



Environmental Impacts of Significant Natural Resource Trade Flows into the EU

METROECONOMICA
Economic and Environmental Consultants

Report to DG ENV

ED 05444

Issue Number 6

Date 27th October 2008

AEA Energy & Environment

Title	Environmental Impacts of Significant Natural Resource Trade Flows into the EU (Issue 6)
Customer	European Commission (DG Environment)
Customer reference	070402/2006/452909/MAR/G4
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File reference	
Reference number	ED05444

AEA
329 Harwell International Business Centre
Didcot
Oxon
OX11 0QJ

t: 00 44 870 190 6411
f: 00 44 870 190 6318

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AEA Technology plc

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and ISO14001

Author	Name	Judith Bates (AEA Energy and Environment) Nick Dale (Metroeconomica)
	Approved by	Name
	Signature	
	Date	30/10/08

Executive Summary

Introduction

European and other major economies depend on natural resources for their prosperity, but current patterns of increasing resource use are causing environmental pressures and environmental degradation globally. In order to tackle this issue the European Commission has developed a “Thematic Strategy on the Sustainable Use of Natural Resources¹” with the overall objective of decoupling economic growth from environmental degradation through improved resource efficiency and reduced environmental impact of resource use. As for most developed regions, the EU is highly dependent on resources coming from outside Europe, and as such is in effect exporting environmental impacts.

Product prioritisation studies based on life cycle analysis (LCA) techniques are often used to help identify which aspects of consumption are particularly damaging to the environment. However, knowledge of the environmental impacts taking place at the very early stages of the product lifecycle (i.e. raw material production and primary processing) is often relatively limited, particularly as impacts often occur outside those major economies where such LCA studies are typically conducted. Improving this information is essential to ensuring that such prioritisation studies deliver accurate assessments.

This study completed for DG Environment (DG ENV), European Commission, by AEA Energy and Environment and Metroeconomica, seeks to help address this issue by reviewing the literature to identify the environmental impacts which occur *outside* the EU from a number of highly significant trade flows of raw materials and processed materials into the EU. The literature review provided useful insights into the types of environmental impacts associated with commodities, including impacts on biodiversity which are difficult to characterise quantitatively in an LCA study.

The study also suggests a simple methodology for using information on these environmental impacts to identify those resource trade flows which have a more significant environmental impact, and makes suggestions for policy developments that could help to reduce these impacts.

Study Methodology

The study:

- i. Selected a set of 40 commodity trade flows, spread across four sectors (agricultural food and non-food commodities, metals and minerals and fossil fuels) on the basis of the significance of volume and value of imports and likely significance of potential environmental impacts (based on expert judgement and results from previous studies).
- ii. Compiled trade data on the commodities identifying the main countries exporting to the EU.
- iii. Conducted a literature review to identify environmental impacts from production, wherever possible gathering country specific information (for main exporting countries) as well as generic information. The literature was also used to identify areas where information on environmental impacts is lacking.
- iv. Using information gained from the literature review and expert judgement, assigned a score (from zero to three) to reflect the severity of potential impacts for each of the 40 flows in four policy areas: climate change, biodiversity, human health and natural resources.

¹ COM(2005) 670 final. ‘Thematic Strategy on the sustainable use of Natural Resources’

- v. Used the ratings together with data on the significance of the trade flow to identify which of the commodities studied had the most significant environmental impacts in their source countries overall.
- vi. Use data on transport modes and transport distances to examine environmental impacts of transporting commodities to the EU.

While existing LCA studies of commodities were examined in the literature review, the focus was on supplementing this information by identifying additional information sources and ensuring that all potential environmental impacts (including those such as biodiversity which may be difficult to characterise in LCA data) were covered. The use of a simple rating system which did not require quantitative data, but relied on guidelines meant that enough information was available on all of the commodities to rate them in the four policy areas. The emphasis on gathering country specific as well as generic information highlighted how and why the severity of particular environmental impacts can vary significantly between countries. Reasons for variations include:

- **Availability of natural resources** necessary to sustain commodity production (e.g. in areas where rainfall is not sufficient to support cotton production, there are severe impacts on water resources affecting both biodiversity and the local people);
- **Patterns of existing land use and existing ecosystems;** whenever land use change is required for commodity production, impacts on biodiversity are very dependent on the existing land use;
- **Production mode and method:** smaller scale production can reduce environmental impacts for some commodities (e.g. by preventing large areas of monoculture), but may also increase impacts due to less efficient production methods, or poorer regulation (e.g. small scale gold mining);
- **Level and quality of environmental regulation;** regulation of extraction and production activities and regulation of use of e.g. herbicides and pesticides in agricultural production may vary significantly between countries. Good regulation and proper monitoring of impacts can lessen the severity of impacts.

