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Guillaume Wright

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2013

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Quantifying the consensus on anthropogenic global warming in the scientific literature



John Cook Dana Nuccitelli, Sarah A Green, Mark Richardson, Bärbel Winkler, Rob Painting, Robert Way, Peter Jacobs and Andrew Skuce

Abstract

We analyze the evolution of the scientific consensus on anthropogenic global warming (AGW) in the peer-reviewed scientific literature, examining 11 944 climate abstracts from 1991–2011 matching the topics 'global climate change' or 'global warming'. We find that 66.4% of abstracts expressed no position on AGW, 32.6% endorsed AGW, 0.7% rejected AGW and 0.3% were uncertain about the cause of global warming. Among abstracts expressing a position on AGW, 97.1% endorsed the consensus position that humans are causing global warming. In a second phase of this study, we invited authors to rate their own papers. Compared to abstract ratings, a smaller percentage of self-rated papers expressed no position on AGW (35.5%). Among self-rated papers expressing a position on AGW, 97.2% endorsed the consensus. For both abstract ratings and authors' self-ratings, the percentage of endorsements among papers expressing a position on AGW marginally increased over time. Our analysis indicates that the number of papers rejecting the consensus on AGW is a vanishingly small proportion of the published research.

2013 *Environ. Res. Lett.* **8** 024024



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Scientists concur that man is causing climate change

environmentalresearchweb.org/cws/article/news/53448

Global premature mortality due to anthropogenic outdoor air pollution and the contribution of past climate change

Raquel A Silva, J Jason West, Yuqiang Zhang, Susan C Anenberg, Jean-François Lamarque, Drew T Shindell, William J Collins, Stig Dalsoren, Greg Faluvegi, Gerd Folberth, Larry W Horowitz, Tatsuya Nagashima, Vaishali Naik, Steven Rumbold, Ragnhild Skeie, Kengo Sudo, Toshihiko Takemura, Daniel Bergmann, Philip Cameron-Smith, Irene Cionni, Ruth M Doherty, Veronika Eyring, Beatrice Josse, I A MacKenzie, David Plummer, Mattia Righi, David S Stevenson, Sarah Strode, Sophie Szopa and Guang Zeng

Abstract

Increased concentrations of ozone and fine particulate matter (PM_{2.5}) since preindustrial times reflect increased emissions, but also contributions of past climate change. Here we use modeled concentrations from an ensemble of chemistry–climate models to estimate the global burden of anthropogenic outdoor air pollution on present-day premature human mortality, and the component of that burden attributable to past climate change. Using simulated concentrations for 2000 and 1850 and concentration–response functions (CRFs), we estimate that, at present, 470 000 (95% confidence interval, 140 000 to 900 000) premature respiratory deaths are associated globally and annually with anthropogenic ozone, and 2.1 (1.3 to 3.0) million deaths with anthropogenic PM_{2.5}-related cardiopulmonary diseases (93%) and lung cancer (7%). These estimates are smaller than ones from previous studies because we use modeled 1850 air pollution rather than a counterfactual low concentration, and because of different emissions. Uncertainty in CRFs contributes more to overall uncertainty than the spread of model results. Mortality attributed to the effects of past climate change on air quality is considerably smaller than the global burden: 1500 (–20 000 to 27 000) deaths yr^{–1} due to ozone and 2200 (–350 000 to 140 000) due to PM_{2.5}. The small multi-model means are coincidental, as there are larger ranges of results for individual models, reflected in the large uncertainties, with some models suggesting that past climate change has reduced air pollution mortality.

2013 *Environ. Res. Lett.* **8** 034005



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Climate change brings small rise in air pollution deaths
environmentalresearchweb.org/cws/article/news/54068

Historic and future increase in the global land area affected by monthly heat extremes

Dim Coumou and Alexander Robinson

Abstract

Climatic warming of about 0.5 °C in the global mean since the 1970s has strongly increased the occurrence-probability of heat extremes on monthly to seasonal time scales. For the 21st century, climate models predict more substantial warming. Here we show that the multi-model mean of the CMIP5 (Coupled Model Intercomparison Project) climate models accurately reproduces the evolution over time and spatial patterns of the historically observed increase in monthly heat extremes. For the near-term (i.e., by 2040),

the models predict a robust, several-fold increase in the frequency of such heat extremes, irrespective of the emission scenario. However, mitigation can strongly reduce the number of heat extremes by the second half of the 21st century. Unmitigated climate change causes most (>50%) continental regions to move to a new climatic regime with the coldest summer months by the end of the century substantially hotter than the hottest experienced today. We show that the land fraction experiencing extreme heat as a function of global mean temperature follows a simple cumulative distribution function, which depends only on natural variability and the level of spatial heterogeneity in the warming.

