



The challenge of Food Security in 2050: can we do it sustainably?

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@timgbenton



Today, food ...

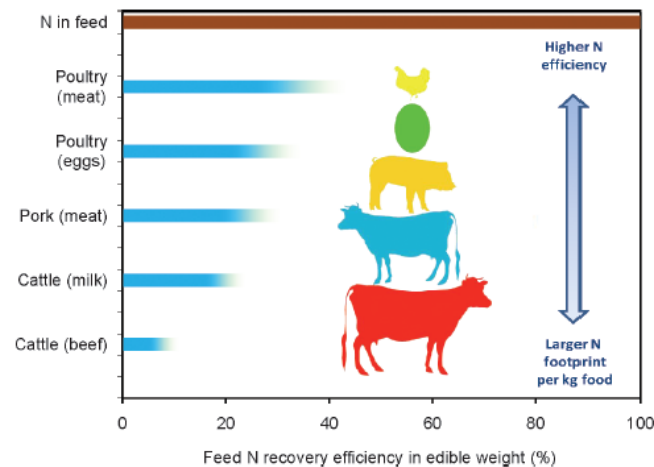
- Is the world's biggest industry
- Is the world's largest land user
- Is the world's largest water user
- Is the world's largest polluter and undermines essential environmental systems
- Contributes to more ill-health than any other factor
- We need it, daily
- ...but increasingly there isn't enough of it



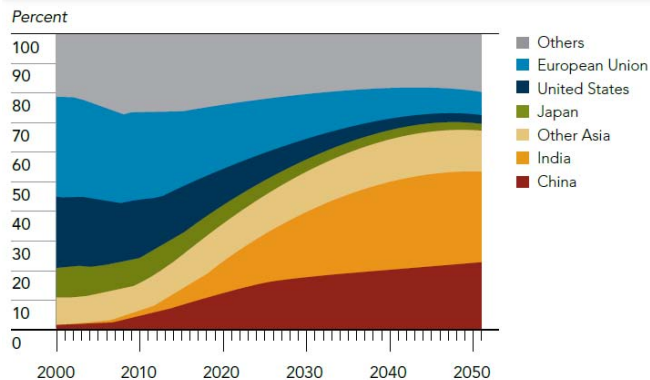


Growth in global food demand

Animal protein expensive in resources to produce: *source ENA*



SHARES OF GLOBAL MIDDLE-CLASS CONSUMPTION, 2000-2050



source: OECD.

2000: 60% middle class
“western” vs 20% “eastern”
2050: 12% vs 68%

- 35% more mouths by 2050
 - Mainly in Asia, Africa and S. Am
- Richer people eat more:
 - ~5bn people in middle class by 2030 (cf 1.8bn now), with associated higher consumption (meat, dairy and total volumes)
 - Mainly in Asia
- 70% urbanised
 - Understanding of food systems
- All add up to projected increased global food demand (FAO estimate 60% more)





WHAT IS FOOD SECURITY AND WHY IS IT GLOBALLY IMPORTANT?



Global food security...



... occurs when everyone has access to safe, affordable and nutritious food, all of the time and in ways the planet can sustain into the future



UK's Global Food Security programme partners





Food crisis in Africa

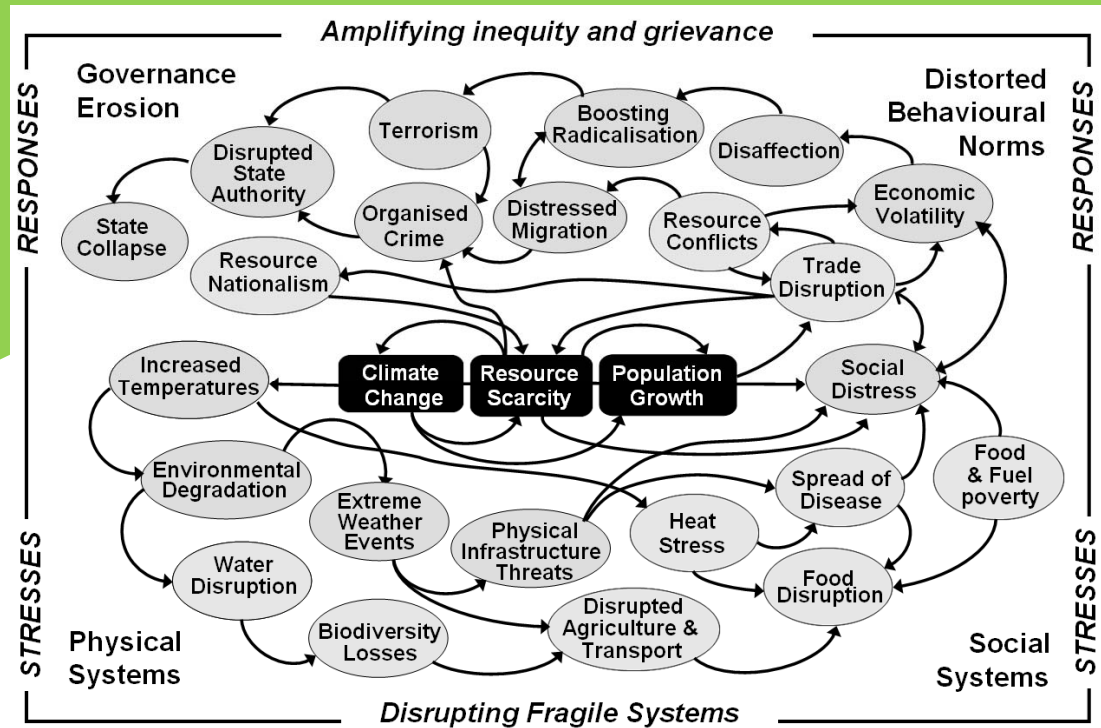
The worst drought in 60 years has caused a severe food crisis in parts of Ethiopia, Somalia and elsewhere in East Africa.



Global
Food Security



Sustainable, healthy food for all



Scottish Government 2009

It is well for us to recollect....the only barrier between us and anarchy is the last nine meals we've had. It may be taken as axiomatic that a starving man is never a good citizen.

AH Lewis 1896





This is a global matter that affects us all...

