

**6 octubre 2016 - 19.30 h**

Aula Magna de la UNED  
Blas Cabrera Felipe, s/n (antiguo Parador)

*Tertulia*  
**HABLEMOS** *de*  
*la* **BIOSFERA**

**Cambio climático y colapso civilizatorio:  
¿Hasta qué punto podría ser inminente?**

**Ferran Puig Vilar**

Ingeniero Superior de Telecomunicaciones  
(ETSET Barcelona, 1978)

Organiza:



Cabildo de Lanzarote



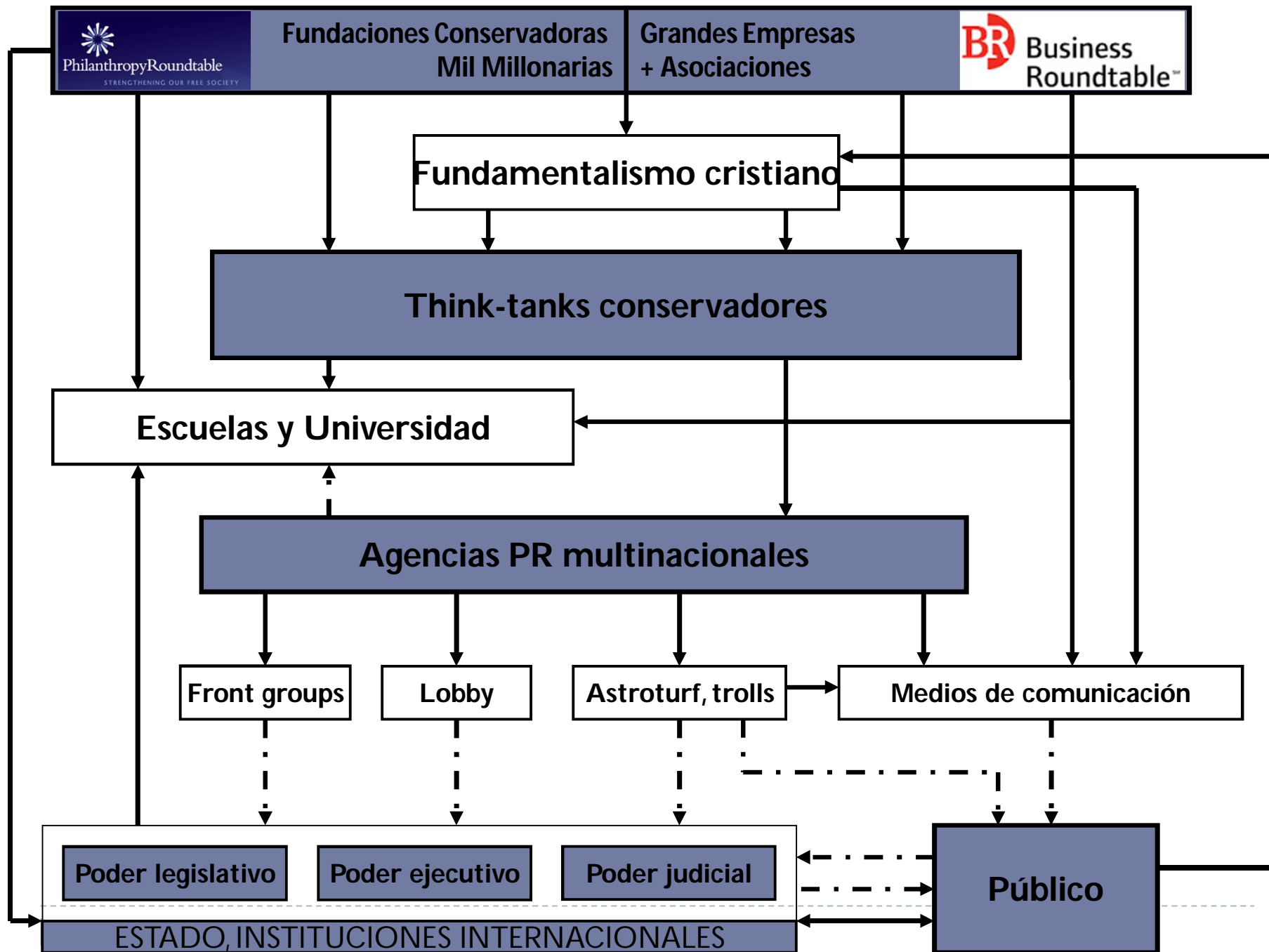
Oficina de la  
Reserva de la Biosfera

Estrategia  
**LANZAROTE**  
**2020**

Colabora:







## **Institutionalizing delay: foundation funding and the creation of U.S. climate change counter-movement organizations**

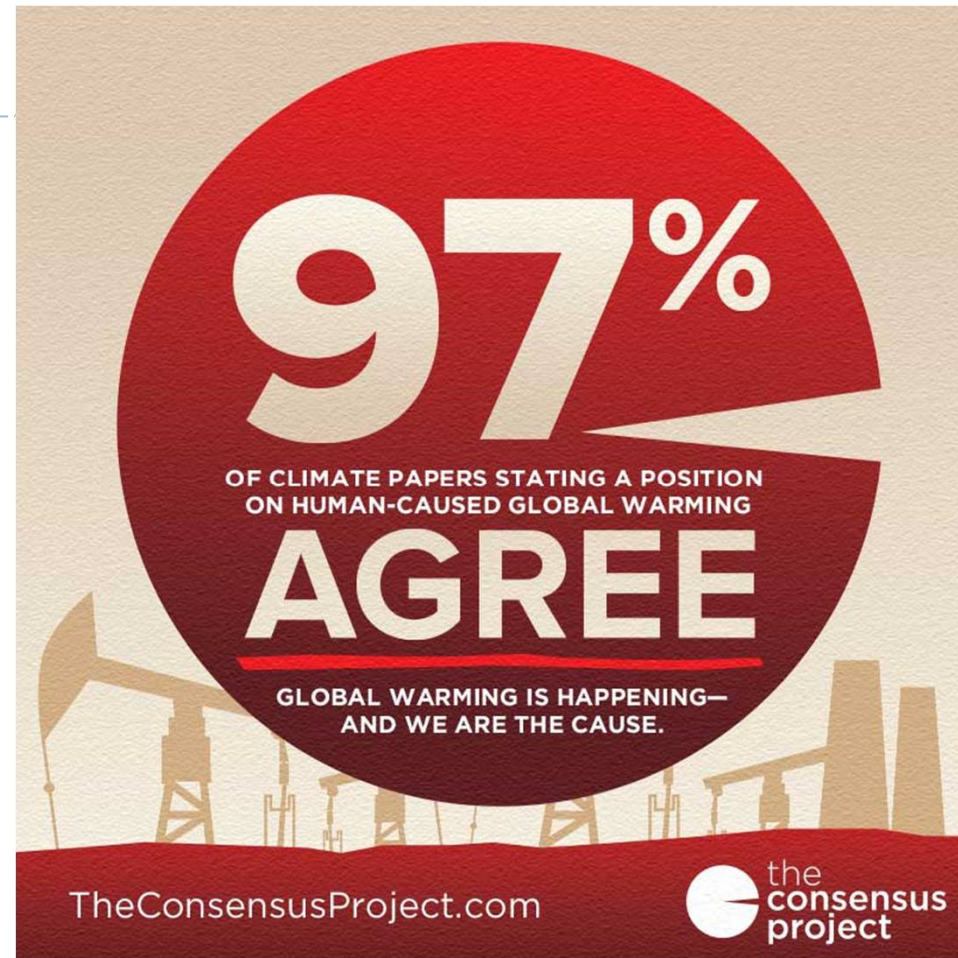
**Robert J. Brulle**

Received: 25 January 2013 / Accepted: 19 November 2013  
© Springer Science+Business Media Dordrecht 2013

**Abstract** This paper conducts an analysis of the financial resource mobilization of the organizations that make up the climate change counter-movement (CCCM) in the United States. Utilizing IRS data, total annual income is compiled for a sample of CCCM organizations (including advocacy organizations, think tanks, and trade associations). These data are coupled with IRS data on philanthropic foundation funding of these CCCM organizations contained in the Foundation Center's data base. This results in a data sample that contains financial information for the time period 2003 to 2010 on the annual income of 91 CCCM organizations funded by 140 different foundations. An examination of these data shows that these 91 CCCM organizations have an annual income of just over \$900 million, with an annual average of \$64 million in identifiable foundation support. The overwhelming majority of the philanthropic support comes from conservative foundations. Additionally, there is evidence of a trend toward concealing the sources of CCCM funding through the use of donor directed philanthropies.



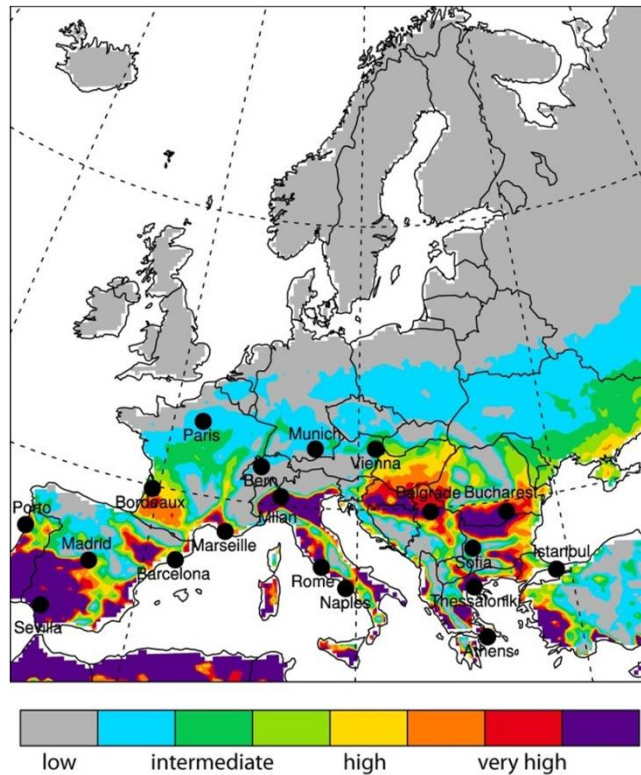




John Cook et al (2013) - Quantifying the consensus on anthropogenic global warming in the scientific literature -  
Environmental Research Letters 8 024024 doi:10.1088/1748-9326/8/2/024024 - Global Change Institute, University of  
Queensland + Skeptical Science + School of Psychology, University of Western Australia - [http://iopscience.iop.org/1748-9326/8/2/024024/pdf/1748-9326\\_8\\_2\\_024024.pdf](http://iopscience.iop.org/1748-9326/8/2/024024/pdf/1748-9326_8_2_024024.pdf) - 9 authors

# Olas de calor combinadas

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Días calurosos en verano con noches tropicales 2071-2100

E.M. Fischer and C. Schär (2010) - Consistent geographical patterns of changes in high-impact European heatwaves - Nature Geoscience 3:398-403 doi:10.1038/ngeo866 - Institute for Atmospheric and Climate Science, ETH Zurich; Climate and Global Dynamics Division, National Center for Atmospheric Research (NCAR)

## Climate migration in northwest Africa

Nigeria, Niger, Algeria and Morocco bear the brunt of this growing security challenge



Source: Center for American Progress (2012).



**DIRECTO**

Sigue aquí todas las reacciones y novedades de la crisis interna abierta en el PSOE

**DIRECTO**

La sonda Rosetta termina esta mañana su misión: la nave se estrellará contra un cometa

ENTREVISTA

# “La mayoría ya son refugiados medioambientales”

Sami Naïr, politólogo francés



Sami Naïr cree que la UE debería impulsar programas de desarrollo en los países de origen y tránsito de la inmigración (Llibert Teixidó)

**Lo + Visto**



Las 10 conductas de los padres que entorpecen la educación de los niños



Emotivo mensaje de Pelayo a su ex, David Delfín



A Isabel Pantoja le



Por qué debes cargar



# Previsiones de temperatura IPCC 5AR

Variable	Scenario	2046–2065		2081–2100	
		mean	likely range <sup>c</sup>	mean	likely range <sup>c</sup>
Global Mean Surface Temperature Change (°C) <sup>a</sup>	RCP2.6	1.0	0.4 to 1.6	1.0	0.3 to 1.7
	RCP4.5	1.4	0.9 to 2.0	1.8	1.1 to 2.6
	RCP6.0	1.3	0.8 to 1.8	2.2	1.4 to 3.1
	RCP8.5	2.0	1.4 to 2.6	3.7	2.6 to 4.8
Global Mean Sea Level Rise (m) <sup>b</sup>		mean	likely range <sup>d</sup>	mean	likely range <sup>d</sup>
	RCP2.6	0.24	0.17 to 0.32	0.40	0.26 to 0.55
	RCP4.5	0.26	0.19 to 0.33	0.47	0.32 to 0.63
	RCP6.0	0.25	0.18 to 0.32	0.48	0.33 to 0.63
	RCP8.5	0.30	0.22 to 0.38	0.63	0.45 to 0.82

IPCC Working Group I (2013) - 5th Assessment Report The Physical Science Basis - Summary for Policymakers - Intergovernmental Panel on Climate Change -

[http://www.climatechange2013.org/images/report/WG1AR5\\_SPM\\_FINAL.pdf](http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf)

# Amount and timing of permafrost carbon release in response to climate warming

By KEVIN SCHAEFER<sup>1\*</sup>, TINGJUN ZHANG<sup>1</sup>, LORI BRUHWILER<sup>2</sup> and ANDREW P. BARRETT<sup>1</sup>, <sup>1</sup>*National Snow and Ice Data Center, Cooperative Institute for Research in Environmental Sciences, University of Colorado at Boulder, Boulder, CO 80309, USA;* <sup>2</sup>*National Oceanic and Atmospheric Administration, Earth System Research Laboratory, Boulder, CO, USA*

(Manuscript received 31 December 2009; in final form 5 January 2011)

## ABSTRACT

The thaw and release of carbon currently frozen in permafrost will increase atmospheric CO<sub>2</sub> concentrations and amplify surface warming to initiate a positive permafrost carbon feedback (PCF) on climate. We use surface weather from three global climate models based on the moderate warming, A1B Intergovernmental Panel on Climate Change emissions scenario and the SiBCASA land surface model to estimate the strength and timing of the PCF and associated uncertainty. By 2200, we predict a 29–59% decrease in permafrost area and a 53–97 cm increase in active layer thickness. By 2200, the PCF strength in terms of cumulative permafrost carbon flux to the atmosphere is  $190 \pm 64$  Gt C. This estimate may be low because it does not account for amplified surface warming due to the PCF itself and excludes some discontinuous permafrost regions where SiBCASA did not simulate permafrost. We predict that the PCF will change the arctic from a carbon sink to a source after the mid-2020s and is strong enough to cancel 42–88% of the total global land sink. The thaw and decay of permafrost carbon is irreversible and accounting for the PCF will require larger reductions in fossil fuel emissions to reach a target atmospheric CO<sub>2</sub> concentration.

