Strategic Perspectives on Biofuels

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Global Sustainable Bioenergy

The two biggest energy supply challenges to get to a low-carbon world

Second half of low-carbon electricity – in light of intermittency of other renewables

Second half of low-carbon transport – in light of unsuitability of electricity, H2 for long-distance transport

Bioenergy is widely thought to be needed in order to address <u>both</u>

Average biomass primary energy supply contribution, 5 prominent global low-carbon energy scenarios for 2050: **25%** (Dale et al., 2014)

Fraction of global transport energy from biofuels, IEA 2DS for 2075: **~ Half** (Fulton et al., BioFPr, 2015)

The world is not advancing bioenergy in a manner consistent with this need.

We are acting as if bioenergy is discretionary when it is likely obligatory.

The risks of inaction are greater than the risks of action in the bioenergy domain today.

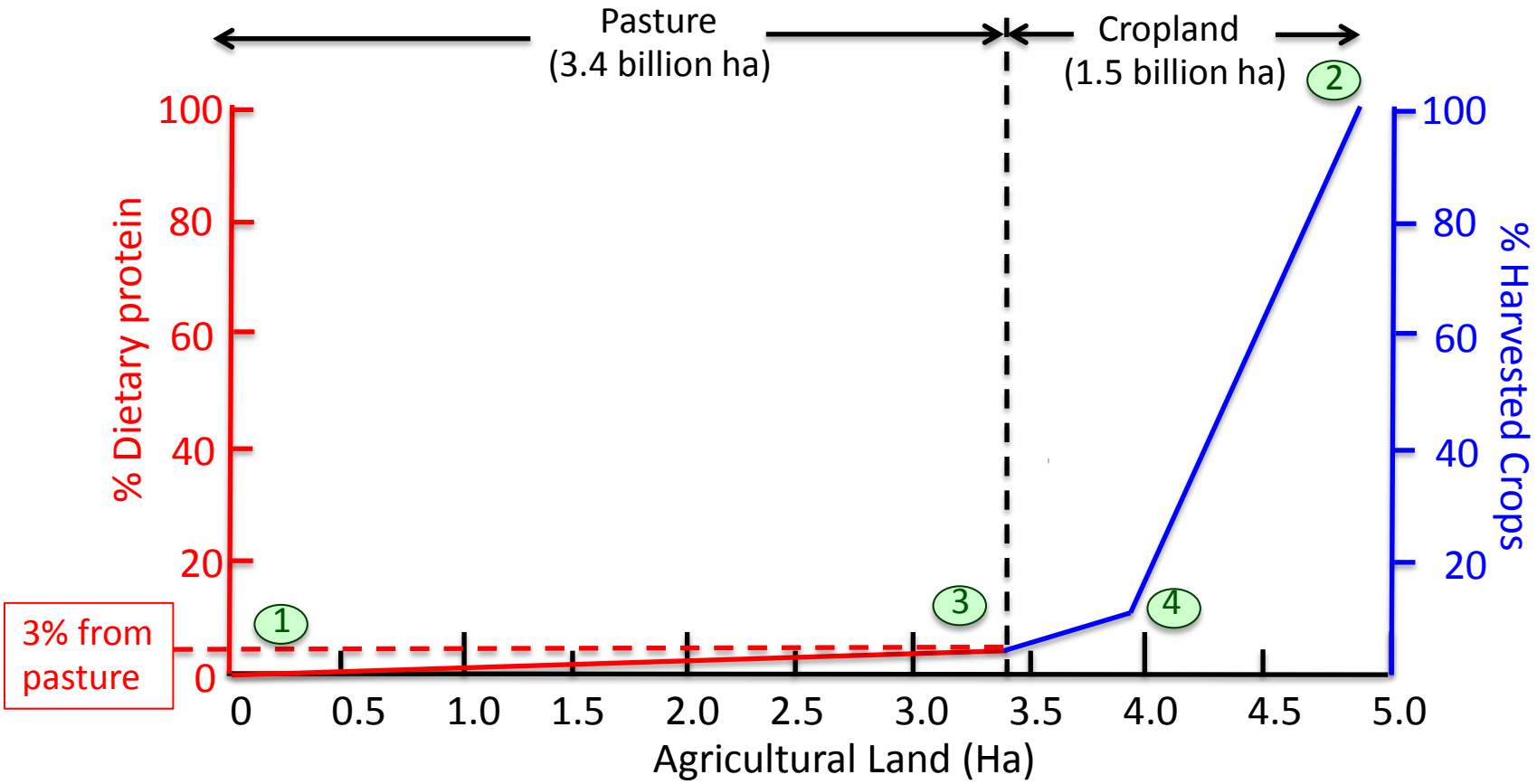
Bioenergy critique in nutshell

Humans manage land for either food or nature

The land we manage for food production is at close to capacity

\ If we devote land to biofuels nature and or food production will suffer

Global food supply (needs to be further refined for publication, but very likely right)



Four points on this curve

1. 0,0
2. 100% at about 4.9 billion ha
3. 2.7% of dietary protein from pasture
4. 86% of food & feed production from 58% of cropland (West et al. Science, 2014)

