Alberta Energy System: A Focus on Diet
The Impact of Dietary Trends on Alberta's Greenhouse Gas Emissions

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INTRODUCTION

Agricultural production in Alberta generates about **16 Mt CO_2e/yr** of greenhouse gas (GHG) emissions, and uses **20.4 Mha** of land. Animal production, the majority of which is beef, accounts for 78% of these emissions.

While Alberta is home to only 11% of the Canadian population, its cattle industry supplies approximately 41% of the nation's beef [1], the remainder being exported to the US, with a small percentage sold overseas [2].

North American red meat consumption has been in decline for the past decade [3]. The change has been primarily driven by higher meat costs as well as medical studies linking red meat intake to a number of health risks [4]. Another emerging driving force has been the widespread awareness over the environmental footprint related to red meats. This is especially true of beef, given that it is a very carbon-intensive protein source.

This study analyzed how Alberta's agricultural industry will be affected as individuals look to replace red meats with other protein sources, such as chicken or beans. The resulting GHG emissions, land use changes and revenue losses from production were considered.
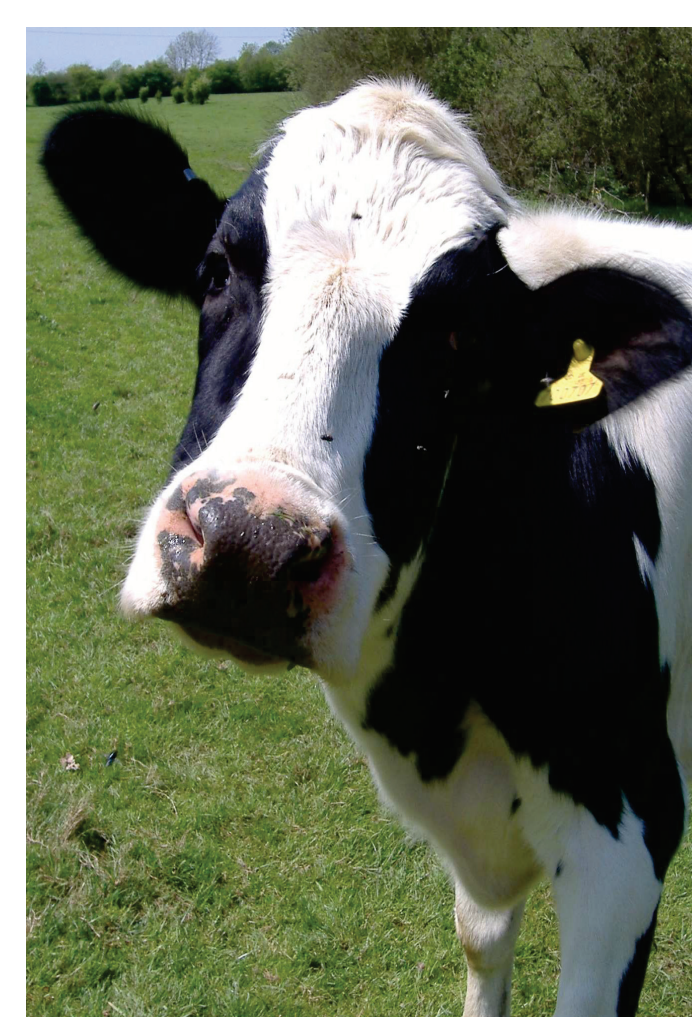
METHODS

The **Holos farm modelling software** [5] and **Stats Canada data** [1] were used to calculate GHGs resulting from agriculture in Alberta, on a per unit basis for each type of product.

Dietary changes were modeled in two scenarios, where beef consumption is reduced by half and replaced with either chicken or beans. The dietary change is assumed to take effect over a **35-year period**. This decrease of consumption was assumed to cause a directly proportional reduction on the size of the beef industry in Alberta; it is assumed that diminished North American demand would not be offset by an increase in exports to overseas or emerging markets.