2013 *Environ. Res. Lett.* **8** 034018



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Heatwaves will become more common
environmentalresearchweb.org/cws/article/news/54334

Redefining agricultural yields: from tonnes to people nourished per hectare



Emily S Cassidy, Paul C West, James S Gerber and Jonathan A Foley

Abstract

Worldwide demand for crops is increasing rapidly due to global population growth, increased biofuel production, and changing dietary preferences. Meeting these growing demands will be a substantial challenge that will tax the capability of our food system and prompt calls to dramatically boost global crop production. However, to increase food availability, we may also consider how the world's crops are allocated to different uses and whether it is possible to feed more people with current levels of crop production. Of particular interest are the uses of crops as animal feed and as biofuel feedstocks. Currently, 36% of the calories produced by the world's crops are being used for animal feed, and only 12% of those feed calories ultimately contribute to the human diet (as meat and other animal products). Additionally, human-edible calories used for biofuel production increased fourfold between the years 2000 and 2010, from 1% to 4%, representing a net reduction of available food globally. In this study, we re-examine agricultural productivity, going from using the standard definition of yield (in tonnes per hectare, or similar units) to using the number of people actually fed per hectare of cropland. We find that, given the current mix of crop uses, growing food exclusively for direct human consumption could, in principle, increase available food calories by as much as 70%, which could feed an additional 4 billion people (more than the projected 2–3 billion people arriving through population growth). Even small shifts in our allocation of crops to animal feed and biofuels could significantly increase global food availability, and could be an instrumental tool in meeting the challenges of ensuring global food security.

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Medieval Irish chronicles reveal persistent volcanic forcing of severe winter cold events, 431–1649 CE

Francis Ludlow, Alexander R Stine, Paul Leahy, Enda Murphy, Paul A Mayewski, David Taylor, James Killen, Michael G L Baillie, Mark Hennessy and Gerard Kiely

Abstract

Explosive volcanism resulting in stratospheric injection of sulfate aerosol is a major driver of regional to global climatic variability on interannual and longer timescales. However, much of our knowledge of the climatic impact of volcanism derives from the limited number of eruptions that have occurred in the modern period during which meteorological instrumental records are available. We present a uniquely long historical record of severe short-term cold events from Irish chronicles, 431–1649 CE, and test the association between cold event occurrence and explosive volcanism. Thirty eight (79%) of 48 volcanic events identified in the sulfate deposition record of the Greenland Ice Sheet Project 2 ice-core correspond to 37 (54%) of 69 cold events in this 1219 year period. We show this association to be statistically significant at the 99.7% confidence level, revealing both the consistency of response to explosive volcanism for Ireland's climatically sensitive Northeast Atlantic location and the large proportional contribution of volcanism to historic cold event frequencies here. Our results expose, moreover, the extent to which volcanism has impacted winter-season climate for the region, and can help to further resolve the complex spatial patterns of Northern Hemisphere winter-season cooling versus warming after major eruptions.

2013 *Environ. Res. Lett.* **8** 024035



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Irish medieval manuscripts reveal volcano cooling
environmentalresearchweb.org/cws/article/news/53679

Future changes in atmospheric rivers and their implications for winter flooding in Britain

David A Lavers, Richard P Allan, Gabriele Villarini, Benjamin Lloyd-Hughes, David J Brayshaw and Andrew J Wade

