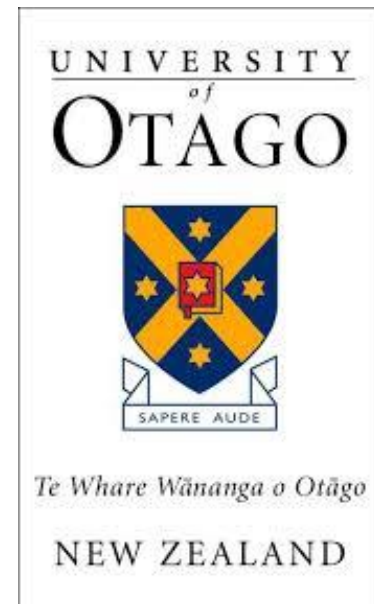# Achieving healthy and sustainable diets: A review of recent studies using optimisation modelling

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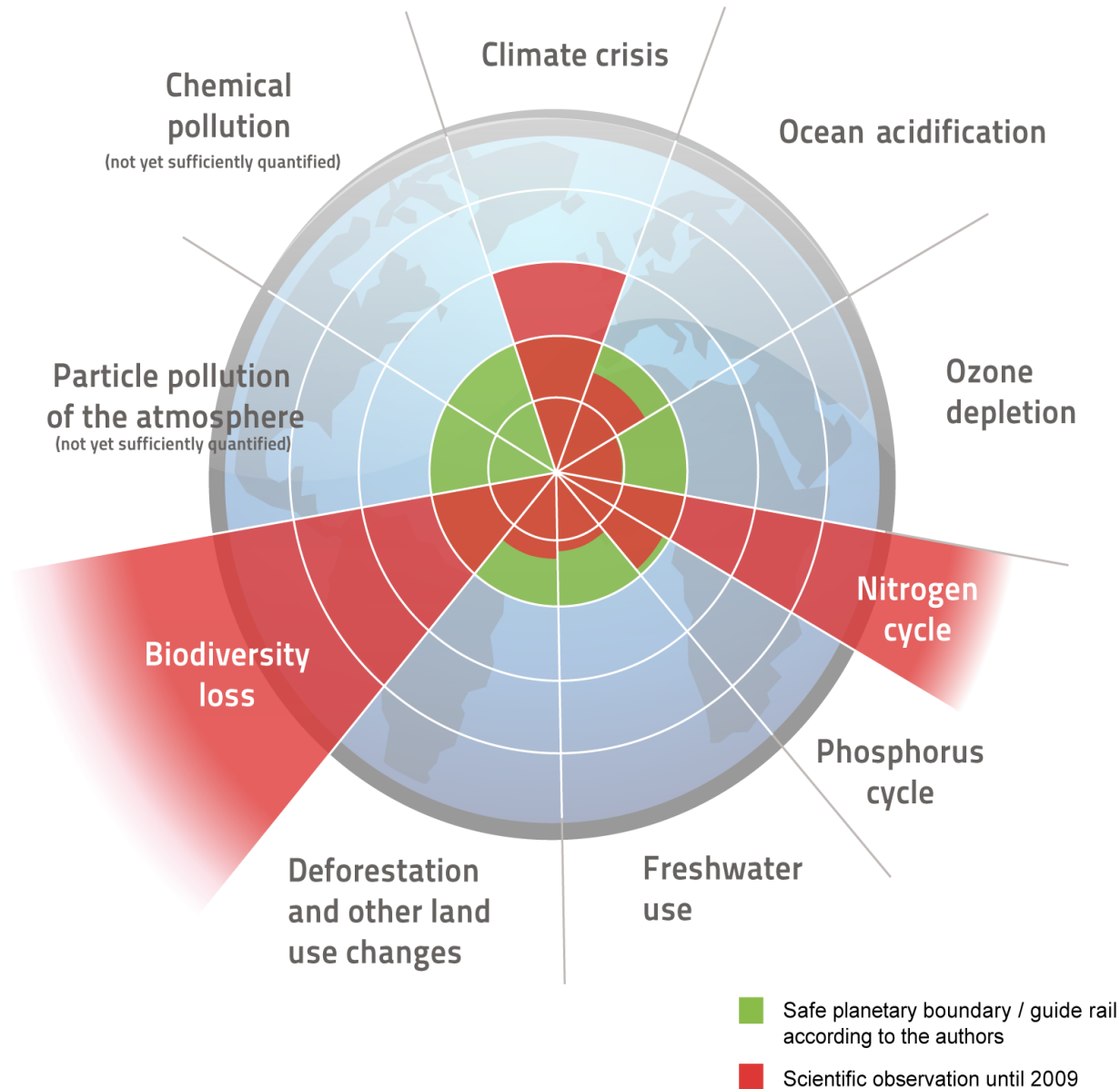
Te Whare Wānanga o Otāgo

