Supermarkets, Smallholders and Standards Project: Determing Natural Resource Impacts of African Horticultural Exports

The Climate Impact of Air-freighted Fresh Fruit and Vegetable Imports

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Zoe Wangler
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Slide 11: Review of Studies of Food Production and GWP

Van Hauwermeiren et al. 2006:

- study compared supermarket and local food distribution systems
- system boundary: principally examined processing, storage and transport to retailer, but accounted for energy use for heated greenhouses and consumer transportation
- did not include: energy used in production (apart from heated greenhouses), consumer's house

Slide 11: Review of Studies of Food Production and GWP

Relevant results:

- Emissions from a kg of tomatoes ranged by two orders of magnitude: from approx. 100g to 10kg of CO_2
- **Most significant factors**:
  - **Heated greenhouse** adds approx. **1.5kg CO_2 per kg** produce
  - **Air-freight** (Kenya) adds approx. **8kg CO_2 per kg**
- Processing and storage were calculated at 78g CO_2 per kg and 199g for supermarket and local distribution chains respectively

Slide 11: Review of Studies of Food Production and GWP

Illustrative scenarios:

supermarket selling non-organic inland tomatoes produced in a heated greenhouse, purchased by bicycle
83 + 19 + 0 + 1459 + 0.00 = 1561 g CO_2 per kg

supermarket selling organic tomatoes produced in Spain in open air, transported by truck over 1500 km purchased by a consumer by car (5 km single trip, specific shopping), buying 10kg in total
83 + 11 + 205 + 0.00 + 404 = 703 g CO_2 per kg

supermarket selling imported organic tomatoes airfreighted from Kenya produced in open air, purchased by a consumer by car (15 km single trip, combined shopping), buying 10kg in total
83 + 11 + 8510 + 0.00 + 757 = 9361g CO_2 per kg

Source: www.brass.cf.ac.uk/uploads/271005AH.pdf

Slide 12: Review of Studies of Food Production and GWP

- Carlsson-Kanyama et al. (2003) examined the life-cycle inputs for 150 ‘everyday foodstuffs’.
- Energy inputs covered: crop production (fertilisers, tractor fuel, crop drying, etc.), food processing and preparation, storage, transportation, home transportation, home preparation and cooking
- Found that energy inputs in food life cycles vary from 2 (cooked Swedish barley) to 220 MJ (cooked shelled shrimps) per kg
- Significant factors: animal or vegetable origin, degree of processing and choice of processing, preparation technology, transportation mode and distance
- One reference to air-freighted food: the authors found that fresh tropical fruits from overseas transported by plane have energy inputs of 115 MJ per kg

Slide 13: Review of Studies of Food Production and GWP

Food type, origin, preparation	MJ Life Cycle Inputs per Kg	Kg per Portion	MJ per Portion
Bananas, fresh, overseas by ship	12	0.105	1.3
Tropical fruit, fresh, overseas by plane	115	0.125	14
Potatoes, Sweden, cooked	4.6	0.2	0.91
Vegetables, canned, overseas by ship	18	0.07	1.3
Broccoli, frozen, Europe by road cooked	18	0.07	1.2
Broccoli, frozen, overseas by ship, cooked	20	0.07	1.4
Peas, frozen, Sweden, cooked	10	0.07	0.72
Peas, frozen, Central Europe by road, cooked	12	0.07	0.84
Tomateos, fresh, greenhouse, Sweden	66	0.07	4.6
Tomatoes, fresh, South Europe by road	5.4	0.07	0.37

Slide 14: Review of Studies of Food Production and GWP

Studies of Food Production and Global Warming Potential (GWP)	
Object of Study	*Reference*
Identify environmental impacts (including GWP) of products and product groups	Tukker A, et al (2005),
Compares energy inputs:	
conventional and local supply chains	Van Hauwermeiren et al. (2006)
small, medium and large farms	Fleissner and Schlich (2003)
components of an average Swedish meal	Carlsson-Kanyama, Ekstrom, Shanahan (2002)
transport emissions and distance/mode of transport	DEFRA (2005), Jones (2002), Garnett (2003)
local sourcing vs. imported	Kooijman (1993)

