Can the environmental impact of pig systems be reduced by utilising co-products as feed?

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Introduction

- This study used Life Cycle Assessment (LCA) to investigate the effect of increased inclusion of co-products in grower/finisher diets on the environmental impacts of Canadian pig systems

- Four co-products were investigated, these were;
  - **Corn Dried Distillers Grains with Solubles (DDGS)**
  - **Wheat shorts**
  - **Bakery Meal**
  - **Meat (pork) Meal**

Objectives

1. To establish the effect of including individual co products on the environmental impact of Canadian pig farming systems

2. Model the effect of increased inclusion of co products in diets formulated for commercial objectives on the environmental impacts

Quantifying Environmental Impacts

The environmental impact categories were:

- **Non Renewable Resource Use (NRRU) (kg Sb eq)**
- **Eutrophication Potential (EP) (PO_4 eq)**
- **Global Warming Potential (GWP) (CO_2 eq)**

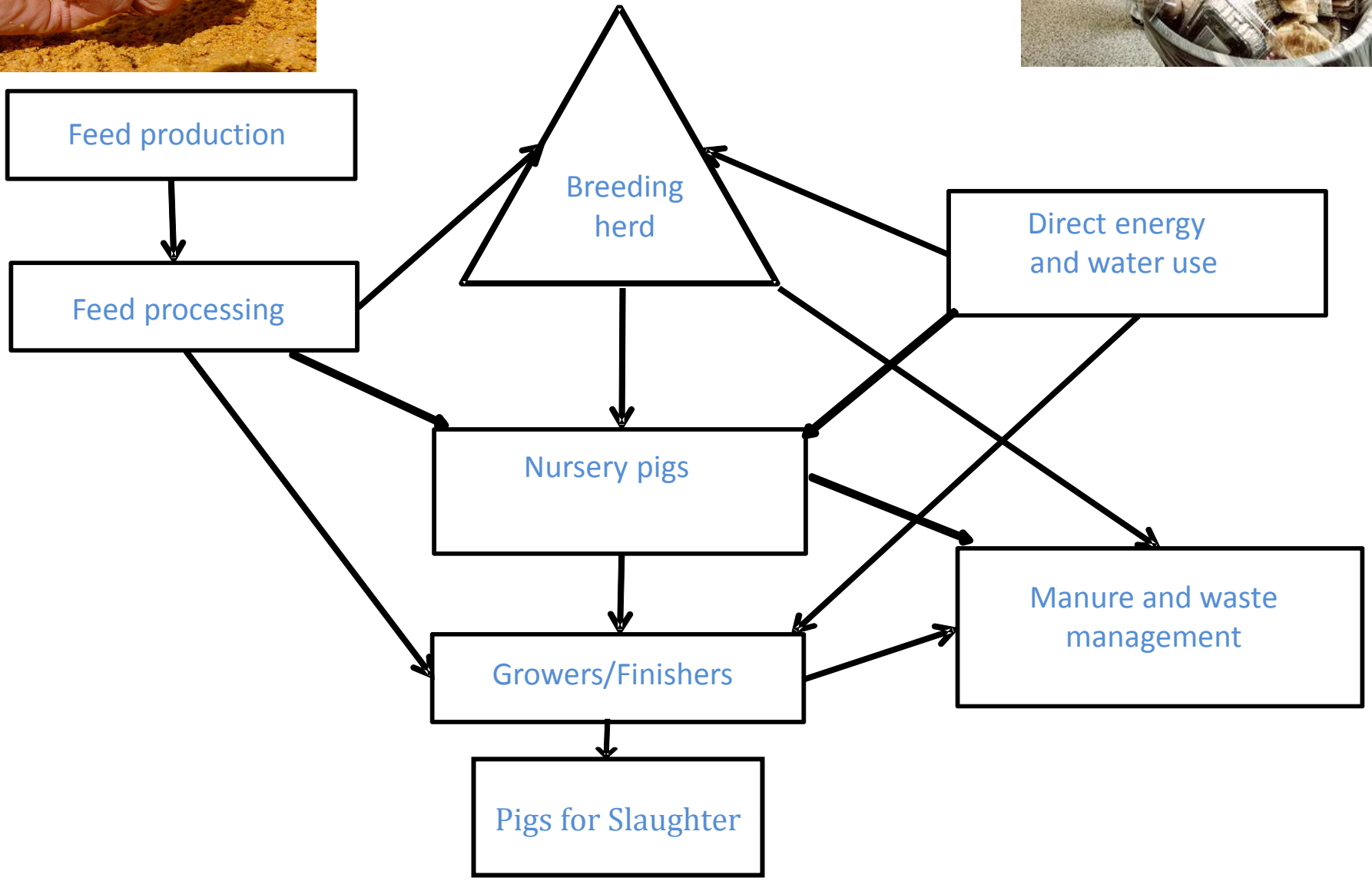
The functional unit = 1 kg expected carcass weight

