

Cumbria Biomass Transport Footprint

Andreas Ottitsch

Cumbria Biomass Transport Footprint

- Objectives
- Methods & Data
- Examples for Results
 - CO₂-balance for biomass transport to selected location
 - Maximum (road) transport distance from Cumbrian Forests
- Conclusions and Outlook

Background

- Transport- CO_2 NOT typically included in CO_2 -balance models (e.g. CO2-FIX)
- Energy / CO_2 „lost in transport“ often a main concern stated in relation to biomass-energy projects
- Need to produce hard data for arguments in public discussion

Wood transport and CO₂

Does burning wood pollute the environment? - Yahoo! Answers - Windows Internet Explorer

http://answers.yahoo.com/question/index?qid=20091003085604AAUnM3o

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Does burning wood pollute the environment?

Nunya

I'm trying to decide wether to get a fireplace wood insert or switch to gas. just how much pollution does wood cause, if any?

5 months ago

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Best Answer - Chosen by Voters

Gas burns more cleanly (if properly supplied with oxygen, it produces mostly CO₂ and water, with small traces of carbon monoxide and nitrogen oxides) whereas wood produces much more particulate pollution (smoke, soot, etc. in addition to CO₂, H₂O, CO, and NO_x).

However, wood is renewable whereas gas is not, and most of the CO₂ produced from burning wood was captured from the atmosphere by the tree - the net amount of CO₂ produced is lower, assuming that more trees are allowed to grow on the land where the tree was cut. However, I would guess that logging and transport of the wood consumed a fair amount of fossil fuels, so the CO₂ savings might not be significant.

There are advantages and disadvantages to both, but gas probably has a lower impact on local air quality and maybe a slightly higher impact on global warming.

As far as safety is concerned, gas can leak out and explode later, but wood can throw sparks up the chimney and onto your roof. Both have hazards, so if safety is a major concern, look up some statistics and see which is safer.

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100% 1 Vote

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Wood transport and CO₂

- How FAR may we go in transporting wood (on roads)?

Main parameters

- CO₂-emission / km
- CO₂ –saving effect of substituting fossil fuel with biomass
 - Depending on fuel AND technology!
 - Assumption in this presentation:
 - OLD: gas oil in boiler
 - NEW: slash fuelwood in boiler (< 50 MW)
 - (large buildings, groups of buildings, district heating)

Substitution effect

- At assumed fuel/technology combinations:
 - Gas oil / boiler **3206 g CO₂ / kg fuel**
 - Energy: 43.3 MJ / kg
 - (Energy efficiency: 33%)
 - Slash firewood / boiler (<50MW): **0 g CO₂ / kg fuel**
 - Energy: 15 MJ / kg
 - (Energy efficiency: 24%)
- **→ 1 kg slash firewood saves 1110.1 g (1.1101kg) CO₂**
 - OTHER GHGs NOT considered
 - But COULD be included
 - All assumptions based on CO2FIX –model data!
 - (Nabuurs et al., 2006)



Timber Transport CO₂ Footprint

- Assumptions on load weight:
 - Truck & trailer, allowable GW: 44 t
 - → typical weight of truck (&loading crane) & trailer: 18-20 t
 - → net LOAD: 24-26 t
- Data on fuel usage:
- **Engineering and Legislative Options for Improved Timber Haulage in Scottish Forests – an Inclusive Stakeholder Approach (Killer at a., 2003)**

How far can we go?

