



INTERNATIONAL FOOD  
POLICY RESEARCH INSTITUTE  
*sustainable solutions for ending hunger and poverty*

# Land Use Change and European Biofuel Policies

---

*David Laborde Debucquet -*  
[d.laborde@cgiar.org](mailto:d.laborde@cgiar.org)

September 2011

*The views expressed by the author are not those of  
IFPRI or the European Commission*

# Preamble: iLUC or LUC

---

- An important and sensitive “policy” issue
- An issue that most models will never address: the spatial dimension
- Few empirical evidences about the relevance of the discrimination
- What matters is the net effects

# The MIRAGE-BIOF

- The MIRAGE model has started to be developed in 2001 in CEPII, Paris. Focusing on EU Integration and Trade Policy analysis of the beginning
- Now used by several institutions around the World, numerous versions ( trade policy focused, FDI, Services, Climate Change etc.)
- Biofuels assessment started in 2008
- On land use:
  - First study for the DG Trade in 2009 (limited to ethanol)
  - Second study for DG Trade in 2010 (part of the public consultation)
  - This new study for: DG Trade in 2011
- But other applications: mandates of other countries, comparison of “traditional” ag policies and biofuels etc., food prices and price stability consequences

# Modeling Biofuels in MIRAGE

---

- MIRAGE model
  - Multi country, Multi sectoral, and global
  - Recursive dynamic set-up
- Modified model and data components
  - Improvement in demand system (food and energy)
  - Improved sector disaggregation
  - New modeling of ethanol sectors
  - Co-products of ethanols and vegetable oils
  - New modeling of fertilizers
  - New modeling of livestock (extensification/intensification)
  - Land market and land extensions at the AEZ level

# Major Efforts on Data: from Values to Quantities

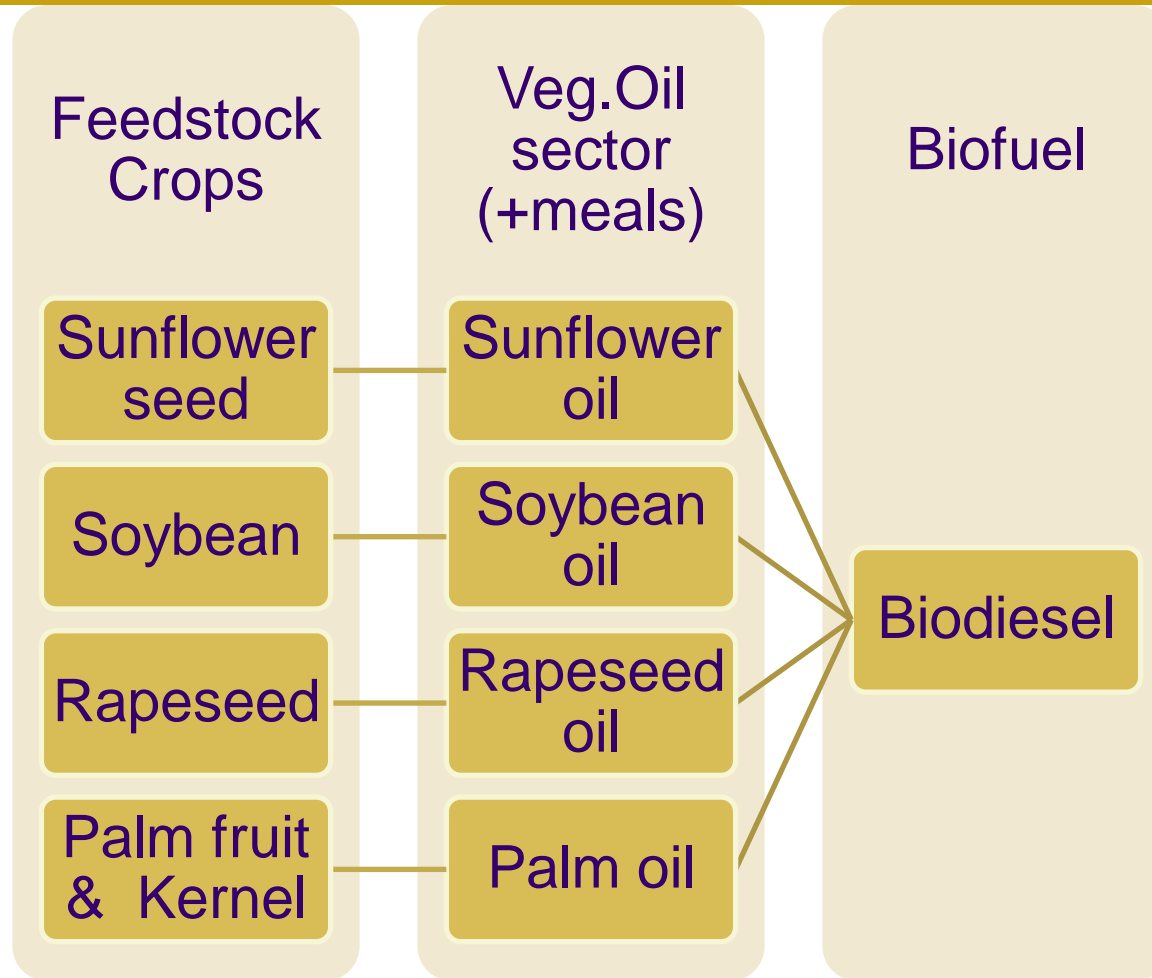
---

- Improvement from the GTAP7 databas
  - Split for fertilizers and fossil fuels
  - Disaggregation with specific procedure for Maize, Soybeans, Sunflower seed, Palm fruit, Rapeseed + relevant Oils + Co-products
  - Production targeting (FAO) for all relevant crops
  - Creation of a “harmonized” price database for calibration
    - Case of co-products
  - Creation of Ethanol and Biodiesel (2008 trade and production structure).
  - Correction of some I-O data (e.g. China)
- Land use (AEZ GTAP database 2001 → 2004, + consistency with FAO and M3)
  - Correction for Sugar cane AEZ in Brazil

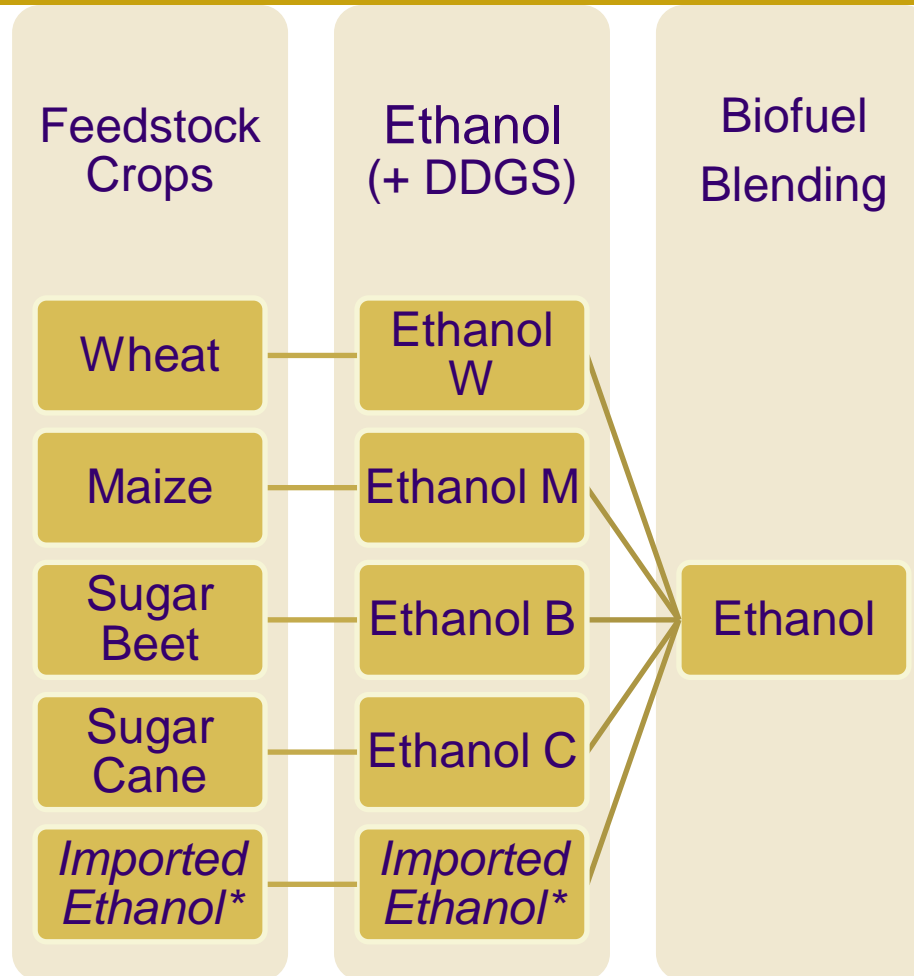
# Sectoral Disaggregation (43)

