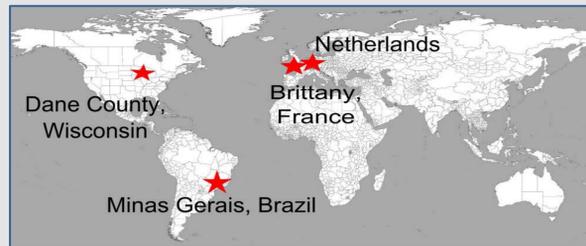


How did the Netherlands get it right? Manure management and water quality in four regions.

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CONTEXT

- Dairy farming produces nutrients (notably nitrogen (N) and phosphorus (P)) that lead to water quality problems like eutrophication and unsafe nitrate levels for drinking.
- Different regions have different levels of environmental pressures from dairy, depending on cattle density, vulnerable waters, and varying substrates.
- The science and policy response also varies by region, depending on social context.
- This poster presents preliminary background research on these inter-related forces in four dairy-intensive regions:



Dane County, Wisconsin: Main problems: eutrophication from P and drinking water contamination from N.



Minas Gerais, Brazil: Main problem: lack of nutrient management.



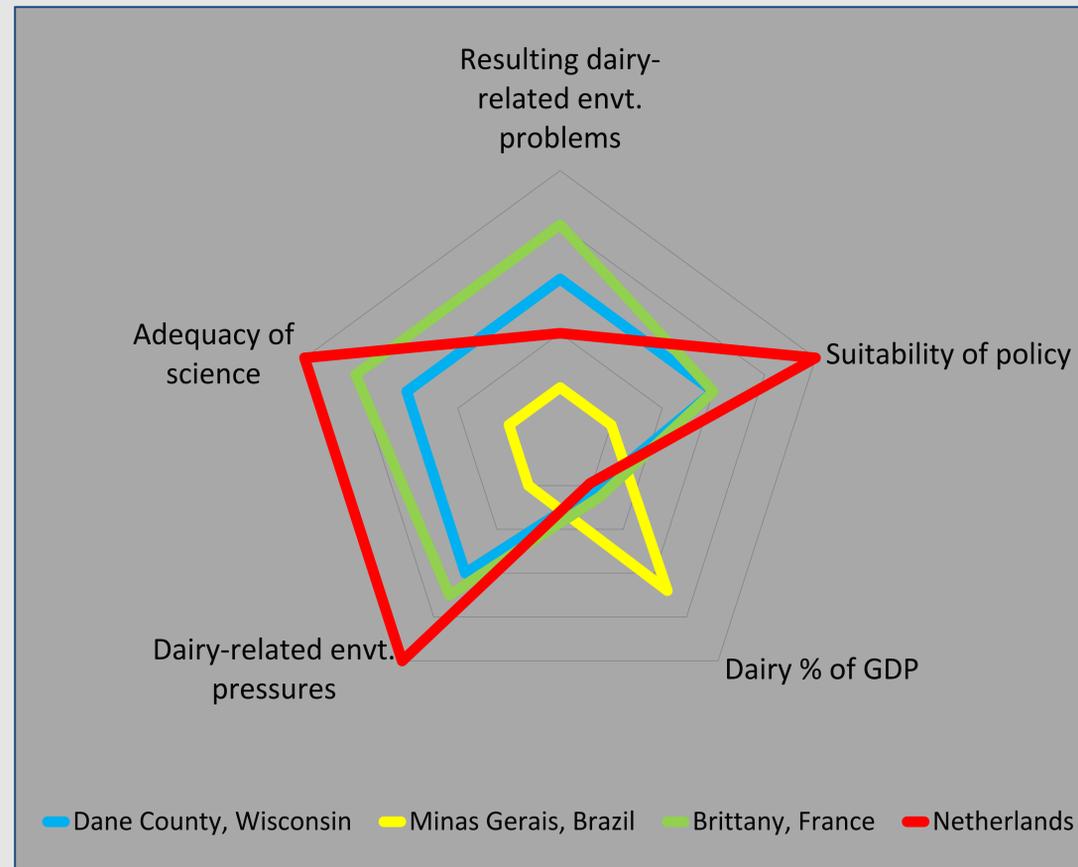
Brittany, France: Main problems: coastal eutrophication, contamination of drinking water.



Netherlands: Main problems: nitrates in drinking water and phosphorus in canals, ditches, groundwater.

UNDERLYING THEORY

- People often conceive policymaking as a straightforward process whereby the findings of science are sought out and incorporated into law. However, we see many instances where the complexity of the science and/or the costs of implementing science-based laws lead to a disconnect between scientific consensus and policy. Social context (economics, culture, governance) mediates the co-production of science and policy.



- This diagram shows the magnitude of environmental problems that result from dairy-related environmental pressures. Science and policy mediate the impact of pressures on ultimate environmental outcomes. The social context (limited to economics in the figure) influences the science and policy response.
- Each branch is an index of factors (except % GDP) and is measured on a continuous (not ordinal) scale.
- You can see that even though Netherlands (red) has greater environmental pressures due to dense population and high water vulnerability, Dutch policy and science have appropriately responded, thus minimizing the resulting dairy-related environmental problems.

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VARIABLES

Magnitude of environmental pressures

Index variable based on:

- Cow density (cows/hectare arable land)
- Amount of vulnerable water
- Bio-geo-chemical context (soils, substrate)

Economic context

- Percent contribution of dairy to the region's GDP. (Our next steps include incorporating culture and governance system into social context.)

Adequacy of the underlying science

Index variable based on:

- Quality of soil and water N and P monitoring
- Historical completion of P budgets
- Water-quality modeling

Suitability of the policy response

Index variable based on:

- Restrictions on manure spreading, N and P fertilizer
- Required permits and nutrient management plan
- Enforcement

Resulting environmental problem

Index variable based on:

- Water nutrient levels
- Nuisance from eutrophication
- Impact on drinking water

DISCUSSION

- As comparison between Netherlands and Minas illustrates, the question is not "How bad is the resulting problem?" but how effectively environmental pressures are mediated by science and policy.
- Dairy-related pressures are greatest in Netherlands, a densely populated and industrialized country with an export-oriented husbandry market and vulnerable waters, and least in Minas Gerais, with an extensive grazing system.
- The Netherlands' manure management policy is the most strict and has been held up as a model for other European Union countries. Brittany's ranking suffered for inattention to phosphorus and Minas has minimal enforcement or guidance.
- Resulting problems are greatest in Brittany (P-related eutrophication), followed by Dane (same problem), Netherlands (N pollution), and lastly Minas Gerais.
- Our conclusion is a question: How did the Netherlands get it right?**
- Next steps include field research on how the Dutch social context (culture, governance system, and economics) facilitates science-based policy, and what is different in the three other regions.