All diets compared in a cradle to farm-gate LCA using 1000 Monte Carlo simulations

Co – product Allocation

- Co-product allocation required when a process has 2 or more outputs with shared inputs
- Such instances common in animal feed supply chain during feed processing.
- Economic allocation used in feed supply chain (as recommended LEAP, 2014)

System Description



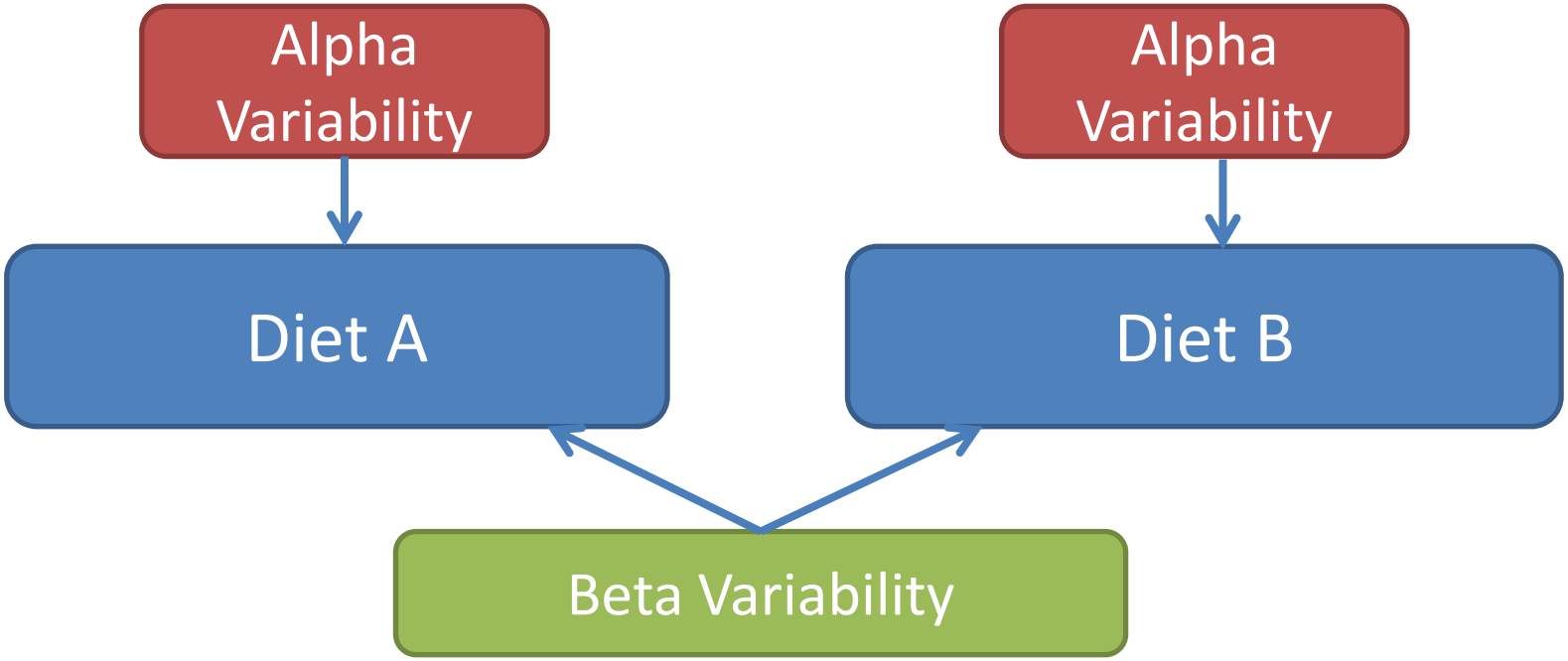
Methodology

Two tests were conducted:

1. Four grower/finisher diets including the maximum amount of the 4 co products were compared to a control diet containing none. **All formulated with same nutritional specifications designed for optimum feed efficiency**

2. Four diets were formulated at incremental levels of energy density. **The first was least cost for optimum feed efficiency. Further diets formulated at least cost for 97.5%, 95% and 92.5% energy density of this diet and compared**

Comparing diets in the LCA model – parallel Monte Carlo simulations



Alpha Variability = specific to one scenario in the LCA

Beta Variability = shared between two scenarios in the LCA

The Diets

- All diets formulated for least cost using average ingredient prices for Canada for 2013
- The diets were formulated using nutritional data from the Stein Laboratory Feed Ingredient Database
- All diets formulated for a 4 phase grower/finisher feeding regime
- Minimum nutrient: net energy constant for key nutrients in all diets

