

# Agro-ecological principles and biofuels

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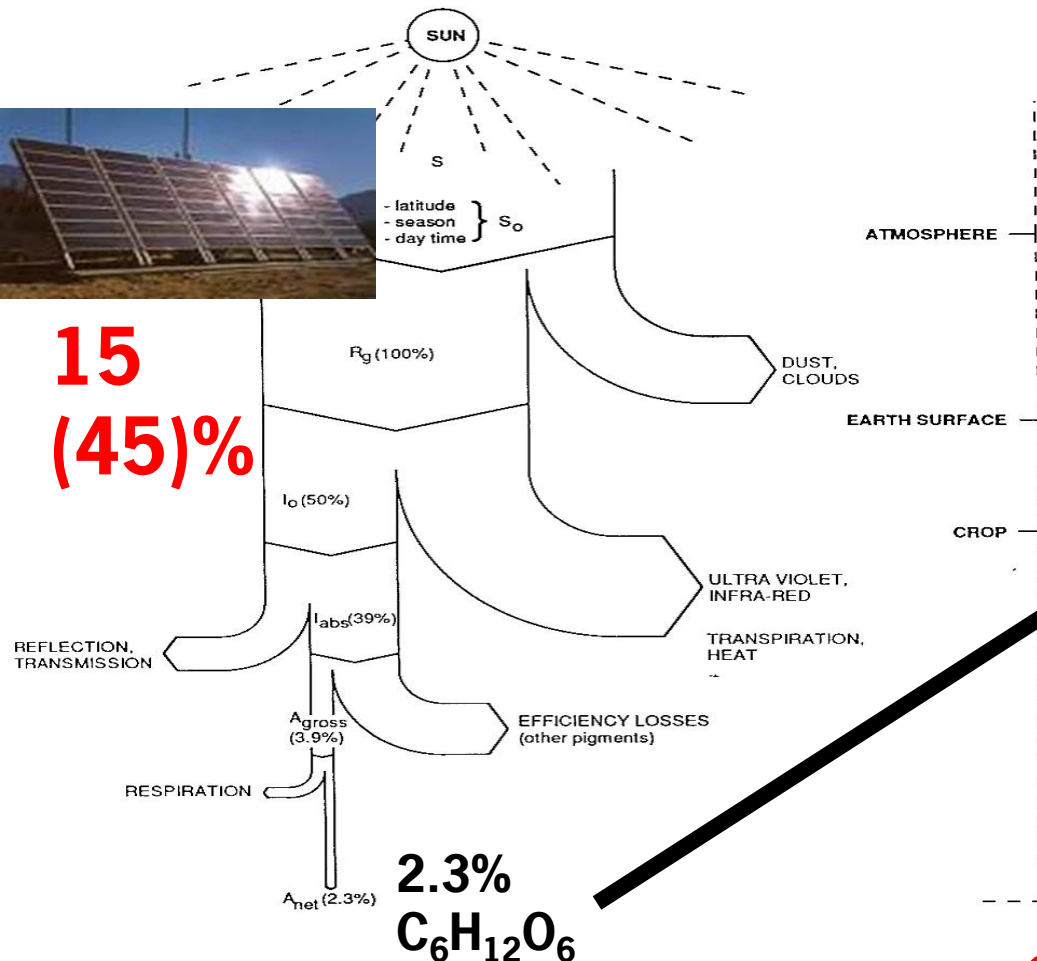
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Bioeconomy Days “Bioeconomy  
in the EU: achievements and  
directions for the future”  
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# Energy efficiency