Sector	Description	Sector	Description	Sector	Description
Rice	Rice	SoybnOil	Soy Oil	EthanolW	Ethanol - Wheat
Wheat	Wheat	SunOil	Sunflower Oil	Biodiesel	Biodiesel
Maize	Maize	OthFood	Other Food sectors	Manuf	Other Manufacturing activities
PalmFruit	Palm Fruit	MeatDairy	Meat and Dairy products	WoodPaper	Wood and Paper
Rapeseed	Rapeseed	Sugar	Sugar	Fuel	Fuel
Soybeans	Soybeans	Forestry	Forestry	PetrNoFuel	Petroleum products, except fuel
Sunflower	Sunflower	Fishing	Fishing	Fertiliz	Fertilizers
OthOilSds	Other oilseeds	Coal	Coal	ElecGas	Electricity and Gas
VegFruits	Vegetable & Fruits	Oil	Oil	Construction	Construction
OthCrop	Other crops	Gas	Gas	PrivServ	Private services
Sugar_cb	Sugar beet or cane	OthMin	Other minerals	RoadTrans	Road Transportation
Cattle	Cattle	Ethanol	Ethanol - Main sector	AirSeaTran	Air & Sea transportation
OthAnim	Other animals (inc. hogs and poultry)	EthanolC	Ethanol - Sugar Cane	PubServ	Public services
PalmOil	Palm Oil	EthanolB	Ethanol - Sugar Beet		
RpSdOil	Rapeseed Oil	EthanolM	Ethanol - Maize		

# Biodiesel Production



# Ethanol Production



*\* for Central America and Caribbean*

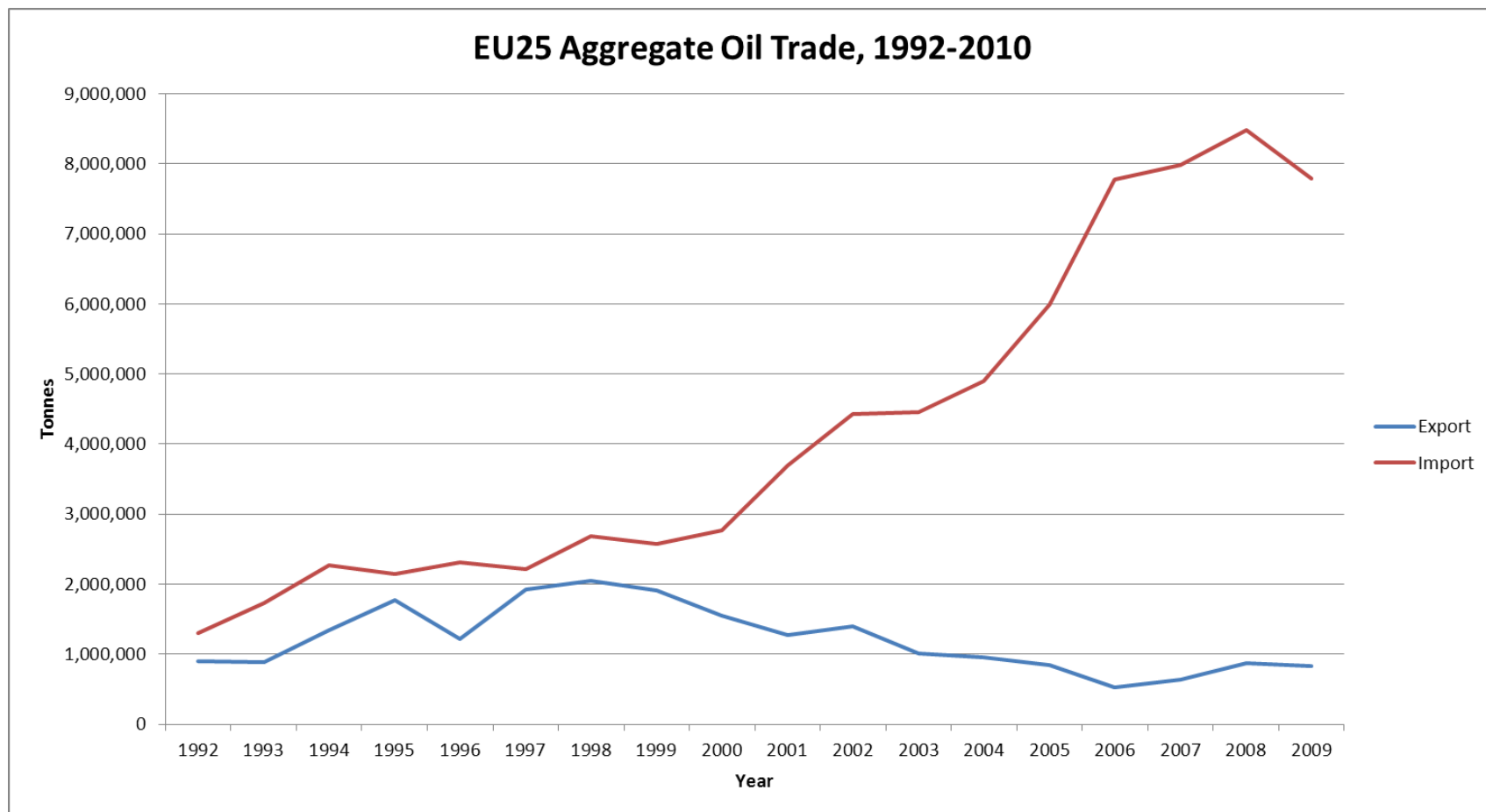


---

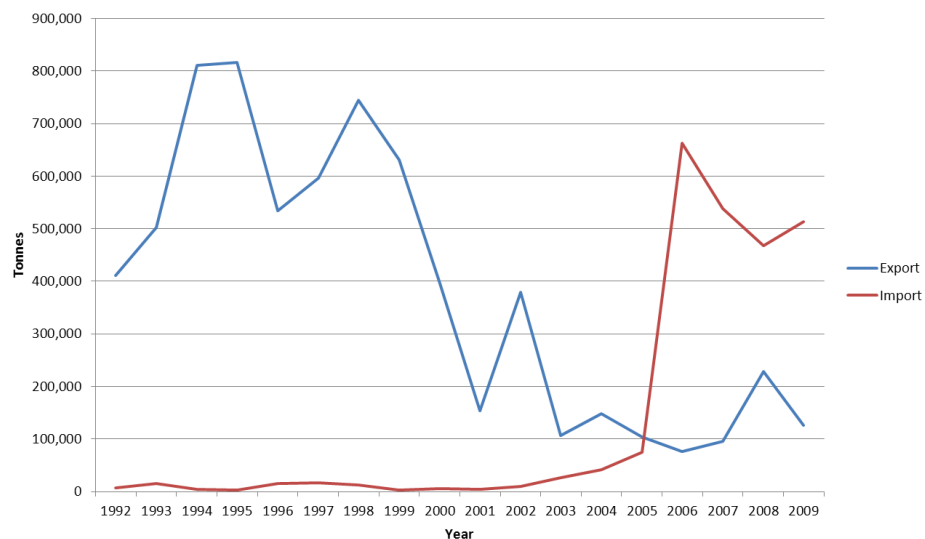
# **EU BIODIESEL AND THE VEGETABLE OIL MARKETS: SOME FACTS**

To put in perspective the modeling exercise and the complexity of the world and why LUC is important and why international trade is the key