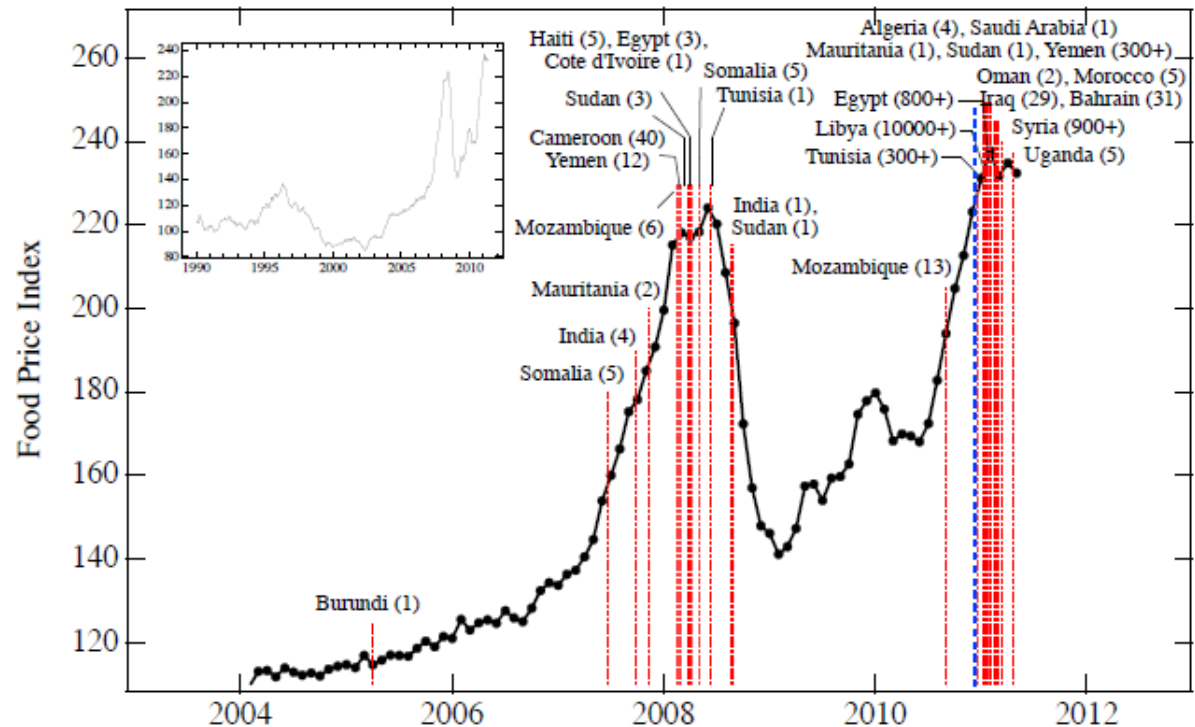


FIG. 1: Time dependence of FAO Food Price Index from January 2004 to May 2011. Red dashed vertical lines correspond to beginning dates of “food riots” and protests associated with the major recent unrest in North Africa and the Middle East. The overall death toll is reported in parentheses [26–55]. Blue vertical line indicates the date, December 13, 2010, on which we submitted a report to the U.S. government, warning of the link between food prices, social unrest and political instability [56]. Inset shows FAO Food Price Index from 1990 to 2011.

The Food Crises and Political Instability
in North Africa and the Middle East

Marco Lagi, Karla Z. Bertrand and Yaneer Bar-Yam
New England Complex Systems Institute

238 Main St., Suite 319, Cambridge, MA 02142, USA

(Dated: August 10, 2011)



Demand sustainability, attainability and equity

If all of humanity lived like an average resident of Indonesia, only two-thirds of the planet's biocapacity would be used; if everyone lived like an average Argentinean, humanity would demand more than half an additional planet; and if everyone lived like an average resident of the USA, a total of four Earths would be required to regenerate humanity's annual demand on nature.

WWF ecological footprint index
From Living Planet Report 2012

Germany: The Melander family – 4 mouths \$500.07 per week

2005



Chad: The Aboubakar family - 6 mouths \$1.23 per week





Equity, movement and social disruption



Burying bodies of migrants in Niger, Oct 2013

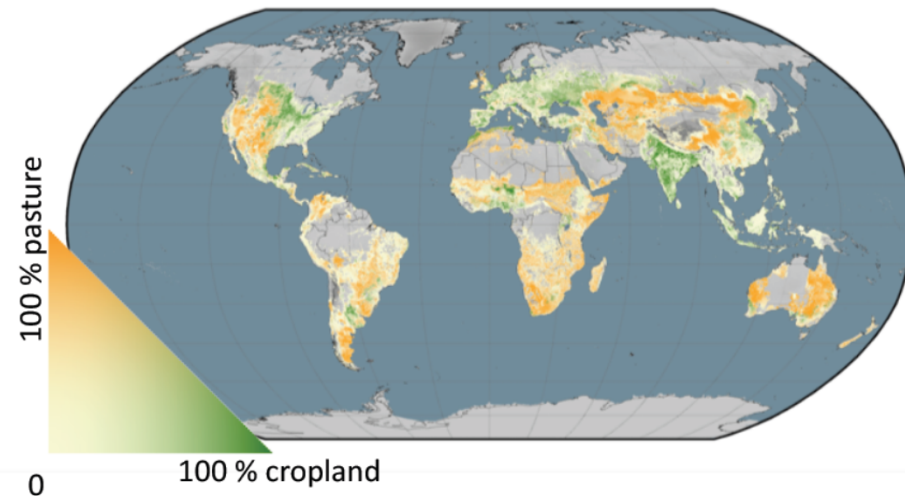


CONSTRAINTS ON GROWING MORE



Competition for natural capital

- Increasing global competition for land and water



Foley et al (2011) , Nature

Figure S1. Extent of Global Agricultural Lands. This map illustrates the global extent of croplands (green) and pastures (brown), as estimated from satellite- and census-based data by Ramankutty *et al.*¹. According to U.N. FAO statistics, croplands currently extend over 1.53 billion hectares (~12% of the Earth's land surface, not counting Greenland and Antarctica), while pastures cover another 3.38 billion hectares (~26% of global land). Altogether, agriculture occupies ~38% of the Earth's terrestrial surface, emerging as the largest use, by far, of land on the planet^{1,2}.



