



# Energy in the future?

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# The world in 2050

- Current forecast
  - Population growth 50%
  - Energy consumption 100% increase
- Challenge
  - Achieving 80% greenhouse gas reductions will require all renewable and CO<sub>2</sub> neutral energy technologies available. *Energy savings are essential!*
  - The way we eat accounts for up to 30% of our greenhouse gas emissions



## Our options

- Solar
- Wind
- **Biomass**
- Waves
- Nuclear
- Carbon sequestration

But what are the limitations?



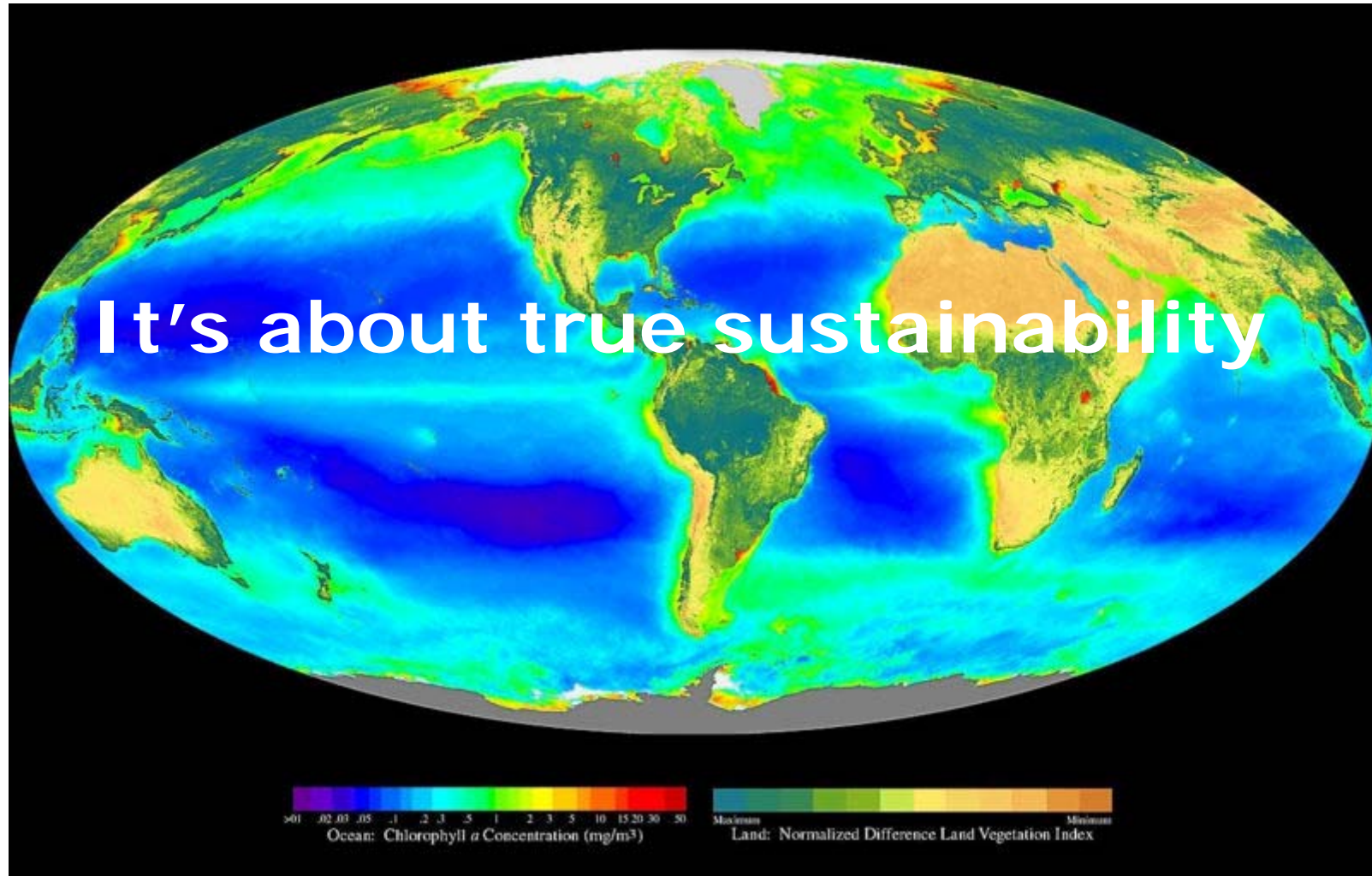
# Forestry and agriculture converts solar energy, water and CO<sub>2</sub> to biomass