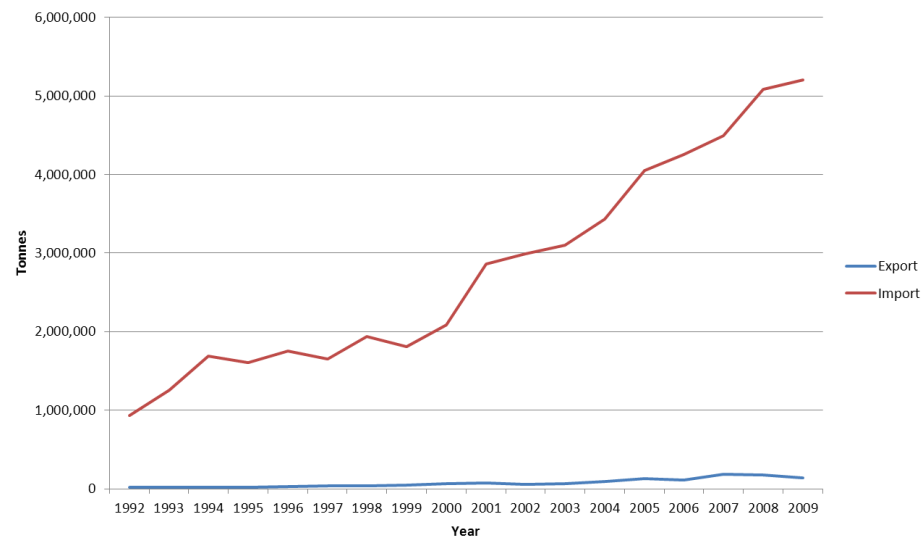
# EU Total Veg Oil trade



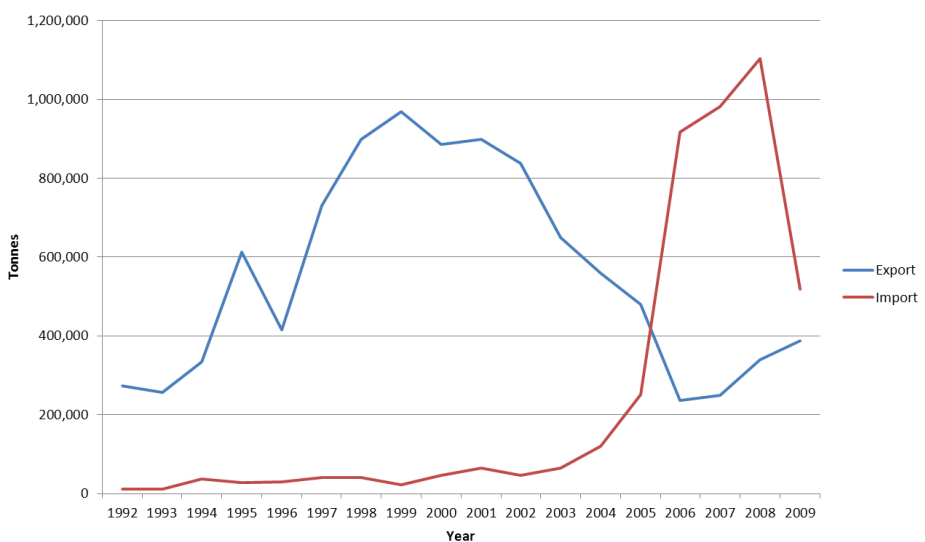
**EU25 Rapeseed Oil Trade, 1992-2010**



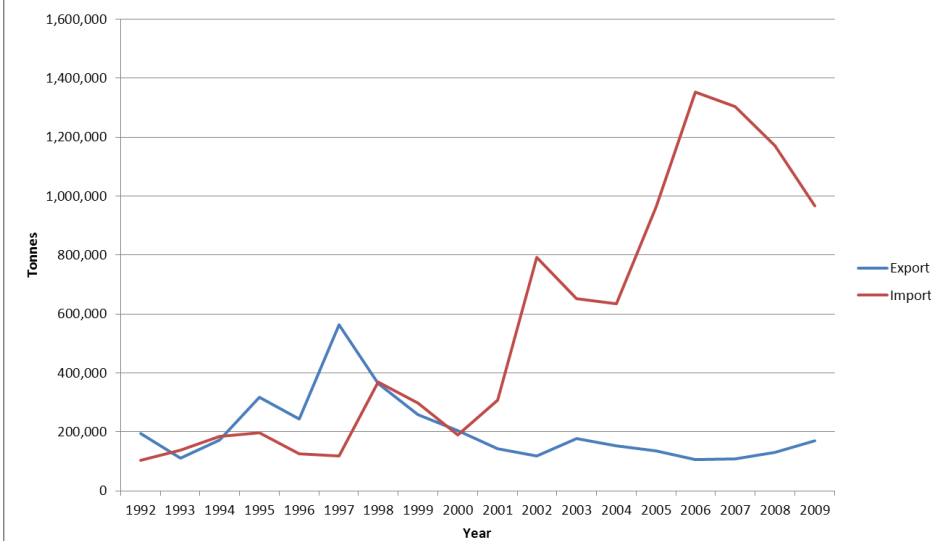
**EU25 Palm Oil Trade, 1992-2010**



**EU25 Soybean Oil Trade, 