## Previsión «oficial» $\Delta$ temperatura

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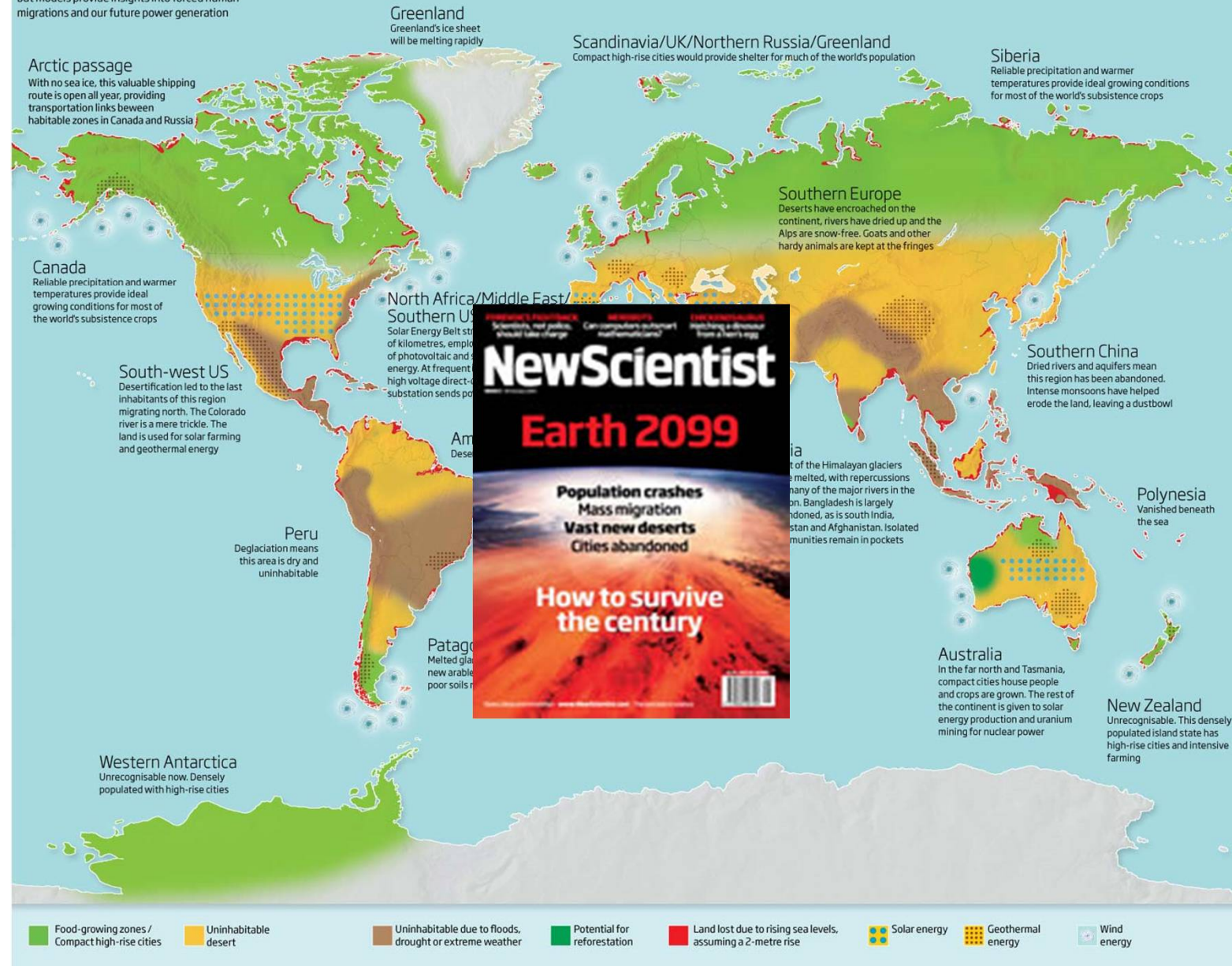
	$\Delta$ 2081-2100 (°C)	$\Sigma$
IPCC WGI 2013 RCP8.5	3,7	
DMS	0,7	4,4
Hidratos + Permafrost		
Extremos		
Otros lazos lentos		5,4
Cambio referencia	0,6	6,0





## The world: 4°C warmer

No one knows exactly what this world will look like, but models provide insights into forced human migrations and our future power generation



----- Gaia Vince (2009) - How to survive the coming century - New Scientist, Marzo 2009 - -----  
<http://www.newscientist.com/article/mg20126971.700-how-to-survive-the-coming-century.html>



Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	J-D	D-N	DJF	MAM	JJA	SON	Year
2001	43	45	57	52	58	54	61	48	55	51	70	55	54	52	40	56	54	59	2001
2002	75	76	91	58	65	53	61	55	65	57	59	43	63	64	68	71	56	60	2002
2003	73	55	57	55	62	48	55	66	66	75	54	75	62	59	57	58	56	65	2003
2004	58	70	64	62	42	42	26	44	53	65	72	53	54	56	68	56	38	63	2004
2005	73	59	68	69	64	66	65	62	78	79	75	68	69	68	61	67	64	77	2005
2006	57	69	63	50	46	64	54	71	64	68	72	76	63	62	65	53	63	68	2006
2007	96	70	70	75	67	58	62	60	64	59	57	49	66	68	81	71	60	60	2007
2008	24	36	72	53	50	48	60	44	65	66	66	54	53	53	36	59	51	66	2008
2009	61	53	53	60	65	65	71	66	70	65	77	65	64	63	56	59	67	71	2009
2010	73	79	92	87	75	64	61	65	61	71	79	48	71	73	72	84	63	70	2010
2011	51	53	64	64	53	58	74	73	56	66	57	54	60	60	51	60	68	60	2011
2012	46	49	57	68	76	62	57	63	76	78	75	53	63	63	50	67	60	76	2012
2013	68	56	66	53	61	65	59	66	78	69	81	67	66	64	59	60	63	76	2013
2014	74	52	78	78	86	66	57	82	90	86	68	79	75	74	64	81	68	81	2014
2015	82	87	91	74	78	78	72	78	81	107	101	110	86	84	83	81	76	96	2015
2016	115	132	128	108	93	80	85	98	***	***	***	***	***	***	119	110	88	***	2016
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	J-D	D-N	DJF	MAM	JJA	SON	Year

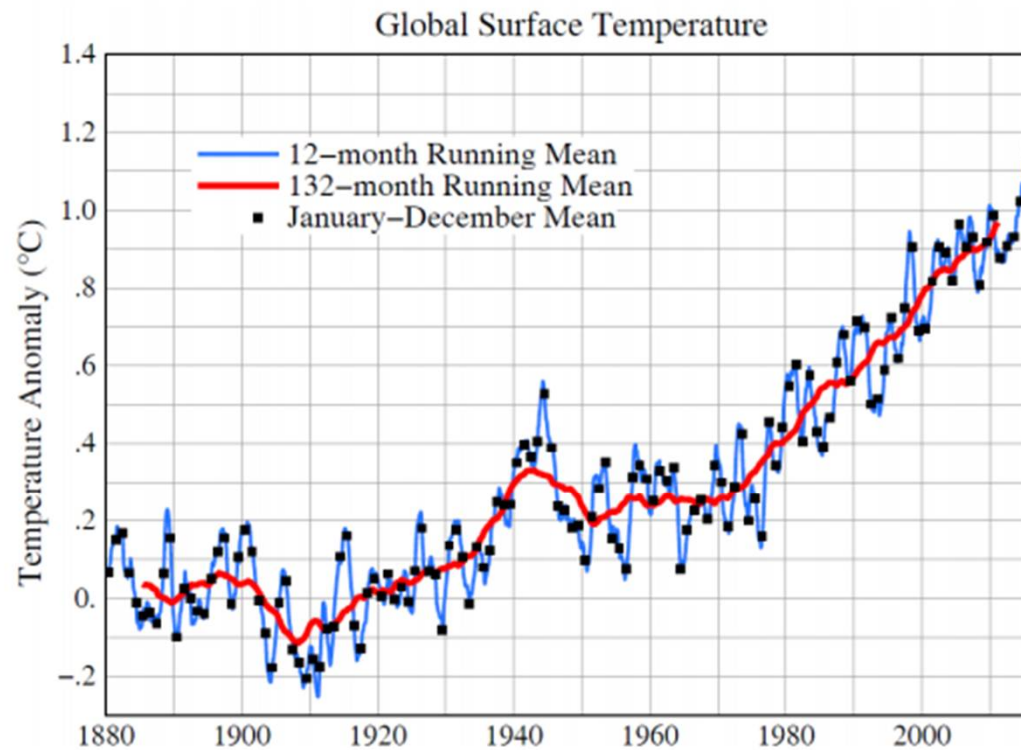
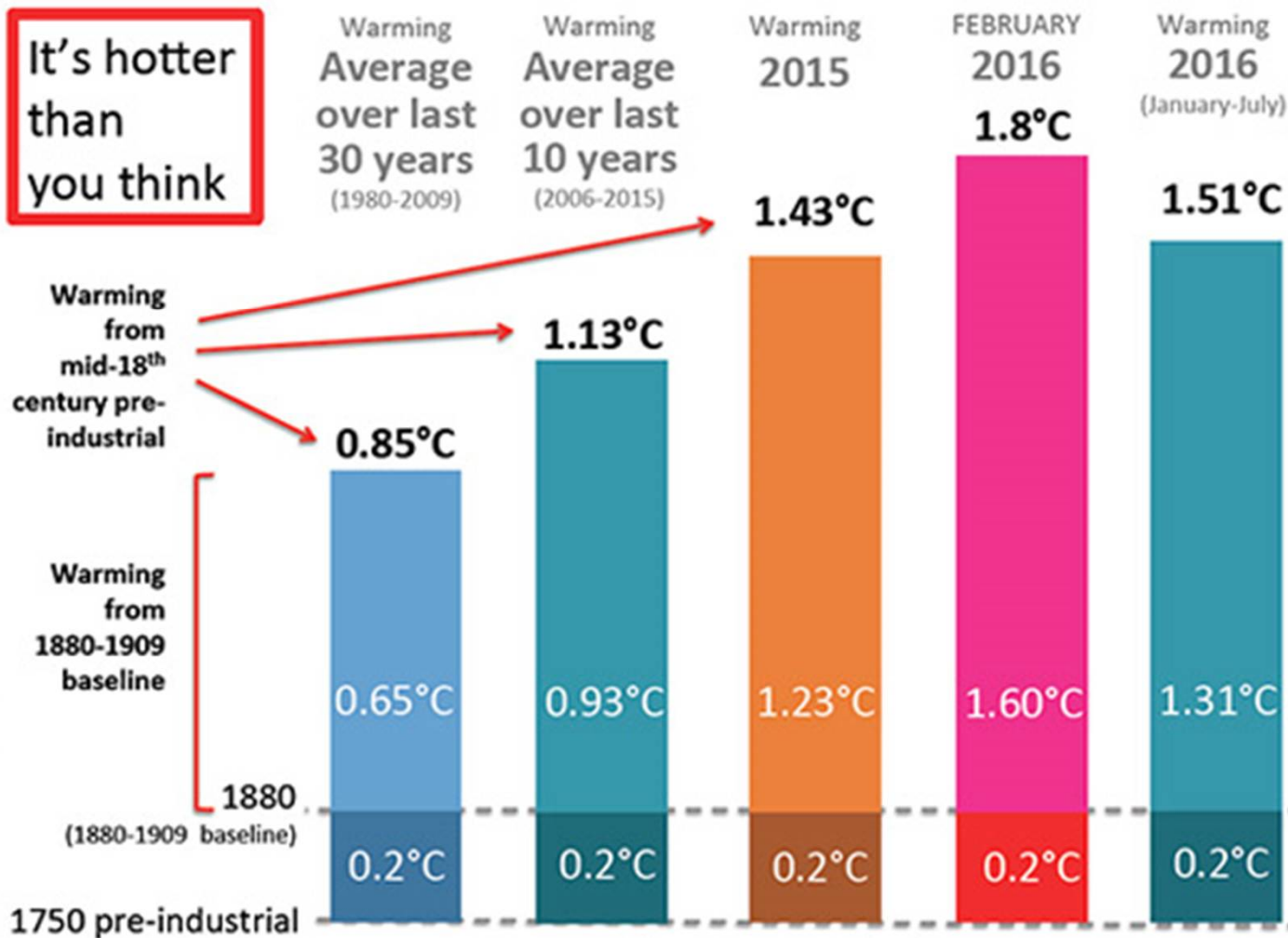


Fig. 1. Global surface temperature relative to 1880-1920 based on GISTEMP analysis (mostly NOAA data sources, as described by Hansen, J., R. Ruedy, M. Sato, and K. Lo, 2010: [Global surface temperature change. Rev. Geophys., 48, RG4004](#). We suggest in an upcoming paper that the temperature in 1940-45 is exaggerated because of data inhomogeneity in WW II. Linear-fit to temperature since 1970 yields present temperature of 1.06°C, which is perhaps our best estimate of warming since the preindustrial period.

**It's hotter  
than  
you think**



Data: Since 1880: NOAA data set. 1750-1880: Mann, Zhang et al, PNAS 105:14252-57; M. Manne pers. comm.