Other resource and regulatory constraints on production growth

Cost-benefit analysis highlights that the environmental costs of all N losses in Europe (estimated at €70–€320 billion per year at current rates) outweighs the direct economic benefits of N in agriculture. (European Nitrogen Assessment 2010)

■ *The planting of oil palm within 100 meters of the river was witnessed at Sungai Sampit (S 02°35'19.7" – E 112°32'54.5")*

Conflict or consent? The oil palm sector at a crossroads

- Nitrogen, phosphates
- Fuel
- Pesticides
- soil



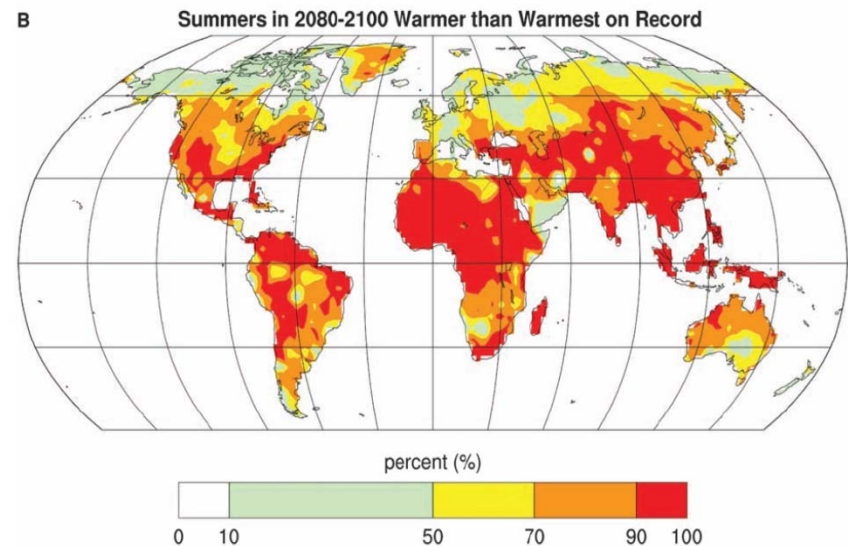
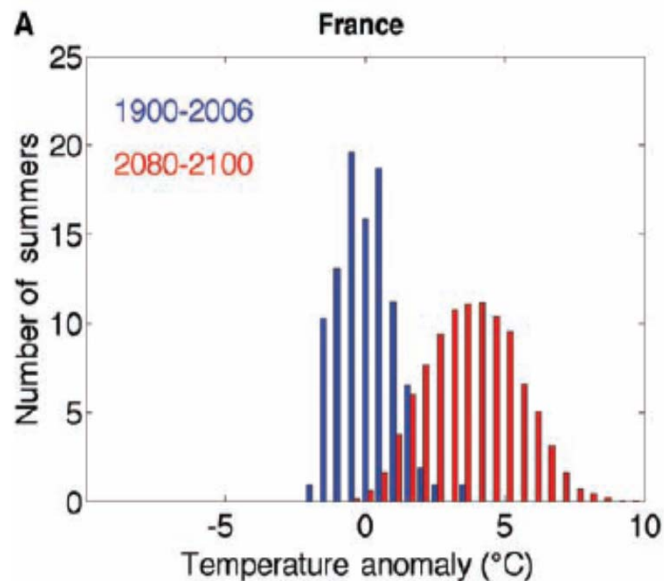


Changing climates

Global
Food Security



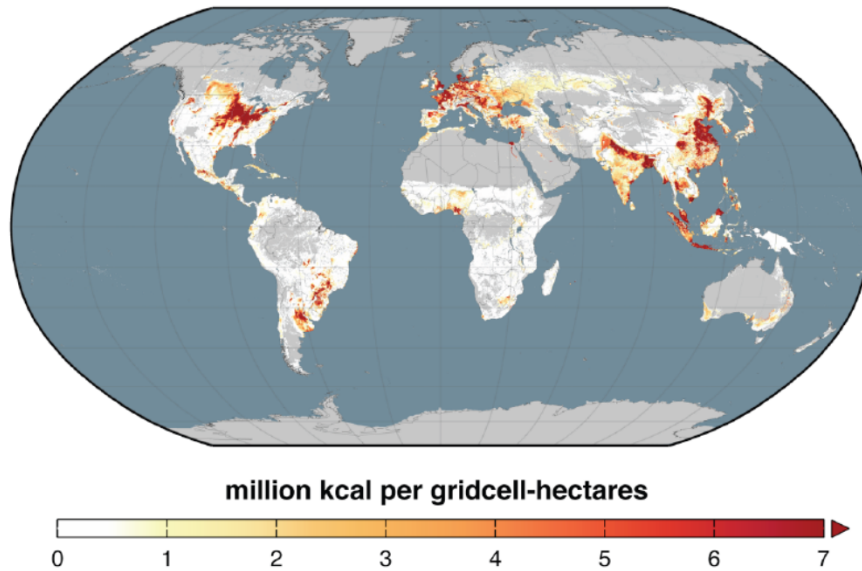
“...in France and northern Italy, where over 70,000 people perished from heat-related causes..... Italy experienced a record drop in maize yields of 36% from a year earlier, whereas in France maize and fodder production fell by 30%, fruit harvests declined by 25%, and wheat harvests (which had nearly reached maturity by the time the heat set in) declined by 21%”