NEW ZEALAND

Background

Health: Improving nutrition – key to Non-Communicable Disease control

Food costs: Food security a challenge internationally – including for some groups in high-income countries

Sustainability: Multiple threats relating to agriculture. Eg, climate disruption – up to a third of greenhouse gas [GHG] emissions from agriculture

Planetary Boundaries

after Johan Rockström, Stockholm Resilience Centre et al. 2009

- Climate crisis
- Ocean acidification
- Ozone depletion
- Nitrogen cycle
- Phosphorus cycle
- Freshwater use
- Deforestation and other land use changes
- Biodiversity loss
- Particle pollution of the atmosphere (not yet sufficiently quantified)
- Chemical pollution (not yet sufficiently quantified)

Legend:
- 🟩 Safe planetary boundary / guide rail according to the authors
- 🟥 Scientific observation until 2009

Mathematical optimisation

Mathematical techniques such as linear programming can allow for the identification of "optimal solutions"

Eg, identifying the dietary patterns/foods that can address combinations of:

1) Meeting nutritional requirements

2) Low food costs

3) Low environmental impacts (eg, GHGs)

4) Maintaining acceptability (eg, minimise deviation from existing dietary patterns)

Methods

- Literature search: Publications on dietary optimisation & sustainability since 1 Jan 2015

- Comparison with recent review articles on diet and sustainability

- Full details in: Wilson et al *Adv Nutr* (in press)

