

## M02. Introduction to Bioenergy – Part 2

Source: ethanolproducer.com

1. Sustainability aspects
2. Biomass in Belize
3. Biogas production and use of digestate



## 2. Sustainability Aspects



## Sustainability Considerations

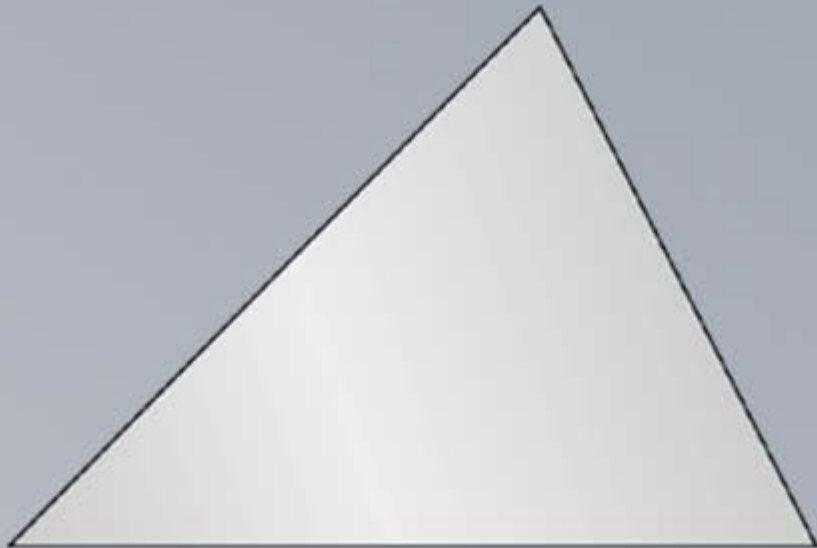
- ✦ Renewable energy
- ✦ Reduction of greenhouse gas emissions
- ✦ Usage of Minerals as fertilizer
- ✦ **But:** Food security and sustainable farming should be given the top priority!
  - ✦ Utilization of food resources and unsustainable biomass production have to be avoided
  - ✦ Deforestation for energy crops production have to be avoided