1 mill m<sup>3</sup> wood = 0,000032% of the global biomass production.  
10% of the global energy supply is from biomass.  
Every year there is enough biomass to supply 5 times our  
global energy consumption



**Atmospheric carbon stock 720 Gton**

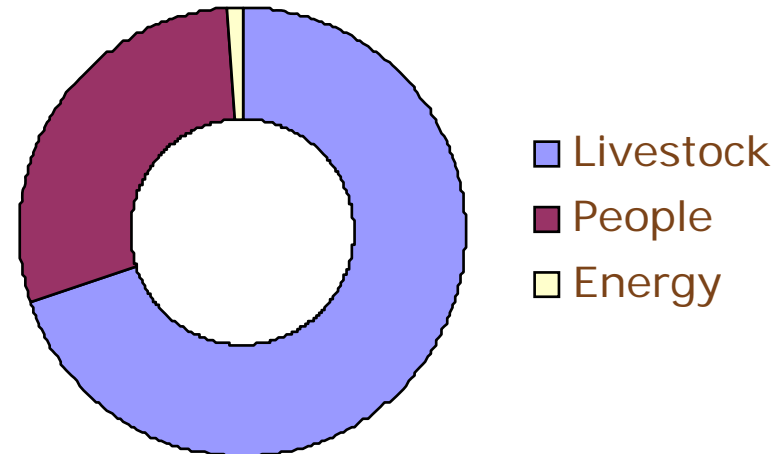


**Terrestrial Biomass carbon stock 2000 Gton**



# Bioenergy -the road ahead

- We need biomass for food, feed and energy
- Sustainable bioenergy needs sustainable biomass
- *The limiting resource is not biomass but land area*
- Wood is the major resource
- We can probably double or triple our use of biomass for energy
- Use biomass where it creates the highest energy density/value – transportation and chemicals



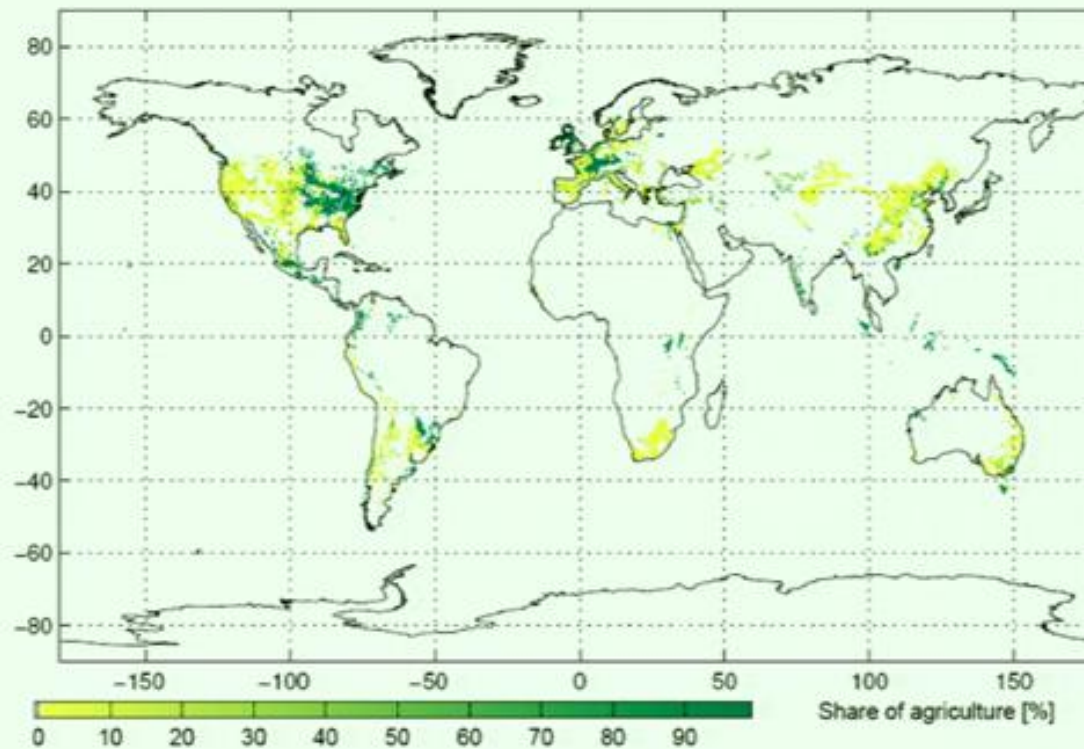
Agricultural crop land use 2008



# Optimised land use

## Mind Game - Optimizing Allocation of Agricultural Sites

Globally optimized production scheme (pop. of 12 billion, diet of 1995)



(Müller et al. 2006)