Assumptions for model:

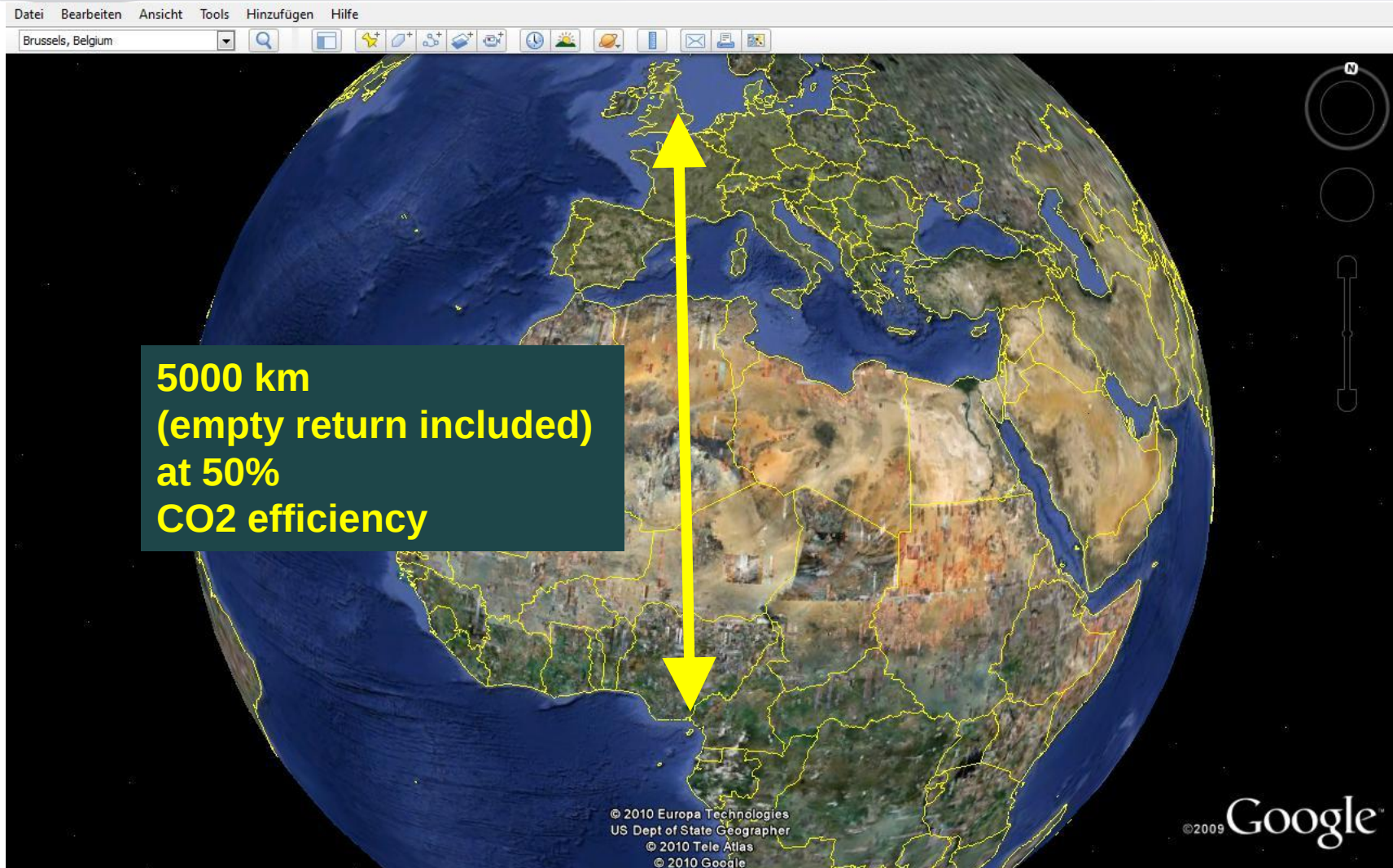
- 1kg wood substitutes 1.110 kg CO2 from fossil fuel use
- Average fuel consumption 6 MPG
- Different NET LOAD assumptions
- Different assumptions for CO2 efficiency requirement
- Table looks only at CO2 spent on TRANSPORT using standard DIESEL
- 50 % empty runs

NET LOAD	kg CO2 saving potential STORED in load	AVERAGE kg CO2/km on public roads (6 MPG)	max Transport distand at 50% CO2 efficiency requirement (50% empty runs)	max transport distance at 90% CO2 efficiency requirment (50% empty runs)	max transport at 95% CO2 efficiency requirement (50% empty runs)	max transport at 99% CO2 efficiency requirement (50% empty runs)
22000	24434	1.2476	4896	979	490	98
24000	26655	1.2476	5341	1068	534	107
26000	28876	1.2476	5786	1157	579	116

London – Southampton
London – Nigeria
London – Orkneys



How far can we go?