The principal disadvantage of the approach is the subjective nature of the rating. Apart from climate change where quantitative data was available from life cycle databases and studies for most of the commodities, the rating is based on expert judgement. The project team made use of sector experts in helping to compile ratings, and is confident that ratings have been assigned as consistently as possible within each sector, it is less confident that ratings for a particular impact category are consistent between sectors.

Apart from the challenges of assigning ratings consistently across all commodities, the main problem encountered was a lack of information and data on which to base the ratings in some cases. In general:

- More information and more quantitative data were found on environmental impacts of metals, minerals and fossil fuels, than for the other commodities.
- More information was also generally available for commodity production in developed countries as environmental reporting at both the national and company level is more developed than in developing and transition countries.
- More comprehensive and comparable data was generally available for climate change, than biodiversity and natural resources, partly because these are much wider in definition.

Recommendations for Improving Methodology

In general, establishing a firmer basis to policy prioritisation between significant natural resource trade flows requires a redoubling of efforts to establish a more comprehensive understanding of their impacts, in particular on biodiversity, human health and natural

resources. This would be achieved through a coordinated policy of data gathering and a more coordinated collation of results from the many and varied current research projects (something which this project is contributing towards).

Key recommendations for improving the methodology adopted in this study are to:

- Refine the guidelines used for assessing rankings, involving a wider range of both sector experts and 'impact' experts, e.g. impacts in biodiversity and human health.
- Include more quantitative criteria in the guidelines.
- Ensure review of the ratings by a range of sector experts and 'impact experts'; consider including experts from producer countries. The study has highlighted a number of countries which supply a range of commodities, where it would be particularly useful to make links with appropriate experts. This might also help in provision of more country specific data. Development of a database of expertise within this project provides a basis for further inclusion of experts in this context.
- Examine sources of quantitative data (e.g. time series on crop areas held by organisation such as the FAO, occupational health statistics) which could potentially be used to give a more quantitative basis for the ratings for biodiversity, human health and natural resources.
- Consider replacing the 'natural resources' impact category with two or three more narrowly and clearly defined different impact categories.

Environmental Impacts of the Commodities Studies

Ratings for the 40 commodities are shown in Table E1. For each of the sectors examined, there are often some generic environmental impacts, which are applicable to all or many of the commodities. This is most clearly so in the 'fossil fuels' category, where oil and gas production are often closely linked so have similar types of impacts. For minerals and metals, there are a large number of common impacts e.g. there are large volumes of waste, acid drainage can lead to water pollution and fugitive dust can cause health problems. Processing of the mineral ores into metals tends to increase global warming significantly due to the energy intensity of the processing and brings additional air and water pollution issues. The pattern of impacts for agricultural commodities tended to vary between commodities more than for fossil fuels and minerals and metals, although this may partly reflect the more diverse nature of the commodities studied. Where cultivation of a commodity results in land use change (e.g. because the crop area is expanding, or it being displaced into previously uncultivated areas) then there can be significant impacts on climate change due to the carbon releases associated with clearing and cultivating land, and on biodiversity as habitats are destroyed.

The variations shown in the severity of the impacts for commodities within each of the four commodity groups highlight the need for caution in generalising about the main impacts of the sectors, apart from perhaps fossil fuels. This partly reflects the fact that a mixture of raw materials and processed materials were selected for study in each sector. For example in the non-food commodities, leather, cotton fabrics and bioethanol, and in the food commodities, meat and milk can be regarded as processed materials as grass and feedstuffs are processed by the animal into a useful product.

Overall Environmental Impact

The overall environmental impact of each commodity was derived by summing the ratings for climate change, biodiversity, human health and natural resources. The ranking of the commodities based on this overall environmental impact is shown as the first column in Table E2. These overall environmental impact ratings were then multiplied by the total volume of EU imports to assess the trade flows likely to have the highest overall impacts in source countries (shown in the second column in Table E2). So for example, while wheat is one of the agricultural commodities with a lower overall environmental impact, very large

amounts are imported, so that the impact of the wheat trade flow is higher than for trade flows of many other commodities.

