



Effect of dietary change on greenhouse gas emissions and land use demand

ELINOR HALLSTRÖM, ANNIKA C-KANYAMA, PÅL BÖRJESSON
ENVIRONMENTAL AND ENERGY SYSTEM STUDIES
FACULTY OF ENGINEERING, LUND UNIVERSITY



Objectives

- i) Evaluate the scientific basis of dietary scenario analyses
- ii) Analyse the potential to reduce GHGE and LUD via dietary change
- iii) Identify gaps of knowledge



Methodology

- Peer reviewed articles, 2005 and Feb 2014
- GHGE and/or LUD of complete diets
- REF scenario of average diet in the population

→ **14 articles - 55 dietary scenarios**

- Healthy omnivorous diets
- Balanced energy intake
- Meat *partially* replaced by:
plant-based food/mixed non meat food/dairy products
- All ruminant meat replaced by monogastric meat
- Vegetarian diets (no meat)
- Vegan diets (no animal products)

Reference scenarios

Average European (affluent) diets (13/14 studies)

GHGE

0.9-1.7 tons of CO₂e cap⁻¹year⁻¹ - *up to farm gate*

1.5-3.2 tons of CO₂e cap⁻¹year⁻¹ - *up to retail*

→ 15-35% of total GHGE of average European citizens

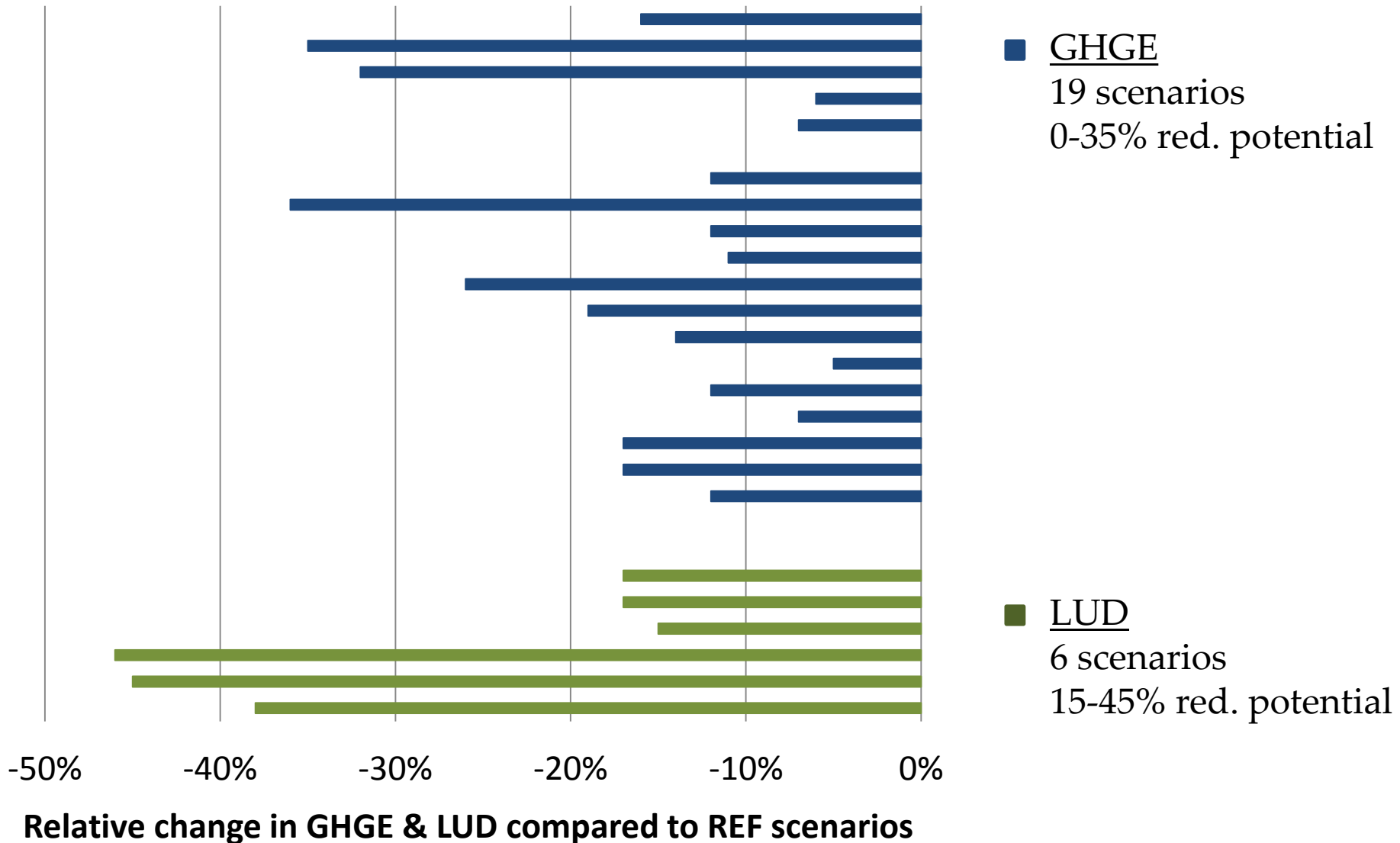
LUD

1400-2100 m² cap⁻¹year⁻¹

Per capita availability of agriculture land

Globally: 7000 m² cap⁻¹year⁻¹ (30% arable, 70% pasture)

