
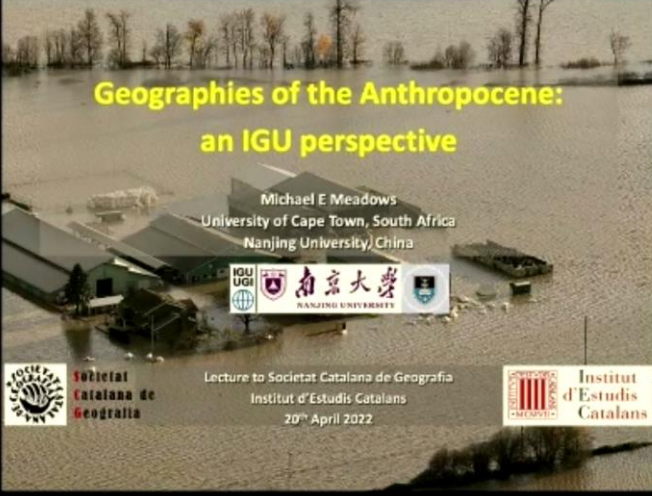


Zoom Webinar



Zoom Webinar



Geographies of the Anthropocene:
an IGU perspective

Michael E Meadows
University of Cape Town, South Africa
Nanjing University, China

IGU UGI 南京大学 NANJING UNIVERSITY

Lecture to Societat Catalana de Geografia
Institut d'Estudis Catalans
20th April 2022

Societat Catalana de Geografia Institut d'Estudis Catalans

Zoom Webinar

[illegible]

Zoom Webinar

Recording

Are we there yet?

Introduction

Are we there yet?

Footprints of the Anthropocene

- climate
- landforms
- biodiversity
- hazard & risk

IGU and the Anthropocene

Conclusions

This is taking forever Shrek, and there ain't no inflight movie or nothin.

Is the Anthropocene identifiable in the earth's stratigraphy?

Broadly, to be accepted as a formal term the 'Anthropocene' needs to be (a) scientifically justified (i.e. the 'geological signal' currently being produced in strata now forming must be sufficiently **large, clear and distinctive**) and (b) **useful** as a formal term to the scientific community.

<http://quaternary.stratigraphy.org/workinggroups/anthropocene/>


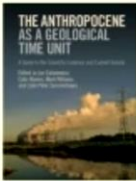
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... "the Anthropocene hypothesis"



Jan Zalasiewicz



IUGS
Earth Science for the Global Community

International Union of Geological Sciences

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Stratigraphically identifiable?— arguments for...

- This record, although very thin, is spatially very extensive and already reflects substantial elapsed (and in part irreversible) change to the Earth System
- The scale of change is comparable to or even greater in magnitude than that of previous stratigraphic transitions.

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Stratigraphically identifiable? – arguments against...

- Evidence does not meet with standard requirements for identification of GSSP
- Focused on observation of human history or speculation about the future rather than geologically significant events
- Inconsistent with chronostratigraphic naming conventions
- Driven more by politics than science

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Anthropocene Science (2022) 1:20–41
<https://doi.org/10.1007/s44177-022-00011-7>

ANTHROPOCENE REVIEW

Is 'Anthropocene' a Suitable Chronostratigraphic Term?

Eugenio Luciano¹

Received: 31 January 2022 / Revised: 10 February 2022 / Accepted: 10 February 2022 / Published online: 24 February 2022
© The Author(s) 2022

...the term 'Anthropocene' is indeed suitable in the context of chronostratigraphic classification...

...this says nothing of the stratigraphic validity of the term... p38

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Footprints of the Anthropocene

Introduction

Are we there yet?