# Sustainability of biofuels

## Arguments for biofuels

Sustainability  
Chain important



Rural development  
Production important

Security of supply  
Application important

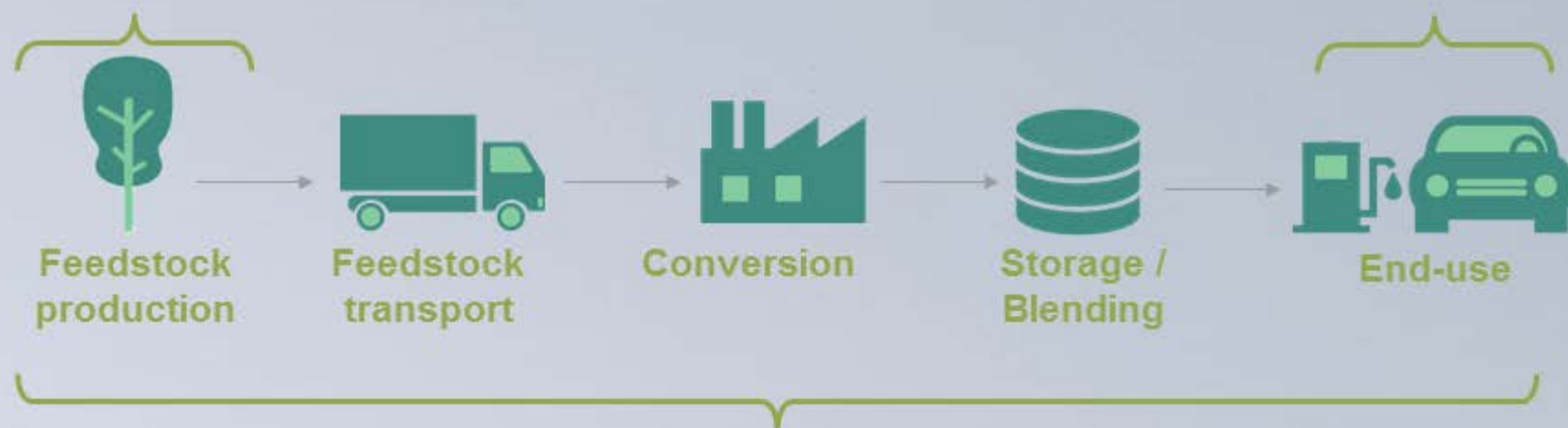
## Lifecycle sustainability

### Feedstock sustainability

e.g. avoid biodiversity loss

### End-use sustainability

e.g. decrease local air pollution

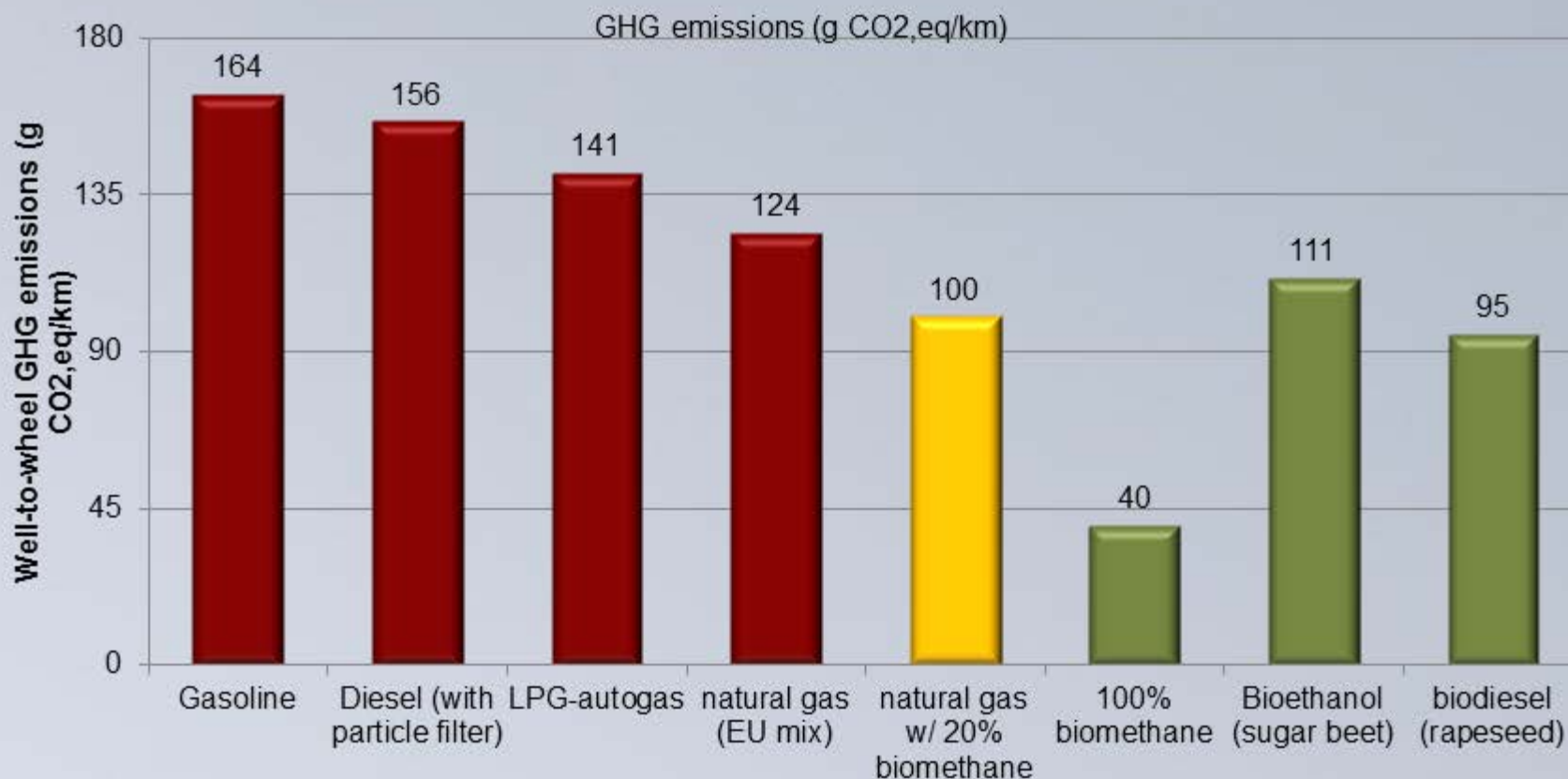