Slide 15: Presentation Contents

A. **What are the environmental critiques of air-freighting agricultural produce?**

B. **Findings of LCAs on food products**

C. **Can we calculate the climate impacts from the production and transportation of agricultural produce from Africa? Can we compare these impacts with other produce and other activities?**

Climate Impacts of Agricultural Produce From Africa

Slide 16: Emission Conversion Factors

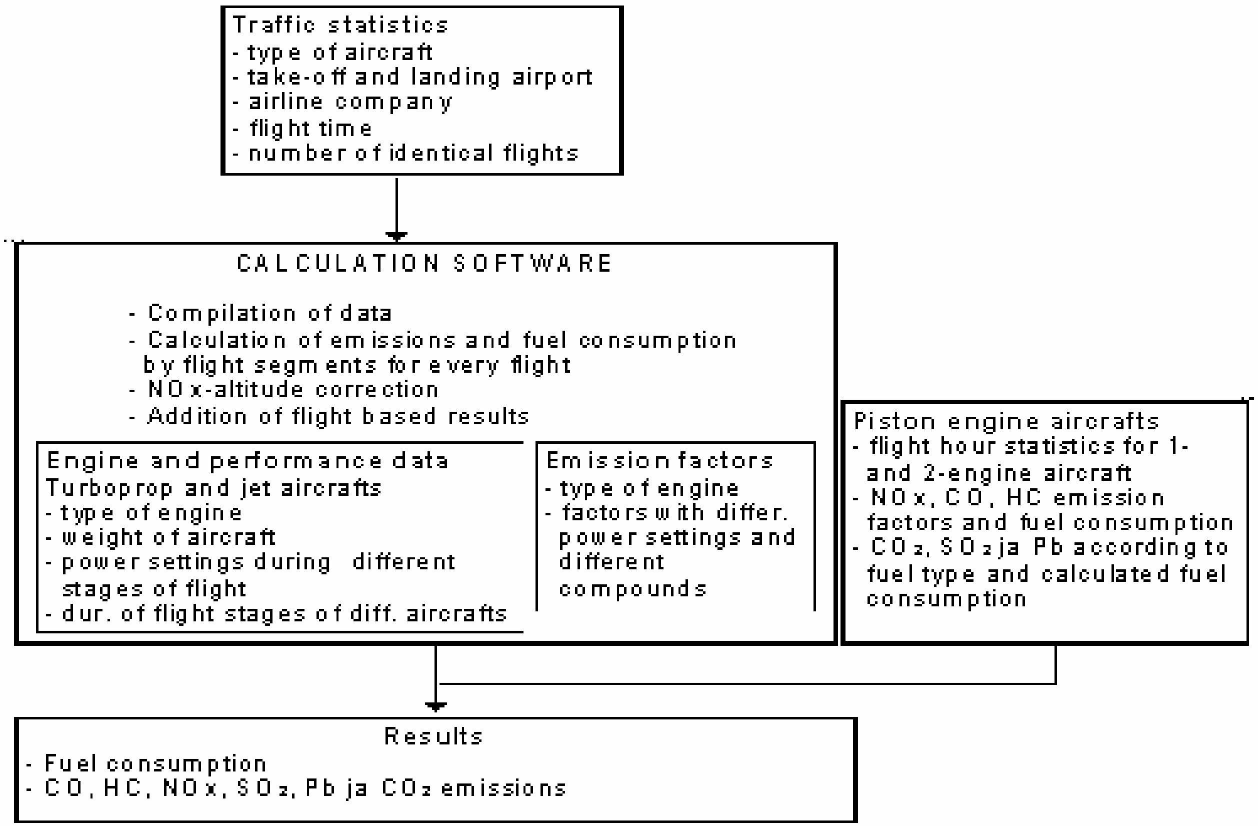
- DEFRA (2005) standard CO2 emission factor for long and short-haul flights

