



International
Resource
Panel



ASSESSING GLOBAL LAND USE

Balancing Consumption
With Sustainable Supply

Structure

PROBLEMS AND CHALLENGES

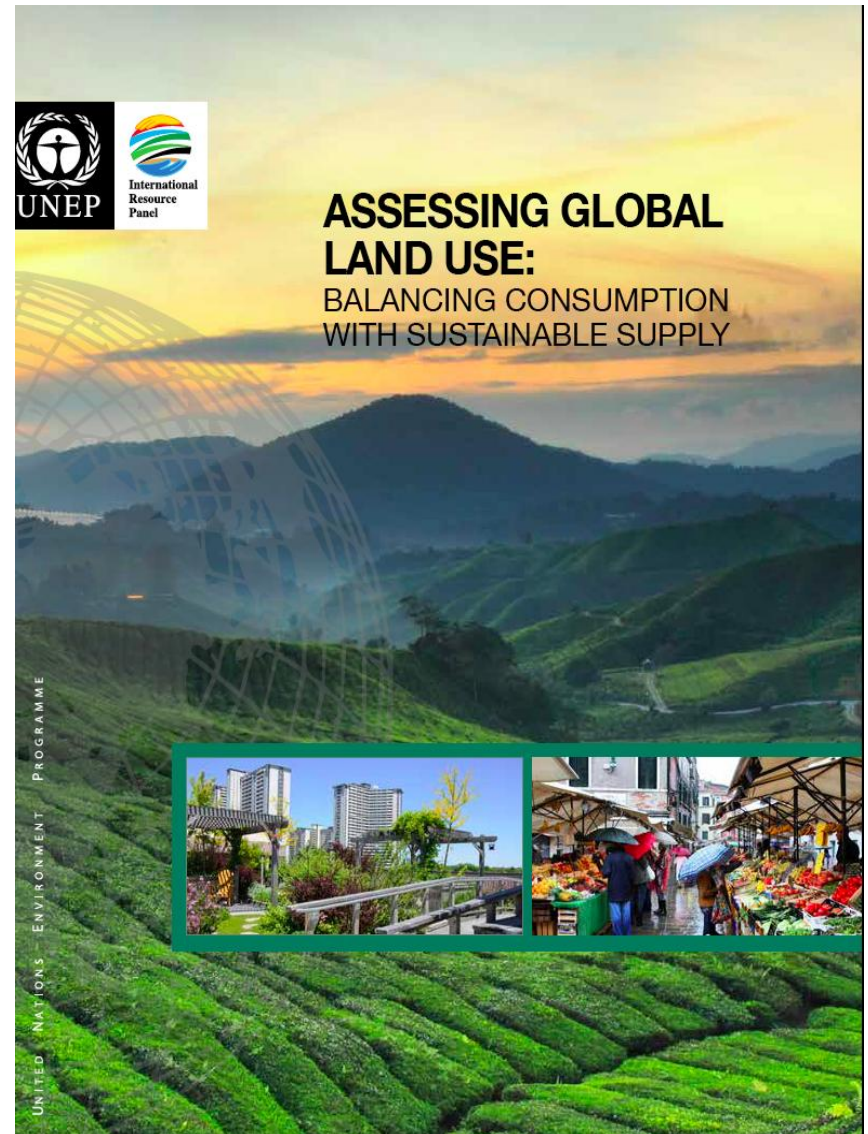
- Global trends
- Drivers of land use change
- Expected magnitude of land use change

ARE WE ON THE RIGHT TRACK?

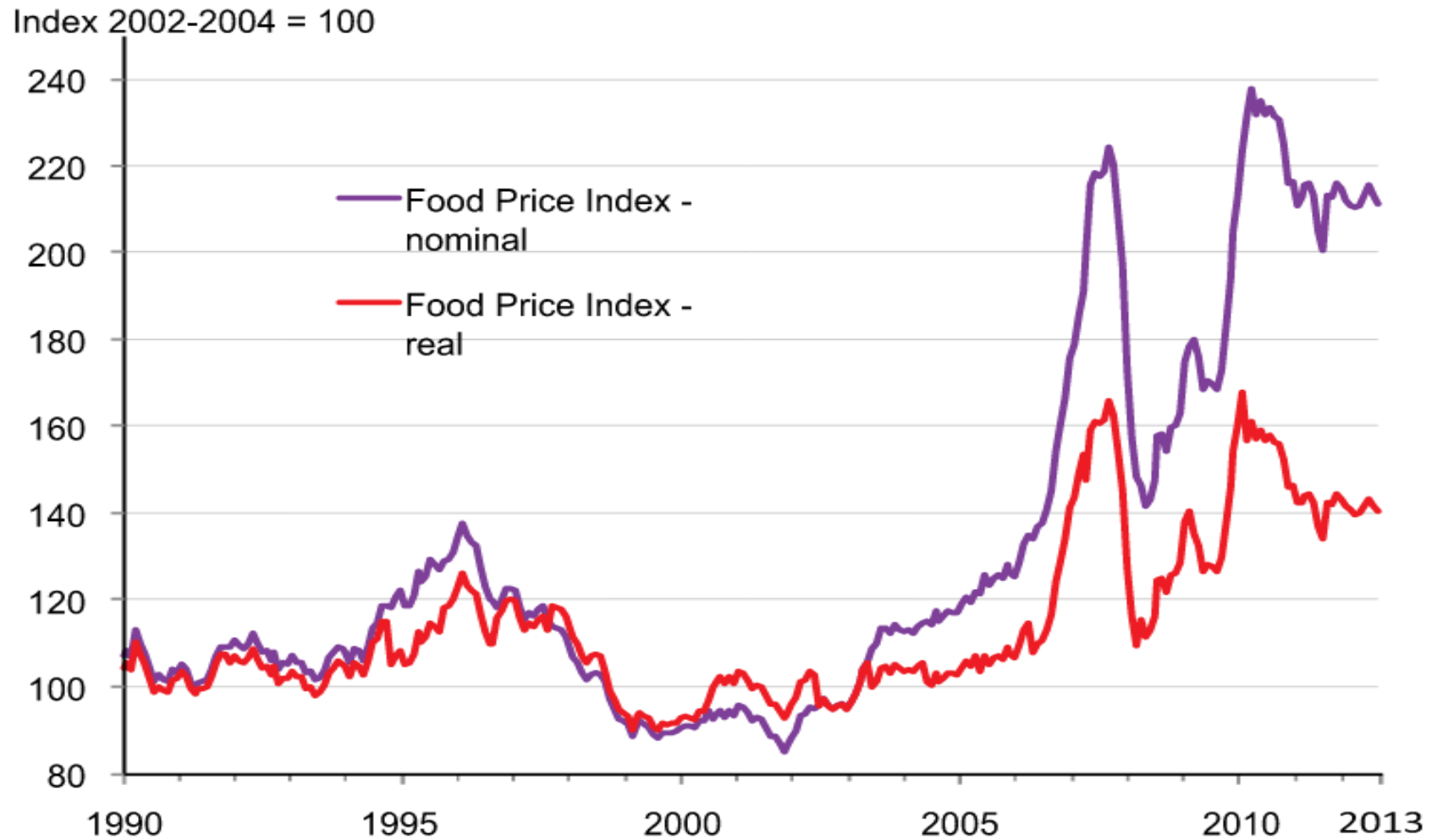
- Safe operating space
- Monitoring global land use

