Ending Deforestation, Increasing Reforestation and Transforming Agriculture: What We've Done, What We Plan, What We Need

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NASA-Goddard
Carbon Monitoring System Seminar
21 March 2017

Union of Concerned Scientists
Science for a healthy planet and safer world

What is UCS?

Union of Concerned Scientists
Science for a healthy planet and safer world

- A non-governmental organization (NGO)
- Founded in 1969 at MIT
- Over 500,000 supporters
- Four offices - Cambridge, Washington, Chicago, Oakland
- About 150 staff
- A **science-based advocacy** organization

Our Tropical Forest and Climate Initiative (TFCI)

Our Approach

Policies rather than Projects

Scale: National, Continental and Global

Venues: Congress, the Administration, the UNFCCC, the IPCC, the scientific community, social media – and businesses

Some primary but mostly secondary research

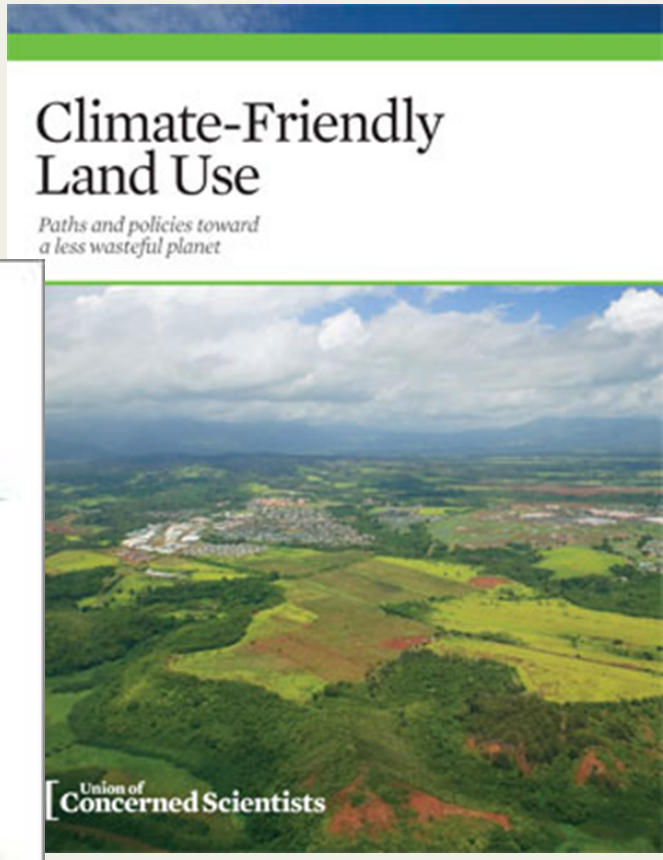
Translating scientific literature into Plain English

Based on the naïve belief that facts matter

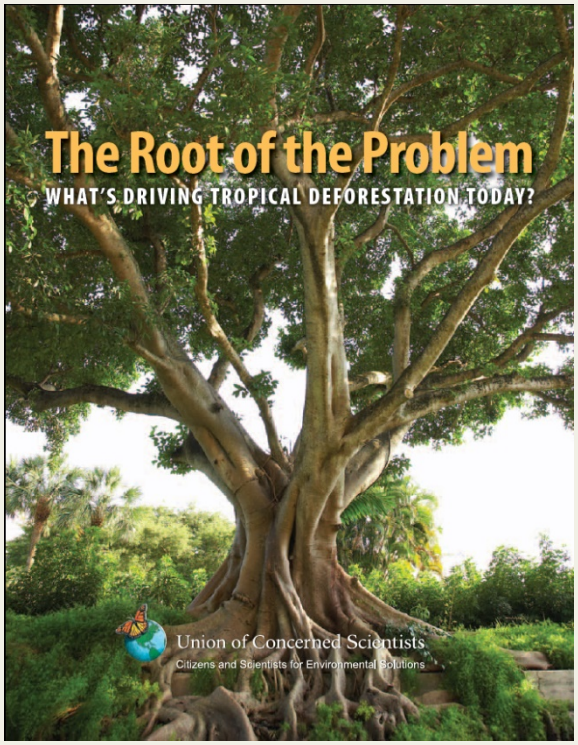
Reports

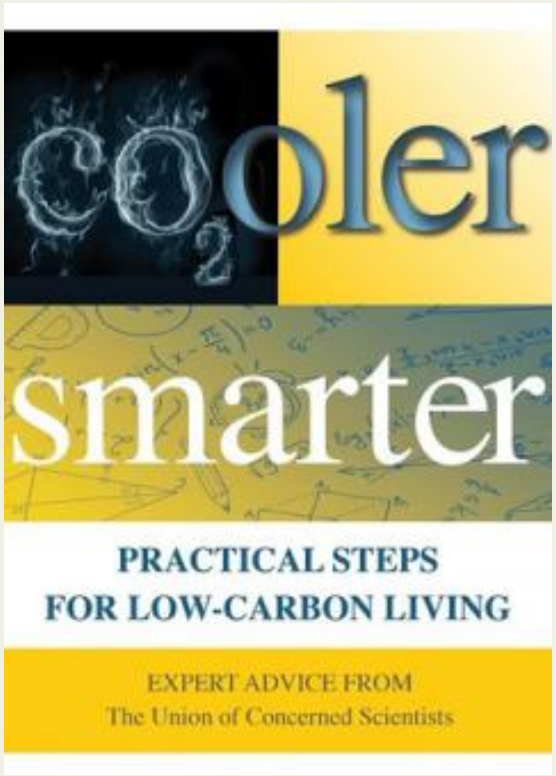

Donuts, Deodorant, Deforestation
Scoring America's Top Brands on Their Palm Oil Commitments
Calen May-Tobin
Lael Goodman
Union of Concerned Scientists

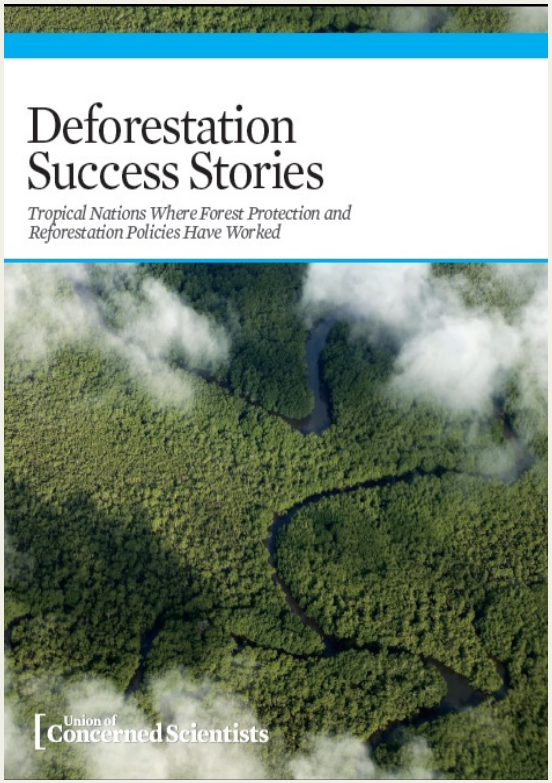

Halfway There?
What the Land Sector Can Contribute to Closing the Emissions Gap
Union of Concerned Scientists


Climate-Friendly Land Use
Paths and policies toward a less wasteful planet
Union of Concerned Scientists

Books


The Root of the Problem
WHAT'S DRIVING TROPICAL DEFORESTATION TODAY?
Union of Concerned Scientists
Citizens and Scientists for Environmental Solutions


cooler
smarter
PRACTICAL STEPS
FOR LOW-CARBON LIVING
EXPERT ADVICE FROM
The Union of Concerned Scientists


Deforestation
Success Stories
Tropical Nations Where Forest Protection and
Reforestation Policies Have Worked
Union of
Concerned Scientists