1992-2010**

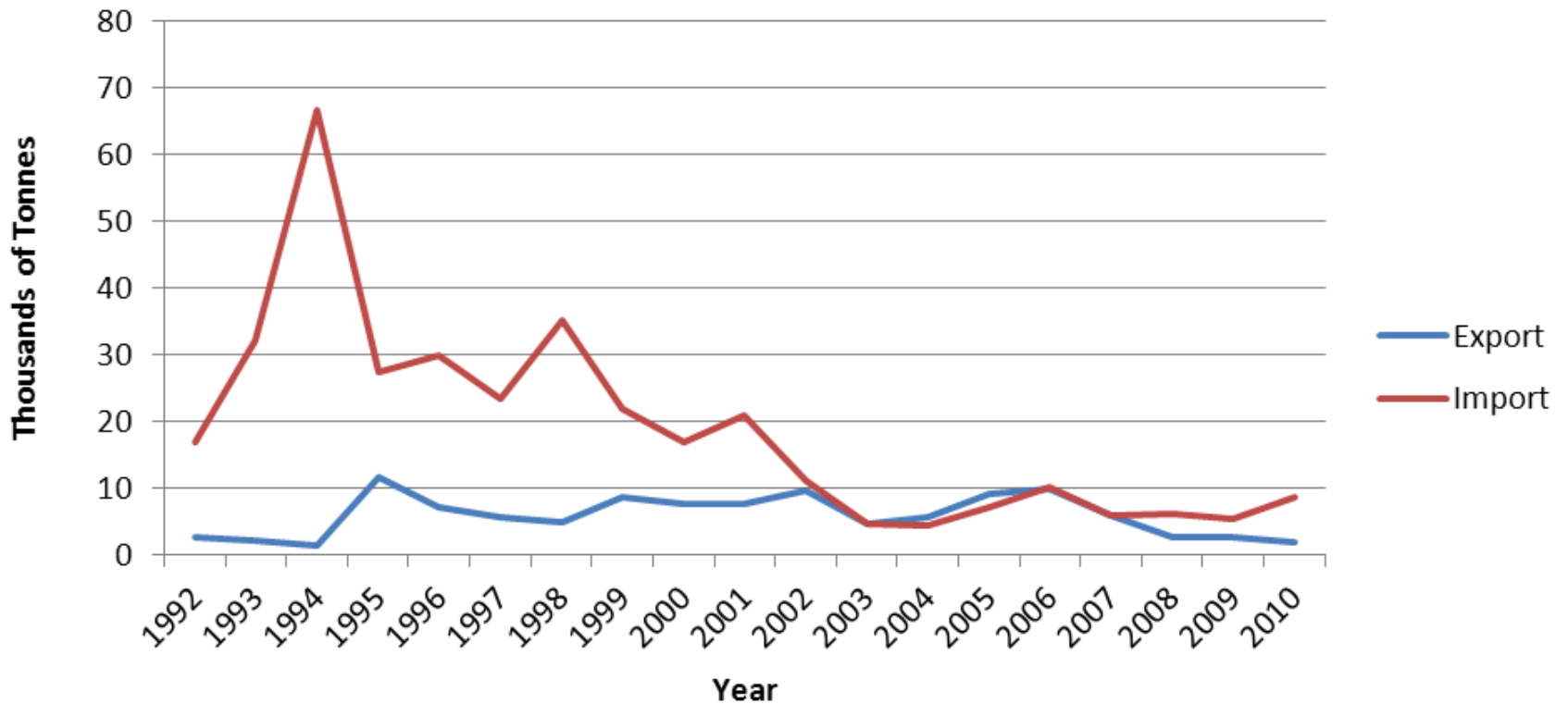


**EU25 Sunflower Oil Trade, 1992-2010**

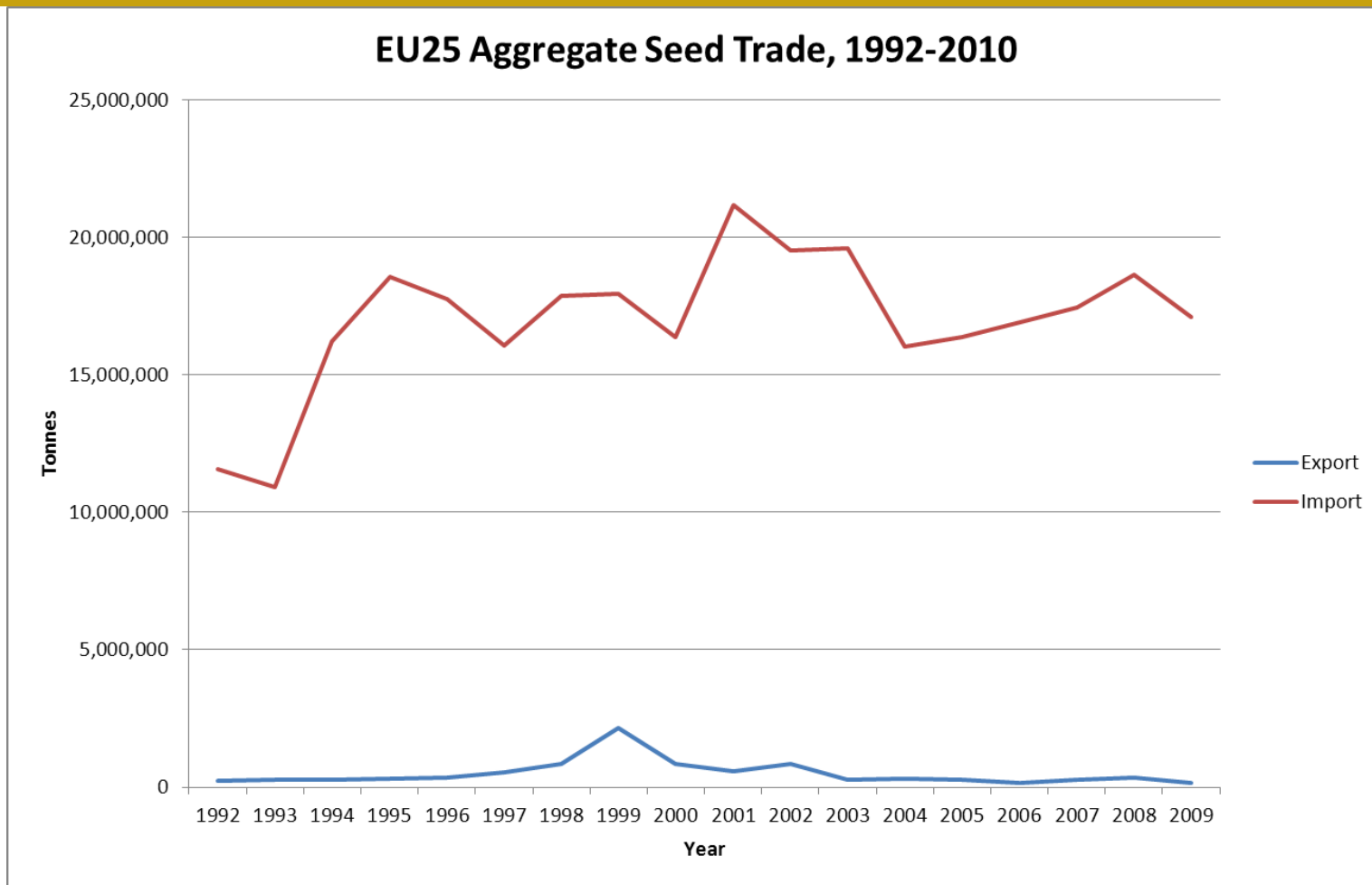


# EU Meal trade

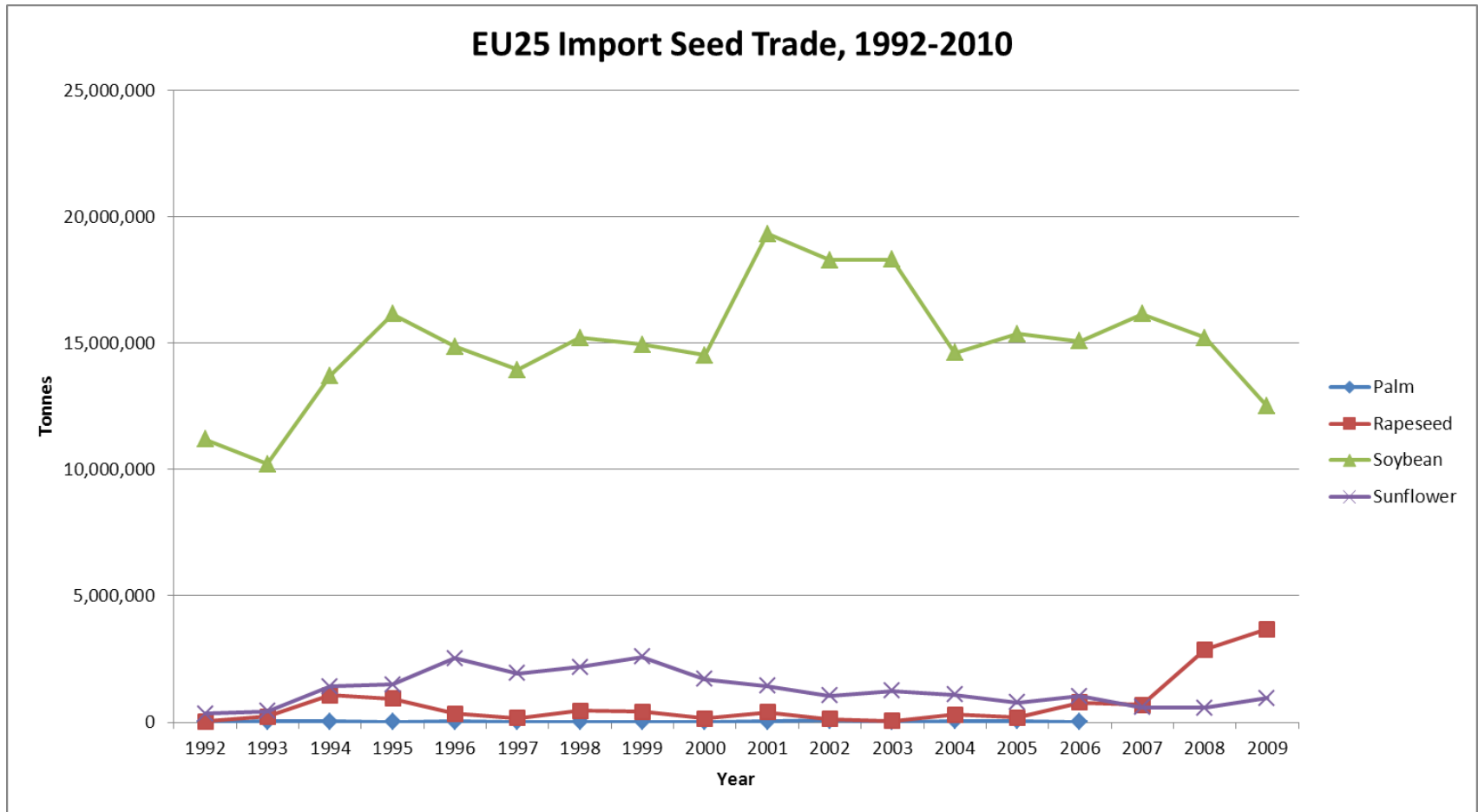
## Protein embodied in EU25 Aggregate Meal Trade, 1992-2010