WAYS FORWARD

- Improving production
- Steering consumption
- Policy options
- Research needs



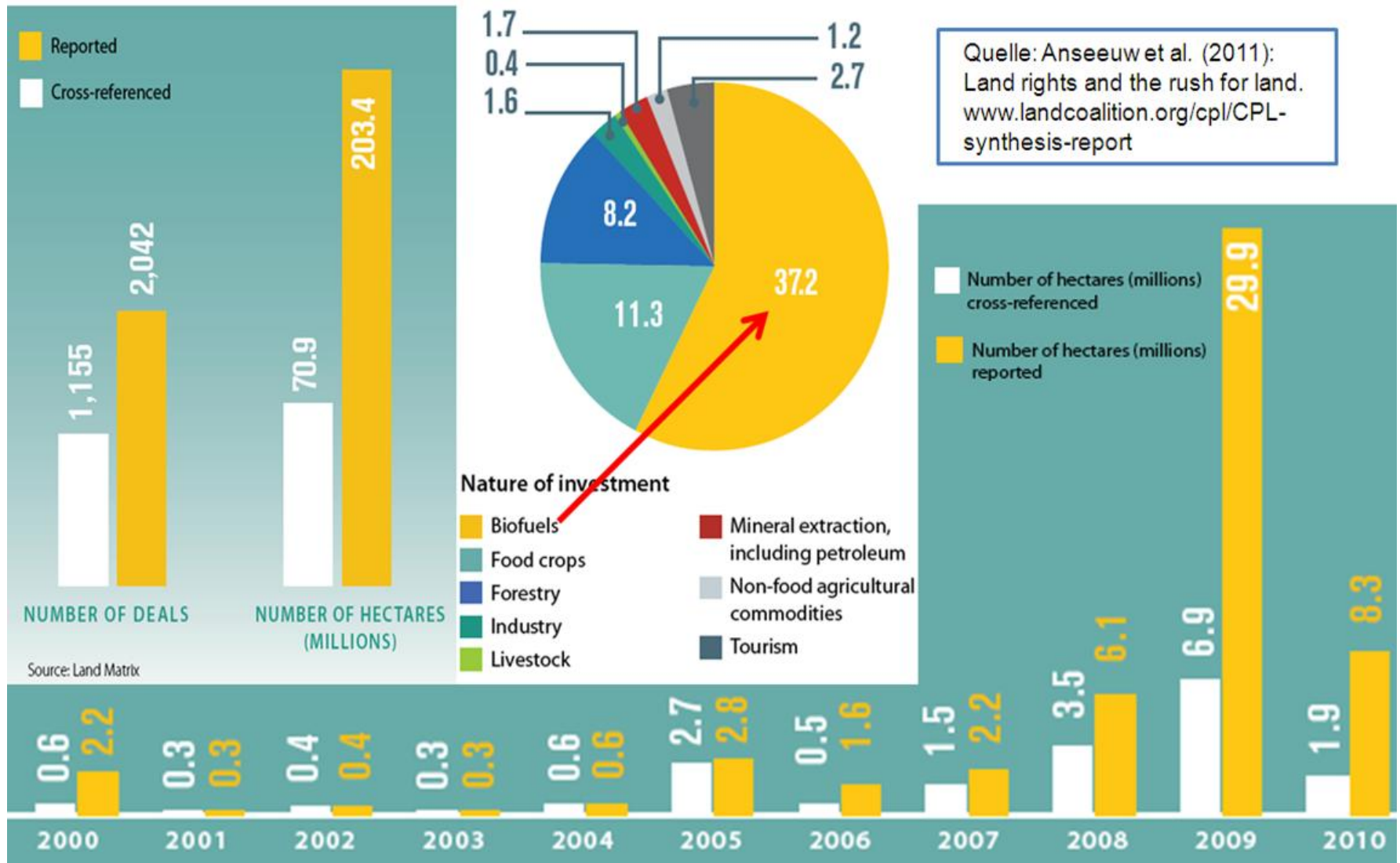
Food Price Development 1990 - 2012



Source: FAOSTAT online database 2013

Large scale land investments indicate growing demand for cropland

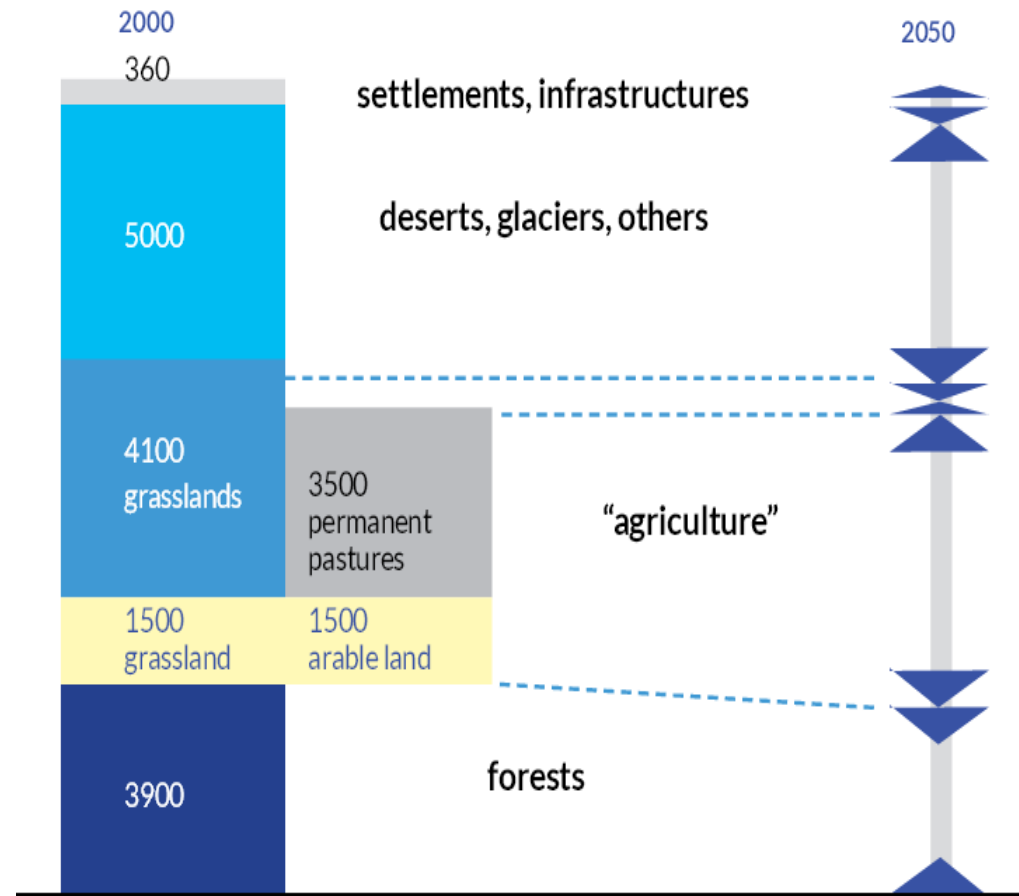
(2000 – Nov 2011)



Global trends: Dynamics of land use change

- Around 15 billion ha of land worldwide.
- Around 30 % used for agriculture.
- Built-up land expands (often at the expense of agriculture).
- Agriculture expands at the expense of forests and savannahs, especially in the tropics.
- Around 13 Mha of forests per year were lost over the last 5 decades.

Major types and trends of global land use and land cover (Mha)



Source: Bringezu and Bleischwitz 2009

Impacts of expanding agriculture: GHG emissions and losses of biodiversity through land use change

- Globally, the conversion of land to cropland has been responsible for the largest emissions of carbon from land-use change (Houghton 2010).
- Habitat change in particular in tropical regions has been a main cause of global losses of biodiversity (MEA 2005).

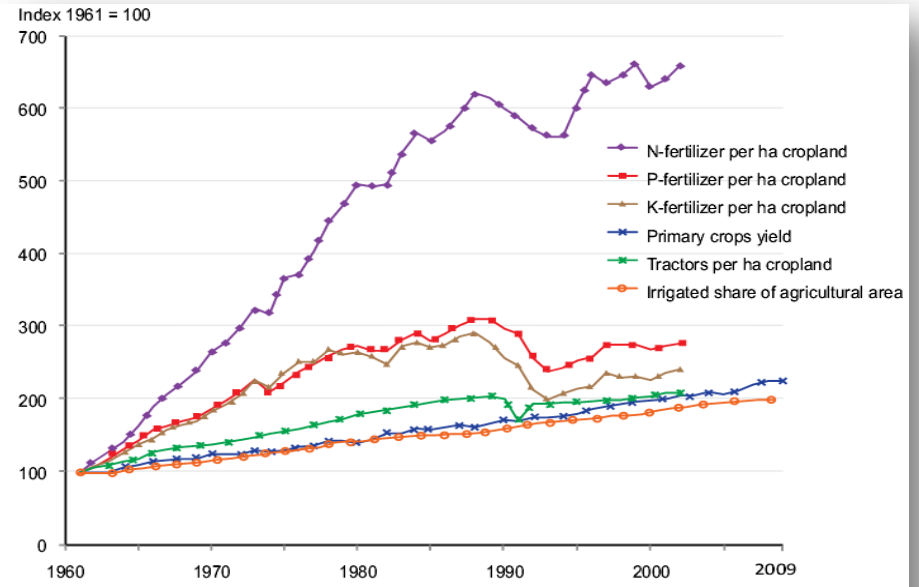


Source: UNEP

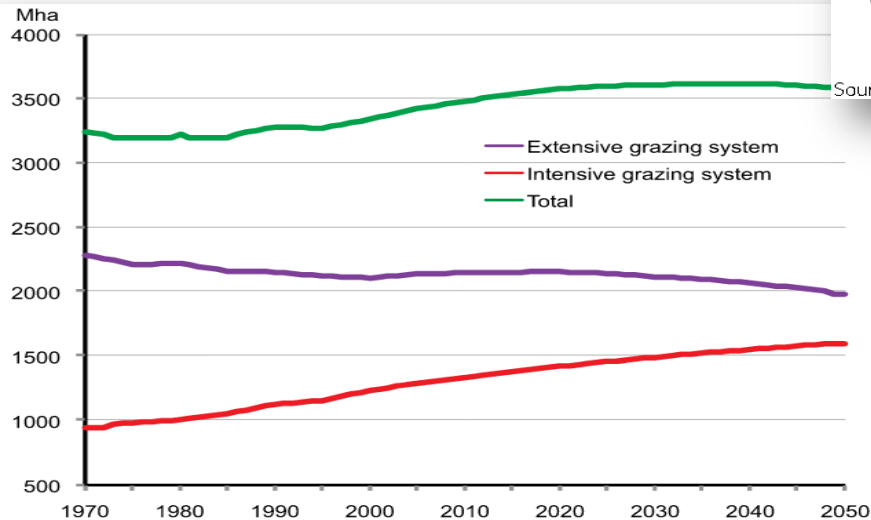


Photo: Bringezu

Intensification of crop and animal production increases



Source: Drawn from FAOSTAT online database.