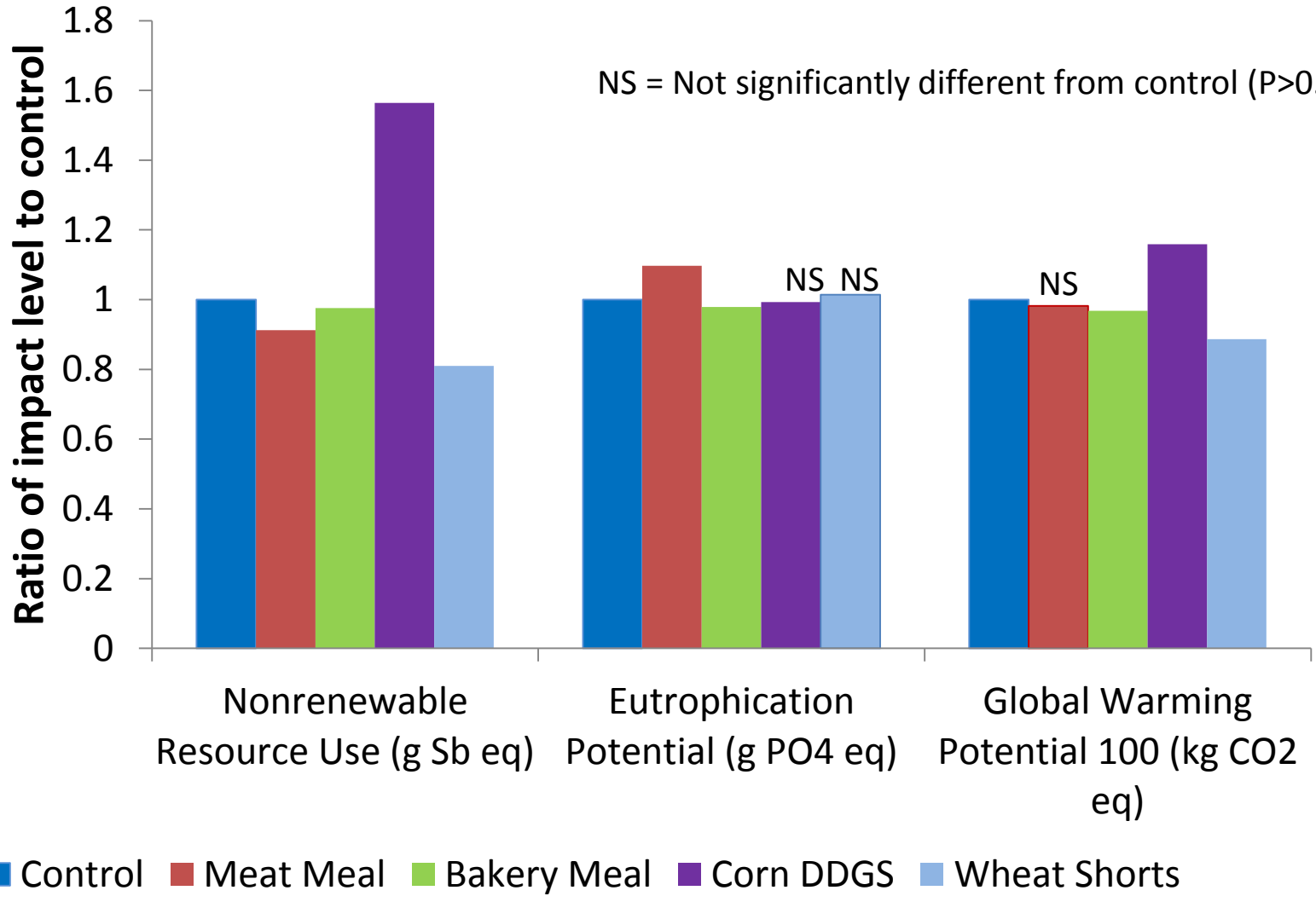
Max inclusion Levels

Ingredient	Starter (g/kg)	Grower (g/kg)	Finisher (g/kg)	Late Finisher (g/kg)
Corn DDGS	200	300	300	200
Wheat Shorts	200	300	400	200
Meat Meal	50	50	75	75
Bakery Meal	50	75	100	100

Ingredient Composition test 1

Ingredient	Control (g/kg)	Meat Meal (g/kg)	Bakery Meal (g/kg)	Corn DDGS (g/kg)	Wheat Shorts (g/kg)
Corn	728	703	646	567	487
Soya Meal	76	67	69	60	102
Canola Meal	169	152	171	61	68
Co-Product	**0**	**65**	**87**	**261**	**291**
CaCO3	12	3	12	14	14
Fat Blend	5	4	5	27	28
Other	10	6	10	10	10

