GÖTEBORGS UNIVERSITET

PRESERVING THE WORLD'S TROPICAL FORESTS: A PRICE ON CARBON MAY NOT DO

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Climate policy and the incentive for tropical deforestation

On the one hand, by pricing the carbon emissions from forest clearing (e.g., through an international REDD system) climate policy could offer an economic incentive for reduced deforestation...

On the other hand, climate policy—through a carbon tax or cap-and-trade system—will increase the demand for bioenergy and hence agricultural land, augmenting land prices and the profitability of forest clearing...

Which effect will dominate?

If we are able to assign responsibility for greenhouse gas emissions associated with direct (and indirect) land use changes from increased bioenergy use, by pricing those emissions, will that suffice to avoid them?

Methodology

Calculate the net present value (NPV) of clearing a hectare of tropical forest, paying for the carbon emissions and earning revenue from bioenergy cultivation over time – if positive, carbon pricing does not suffice:

$$\mathrm{NPV}(t) = -\Delta S_C \cdot P_C(t) + R - c_{c\&e} + \sum_{\bar{t}=t}^{\infty}\left[\left(\sum_i \left[Y_i(\bar{t}) \cdot p_i(\bar{t})\right] - c_p(\bar{t})\right) \Big/ (1+r)^{\bar{t}-t}\right]$$

costs

time *t*

establishment

Timber revenues

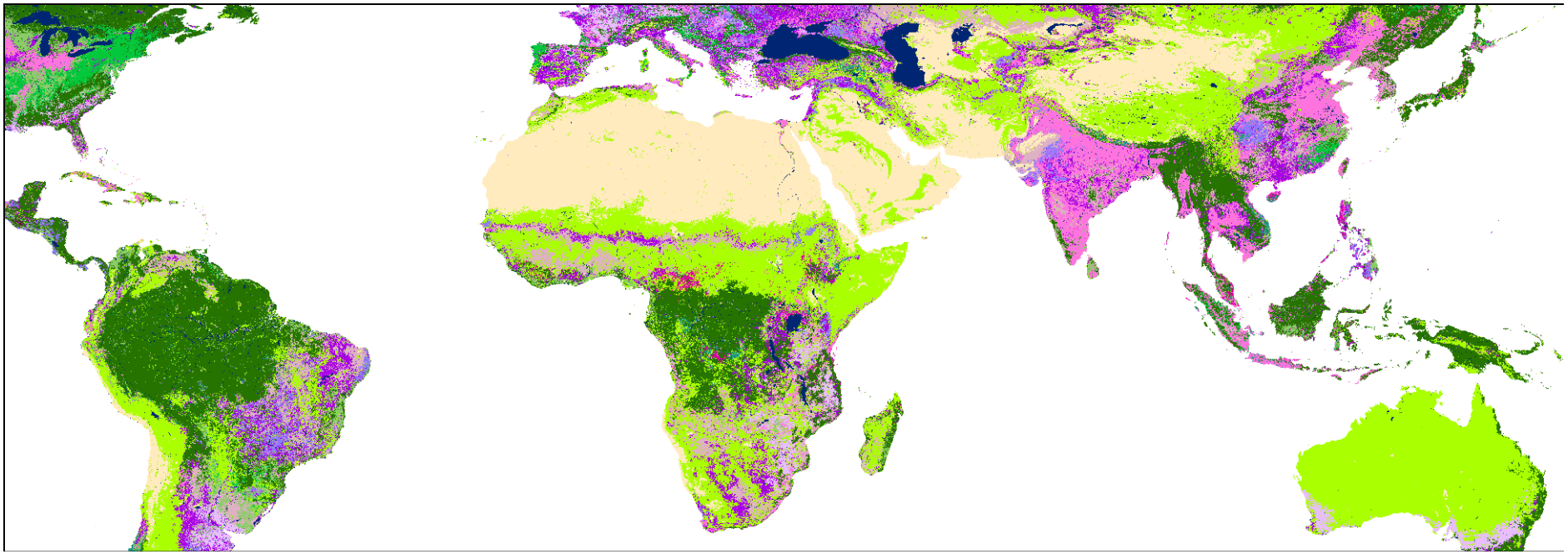
Carbon price at time *t*

Cost of clearing and planation

Yield & price of bioenergy prod. (*i*) at

Bioenergy prod.