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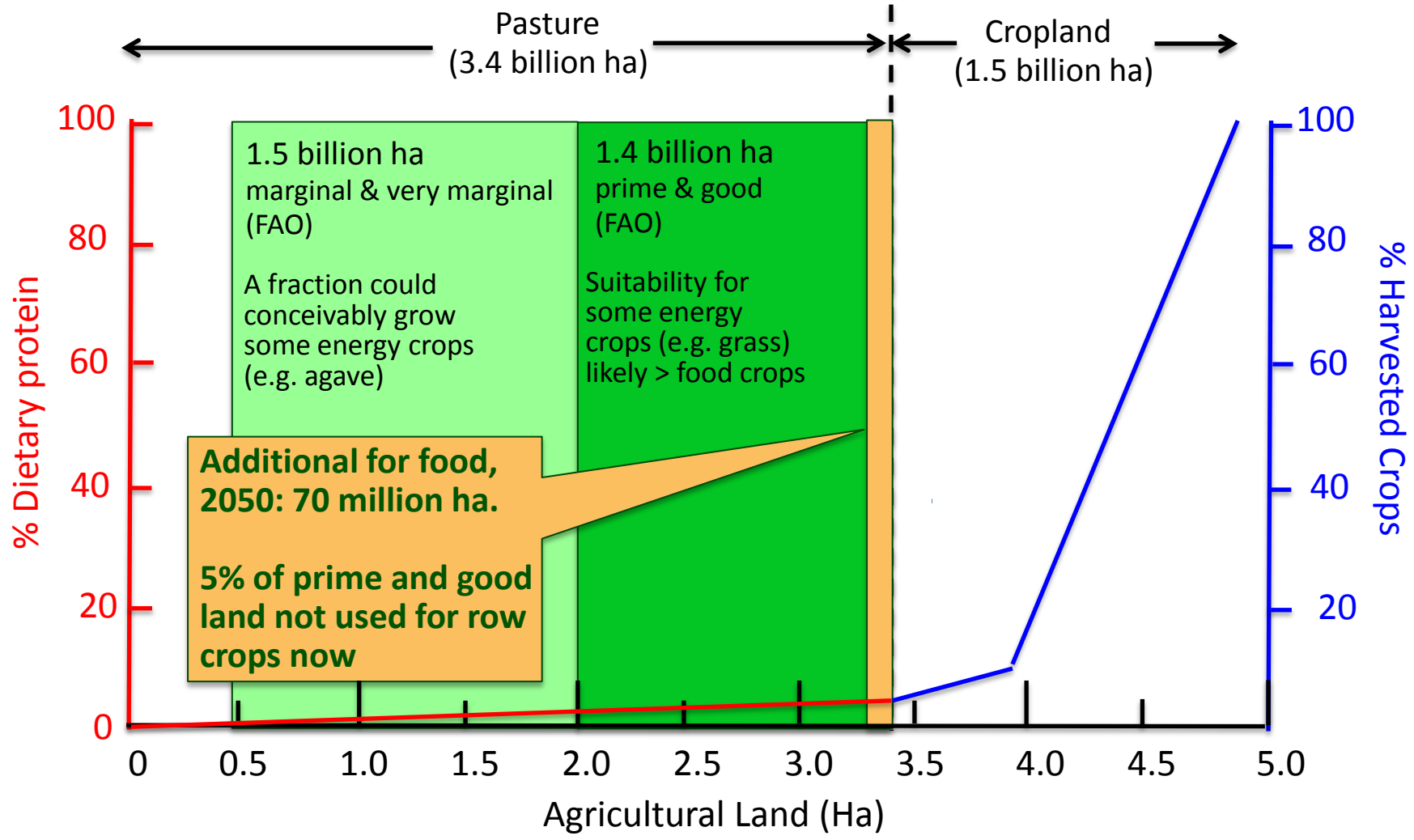
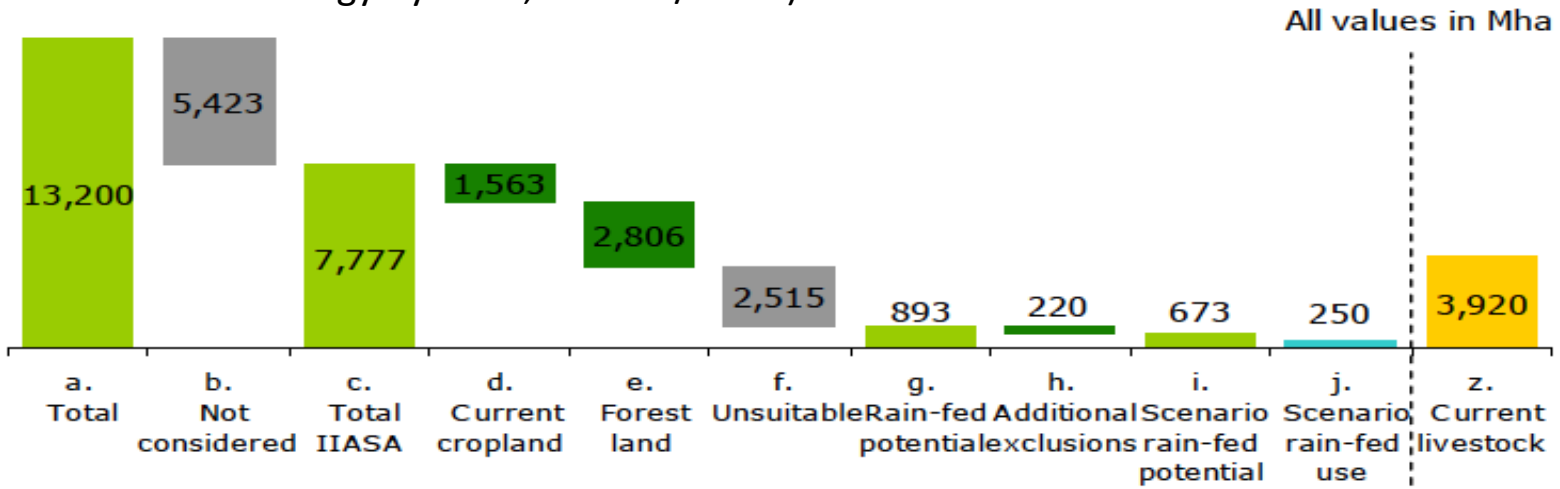


Humans manage land for food or nature? Actually land that makes a minor contribution to global food production but is not managed primarily for nature > 2x land important for food.

Land we manage for food production is at near capacity? Actually potential additional cropland ~= that we use now, little more believed needed for food, pastures far below capacity.

Results of the Energy Scenario Assessment of Land Potential of Rainfed Cultivation of Energy Crops.
(100% Renewable Energy by 2050, ECOFYS/WWF)



a. Total global land mass (excluding Antarctica)
b. Excluded: protected land, barren land, urban areas, water bodies
c. Total land considered in the IIASA study
d. Excluded: current agricultural cropland
e. Excluded: unprotected forested land
f. Excluded: not suitable for rain-fed agriculture
g. Potential for rain-fed agriculture
h. Excluded: additional land for biodiversity protection, human development, food demand
i. Energy Scenario potential for energy crops
j. Energy Scenario: land use for energy crops
z. Current land used to support livestock (for reference only; overlaps with other categories)

Figure 5 - 5 Results of the Energy Scenario assessment of land potential for rain-fed cultivation of energy crops.