Journal papers

Journal of Sustainable Forestry, 34:547–558, 2015
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ISSN: 1054-9811 print/1540-756X online
DOI: 10.1080/10549811.2015.1031909

Taylor & Francis

The REDD/Carbon Market Offsets Debate: Big Argument, Small Potatoes

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Both proponents and opponents of using forest carbon markets to pay for Reductions in Emissions from Deforestation and forest Degradation (REDD) have exaggerated their importance. The resources mobilized by the principal drivers of deforestation—beef, soy, palm oil, and wood products—dwarf all REDD funding, even if one only counts exports of these commodities from tropical forest countries. By far the largest part of that REDD money has come from public funding, not carbon markets, and even that has mostly been "voluntary market" funding, not offsets usable for regulatory compliance. While substantial carbon market growth is projected, the rules of most of those markets do not allow the use of REDD offset credits. It is important for those on both sides to realize that they are talking about an alternative that is very small, compared both to other kinds of REDD funding and to the scale of finance operating to drive deforestation. Far more urgent than continuing the debate about whether forest carbon markets are a solution or a threat, is the question of how to change the behavior of the industries and commodities driving deforestation so as to move them to a zero-deforestation business model.

KEYWORDS beef, carbon markets, compliance, credits, deforestation, drivers, forest, degradation, greenhouse gas emissions, offsets, palm oil, pulp and paper, REDD, soy, timber, voluntary

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Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/wjsf.

opinion & comment

COMMENTARY:

Ruminants, climate change and climate policy

William J. Ripple, Pete Smith, Helmut Haberl, Stephen A. Montzka, Clive McAlpine and Douglas H. Boucher

Greenhouse gas emissions from ruminant meat production are significant. Reductions in global ruminant numbers could make a substantial contribution to climate change mitigation goals and yield important social and environmental co-benefits.

Although a main focus of climate policy has been to reduce fossil fuel consumption, large cuts in CO_2 emissions alone will not abate climate change. At present non-CO_2 greenhouse gases contribute about a third of total anthropogenic CO_2 equivalent (CO_2e) emissions and 35–45% of climate forcing (the change in radiant energy retained by Earth owing to emissions of long-lived greenhouse gases) resulting from those emissions[1] (Fig. 1a). Only with large simultaneous reductions in CO_2 and non-CO_2 emissions will direct radiative forcing be reduced during this century (Fig. 1b). Methane (CH_4) is the most abundant non-CO_2 greenhouse gas and because it has a much shorter atmospheric lifetime (~9 years) than CO_2 it holds the potential for more rapid reductions in radiative forcing than would be possible by controlling emissions of CO_2 alone.

There are several important anthropogenic sources of CH_4: ruminants, the fossil fuel industry, landfills, biomass burning and rice production (Fig. 1c). We focus on ruminants for four reasons. First, ruminant production is the largest source of anthropogenic CH_4 emissions (Fig. 1c) and globally occupies more area than any other land use. Second, the relative neglect of this greenhouse gas source suggests that awareness of its importance is inappropriately low. Third, reductions in ruminant numbers and ruminant meat production would simultaneously benefit global food security, human health and environmental conservation. Finally, with political will, decreases in worldwide ruminant populations could potentially be accomplished quickly and relatively inexpensively.

Ruminant animals consist of both native and domesticated herbivores that consume plants and digest them through the process of enteric fermentation in a multichambered stomach. Methane is produced as a by-product of microbial digestive processes in the rumen. Non-ruminants or 'monogastric' animals such as pigs and poultry have a single-chambered stomach to digest food, and their methane emissions are negligible in comparison. There are no available estimates of the number of wild ruminants, but it is likely that domestic ruminants greatly outnumber the wild population, with a reported 3.6 billion domestic ruminants on Earth in 2011 (1.4 billion cattle, 1.1 billion sheep, 0.9 billion goats and 0.2 billion buffalo)[2]. On average, 25 million domestic ruminants have been added to the planet each year (2 million per month)[2] over the past 50 years (Fig. 1d).

Worldwide, the livestock sector is responsible for approximately 14.5% of all anthropogenic greenhouse gas emissions[3] (7.1 of 49 Gt CO_2e yr^{-1}). Approximately 44% (3.1 Gt CO_2e yr^{-1}) of the livestock sector's emissions are in the form of CH_4 from enteric fermentation, manure and rice feed, with the remaining portions almost equally shared between CO_2 (27%, 2 Gt CO_2e yr^{-1}) from land-use change and fossil fuel use, and nitrous oxide (N_2O) (29%, 2 Gt CO_2e yr^{-1}) from fertilizer applied to feed-crop fields and manure[3]. Ruminants contribute significantly more (5.7 Gt CO_2e yr^{-1}) to greenhouse gas emissions than monogastric livestock (1.4 Gt CO_2e yr^{-1}), and emissions due to cattle (4.6 Gt CO_2e yr^{-1}) are substantially higher than those from buffalo (0.6 Gt CO_2e yr^{-1}) or sheep and goats (0.5 Gt CO_2e yr^{-1})[3]. Globally, ruminants contribute 11.6% and cattle 9.4% of all greenhouse gas emissions from anthropogenic sources. The total area dedicated to grazing encompasses 26% of the terrestrial surface of the planet[4]. Livestock production accounts for 70% of global agricultural land and the area dedicated to feed-crop production represents 33% of total arable land[4]. The feeding of crops to livestock is in direct competition with producing crops for human consumption (food security) and climate mitigation (bioenergy production or carbon sequestration)[5].

Deforestation has been responsible for a significant proportion of global greenhouse gas emissions from the livestock sector and takes place mostly in tropical areas, where expansion of pasture and arable land for animal feed crops occurs primarily at the expense of native forests[4,6]. Lower demand for ruminant meat would therefore reduce a significant driver of tropical deforestation and associated burning and black carbon emissions. The accompanying reduction in grazing intensity could also allow regrowth of forests and other natural vegetation, resulting in additional carbon sequestration in both biomass and soils with beneficial climate feedbacks[5,6].

Lower global ruminant numbers would have simultaneous benefits for other systems and processes. For example, in some grassland and savannah ecosystems, domestic ruminant grazing contributes to land degradation through desertification and reduced soil organic carbon[5]. Ruminant agriculture can also have negative impacts on water quality and availability, hydrology and riparian ecosystems[4,7]. Ruminant production can erode biodiversity through a wide range of processes such as forest loss and degradation, land-use intensification, exotic plant invasions, soil erosion, persecution of large predators and competition with wildlife for resources[4–7].

Ruminant production also has implications for food security and human

PLOS ONE

RESEARCH ARTICLE

The Impacts of Oil Palm on Recent Deforestation and Biodiversity Loss

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OPEN ACCESS

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Data Availability Statement: Data associated with each of the analyses performed in this paper: site analysis, vulnerable forest analysis and biodiversity prioritization are available through the Dryad data repository (doi:10.5061/dryad.2v77) and Supporting Information.

Funding: This material is based upon work supported by the National Science Foundation (www.nsf.gov) under Grant No.1106401. CNJ received support from Ciência Sem Fronteiras (A025_2013). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Abstract

Palm oil is the most widely traded vegetable oil globally, with demand projected to increase substantially in the future. Almost all oil palm grows in areas that were once tropical moist forests, some of them quite recently. The conversion to date, and future expansion, threatens biodiversity and increases greenhouse gas emissions. Today, consumer pressure is pushing companies toward deforestation-free sources of palm oil. To guide interventions aimed at reducing tropical deforestation due to oil palm, we analysed recent expansions and modelled likely future ones. We assessed sample areas to find where oil palm plantations have recently replaced forests in 20 countries, using a combination of high-resolution imagery from Google Earth and Landsat. We then compared these trends to countrywide trends in FAO data for oil palm planted area. Finally, we assessed which forests have high agricultural suitability for future oil palm development, which we refer to as vulnerable forests, and identified critical areas for biodiversity that oil palm expansion threatens. Our analysis reveals regional trends in deforestation associated with oil palm agriculture. In Southeast Asia, 45% of sampled oil palm plantations came from areas that were forests in 1989. For South America, the percentage was 31%. By contrast, in Mesoamerica and Africa, we observed only 2% and 7% of oil palm plantations coming from areas that were forest in 1989. The largest areas of vulnerable forest are in Africa and South America. Vulnerable forests in all four regions of production contain globally high concentrations of mammal and bird species at risk of extinction. However, priority areas for biodiversity conservation differ based on taxa and criteria used. Government regulation and voluntary market interventions can help incentivize the expansion of oil palm plantations in ways that protect biodiversity-rich ecosystems.