An illustrative example: palm oil bioenergy



Land cover classification

IFPRI Land cover

DESCRIPTION

- Cropland
- Islands
- Plantations
- Managed Pasture
- Cropland / Pasture
- Agriculture with forest
- Agriculture with other vegetation
- Agriculture / Forest mosaic
- Agriculture / Other mosaic
- Forest with agriculture
- Other vegetation with agriculture
- Agriculture / 2 other land cover types
- Primarily Forest (>60%)
- Primarily Grassland (>60%)
- Other vegetation: wetlands, mangroves
- Non-vegetated / Sparsely vegetated
- In-land water
- Ocean

Data source: Wood, Sebastian & Scherr, 2001

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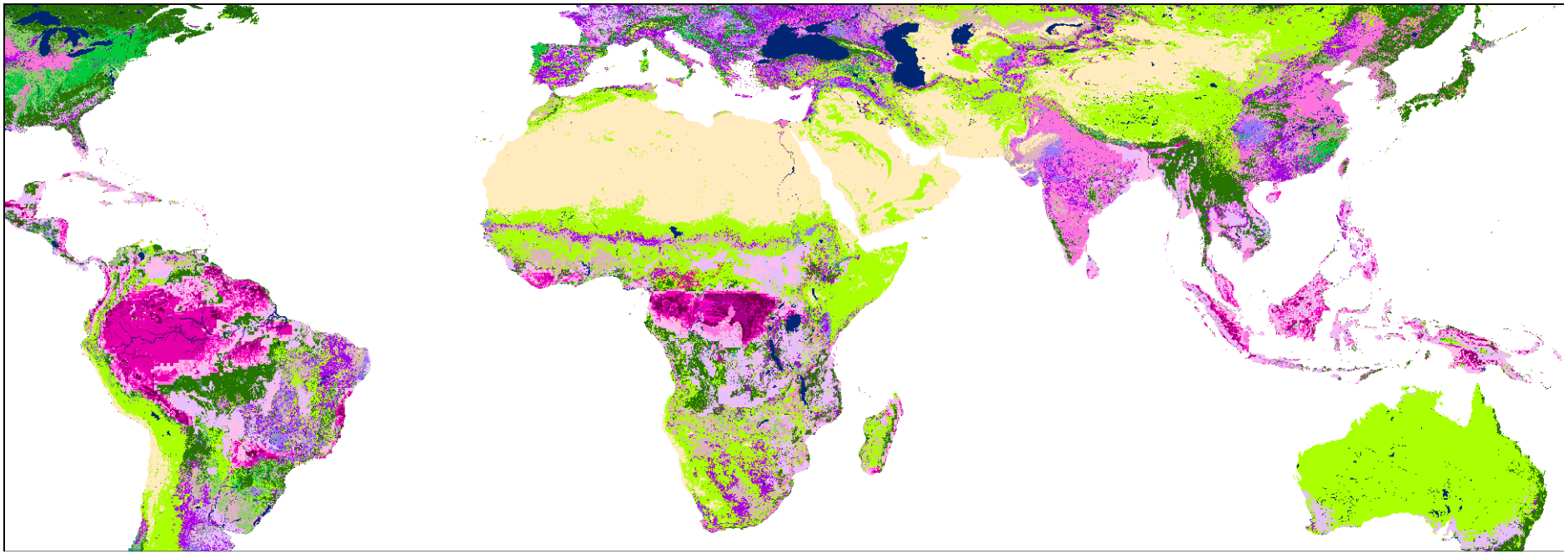


Oil palm suitability classes

- Undefined
- Suitability index: >85% of potential yield
- 70-85% of potential yield
- 55-70% of potential yield
- 40-55% of potential yield
- 25-40% of potentialyield
- 5-25% of potential yield
- 0-5% of potential yield
- Unsuitable
- Inland water