**15  
(45)%**



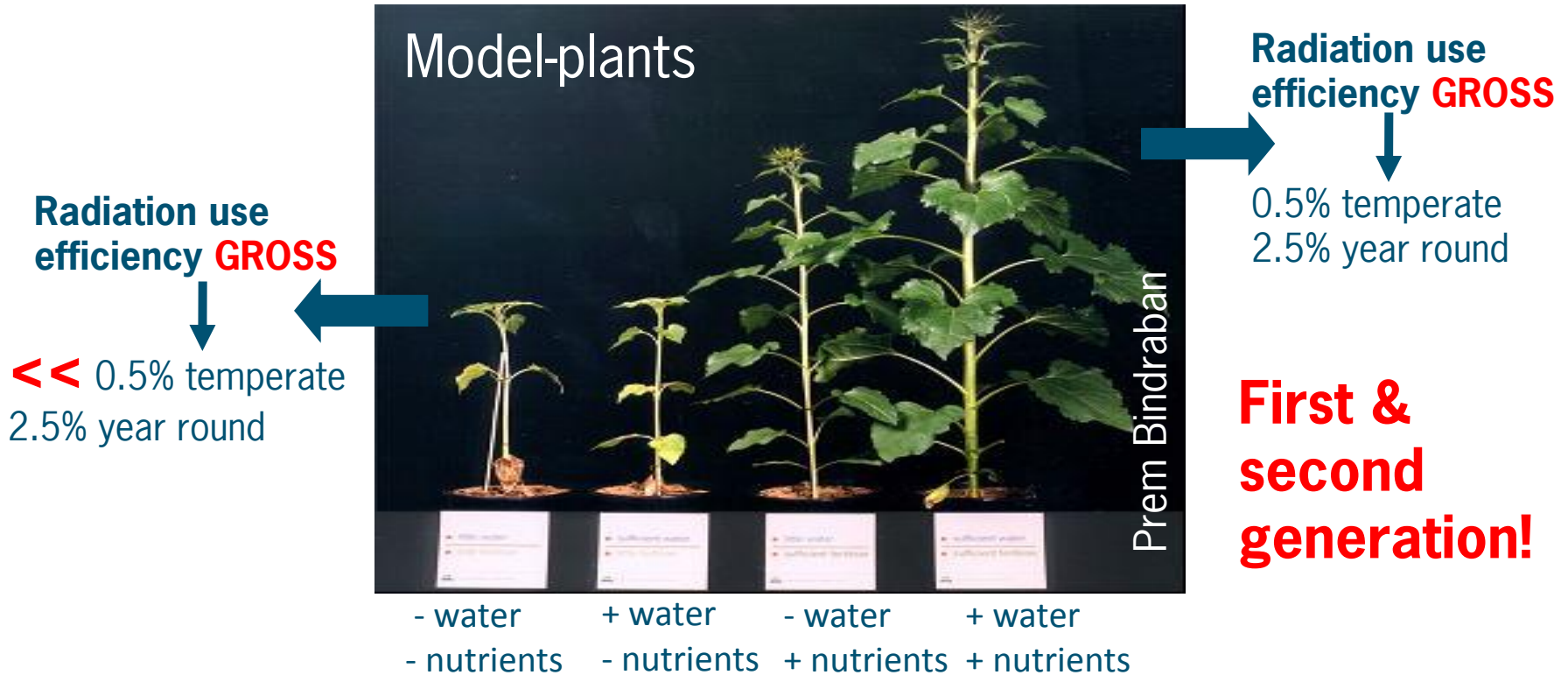
Annual actual efficiency

0.5% temperate regions  
2.5% year round tropical

**Gross !!**

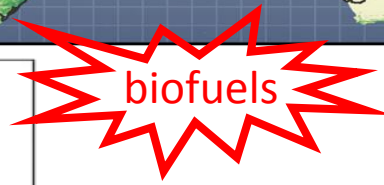
**0.2 – 0.8 % net energy**

# Basic production ecological principles

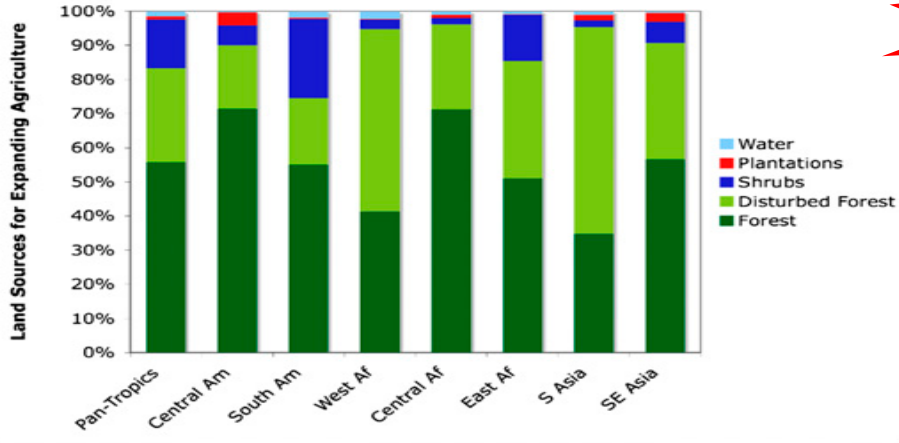


# Ultimate expansion into forests and savanna

1980s  
and  
1990s



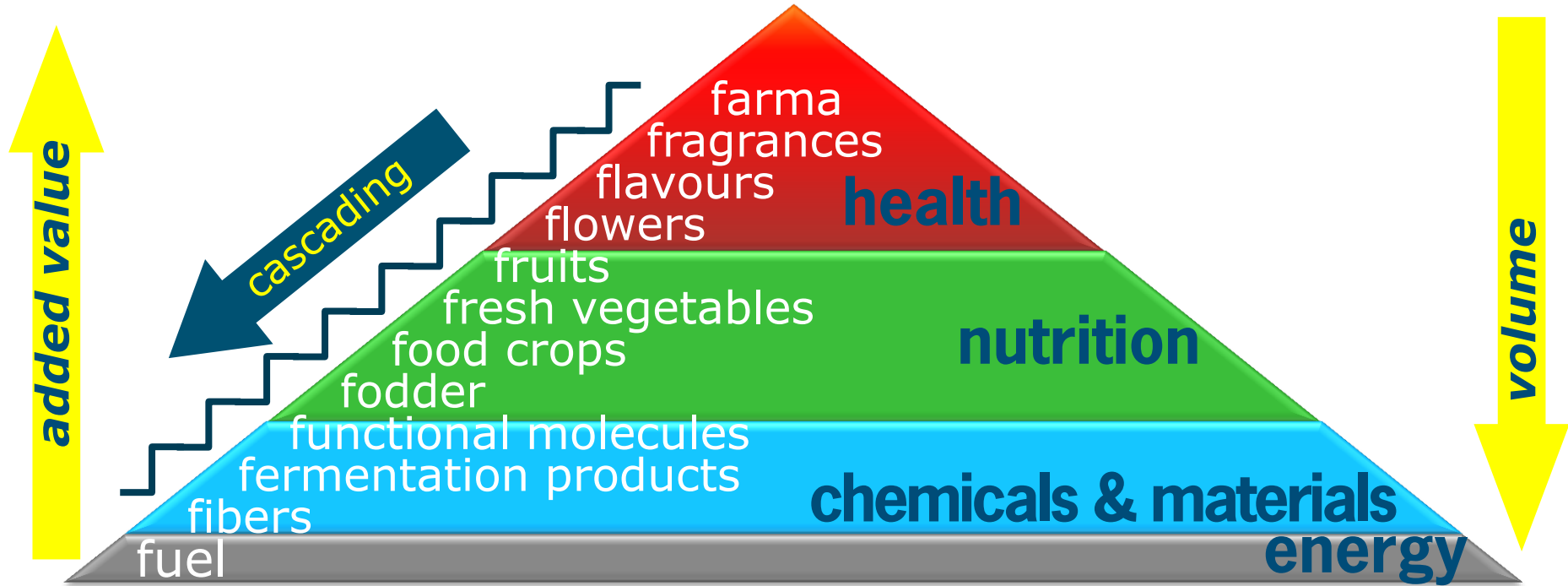
**will exacerbate expansion**



expansion of agricultural land appears to come from expansion into intact forest (55%), disturbed forest (28%) and savannah (8%)