### Lifecycle sustainability

e.g. realise greenhouse gas savings



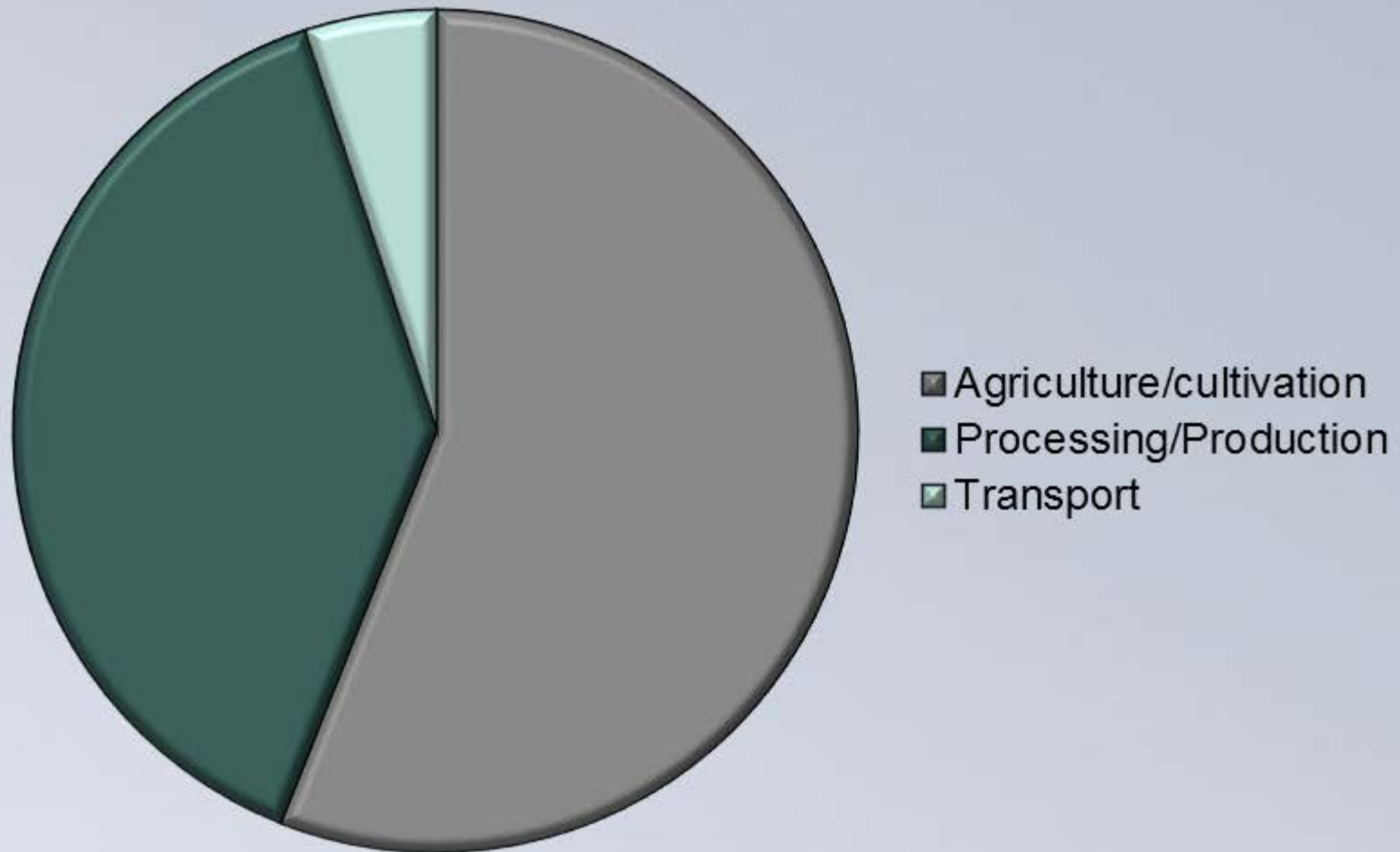
# Well-to-wheel GHG emissions



Source: (graph): KWA Eviva GmbH

Source (data): Erdgas und Biomethan im künftigen Kraftstoffmix, dena 2011 & CNG und LPG – Potenziale dieser Energieträger auf dem Weg zu einer nachhaltigeren Energieversorgung des Straßenverkehrs, DLR et al. 2013

