

Ethanol production in Brazil: A sustainability quick scan

Biofuels offer a promising perspective for Brazil, world's second largest producer of bioethanol, for generating income and employment in areas where economic opportunities are limited. Expansion of sugar cane production may, however, threaten functions like food and feed production and biodiversity. Countries like the Netherlands are interested to import biofuels, provided it does not come at the expense of local farmers, food production or nature areas. It is therefore important to assess the impacts of sugar cane expansion, and to communicate these results to potential biofuel users. So far, however, a practical tool to evaluate biofuel sustainability requirements is missing.

Biomass Research and Zero-e have developed a *Sustainability Quick Scan* which is both practical and comprehensive. Following the principles and criteria of the Dutch Cramer commission (Cramer, 2007), the impact on six dimensions of sustainability are evaluated: greenhouse gas (GHG) emissions, biodiversity, natural resources, food and land prices, economic prosperity, and social well-being. The results of this evaluation are then translated into so-called 'sustainability labels', and presented in an easily understandable figure. An application of this Quick Scan to the case of ethanol production in Brazil is presented below.

Brazil's ethanol production has shown a spectacular growth in the last decades and may further increase in the future. Its feedstock (sugar cane) is mainly cultivated in the South-Central Cerrado region. In our scenario we evaluate an area expansion of 1 mln ha. Most of this land (80%) is obtained through conversion of cultivated or natural grasslands, and a small part (20%) from former croplands. This will lead to the displacement of cattle and maize production, which must be compensated for elsewhere, most likely in the Amazon region. The impacts on the six dimensions of sustainability are:

- **GHG reduction:** GHG emission reduction is close to 11 mln tonnes of CO₂-equivalent per year. The land conversion process in the Cerrado area will sequester 23 mln tonnes of CO₂-equivalent, which is much less than the carbon released by the induced deforestation in the Amazon region (164 mln tonnes of CO₂-equivalent). Payback time is 13 years: after this period, there is a net GHG emission reduction.
- **Biodiversity:** Conversion of grasslands and maize croplands will somewhat affect the local (agro-) biodiversity. The clearing of Amazon rainforest for the displaced cattle and maize production will have a much stronger negative impact.
- **Natural resources:** Land is provided for by conversion of grassland and maize croplands. In our scenario we assume this is compensated for by the clearing of an equal area of Amazon rainforest. As sugar cane is mostly rainfed, local water availability in the Cerrado area will not be affected. Deforestation may however affect water availability and soil-water cycles in the Amazon region.
- **Food and land prices:** Although expansion of biofuel production has the potential to affect local food and land prices, according to Macedo (2008) this is not the case with cane production in the Cerrado areas. An expansion of the sugar cane area with 1 mln ha will anyway have limited impact, compared to the total of 264 mln ha of agricultural lands currently under cultivation in Brazil.
- **Prosperity:** Cane area expansion will substantially increase local employment in the sugar and ethanol industry. Their wage levels exceed those in other rural sectors. Regions with sugar/ethanol industries generate high economic growth compared to neighbouring regions that lack these opportunities. Labour conditions can however be extremely severe, and jobs are under threat of mechanisation.
- **Well-being:** Bioethanol production may increase the concentration of land ownership at the expense of small farmers. Income differences between those involved in cane/ethanol production and those who are not, may affect social coherence. On the other hand, sugar mills are known to provide social benefits such as schools, day care, health care, life insurance and meals to workers.

The results of this *Sustainability Quick Scan* are summarized in the figure on the backside. Expansion of ethanol production from sugar cane in Brazil scores well on GHG emission reduction, competition for natural resources and impact on local food and land prices, but may have a strong negative impact on (Amazonian) biodiversity and to a lesser degree affect social well-being.

Bioethanol production leads to concentration of land tenure as sugar cane monocultures call for upscaling and mechanization.

Differences in incomes between cane producers and mill owners on the one side, and (seasonal) workers on the other side, may negatively affect social coherence.

On the other hand, sugar mills are known to provide facilities such as schools, day care and health care, life insurance and meals to workers.

Wellbeing

Sugar cane production requires limited amounts of fertilizer and other inputs.

Net GHG emission reduction of ethanol production from sugar cane is 11 mln tonnes of CO₂-equivalent per year.

It takes 13 years to compensate for the initial carbon released by area expansion (clearing of Amazon rainforest because of the displaced cattle and maize production).

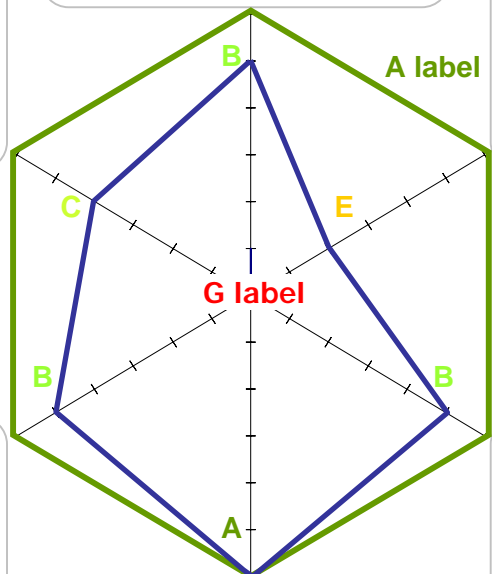
GHG reduction

Conversion of grassland and maize cropland to cane monocultures causes some loss of (agro-) biodiversity.

The clearing of Amazon rainforest for displaced cattle and maize production has a strong negative impact on biodiversity.

The overall impact on biodiversity is negative.

Biodiversity



Employment in the sugar and ethanol industry has a substantial positive impact on regional incomes. In the Central South region, recent cane production expansion resulted in higher economic growth compared to neighbouring regions that did not experience such expansion.

There are however serious doubts about the quality of labour conditions in cane production, and progressive mechanisation may eventually reduce job availability.

Prosperity

Expansion of sugar cane production in the Cerrado area is not known to affect local food or land prices.

An area expansion of 1 mln ha is relatively small compared to a total of 264 mln ha of agricultural land currently under cultivation in Brazil, therefore the impact is expected to be limited.

Food and land prices

Natural resources

Land is provided through the conversion of grasslands and maize croplands. This in turn is compensated for by the clearing of an equal area of Amazon rainforest.

As sugar cane is mostly rainfed, water availability is not affected. Deforestation in the Amazon region may however affect local water availability and soil-water cycles.

Label	Remarks
G	Very poor
F	Poor
E	Below average
D	Average
C	Above average
B	Good
A	Very good

For the full report, please contact Biomass Research.