H. K. Gibbs, et al., 2010. Tropical forests were the primary sources of new agricultural land in the 1980s and 1990s. PNAS, 107 (38) 16732–16737.

# From Food to Fashion (RR's 12 F's)

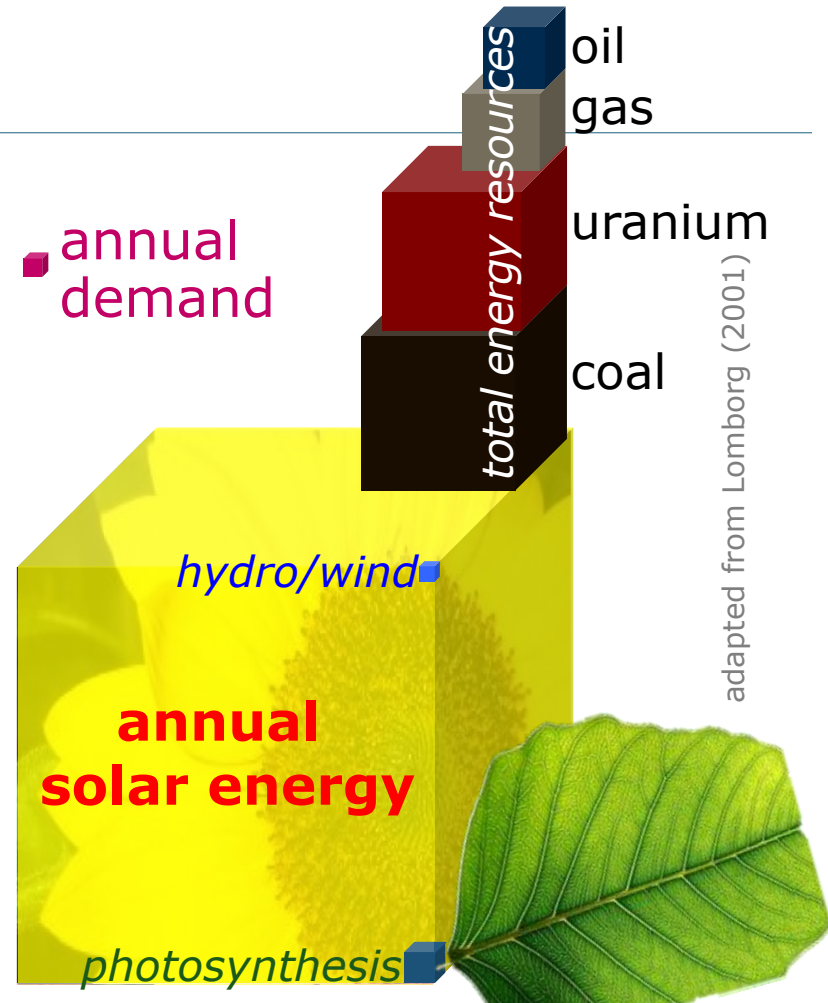


# Solar energy

Enormous potential, but ...

- Biology inefficient to fix solar energy
- 10% of all transport fuels needs 26% or all crop production!
- Totality of world's crops would produce 13% of world's primary energy (9% when efficiencies in appropriation included)

(V0 version HPLE report Biofuels and Food Security:  
[www.fao.org/cfs/cfs-hple](http://www.fao.org/cfs/cfs-hple))



We have a  
food  
problem !



We have no energy problem !