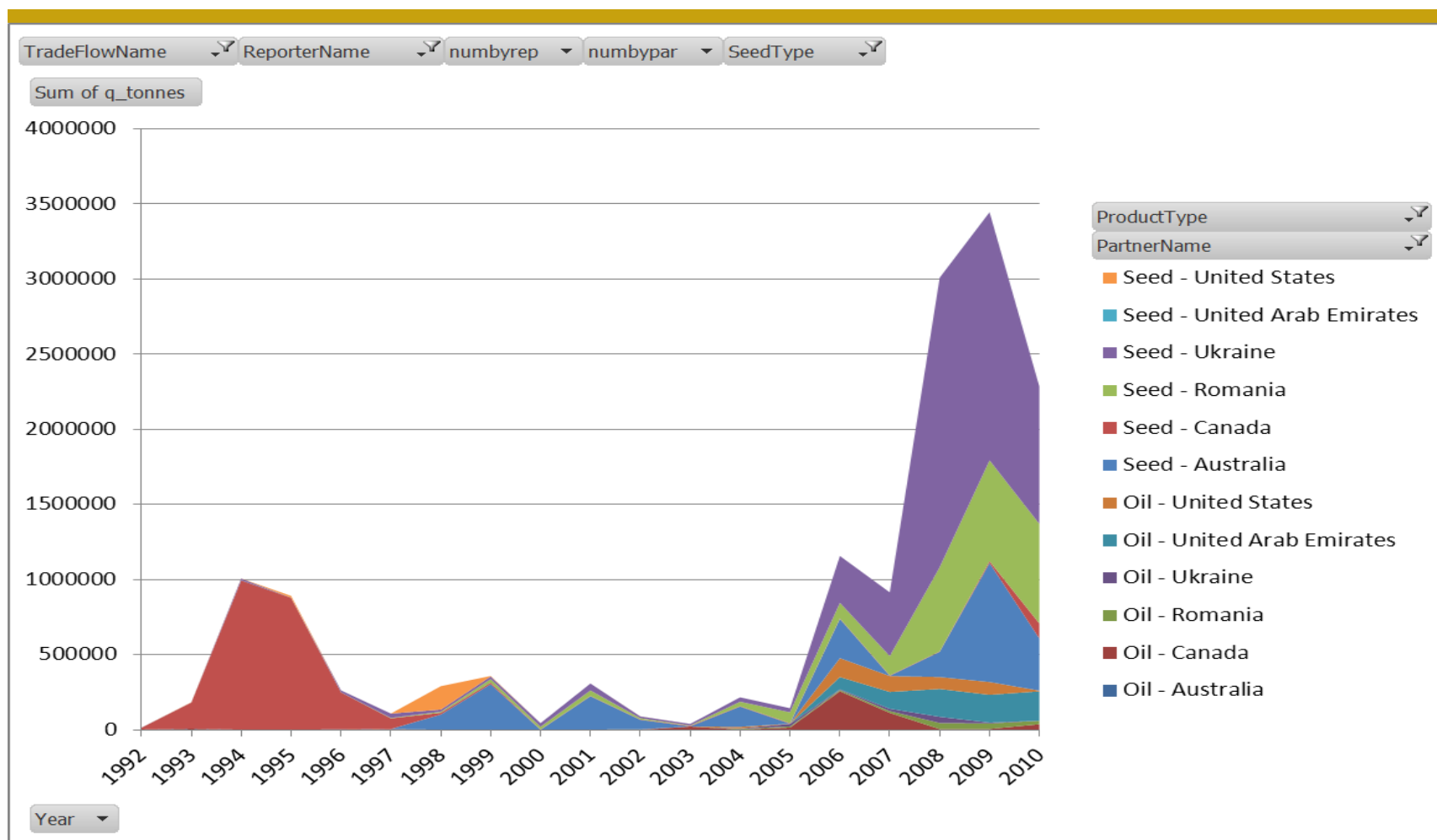
# EU Seed trade



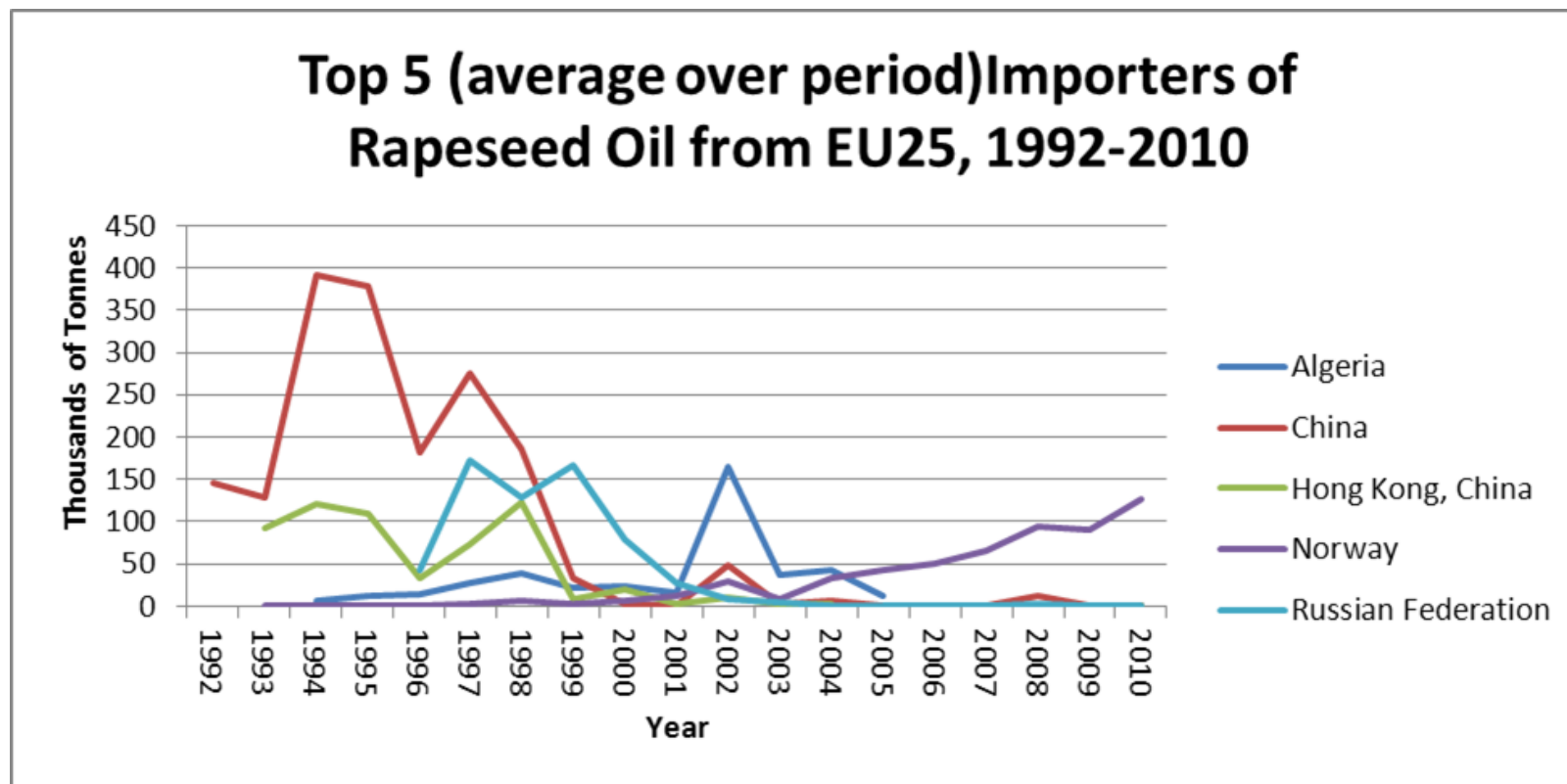
# Seed trade by type



# EU Suppliers (! Exports data =80% of EU declaration)

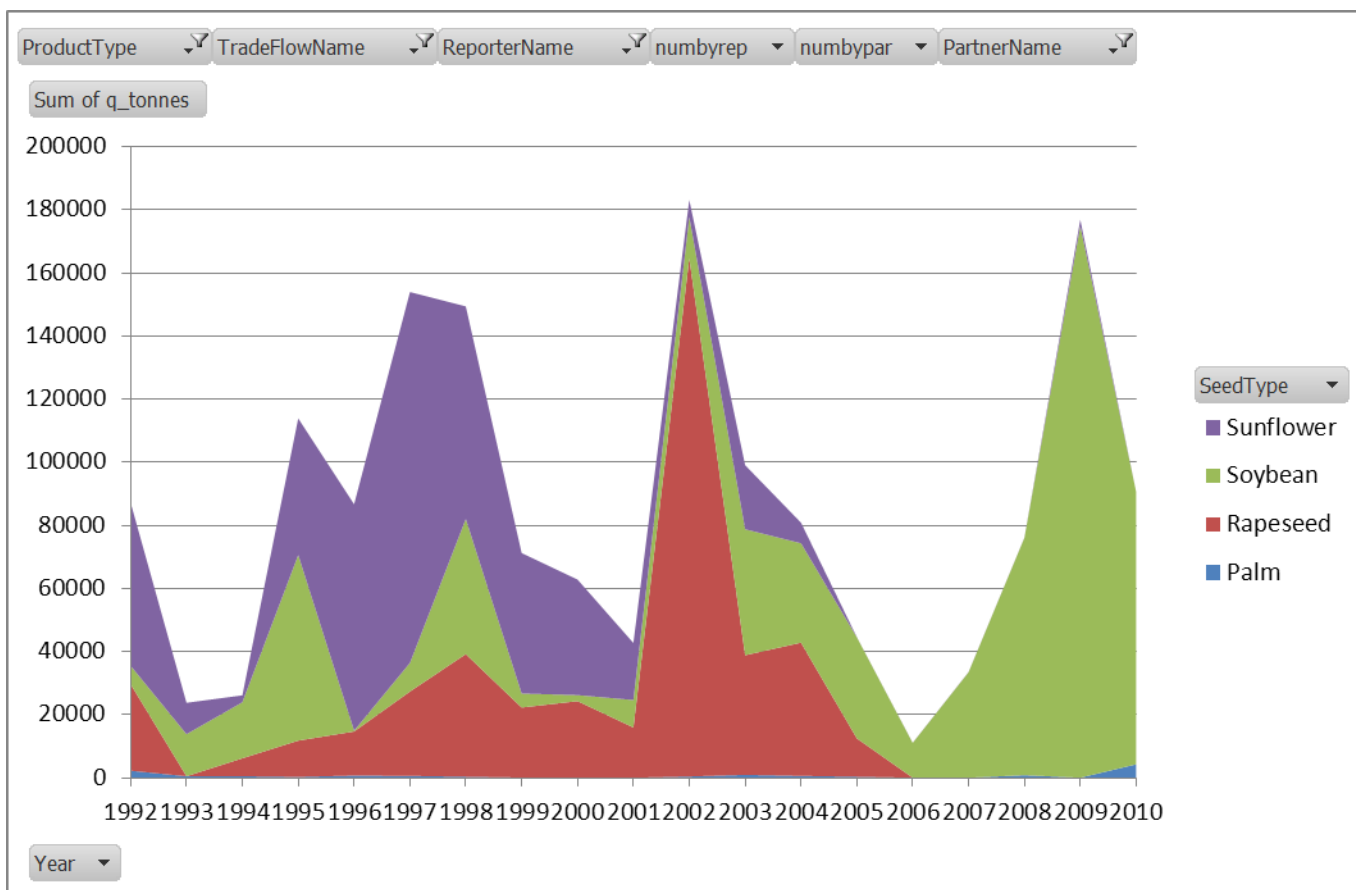


# Top 5 Importers of Rapeseed Oil

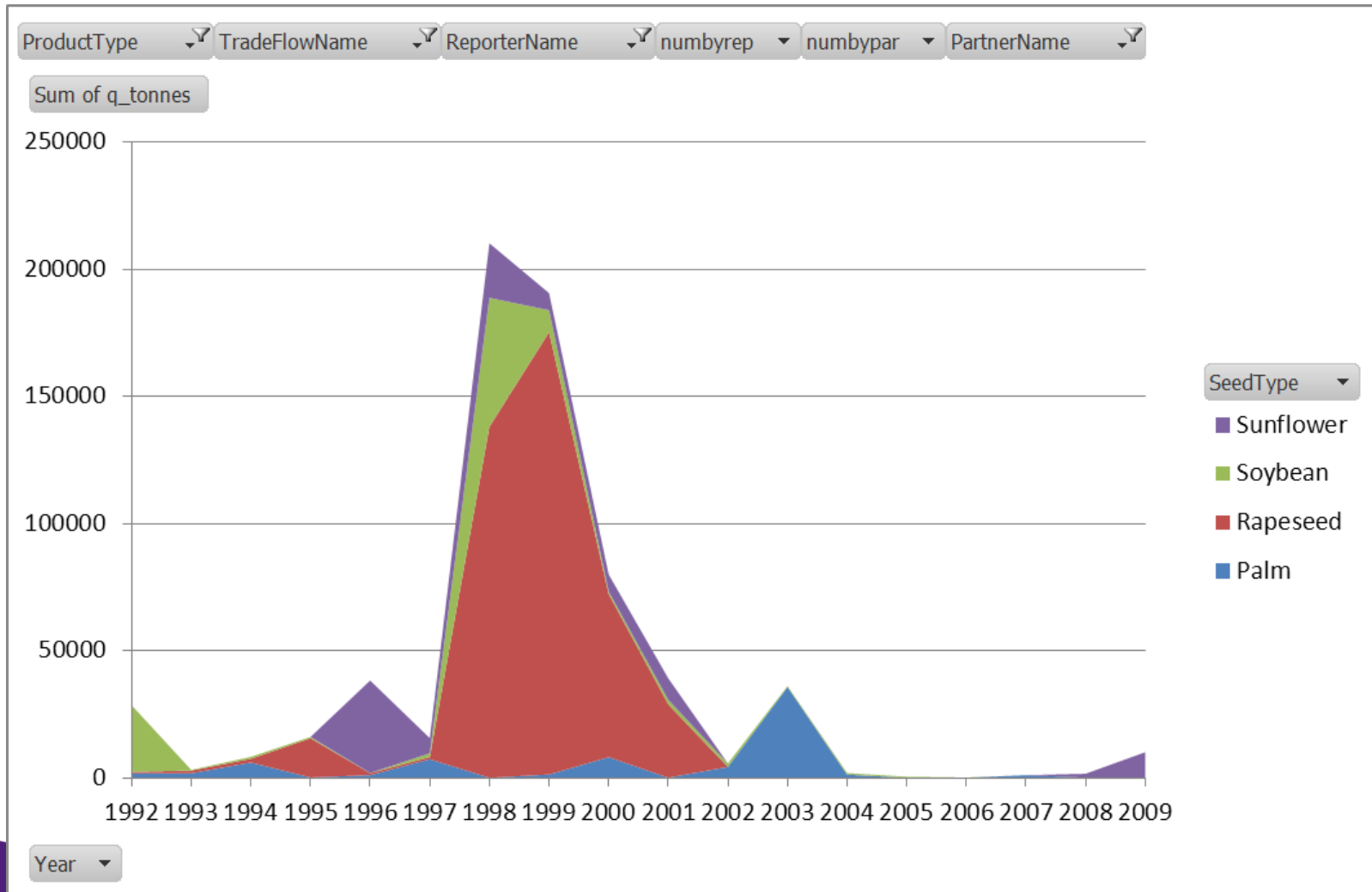




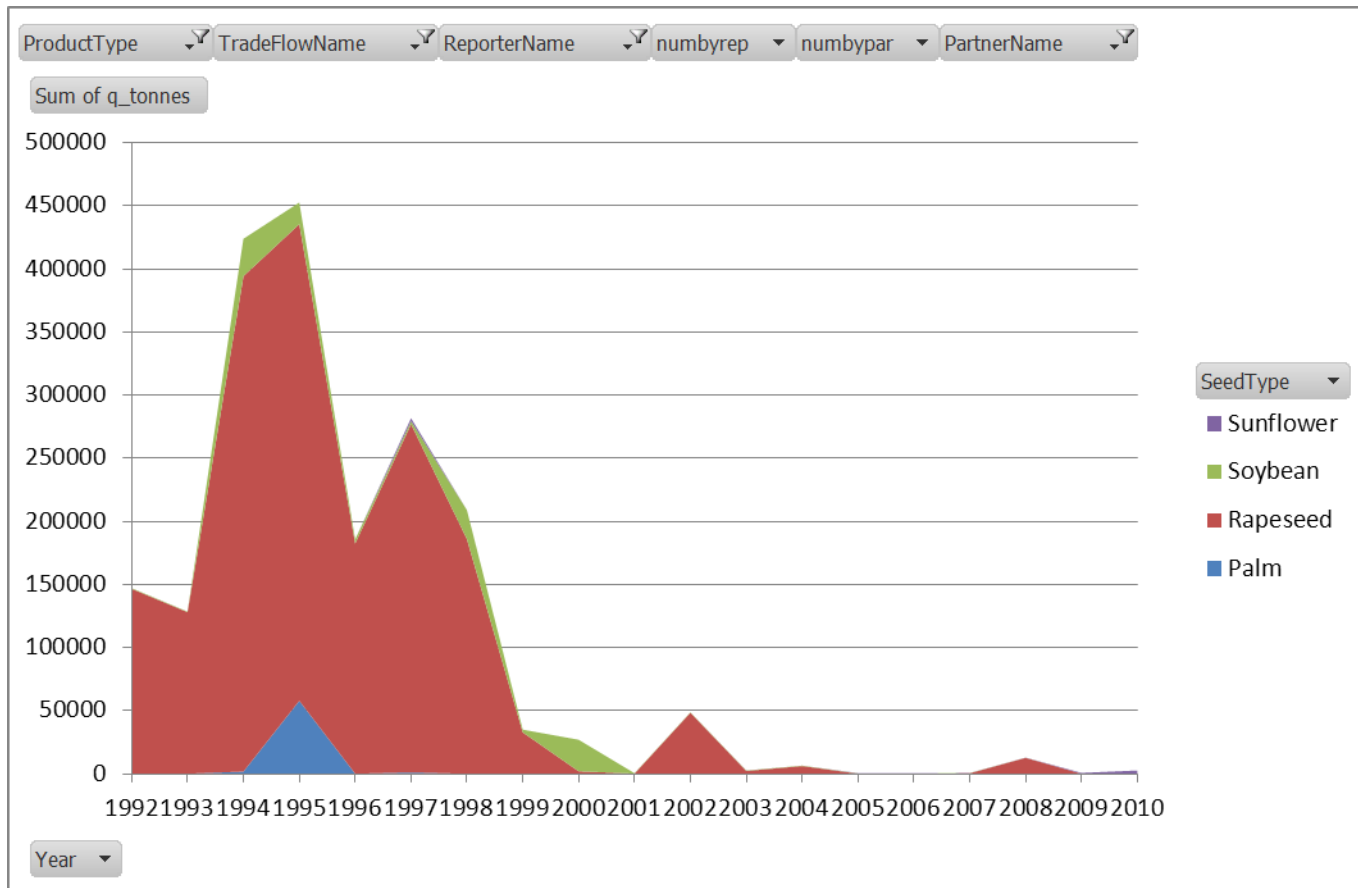
# EU exports to Algeria



# EU exports to India



# EU exports to China



---