Table 11: Other Freight Mileage Conversion Factors					
Freight transport mode		**Tonne km**	**x**	**Factor**	**Total kg CO_2**
Air	Long haul		x	.57	
	Short haul		x	1.58	

Source: http://www.defra.gov.uk/environment/business/envrp/gas/10.htm

- AEA (Defra 2005) uses DEFRA standard and multiples by 2.7 - IPCC's factor for radiative forcing
- CE (2003) a Dutch research and consultancy organisation uses a similar methodology to AEA but expands the system boundary to include transport to and from loading points and emissions for refining aviation fuel and consequently has a slighter higher emission factor
- Finnish VTT Research Centre also provides an emission factor for long-haul flights (Marriott 2005)

Slide 17: Emissions Modelling



Finnish calculation system based on model by Civil Aviation Authority (UK)

Climate Impacts of Agricultural Produce From Africa

Slide 18: Existing Emission Factors

Source	**Emission Factor**	**Used**
DEFRA	0.00057 CO_2 kg per kg/km	By Marriott (2005) to calculate CO2 emissions from all non-EU air freighted FFVs
AEA from *Validity of Food Miles* (2005)	0.001539 CO_2e kg per kg/km	By AEA/DEFRA (2005) to calculate CO2e emissions from all non-EU air freighted food
CE	0.00141828 CO_2e kg per kg/km	By van Hauwermeiren et al. (2006) to calculate CO2 emissions from air-freighted Kenyan tomatoes
VTT (cited in Marriott 2005)	0.000719 CO2 kg per kg/km	
Sustain	0.001206	

Climate Impacts of Agricultural Produce From Africa

Slide 19: Accuracy of Trade Data

- Goods from a non-EU country and stored temporarily in an EU country are sometimes being coded as of EU origin
  - "a certain proportion come via other EU States. Dedicated airfreight cargo carriers such as Cargolux, Martinair and MK Airlines operate cargo services through their continental hubs, from where goods are then transported by Road Feeder Service (RFS) to the UK" Marriott 2005.
  - According to trade data providers Business & Trade Statistics Ltd this could either be coded as EU imports or coded with original country but with the last mode of transport.
- Questionable mode of transport coding found in HRMC data (Marriott 2005)

Climate Impacts of Agricultural Produce From Africa

Slide 20: Calculation Emissions - Existing Emission Factors

Kg kilometres x emission factor = total kg CO2 / CO2E
or
Tonne kilometres x emission factor = total tonnes CO2 / CO2E

Example: air-freighted green beans from Kenya 2005

Source	A. Emission Factor	B. Total Imports (tonnes)	C. Distance (km)	D. Tonne kms (B x C)	E. Total CO_2 / CO_2e (tonnes) (D x A)	On a kg CO2 /CO2e per kg produce
DEFRA	0.00057 CO_2 kg per km	19,618	6840	134,193,501	76,490 CO_2	4kg CO2
AEA from *Validity of Food Miles* (2005)	0.001539 CO_2e kg per km	19,618	6840	134,193,501	206,524 CO_2e	11kg CO2e
CE	0.00141828 CO_2e kg per km	19,618	6840	134,193,501	166,951 CO_2e	9kg CO2e
VTT	0.000719	19,618	6840	134,193,501	96,485	5kg
Sustain	0.001206	19,618	6840	134,193,501	161,837	8kg

Climate Impacts of Agricultural Produce From Africa

Slide 21: How a 250g Pack of Kenyan Beans Compares

City Break in Barcelona
A return flight from London to Barcelona compares with 420 packs of air-freighted Kenyan green beans (250g)

Week in the Big Apple
A return flight from Liverpool to New York compares with 1200 packs of air-freighted Kenyan green beans (250g)

The School Run
A pack of 250g air-freighted Kenyan beans compares with 12 school runs in the car

Using Your Laptop
A pack of 250g air-freighted Kenyan beans compares with using a large laptop every week day for a month

Shipping compared to Air-Freighting
A pack of 250g air-freighted Kenyan beans compares with 177 250g sea-shipped packs of Kenyan beans (although beans are not usually sea-shipped this has been used to illustrate the difference)