Introduction

African oil palm (*Elaeis guineensis* Jacq.) is a tropical crop grown primarily for the production of palm oil. It is the world's highest yielding and least expensive vegetable oil, making it the preferred cooking oil for millions of people globally and a source of biodiesel. Palm oil and its derivatives are also common ingredients in many packaged and fast foods, personal care and

Fact Sheets (2-8 pages)

Union of Concerned Scientists

FACT SHEET

JANUARY 2013

A Business Guide to a

DEFORESTATION-FREE SUPPLY CHAIN

Intact tropical forests provide valuable resources such as clean air and water, and local residents depend on the forest for their livelihoods. In addition, these forests are home to an incredible diversity of plants and animals, and capture a huge amount of heat-trapping carbon dioxide that would otherwise contribute to climate change.

Thousands of products sold all over the world—including vegetable oils, meats and other foods, wood, paper, and medicines—rely on materials obtained from the tropics. Unfortunately, some of the methods used to obtain these raw materials destroy or degrade tropical forests and produce carbon emissions.

Is Your Supply Chain Part of the Solution?

To protect your brand from claims that it contributes to deforestation, and even be a leader in protecting tropical forests, there are a number of steps your business can take to ensure that its goods and services help preserve our climate and tropical forests. Your business can help both suppliers and customers understand the importance of tropical forests and deforestation-free products, and these business decisions will, in turn, encourage others to adopt sustainable forest management practices.

Here's how your business can become a leader in deforestation-free supply chains:

- **Publicly pledge to become deforestation-free.**
  Make a strong, clear pledge that your business is expanding its definition of sustainability and actively working to ensure that none of the materials it uses or the products it sells drive tropical deforestation. This will not only signal to the market that your business is committed to sourcing from suppliers that share this pledge, but also highlight for customers your commitment to sustainability and social responsibility. As your pledge draws publicity, your company will be highlighted as a leader.
- **Source, sell, and promote deforestation-free goods.**
  Ensuring a strong market for deforestation-free goods is vital to promoting sustainable practices in tropical regions. Featuring and prominently displaying deforestation-free goods and sourcing policies helps customers become more aware of the issues at stake, and helps your business gain the recognition it deserves for making this important decision.
- **Build transparent supply chains and maintain good relationships with suppliers.**
  A commitment to zero deforestation means knowing the source of your products and ingredients and ensuring your suppliers have the same values you do. Only by having a working knowledge of your supply chains and producers can your business be confident that its goods and services have minimal forest and carbon footprints.
- **Work with other organizations and/or roundtables.**
  Your company should assess its values and then determine whether there is a certification scheme or roundtable that addresses some or all of those values. Certifications, businesses associations, and roundtables can be an easy way to ensure specific standards are met for a limited set of products, and to advertise the care your organization takes in ensuring environmental and social responsibility. However, you may need to go above and beyond the standards set by these organizations to ensure your products are truly deforestation-free.

Hundreds of major consumer goods companies and retailers have already pledged (via the Consumer Goods Forum) to establish zero-deforestation supply chains by 2020. And many have taken the first steps by assessing products such as palm oil, beef, and paper for their deforestation footprints. Much of this progress has been spurred by consumers' growing awareness of the relationship between deforestation and the food and products they buy.

Union of Concerned Scientists

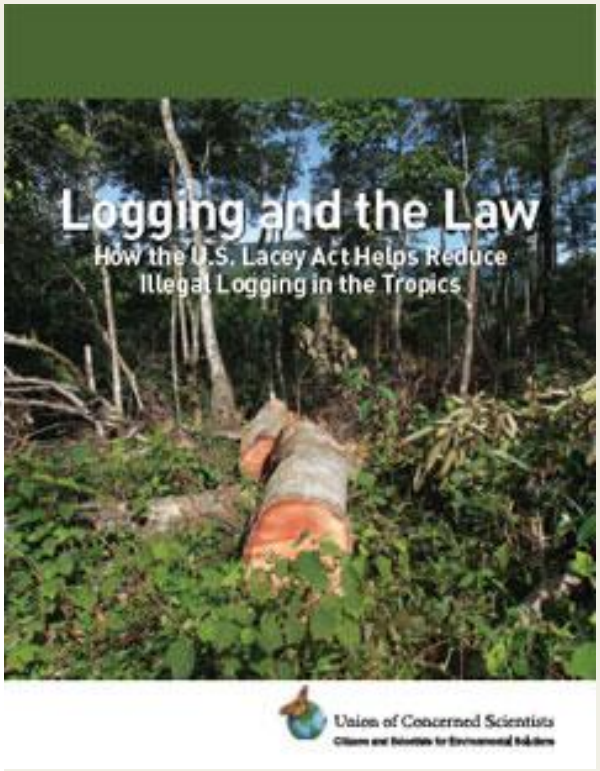
Points of Reference

Finding Common Ground among Reference Level Approaches to Move REDD+ Forward

MARCH 2011

SUMMARY

INTRODUCTION



Logging and the Law

How the U.S. Lacey Act Helps Reduce Illegal Logging in the Tropics

Union of Concerned Scientists

Citizens and Scientists for Environmental Solutions

Deforestation for Palm Oil by Global Corporations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Donuts, Deodorant, Deforestation

Scoring America's Top Brands on Their Palm Oil Commitments

Calen May-Tobin
Lael Goodman

March 2014

Union of Concerned Scientists

Packaged Foods

Fast Food

Personal Care

Packaged Food Companies

Company	Example Brands	OVERALL SCORE	Deforestation-free	Peat-free	Traceability	Transparency	Early Action
Nestlé Good Food, Good Life	Toll House PowerBar	+	+	+	−	+	+
Unilever	Ben and Jerry's Popsicle Slimfast	+	+	+	−	+	−
Mondelēz International	Oreo Ritz Nutter Butter	+	+	−	−	−	−
Kellogg's	Pop-Tarts Nutri-Grain	−	−	−	−	−	−
DANONE	Danimals	−	−	−	−	−	−
General Mills	Pillsbury Nature Valley	−	−	−	X	−	−
Heinz	Ore-Ida Smart Ones	−	−	−	X	−	−
PEPSICO	Quaker	−	−	−	−	−	−
ConAgra Foods	Act II popcorn Marie Callender's	−	−	−	−	−	−
Kraft	Cool Whip JELL-O	X	X	X	X	X	X