Source: Drawn from data provided by E. Stehfest (Netherlands Environmental Assessment Agency, PBL), based on the IMAGE model, cited in Bouwman et al. 2006

Land degradation by soil erosion

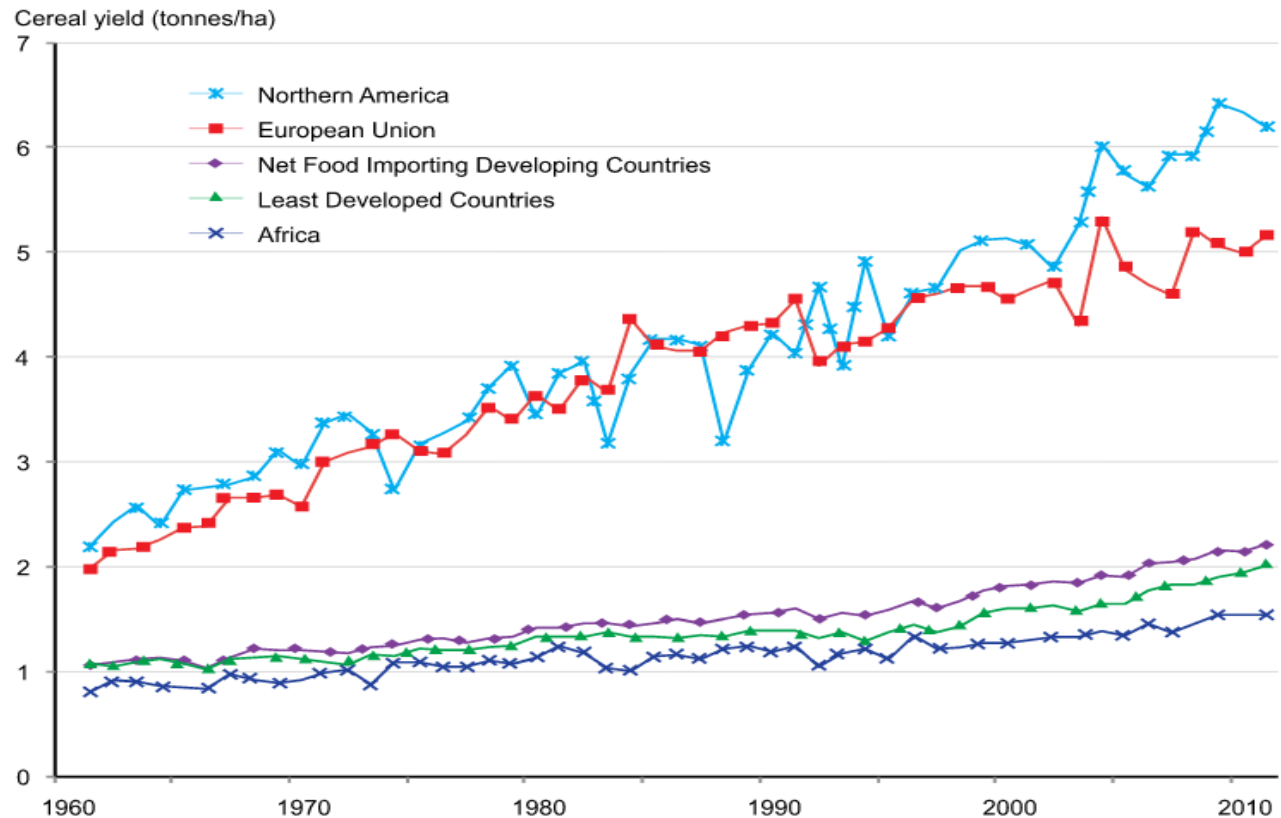
- More than a billion ha affected worldwide
- 2 – 5 Mha cropland severely degraded every year
- Data and effects with high variability



Drivers of land use change

Constrained yield increases and the "yield gap" in DCs

Cereal yields by selected world regions, 1961 - 2011

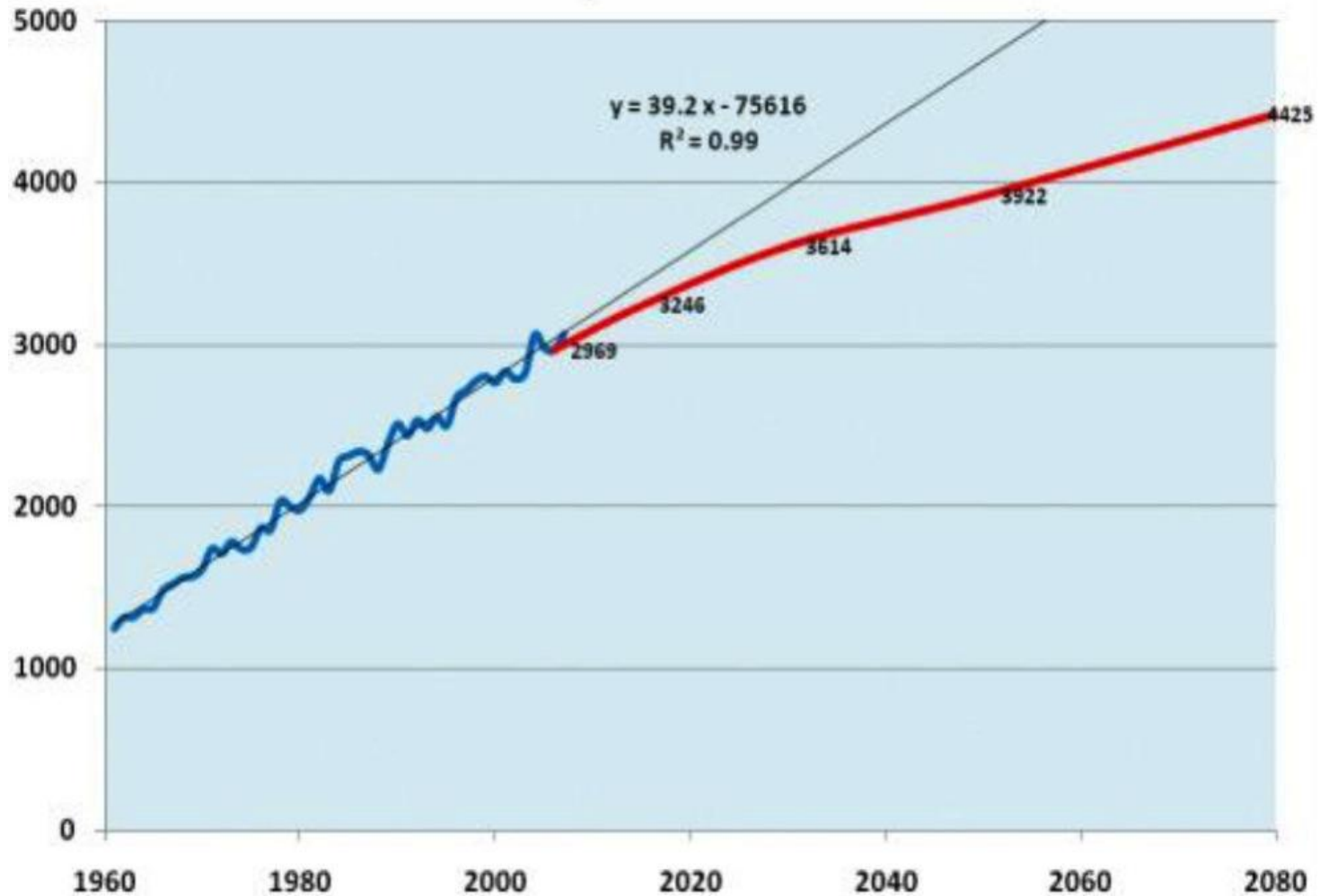


- Potential for increasing yields still exists in "developing countries"