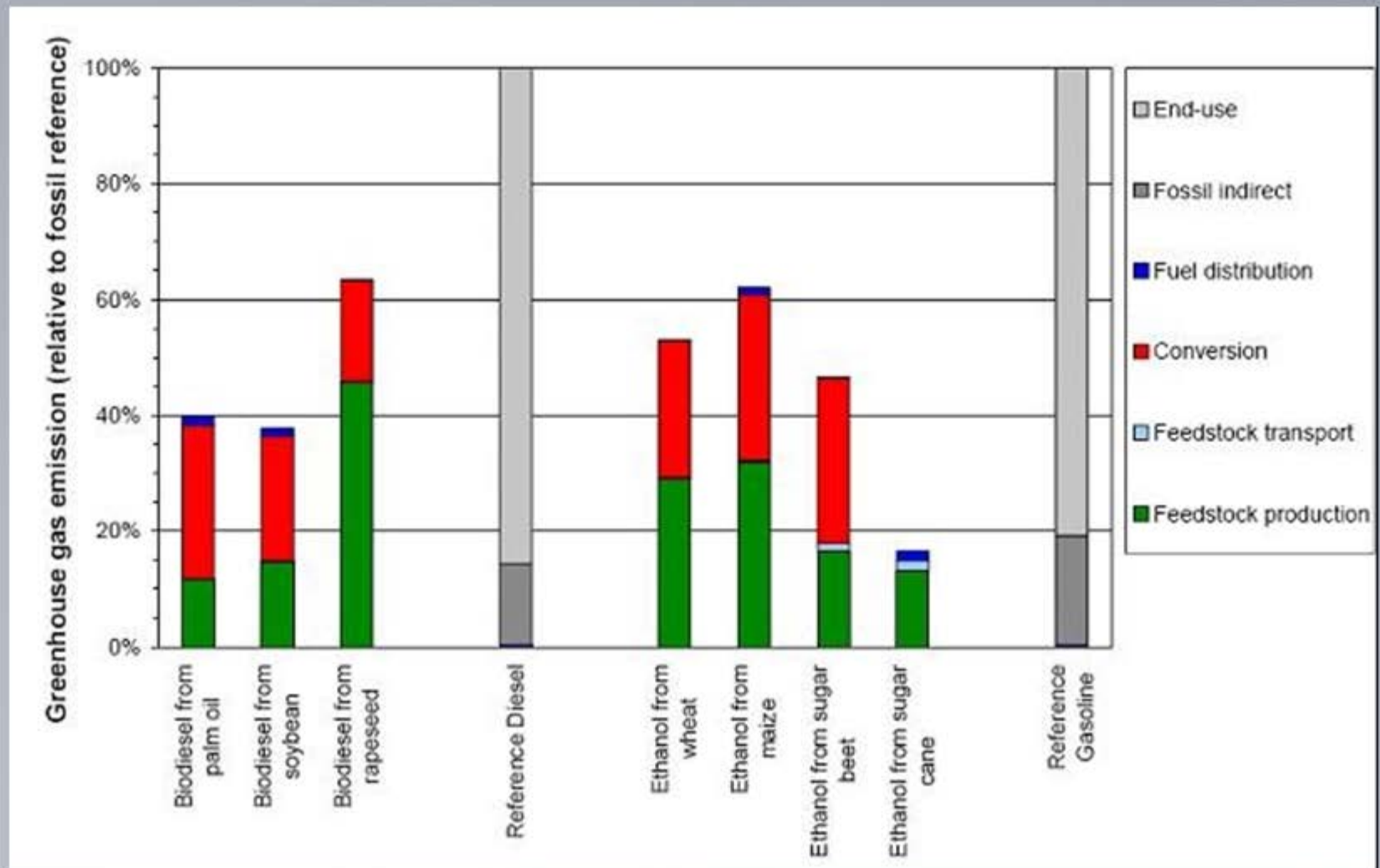
# Greenhouse Gas Emissions for Biodiesel from Canola



Source: KWA Eviva GmbH (Grafic) , Verband der Deutschen Biokraftstoffindustrie e.V. (Data)



# Well-to-wheel GHG emissions for fuels from different crops



- ✦ Edibility of feedstock is not per se relevant
- ✦ The actual issue is competition for suitable land
- ✦ There is no shortage of food, but a bad distribution
- ✦ High prices → increase in acreage
  