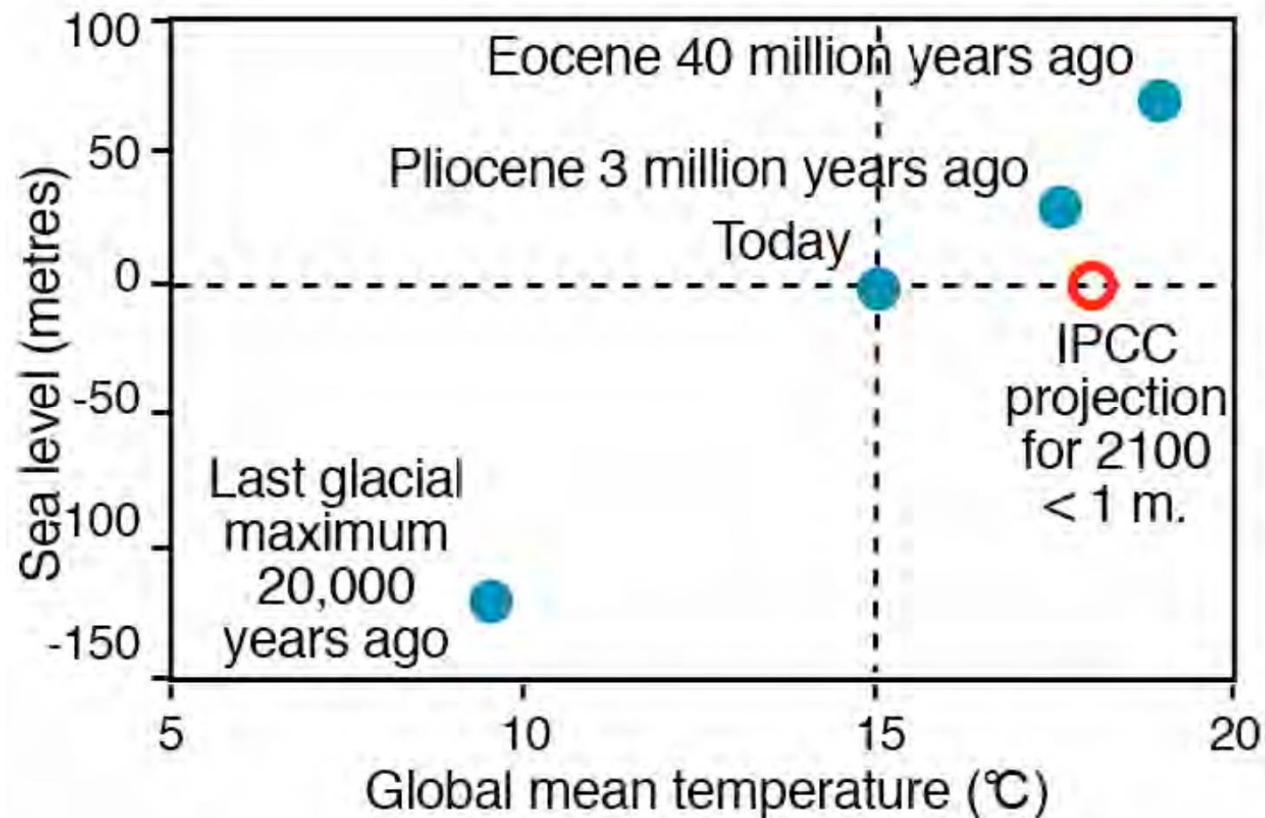


Alejandro Luísi



# El term-ómetro

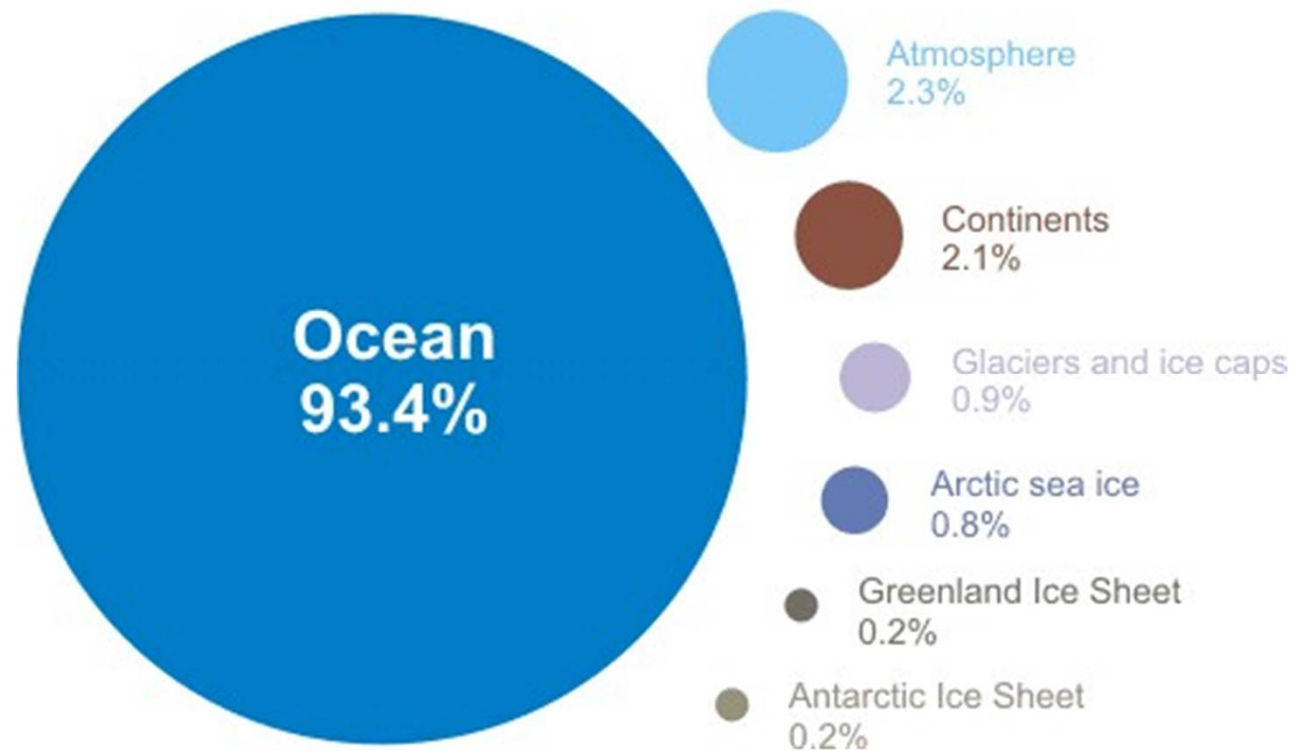
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David Archer (2006) - Global warming: Understanding the forecast - Blackwell Publishers: Oxford

# ¿Adónde va el calentamiento?

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Ocean Sci., 12, 925–935, 2016  
www.ocean-sci.net/12/925/2016/  
doi:10.5194/os-12-925-2016  
© Author(s) 2016. CC Attribution 3.0 License.



Ocean Science  Open Access

## Observed and simulated full-depth ocean heat-content changes for 1970–2005

Lijing Cheng<sup>1</sup>, Kevin E. Trenberth<sup>2</sup>, Matthew D. Palmer<sup>3</sup>, Jiang Zhu<sup>1</sup>, and John P. Abraham<sup>4</sup>

<sup>1</sup>International Center for Climate and Environment Sciences, Institute of Atmospheric Physics, Chinese Academy of Sciences, 100029, Beijing, China

<sup>2</sup>National Center for Atmospheric Research, Boulder, CO, USA

<sup>3</sup>Met Office Hadley Centre, FitzRoy Road, Exeter, EX1 3PB, UK

<sup>4</sup>School of Engineering, University of St. Thomas, St. Paul, MN, USA

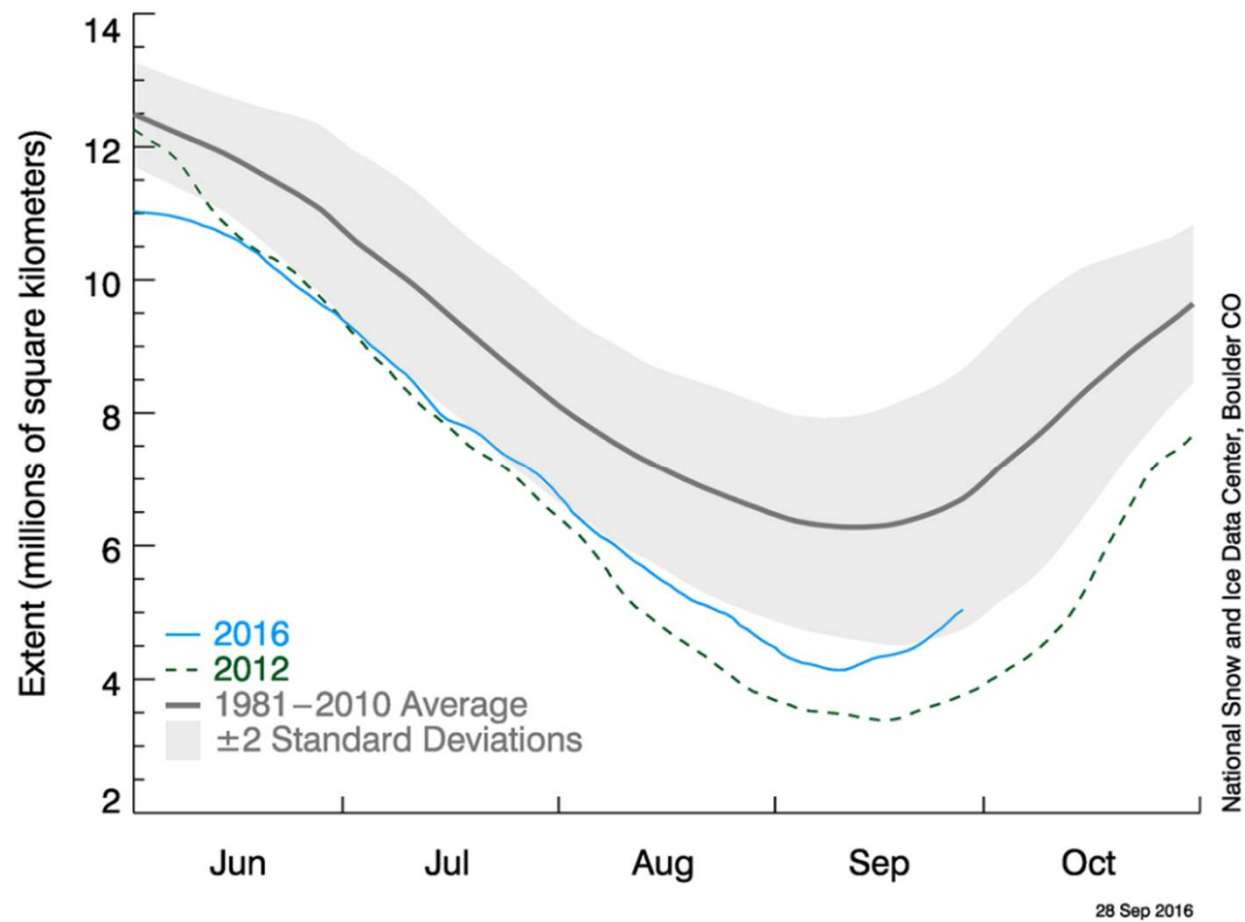
*Correspondence to:* John Abraham (jpabraham@stthomas.edu) and Lijing Cheng (chenglij@mail.iap.ac.cn)

Received: 4 April 2016 – Published in Ocean Sci. Discuss.: 8 April 2016

Revised: 7 June 2016 – Accepted: 9 July 2016 – Published: 26 July 2016

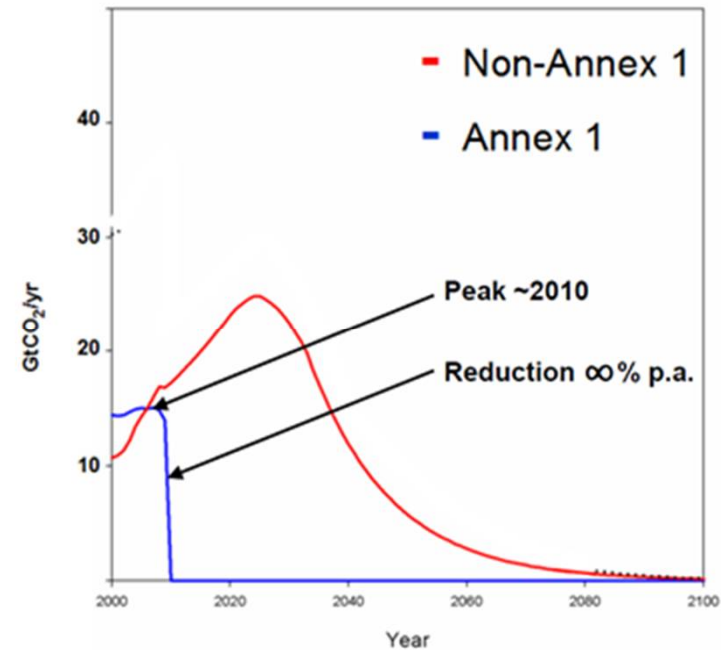
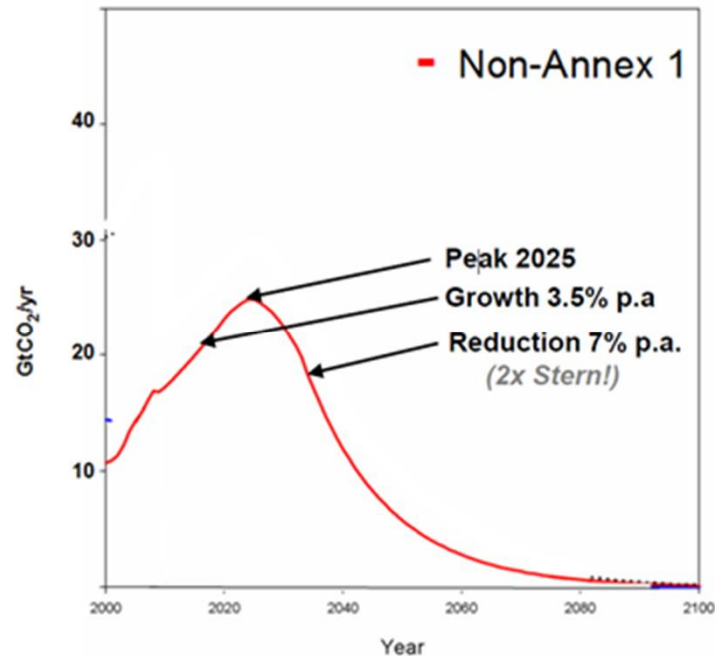


# Extensión de hielo Ártico



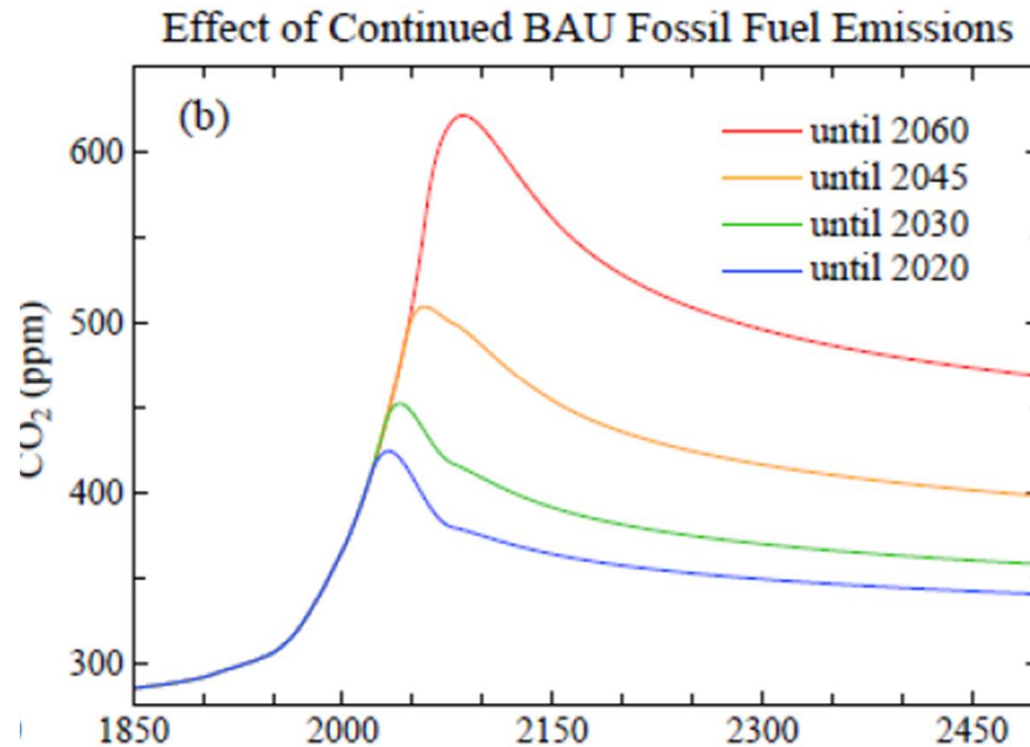


# ¿Solución?



Kevin Anderson and Alice Bows (2011) - Beyond 'dangerous' climate change: emission scenarios for a new world - Philosophical Transactions of the Royal Society of London A 369:20-44 doi:10.1098/rsta.2010.0290 - Tyndall Centre for Climate Change Research + School of Mechanical, Aerospace and Civil Engineering + School of Environmental Sciences and School of Development, University of East Anglia; Sustainable Consumption Institute, School of Earth, Atmospheric and Environmental Sciences, University of Manchester

# Continuación del BAU hasta...



James Hansen et al (2011) – The Case for Young People and Nature: A Path to a Healthy, Natural, Prosperous Future – Columbia University – 04/05/2011 – Columbia University Earth Institute, New York –  
[http://www.columbia.edu/~jeh1/mailings/2011/20110505\\_CaseForYoungPeople.pdf](http://www.columbia.edu/~jeh1/mailings/2011/20110505_CaseForYoungPeople.pdf) - 15 authors