Table E1 Impact Ratings for Commodities

	Climate Change	Bio-diversity	Human Health	Natural Resources
<i>Agricultural Food Products</i>				
Bananas	**	**	**	**
Bovine meat	***	***	-	**
Cocoa	*	*	-	- / *
Coffee	**	**	*	**
Crustaceans	***	***	* / **	- / **
Fish, fresh, chilled, frozen	**	** / ***	-	***
Maize	**	* / **	*	* / **
Milk products	***	*	-	* / **
Rice	***	*	**	**
Soybeans	** / ***	***	*	* / **
Sugar	*	* / **	*	**
Tea	**	**	*	**
Wheat and wheat flour	**	*	*	* / **
<i>Non-food agricultural products</i>				
Bioethanol	**	**	*	*
Cotton lint	**	***	***	***
Cotton fabrics, woven	**	***	***	***
Leather	* / **	*	*	**
Natural rubber	* / **	* / **	*	*
Palm oil	***	***	*	*
Tobacco	***	** / ***	**	**
Wood, simply worked	* / **	**	- / *	*
Chemical wood pulp	**	**	- / *	**
<i>Minerals and metals</i>				
Aggregates	-	* / **	**	*
Aluminium	***	* / **	**	**
Bauxite and other aluminium ores	-	* / **	*	**
Cadmium	-	**	**	-
Cement	***	*	**	**
Copper ores and concentrates	* / **	* / **	*	**
Gold	***	*	* / ***	**
Iron and steel	***	* / **	*	* / **
Iron ores and concentrates	-	* / **	*	**
Mercury	*	**	**	*
Phosphate rock	*	* / **	*	*
Zinc ore and concentrates	* / **	* / **	*	**
<i>Fossil fuels</i>				
Coal	* / **	**	***	***
Crude petroleum	* / **	**	***	**
Gas, natural and manufactured	**	**	***	**
Liquefied propane and butane gas	**	**	***	***
Petroleum oils other than crude	**	**	***	***
Synthetic rubber	***	**	***	***

Table E2 Assessment of Relative Overall Environmental Impact

Environmental impacts only considered		Environmental impacts & EU import volume considered	
Rank	Commodity	Rank	Commodity
Food Agricultural Commodities			
1	Crustaceans	1	Soybean
2 =	Bananas	2	Wheat and wheat flour
2 =	Bovine meat	3	Bananas
2 =	Rice	4	Maize
2 =	Soybean	5	Coffee
6	Fish, fresh, chilled, frozen	6	Sugar
7 =	Coffee	7	Crustaceans
7 =	Tea	8	Rice
9	Maize	9	Cocoa
10	Milk products	10	Fish, fresh, chilled, frozen
10 =	Sugar	11	Tea
10 =	Wheat and wheat flour	12	Milk Products
13	Cocoa	13	Bovine Meat
Non Food Agricultural Commodities			
1	Cotton	1	Wood
1 =	Cotton fabrics, woven	2	Chemical Wood Pulp
3	Tobacco	3	Palm Oil
4	Palm oil	4	Natural Rubber
5 =	Chemical wood pulp	5	Tobacco
5 =	Bioethanol	6	Cotton fabrics, woven
7	Leather	7	Cotton
8	Natural Rubber	8	Leather
9	Wood	9	Bioethanol
Metals and Minerals²			
1	Gold	1	Iron Ores and Concentrates
2	Aluminium	2	Iron and Steel
3	Cement	3	Cement
4	Iron and Steel	4	Aggregates
5 =	Copper ores and concentrates	5	Bauxite and other aluminium ores
5 =	Zinc ore and concentrates	6	Aluminium
5 =	Mercury	7	Phosphate Rock
8 =	Aggregates	8	Copper Ores and Concentrates
8 =	Bauxite and other aluminium ores	9	Zinc Ore and Concentrates
8 =	Iron ores and concentrates	10	Cadmium
8 =	Phosphate rock	11	Mercury
12	Cadmium		
Fossil Fuels			
1	Synthetic Rubber	1	Crude petroleum
2	Liquefied propane and butane	2	Coal
2 =	Petroleum oils other than crude	3	Natural Gas
4	Coal	4	Petroleum oils other than crude
5	Natural Gas	5	Liquefied propane and butane
6	Crude petroleum	6	Synthetic Rubber

² Gold has been excluded from the ranking for "environmental impacts and EU import volume" due to insufficient data on EU imports.