Export values are projected based on the overall industry size with the export values of animals and crops in 2014 [6].

RESULTS & DISCUSSION

1a. Daily Diet Profile

By 2050:
Scenario 1: 50% beef replaced with chicken

Scenario 2: 50% beef replaced with beans

Reference

Domestic Consumption 2050 (567kg/per/yr)
- Meats 8%
- Dairy and eggs 17%
- Cereal, pulses and nuts 10%
- Fruits and vegetables 27%
- Oils and fats 4%
- Beverages and sugars 34%

Scenario 1: Chicken Replacement

Domestic Consumption 2050 (567kg/per/yr)
- Meats 8%
- Dairy and eggs 17%
- Cereal, pulses and nuts 10%
- Fruits and vegetables 27%
- Oils and fats 4%
- Beverages and sugars 34%

Scenario 2: Bean Replacement

Domestic Consumption 2050 (570kg/per/yr)
- Meats 7%
- Dairy and eggs 17%
- Cereal, pulses and nuts 12%
- Fruits and vegetables 27%
- Oils and fats 3%
- Beverages and sugars 34%

1b. Daily Diet-Related Emissions

Domestic Consumption 2050 (1.64 tCO_2e/per/yr)
- Pork 6%
- Beef 33%
- Poultry 3%
- Other meats 5%
- Dairy and eggs 14%
- Cereal, pulses and nuts 1%
- Fruits and vegetables 20%
- Beverages and sugars 14%
- Oils and fats 4%

Domestic Consumption 2050 (1.40 tCO_2e/per/yr)
- Pork 7%
- Beef 20%
- Poultry 6%
- Other meats 6%
- Dairy and eggs 17%
- Cereal, pulses and nuts 1%
- Fruits and vegetables 23%
- Beverages and sugars 16%
- Oils and fats 4%

Domestic Consumption 2050 (1.38 tCO_2e/per/yr)
- Pork 7%
- Beef 20%
- Poultry 4%
- Other meats 5%
- Dairy and eggs 17%
- Cereal, pulses and nuts 2%
- Fruits and vegetables 24%
- Beverages and sugars 17%
- Oils and fats 4%

➢ **0.24 tCO_2e/person/year reduction by 2050**

➢ **0.26 tCO_2e/person/year reduction by 2050**

2a. Land Use

Change in land use resulting from dietary changes (Mha) [7]

Scenario 1: Chicken Replacement / Scenario 2: Bean Replacement (Land Use (Mha), 2010–2050: Reference, Crop Production for Human, Beef Operations, Poultry)
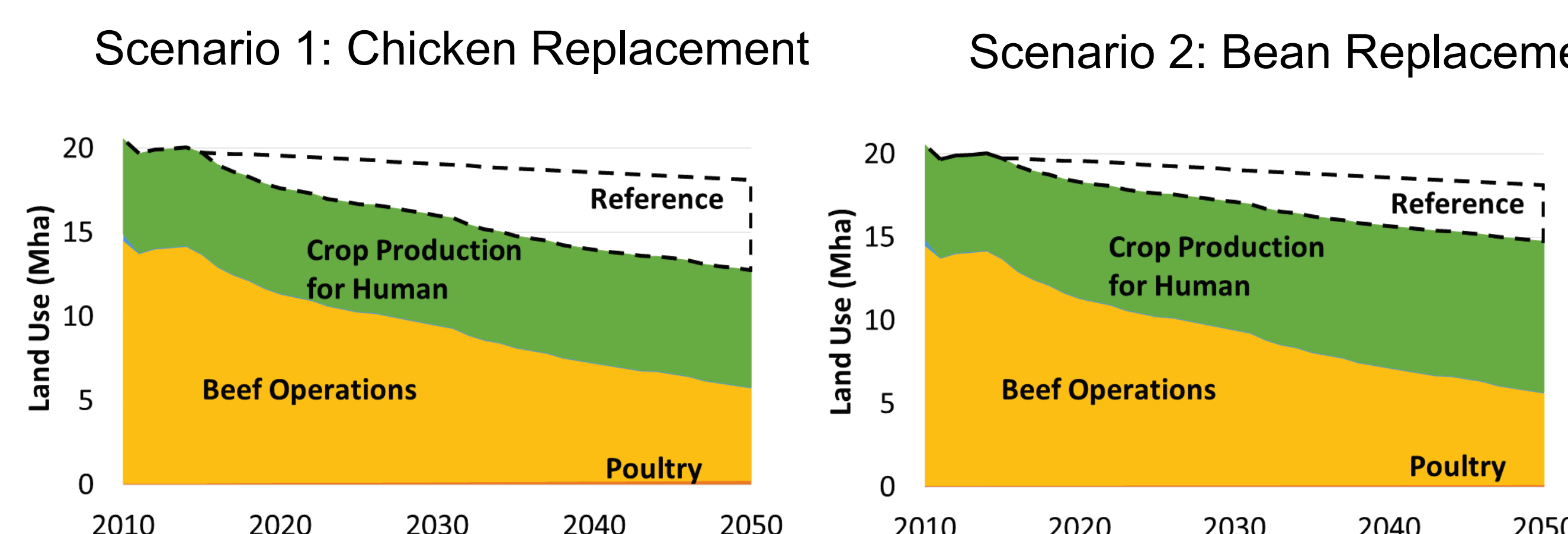
➢ **22%** and **18%** total **reduction in land used** for Scenario 1 and 2, respectively