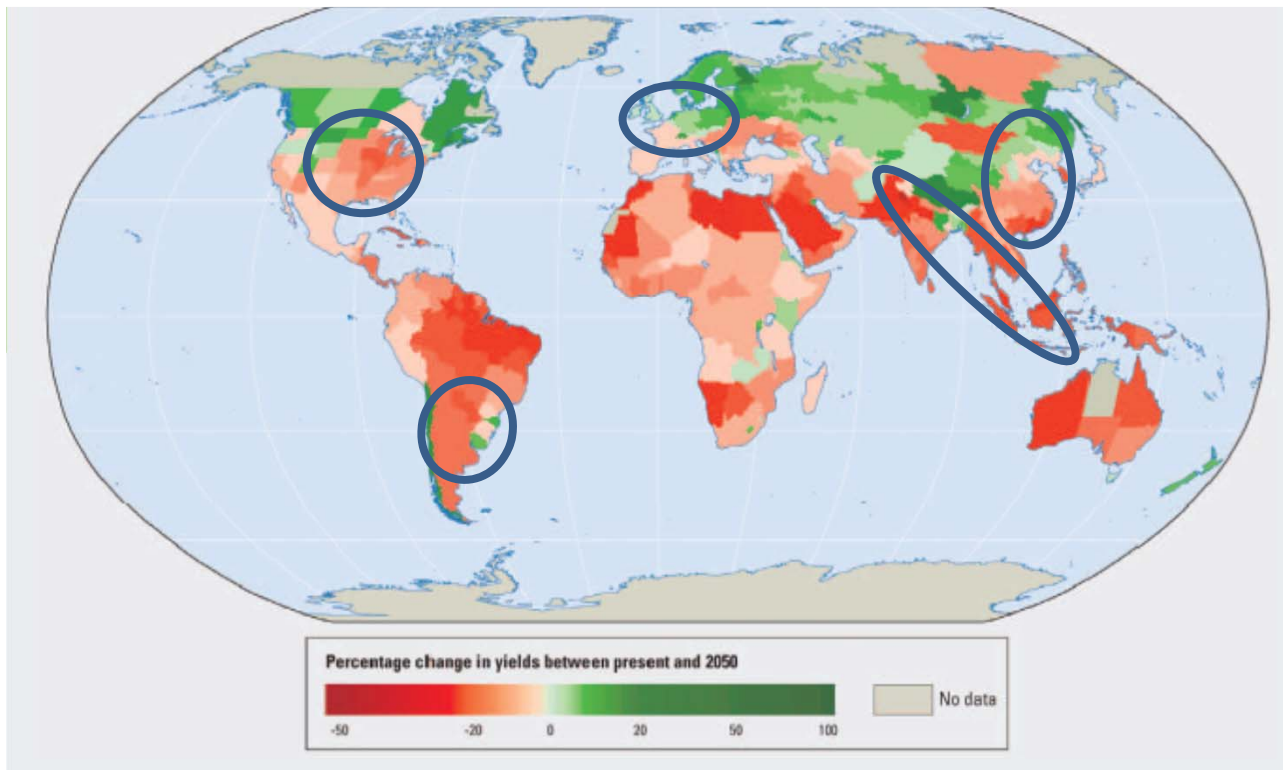
Battisti 2009 Science

Fig 37a

Intrinsic Calorie Production



Foley et al 2011



From Wheeler & Von
Braun (2013) after
World Bank (2010)

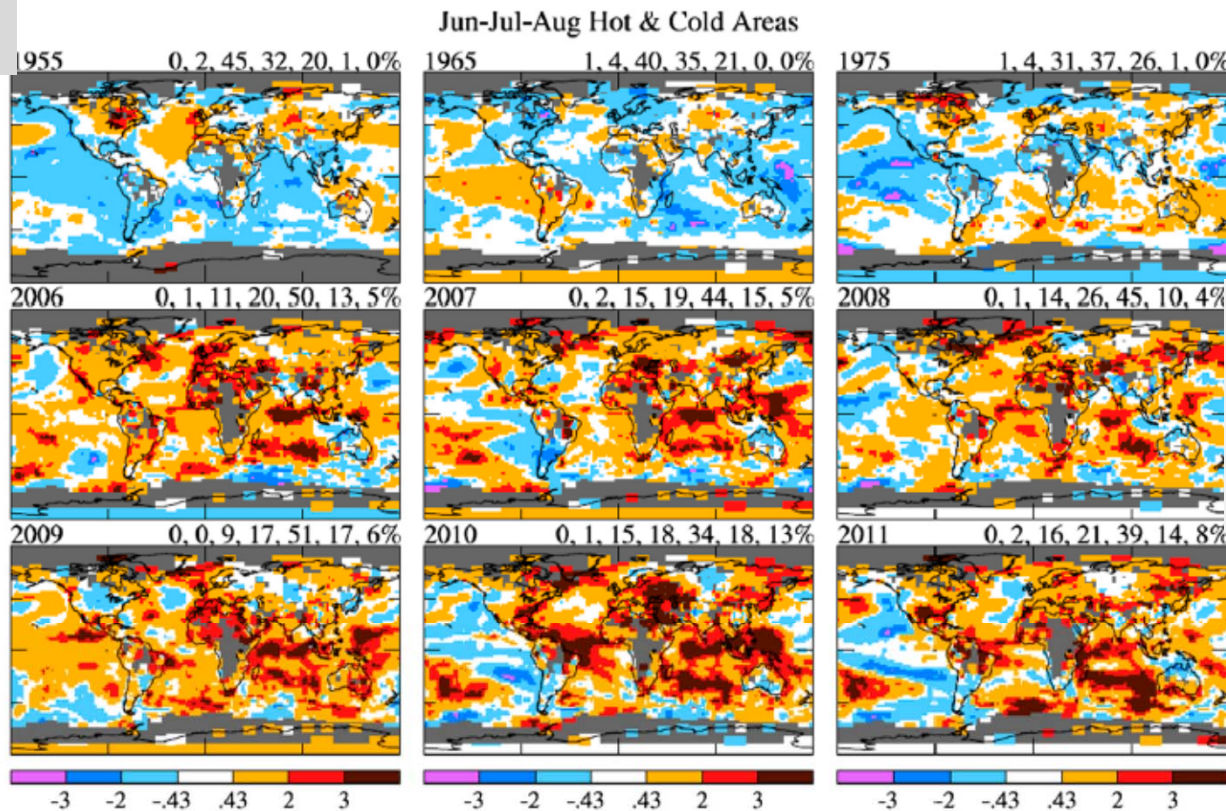


Expected area covered under “normal” historical conditions

“Extreme weather” becoming common: with widespread impacts



Haiyan Nov 2013



1 in 750 year event now happening every 11 years

Fig. 3. June–July–August surface temperature anomalies in 1955, 1965, 1975, and in 2006–2011 relative to 1951–1980 mean temperature in units of the local detrended 1981–2010 standard deviation of temperature. Numbers above each map are percent of the area with data covered by each category in the color bar.