The need for caution regarding the use of ratings for environmental impacts, particularly due to variations in data availability and quality, and the difficulties of comparing impacts across commodities has been noted earlier. Using this methodology the trade flows with highest overall environmental impact scores are those that have scored relatively highly in most impact categories and not those trade flows that may have a very high impact in only one or two impact categories. Moreover, the scoring on which the analysis is based is for source countries with the most significant impacts and therefore overall scores may not reflect impacts in all source countries. For these reasons the analysis here is necessarily tentative and simply intended to contribute to discussion on priority resource flows given these constraints. It is only concerned with assessing environmental impacts outside the EC; including the impacts from activities which happen inside the EU such as further processing, incorporation into products, use and disposal is likely to give a different ranking.

Environmental Impacts of Transporting Commodities to the EU

The impact of transport of commodities from the country of origin to the EU was examined by combining information on transport mode for the top three exporting countries, with typical distances for the appropriate sea or road/rail journey and lifecycle data on the impacts of road, rail, ship and air transport. Figure E1 shows the climate change impacts from transport on both a per tonne of commodity basis and for total imports from the top three exporting countries. Commodities with a higher climate change impact from transport are bovine meat, as a substantial proportion (75%) arrives by air; cotton, as almost 80% comes by road, and leather as about 40% comes by road and 40% by air. In terms of total transport impacts iron ore and coal dominate due to the much larger volumes of these commodities. Crude oil and wood are also significant; in the case of crude oil, this again is due to the volume of imports, and in the case of wood due to a relatively high volume and relatively high impact per tonne.

A full comparison of climate change impacts from transport of the commodities with impacts from production of the commodities could not be made, as quantitative data on the climate change impacts of all commodities was not available. However for those commodities where a comparison could be made, there were several - typically those with a very low to low climate change impact - where the impacts from transport were of the same magnitude or in some cases larger than impacts from commodity production.