2b. Emissions

Change in emission resulting from dietary changes (Mt CO_2e) [5]

(GHG Emissions (Mt CO_2e), 2010–2050: Reference, Crop Production, Other Animals, Beef Operations, Poultry)
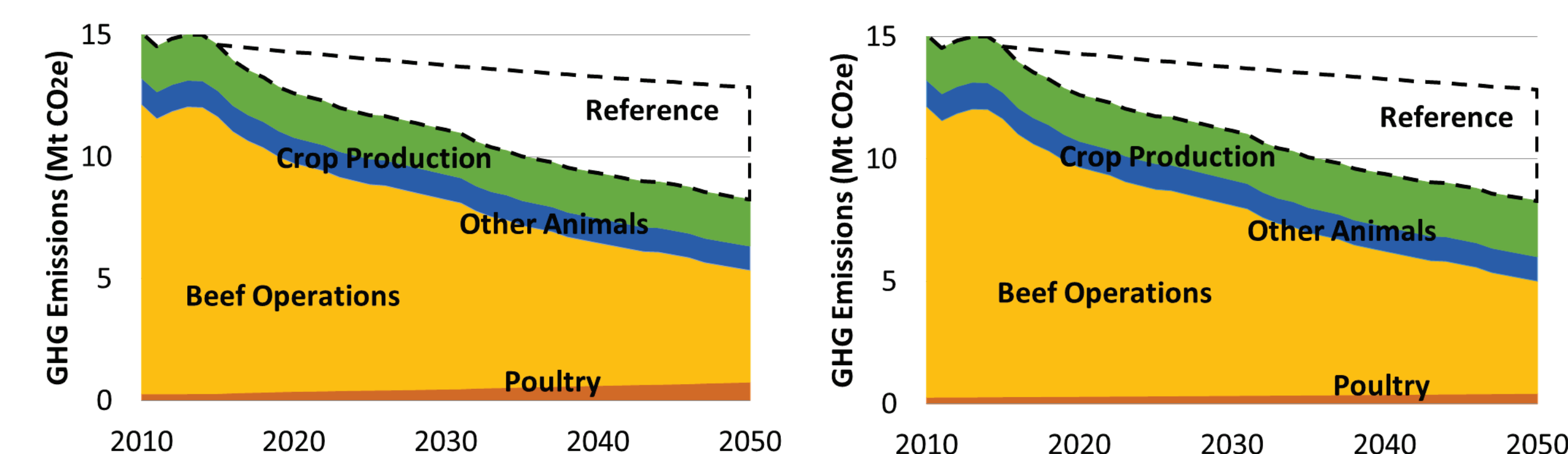
➢ **35%** and **34%** total **reduction in emission** (CO_2e) for Scenario 1 and 2, respectively