Perception of climate change PNAS, online Aug 2012

James Hansen^{a,1}, Makiko Sato^a, and Reto Ruedy^b



**SUSTAINABILITY:
TYPICALLY REDUCES PRODUCTION**



Defining sustainability

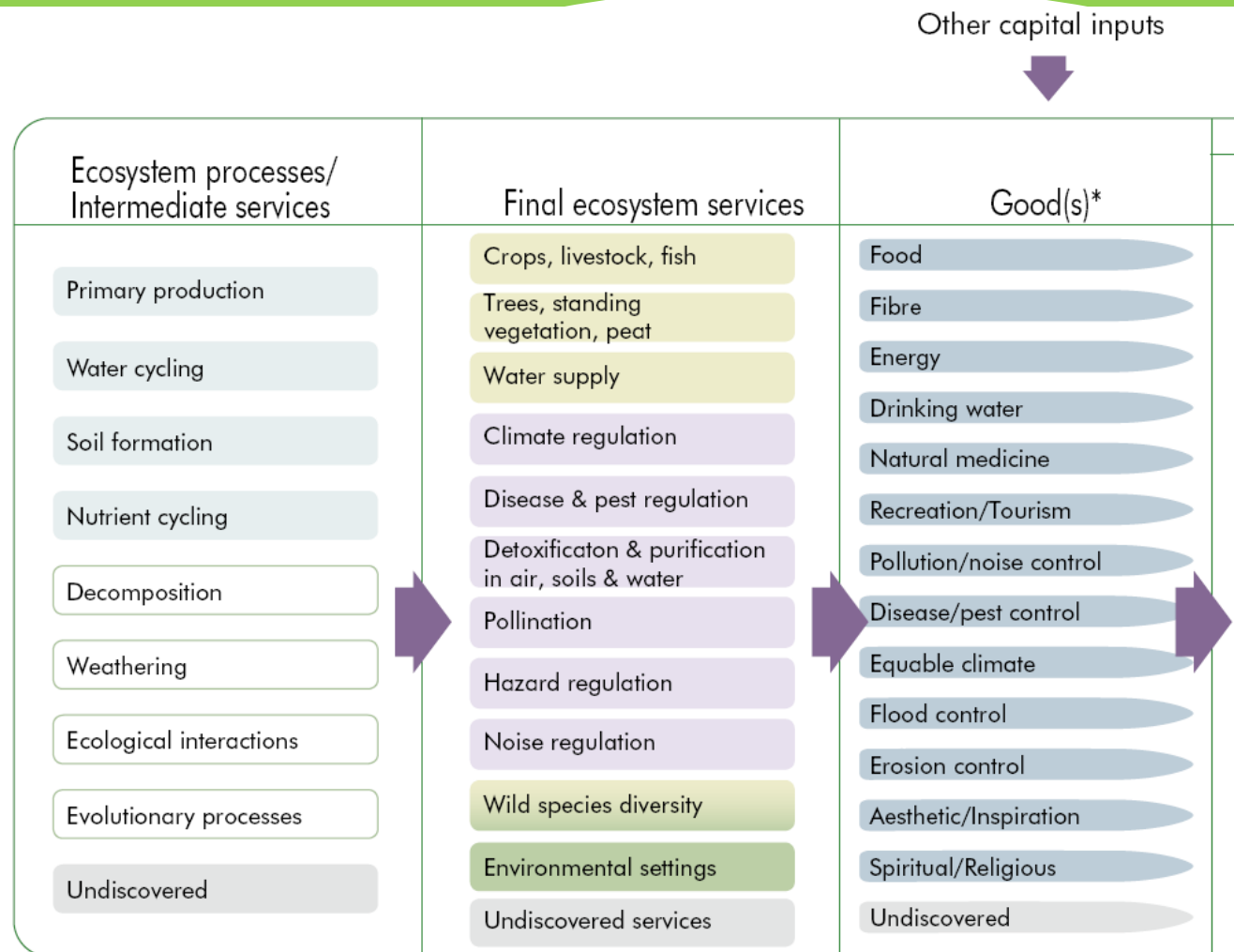
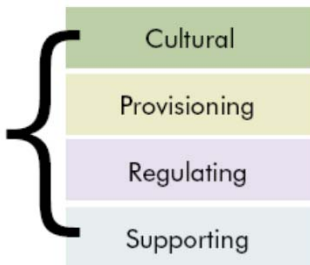
- **Sustainability** is the capacity to endure
 - Brundtland: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs".
- Forest clearance for large scale plantation agriculture cannot be sustainable because it is a "one way transition"



Natural capital is finite and provides services



Millennium
Ecosystem
Assessment
categories



UK National ecosystem assessment 2011



Natural capital subsidises the landuse economy

- Unaccounted degradation of natural capital
- What do we know about long term consequences?

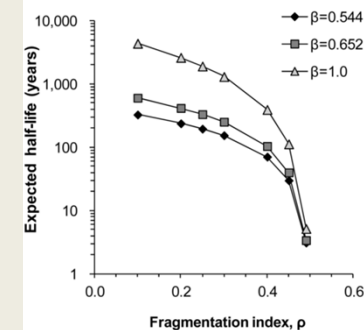
BARCLAYS

Barclays Bank
54 Lombard Street
London
EC3N 3AH
Sort Code: 20-00-60
Account Number: 708000085

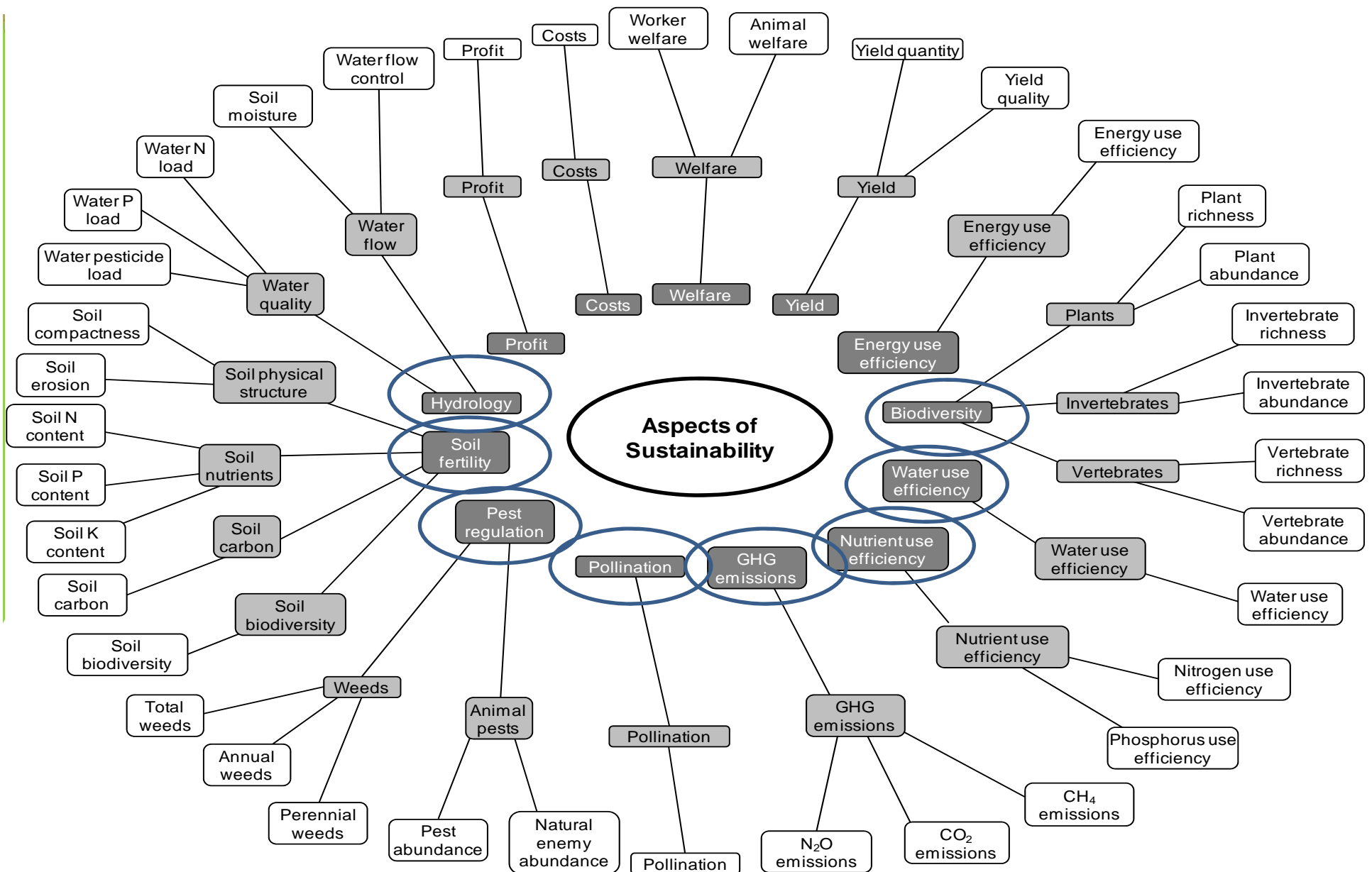
Account Name: Capital Westland
1st October — 30th April