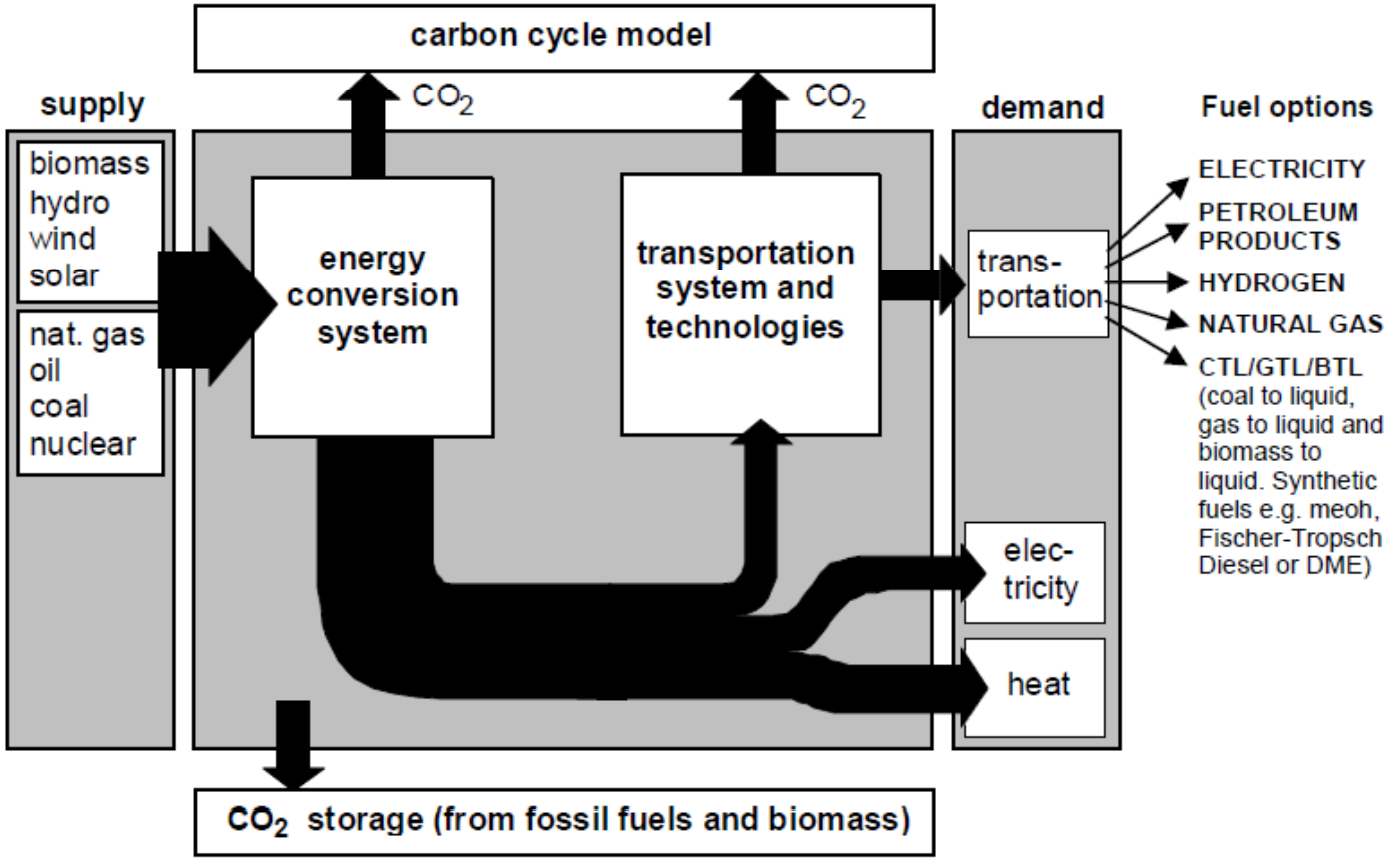
Data source: FAO/IIASA, 2002

An illustrative example: palm oil bioenergy

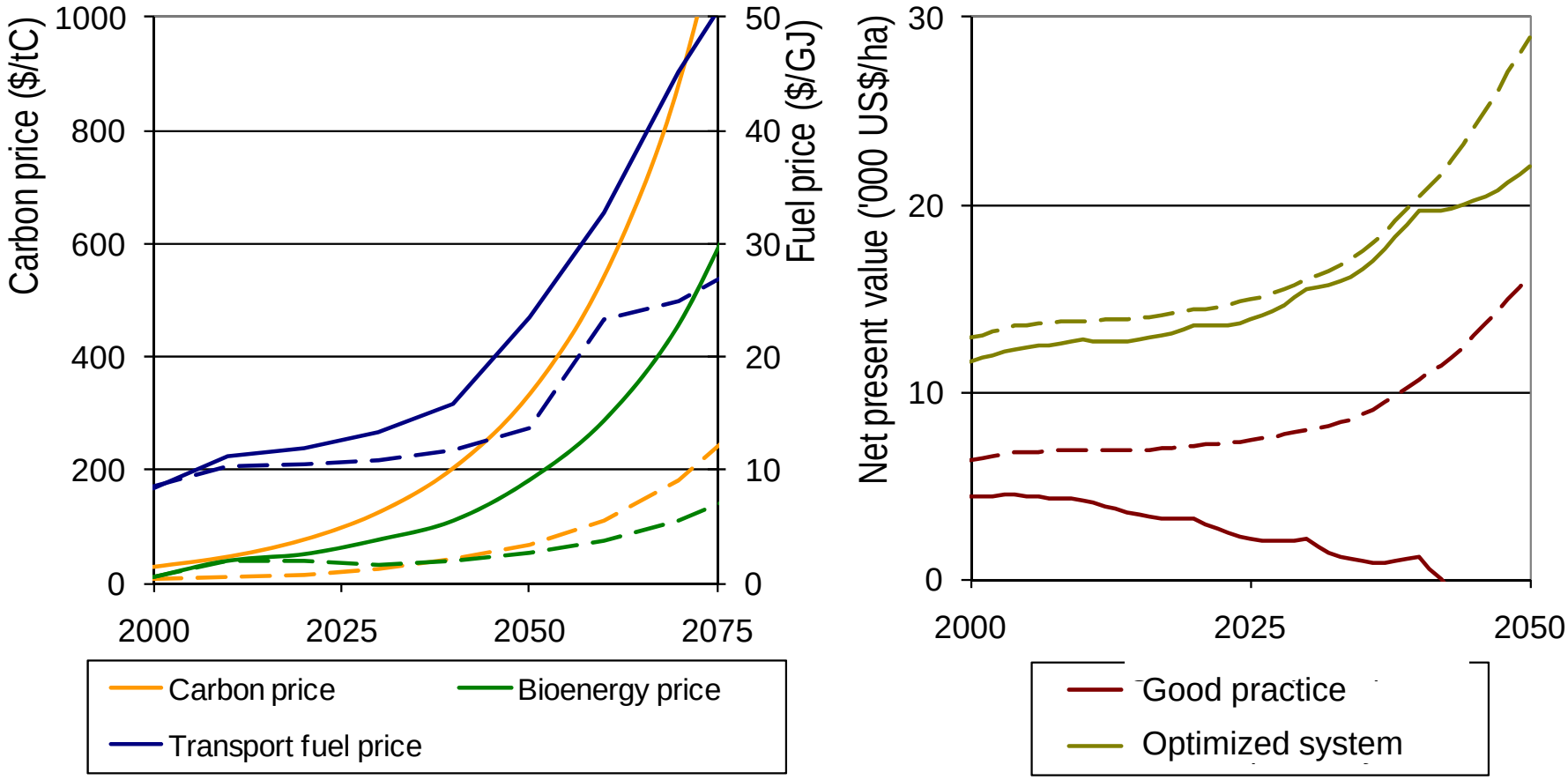
	Good practice	Optimized system
Crude palm oil yield (tCPO/ha/yr)	4	5
Palm oil biodiesel yield (GJ/ha/yr)	172	210
(l/ha/yr)	~4 900	~6 000
Residue bioenergy yield (GJ/ha/yr)	59	146
(% of available residue stream)	20	50
Carbon payback time	(206 [tC/ha] – 50 [tC/ha]) / 3.5 (tC/ha/yr) = 45 yrs	(206 [tC/ha] – 50 [tC/ha]) / 5.7 (tC/ha/yr) = 27 yrs