- ✦ Biofuels cause higher commodity prices;  
poor countries pay currently 25% more for cereals import  
(FAO Food Outlook 2007)
- ✦ Bioenergy could contribute to poverty decrease  
(WorldWatchInstitute 2007)
- ✦ Real agricultural prices declined 56% in last 46 years  
(World Bank 2007)

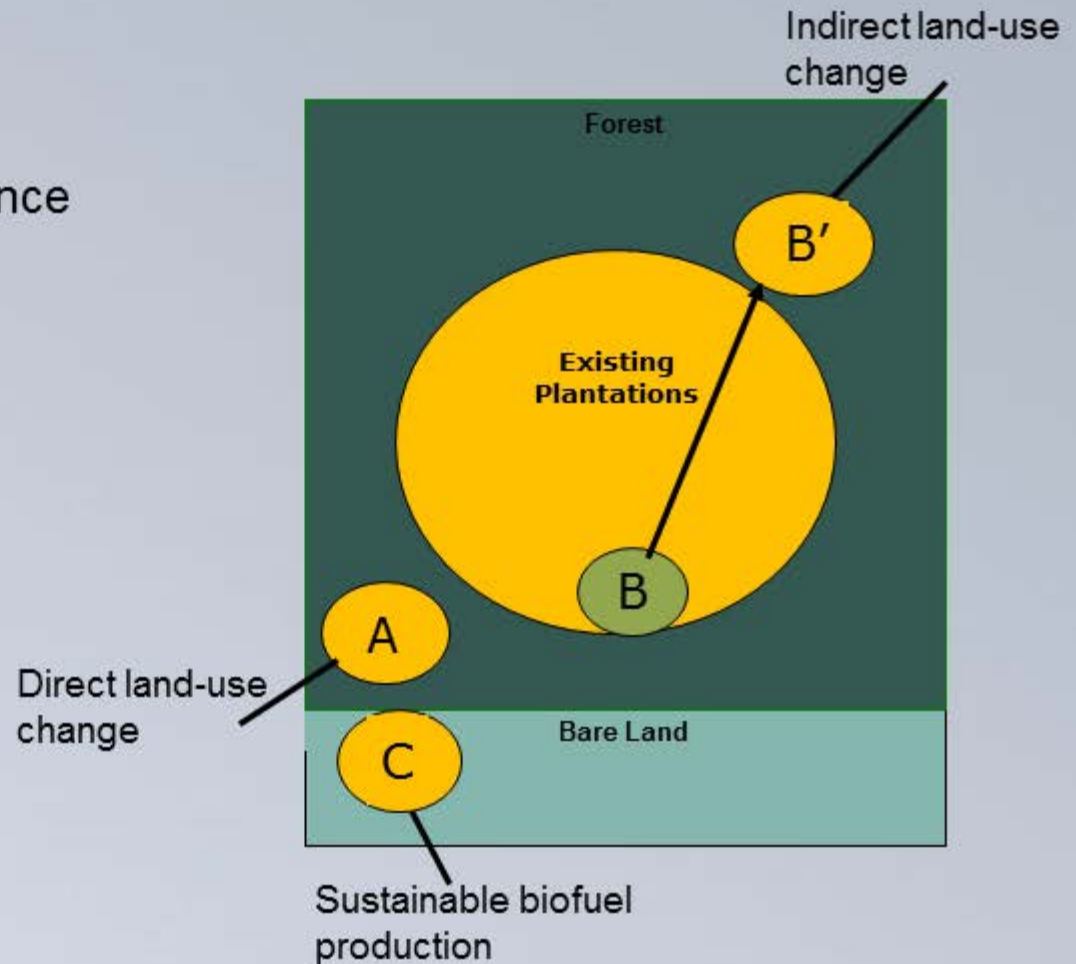
# Feedstock sustainability

## Indirect land-use change



Consequences:

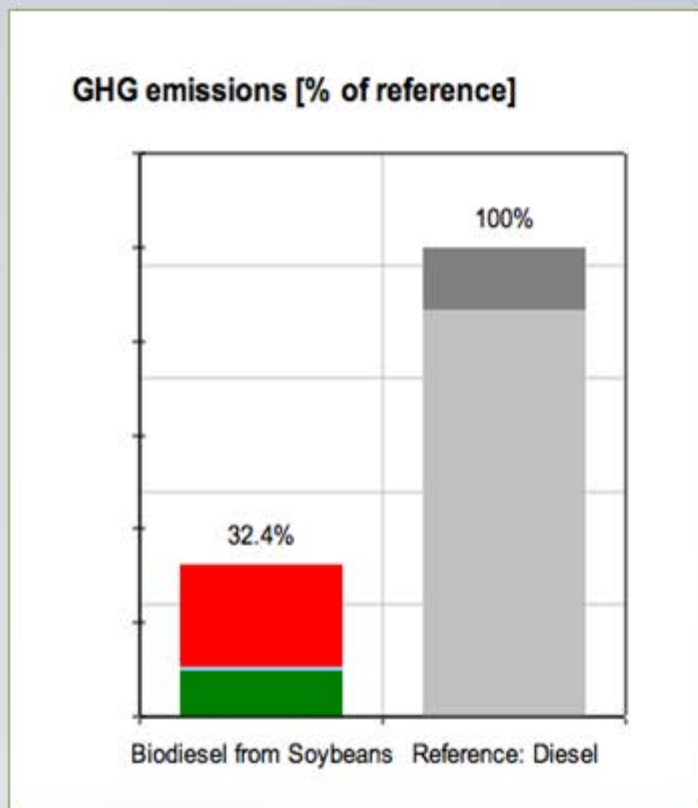
- ✦ Change in carbon storage  
→ very large effect GHG-balance
- ✦ Biodiversity
- ✦ Land-right issues



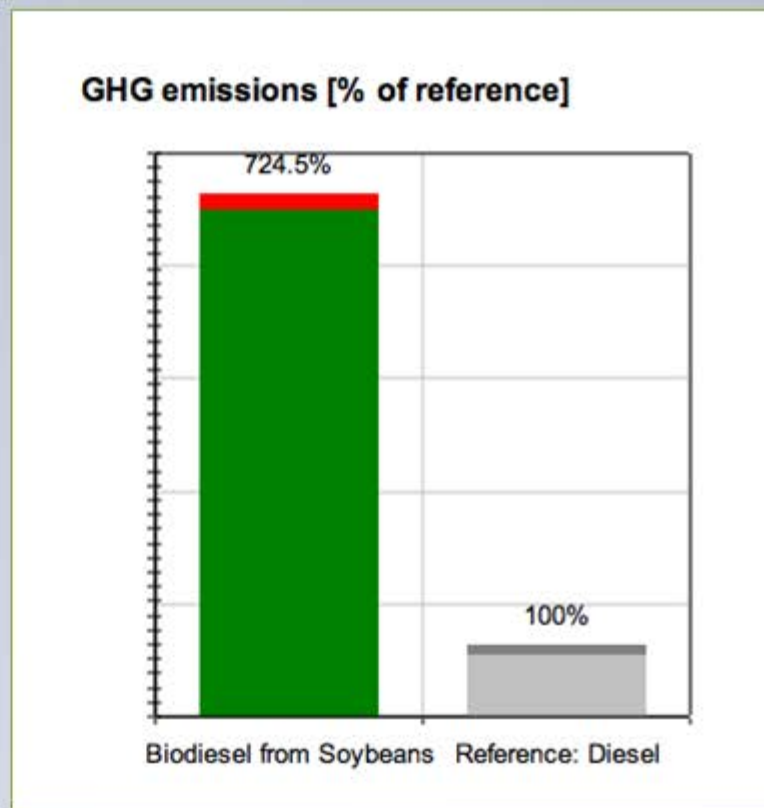
# Is sustainability an issue for biofuels?

If produced unsustainable, biofuels can emit *more GHG than fossil fuels*

## Without deforestation



## With deforestation



(Draft Dutch CO<sub>2</sub>-tool)







## Biomass resources in Belize

- ✦ 25,000 ha of cropland are currently (2014) used to produce 1.5.mill. tons of sugar cane
- ✦ Residues of lumber yards can be used in CHP plants
- ✦ Sugar cane can be used directly to produce bioethanol
- ✦ Bagasse can be used for combustion in cogeneration plants which is done currently at very low efficiency
- ✦ Vinasse can be used for biogas production
- ✦ In addition there are coffee pulp and coconut husks for co-generation
- ✦ Jatropha or other oil crops could be cultivated
- ✦ Organic wastes from households and food industry for biogas production
- ✦ Animal waste can be used to produce biogas

# Thank you

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