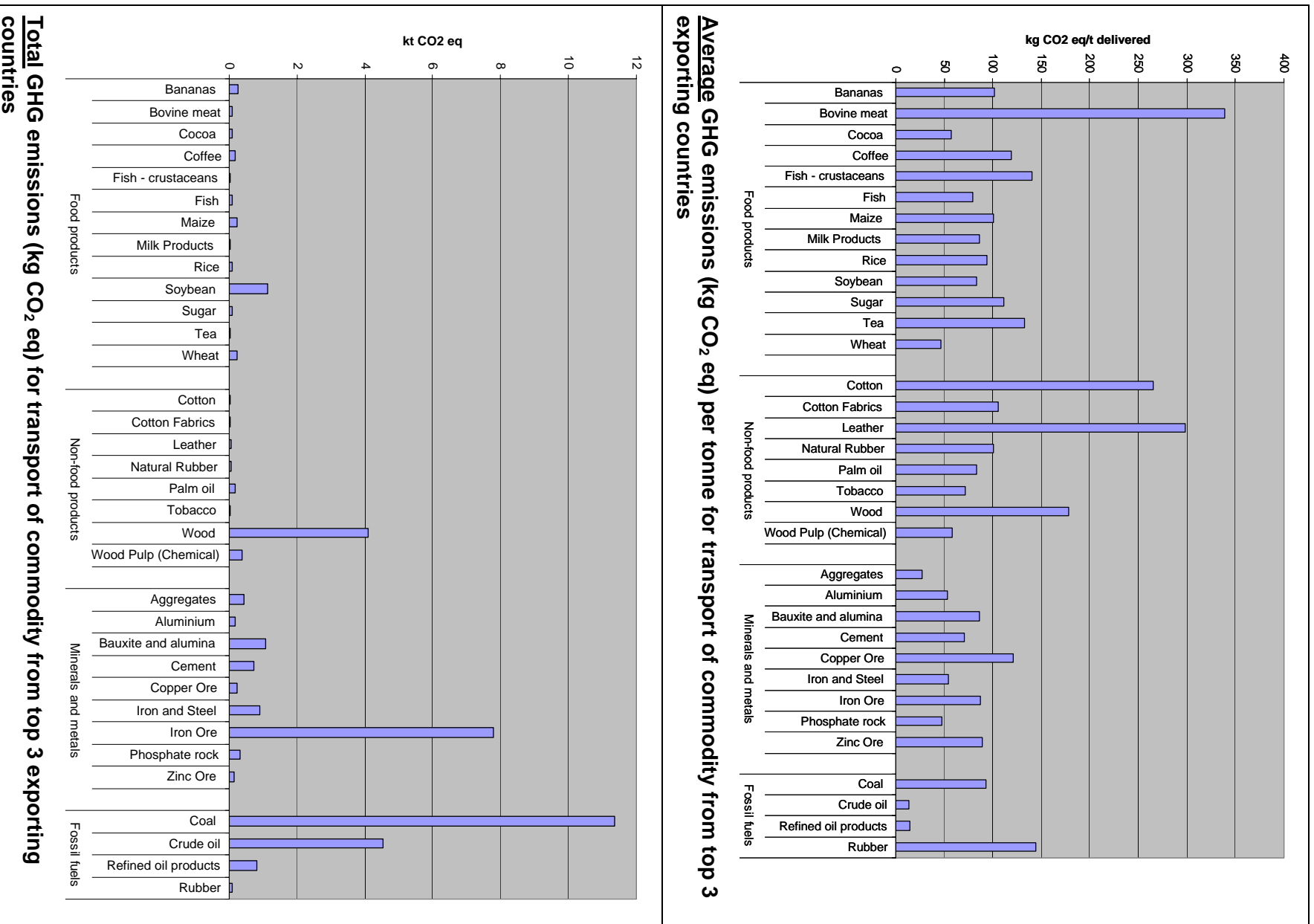
Recommendations for Policy Development

From a review of the current policy framework on trade flows of commodities the study identified four key areas for future policy development

(1) Further promotion of policies influencing patterns of consumption in the EU: We suggest there is great potential in further developing policies that aim to reduce impacts in source countries of natural resource trade flows through addressing volume and nature of trade flows to EU. Such policies would be aimed at encouraging demand in the EU of products with lower environmental impacts and the sourcing of products from those locations with lower impacts. This should include supporting: (i) sustainable production certifications schemes and eco-labelling across an expanding range of imported commodities, e.g. the development of certification for “green” metals, (ii) eco-design of products based on minimisation of resource use and environmental impacts of source materials (“Design for Sustainability”), (iii) innovation designed to reduce physical flows of natural resources (e.g. development of product service systems concept) and (iv) sustainable procurement policies.

(2) Further promotion of policies aimed at reducing environmental impact in source countries: The range of environmental programmes in source countries generally address specific impact categories (climate change etc.) rather than being focused on the production of particular commodities. However, there is potential to target further specific commodities

Figure E1: Global warming impacts from transport of commodities to EU



or sectors, This should include supporting: (i) take up of existing sustainable production certification in source countries and development of new schemes for different commodities (linked to support for demand for certificated products in EU stated above), (ii) sustainable production schemes in commodity dependent developing countries, (iii) capacity building in source countries in development of environmental standards and enforcement, (iv) technology transfer (v) further development of the concept of biodiversity offsets in source countries, with EU importers taking some responsibility for addressing residual impacts

(3) Investigation of scope for reducing environmental impact in source countries through trade policies: Direct trade policies as a means of promoting specific sustainable production objectives in import source countries are limited by WTO agreements for trade liberalisation. However, there is some scope for further regulation of trade to have environmental benefits, particularly in production standards and product sourcing for the food and non-food agricultural sectors.

(4) Finally, we suggest that there is a need for a full assessment of policy options for addressing impacts of natural resource trade flows: This project has focused chiefly on environmental impacts in source countries of significant natural resource trade flows into the EU. Policy recommendations given here are based on initial scoping of policies of relevance to addressing these impacts. Therefore, we recommend that thorough policy analysis is necessary to assess the potential of specific policy recommendations in the context of specific priority resource trade flows. This would not only include assessing the effectiveness of a recommended policy in tackling the specified environmental impacts but also the wider socio-economic costs and benefits in source countries of implementing policies.