SEPTEMBER 2016

# THE SKY'S LIMIT

WHY THE PARIS CLIMATE GOALS REQUIRE A  
MANAGED DECLINE OF FOSSIL FUEL PRODUCTION

**OILCHANGE**  
INTERNATIONAL

PUBLISHED IN COLLABORATION WITH

**350.org**

**AMAZON WATCH**

**APMDD**  
Association pour le Climat et le Développement

**aycc**  
Association pour le Climat et le Développement

**BOLD ALLIANCE**

**Christian aid**

**equiterre**

**equiterre**

**equiterre**

**equiterre**

**equiterre**

**IndyACT**

**RAMPART ACTION NETWORK**

**STAND**  
earth

En explotación ahora: 942 GtCO<sub>2</sub>

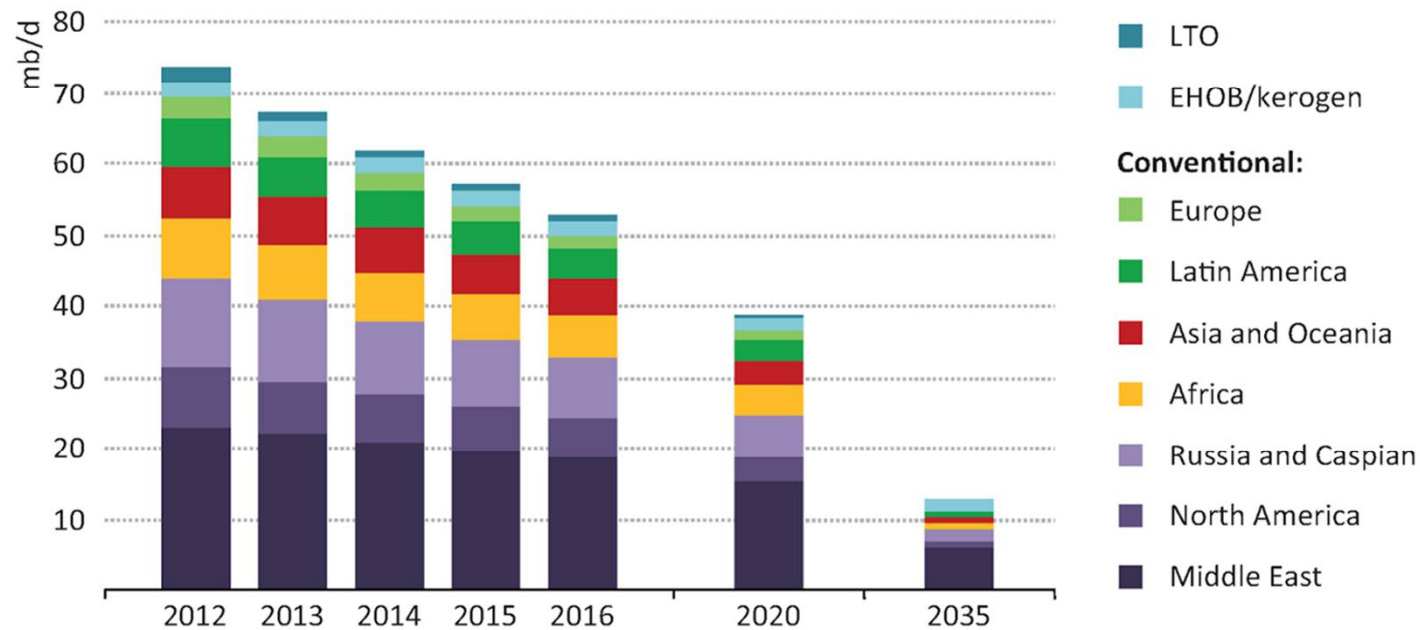
**2 °C: 800 GtCO<sub>2</sub>**

**1,5°C: 353 GtCO<sub>2</sub>**

**50%-50% !!**

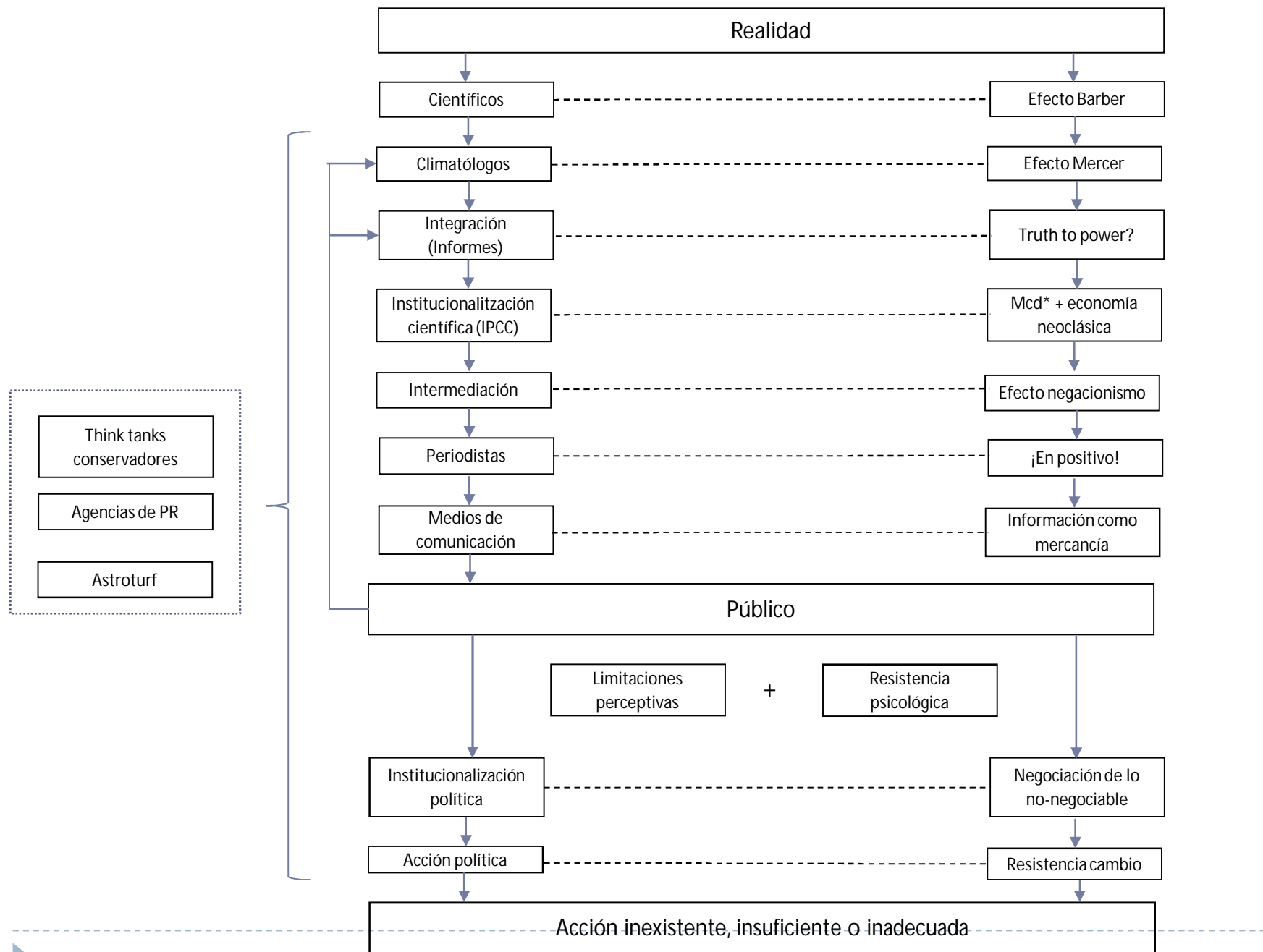
# Evolución producción estimada yacimientos en producción

**Figure 14.6** ▷ Production that would be observed from all currently producing fields in the absence of further investment (excluding NGLs)



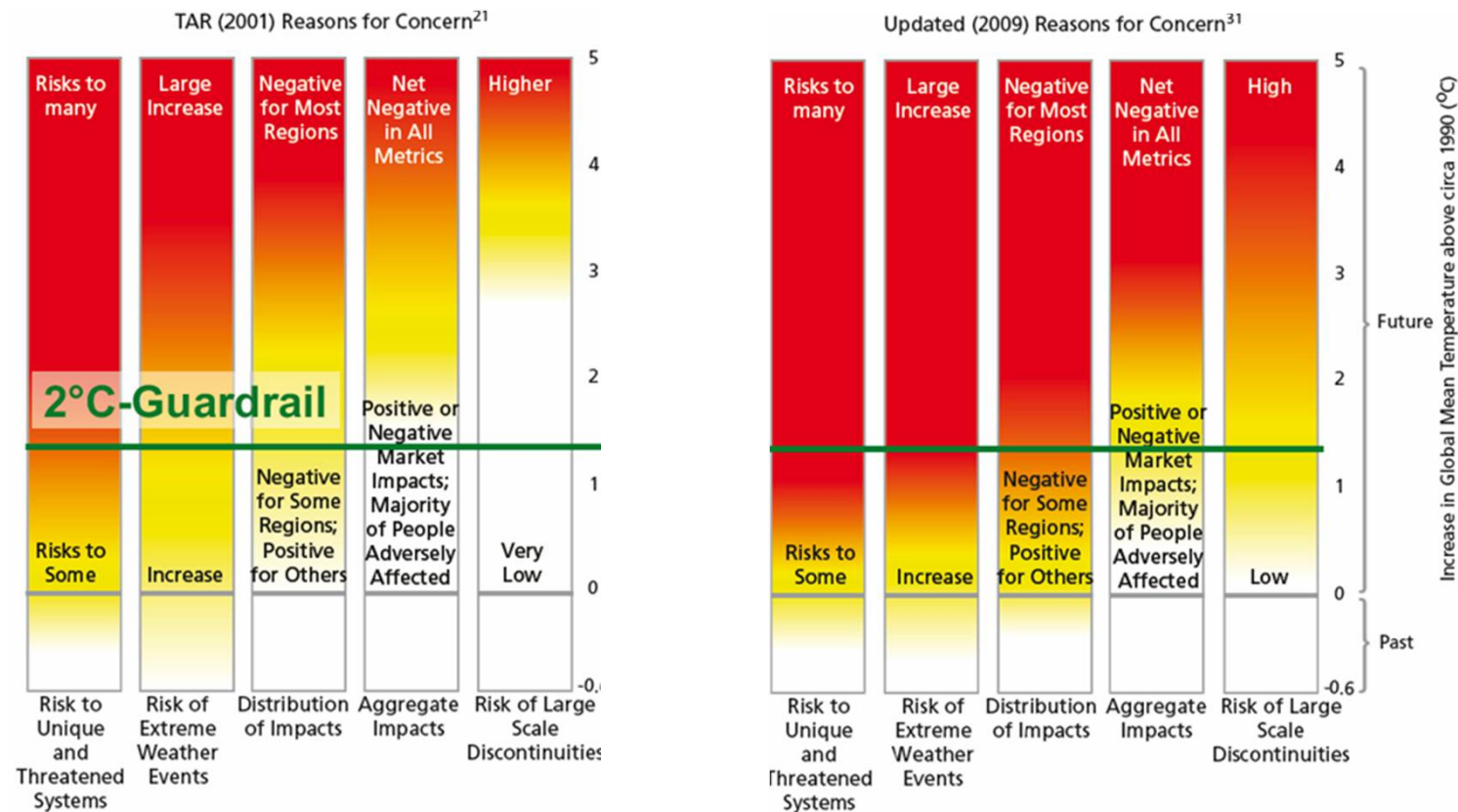
Note: EHOB = extra-heavy oil and bitumen.





\* Mínimo común denominador

# Son seguros + 2°C?



Joel B. Smith et al (2009) – Assessing dangerous climate change through an update of the Intergovernmental Panel on Climate Change (IPCC) ‘reasons for concern’ - Proceedings of the National Academy of Sciences PNAS 106:4133–4137 doi:10.1073/pnas.0812355106 – 15 autores



“Mi convivencia de larga duración con muchos colegas no me ofrece duda alguna: aunque trabajan con diligencia, a menudo con un telón de fondo de escepticismo organizado, muchos acaban censurando su propia investigación.”

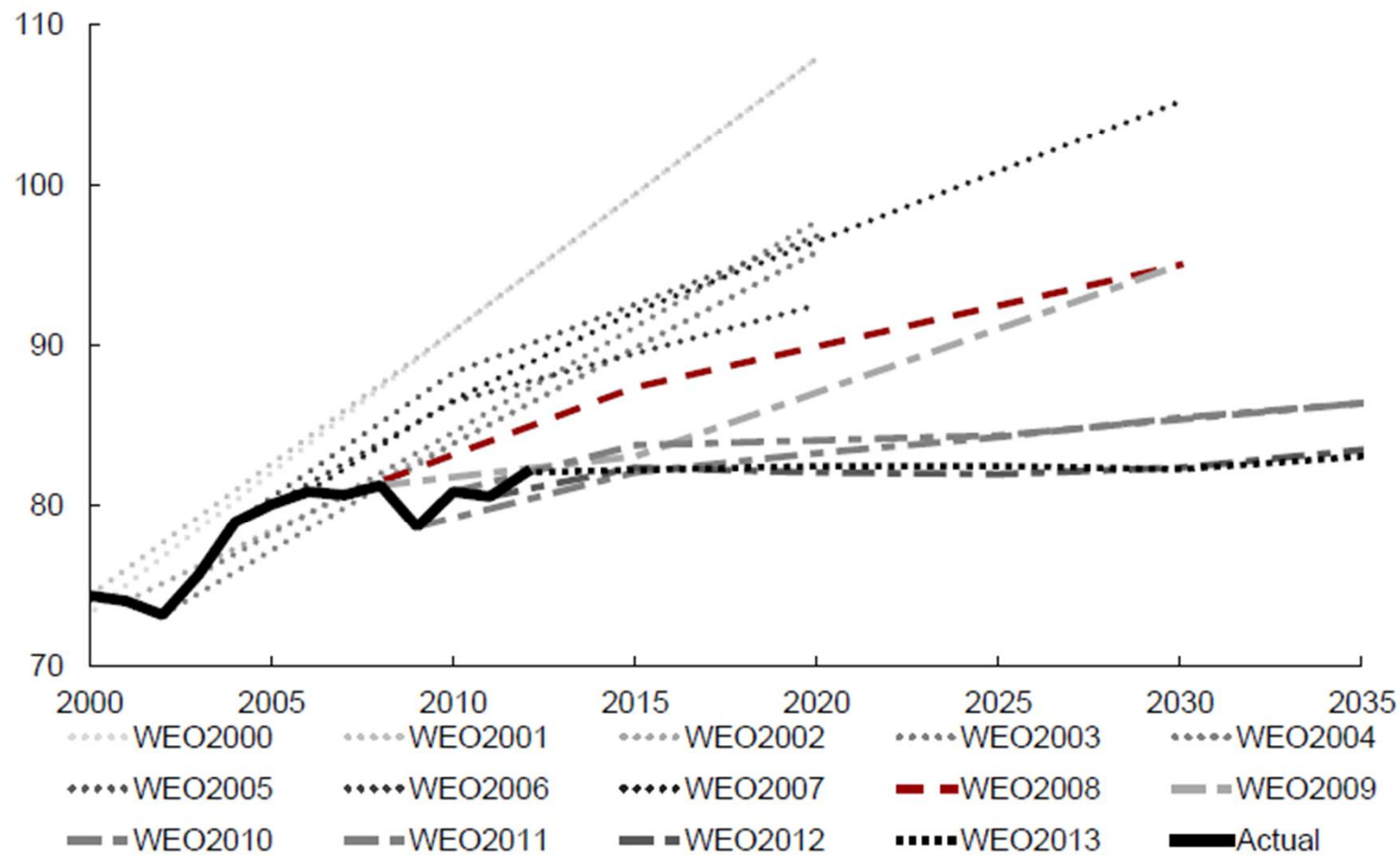
Kevin Anderson (2015) - Duality in climate science - Nature Geoscience 8:898–900 doi:10.1038/ngeo2559 – 12/10/2015 - Tyndall Centre for Climate Change Research, University of Manchester - <http://goo.gl/gbWEVD>





UPPSALA  
UNIVERSITET

# Conventional outlook



Sources: IEA World Energy Outlook 2000-2013





**Ecology Community**  
@PLOSEcology



 Follow

Good panel on "Reticent Researchers: Are we failing humanity!" #scicomm  
#climatechange #AGU15



# Dinámica de sistemas

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- ▶ Qué es un modelo
- ▶ Modelización bottom-up / top-down
  - ▶ Propiedades emergentes
- ▶ Contorno de un sistema
  - ▶ Bosque y árboles; mapa
  - ▶ Ciclo de vida