Source: Drawn from FAOSTAT online database

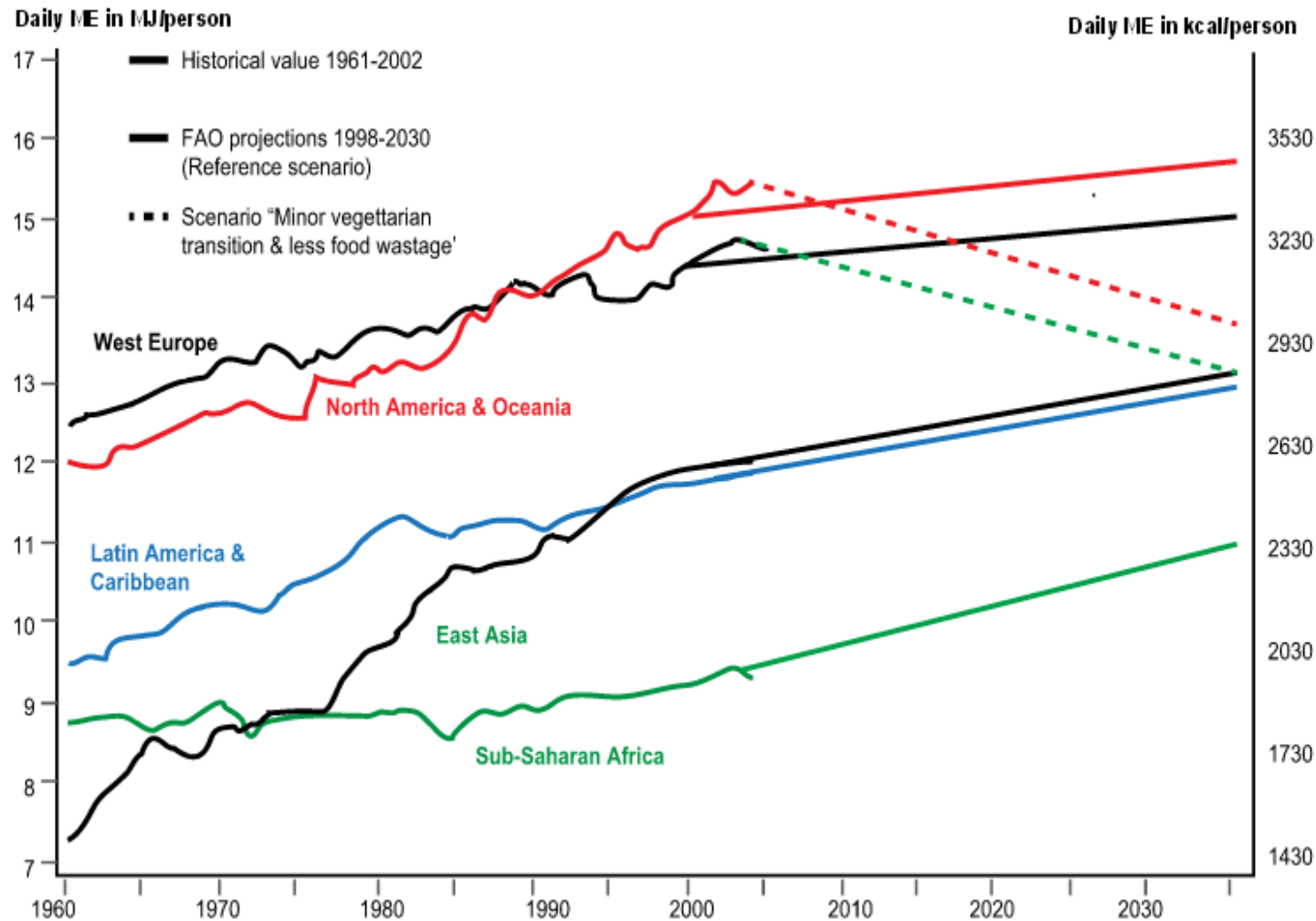
Note: Data for regions are as derived originally from FAO. See FAOSTAT online database country classifications for more information

World cereal yield development 1961 - 2080



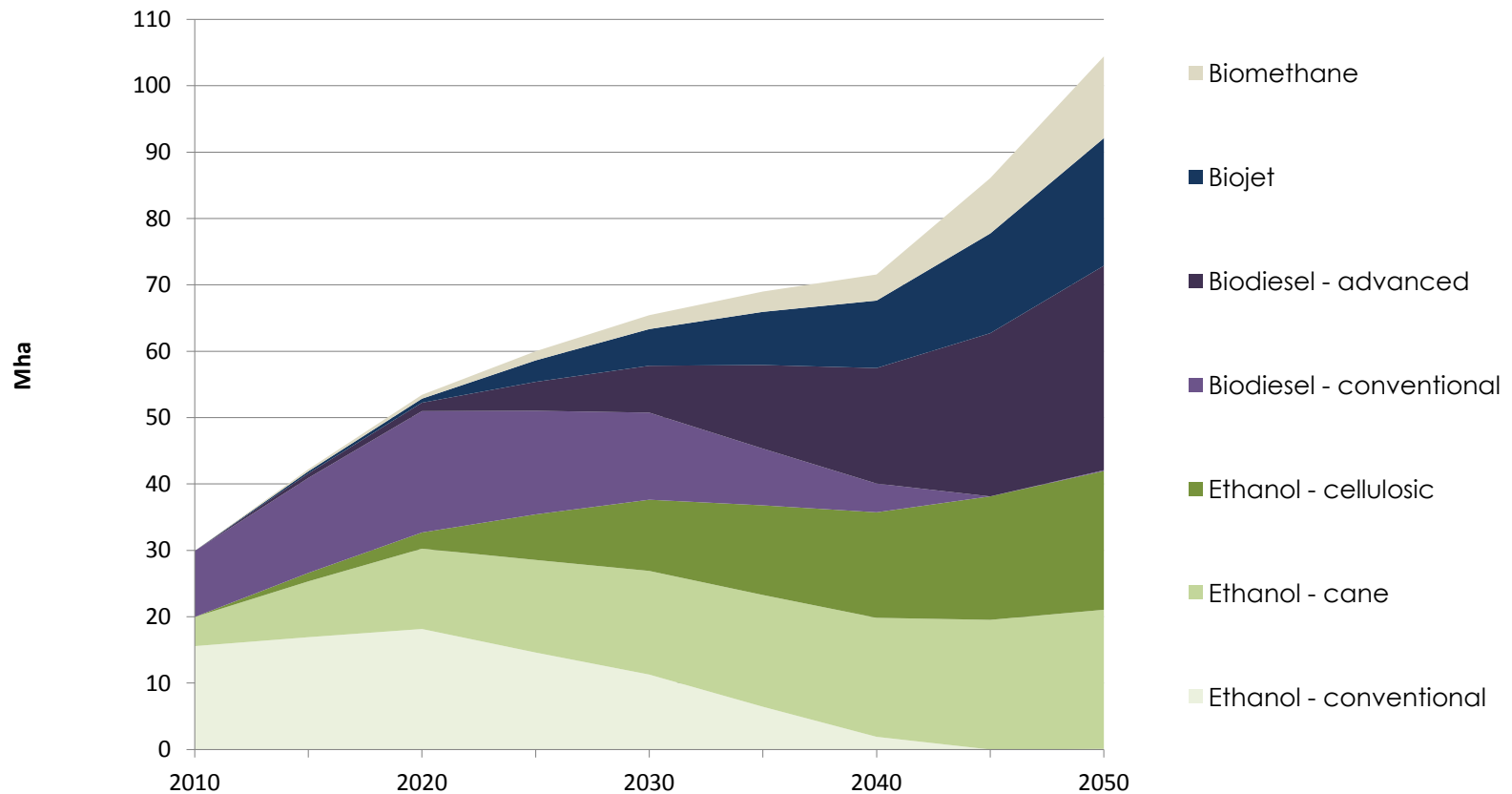
Source: Bruinsma (2011)

Diets are converging: DCs are going to get more protein rich meals



Source: Wirsenius et al. 2010b based on historical data from FAOSTAT online database and FAO projections from Bruinsma 2003

Projected land demand for global use of biofuels

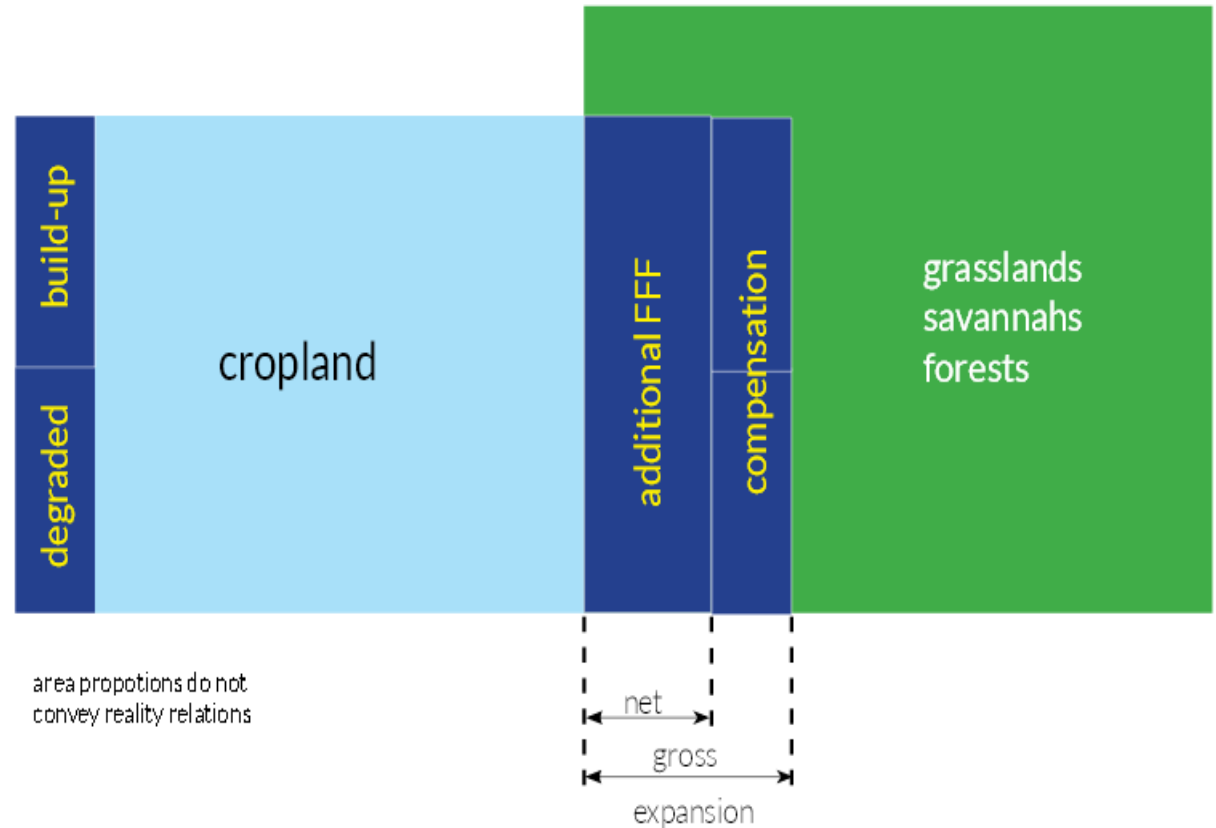


Source: IEA, 2011

Global land use change

- **Net expansion** is a result of rising demand for food and non-food biomass which cannot be compensated by higher yields.
- **Gross expansion** includes also the shift of cropland to other areas due to losses by severe degradation and built-up land.