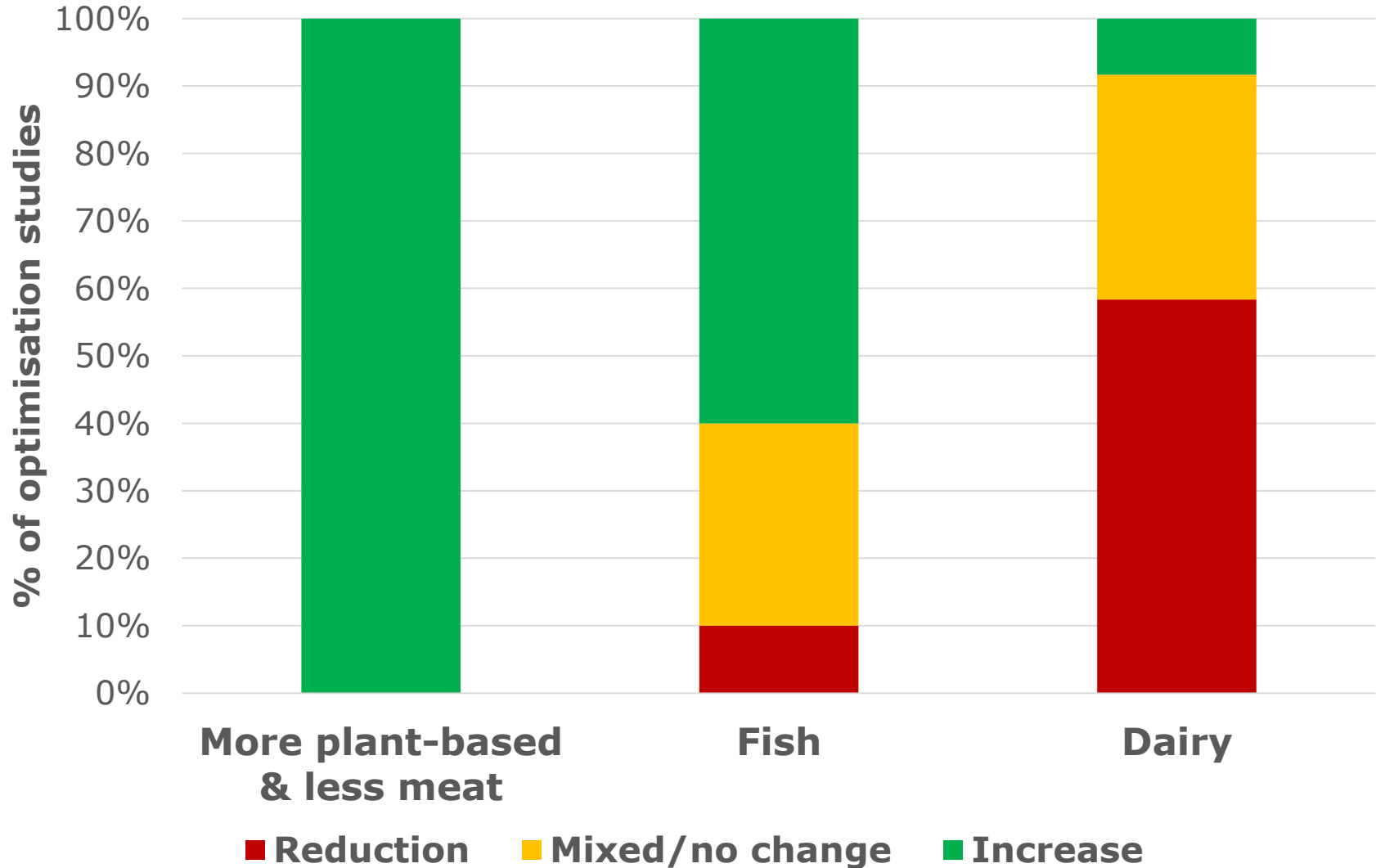# Results: Study characteristics

- 12 recent studies: optimisation to achieve both nutrition & environmental sustainability aims.

- 7 high-income countries (France, Finland, Italy, Netherlands, Sweden, UK, USA).

- 3 others: China, India, & Tunisia

- Most (10/12) aimed to reduce GHGE

- Half (6/12) aimed to also reduce at least one other impact eg, water use, fossil energy use, land use, marine eutrophication, atmospheric acidification, & nitrogen release.

Results: Study characteristics

- Most (9/12) considered dietary acceptability (minimising shifts from current patterns)

- No statement on competing interests (5/12); 1 funded by dairy industry

- Our additional research: 7/12 had potential for competing interests (eg, an author with links to industry)

Main results

Consumption changes with more optimised diets: health & sustainability (12 recent studies)

% of optimisation studies (y-axis)

Categories (x-axis): More plant-based & less meat, Fish, Dairy

Legend: ■ Reduction ■ Mixed/no change ■ Increase

Results: Other patterns

Other foods that **tended to be reduced** in more healthy and sustainable diets: sweet foods (biscuits, cakes and desserts), savory snacks, white bread, & beverages (alcoholic & soda drinks).

Cost of more sustainable diets:

- 2 studies: less expensive (eg, only 40% of average Dutch diet)

- 1 study: healthy diet was slightly more expensive but GHGE reduction diet was less expensive

Compatibility of optimisation studies with recent reviews

- Findings in these 12 studies, broadly compatible with 7/8 recent reviews on diets & sustainability: Vegan & vegetarian diets & low-meat (eg, Mediterranean style diets) are typically healthier and more sustainable

- Review literature suggestive that healthy and sustainable diets may typically be cost neutral or cost-saving (but still uncertainty)

Limitations with the optimisation research

- Need more studies by authors with no **competing interests** (no food industry funding)

- Need more research in low and middle income countries

- Need improvements to sustainability **metrics** for food production and consumption

- Need consideration of **infectious disease risks** & antimicrobial resistance risks from livestock agriculture and meat consumption

Infectious disease risks : In 2016 NZ had world's largest ever outbreak of waterborne campylobacteriosis (livestock faeces contaminated drinking water)