## Dinámica

Rápida, lenta

Comportamiento exponencial

Ciclos, retardos

Limitaciones perceptivas

Realimentación, interacción y causalidad mutua

Estados de equilibrio y margen de estabilidad

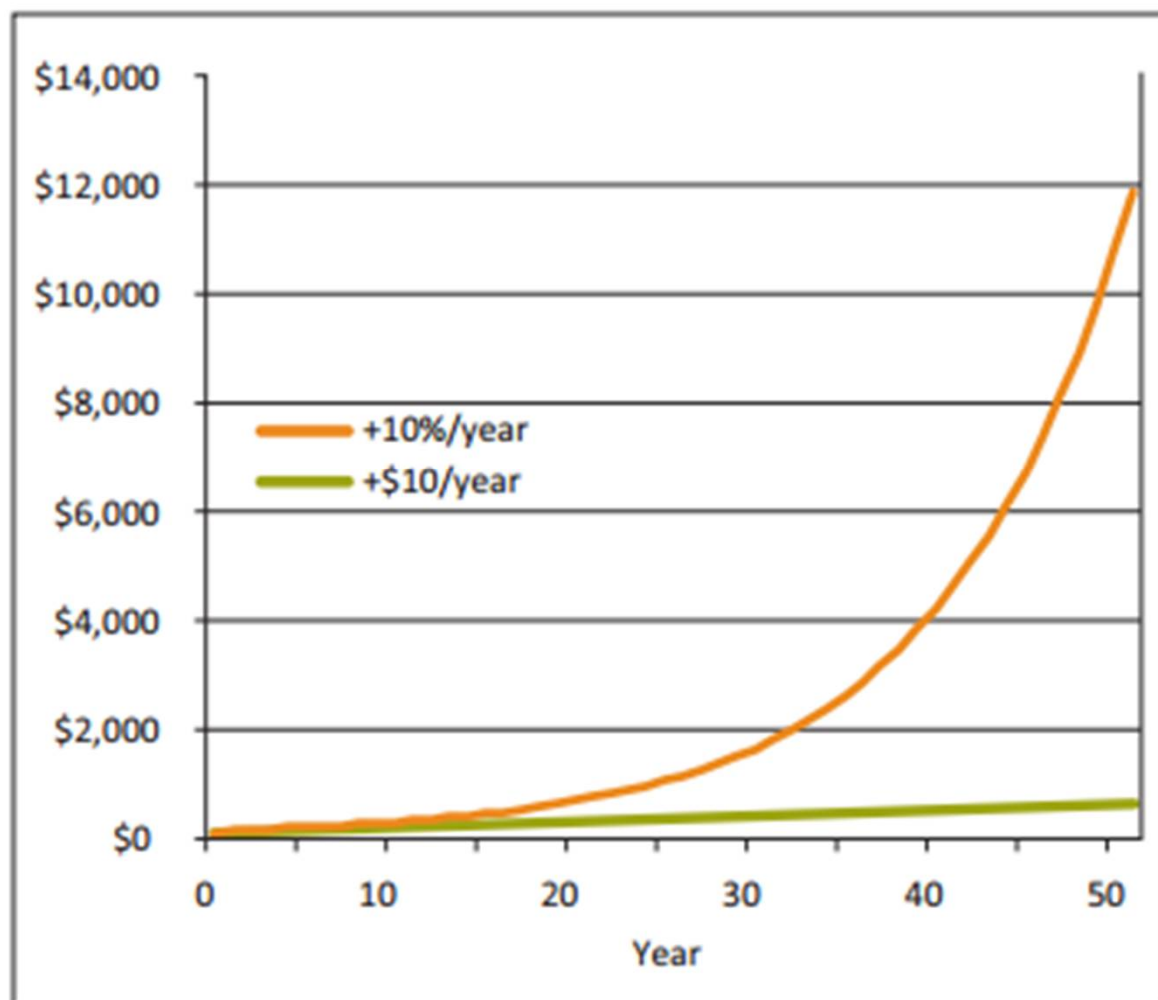
Controladores: geoingeniería...

Sistemas lineales y no lineales





### Exponential Growth Versus Arithmetic Growth

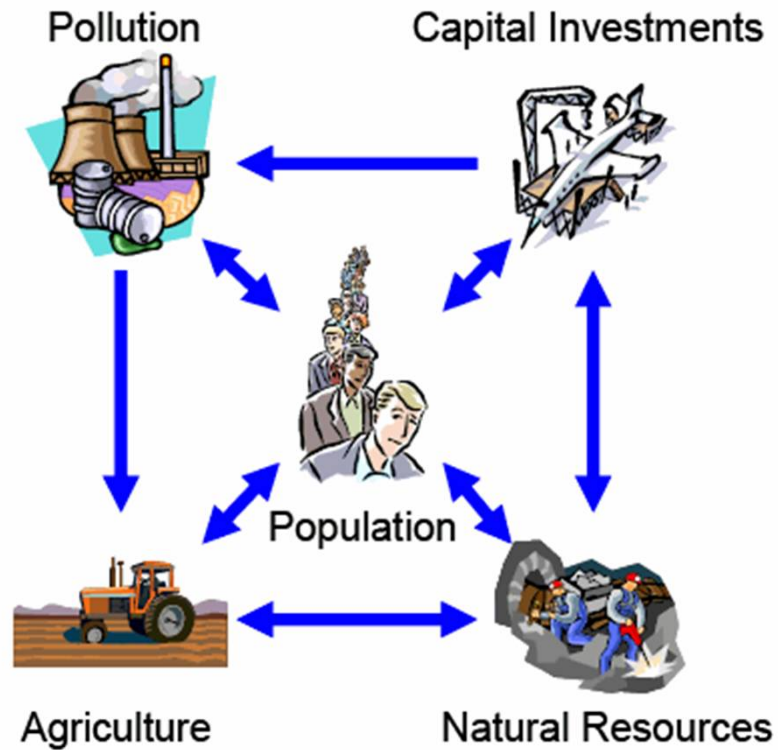




# Informe: Los límites del crecimiento

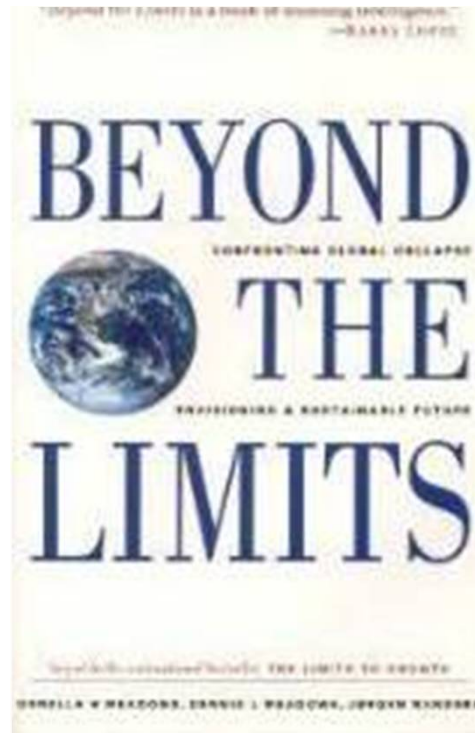
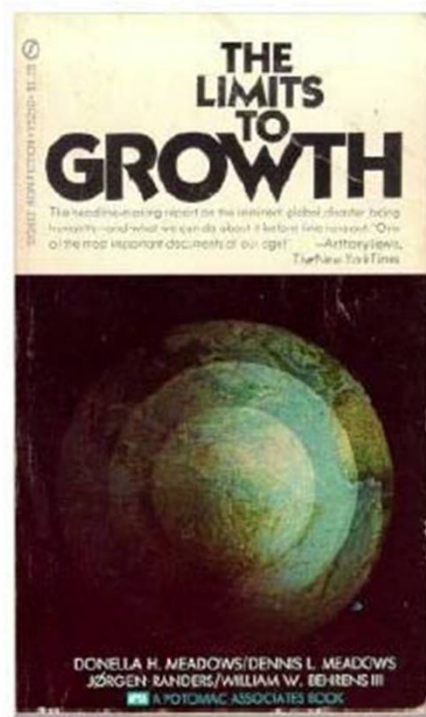
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Modelo World3

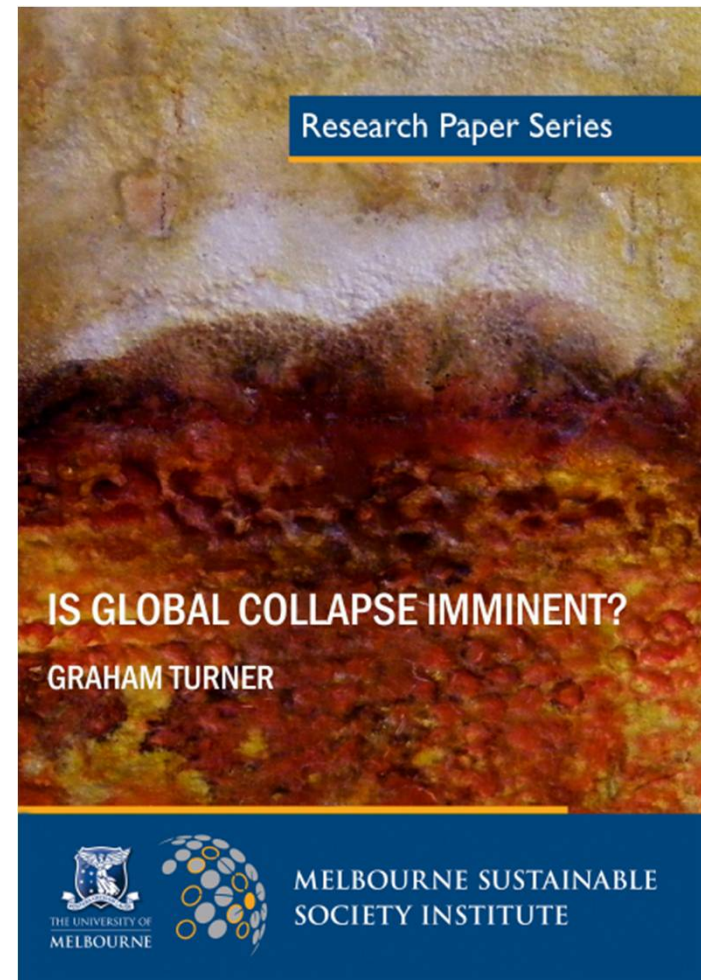
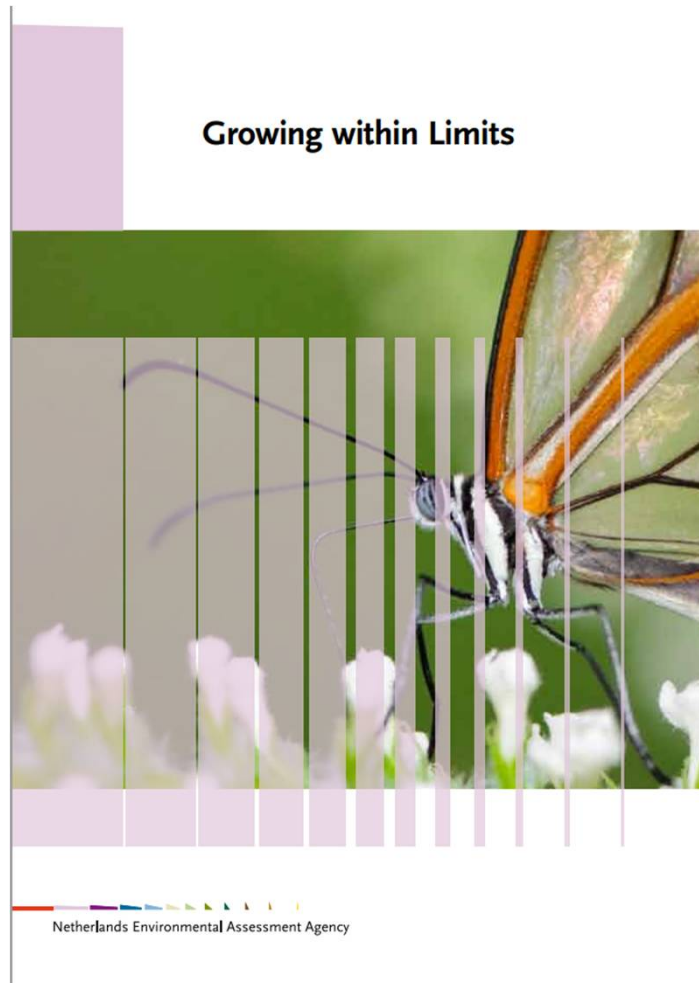


# Original y revisiones propias

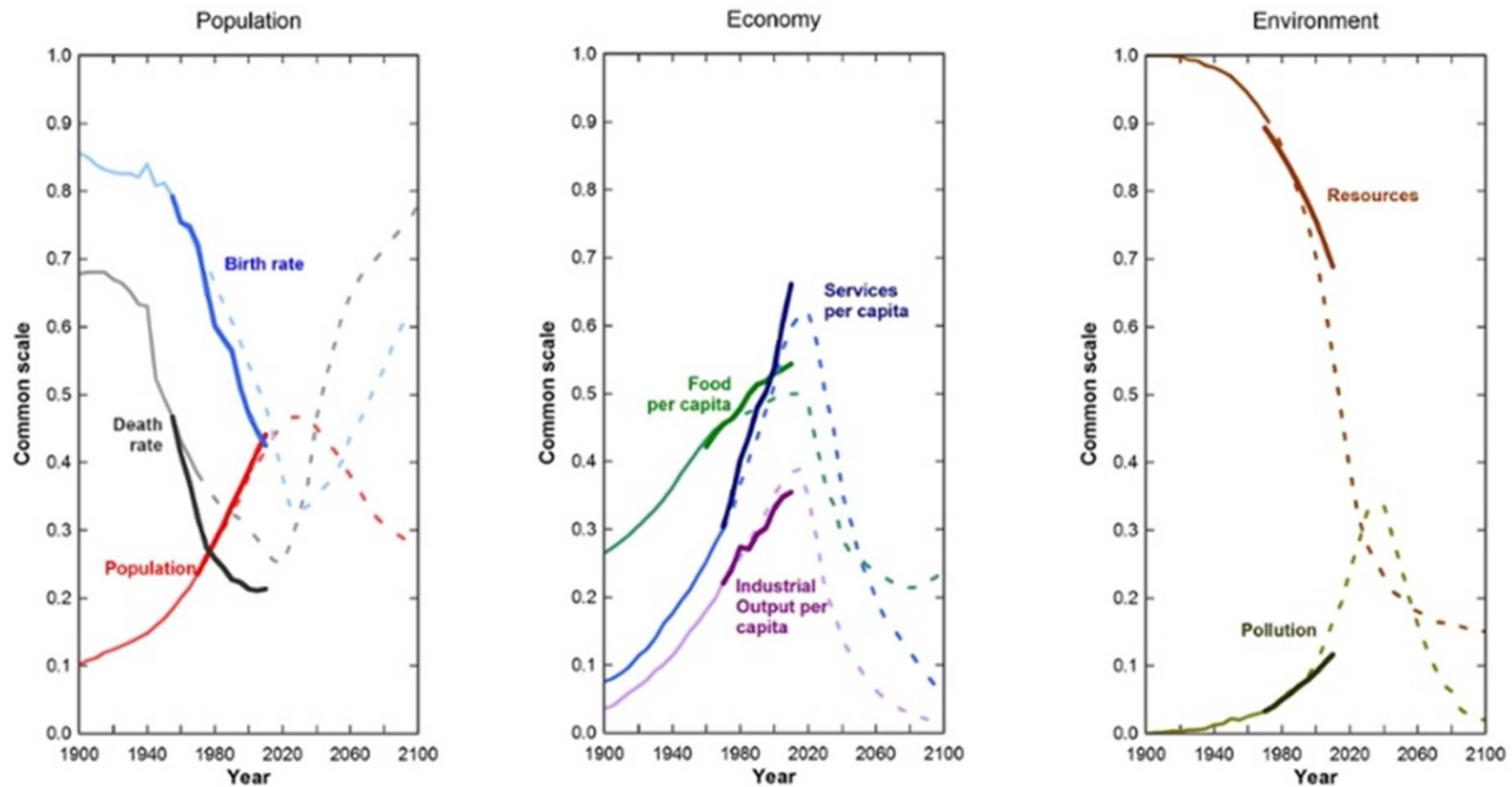
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# Revisiones externas

