

Sustainable Biofuels: Environmental Considerations

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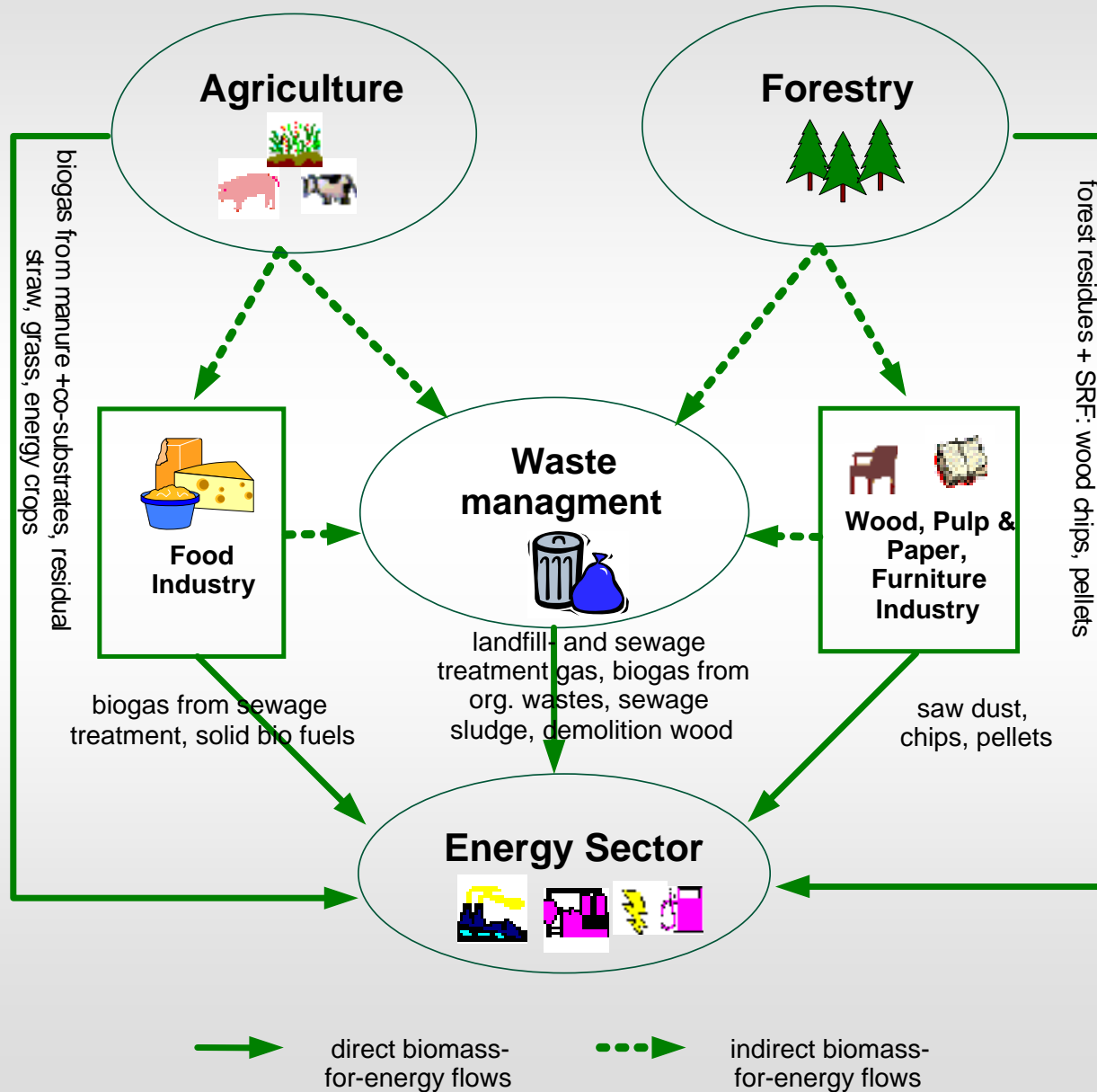
Öko-Institut (Institute for Applied Ecology), Darmstadt Office