Footprints of the Anthropocene

- climate
- landforms
- biodiversity
- hazard & risk

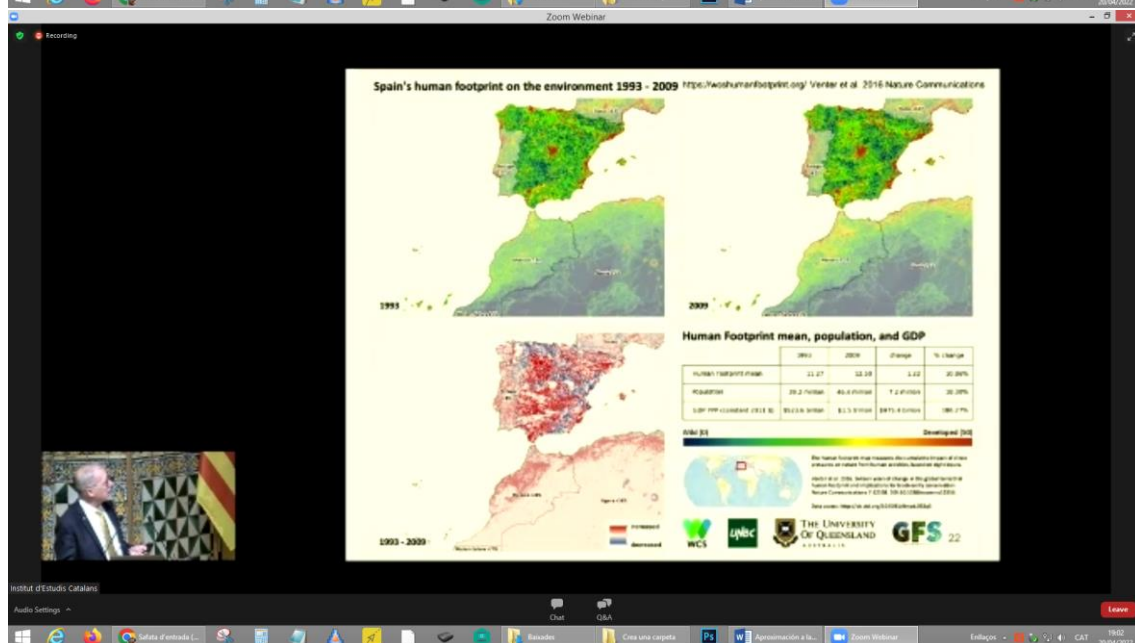
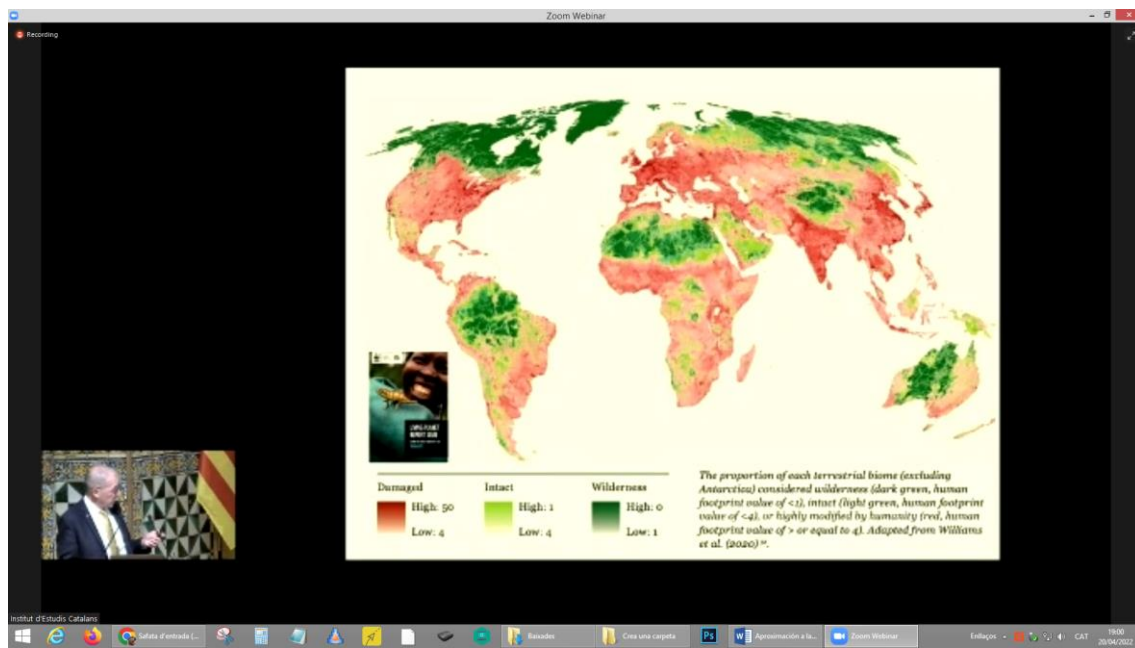
IGU and the Anthropocene

Conclusions

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"The human dominance is ... reflected in the weight of the current human population—10 times the weight of all wild mammals. If we add the weight of livestock for human use and consumption to the human weight, only 4% of the weight of mammals on Earth remain wild mammals". Folke et al. 2021

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Climate emergency



Introduction

Are we there yet?

