

Ethanol production with grassland improvement: a sustainability quick scan.

Biofuels offer promising perspectives for Brazil, the world's second largest producer of bioethanol. They can generate income and employment in areas where economic opportunities are limited. Expansion of sugar cane production may, however, threaten food or feed production and biodiversity. Countries like the Netherlands are keen to import biofuels, provided production does not go at the expense of local farmers, food production or nature areas. It is important to assess the impacts of sugar cane expansion, and to communicate the results to biofuel users. So far, however, a practical tool for the evaluation of biofuel sustainability is missing.

Biomass Research and Zero-e developed a practical and comprehensive *Sustainability Quick Scan*. Following the principles and criteria of the Dutch Cramer commission (Cramer et al., 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. Results are translated into so-called 'sustainability labels', and presented in a spider-web figure. An application 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 maize croplands. We assume that the loss of production from these converted lands is compensated for by a 20% yield increase on 5 mln ha of remaining grasslands, through increased fertilizer applications and use of more productive grass species. The impacts on the six dimensions of sustainability are:

- **GHG reduction:** GHG emission reduction of ethanol from sugar cane is close to 11 mln tonnes of CO₂-equivalent per year. The land conversion process will sequester 23 mln tonnes of CO₂-equivalent, while improved grassland production may further lead to additional carbon sequestration.
- **Biodiversity:** Conversion of grasslands and maize croplands to sugar cane will affect (agro-)biodiversity. Intensification of grassland production may also decrease biodiversity. Overall impact will be limited.
- **Natural resources:** Land is provided for by conversion of grassland and maize cropland. We assume that production loss from converted land is fully compensated for by yield increases on remaining grasslands. As both sugar cane and grasslands are mostly rainfed, water availability will not be affected.
- **Food and land prices:** Although expansion of biofuel production may potentially affect local food and land prices, this is probably not the case with cane production in the Cerrado (Macedo, 2008). Expansion of the sugar cane area with 1 mln ha will 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, where wage levels exceed those of other rural sectors. Expansion of the cane sector combined with a more intensive use of grasslands is likely to increase income generating opportunities, which may be spread more evenly among farmers.
- **Well-being:** The combined improvement of sugarcane and animal production will lead to a more balanced economic development and a more equal income distribution. This can be expected to have a positive impact on social structure.

The results of this *Sustainability Quick Scan* are summarized in the figure on the backside. Expansion of ethanol production from sugar cane in Brazil, combined with grassland improvement in the remaining grasslands, scores very well (A label) on GHG emission reduction, local food and land prices and economic prosperity, and well (B label) on biodiversity, competition for natural resources, and local well-being.

The combined improvement of sugarcane and animal production will lead to a more balanced economic development and to a more equal income distribution.

As such it can be expected to have a positive impact on social structure.

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.

The land conversion process will sequester 23 mln tonnes of CO₂-equivalent, while improved grassland production may further lead to additional carbon sequestration.

GHG reduction

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

Intensification of grassland production may also decrease (agro)biodiversity.

Overall impact is expected to be limited.

Biodiversity

Prosperity

Employment in the sugar and ethanol industry has a substantial positive impact on regional incomes.

Expansion of the sugarcane sector combined with a more intensive use of the remaining grasslands is likely to increase income generating opportunities, and to spread them more evenly throughout the year.

Food and land prices

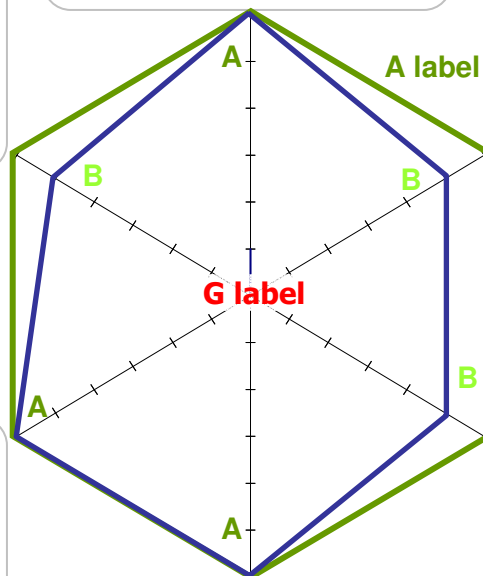
Expansion of sugar cane production in the Cerrado area is not known to affect local food or land prices.

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.

Natural resources

Land is provided for by conversion of grassland and maize cropland. We assume that production loss from the conversion fully compensated for by improved management of the remaining grasslands.

As both sugar cane and grasslands are mostly rainfed, water availability will not be affected.



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.