Net and gross expansion of cropland



Expected magnitude of land use change 2005 to 2050

BUSINESS-AS-USUAL EXPANSION	LOW ESTIMATE (Mha)	HIGH ESTIMATE (Mha)	SOURCE
Food supply	71	300	Based on Bruinsma 2009, RFA 2008, Bringezu et al. 2009a
Biofuel supply	48	80	Based on Fischer 2009, IEA 2011
Biomaterial supply	4	115	Based on Colwill et al. 2011, Raschka and Carus 2012
Net expansion	123	495	
Compensation for built environment	107	129	Based on Electris et al. 2009
Compensation for soil degradation	90	225	Based on Scherr 1999
Gross expansion	320	849	

- Interpret data with caution as data not derived from one modelling approach; competitive effects, natural limits and climate change not considered explicitly
- Altogether, data indicate that it is very likely land competition will increase in the future

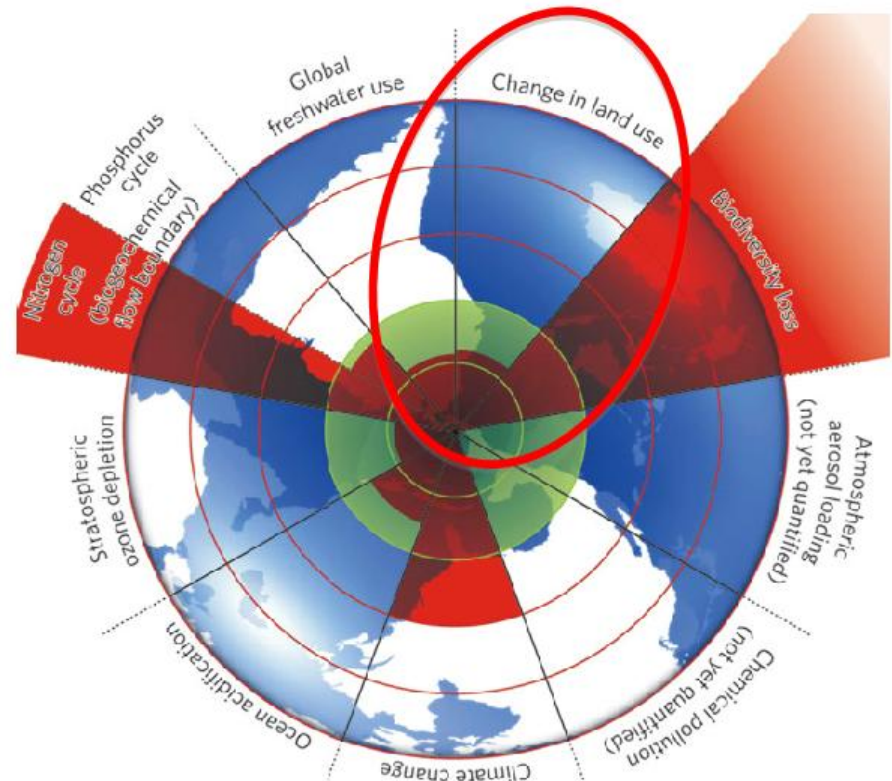
Interim conclusion

- Only to feed the world will require an expansion of cropland under BAU conditions
- Demand for non-food biomass must be expected to increase the pressure on the conversion of grasslands, savannahs and forests mainly in tropical regions
- So will the losses by soil degradation

How far can we safely expand global cropland? Approaching the Safe Operating Space

- How much more land use change can occur before the risk of irreversible damages becomes unacceptable?
- In particular regarding **biodiversity loss**
 - Agricultural expansion is a **key cause** of global biodiversity loss
 - The Convention on Biological Diversity: there is a **high risk** of dramatic biodiversity loss if ecosystems are pushed beyond tipping points and the loss **should be halted**
- Modeling results show that to halt biodiversity loss agricultural land needs to, at least, **stabilize from 2020** (Van Vuuren and Faber 2009)

Estimate of quantitative evolution of control variables for seven planetary boundaries from pre-industrial level to the present



Source: Rockström et al. 2009

What are the targets?

- A cautious global target would be to halt the expansion of global cropland into grasslands, savannahs and forests by 2020
- Implies BAU can “safely” continue until 2020



Reference value: around **1,640 Mha** available for supplying demand in 2020



**0.20 ha /
person**

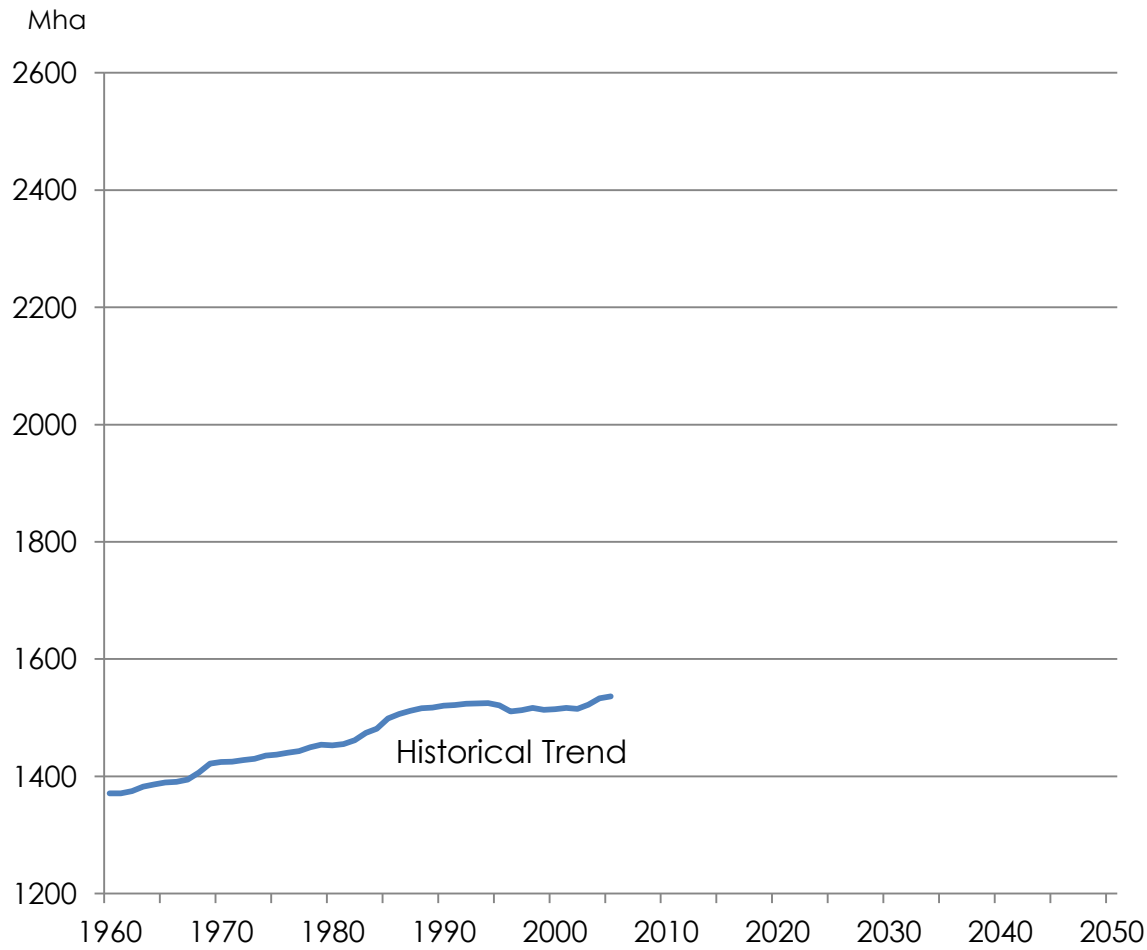
Target of **0.20 ha** of cropland (1,970 m²) per person in 2030

Are we on the right track?