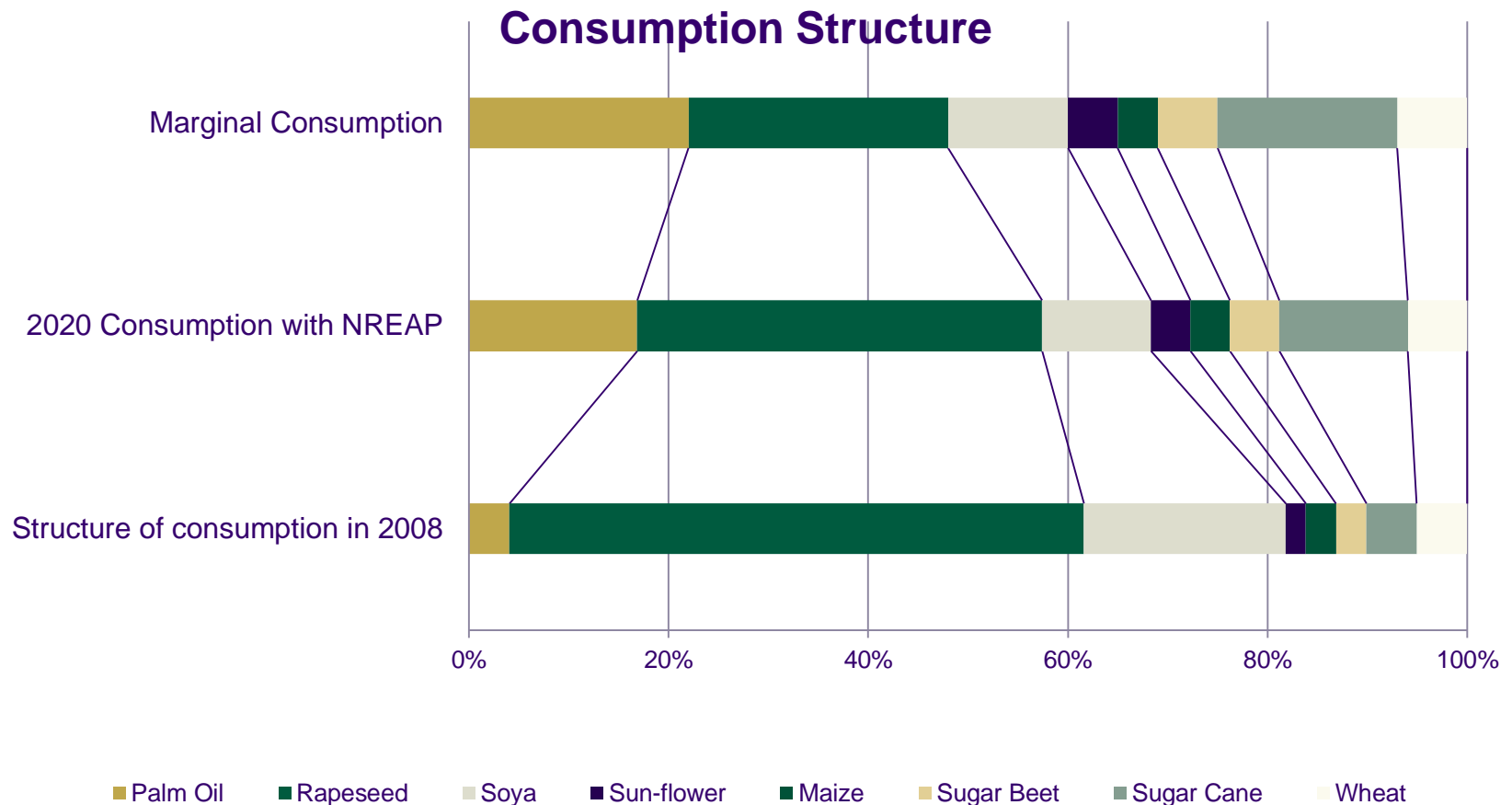
Due to the confidentiality clause of the “ongoing’ EU Study, the results displayed here are based on Laborde and Valin (2011)

# **SIMULATION DESIGN AND RESULTS**

# Baseline

- Mandates in OECD countries, China, ASEAN, Brazil based on announced policies
- Sugar reform (still a source of numerical problems)
- End of the Land Set Aside
- EU trade measures vs US Biodiesel
- No change for Ethanol
- Some restrictions on Brazilian exports to the US in the baseline:
  - Partially capture the change in the real exchange rate real/USD
  - Avoid too much confusion between corn and sugar cane ethanol for the central scenario
- Stronger Brazilian domestic consumption: but still (too) large export supply response
- Modification of initial profitability in Argentina
- New yield changes: Aglink Cosimo
  - VERY IMPORTANT EFFECTS but no SENSITIVITY ANALYSIS on this assumption