How far can we go?

Assumptions for model:

- 1kg wood used in heating substitutes 1.110 kg CO₂ from fossil fuel burner
- Average fuel consumption 6 MPG
- Different NET LOAD assumptions
- Different assumptions for CO₂ efficiency requirement

• T
• 5

PRETTY FAR.....

No real limitations based on CO₂-efficiency!

BUT interest in „CO₂-miles“ remains

NEED TO CONSIDER ACTUAL ROAD
NETWORK

NET
LOAD
22000
24000
26000

support at
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ty runs)
98
107
116



Approach

- Development of model to estimate „transport CO₂“ for wood biomass transport
- For county-wide assessment in CUMBRIA only transport on public roads considered (only few extensive forest road systems)
- Combination with woodland management data to provide more accurate assessment for biomass „transport footprint“ from existing woodprint to existing and planned boiler installations

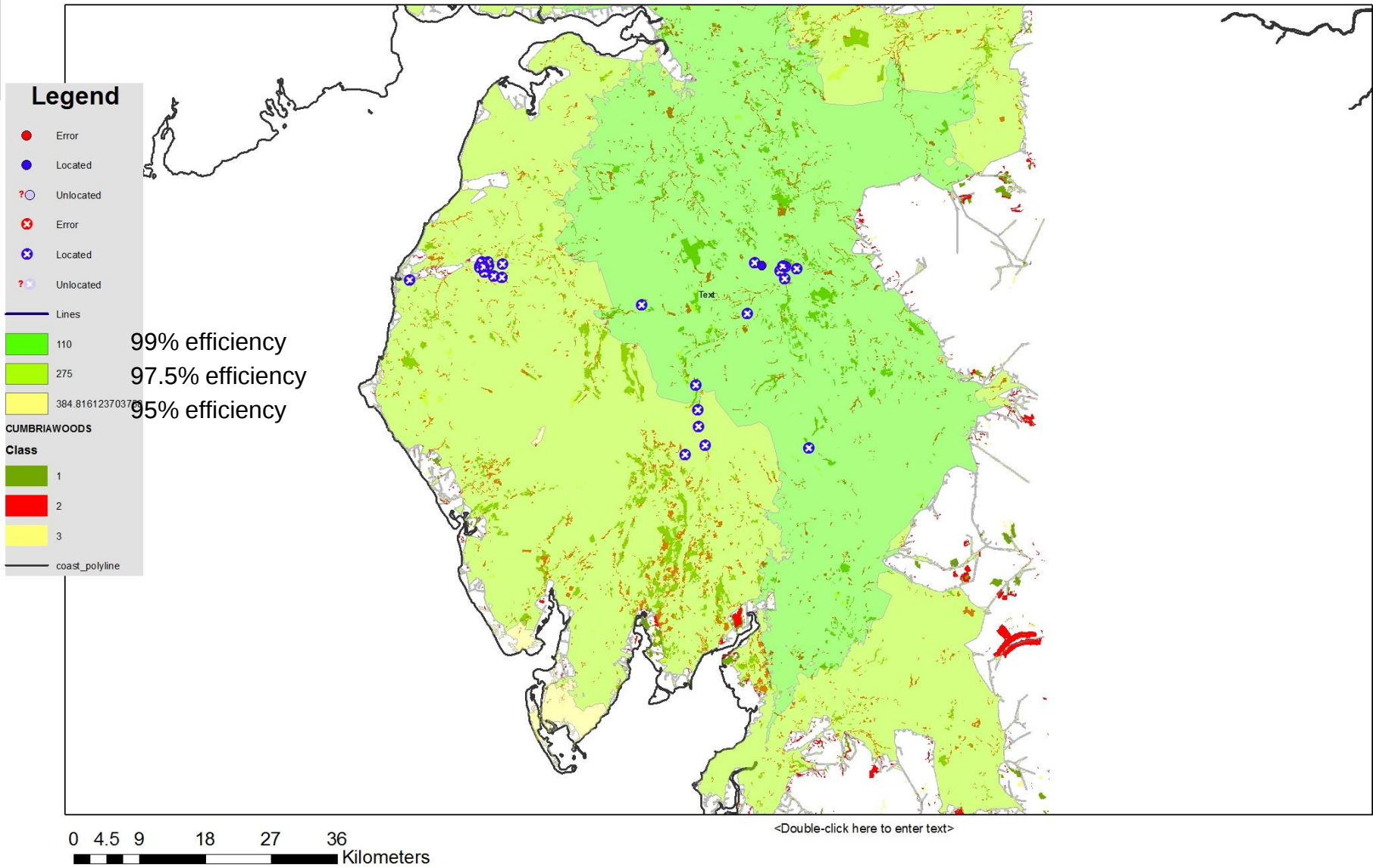
- Road network
 - OS Mastermap ITN-layer
 - Information on barriers (non suited for HGV > 7.5t)
- CO₂-emission on different road-types:
 - A roads & MW: 6 mpg
 - B-roads 5 mpg
 - minor roads 4.5 mpg
 - ALL OTHERS 3.155 mpg
- Wood biomass supply
 - FC WMI (woodland management inventory)