Abstract

Within the warm conveyor belt of extra-tropical cyclones, atmospheric rivers (ARs) are the key synoptic features which deliver the majority of poleward water vapour transport, and are associated with episodes of heavy and prolonged rainfall. ARs are responsible for many of the largest winter floods in the mid-latitudes resulting in major socioeconomic losses; for example, the loss from United Kingdom (UK) flooding in summer/winter 2012 is estimated to be about \$1.6 billion in damages. Given the well-established link between ARs and peak river flows for the present day, assessing how ARs could respond under future climate projections is of importance in gauging future impacts from flooding. We show that North Atlantic ARs are projected to become stronger and more numerous in the future scenarios of multiple simulations from five state-of-the-art global climate models (GCMs) in the fifth Climate Model Intercomparison Project (CMIP5). The increased water vapour transport in projected ARs implies a greater risk of higher rainfall totals and therefore larger winter floods in Britain, with increased AR frequency leading to more flood episodes. In the high emissions scenario (RCP8.5) for 2074–2099 there is an approximate doubling of AR frequency in the five GCMs. Our results suggest that the projected change

in ARs is predominantly a thermodynamic response to warming resulting from anthropogenic radiative forcing.

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Atmospheric rivers set to increase UK winter flooding
environmentalresearchweb.org/cws/article/news/54233

Climate forcing growth rates: doubling down on our Faustian bargain

James Hansen, Pushker Kharecha and Makiko Sato

Abstract

Rahmstorf et al's (2012) conclusion that observed climate change is comparable to projections, and in some cases exceeds projections, allows further inferences if we can quantify changing climate forcings and compare those with projections. The largest climate forcing is caused by well-mixed long-lived greenhouse gases. Here we illustrate trends of these gases and their climate forcings, and we discuss implications. We focus on quantities that are accurately measured, and we include comparison with fixed scenarios, which helps reduce common misimpressions about how climate forcings are changing.

2013 *Environ. Res. Lett.* **8** 011006



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James Hansen on pacts with the devil
blog.environmentalresearchweb.org/2013/04/02/james-hansen-on-pacts-with-the/

Mariculture: significant and expanding cause of coastal nutrient enrichment



Lex Bouwman, Arthur Beusen, Patricia M Glibert, Ciska Overbeek, Marcin Pawlowski, Jorge Herrera, Sandor Mulsow, Rencheng Yu and Mingjiang Zhou

Abstract

Mariculture (marine aquaculture) generates nutrient waste either through the excretion by the reared organisms, or through direct enrichment by, or remineralization of, externally applied feed inputs. Importantly, the waste from fish or shellfish cannot easily be managed, as most is in dissolved form and released directly to the aquatic environment. The release of dissolved and particulate nutrients by intensive mariculture results in increasing nutrient loads (finfish and crustaceans), and changes in nutrient stoichiometry (all mariculture types). Based on different scenarios, we project that nutrients from mariculture will increase up to six fold by 2050 with exceedance of the nutrient assimilative capacity in parts of the world where mariculture growth is already rapid. Increasing nutrient loads and altered nutrient forms (increased availability of reduced relative to oxidized forms of nitrogen) and/or stoichiometric proportions (altered nitrogen:phosphorus ratios) may promote an increase in harmful algal blooms (HABs) either directly or via stimulation of algae on which mixotrophic HABs may feed. HABs can kill or intoxicate the mariculture product with severe economic losses, and can increase risks to human health.

2013 *Environ. Res. Lett.* **8** 044026



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Marine pollution by fish farms set to increase six-fold
environmentalresearchweb.org/cws/article/news/55505

Spatial decoupling of agricultural production and consumption: quantifying dependences of countries on food imports due to domestic land and water constraints

Marianela Fader, Dieter Gerten, Michael Krause, Wolfgang Lucht and Wolfgang Cramer

Abstract

In our globalizing world, the geographical locations of food production and consumption are becoming increasingly disconnected, which increases reliance on external resources and their trade. We quantified to what extent water and land constraints limit countries' capacities, at present and by 2050, to produce on their own territory the crop products that they currently import from other countries. Scenarios of increased crop productivity and water use, cropland expansion (excluding areas prioritized for other uses) and population change are accounted for. We found that currently 16% of the world population use the opportunities of international trade to cover their demand for agricultural products. Population change may strongly increase the number of people depending on ex situ land and water resources up to about 5.2 billion (51% of world population) in the SRES A2r scenario. International trade will thus have to intensify if population growth is not accompanied by dietary change towards less resource-intensive products, by cropland expansion, or by productivity improvements, mainly in Africa and the Middle East. Up to 1.3 billion people may be at risk of food insecurity in 2050 in present low-income economies (mainly in Africa), if their economic development does not allow them to afford productivity increases, cropland expansion and/or imports from other countries.

