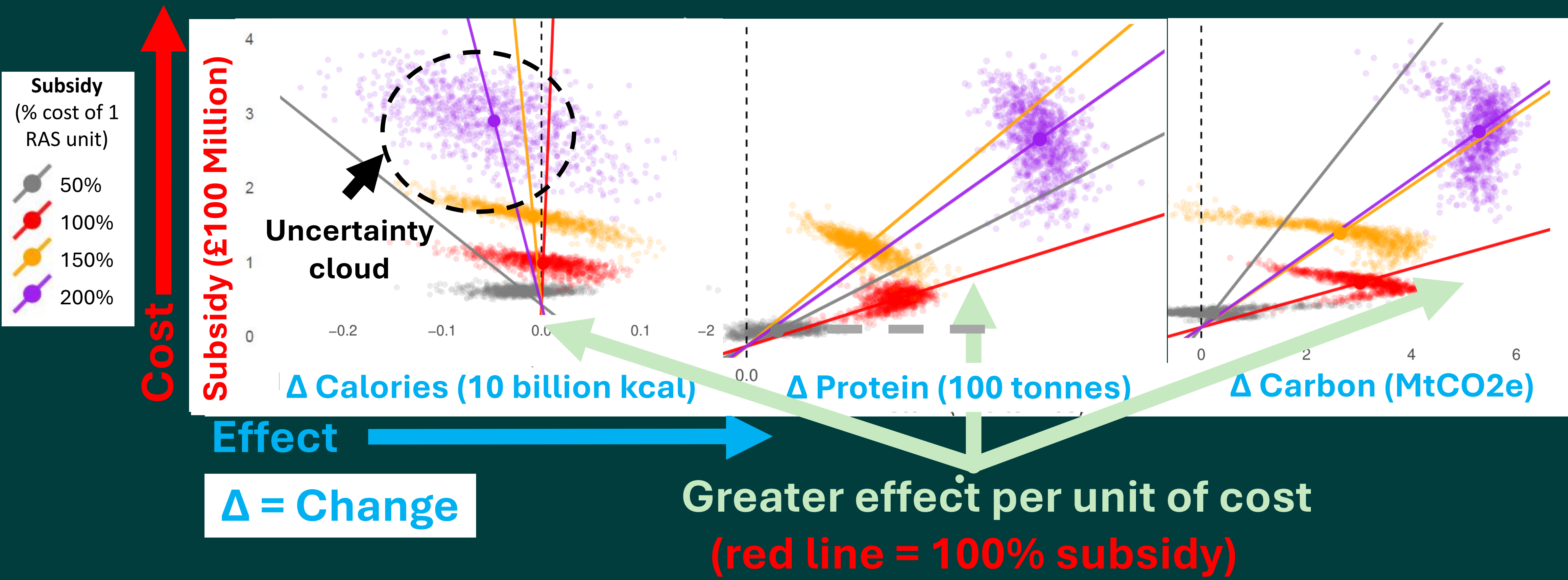
New woodland: Optimal location



As RAS capital subsidies increase:

- Prawn price to the retailer falls & production rises to 37% of imports;
- Food loss offset rises to 16% of calories and over 100% of protein;
- Subsidies are most cost-effective at 100% of one RAS unit's CAPEX.

Cost-effectiveness plots (baseline = no RAS capital grant policy)



References

- Climate Change Committee (2025) *The Seventh Carbon Budget*.
- ONS (2025) *Greenhouse gas emissions and trade*
- Ming et al (2023) Deep Gaussian Process Emulation with Stochastic Imputation. *Technometrics*, 65 (2).
- Morello et al. (2025) Sequestering carbon without reducing food production: The role of recirculating aquaculture systems. *Ecological Economics*, 237, 108692.



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Project website



<https://sites.exeter.ac.uk/kingprawn/>