Key

+ Strong commitment

− Some commitment

− Little commitment

X No commitment

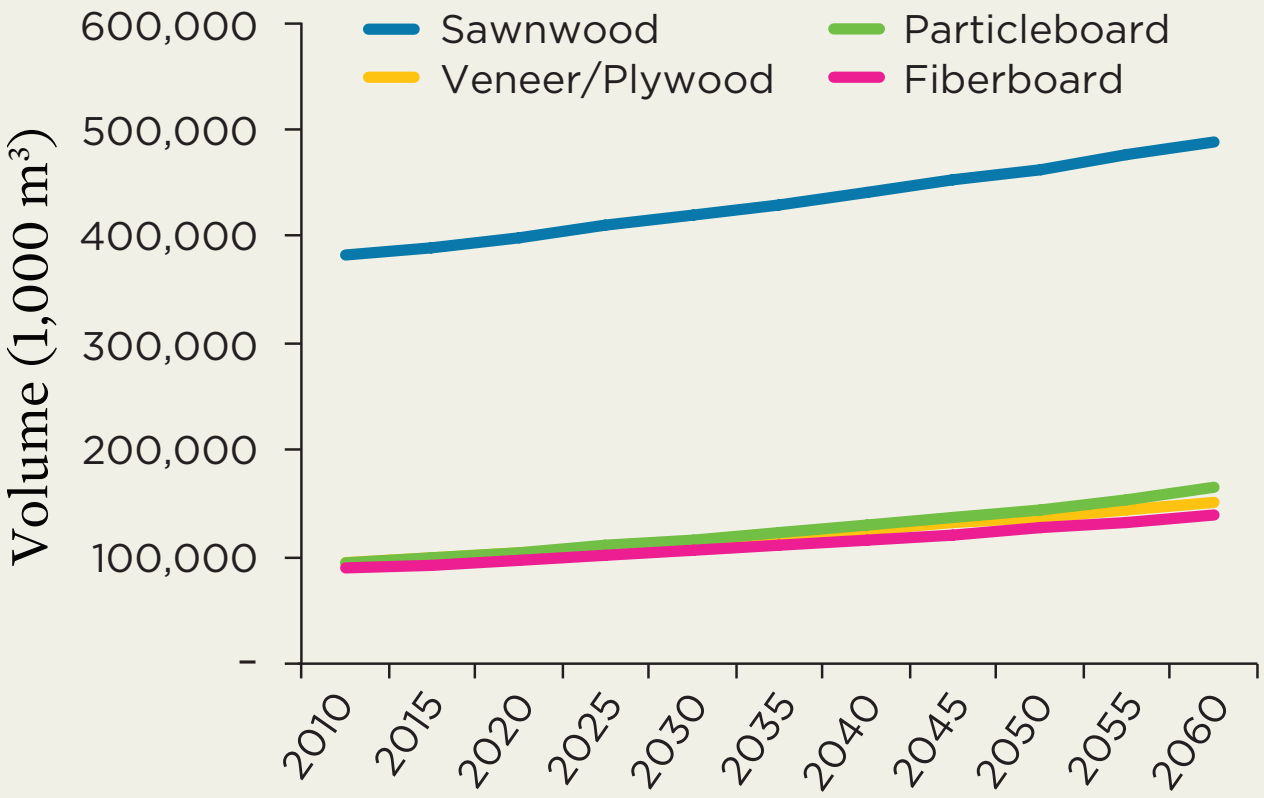
Is Deforestation Necessary to Supply the World's Demand for Wood?

Projected growth in demand for wood products (Elias and Boucher)

- We used the Global Forest Products Model (GFPM)
- Developed by Joseph Buongiorno at the University of Wisconsin
- A dynamic model; based mostly on FAO data
- Models future supply and demand, by product

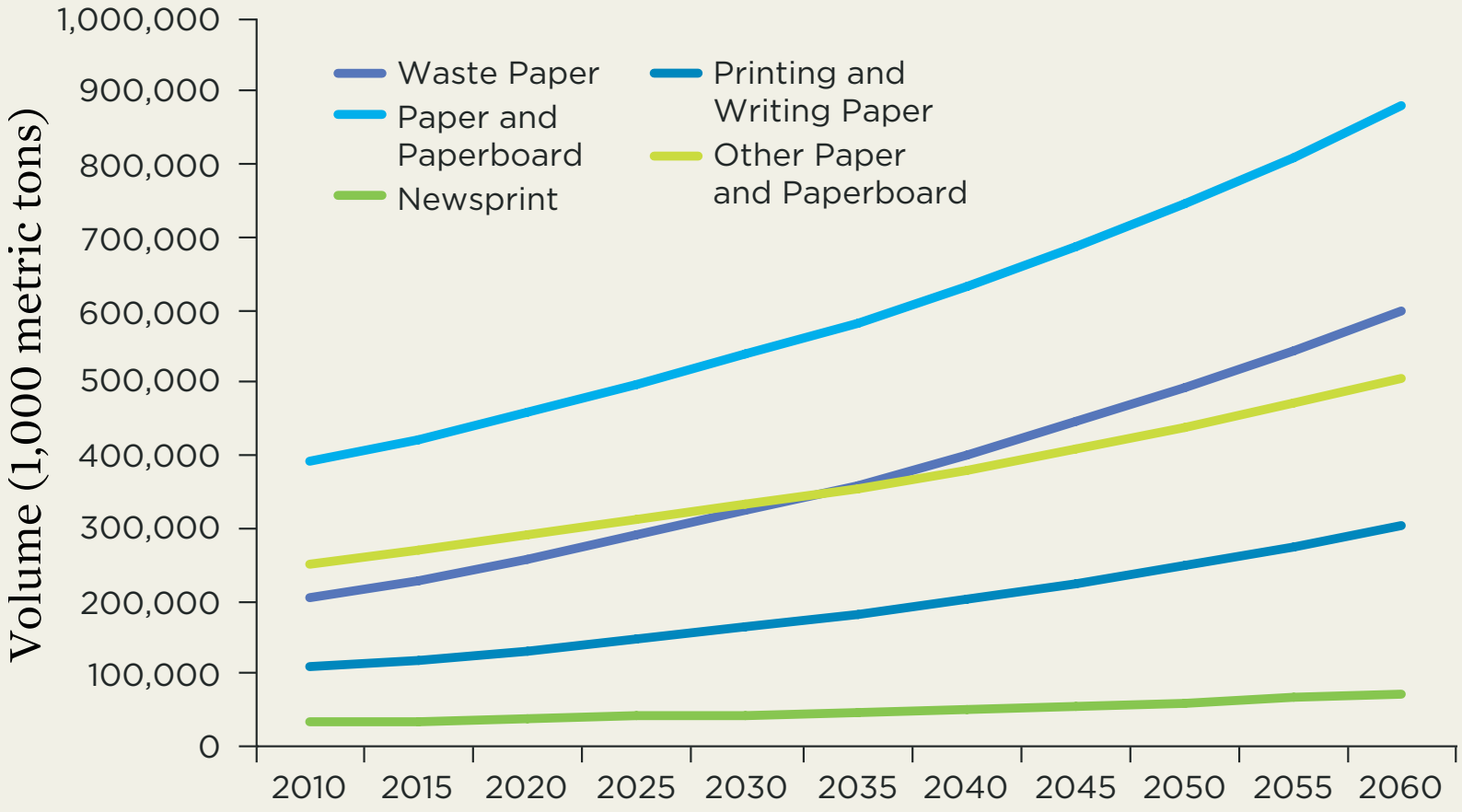
Moderate demand growth for solid wood products