Scenario 1

- ALL ROADS from OS-MM ITN-layer used
 - Network only restricted by set barriers



CO2 -emissions for transport TO Newton Rigg woodfuel boiler
variable CO2-emission settings 22t load
ALL ROADS USED



BUT

- NOT ALL ROADS ARE AVAILABLE
- What are the impacts of possible restrictions?

Scenario 2

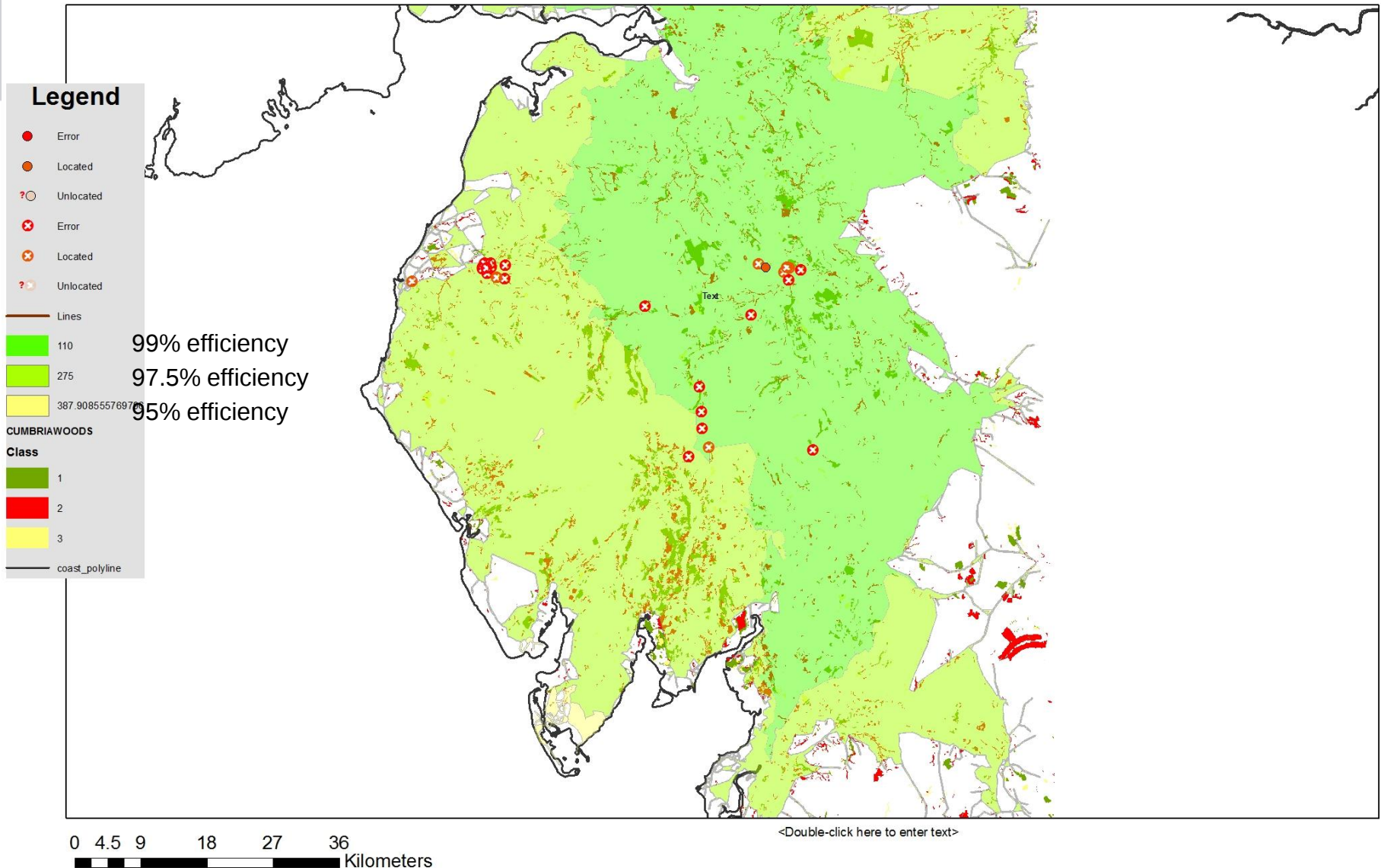
- NO USE of „local“ and „private“ roads
 - Based on „Descript_2“-field in OS-MM