2013 *Environ. Res. Lett.* **8** 014046



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Over half world's population could depend on imported food by 2050
environmentalresearchweb.org/cws/article/news/53329

Asynchronous exposure to global warming: freshwater resources and terrestrial ecosystems

Dieter Gerten, Wolfgang Lucht, Sebastian Ostberg, Jens Heinke, Martin Kowarsch, Holger Kreft, Zbigniew W Kundzewicz, Johann Rastgooy, Rachel Warren and Hans Joachim Schellnhuber

Abstract

This modelling study demonstrates at what level of global mean temperature rise (ΔT_g) regions will be exposed to significant decreases of freshwater availability and changes to terrestrial ecosystems. Projections are based on a new, consistent set of 152 climate scenarios (eight ΔT_g trajectories reaching 1.5–5 °C above pre-industrial levels by 2100, each scaled with spatial patterns from 19 general circulation models). The results suggest that already at a ΔT_g of 2 °C and mainly in the subtropics, higher water scarcity would occur in >50% out of the 19 climate scenarios. Substantial biogeochemical and vegetation structural changes would also occur at 2 °C, but mainly in subpolar and semiarid ecosystems. Other regions would be affected at higher ΔT_g levels, with lower intensity or with lower confidence. In total, mean global warming levels of 2 °C, 3.5 °C and 5 °C are simulated to expose an additional 8%, 11% and 13% of the world population to new or aggravated water scarcity, respectively, with >50% confidence (while ~1.3 billion people already live in water-scarce regions). Concurrently, substantial habitat transformations would occur in biogeographic regions that contain 1% (in zones affected at 2 °C), 10%

(3.5 °C) and 74% (5 °C) of present endemism-weighted vascular plant species, respectively. The results suggest nonlinear growth of impacts along with ΔT_g and highlight regional disparities in impact magnitudes and critical ΔT_g levels.

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Water scarcity and biodiversity under threat as temperatures warm
environmentalresearchweb.org/cws/article/news/54636

The upper end of climate model temperature projections is inconsistent with past warming

Peter Stott, Peter Good, Gareth Jones, Nathan Gillett and Ed Hawkins

Abstract

Climate models predict a large range of possible future temperatures for a particular scenario of future emissions of greenhouse gases and other anthropogenic forcings of climate. Given that further warming in coming decades could threaten increasing risks of climatic disruption, it is important to determine whether model projections are consistent with temperature changes already observed. This can be achieved by quantifying the extent to which increases in well mixed greenhouse gases and changes in other anthropogenic and natural forcings have already altered temperature patterns around the globe. Here, for the first time, we combine multiple climate models into a single synthesized estimate of future warming rates consistent with past temperature changes. We show that the observed evolution of near-surface temperatures appears to indicate lower ranges (5–95%) for warming (0.35–0.82 K and 0.45–0.93 K by the 2020s (2020–9) relative to 1986–2005 under the RCP4.5 and 8.5 scenarios respectively) than the equivalent ranges projected by the CMIP5 climate models (0.48–1.00 K and 0.51–1.16 K respectively). Our results indicate that for each RCP the upper end of the range of CMIP5 climate model projections is inconsistent with past warming.

2013 *Environ. Res. Lett.* **8** 014024



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Highest rates of projected warming are unlikely
environmentalresearchweb.org/cws/article/news/53102

Cosmic rays, solar activity and the climate

T Sloan and A W Wolfendale

Abstract

Although it is generally believed that the increase in the mean global surface temperature since industrialization is caused by the increase in greenhouse gases in the atmosphere, some people cite solar activity, either directly or through its effect on cosmic rays, as an underestimated contributor to such global warming. In this letter a simplified version of the standard picture of the role of greenhouse gases in causing the global warming since industrialization is described. The conditions necessary for this picture to be wholly or partially wrong are then introduced. Evidence is presented from which the contributions of either cosmic rays or solar activity to this warming is deduced. The contribution is shown to be less than 10% of the warming seen in the twentieth century.