FIGURE 3. Solid Wood Product Consumption through 2060



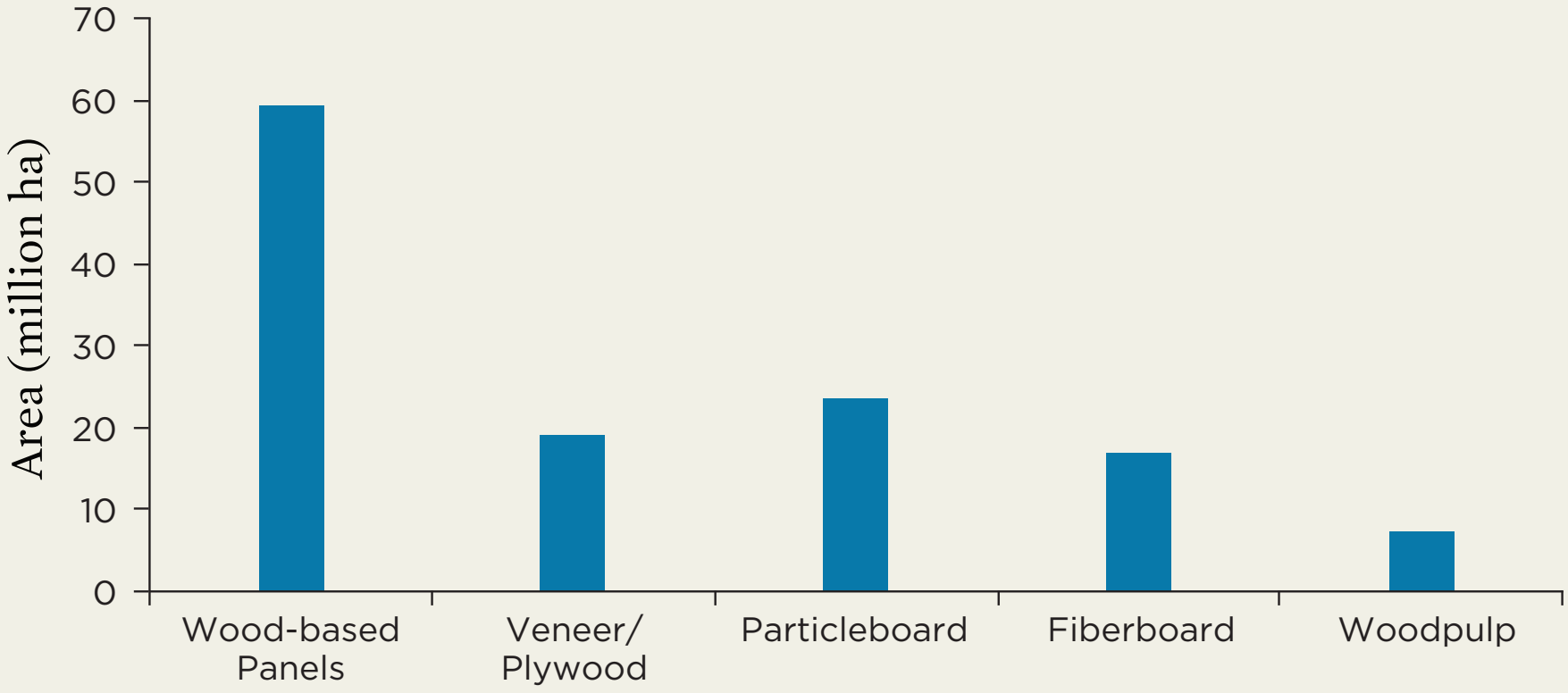
More rapid for paper products

FIGURE 5. Woodpulp-based Products Consumption through 2060

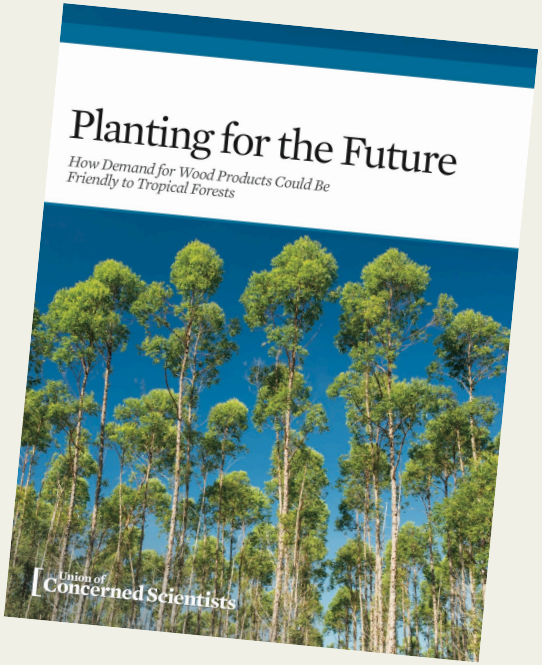


The area of plantations needed to meet 2060 global demand is about 150 million ha - i.e. relatively small

FIGURE 7. Fast Wood Plantation Area Needed to Meet 2060 Demand



These results are explained in more detail in the UCS report *Planting for the Future*



Greenhouse Gas Emissions due to Meat Consumption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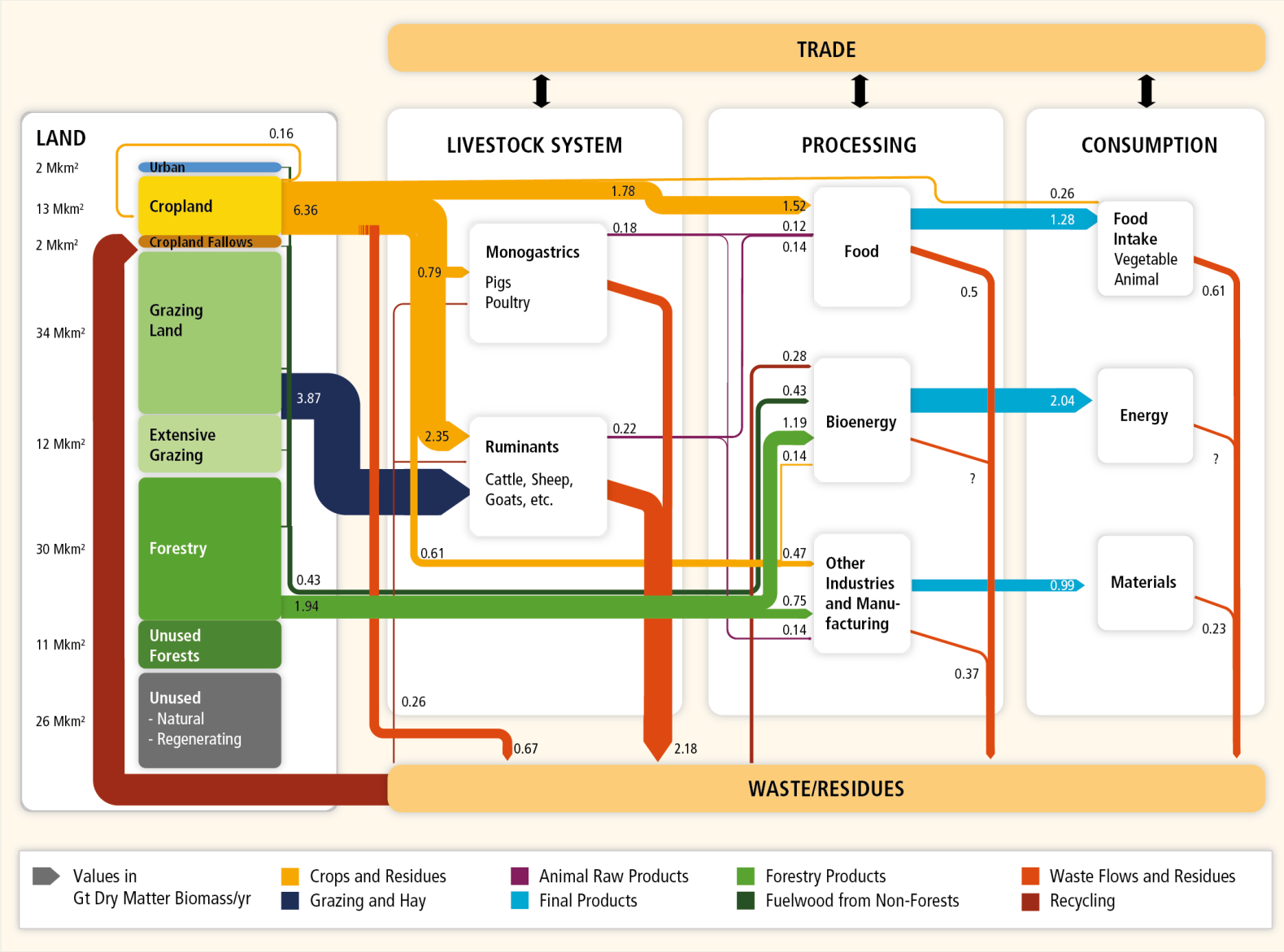


Figure 1 of P. Smith et al. 2013. *Global Change Biology* 19: 2285–2302. Based on original analyses by F. Kraussman et al. 2008. *Ecological Economics* 65: 471-487


Agricultural Land
CROPLAND 25%
GRAZING 75%
Energy (% of biomass)
NONFOOD
CROPS 3%
PLANT FOOD 8%
PIG
CHICKEN 3%
COWS 86%
Food (% of biomass)
85%
7 %
8%
When it comes to land use around the world, cows are the real hogs. They use 86% of the energy from agricultural land but account for only 8% of the food we eat.
Cows are the real hogs.

