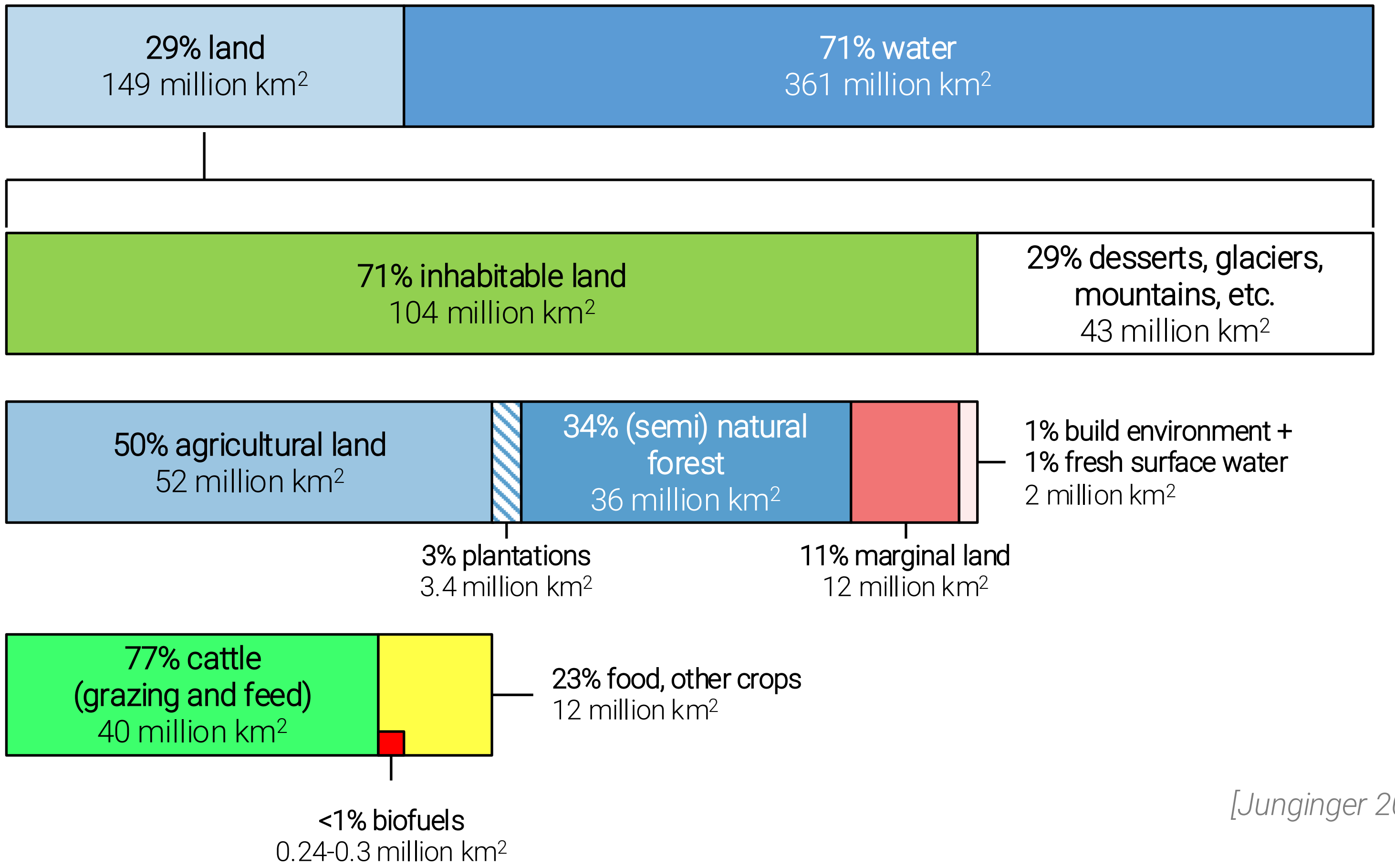
Land use for the supply of biofuels is (still) small