2013 *Environ. Res. Lett.* **8** 045022



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Solar activity not making large contribution to global warming
environmentalresearchweb.org/cws/article/news/55245

Estimation of regional air-quality damages from Marcellus Shale natural gas extraction in Pennsylvania



Aviva Litovitz, Aimee Curtright, Shmuel Abramzon, Nicholas Burger and Constantine Samaras

Abstract

This letter provides a first-order estimate of conventional air pollutant emissions, and the monetary value of the associated environmental and health damages, from the extraction of unconventional shale gas in Pennsylvania. Region-wide estimated damages ranged from \$7.2 to \$32 million dollars for 2011. The emissions from Pennsylvania shale gas extraction represented only a few per cent of total statewide emissions, and the resulting statewide damages were less than those estimated for each of the state's largest coal-based power plants. On the other hand, in counties where activities are concentrated, NO_x emissions from all shale gas activities were 20–40 times higher than allowable for a single minor source, despite the fact that individual new gas industry facilities generally fall below the major source threshold for NO_x . Most emissions are related to ongoing activities, i.e., gas production and compression, which can be expected to persist beyond initial development and which are largely unrelated to the unconventional nature of the resource. Regulatory agencies and the shale gas industry, in developing regulations and best practices, should consider air emissions from these long-term activities, especially if development occurs in more populated areas of the state where per-ton emissions damages are significantly higher.

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Insight: emissions from shale-gas extraction could be costly for environment
environmentalresearchweb.org/cws/article/news/52902

Are global wind power resource estimates overstated?



Amanda S Adams and David W Keith

Abstract

Estimates of the global wind power resource over land range from 56 to 400 TW. Most estimates have implicitly assumed that extraction of wind energy does not alter large-scale winds enough to significantly limit wind power production. Estimates that ignore the effect of wind turbine drag on local winds have assumed that wind power production of 2–4 W m^{-2} can be sustained over large areas. New results from a mesoscale model suggest that wind power production is limited to about 1 W m^{-2} at wind farm scales larger than about 100 km^2 . We find that the mesoscale model results are quantitatively consistent with results from global models that simulated the climate response to much larger wind power capacities. Wind resource estimates that ignore the effect of wind turbines in slowing large-scale winds may therefore substantially overestimate the wind power resource.

2013 *Environ. Res. Lett.* **8** 015021



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Scientists revise wind-power estimates downwards
environmentalresearchweb.org/cws/article/news/52522

A global fingerprint of macro-scale changes in urban structure from 1999 to 2009

Steve Frolking, Tom Milliman, Karen C Seto and Mark A Friedl

Abstract

Urban population now exceeds rural population globally, and 60–80% of global energy consumption by households, businesses, transportation, and industry occurs in urban areas. There is growing evidence that built-up infrastructure contributes to carbon emissions inertia, and that investments in infrastructure today have delayed climate cost in the future. Although the United Nations statistics include data on urban population by country and select urban agglomerations, there are no empirical data on built-up infrastructure for a large sample of cities. Here we present the first study to examine changes in the structure of the world's largest cities from 1999 to 2009. Combining data from two space-borne sensors—backscatter power (*PR*) from NASA's SeaWinds microwave scatterometer, and nighttime lights (*NL*) from NOAA's defense meteorological satellite program/operational linescan system (DMSP/OLS)—we report large increases in built-up infrastructure stock worldwide and show that cities are expanding both outward and upward. Our results reveal previously undocumented recent and rapid changes in urban areas worldwide that reflect pronounced shifts in the form and structure of cities. Increases in built-up infrastructure are highest in East Asian cities, with Chinese cities rapidly expanding their material infrastructure stock in both height and extent. In contrast, Indian cities are primarily building out and not increasing in verticality. This new dataset will help characterize the structure and form of cities, and ultimately improve our understanding of how cities affect regional-to-global energy use and greenhouse gas emissions.