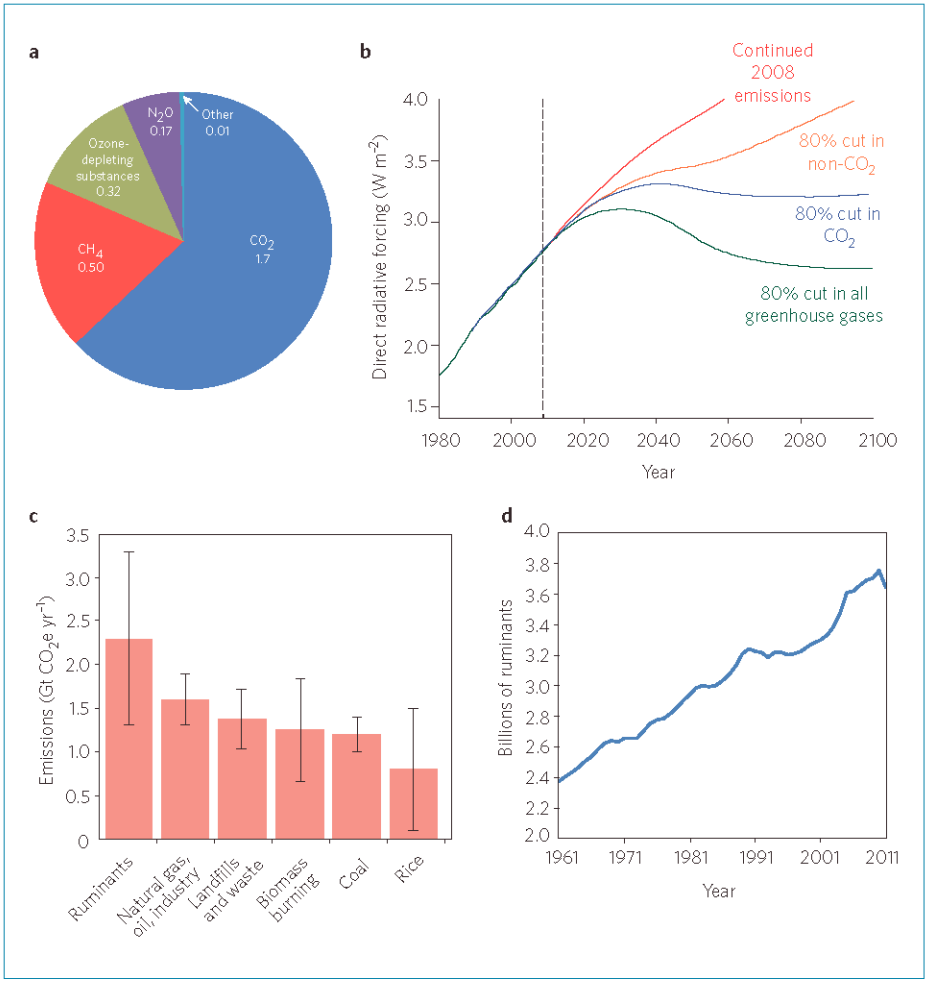


Figure 1 | Compound- and sector-specific emissions of greenhouse gases, associated radiative forcing and global ruminant numbers over the past 50 years. **a**, Estimates of direct radiative forcing in 2008 for CO_2 and non-CO_2 greenhouse gases from anthropogenic sources. **b**, Projections of radiative forcing in four different scenarios: constant future emissions at 2008 levels (red); 80% reduction in only non-CO_2 emissions (orange), 80% reduction in only CO_2 emissions (blue), and 80% reductions in both non-CO_2 and CO_2 emissions (green). **c**, Estimated annual anthropogenic emissions from major sources of methane in recent years. Error bars represent 1 standard deviation. **d**, Global ruminant numbers from 1961 to 2011. Data for **a**–**c** from ref. 1, **d** from ref. 2.

Ruminants are a large, increasing and neglected source of GHG emissions from methane and deforestation.
But they also could be an important short-term mitigation option, since methane is a much shorter-lived climate forcer than CO_2.