Historical trend of global cropland

Historical expansion of global cropland

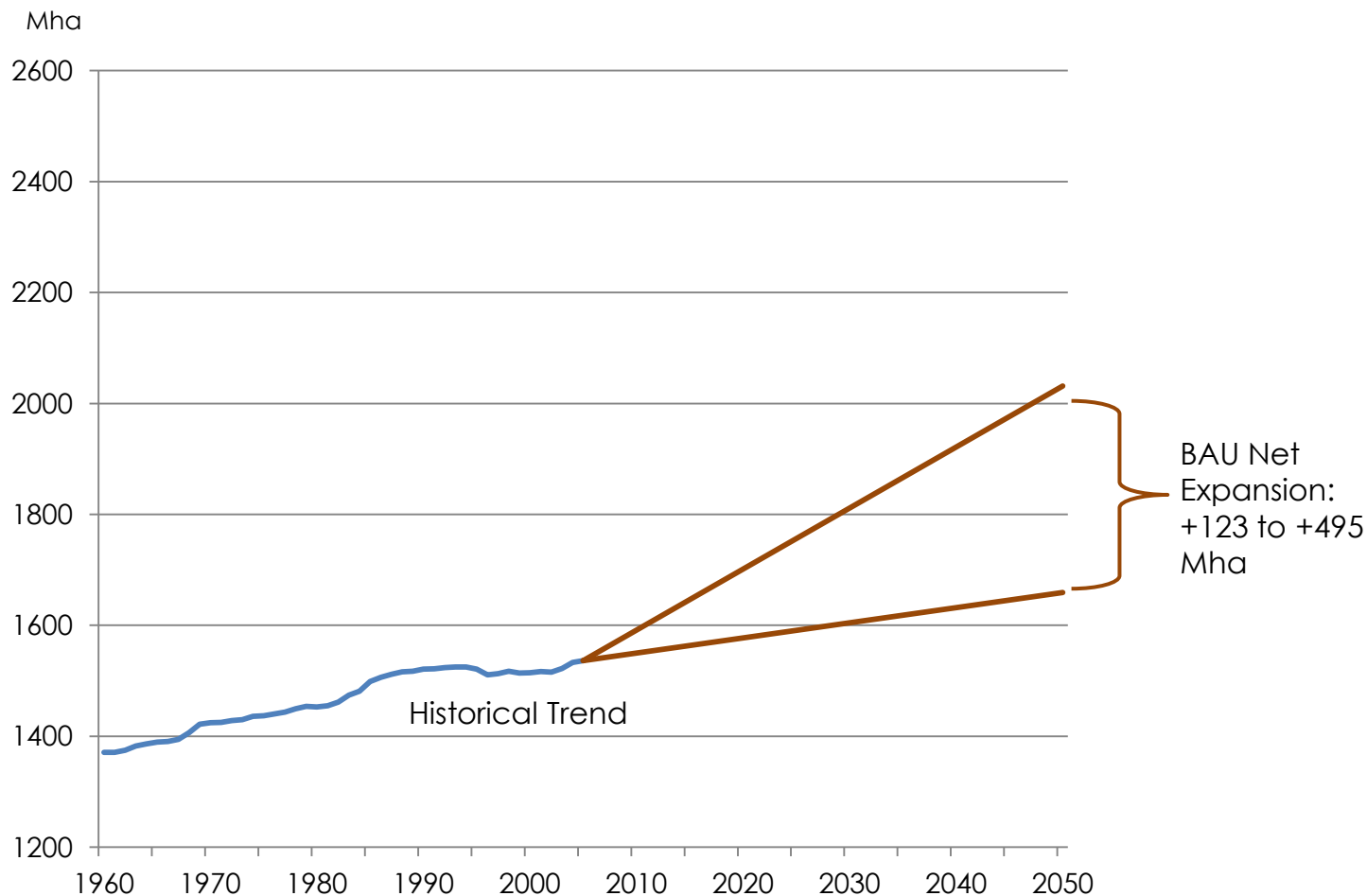
12% net
expansion
since 1960



Are we on the right track? Net expansion of global cropland

BAU net expansion of global cropland

+8 to 32% net expansion expected by 2050

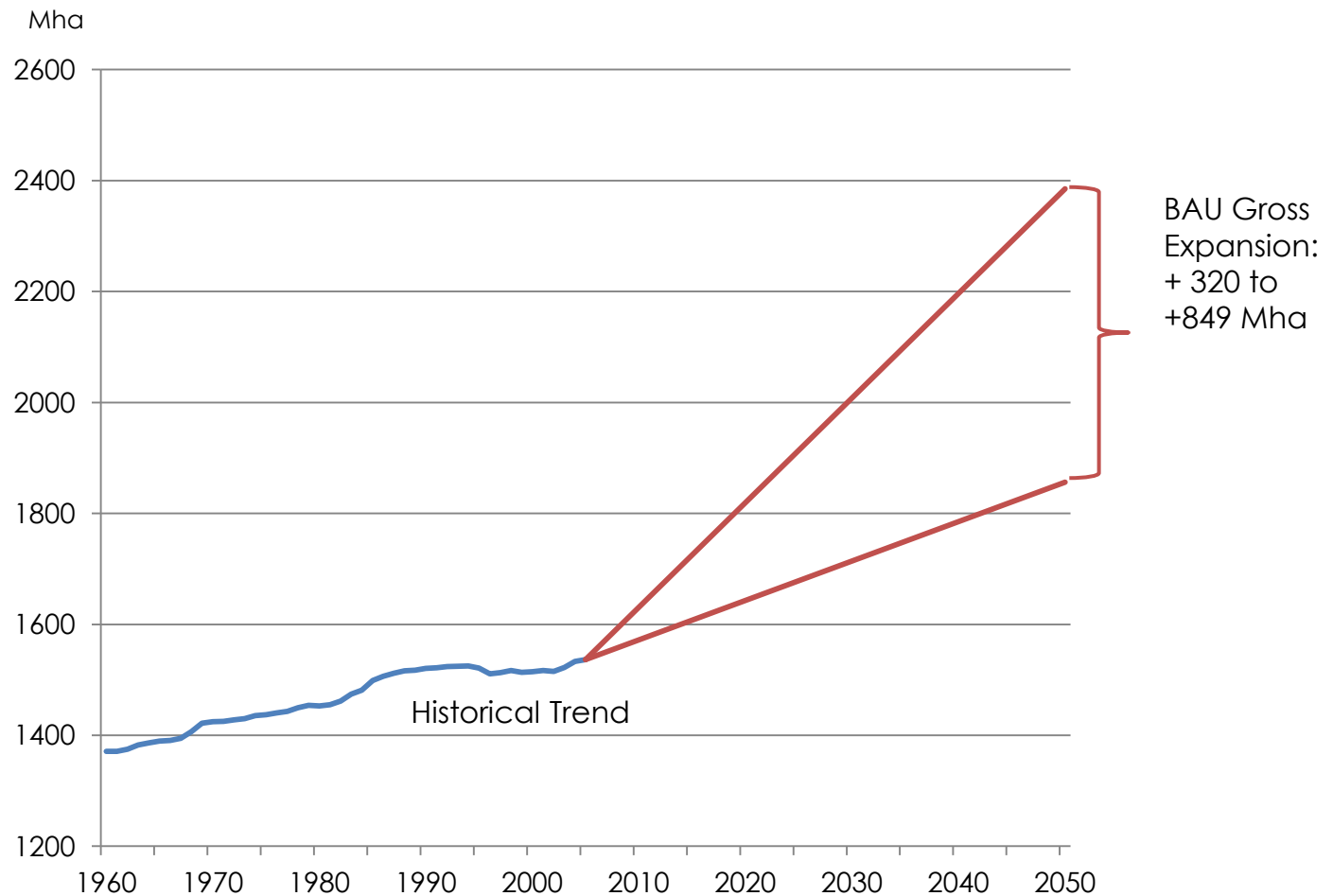


Are we on the right track?

Gross expansion of global cropland

BAU Gross expansion of global cropland

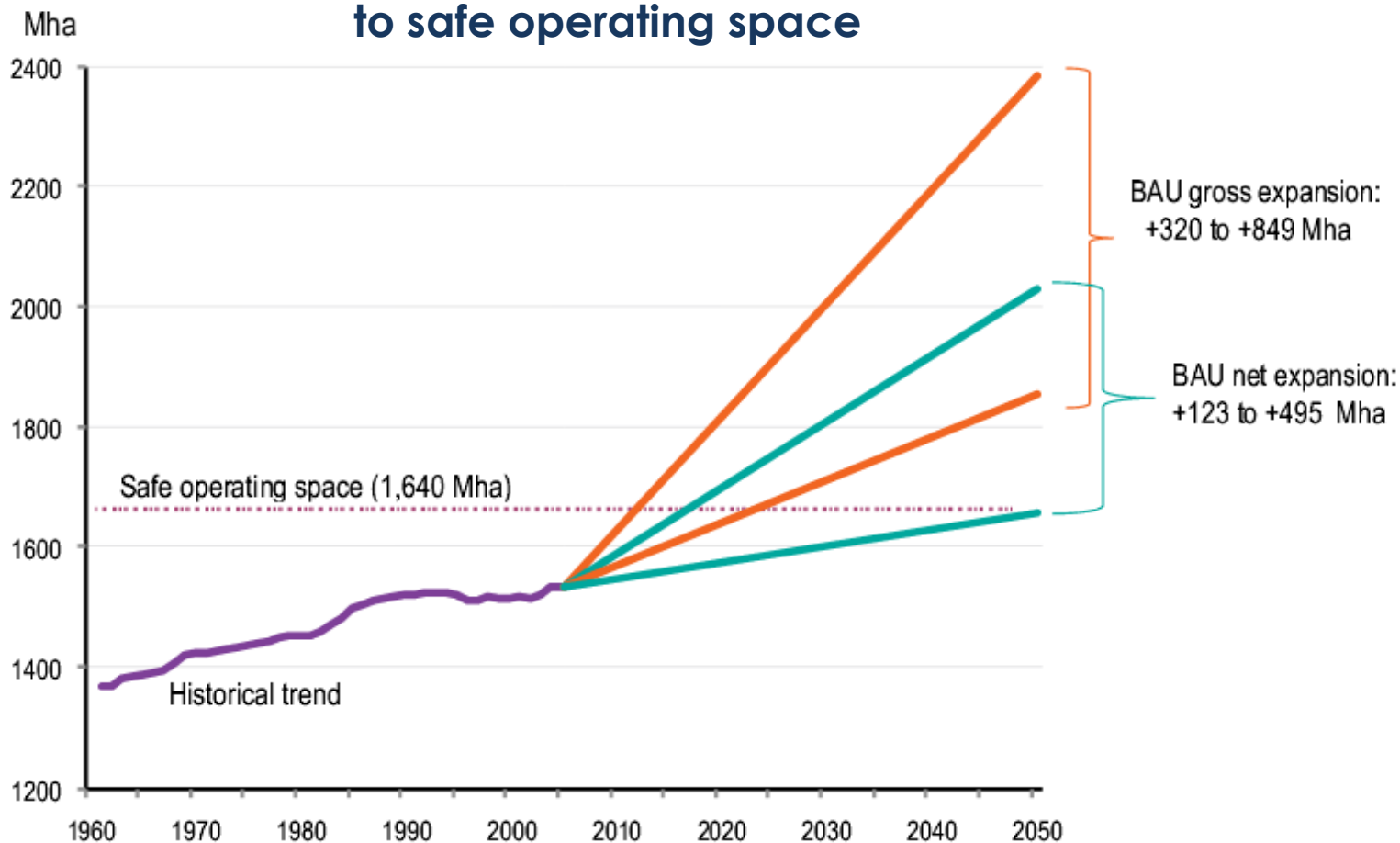
+21 to 55%
gross
expansion
expected by
2050