2013 *Environ. Res. Lett.* **8** 024004



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Cities grow up and out as population booms
environmentalresearchweb.org/cws/article/news/53902

Electrical signature in polar night cloud base variations



R Giles Harrison and Maarten H P Ambaum

Abstract

Layer clouds are globally extensive. Their lower edges are charged negatively by the fair weather atmospheric electricity current flowing vertically through them. Using polar winter surface meteorological data from Sodankylä (Finland) and Halley (Antarctica), we find that when meteorological diurnal variations are weak, an appreciable diurnal cycle, on average, persists in the cloud base heights, detected using a laser ceilometer. The diurnal cloud base heights from both sites correlate more closely with the Carnegie curve of global atmospheric electricity than with local meteorological measurements. The cloud base sensitivities are indistinguishable between the northern and southern hemispheres, averaging a (4.0 ± 0.5) m rise for a 1% change in the fair weather electric current density. This suggests that the global fair weather current, which is affected by space weather, cosmic rays and the El Niño Southern Oscillation, is linked with layer cloud properties.

2013 *Environ. Res. Lett.* **8** 015027



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Atmospheric electricity affects cloud height
environmentalresearchweb.org/cws/article/news/52605

Influence of Arctic sea ice on European summer precipitation



JA Screen

Abstract

The six summers from 2007 to 2012 were all wetter than average over northern Europe. Although none of these individual events are unprecedented in historical records, the sequence of six consecutive wet summers is extraordinary. Composite analysis reveals that observed wet summer months in northern Europe tend to occur when the jet stream is displaced to the south of its climatological position, whereas dry summer months tend to occur when the jet stream is located further north. Highly similar mechanisms are shown to drive simulated precipitation anomalies in an atmospheric model. The model is used to explore the influence of Arctic sea ice on European summer climate, by prescribing different sea ice conditions, but holding other forcings constant. In the simulations, Arctic sea ice loss induces a southward shift of the summer jet stream over Europe and increased northern European precipitation. The simulated precipitation response is relatively small compared to year-to-year variability, but is statistically significant and closely resembles the spatial pattern of precipitation anomalies in recent summers. The results suggest a causal link between observed sea ice anomalies, large-scale atmospheric circulation and increased summer rainfall over northern Europe. Thus, diminished Arctic sea ice may have been a contributing driver of recent wet summers.

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Did melting Arctic sea ice cause wet summers?
environmentalresearchweb.org/cws/article/news/55156

Global climate targets and future consumption level: an evaluation of the required GHG intensity



Bastien Girod, Detlef Peter van Vuuren and Edgar G Hertwich

Abstract

Discussion and analysis on international climate policy often focuses on the rather abstract level of total national and regional greenhouse gas (GHG) emissions. At some point, however, emission reductions need to be translated to consumption level. In this article, we evaluate the implications of the strictest IPCC representative concentration pathway for key consumption categories (food, travel, shelter, goods, services). We use IPAT style identities to account for possible growth in global consumption levels and indicate the required change in GHG emission intensity for each category (i.e. GHG emission per calorie, person kilometer, square meter, kilogram, US dollar). The proposed concept provides guidance for product developers, consumers and policymakers. To reach the 2 °C climate target (2.1 tCO₂-eq. per capita in 2050), the GHG emission intensity of consumption has to be reduced by a factor of 5 in 2050. The climate targets on consumption level allow discussion of the feasibility of this climate target at product and consumption level. In most consumption categories products in line with this climate target are available. For animal food and air travel, reaching the GHG intensity targets

with product modifications alone will be challenging and therefore structural changes in consumption patterns might be needed. The concept opens up possibilities for further research on potential solutions on the consumption and product level to global climate mitigation.

2013 *Environ. Res. Lett.* **8** 014016



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Air travel and meat eating may not fit with 2° temperature target
environmentalresearchweb.org/cws/article/news/52798

Economic mitigation challenges: how further delay closes the door for achieving climate targets

Gunnar Luderer, Robert C Pietzcker, Christoph Bertram, Elmar Kriegler, Malte Meinshausen and Ottmar Edenhofer

Abstract

While the international community aims to limit global warming to below 2 °C to prevent dangerous climate change, little progress has been made towards a global climate agreement to implement the emissions reductions required to reach this target. We use an integrated energy–economy–climate modeling system to examine how a further delay of cooperative action and technology availability affect climate mitigation challenges. With comprehensive emissions reductions starting after 2015 and full technology availability we estimate that maximum 21st century warming may still be limited below 2 °C with a likely probability and at moderate economic impacts. Achievable temperature targets rise by up to ~0.4 °C if the implementation of comprehensive climate policies is delayed by another 15 years, chiefly because of transitional economic impacts. If carbon capture and storage (CCS) is unavailable, the lower limit of achievable targets rises by up to ~0.3 °C. Our results show that progress in international climate negotiations within this decade is imperative to keep the 2 °C target within reach.