Healthy omnivorous diets



Scenario	Reduction of GHGE		Reduction of LUD	
	(%)*	(n)	(%)*	(n)
Healthy diet	0-35	19	15-45	6
Balancing energy intake and expenditure	0-10	2	-	0
Meat partially replaced by plant-based food	+5-0	2	15	1
Meat partially replaced by dairy products	0-5	2	-	0
Meat partially replaced by mixed food	5	2	-	0
Ruminant meat replaced by monogastric meat	20-35	2	-	0
Vegetarian diet	20-55	9	30-50	2
Vegan diet	25-55	6	50-60	3

*Reduction of GHGE alt LUD in % relative REF scenarios, n= number of scenarios
+ indicates increase in GHGE alt LUD

Gaps of knowledge

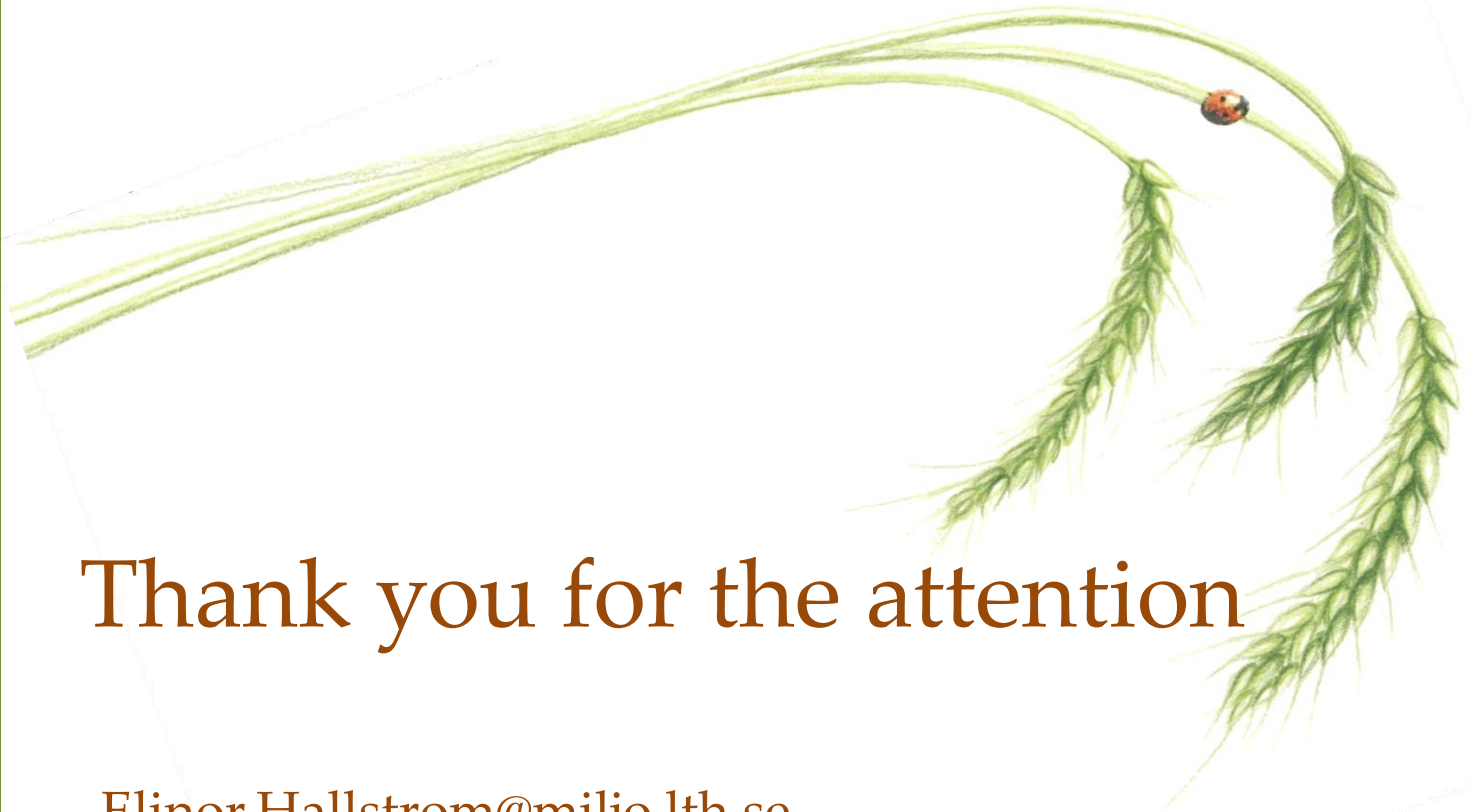
- Effect of dietary change in different populations
 - 13/14 articles - European affluent diets
- Differentiation of plant-based dietary scenarios
 - Limited knowledge of processed plant-based foods
- Differentiation of agriculture land
 - Cropland or pasture land? Domestic or foreign land?
- Accounting for uncertainty
 - Lack of uncertainty analyses (1/14 articles)



Summary

- First quantitative review of dietary scenarios
- Largest potential for reducing GHGE and LUD from vegan and vegetarian diets, followed by replacing ruminant meat with pork and poultry and changing to a healthier diet
- Dietary change can play an important role in reaching environmental goals regarding GHG and LUD
- More holistic sustainability assessments required





Thank you for the attention

Elinor.Hallstrom@miljo.lth.se



Scenario	Reduction of GHGE kg Co ₂ e/cap,yr	Reduction of LUD m ² /cap,yr
Healthy diet	100-500	200-900
Balancing energy intake and expenditure	0-200	-
Meat partially replaced by plant-based food	0	300
Meat partially replaced by dairy products	100	-
Meat partially replaced by mixed food	0-100	-
Ruminant meat replaced by monogastric meat	600	-
Vegetarian diet	300-1700	600-1000
Vegan diet	500-1100	700-1200



Relative change in LUD