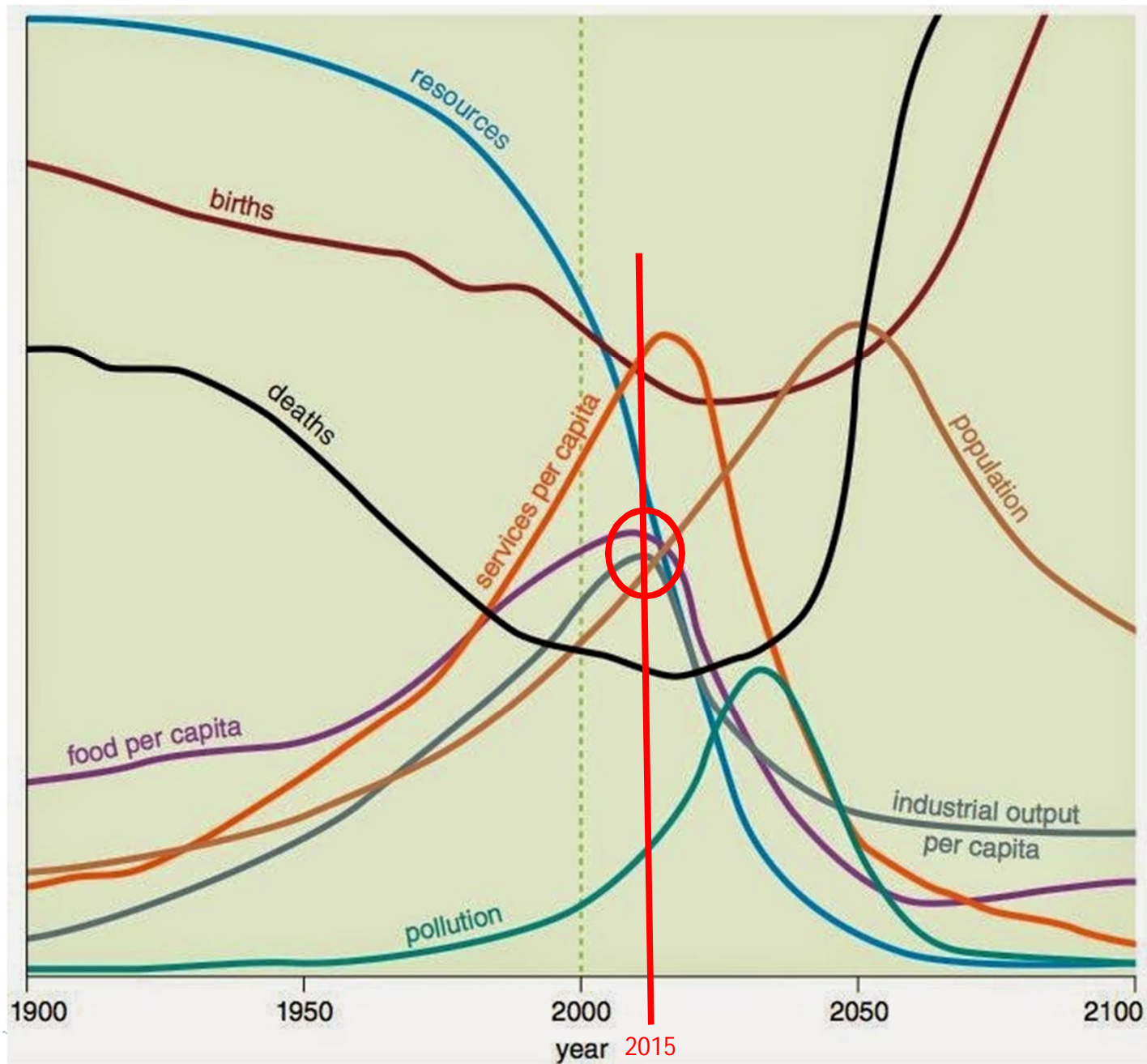


# Última revisión (agosto 2014)



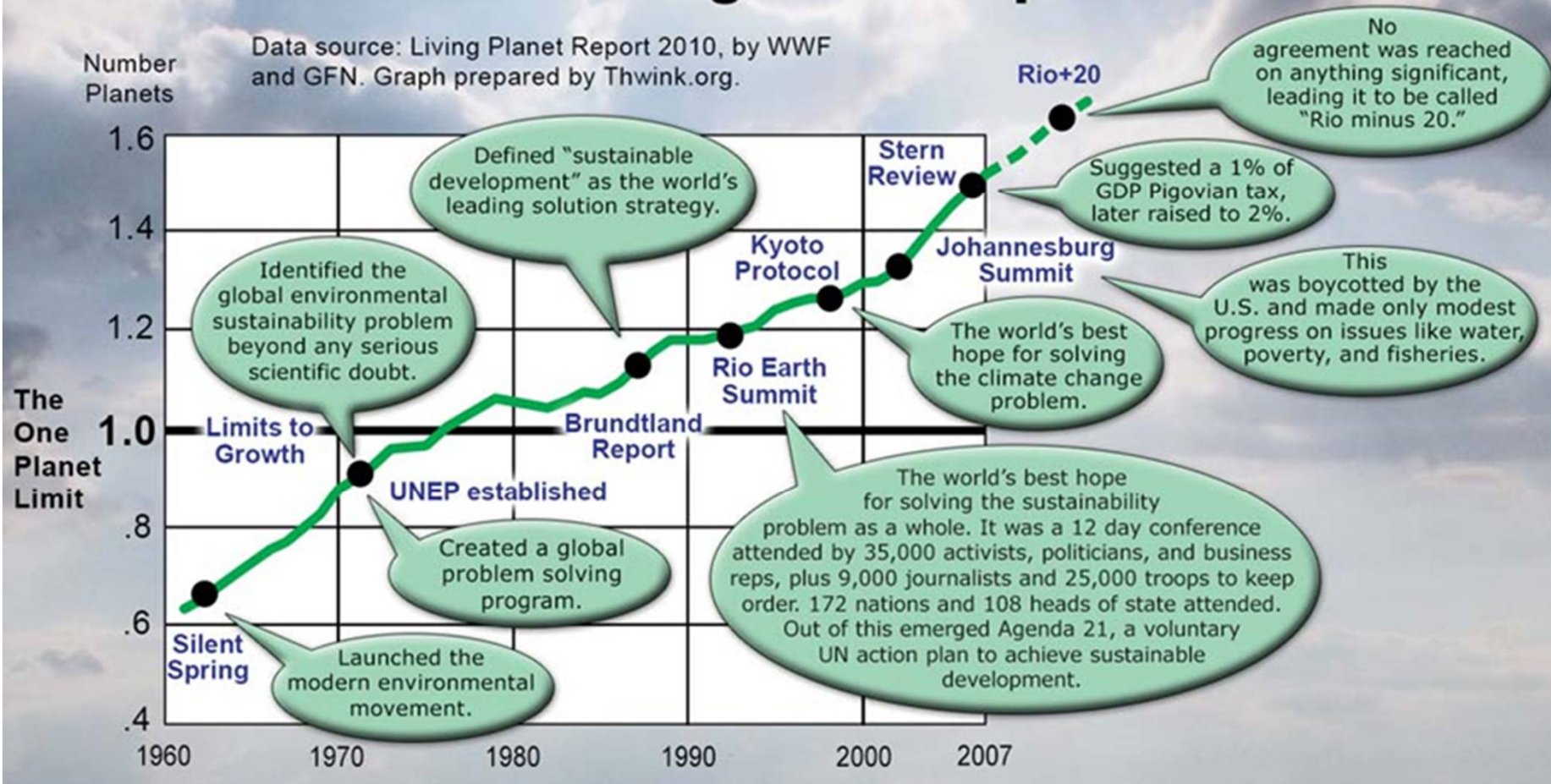
Graham Turner and Cathy Alexander - Limits to Growth was right. New research shows we're nearing collapse - The Guardian, 02/09/2014 - <http://www.theguardian.com/commentisfree/2014/sep/02/limits-to-growth-was-right-new-research-shows-were-nearing-collapse>





# The World's Ecological Footprint

Data source: Living Planet Report 2010, by WWF and GFN. Graph prepared by Thwink.org.



# La energía que cuesta tener energía

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Para obtener energía útil necesitamos antes emplear energía útil para acceder a los recursos primarios y convertirlos a una forma “usable”

TRE = Energía obtenida tras exploración, reunión y conversión / energía empleada en esos procesos

- ▶ TRE = 1,1:1 Bombear el petróleo, y contemplarlo
- ▶ TRE = 1,2:1 Refinarlo obteniendo diésel
- ▶ TRE = 1,3:1 Ubicar el diésel en la estación de servicio
- ▶ TRE = 3:1 Accionar un camión
- ▶ TRE = 5:1 Cargar un camión con alimentos y realizar entregas
- ▶ TRE = 8:1 Proporcionar una vivienda a los trabajadores del campo petrolífero, el conductor del camión y el agricultor
- ▶ TRE = 10:1 Disponer de una atención sanitaria mínima y algunos servicios educativos
- ▶ TRE = 20:1 Disponer de privilegios elementales: refrigerador, fogones, radio, TV. Tal vez un pequeño vehículo
- ▶ TRE > 30:1 Estilo de vida próspero

Y/o energía extra para lidiar con los problemas ecológicos e invertir en seguridad energética futura





# La energía que cuesta tener energía



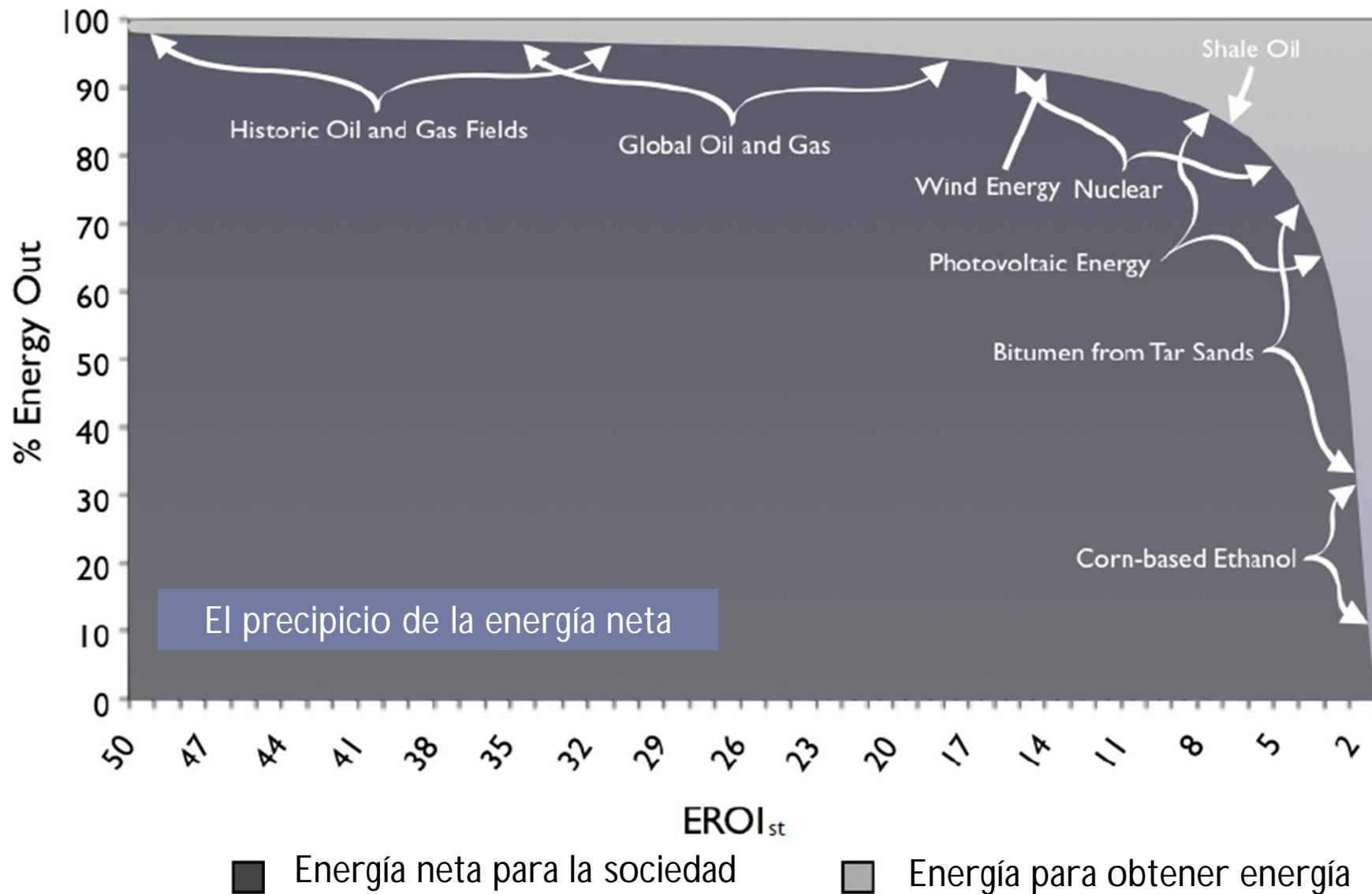
Sociedad industrial  
y tecnológica TRE 12-25

Sociedad industrial  
desarrollada TRE 8-15

Sociedad industrial  
incipiente TRE 6-13

Sociedad agropecuaria  
avanzada TRE 5-6





Jessica Lambert et al (2012) - EROI of Global Energy Resources: Preliminary Status and Trends - Robotics Caucus - State

University of New York, College of Environmental Science and Forestry

[http://www.roboticscaucus.org/ENERGYPOLICYCMTEMTGS/Nov2012AGENDA/documents/DFID\\_Report1\\_2012\\_11\\_04-2.pdf](http://www.roboticscaucus.org/ENERGYPOLICYCMTEMTGS/Nov2012AGENDA/documents/DFID_Report1_2012_11_04-2.pdf) - 5 authors



Contents lists available at ScienceDirect

Energy

journal homepage: [www.elsevier.com/locate/energy](http://www.elsevier.com/locate/energy)

# Fossil fuel depletion and socio-economic scenarios: An integrated approach

Iñigo Capellán-Pérez <sup>a,\*</sup>, Margarita Mediavilla <sup>b</sup>, Carlos de Castro <sup>c</sup>, Óscar Carpintero <sup>d</sup>,  
Luis Javier Miguel <sup>b</sup>

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<sup>b</sup> Systems Engineering and Automatic Control, Escuela de Ingenierías Industriales, Paseo del Cauce s/n, University of Valladolid, 47011 Valladolid, Spain

<sup>c</sup> Applied Physics Department, Escuela de Arquitectura, Av Salamanca, 18, University of Valladolid, 47014 Valladolid, Spain

<sup>d</sup> Applied Economics Department, Facultad de Ciencias Económicas, Paseo del Cauce, s/n, University of Valladolid, 47011 Valladolid, Spain

## ARTICLE INFO

### Article history:

Received 14 January 2014

Received in revised form

12 September 2014

Accepted 14 September 2014

Available online xxx

### Keywords:

Renewable limits

Fossil fuel depletion

Global warming

System dynamics

Peak oil

Global Environmental Assessment

## ABSTRACT

The progressive reduction of high-quality-easy-to-extract energy is a widely recognized and already ongoing process. Although depletion studies for individual fuels are relatively abundant, few of them offer a global perspective of all energy sources and their potential future developments, and even fewer include the demand of the socio-economic system.

This paper presents an Economy-Energy-Environment model based on System Dynamics which integrates all those aspects: the physical restrictions (with peak estimations for oil, gas, coal and uranium), the techno-sustainable potential of renewable energy estimated by a novel top-down methodology, the socio-economic energy demands, the development of alternative technologies and the net CO<sub>2</sub> emissions.