Bioenergy in Relation to Metrics and Causes of Food Insecurity

When food insecurity is viewed in terms of ***metrics*** – availability, access, utilization, stability – the impact of bioenergy may appear obscure

Consider instead the **causes** of food insecurity*

Poverty
- Rural unemployment
- Lack of marketable skills
- Low currency value
- High food prices

Poverty and food insecurity: More one problem than two
- ***All wealthy people have access to food***
- ***All involuntarily hungry people are poor***

Poorly developed infrastructure
(Physical, market, knowhow)

Local production undermined by foreign subsidies

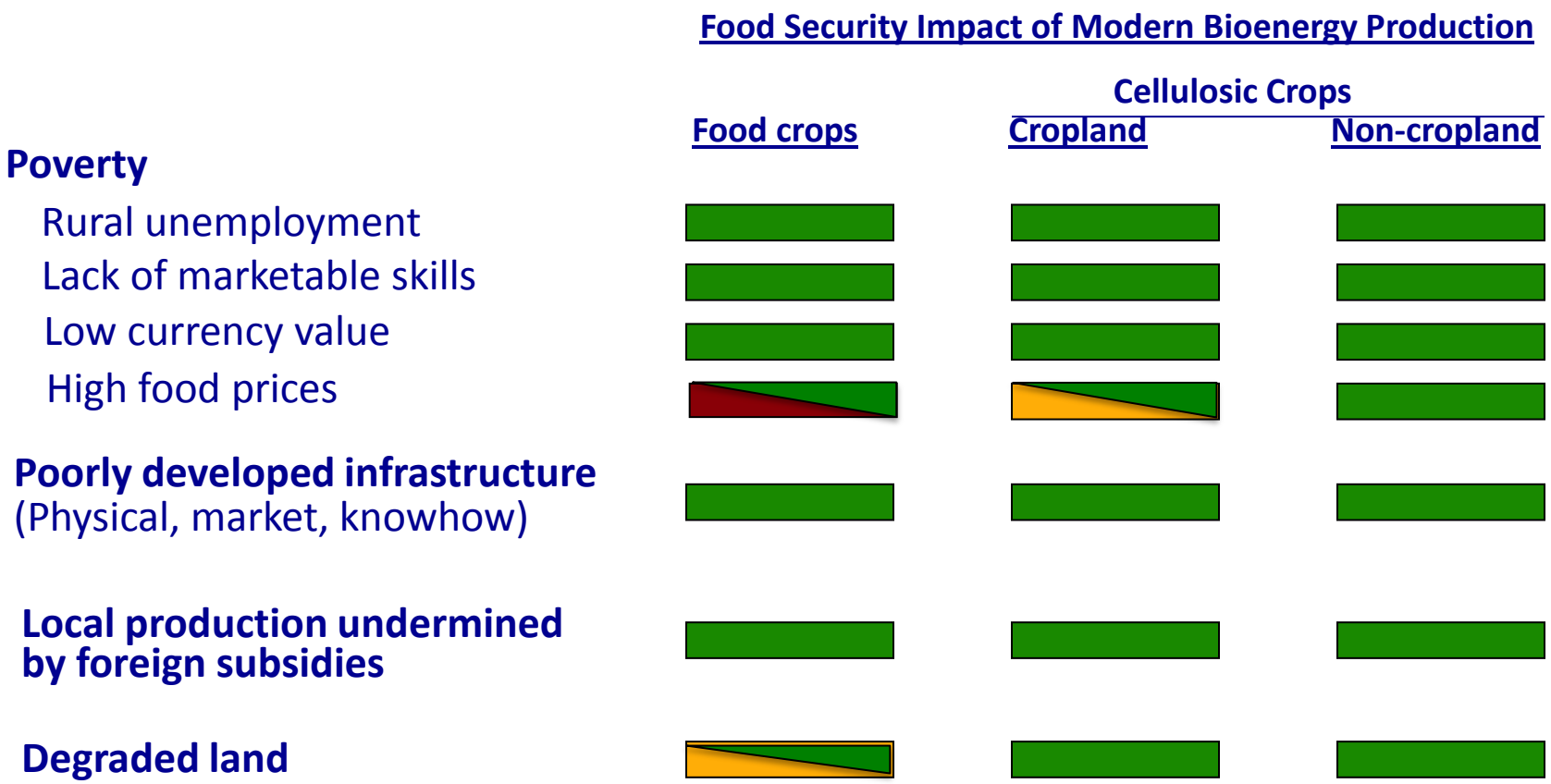
Degraded land

Bioenergy critics assume that the main factor limiting food security is the lack of land when fact it is the lack of economic development – particularly in Africa. (Lynd and Woods, Nature, 2011).