# Additional EU consumption from 2008 to 2020 driven by NREAP: +16 Mtoe (to reach 27.2 Mtoe)

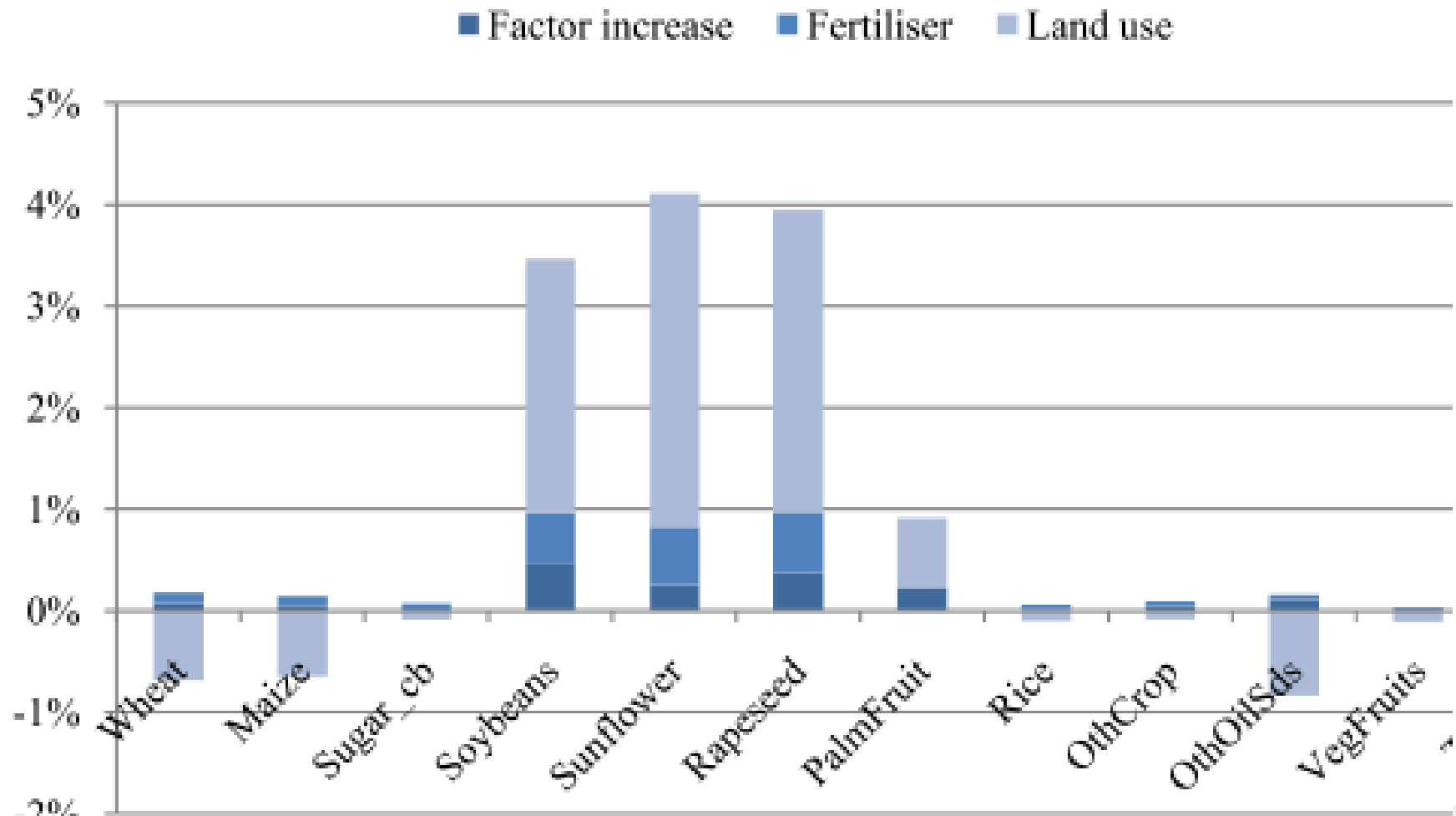


# Cropland extension: alternative scenarios



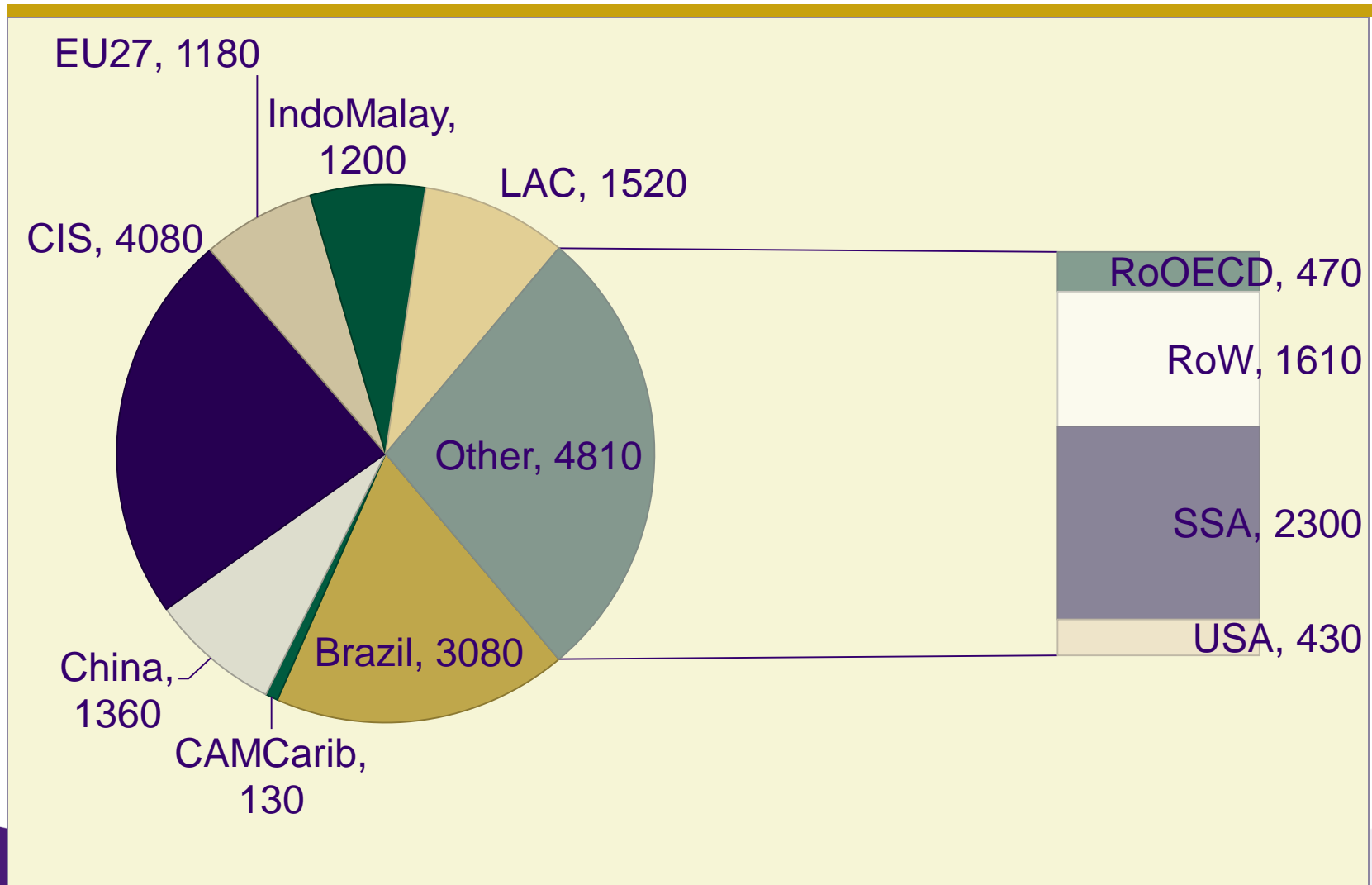
Total: between 11,000 and 19,000  
Km2 of additional cropland

# World Production changes (decomposition by source)





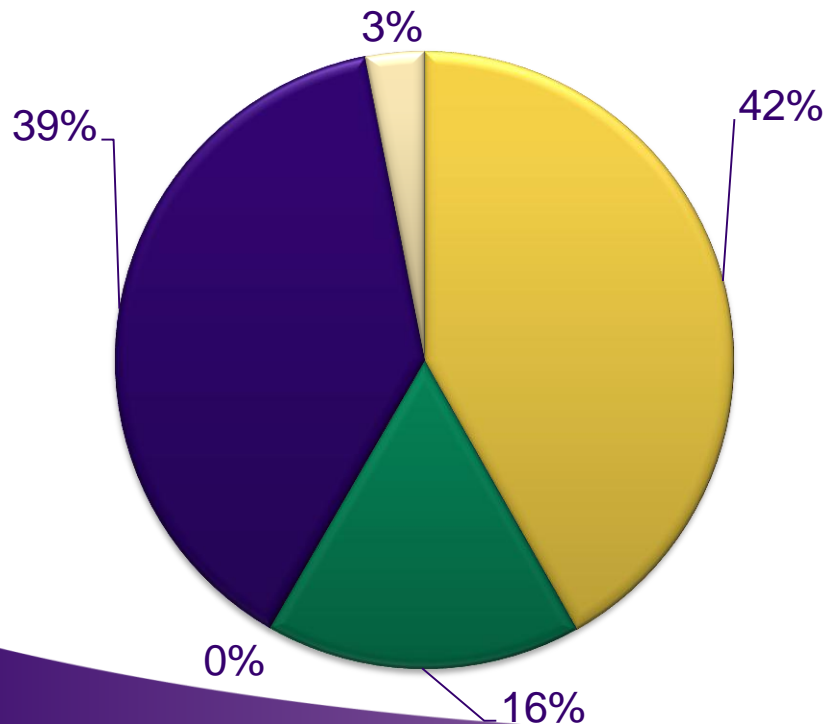
# Location of cropland extension



# From cropland to emissions

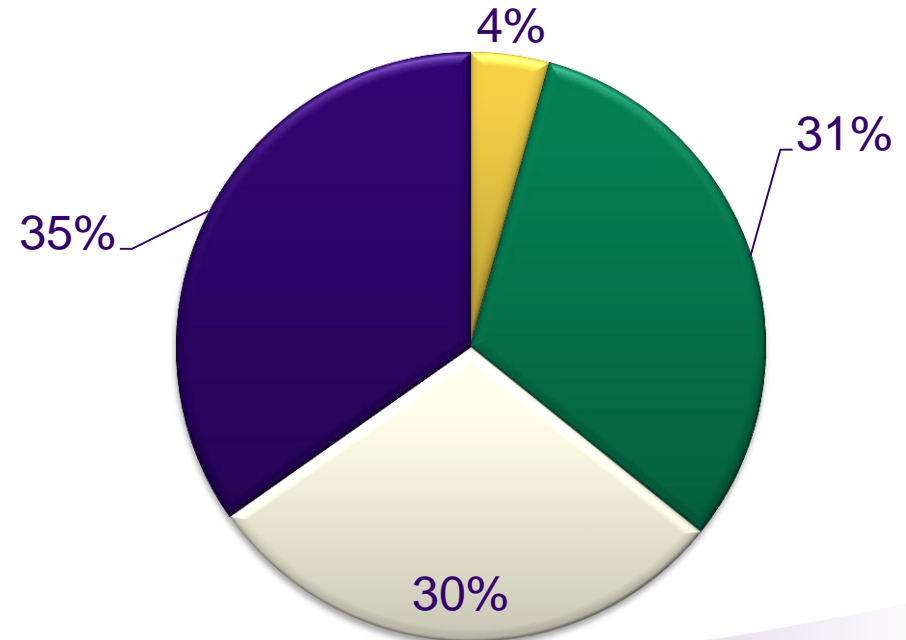
## Source of cropland

- Pasture
- Other
- Forest\_primary
- SavnGrassInd
- Forest\_managed

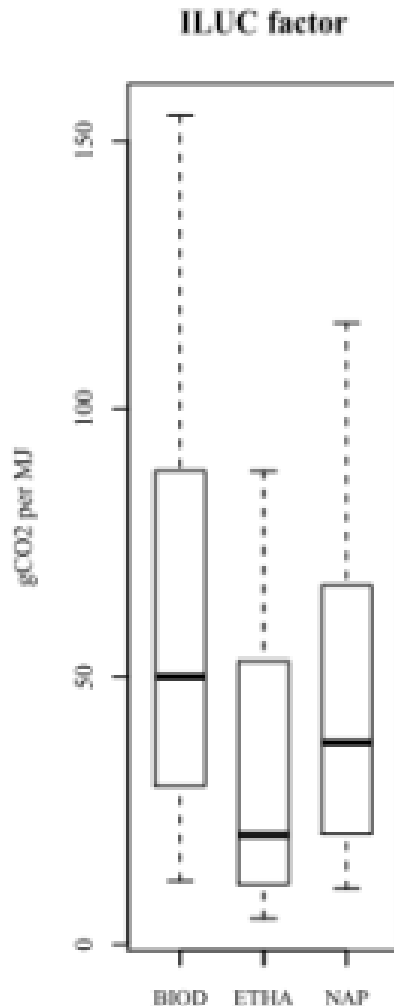


## Source of emissions

- Biomass change - Primary Forest
- Biomass change - Managed Forest
- Carbon in mineral soil
- Peatland emissions from Indonesia - Malaysia



# LUC emissions



- Median of 38grCO<sub>2</sub>eq/MJ over 20 years
- Differences between biodiesel and Ethanol
- To be compared to direct savings (also higher for ethanol than biodiesel)