We confront our model with the basic assumptions of previous Global Environmental Assessment (GEA) studies. The results show that demand-driven evolution, as performed in the past, might be unfeasible: strong energy-supply scarcity is found in the next two decades, especially in the transportation

# Iñigo Capellán et al (2015)

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## ▶ No contempla

- ▶ Intermittencia renovables
- ▶ TRE
- ▶ Efecto rebote ganancias eficiencia
- ▶ Conflictos y desastres inexistentes
- ▶ Sólo emisiones CO<sub>2</sub>
- ▶ Absorción constante por biosfera
- ▶ No aumento temperatura por menos aerosoles
- ▶ No realimentación energía-economía (no consenso...)

## ▶ Resultados

- ▶ No compatibles con agencias internacionales
- ▶ Problemas antes de 2020 en *todos* los escenarios



# Y más



“Mientras algunos miembros de la sociedad pueden estar haciendo sonar la alarma mostrando cómo el sistema se mueve hacia un colapso inminente y que, por lo tanto, es preciso adoptar medidas de cambio estructural para evitarlo, las élites y sus seguidores, que se oponen a estos cambios, pueden recurrir a la larga trayectoria sostenible ocurrida ‘hasta ahora’ para defender la inacción.”

## REVIEW

doi:10.1038/nature11018

### Approaching a state shift in Earth's biosphere

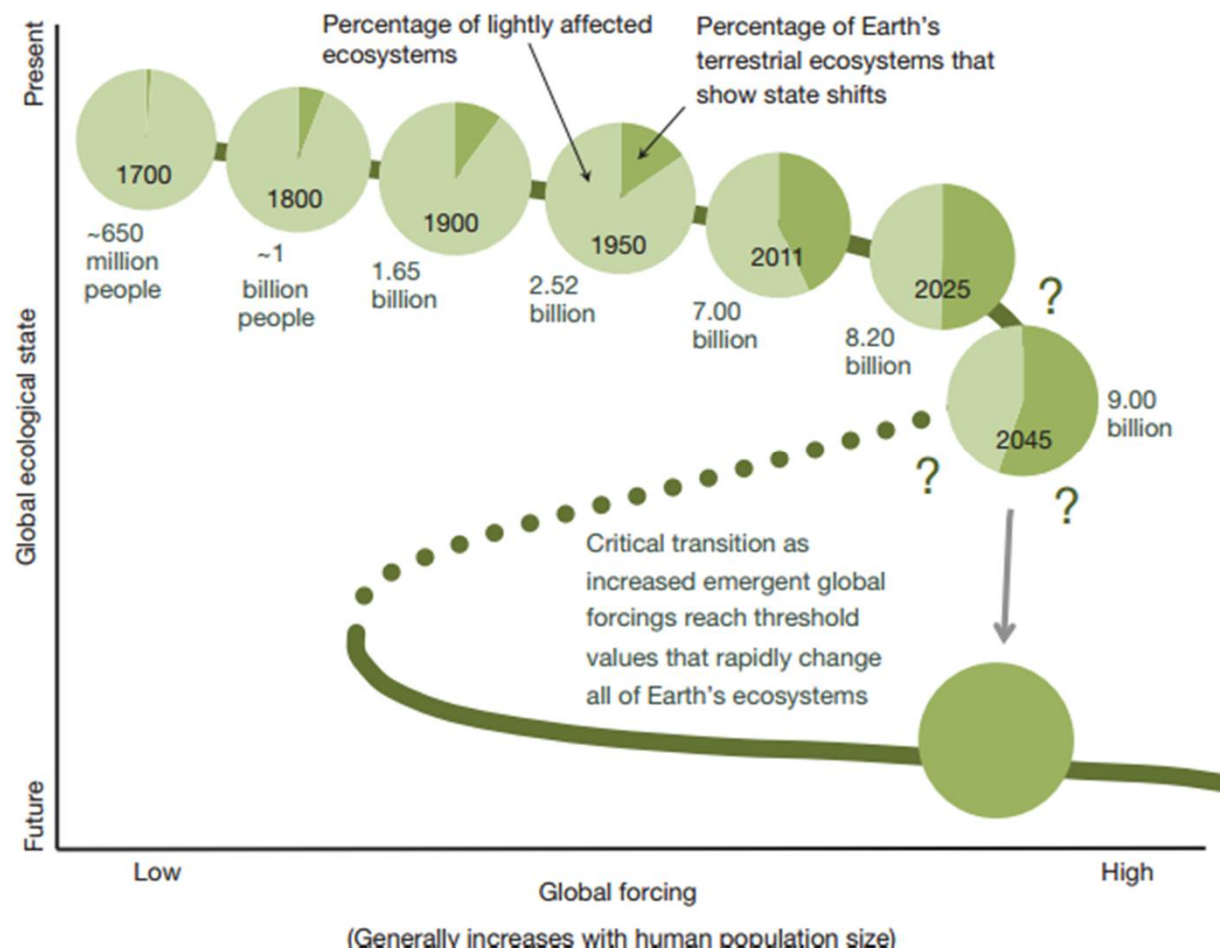
Anthony D. Barnosky<sup>1,2,3</sup>, Elizabeth A. Hadly<sup>4</sup>, Jordi Bascompte<sup>5</sup>, Eric L. Berlow<sup>6</sup>, James H. Brown<sup>7</sup>, Mikael Fortelius<sup>8</sup>, Wayne M. Getz<sup>9</sup>, John Harlie<sup>9,10</sup>, Alan Hastings<sup>11</sup>, Pablo A. Marquet<sup>12,13,14,15</sup>, Neo D. Martinez<sup>16</sup>, Arne Mooers<sup>17</sup>, Peter Roopnarine<sup>18</sup>, Geerat Vermeij<sup>19</sup>, John W. Williams<sup>20</sup>, Rosemary Gillespie<sup>21</sup>, Justin Kitzes<sup>22</sup>, Charles Marshall<sup>23</sup>, Nicholas Matzke<sup>24</sup>, David P. Mindell<sup>25</sup>, Eloy Revilla<sup>26</sup> & Adam B. Smith<sup>27</sup>

Localized ecological systems are known to shift abruptly and irreversibly from one state to another when they are forced across critical thresholds. Here we review evidence that the global ecosystem as a whole can react in the same way and is approaching a planetary-scale critical transition as a result of human influence. The plausibility of a planetary-scale ‘tipping point’ highlights the need to improve biological forecasting by detecting early warning signs of critical transitions on global as well as local scales, and by detecting feedbacks that promote such transitions. It is also necessary to address root causes of how humans are forcing biological changes.

“La comparación de la intensidad actual del cambio planetario con la situación que caracterizó cambios de estado de escala global en el pasado, y los enormes forzamientos que seguimos ejerciendo, sugieren que una nueva transición a escala global es altamente plausible en el plazo de décadas o siglos, si no se ha iniciado ya.”



# Cambio de estado de la biosfera



- Approaching a state shift in Earth's biosphere - Anthony D. Barnosky et al (2012) – Nature 486:52-58 doi:10.1038/nature11018  
- Department of Integrative Biology, + Museum of Paleontology + 3 Museum of Vertebrate Zoology, University of California

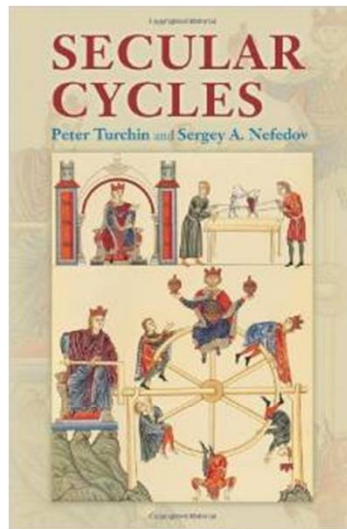
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New Studies in Archaeology

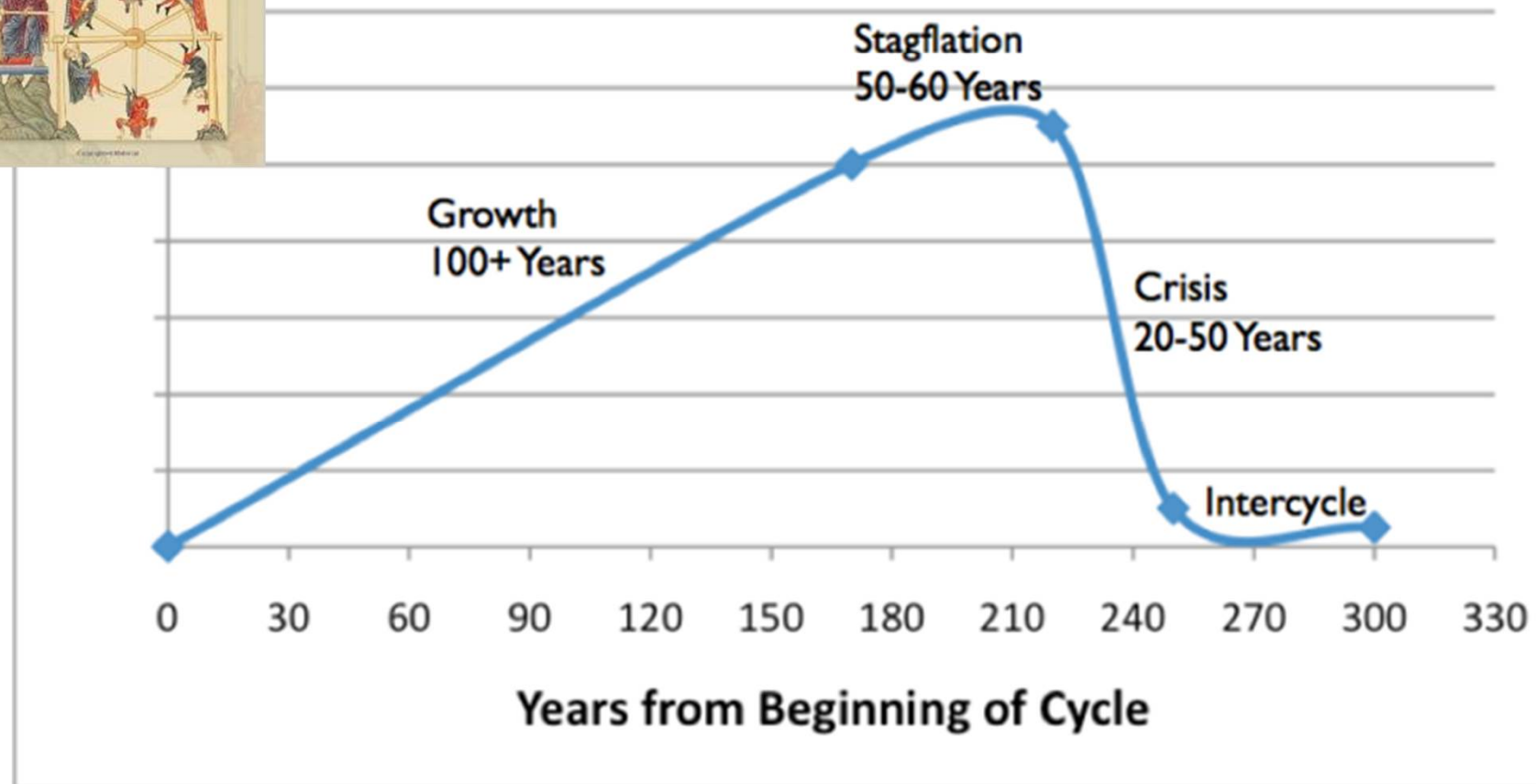
# The Collapse of Complex Societies

JOSEPH A. TAINTER





## Shape of Typical "Secular Cycle"

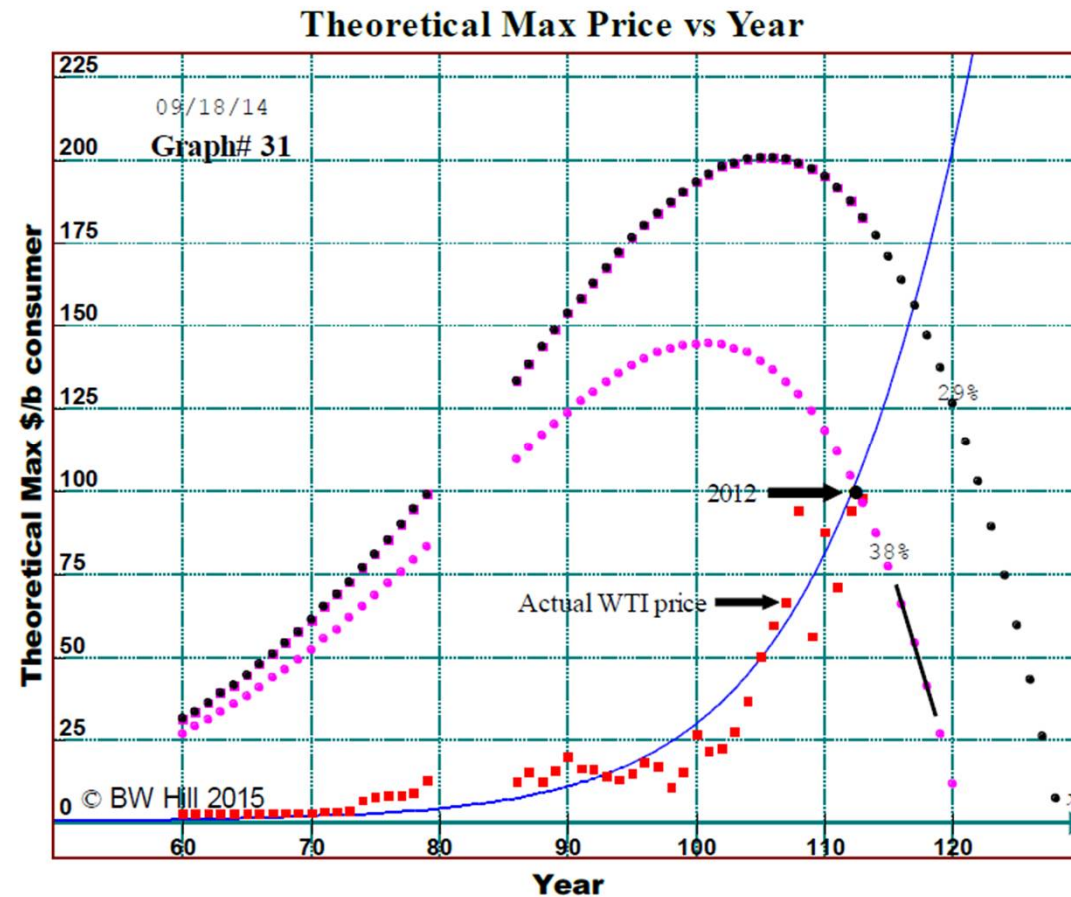


Ciclos seculares de Peter Turchin y Sergey Nefedov (Interpretación de Gail Tverberg, 2013)

- 
- ▶ Una herencia cultural puede persistir tras las condiciones que la produjeron. El exceso de capacidad de carga ha desaparecido ya, erosionada tanto por el incremento poblacional como por la inmensa ampliación de los apetitos tecnológicos y los impactos medioambientales.
  - ▶ La vida humana transcurre ahora en el marco de una era de déficit creciente de la capacidad de carga. Todos los aspectos familiares de la vida social humana se encuentran ahora bajo fuerte presión de cambio en esta nueva era en la que la carga excede cada vez más su capacidad en muchas regiones locales y en un planeta finito.
  - ▶ Asistiremos a una escalada de desorganización social, fricciones crecientes, conflictos y desmoralización."