Source: Figure 1 of W. Ripple et al. 2014. *Nature Climate Change* 4: 2-5

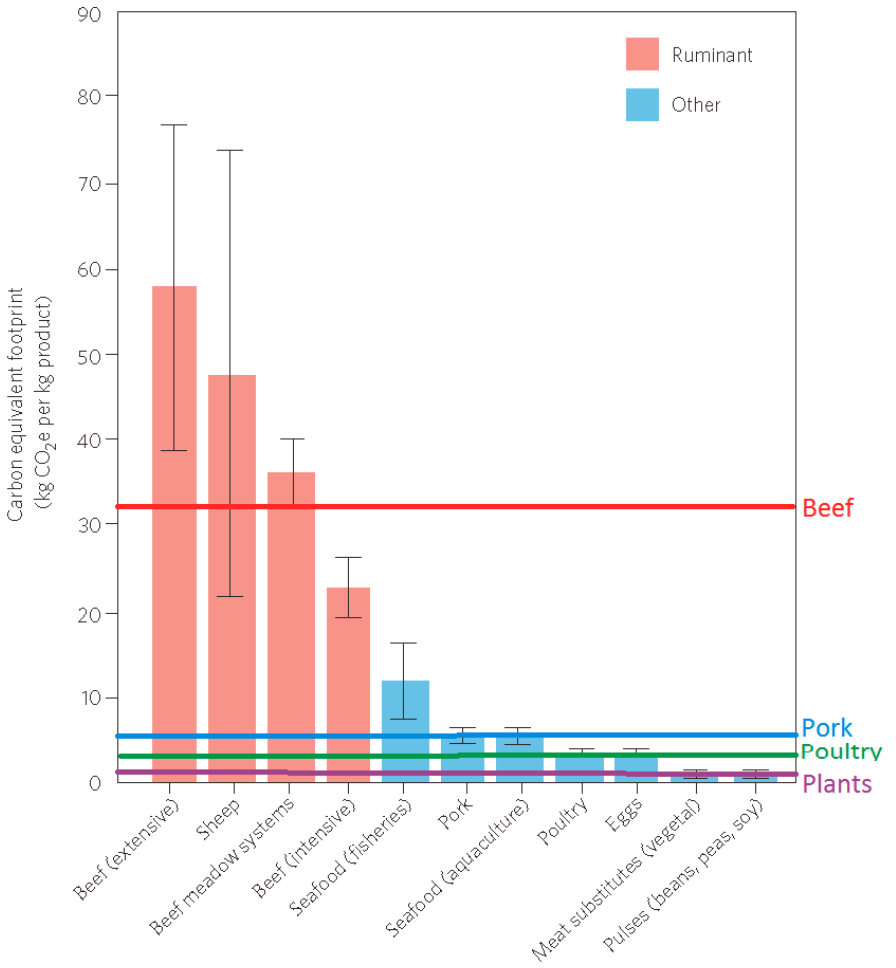
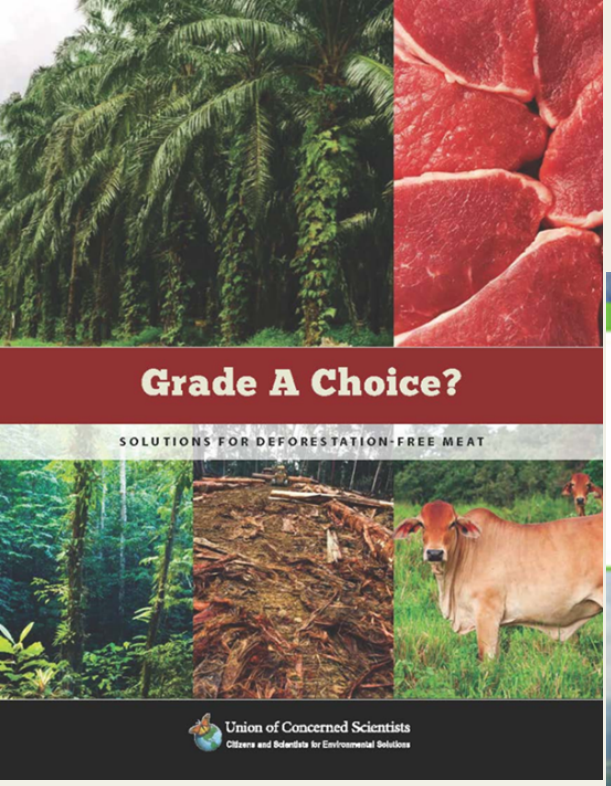
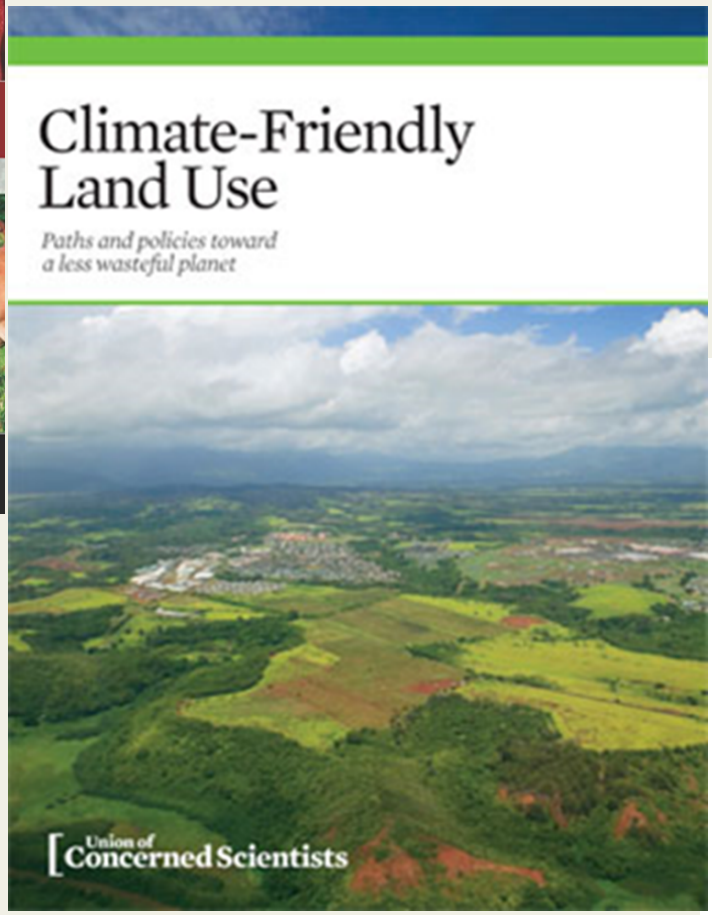


Figure 2 | Average carbon equivalent footprint of protein-rich solid foods per kilogram of product from a global meta-analysis of life-cycle assessment studies. Extensive beef involves cattle grazing across large pastoral systems, whereas intensive beef typically involves feedlots. Meat substitutes are also known as meat analogues, which are high-protein plant products that have aesthetic qualities (such as flavour, texture, appearance) of specific types of meat. Error bars represent standard errors. Data from ref. 17.

The greenhouse gas footprint of cattle is very high – not only compared to plant foods, but also to other sources of meat.

Source: Figure 2 of W. Ripple et al. 2014. *Nature Climate Change* 4: 2-5, with horizontal lines added by me





opinion & comment

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Worldwide, the livestock sector is responsible for approximately 14.5% of all anthropogenic greenhouse gas emissions[3] (7.1 of 49 Gt CO_2e yr^{-1}). Approximately 44% (3.1 Gt CO_2e yr^{-1}) of the livestock sector's emissions are in the form of CH_4 from enteric fermentation, manure and rice feed, with the remaining portions almost equally shared between CO_2 (27%, 2 Gt CO_2e yr^{-1}) from land-use change and fossil fuel use, and nitrous oxide (N_2O) (29%, 2 Gt CO_2e yr^{-1}) from fertilizer applied to feed-crop fields and manure[3]. Ruminants contribute significantly more (5.7 Gt CO_2e yr^{-1}) to greenhouse gas emissions than monogastric livestock (1.4 Gt CO_2e yr^{-1}), and emissions due to cattle (4.6 Gt CO_2e yr^{-1}) are substantially higher than those from buffalo (0.6 Gt CO_2e yr^{-1}) or sheep and goats (0.5 Gt CO_2e yr^{-1})[3]. Globally, ruminants contribute 11.6% and cattle 9.4% of all greenhouse gas emissions from anthropogenic sources. The total area dedicated to grazing encompasses 26% of the terrestrial surface of the planet[4]. Livestock production accounts for 70% of global agricultural land and the area dedicated to feed-crop production represents 33% of total arable land[4]. The feeding of crops to livestock is in direct competition with producing crops for human consumption (food security) and climate mitigation (bioenergy production or carbon sequestration)[5].

Deforestation has been responsible for a significant proportion of global greenhouse gas emissions from the livestock sector and takes place mostly in tropical areas, where expansion of pasture and arable land for animal feed crops occurs primarily at the expense of native forests[4,6]. Lower demand for ruminant meat would therefore reduce a significant driver of tropical deforestation and associated burning and black carbon emissions. The accompanying reduction in grazing intensity could also allow regrowth of forests and other natural vegetation, resulting in additional carbon sequestration in both biomass and soils with beneficial climate feedbacks[5,6].

Lower global ruminant numbers would have simultaneous benefits for other systems and processes. For example, in some grassland and savannah ecosystems, domestic ruminant grazing contributes to land degradation through desertification and reduced soil organic carbon[4]. Ruminant agriculture can also have negative impacts on water quality and availability, hydrology and riparian ecosystems[4,7]. Ruminant production can erode biodiversity through a wide range of processes such as forest loss and degradation, land-use intensification, exotic plant invasions, soil erosion, persecution of large predators and competition with wildlife for resources[4–7].