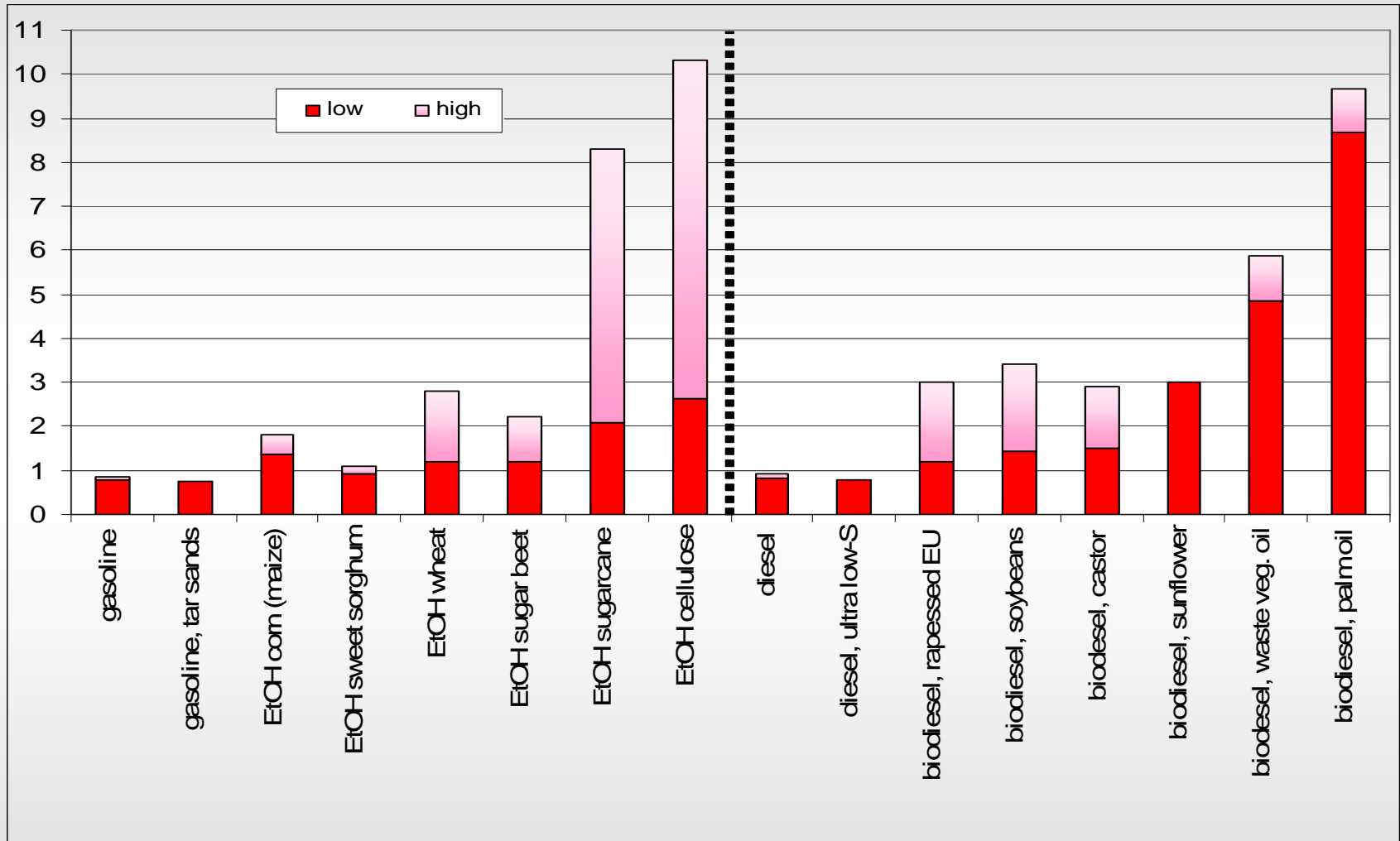
presented at the BMELV/gtz/WWI International Conference