The Global Energy Transitions (GET) model

A globally aggregated dynamic linear programming model

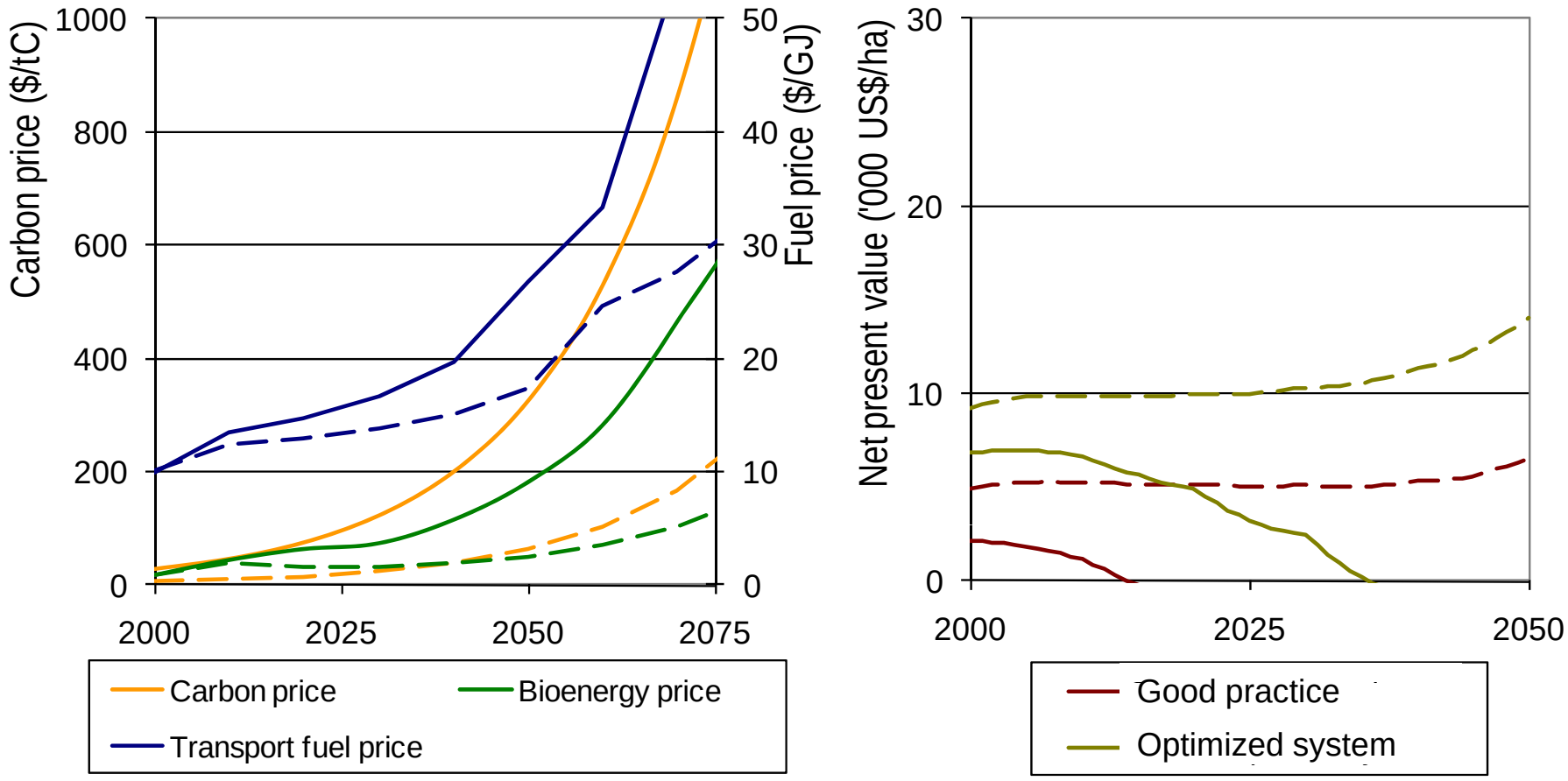


Results – Base case



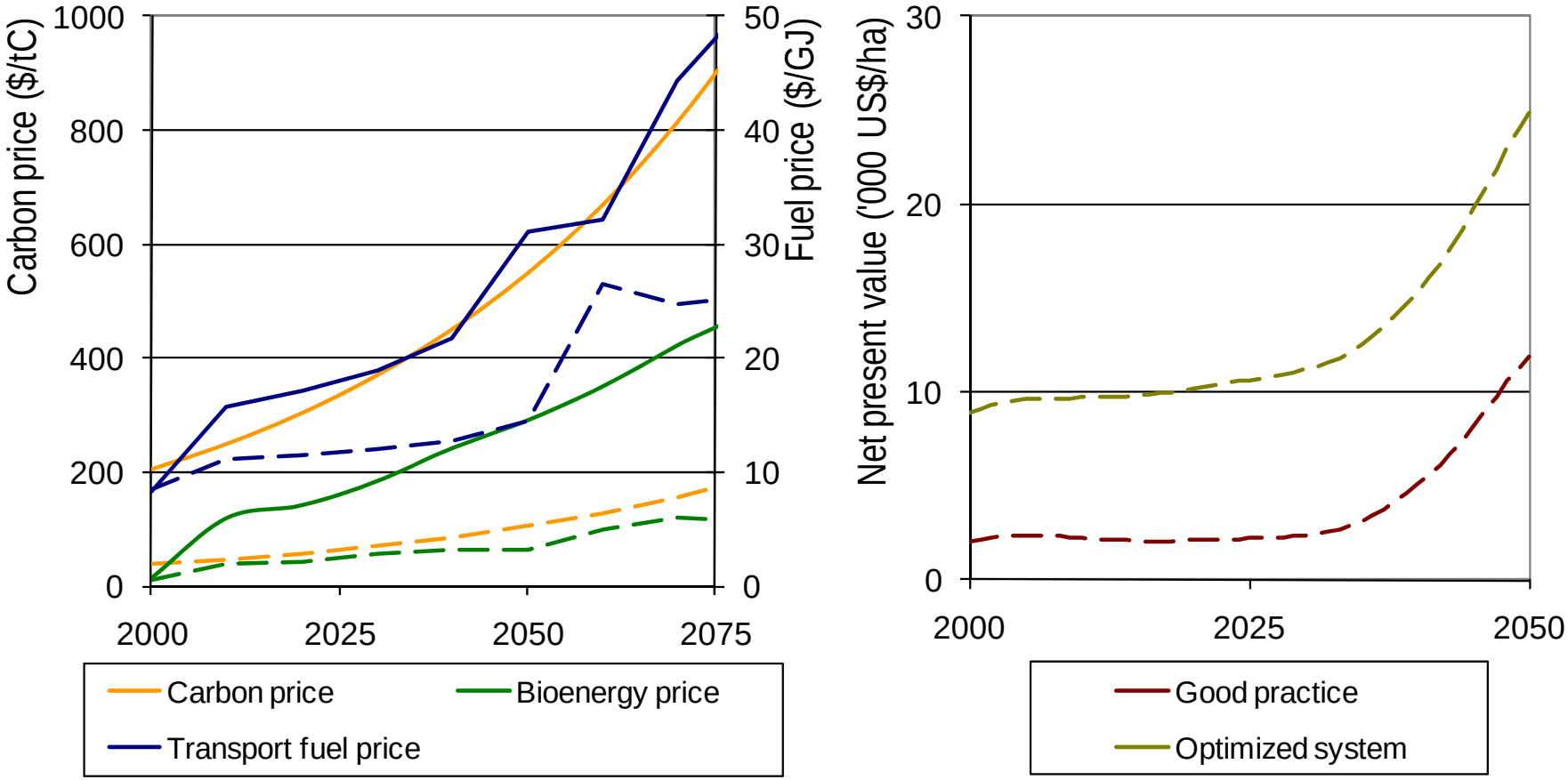
Carbon and energy prices from the GET5.0 model (left) and net present value of deforestation and palm oil production (right) for two CO_2 concentration targets: 350 ppm (solid lines) and 550 ppm (dashed lines).

Results – sensitivity analysis: 15% discount rate



Carbon and energy prices from the GET5.0 model (left) and net present value of deforestation and palm oil production (right) for two CO_2 concentration targets: 350 ppm (solid lines) and 550 ppm (dashed lines).