Ruminant production also has implications for food security and human

Problems We've Encountered

Differing Estimates from Different Studies

Net vs. Gross Deforestation

Estimates of Degradation (selective logging, shifting cultivation, understory fires)

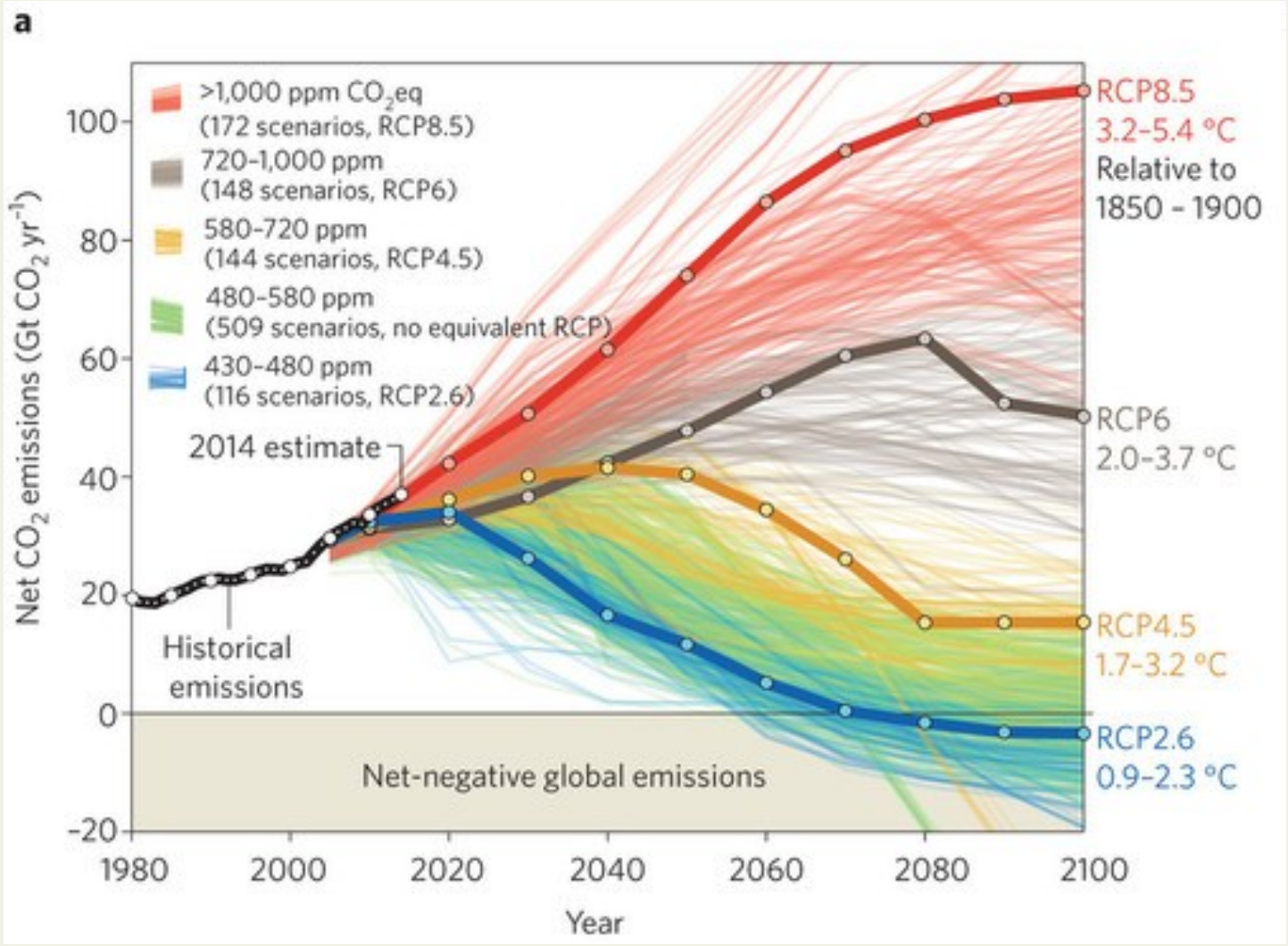
What/who are the Drivers?

Who is responsible (the end of the supply chain)?

How much carbon sequestration could come from natural reforestation?

Reforestation and Net Zero Global Emissions

Net Zero Emissions and why we need to get there (and beyond)

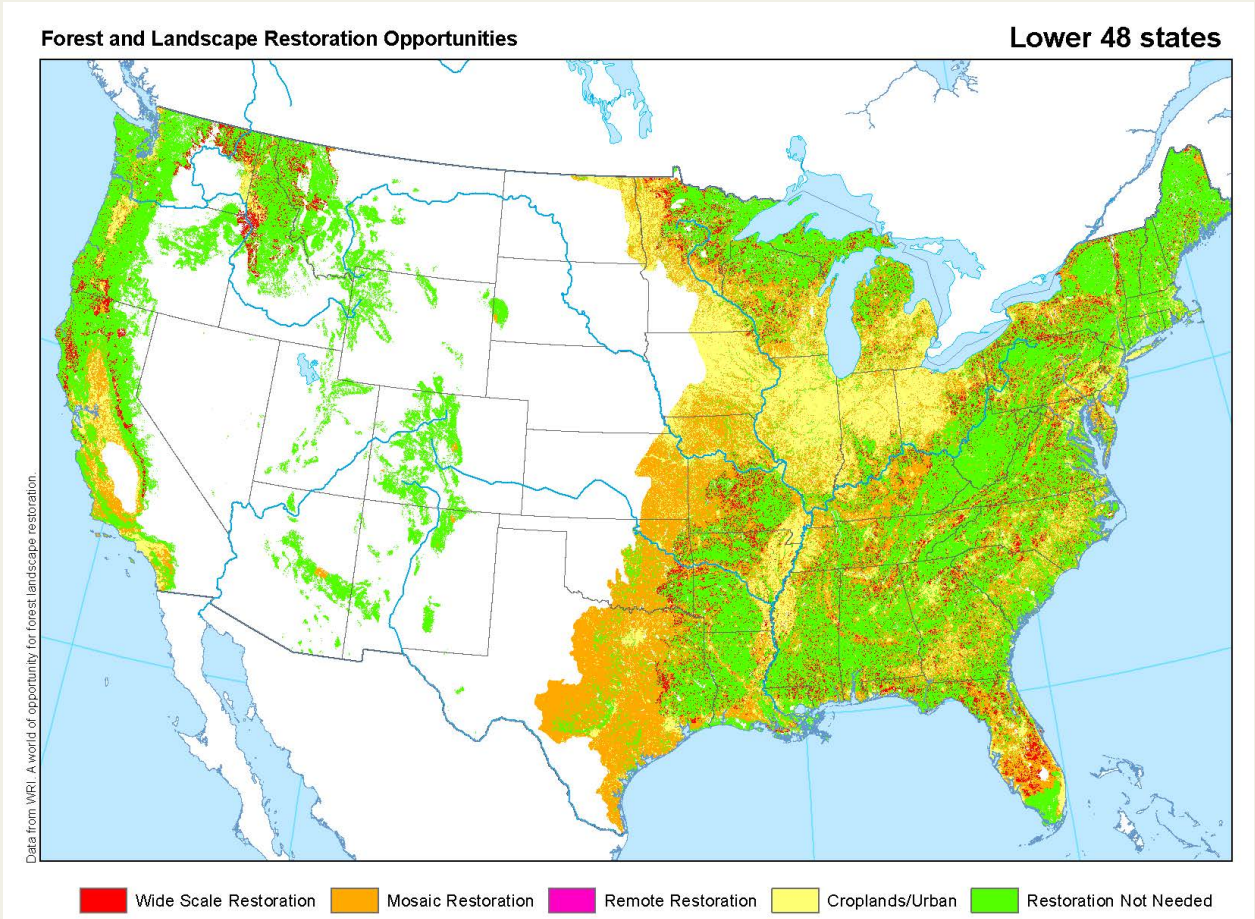


The Paris Agreement

Agreed to by nearly 200 countries at the climate change negotiations in December 2015

Its Article 4 expresses the long-term goal:

> "…to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century…"


Forest and Landscape Restoration Opportunities
Lower 48 states
Data from WRI A world of opportunity for forest landscape restoration.
Wide Scale Restoration
Mosaic Restoration
Remote Restoration
Croplands/Urban
Restoration Not Needed

Year 0

Year 7

Year 13

My current research question: How Good is Wood?

i.e.

How much could U.S. reforestation contribute to the goal of Net Zero U.S. Emissions by 2050?

My recent colleagues at the TFCI

Sharon Smith, Miriam Swaffer and Lael Goodman

Thank you!

Doug Boucher

Union of Concerned Scientists

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