“Biofuels for Transportation – Global Potential and Implications for Sustainable Agriculture, Energy, and Security in the 21st Century”

Washington DC, June 7, 2006

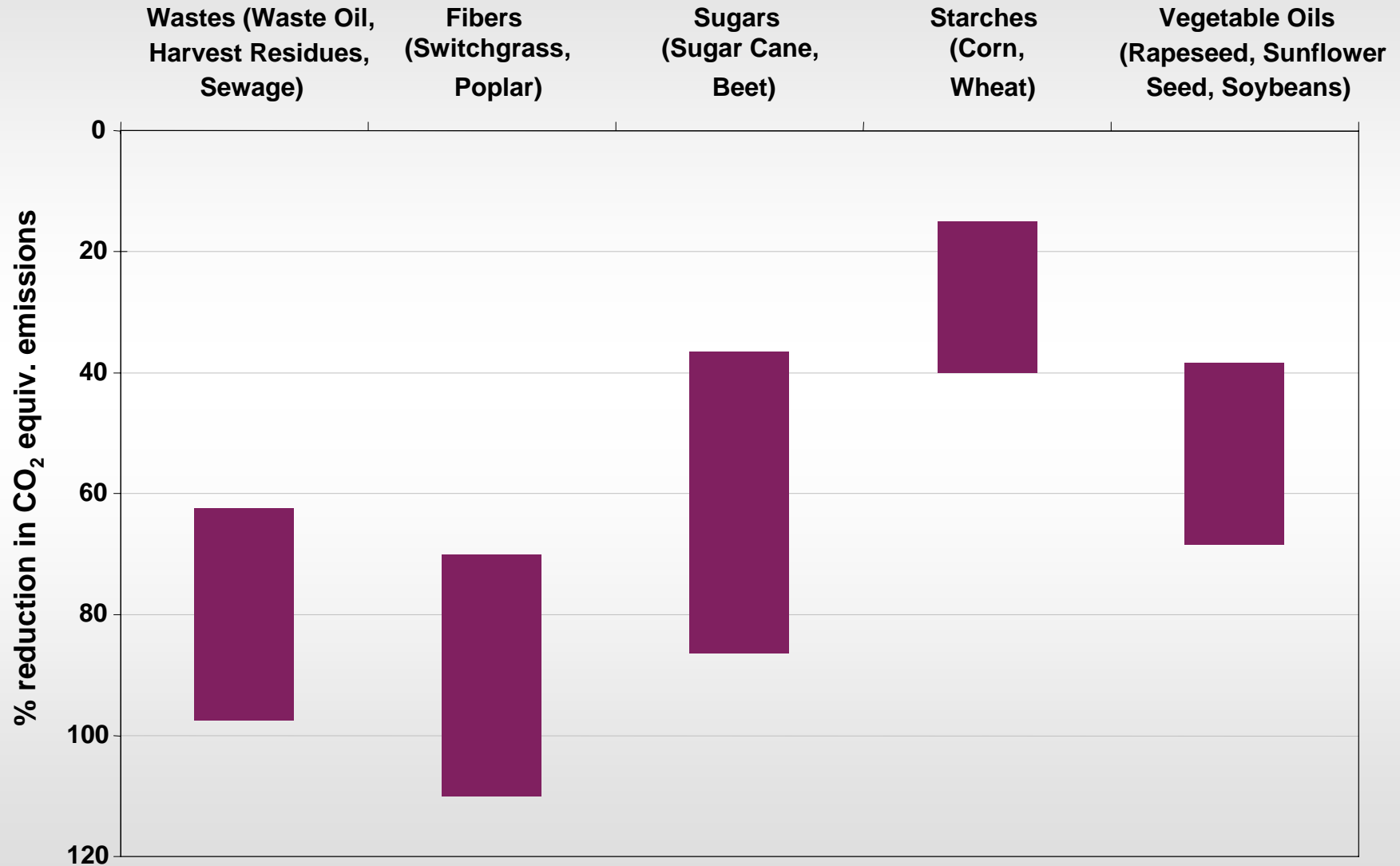
- Current and future **energy and emission balances** of biofuel production
- **GHG abatement costs** of biofuels: contribution to **climate protection**?
- How to **secure sustainable** biofuel production?