Results – sensitivity analysis: carbon price increase 2%/yr



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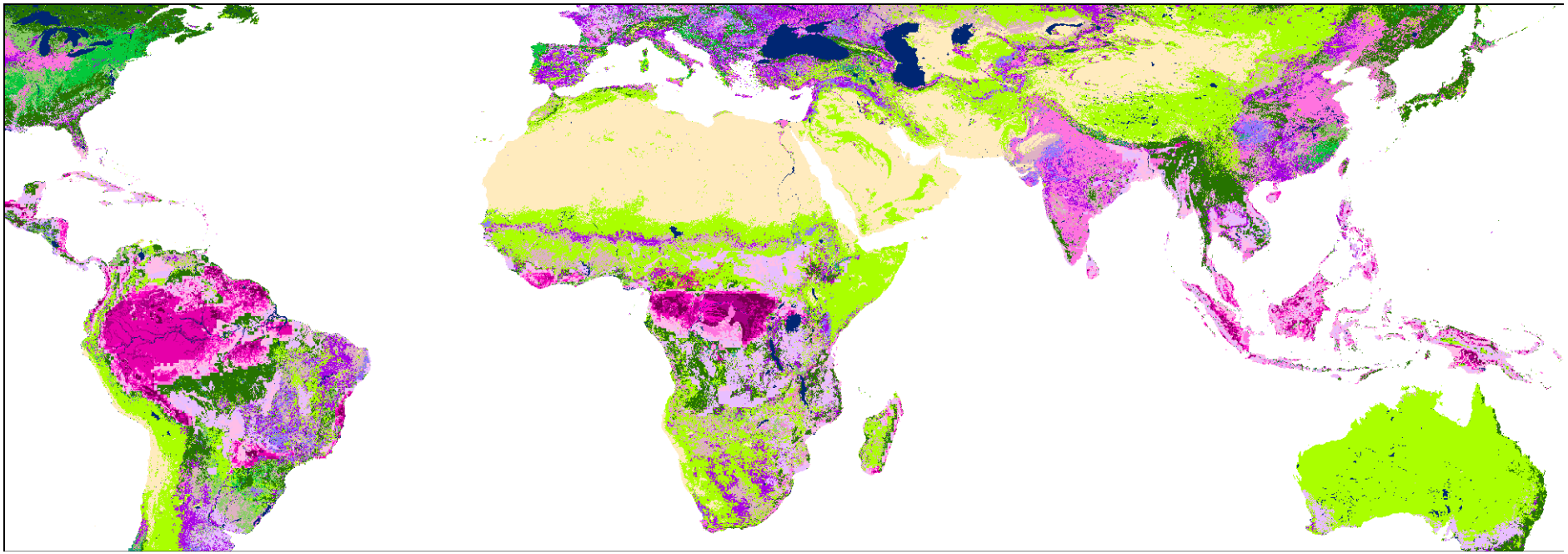
A geographically explicit analysis – preliminary results!