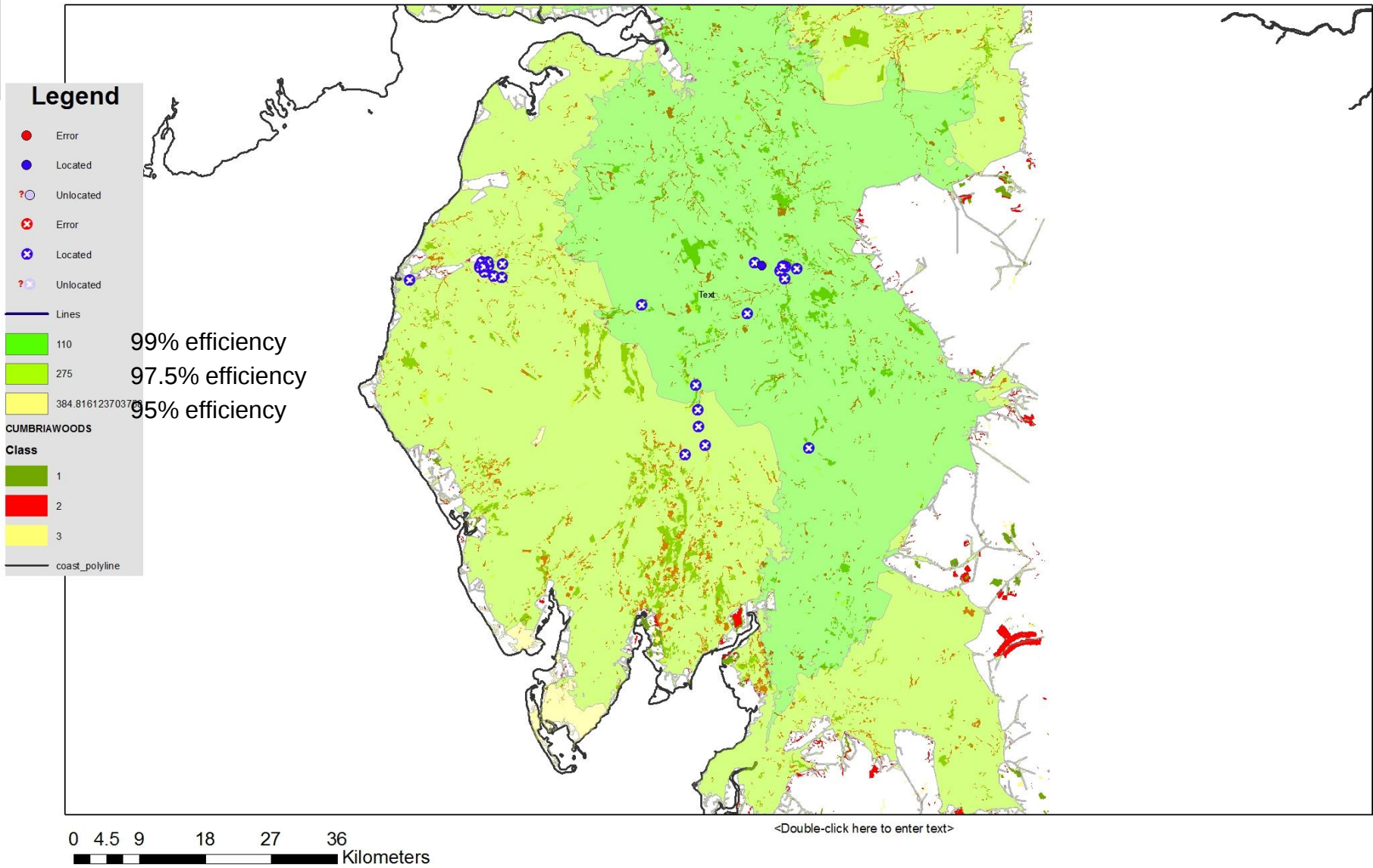
CO2 -emissions for transport TO Newton Rigg woodfuel boiler