2c. Export Values

Change in export values resulting from dietary changes (B$) [6]

(Export Value (B$), 2010–2050: Reference, Beans, Beef Operations, Poultry)
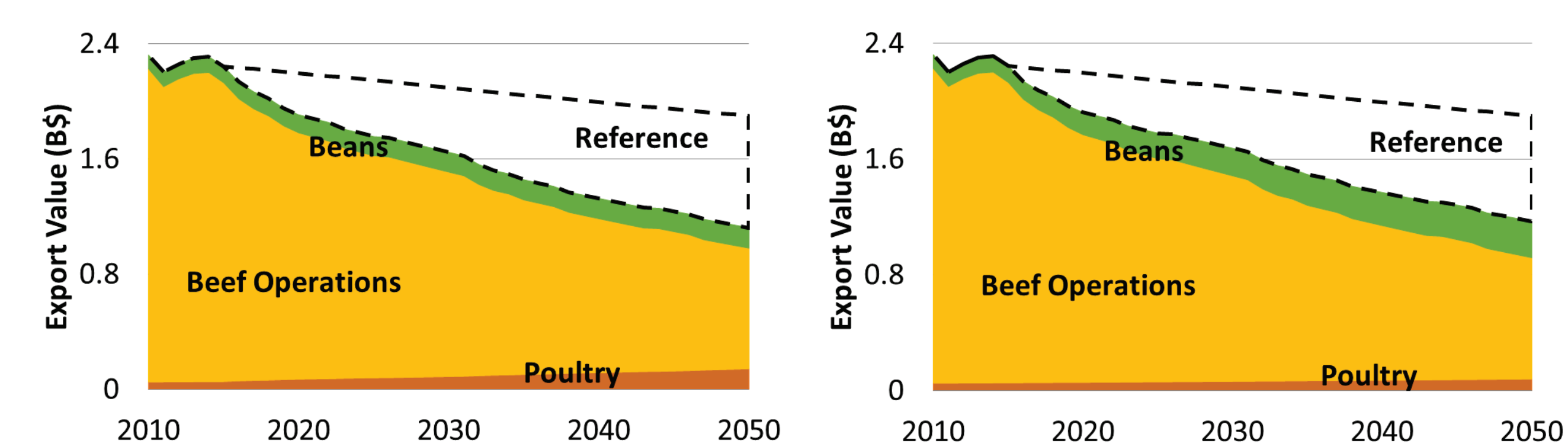
➢ **40%** and **39%** total **loss in export values** for Scenario 1 and 2, respectively

CONCLUSIONS

The current North American dietary trend away from red meat, towards white meat and plant proteins, result in both health and environmental benefits.

If the dietary trend were to continue so that 50% of present-day beef consumption is replaced by less carbon-intensive protein alternatives (such as chicken and beans), a person's daily protein requirements would still be met. This would result in approximately 4.6 Mt CO_2e per year reduction by 2050.

Land use patterns in Alberta would also change, as land that had previously been used to graze and feed cattle could be used for environmental or economical purposes. This could include planting trees or cash crops.

It can be assumed that the decreased beef demand would proportionally diminish Alberta's cattle industry, since North America is its primary market. A 40% reduction in export values equals to loss of $0.8 billion.

Given that one of the main drivers away from red meats is its associated carbon footprint, Alberta's agricultural industry should look into reducing the emissions associated with cattle. Studies suggest that this can be achieved by feeding cattle higher quality grains [8]. Such initiatives would offset the revenue losses as Albertan beef becomes a more environmentally attractive protein option to North American consumers.

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ACKNOWLEDGEMENTS