Credit:			
October	£17,258.25	February	£11,581.90
November	£17,815.55	March	£10,126.00
December	£ 5,821.67	April	£28,651.00
January	£ 3,432.87		
Total:			£94,693.24

Extinction risk as a non-linear function of large scale habitat fragmentation: what happens on your farm may depend on the neighbours



Land use impacts on many axes: costs of impacts not paid



Quantitative review of studies assessing “sustainable agriculture” (German, Thompson & Benton, in prep)

- LUC=10% global carbon
 - “the time to act is now”
- IPCC AR5 2013

Environmental impacts for palm



Carbon
payback time

Nr	Author	CPBT (y)	Remarks
1	Achten et al. 2010	47–49	
2	de Souza et al. 2010	39	
3	Danielsen et al. 2008	75–93	From nonpeat forest
		10	From degraded land
4	Fargione et al. 2008	420	From peatland forest
		86	From nonpeat forest
5	Gibbs et al. 2008	900	From peatland forest
		30–120	From nonpeat forest
7	Wicke et al. 2008	169	From peatland forest
		30	From nonpeat forest
		0	From degraded land

Nr	Author	Eutrophication
1	Achten et al. 2010	31.9 < EP < 39.6 g O ₂ eq/FU
2	Puah et al. 2010	5 pt
3	Schmidt 2008	80.6 < EP < 337 kg NO ₃ eq/FU
4	Stichnote and Schuchardt 2010	–0.003 << EP << 1.4 kg PO ₄ ^{3–} eq/FU
5	Yusoff and Hansen 2007	2.7 pt

Impacts on biodiversity
considerable: 385 fewer
species per 100 m² in palm
than forest (Schmidt 2010)

A Meta-Analytic Review of Life Cycle Assessment and Flow Analyses Studies of Palm Oil Biodiesel

Yosef Manik*† and Anthony Halog†

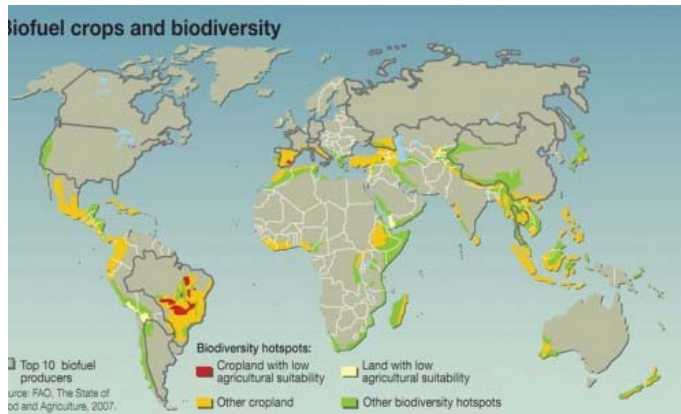
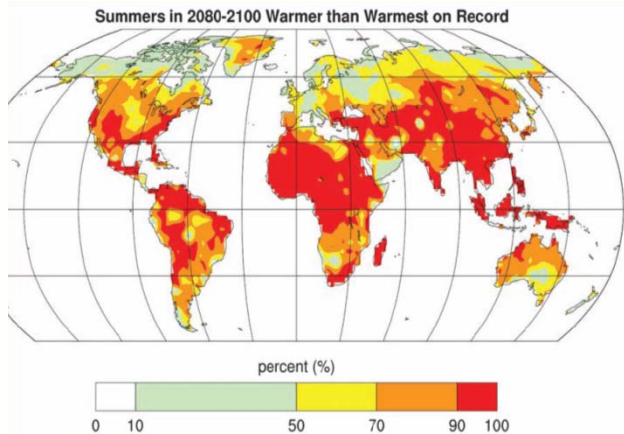
*Research Group for Industrial Ecology, LCA and System Sustainability, School of Forest Resources, University of Maine



“Sustainable production” needs...

- Management of farming's impacts within the production land
- management of sufficient non-production land to maintain other services

Sustainable agricultural landscapes require landscape planning: many services depend on the amount, quality and configuration of non-cropped habitat



Spatial games, governance and sovereignty

- Different areas have different capabilities
 - Land use potential and natural capital, some of which is “world heritage status”
- Actions have consequences from local to global scales
 - Deforestation harms all, profits whom?
 - Need smarter landuse
 - Sparing vs sharing ?
 - Spatial scales?
- Citizens, corporations, nations
 - “public good” legality at nation state level
 - Need to take the long view and ensure “good” occurs to appropriate “publics”

Social life cycle assessment of palm oil biodiesel: a case study in Jambi Province of Indonesia