Test 1- Results

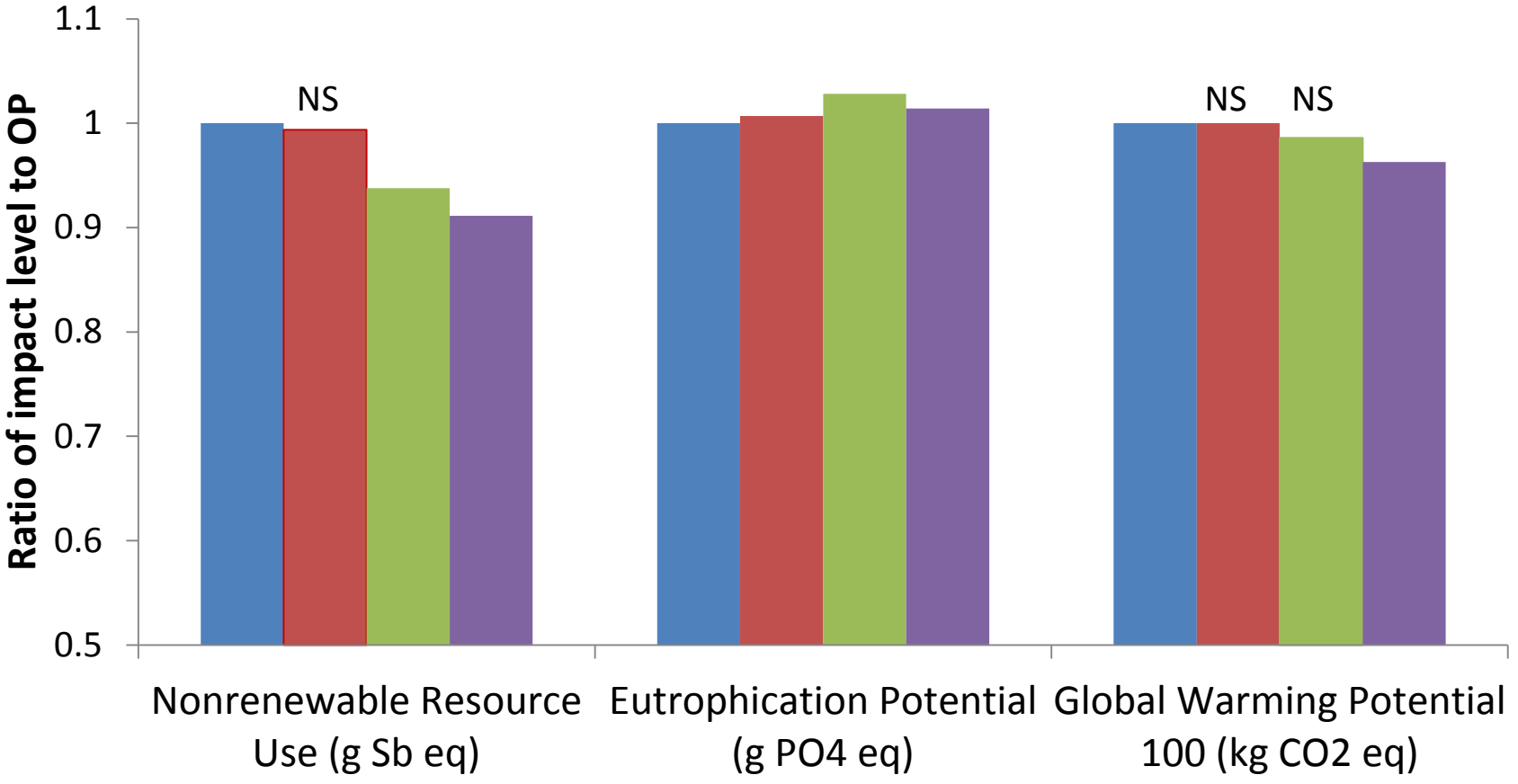


Ingredient Composition – test 2

Ingredient	Least Cost for Optimum Feed Efficiency (OP) (g/kg)	0.975 OP (g/kg)	0.95 OP (g/kg)	0.925 OP (g/kg)
Corn	642	663	593	543
Soya Meal	69	65	64	70
Canola Meal	150	130	94	58
Wheat Shorts	**26**	**89**	**191**	**287**
Bakery Meal	**82**	**28**	**28**	**1**
Other	31	25	30	41
Total Co Products	**108**	**119**	**223**	**294**

Test 2-Results

NS = No significant difference to (P>0.05)



Conclusions

- Including bakery meal and wheat shorts in nutritionally equivalent grower/finisher diets reduced the environmental impacts of the pig farming system

- Increased co product inclusion **reduced Global Warming Potential** and **Non-renewable Resource Use** but **increased Acidification Potential** per kg of carcass weight in diets formulated for commercial objectives

Newcastle University

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Thanks to Sugarich for providing data on the processing of bakery meal

Any Questions?

Nutritional Composition – Phase 2

	Least Cost for optimum Feed Efficiency (OP) (g/kg)	0.975 OP (g/kg)	0.95 OP (g/kg)	0.925 OP (g/kg)
Net Energy (MJ/kg)	9.81	9.56	9.32	9.07
Dig Lys %	0.80	0.78	0.76	0.74
Dig CP %	12.94	12.63	12.42	12.21
CP %	16.3	16.0	16.2	16.1
P %	0.49	0.50	0.52	0.54
K %	0.58	0.60	0.65	0.70
Predicted feed intake for Growth Phase (kg/pig)	**264**	**271**	**277**	**285**