variable CO2-emission settings 22t load

NO USE of LOCAL or PRIVATE roads

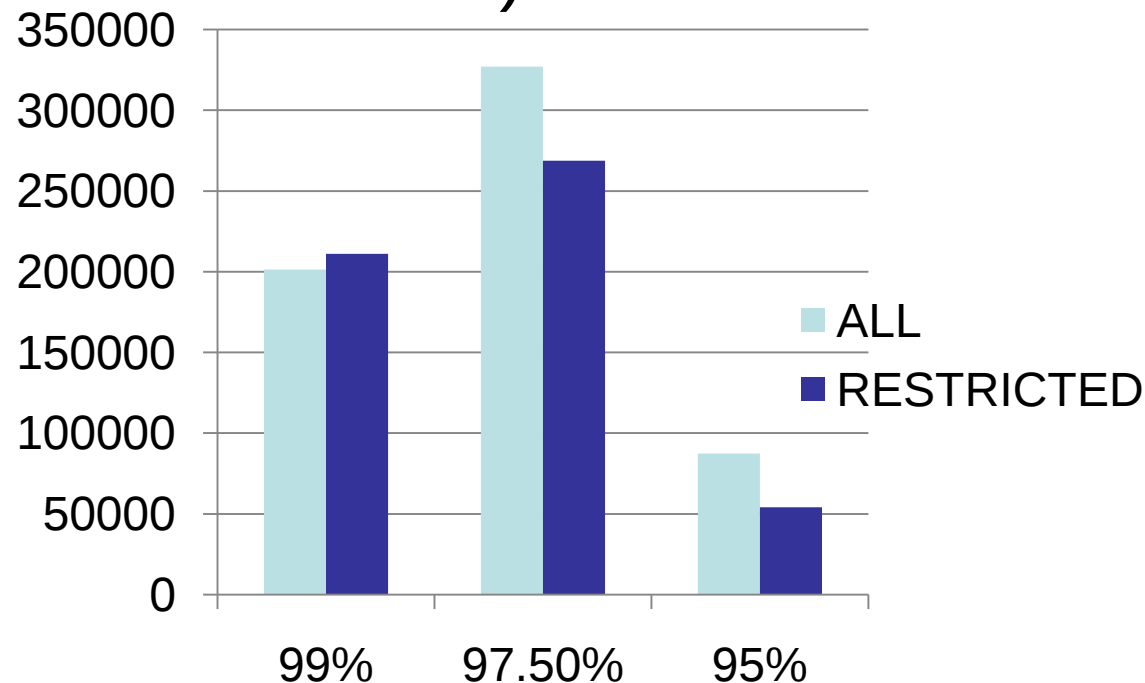


CO2 -emissions for transport TO Newton Rigg woodfuel boiler
variable CO2-emission settings 22t load
ALL ROADS USED



Impact on timber availability

- Annual timber supply based on FC WMI-data
- TOTAL timber (no reduction to potential fuelwood share!)



LESS MATERIAL and HIGHER CO₂-emissions

Conclusions

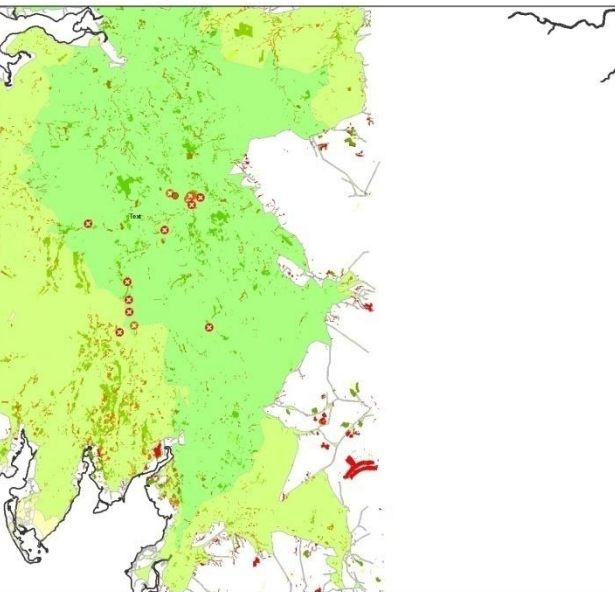
- Carbon efficiency for biomass transport HIGH
 - Substitution effects!
- Model can also be used for other product categories
- Need to collect detailed information on:
 - ROAD CHARACTERISTICS
 - ROAD AVAILABILITY (local restrictions)
 - BARRIERS (bridges, underpasses, statutory restrictions, closures...)

Conclusions cont.

- Model available to highlight impacts of local or regional road usage agreements
- Comparison of different bio-energy production arrangements
 - LOCAL/REGIONAL vs. CENTRAL
- Need for additional data on loads, fuel usage and logistics

Does burning wood pollute the environment?

O Newton Rigg woodfuel boiler
22t load
roads



Double-click here to enter text

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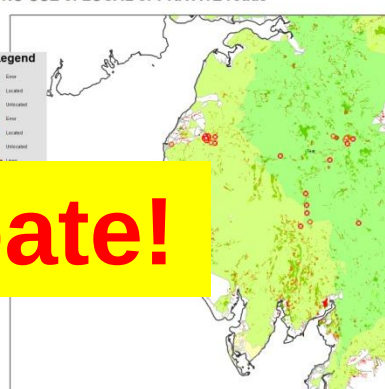
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variable CO₂-emission settings 22t load
NO USE of LOCAL or PRIVATE roads

Legend



0 4.5 9 18 27 36 Kilometers

100% 1 Vote

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Answers available for public debate!

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