Yosef Manik · Jessica Leahy · Anthony Halog

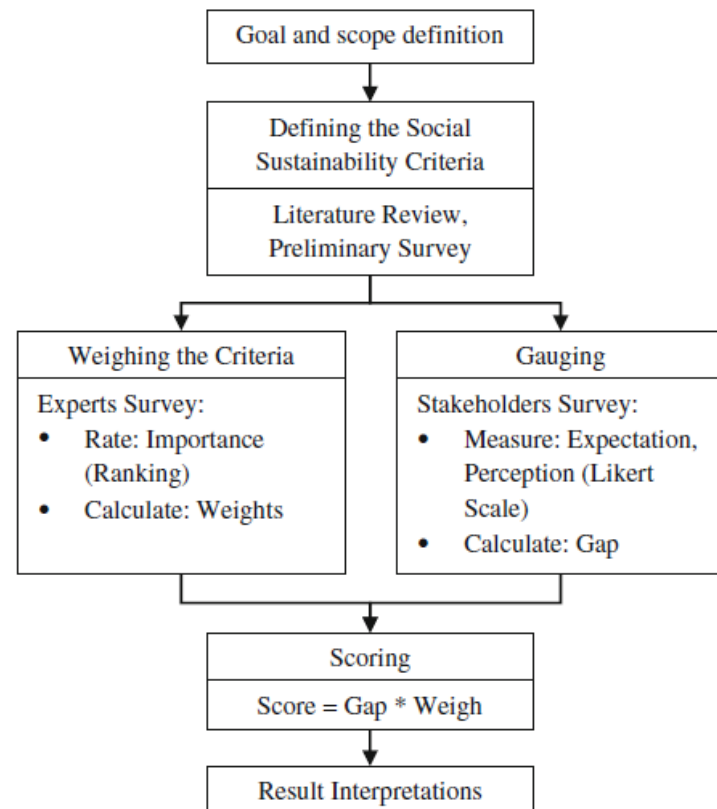


Fig. 1 Framework of research methodology

Jambi Province, Indonesia

Social impacts are measurable

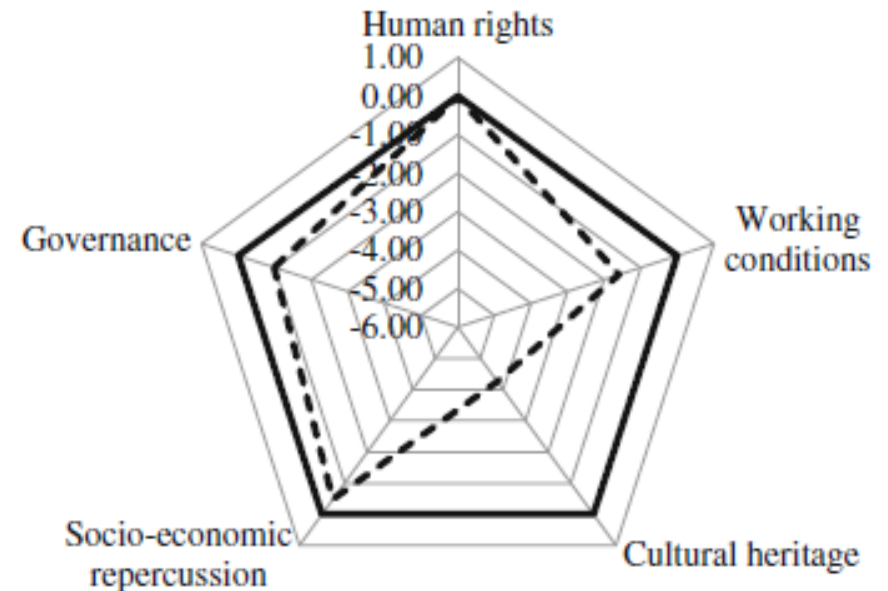
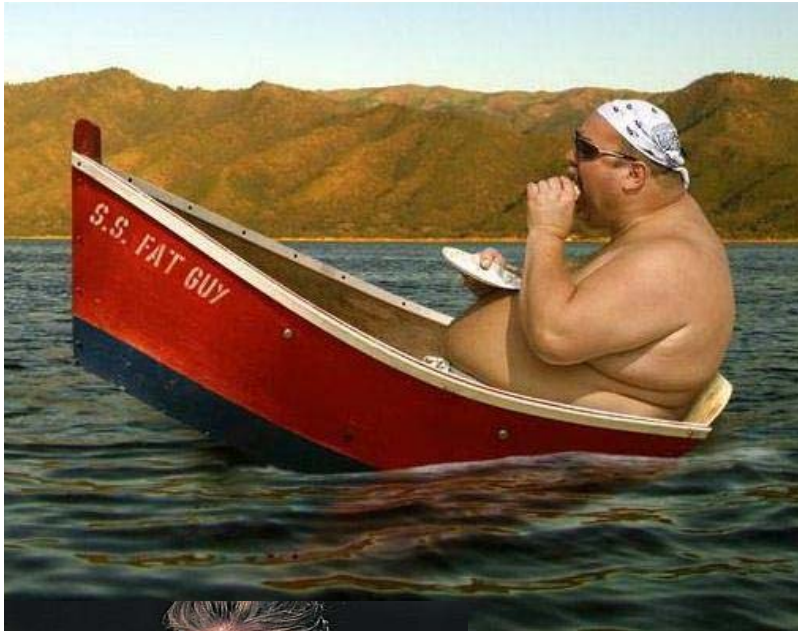


Fig. 2 The stakeholders' perspective in a radar chart

- 4 groups stakeholders: (1) growers, millers, transporters, (2) workers, (3) community, (4) wider society



**FOOD SECURITY IS NOT JUST
ABOUT SUPPLYING MORE FOOD**



IT'S NOT JUST ABOUT PRODUCTION

Global food losses/waste is estimated to be 1.3 billion tonnes per annum (pa), equating to approximately one third of edible food intended for human consumption

The total food production of sub-Saharan Africa = EU+N Am food waste (230mt)

Obesity cost the UK >£15bn in 2007; over-consumption associated with >20% of deaths globally



How much land-based greenhouse gas mitigation can be achieved without compromising food security and environmental goals?

PETE SMITH*, HELMUT HABERL†, ALEXANDER POPP‡, KARL-HEINZ ERB†, CHRISTIAN LAUK†, RICHARD HARPER§, FRANCESCO N. TUBIELLO¶, ALEXANDRE DE SIQUEIRA PINTO||, MOSTAFA JAFARI**, SARAN SOHI††, OMAR MASERA‡‡, HANNES BÖTTCHER§§, GÖRAN BERNDES¶¶, MERCEDES BUSTAMANTE|||, HELAL AHAMMAD||||, HARRY CLARK***, HONGMIN DONG†††, ELNOUR A. ELSIDDIG‡‡‡, CHEIKH MBOW§§§, NIJAVALLI H. RAVINDRANATH¶¶¶, CHARLES W. RICE|||||, CARMENZA ROBLEDÓ ABAD****, ††††, ANNA ROMANOVSKAYA‡‡‡‡, FRANK SPERLING§§§§, MARIO HERRERO¶¶¶¶, |||||, JOANNA I. HOUSE***** and STEVEN ROSE†††††

HERE'S HOW EATING LESS MEAT MEASURES UP AGAINST OTHER CLIMATE-SAVING ACTIONS		
IF YOU eat one less burger per week	OVER 1 YEAR	It's like taking your car off the road for 320 miles, or line-drying your clothes half the time.
IF YOUR 4-PERSON FAMILY skips meat + cheese 1 day a week	OVER 1 YEAR	It's like taking your car off the road for 5 weeks or shortening everyone's daily shower by 3 minutes.
IF YOUR 4-PERSON FAMILY skips steak 1 day a week	OVER 1 YEAR	It's like taking your car off the road for almost 3 months.
IF EVERYONE IN THE U.S. ate NO meat or cheese just 1 day a week	OVER 1 YEAR	It's like not driving 91 billion miles – or taking 76 million cars off the road.

Production
(sustainable)

“full cost of food”

Less waste
Healthy consumption
Low environmental impact
Managed demand

Sustainable nutrition

Production
(unsustainable)

Cheap food

Waste
Over consumption
Environmental impact
Increasing demand



The M25 model

(or the “economic growth increases wellbeing model”)



PALM, RSPO AND SUSTAINABILITY



How much does palm contribute to food security?