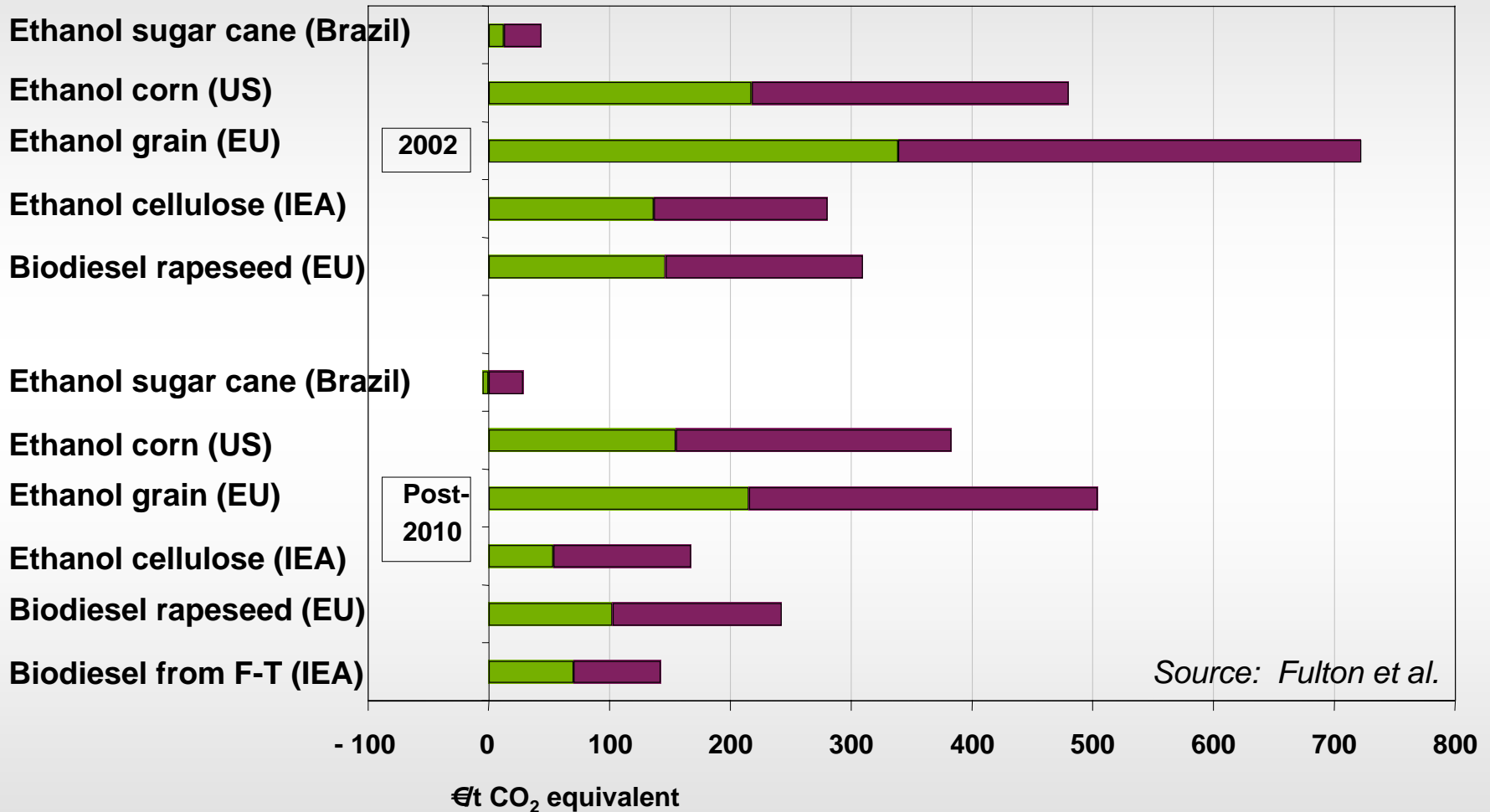


Fossil Energy Balance of Transport Fuels, data from WWI/gtz (2006)

Data given as ratio of energy output per **fossil** energy input



Source: based on IEA (2005)



Source: Fulton et al.