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Delay 'closes the door' on meeting climate targets
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Pathways to achieve universal household access to modern energy by 2030



VIDEO
ABSTRACT

Shonali Pachauri, Bas J van Ruijven, Yu Nagai, Keywan Riahi,
Detlef P van Vuuren, Abeeku Brew-Hammond and Nebojsa Nakicenovic

Abstract

A lack of access to modern energy impacts health and welfare and impedes development for billions of people. Growing concern about these impacts has mobilized the international community to set new targets for universal modern energy access. However, analyses exploring pathways to achieve these targets and quantifying the potential costs and benefits are limited. Here, we use two modelling frameworks to analyse investments and consequences of achieving total rural electrification and universal access to clean-combusting cooking fuels and stoves by 2030. Our analysis indicates that these targets can be achieved with additional investment of US\$₂₀₀₅65–86 billion per year until 2030 combined with dedicated policies. Only a combination of policies that lowers costs for modern cooking fuels and stoves, along with more rapid electrification, can enable the realization of these goals. Our results demonstrate the critical importance of accounting for varying demands and affordability across heterogeneous household groups in both analysis and policy setting. While the investments required are significant, improved access to modern cooking fuels alone can avert between 0.6 and 1.8 million premature deaths annually in 2030 and enhance wellbeing substantially.

2013 *Environ. Res. Lett.* **8** 024015



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Bringing energy to all would cost 4% of current investment
environmentalresearchweb.org/cws/article/news/53309

Globalization's unexpected impact on soybean production in South America: linkages between preferences for non-genetically modified crops, eco-certifications, and land use



VIDEO
ABSTRACT

Rachael D Garrett, Ximena Rueda and Eric F Lambin

Abstract

The land use impacts of globalization and of increasing global food and fuel demand depend on the trade relationships that emerge between consuming and producing countries. In the case of soybean production, increasing trade between South American farmers and consumers in Asia and Europe has facilitated soybean expansion in the Amazon, Chaco, and Cerrado biomes. While these telecouplings have been well documented, there is little understanding of how quality preferences influence trade patterns and supply chains, incentivizing or discouraging particular land use practices. In this

study we provide empirical evidence that Brazil's continued production of non-genetically modified (GM) soybeans has increased its competitive advantage in European countries with preferences against GM foods. Brazil's strong trade relationship with European consumers has facilitated an upgrading of the soybean supply chain. Upgraded soybean supply chains create new conservation opportunities by allowing farmers to differentiate their products based on environmental quality in order to access premiums in niche markets in Europe. These interactions between GM preferences, trade flows, and supply chain structure help to explain why Brazilian soybean farmers have adopted environmental certification programs on a larger scale than Argentinian, Bolivian, Paraguayan, and Uruguayan soybean producers.

2013 *Environ. Res. Lett.* **8** 044055



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Is demand for non-GM soy boosting 'green agriculture' in the Amazon?
environmentalresearchweb.org/cws/article/news/55966

Historical trends in greenhouse gas emissions of the Alberta oil sands (1970–2010)

Jacob G Englander, Sharad Bharadwaj and Adam R Brandt

Abstract

There has been increased scrutiny of the Alberta oil sands due to their high carbon intensity (CI) relative to conventional crude oil. Relying entirely on public and peer-reviewed data sources, we examine historical trends in the CI of oil sands extraction, upgrading, and refining. Monthly data were collected and interpolated from 1970 to 2010 (inclusive) for each oil sands project. Results show a reduction in oil sands CI over time, with industry-average full-fuel cycle (well-to-wheels, WTW) CI declining from 165 gCO₂e MJ⁻¹ higher heating value (HHV) of reformulated gasoline (RFG) to 105 (–12, +9) gCO₂e MJ⁻¹ HHV RFG. 2010 averages by production pathways are 102 gCO₂e MJ⁻¹ for Mining and 111 gCO₂e MJ⁻¹ for *in situ*. The CI of mining-based projects has declined due to upgrader efficiency improvements and a shift away from coke to natural gas as a process fuel. *In situ* projects have benefitted from substantial reductions in fugitive emissions from bitumen batteries. Both mining and *in situ* projects have benefitted from improved refining efficiencies. However, despite these improvements, the CI of oil sands production (on a pathway-average basis) ranges from 12 to 24% higher than CI values from conventional oil production. Due to growing output, total emissions from the oil sands continue to increase despite improved efficiency: total upstream emissions were roughly 65 MtCO₂e in 2010, or 9% of Canada's emissions.