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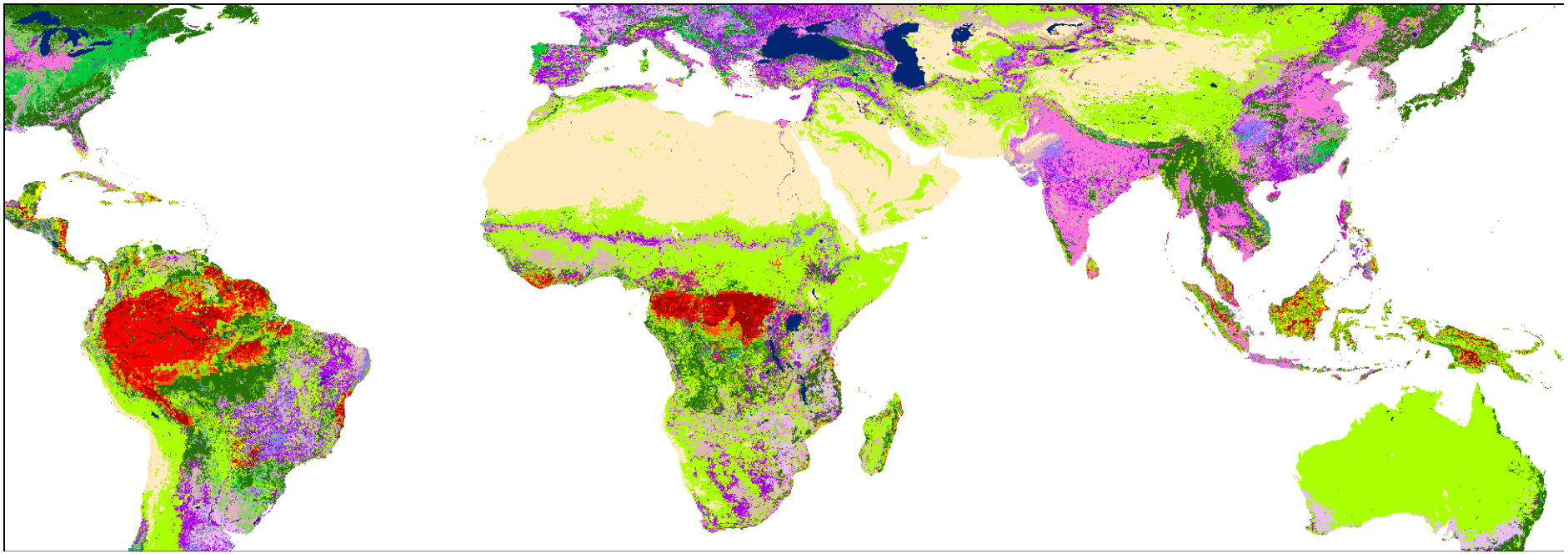
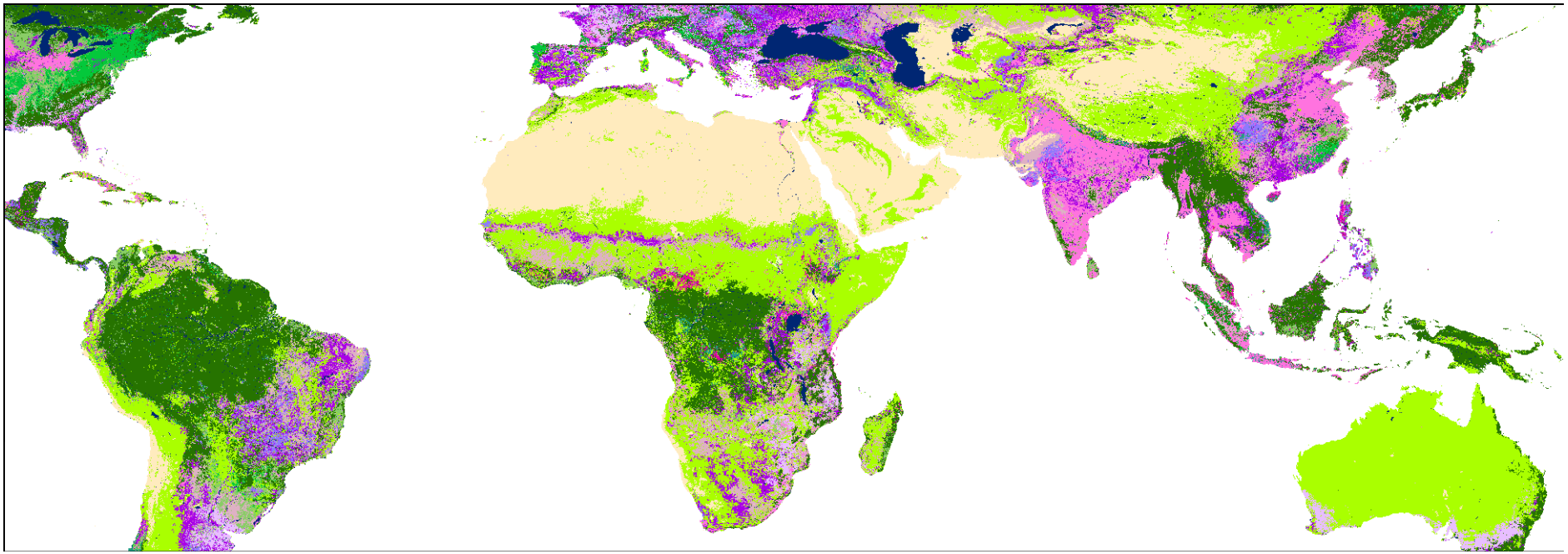


450 ppm scenario; achievable yields 90% of potential

A geographically explicit analysis – preliminary results!



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Discussion

Real conflict – many tropical countries are considering both large-scale bioenergy & REDD participation (e.g., Brazil, Indonesia, Colombia, etc)...

Which will deliver first? REDD or biofuels (through policies or high oil prices)...

Land-competition will considerably raise the stakes in forest conservation:

	South America	Central Africa	Southeast Asia
Total forest cover (Mha)	654	179	258
Share suitable for palm oil (VS/S/MS)	12% / 12% / 4%	18% / 25% / 6%	9% / 4% / 1%
Total value 2020 (billion USD)	2 000-2 600	730 - 950	370 - 450

Conclusions

A price on carbon may not be enough to protect tropical forests from the expansion of high yielding bioenergy crops, like palm oil...

...rephrased, forests suitable for palm oil plantations may not be worth preserving solely on the basis of their carbon content; from a climate protection perspective clearing forests for high-yielding bioenergy crops may indeed make economic sense

Not an argument for not pricing the carbon emissions from tropical deforestation – that would only worsen the situation – but implies that additional policy instruments (e.g, traditional conservation measures, payments for other ecosystem services) still may be needed!

THANKS FOR LISTENING!

QUESTIONS & COMMENTS?