# Modelo ETP (The Hills Group)

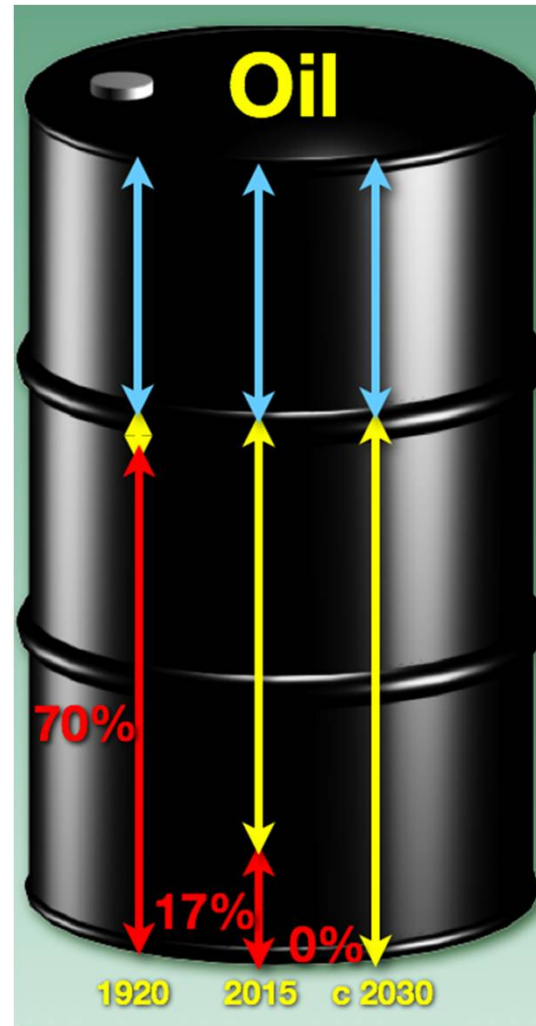


A reserve status report Report# HC3 - 433 - Depletion: A determination for the world's petroleum reserve. An exergy analysis employing the ETP model. Study Overview - The Hills Group – 12/2013 - [http://www.thehillsgroup.org/depletion2\\_002.htm](http://www.thehillsgroup.org/depletion2_002.htm)

Calor disipado  
inevitable (2ª LT)

Costes energéticos  
de exploración,  
extracción,  
transporte, refino y  
distribución

Energía neta  
disponible



## Arañando el fondo del barril

- En el plazo de 10 años, la industria del petróleo se habrá desintegrado, con implicaciones de gran trascendencia para las sociedades industriales
- Este hecho está relacionado con las leyes de la termodinámica y no tienen nada que ver con las finanzas
- La combinación de cambio climático, escasez energética, pérdida de biodiversidad y exceso de deuda global conducen a una "tormenta perfecta"

## Modelo ETP (The Hills Group)

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- ▶ El agotamiento del petróleo se encuentra muy avanzado, y su producción declinará más deprisa de lo que se suele suponer. Los métodos convencionales de estimación de los yacimientos están basados en la 1ª ley de la termodinámica, pero desatienden los efectos de la 2ª ley.
- ▶ El último 25% del suministro global de energía será varios órdenes de magnitud más caro que el primer 25%. El agotamiento creciente de las reservas mundiales de petróleo puede comportar cambios que no han sido presenciados en los últimos milenios.



## Food security requires a new revolution

PAUL R. EHRLICH†\* AND JOHN HARTE‡

†Department of Biology, Stanford University, Stanford, CA 94305, USA; ‡Energy and Resources Group, University of California, 310 Barrows Hall, Berkeley, CA 94720, USA

A central responsibility of societies should be supplying adequate nourishment to all. For roughly a third of the global human population, that goal is not met today. More ominously, that population is projected to increase some 30% by 2050. The intertwined natural and social systems, that must meet the challenge of producing and equitably distributing much more food without wrecking humanity's life-support systems, face a daunting array of challenges and uncertainties. These have roots in the agricultural revolution that transformed our species and created civilization. Profound and multifaceted changes, revising closely-held cultural traditions and penetrating most of civilization will be required, if an unprecedented famine is to be avoided.

*Keywords:* Food; Environment; Population; Consumption; Equity; Governance



PROCEEDINGS  
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[rspb.royalsocietypublishing.org](http://rspb.royalsocietypublishing.org)

Perspective



**Cite this article:** Ehrlich PR, Ehrlich AH. 2013

Can a collapse of global civilization  
be avoided? *Proc R Soc B* 280: 20122845.  
<http://dx.doi.org/10.1098/rspb.2012.2845>

# Can a collapse of global civilization be avoided?

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Paul R. Ehrlich<sup>†</sup> and Anne H. Ehrlich

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Department of Biology, Stanford University, Stanford, CA 94305, USA

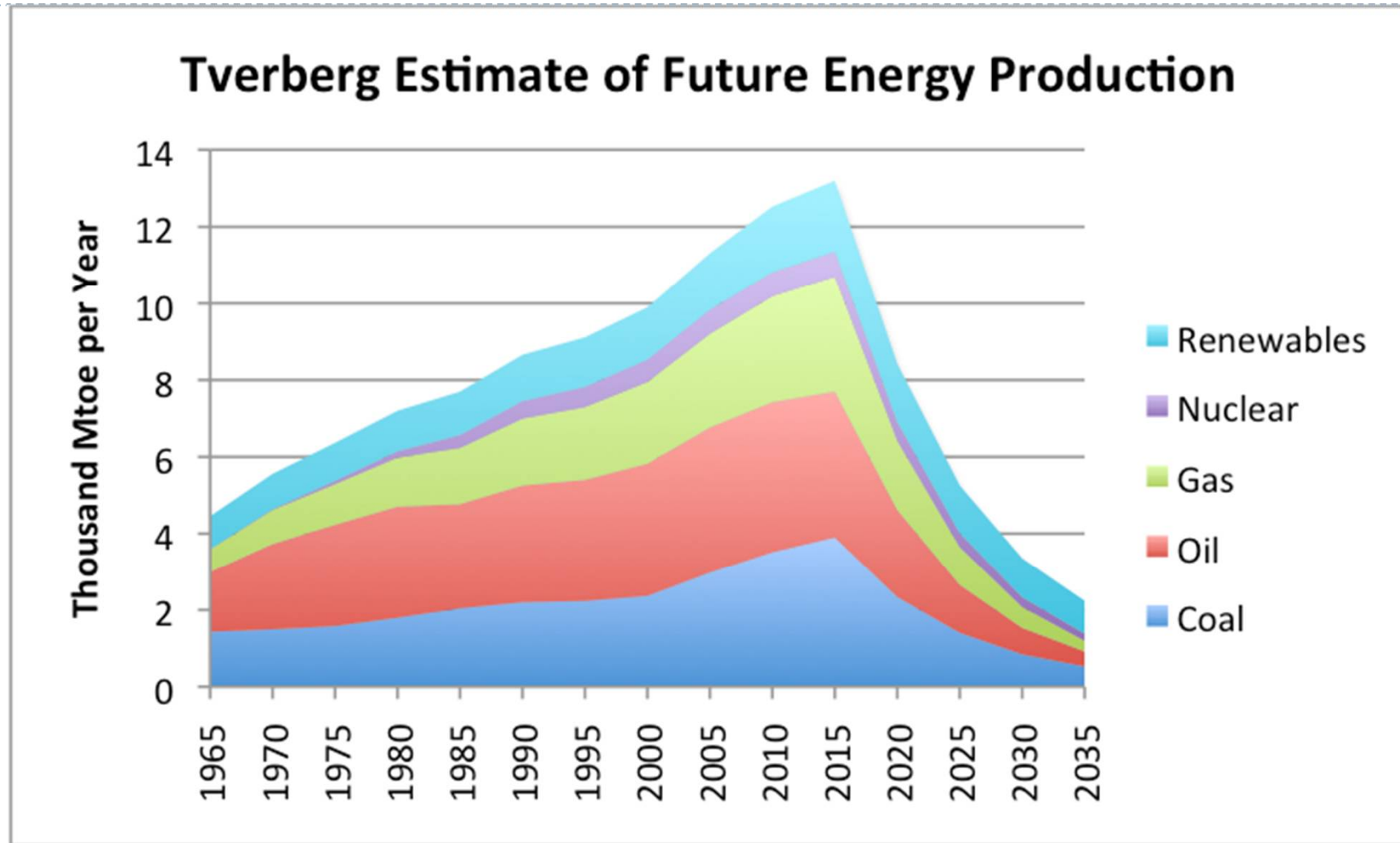
Environmental problems have contributed to numerous collapses of civilizations in the past. Now, for the first time, a global collapse appears likely. Overpopulation, overconsumption by the rich and poor choices of technologies are major drivers; dramatic cultural change provides the main hope of averting calamity.

## 1. Introduction

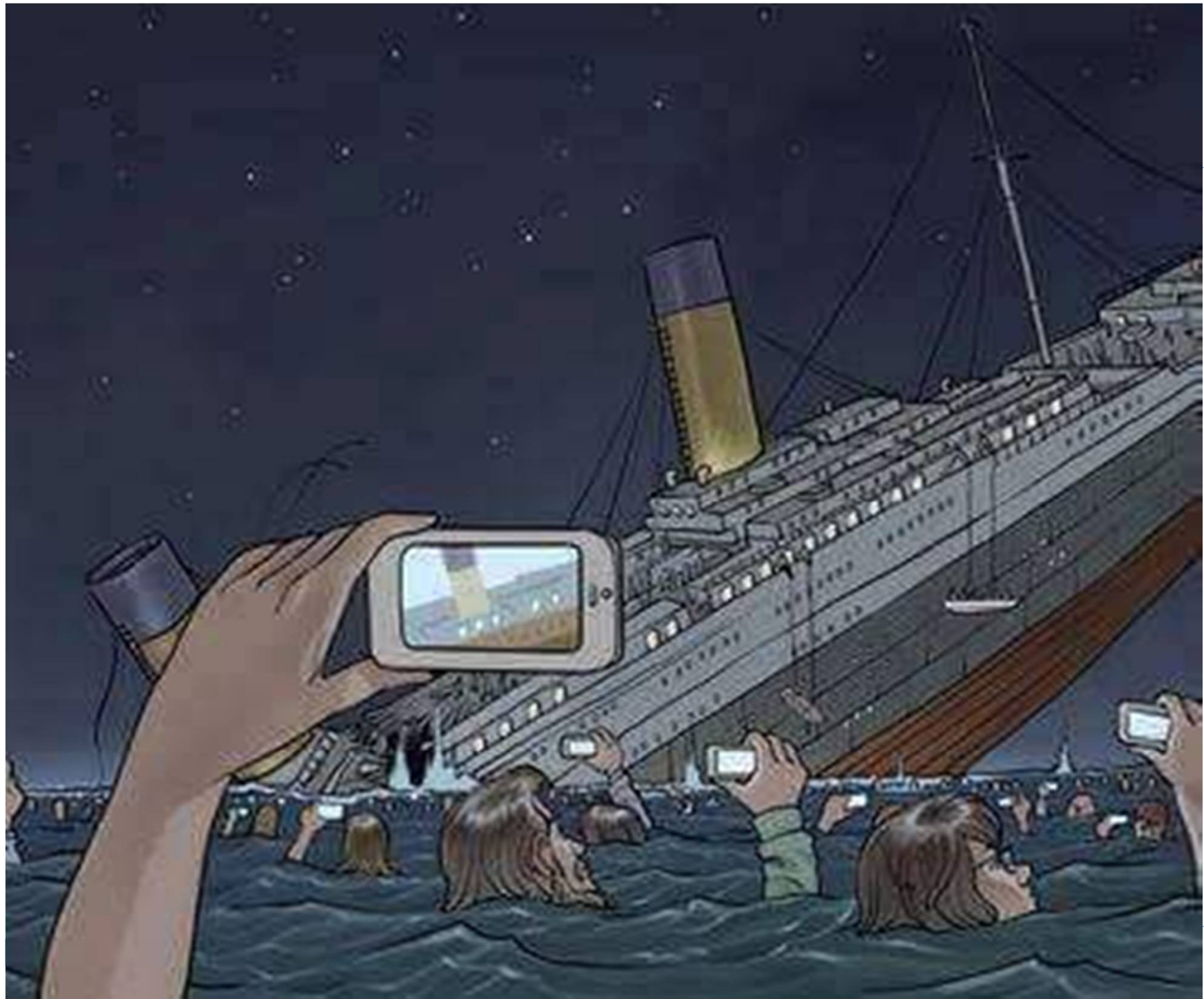
Virtually every past civilization has eventually undergone collapse, a loss of socio-political-economic complexity usually accompanied by a dramatic decline



# ¿Solución?



¿Risco de Famara?





Scientific American, 2008



# ¿Sálvese quien pueda?

---

- ▶ Salva cuantos puedas
- ▶ Salva todo lo que puedas
  - ▶ Conocimiento
  - ▶ Belleza contextuada
- ▶ Separa fines de medios
  - ▶ No esperes resultados: Kant
- ▶ Orienta bien tus energías escasas

JMA: Amaos más y no os multipliquéis tanto



# Ámbito privado

Crece hacia adentro

Trabaja con las dos manos



## 2. Ámbito público

---

- ▶ Competencia
  - ▶ Cooperación
- 
- ▶ Cantidad (lógica de maximización)
  - ▶ Calidad (lógica de satisfacción)



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Igualdad  
Cooperación  
Cuidado





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‘El amor - y no sólo el amor erótico - es la única cosa importante en el mundo. Todo lo demás es fuego fatuo.’

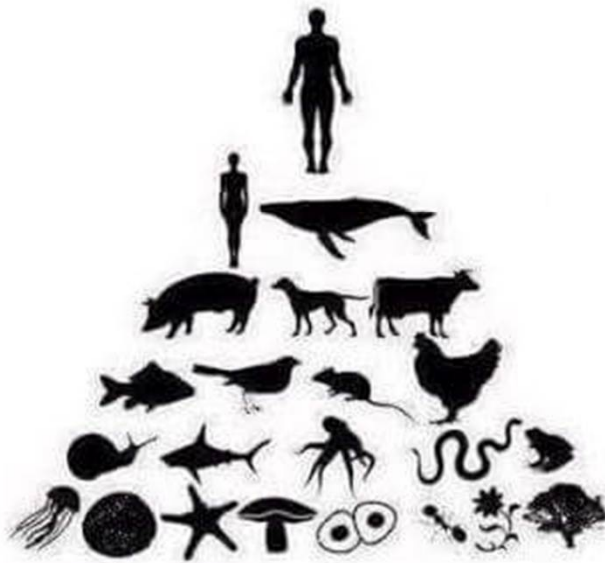
Gustavo Pereira

César Manrique, en Lanzarote, supo iniciar un proceso de transición hacia la sustentabilidad diciendo la verdad a la gente.

Jorge Riechmann



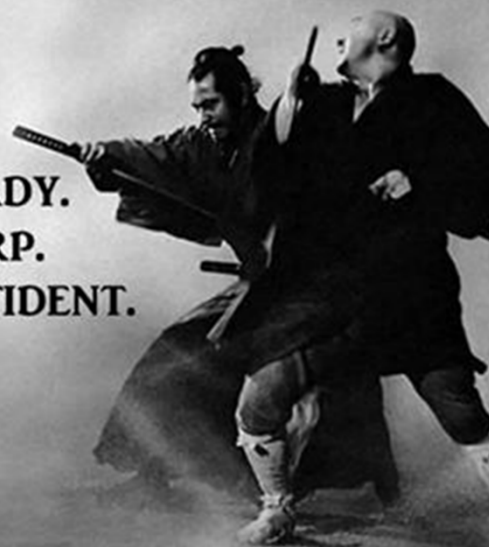
# EGO



# ECO



**CALM, BUT ALERT.  
RELAXED, BUT READY.  
SMOOTH, BUT SHARP.  
HUMBLE, BUT CONFIDENT.**



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# Gracias

<http://ustednoselocree.com>

<https://www.facebook.com/Usted-no-se-lo-Cree-107455072629647/>