Are we on the right track? Safe operating space

BAU expansion of global cropland compared to safe operating space

Overshoot
of safe
operating
space



Interim conclusion

- The safe operating space concept provides a framework to derive sustainability targets for resource use
- Business-as-usual development will lead to an overshoot of the safe operating space for global cropland use

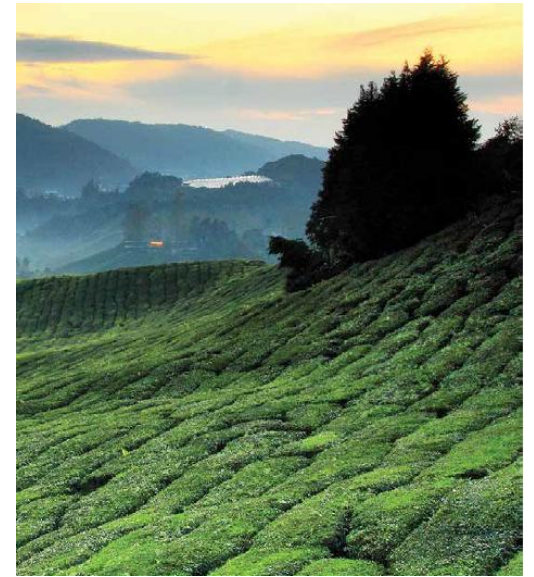
Ways forward

Two major complementary strategies should be pursued in parallel:

1. improve local management of each square meter, including decisions on its optimal use (land potential capacity)

and

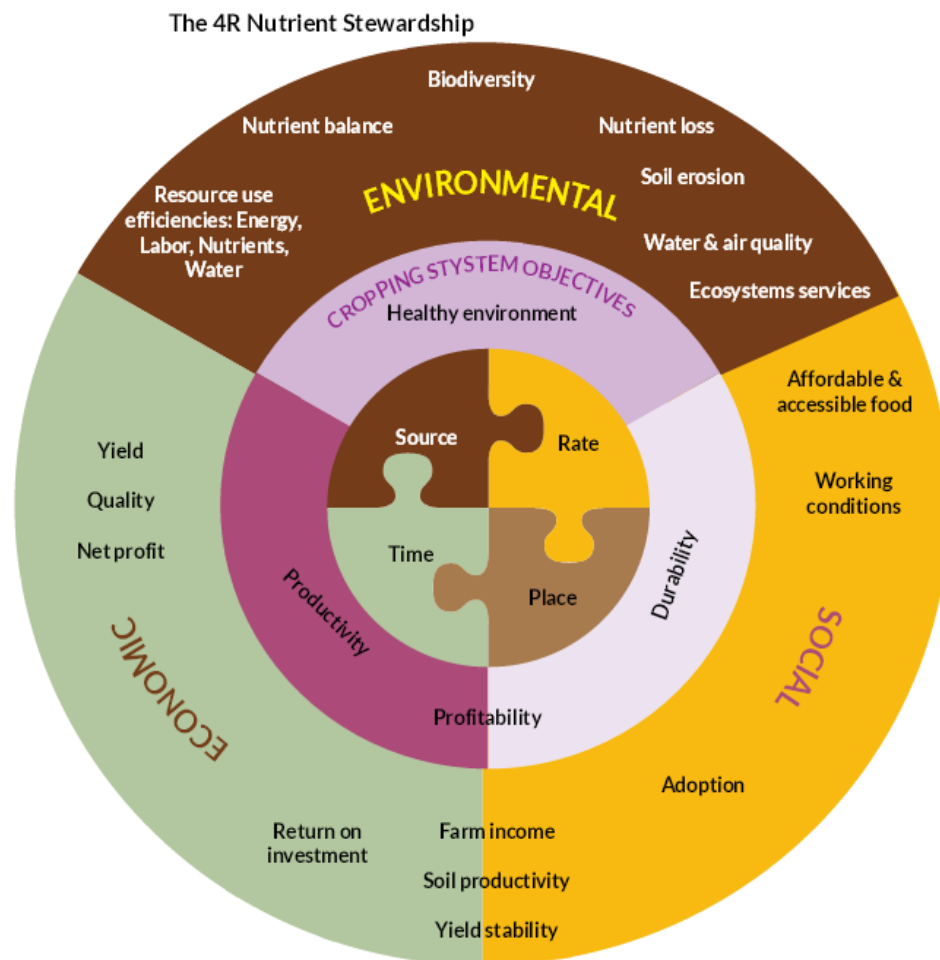
2. keep national production and consumption within the limits of a safe operating space (control the number of square meters used)



Improving agricultural production

Fertilizer use BMPs—applying the right nutrient source at the right rate, time, and place

- Improve agricultural production through application of best management practices (BMPs)
- Base BMPs on scientific principles that are universal, but adapt them to the local context
- Integrate scientific and local knowledge
- Large opportunity for improvement across all types of land management systems
- Involvement of farmers and other stakeholders in research and dissemination of BMPs is crucial



Steering economy-wide resource use Transition cycle

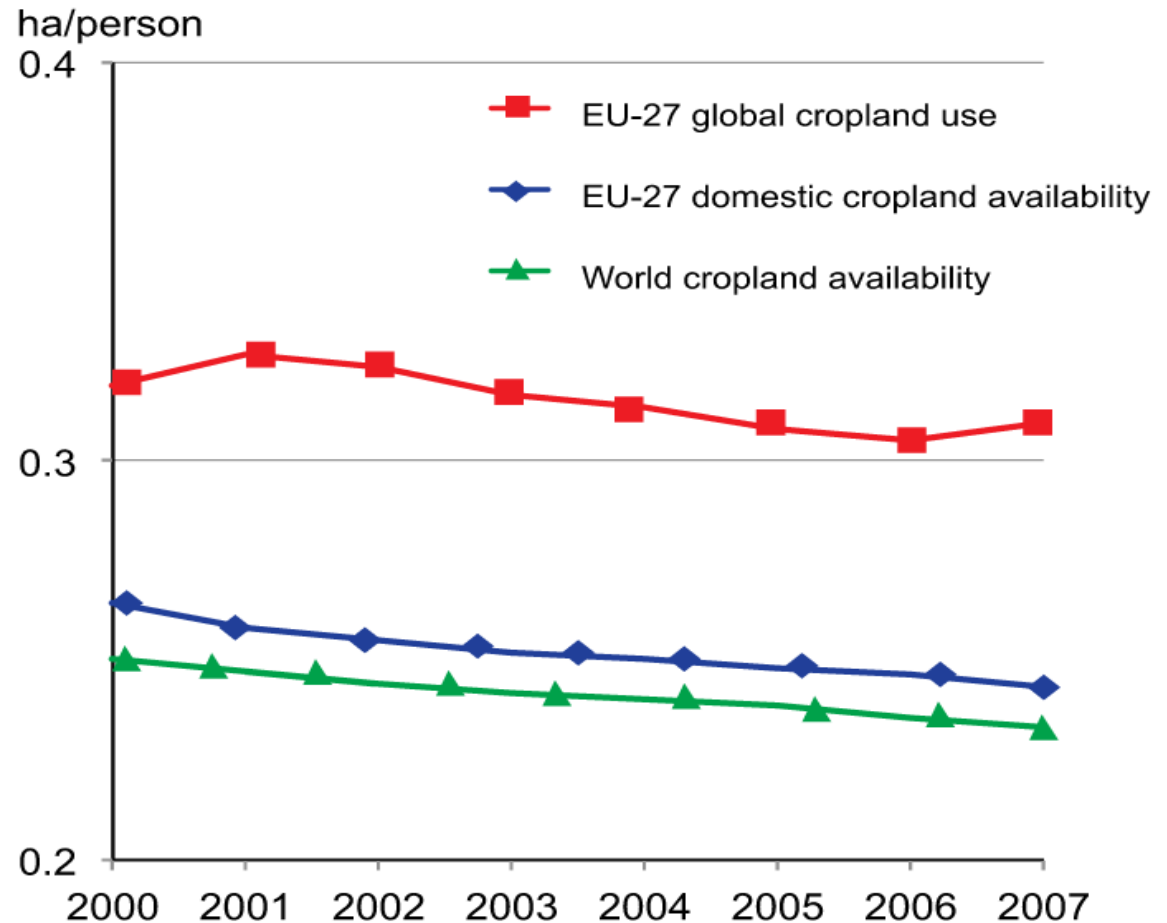
1. Monitor current performance
2. Set targets and define future objectives
3. Adjust existing and implement new strategies and policies to steer current performance towards future objectives
4. Learn from effectiveness and evaluation