Note:

Ranges were developed using highest cost/ lowest GHG reduction estimate, and lowest cost/ highest GHG reduction estimate for each option, then taking the 25% and 75% percentile of this range to represent the low and high estimates in this figure.

		costs 2010	2020	jobs	CO ₂ -eq.	SO ₂ -eq.
person transport		€cent/kWh _{input}		pers./TWh _{input}	g/kWh _{input}	
DIESEL-CAR	fossil diesel with tax	12,0	14,0			
	ditto, without tax	5,4	6,3	9	326	0,5
	biodiesel DE	7,7	8,2	314	65	1,0
	biodiesel from palmoil	5,6	6,0	-	275	1,0
	BtL wood-residue DE	6,9	5,3	153	-131	0,6
	BtL wood-SRF DE	8,8	7,7	1757	-100	0,8
	BtL wood-SRF from PL	4,1	5,2	-	-222	-0,6
OTTO-CAR	fossil gasoline, with tax	15,0	17,0			
	ditto, without tax	6,8	7,7	9	343	0,5
	EtOH wheat DE	7,2	7,8	217	197	0,7
	EtOH lignocellulosic DE	6,5	6,1	83	79	0,5
	EtOH wheat from PL	3,3	3,4	-	219	0,8
	EtOH sugarcane from BR	3,4	3,4	-	108	1,0
	Biogas (maize)	6,9	6,7	220	87	0,6
	Biogas (double-cropping)	6,0	5,0	1.870	89	0,5

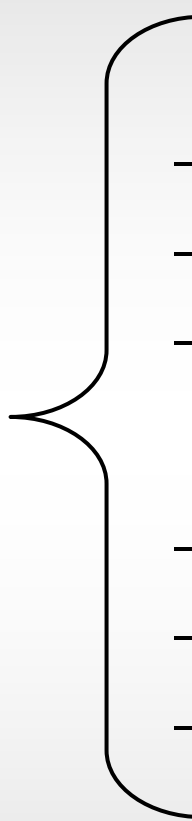
Source: Öko-Institut (2006); **preliminary** data for palmoil, and lignocellulose EtOH (whole plant)

Biofuels **excluding** taxes; but **including credits** for by-products (glycerine; electricity...)

Basic considerations:

- consider land for **organic** farming (e.g. **30%** in 2030)
- **set-aside** farmland for **nature conservation** (e.g. 5% “stepping-stones” for species)
- no **forests** or **grasslands** for biocrops (soil carbon)
- no forest residues from critical sites
- straw use only if soil is protected

Approach

- Differentiate between “climatic” zones
 - Determine the environmental impact of bioenergy crops
 - Introduce mix of bioenergy crops (maintain crop and landscape diversity)
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- erosion
 - soil compaction
 - nutrient + pesticide inputs to surface/ground water, and soils
 - water abstraction
 - fire risk
 - diversity of crop types

- bio wastes are **robust** options
- for nature conservation + biodiversity, **perennials often** better than annual crops
- high net yield of **whole-plant** conversion (SRC + perennials) → lower impacts
- **promising biofuels**: lignocellulose EtOH + BtL, perennial oil plants; **biogas**?

- **Biowastes and biocrops need environmental “guardrails”** (extraction rates, species...)
- **Bioenergy needs cross-sectoral land-use policy** (agriculture, forestry, tourism, nature protection...)
- **Im/exports interesting as addition:**
→ international sustainability standards !
- **Research in sustainable cropping systems**
- **Biofuels only part of sustainable transport**