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The influence of political ideology on trust in science



Aaron M McCright, Katherine Dentzman, Meghan Charters and Thomas Dietz

Abstract

In recent years, some scholars, journalists, and science advocates have promoted broad claims that 'conservatives distrust science' or 'conservatives oppose science'. We argue that such claims may oversimplify in ways that lead to empirical inaccuracies. The Anti-Reflexivity Thesis suggests a more nuanced examination of how political ideology influences views about science. The Anti-Reflexivity Thesis hypothesizes that some sectors of society mobilize to defend the industrial capitalist order from the claims of environmentalists and some environmental scientists that the current economic system causes serious ecological and public health problems. The Anti-Reflexivity Thesis expects that conservatives will report significantly less trust in, and support for, science that identifies environmental and public health impacts of economic production (i.e., impact science) than liberals. It also expects that conservatives will report a similar or greater level of trust in, and support for, science that provides new inventions or innovations for economic production (i.e., production science) than liberals. Analyzing data from a recent survey experiment with 798 adults recruited from the US general public, our results confirm the expectations of the Anti-Reflexivity Thesis. Conservatives report less trust in impact scientists but greater trust in production scientists than their liberal counterparts. We argue that further work that increases the accuracy and depth of our understanding of the relationship between political ideology and views about science is likely crucial for addressing the politicized science-based issues of our age.

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Strategic incentives for climate geoengineering coalitions to exclude broad participation



Katharine L Ricke, Juan B Moreno-Cruz and Ken Caldeira

Abstract

Solar geoengineering is the deliberate reduction in the absorption of incoming solar radiation by the Earth's climate system with the aim of reducing impacts of anthropogenic climate change. Climate model simulations project a diversity of regional outcomes that vary with the amount of solar geoengineering deployed. It is unlikely that a single small actor could implement and sustain global-scale geoengineering that harms much of the world without intervention from harmed world powers. However, a sufficiently powerful international coalition might be able to deploy solar geoengineering. Here, we show that regional differences in climate outcomes create strategic incentives to form coalitions that are as small as possible, while still powerful enough to deploy solar geoengineering. The characteristics of coalitions to geoengineer climate are modeled using a 'global thermostat setting game' based on climate model

results. Coalition members have incentives to exclude non-members that would prevent implementation of solar geoengineering at a level that is optimal for the existing coalition. These incentives differ markedly from those that dominate international politics of greenhouse-gas emissions reduction, where the central challenge is to compel free riders to participate.

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Elevation gradient of successful plant traits for colonizing alpine summits under climate change

Magali Matteodo, Sonja Wipf, Veronika Stöckli, Christian Rixen and Pascal Vittoz

Abstract

Upward migration of plant species due to climate change has become evident in several European mountain ranges. It is still, however, unclear whether certain plant traits increase the probability that a species will colonize mountain summits or vanish, and whether these traits differ with elevation. Here, we used data from a repeat survey of the occurrence of plant species on 120 summits, ranging from 2449 to 3418 m asl, in south-eastern Switzerland to identify plant traits that increase the probability of colonization or extinction in the 20th century. Species numbers increased across all plant traits considered. With some traits, however, numbers increased proportionally more. The most successful colonizers seemed to prefer warmer temperatures and well-developed soils. They produced achene fruits and/or seeds with pappus appendages. Conversely, cushion plants and species with capsule fruits were less efficient as colonizers. Observed changes in traits along the elevation gradient mainly corresponded to the natural distribution of traits. Extinctions did not seem to be clearly related to any trait. Our study showed that plant traits varied along both temporal and elevational gradients. While seeds with pappus seemed to be advantageous for colonization, most of the trait changes also mirrored previous gradients of traits along elevation and hence illustrated the general upward migration of plant species. An understanding of the trait characteristics of colonizing species is crucial for predicting future changes in mountain vegetation under climate change.

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