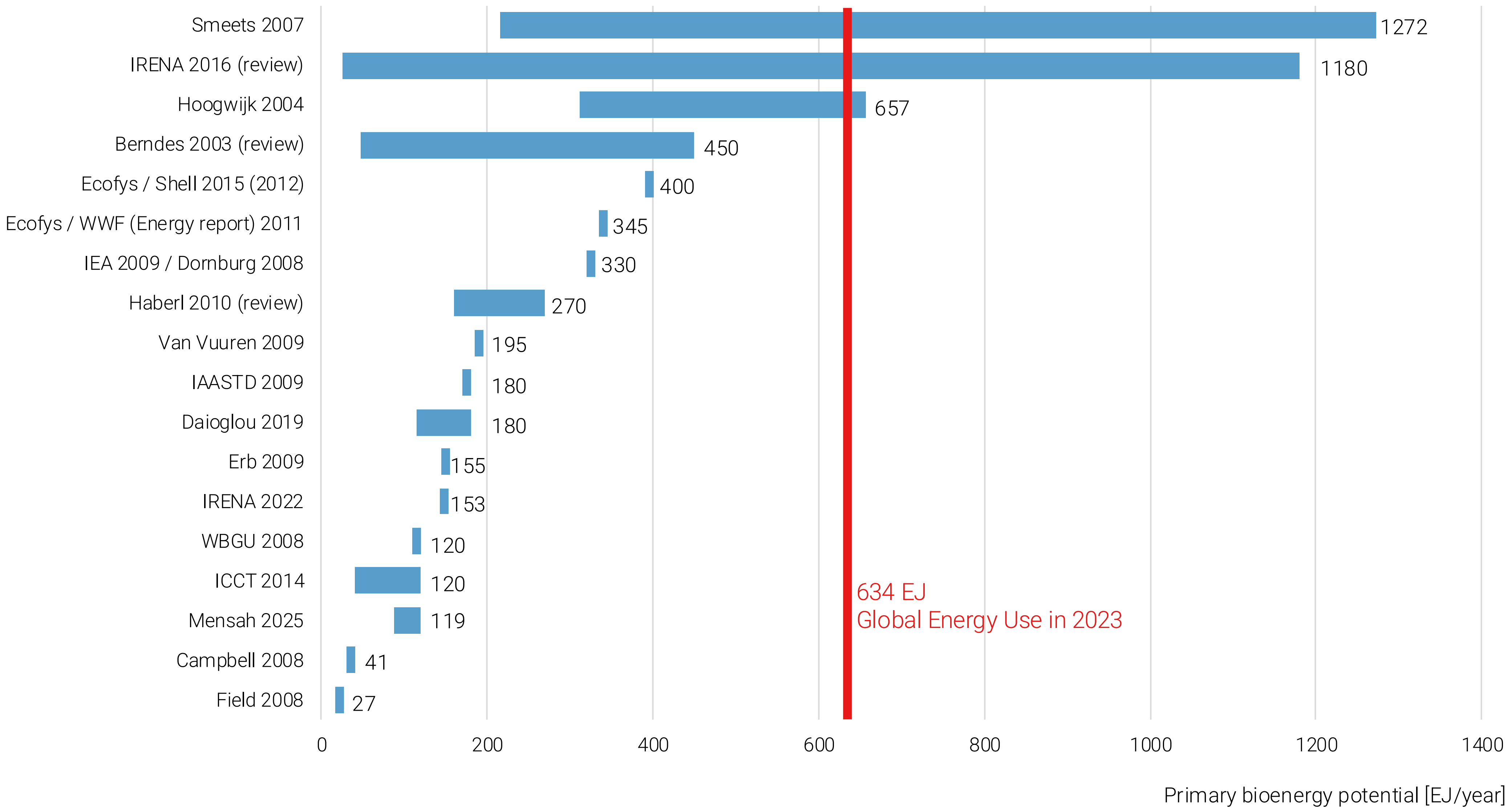


[Junginger 2017, towards a biobased economy]

Considerations

- Area for biofuels takes considers co-products (via energy allocation)
- Most crop land is only used during part of the year – more production is possible on same land by changing rotation
- Degraded and abandoned land provide more space for bioenergy (located in marginal land?)

Global bioenergy potential in 2050 is more than enough or not worth the effort?



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Understand why the range is so broad

Contribution of categories
- Based on IRENA 2016 (review of many studies)

Crops grown
- Non-food energy crops 0 – 700 EJ
  - High potentials include abandoned or degraded land
  - High potentials include high technological development
- Algae 0 – 50 EJ

Waste and residues
- Solid biogenic waste 9 – 27 EJ
- Forest residues 5 – 100 EJ
- Agricultural residues 10 – 300 EJ

Assumptions and uncertainties determine range
- Population growth
- GDP development
- “Management factor” (technological development)
- Recycling (of biomaterials)
- Supply chain efficiency
- Alternative and competing uses
- Nature conservation
- Diet
- Globalisation and trade
- Temperature and rainfall

Can underlying data be used to better understand potential at plot level?

Example models

IMAGE/ TIMER (PBL Netherlands)

- Integrated assessment
- Interactions between land-use, agricultural, energy, and climate systems, to calculate a range of impacts
- Model set-up is mainly mechanistic and causal

GLOBIOM (IIASA Austria)

- Partial equilibrium model
- Global agri-food market by prices and market clearing
- Detailed inclusion of land allocation
- To understand effects of policy interventions on agri-food supply and environmental sustainability, notably ILUC

GTAP-BIO (Purdue University US)

- Computable general equilibrium (CGE) model
- Evaluation of abatement policies via international trade and sectoral interaction, also ILUC

Data in general

- GIS data for almost anything
- Current + historic: from statistics, remote sensing, or both
- Future: from modeling

Example data

- Land status: cropland, degraded land, salination
- Demarcation of nature and protection areas
- Irrigated areas
- Biophysical suitability, potential yield
- Temperature, rainfall, sunshine
- Accessibility (infrastructure connection)
- Population

Data granularity differs per dataset

- Country level or NUTS 1, 2, 3
- Square pixels, down to e.g. 100 x 100 m
- Angular cells, down to e.g. 30 arcseconds (1 km at equator)

Plot specific analysis on basis of underlying maps

- GRAS (ISCC) : Risk assessment on plot level

How ~~much~~ can we achieve?

Range of results lead to disputes

- Policy makers ask: how much can bioenergy contribute?
- Policy makers and scientists argue over the outcomes and the assumptions
- Low and high end promotors do not understand each other – sometimes do not speak
- Low end promotors find the opposite too optimistic and unsustainable
- High end promotors find the opposite only include what is left after other sectors fulfilled their demand
- Policy makers are confused, and think (1) the reality may be in the middle, (2) bioenergy is risky

Consequence

- Lack of action

Bold view

- The low is what you get if you don't act
- The high shows what is possible if you act
- The low is accepting failures in the agro food system – you may call this "realistic" – I prefer "defeatist"
- The high is not accepting those failures – you may call this "idealistic" – I prefer "programatic"

Consequence

- The high potential is not a carte blanche
- The assumptions are more interesting than the outcome
- They teach you about what is needed to improve the achieve higher productivity

- Studies should be used to understand: "how can we achieve", rather than "how much can we achieve"

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