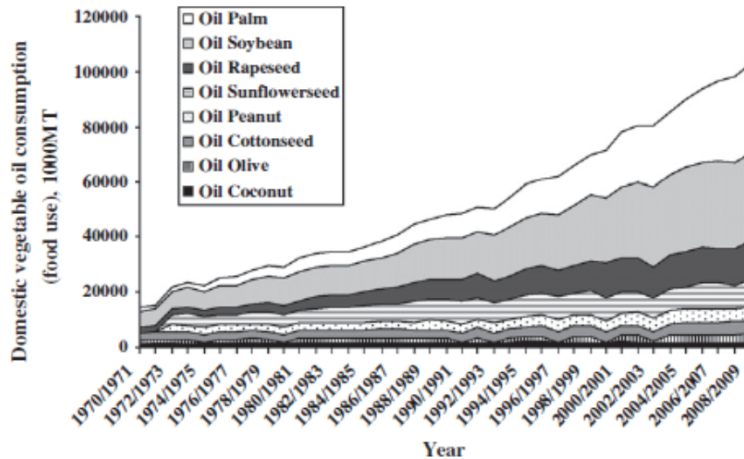


Fig. 1. Global availability for consumption of vegetable oils, 1960–2008. Source: USDA FAS Production, supply and demand database, available at: <http://www.fas.usda.gov/psdonline/>. Accessed August 16 2011.

Linking agricultural policies with obesity and noncommunicable diseases:
A new perspective for a globalising world

Corinna Hawkes^{a,*}, Sharon Friel^b, Tim Lobstein^c, Tim Lang^a

Food Policy 37 (2012) 343–353

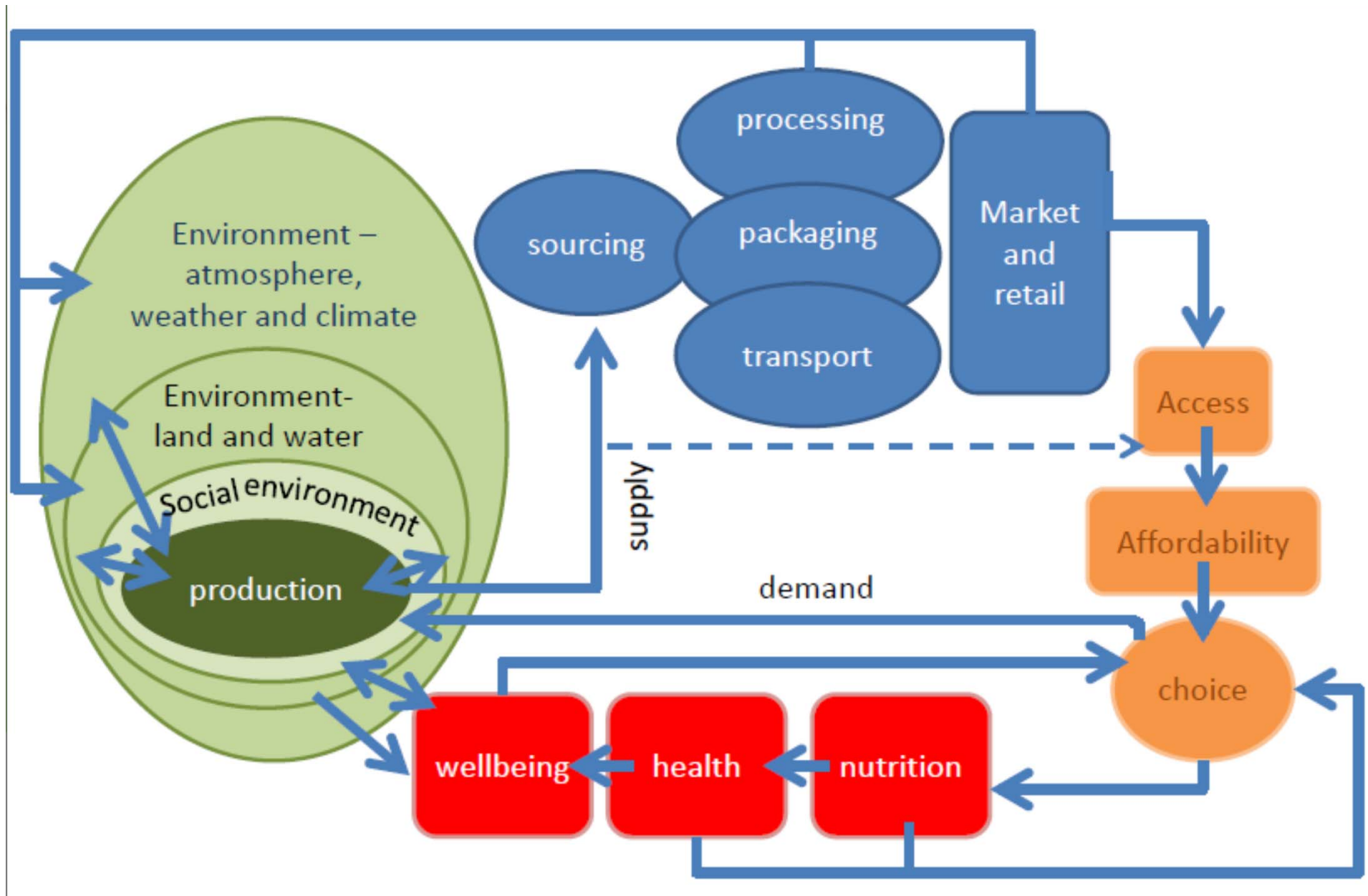
- Agricultural policy stimulates production
- Production produces cheaper goods which leads to substitution
- Public health impacts
- 11% Chinese adults have diabetes, 50% pre-diabetic

JAMA. 2013;310(9):948-958.
doi:10.1001/jama.2013.168118



The legacy of palm

- Growing consumer-driven demand for sustainability
 - UK statement on SPO 2012
 - But growing distrust and cynicism
- Trust, equity and transparency
 - What is “sustainable”?
 - is the brand trustworthy and verifiable?
 - Does it lead to positive change in all aspects covered?
 - Auditing of outcomes?
- Opportunity for positive legacy
- RSPO needs to push the bar higher year on year



Complex system: who has the power?



Conclusions



- Food insecurity has the potential to increase migration, increase the disparity between rich and poor and undermine social order
- Demand for (healthy) food is likely to be a big driver of environmental issues in coming decades
- Increasing climate change will drive greater demand for sustainability and resilience
- Will PO be part of the solution or seen to be part of the problem?
- RSPO has important role to play in ensuring trust in PO



Thank you!

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