* Thurow, R, S. Kilman. Enough: Why the World's Poor Starve in an Age of Plenty. 2009.

Bioenergy in Relation to Metrics and Causes of Food Insecurity

Most of the impacts of bioenergy on the causes of food insecurity are positive



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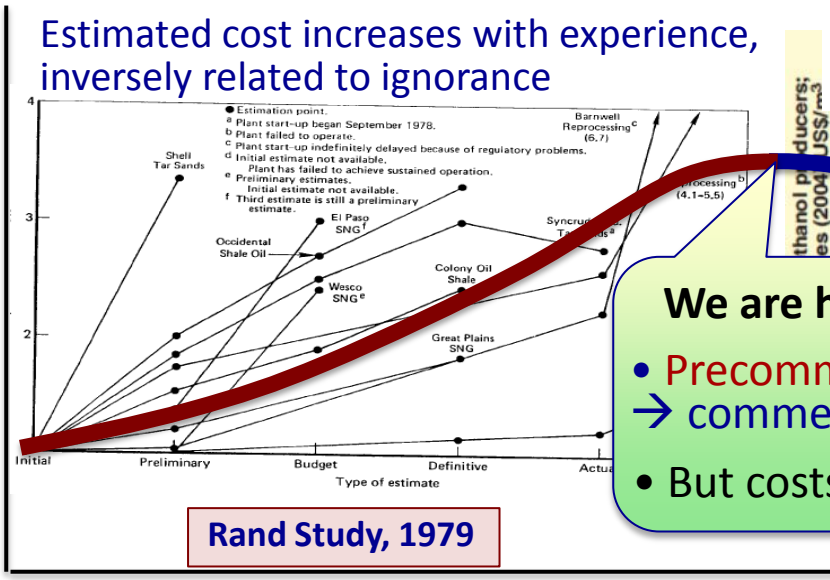
Cellulosic biofuels: Strategically important for achieving environmental objectives

As we seek to rapidly navigate the "new technology activation energy"

Rand Curve

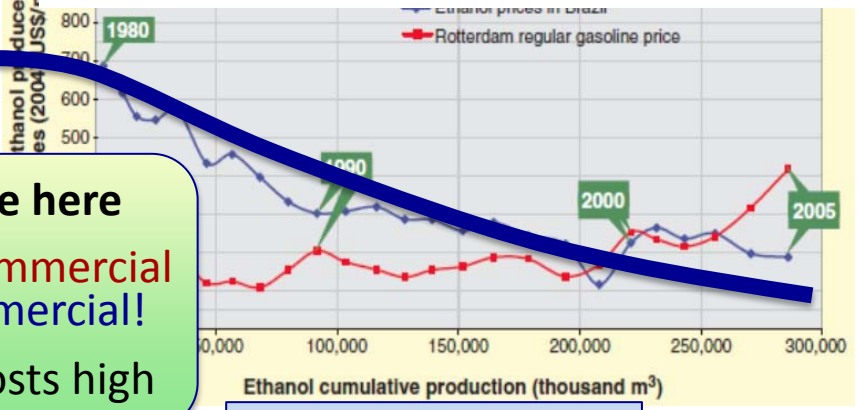
Estimated cost increases with experience, inversely related to ignorance



Rand Study, 1979

Brazil 1st Gen Ethanol Curve

Actual cost decreases with experience & innovation



Goldemberg *et al.*, 2004

We are here

- Precommercial → commercial!
- But costs high

Progress/Experience

…looking beyond cellulosic ethanol is counter productive.