Monitoring global land use

Use of global cropland by the EU-27 for the consumption of agricultural goods

- EU-27 used one-fourth more cropland than domestic cropland area in 2007
- EU-27 used one-third more cropland than the globally available per person cropland of the world population in 2007
- Until 2030, the EU would have to adjust its use of agricultural products so that one third less cropland would be required, if the 0.2 ha/person SOS reference shall be reached



Source: Bringezu et al. 2012

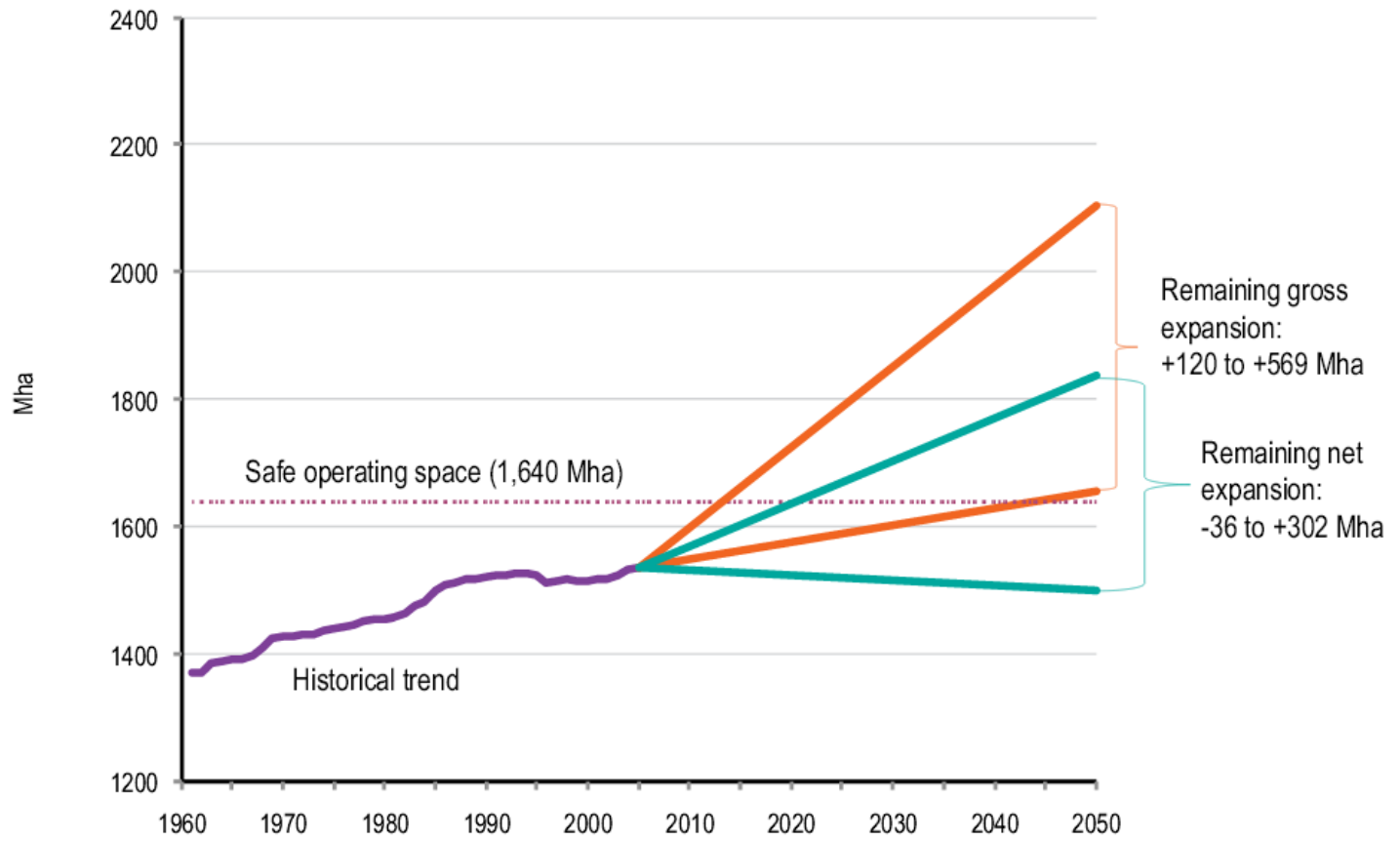
Steering consumption and improving land management Strategies

Strategies	Save
❖ Improve diet and reduce waste	96 to 135 Mha
❖ Halve biofuel targets	24 to 40 Mha
❖ Control biomaterials demand	Up to 57 Mha
❖ Improve land use planning (10% avoidance of building on fertile land)	11 to 13 Mha
❖ Invest in regenerating degraded soils (restore one-third of degraded and abandoned lands)	30 to 74 Mha

- A mix of strategies and measures to reduce overconsumption of food and non-food biomass products and to improve land management could save around 160 to 320 Mha by 2050.
- Cropland would still expand, but not as much.

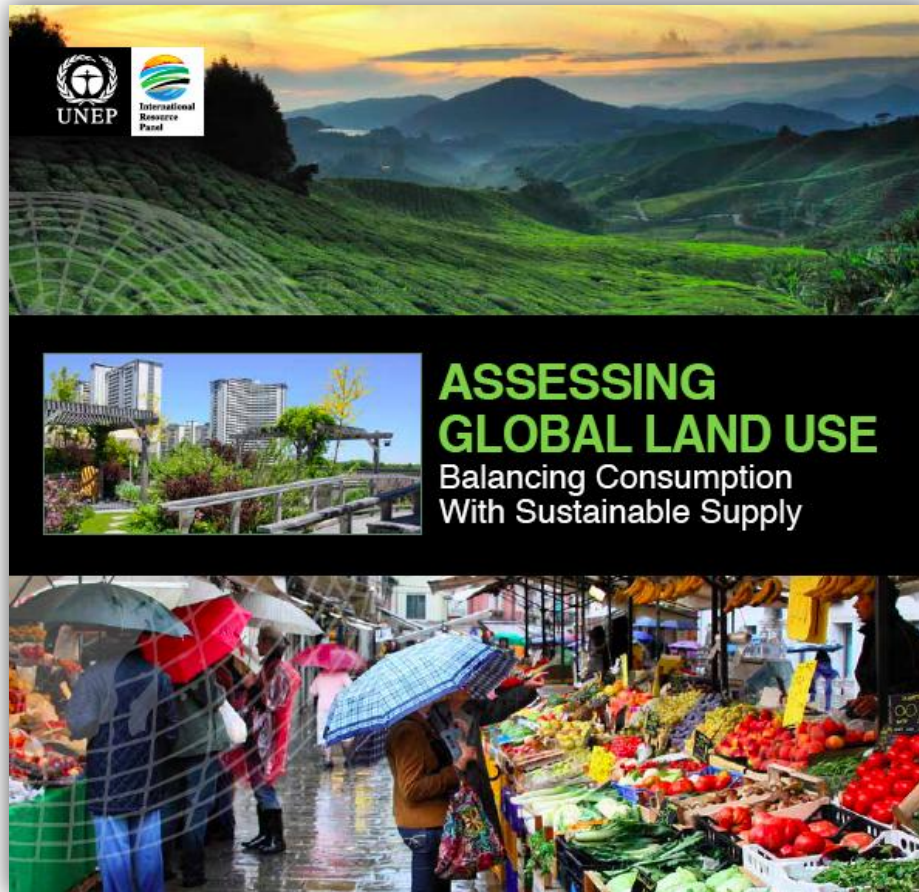
Steering consumption and land management Reaching targets

Expansion of global cropland with land saving measures compared to safe operating space



Main messages

- Growing demand for food and non-food biomass will lead to an expansion of global cropland (BAU). Product certification cannot control global expansion of cropland
- Changing consumption provides high untapped potentials compared to globally slowing increase of crop production (esp. high-consuming countries)
- Large areas with degraded soils need restoration and land use planning and there is a need to avoid building activities on fertile land
- A more efficient use of biomass and its substitutes is necessary and possible, esp. by reducing losses and food waste, shift to more vegetal diet (esp. in high-consuming countries), and fuel car fleets consuming less fuel
- Markets for food and fuels should rather be delinked (e.g. reducing biofuel quota)
- Countries should monitor and control their global land use for their domestic consumption



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