Pandemic risks from livestock: (Eg, new pandemic influenza from poultry & pigs)
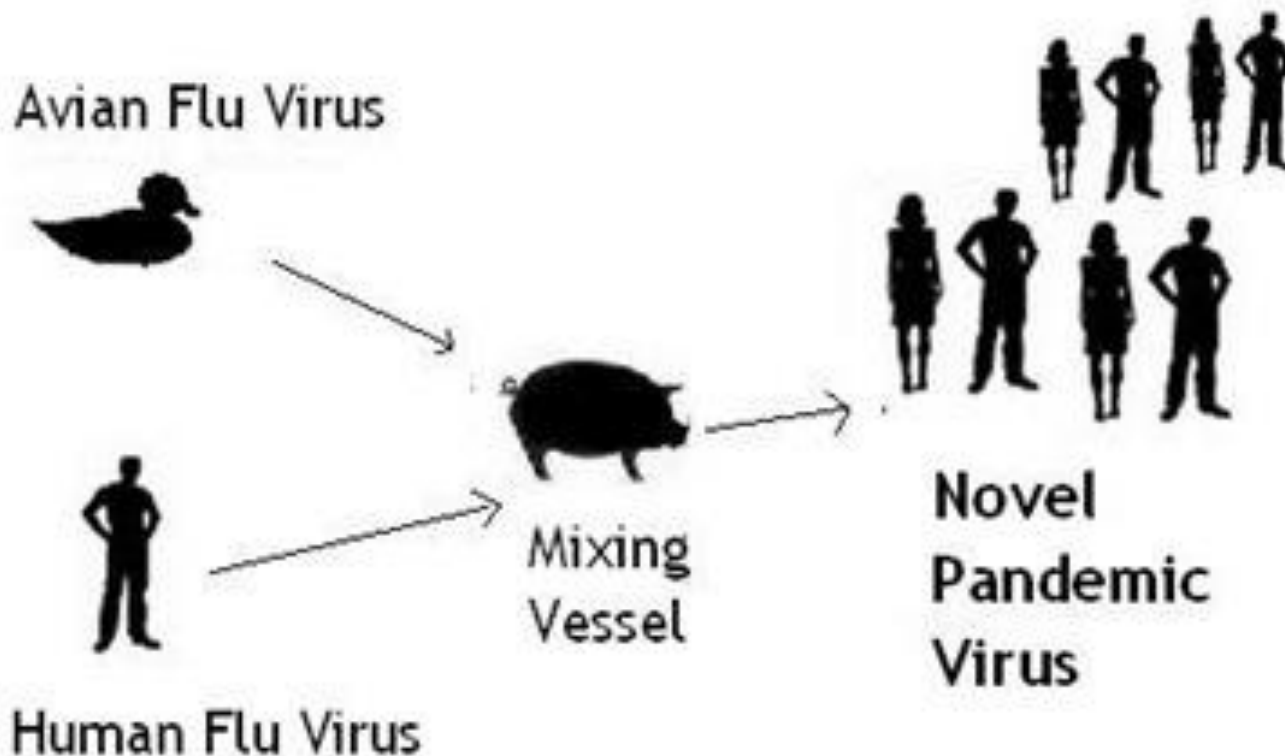
Flooding: Increased flooding risks from previously forested hill country now used for livestock grazing (NZ)

Implications for policy-makers

Sustainability Rating

This shows how environmentally-friendly a product is based on the **amount of water, nitrogen, and carbon** pollution caused during production. **5 stars is the most environmentally-friendly** and 1 star is the least.

- Build sustainability into national dietary **guidelines**

- Food **labelling** eg, green stars

- Phase-out **subsidies** to agriculture (free water for irrigation etc)

- Apply **GHG taxes** to agriculture (methane, carbon, nitrogen) & recycle tax revenue to communities (as per British Columbia)

- **Tax junk food** & recycle tax eg, healthy & sustainable school lunches

- Programmes to reduce **food waste**

Conclusions

- Recent optimisation work: Clearly shows that for diets to be healthy & sustainable they need to be **more plant-based** (eg, reductions in ruminant meats)

- This conclusion is consistent with all the non-industry funded major reviews on the topic

- Future optimisation work should continue to expand metrics used and better clarify cost impacts of sustainable diets

Questions?