Footprints of the Anthropocene

- climate
- landforms
- biodiversity
- hazard & risk

IGU and the Anthropocene

Conclusions



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Climate: "the miner's canary"



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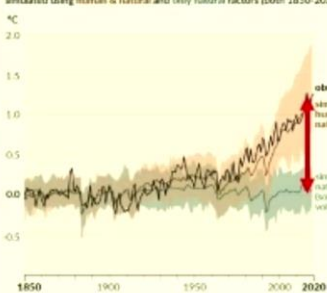
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ipcc
AR6
Climate Change 2021
The Physical Science Basis

IPCC AR 6

b) Change in global surface temperature (annual average) as observed and simulated using human & natural and only natural factors (both 1850-2020)



°C

2.0
1.5
1.0
0.5
0.0
-0.5

1850 1900 1950 2000 2020


observed
simulated: human & natural
simulated: natural only (volcanic)

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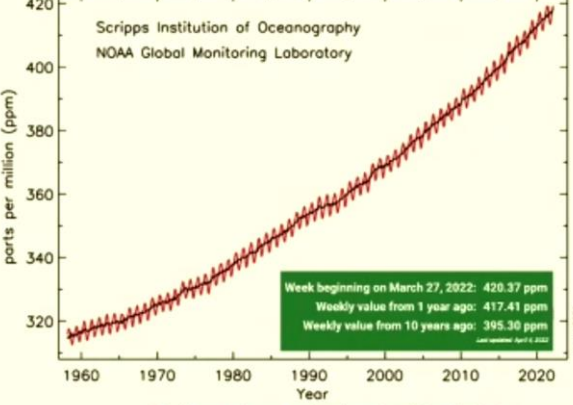
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Atmospheric CO₂ at Mauna Loa Observatory

Scripps Institution of Oceanography
NOAA Global Monitoring Laboratory



parts per million (ppm)

420
400
380
360
340
320

1960 1970 1980 1990 2000 2010 2020

Year

Week beginning on March 27, 2022: 420.37 ppm
Weekly value from 1 year ago: 417.41 ppm
Weekly value from 10 years ago: 395.30 ppm
last updated: April 6, 2022

<http://www.esrl.noaa.gov/gmd/ccgg/trends/weekly.html>

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ipcc
INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

Climate Change 2022 Mitigation of Climate Change

Reducing GHG emissions across the full energy sector requires major transitions, including a substantial reduction in overall fossil fuel use, the deployment of low-emission energy sources, switching to alternative energy carriers, and energy efficiency and conservation.

Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change

Figures 6.10.7: Overview of mitigation options and their estimated ranges of costs and potentials in 2050.

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Global climate crisis: inevitable, unprecedented and irreversible

FINANCIAL TIMES

World likely to be 1.5C warmer by 2040, UN's science panel warns

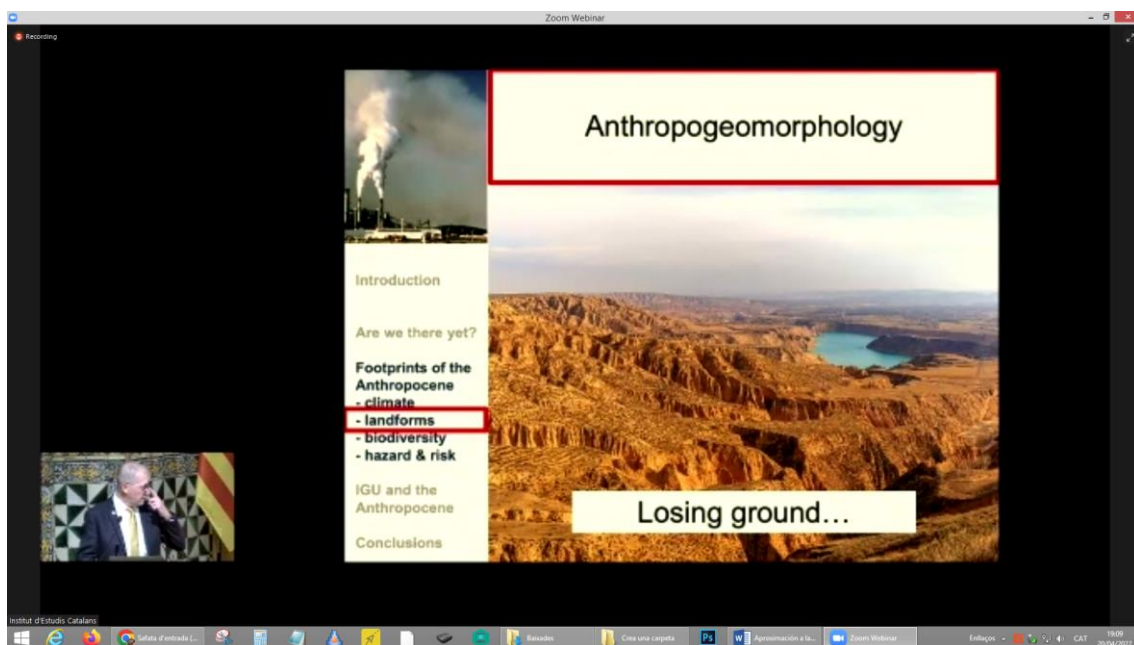
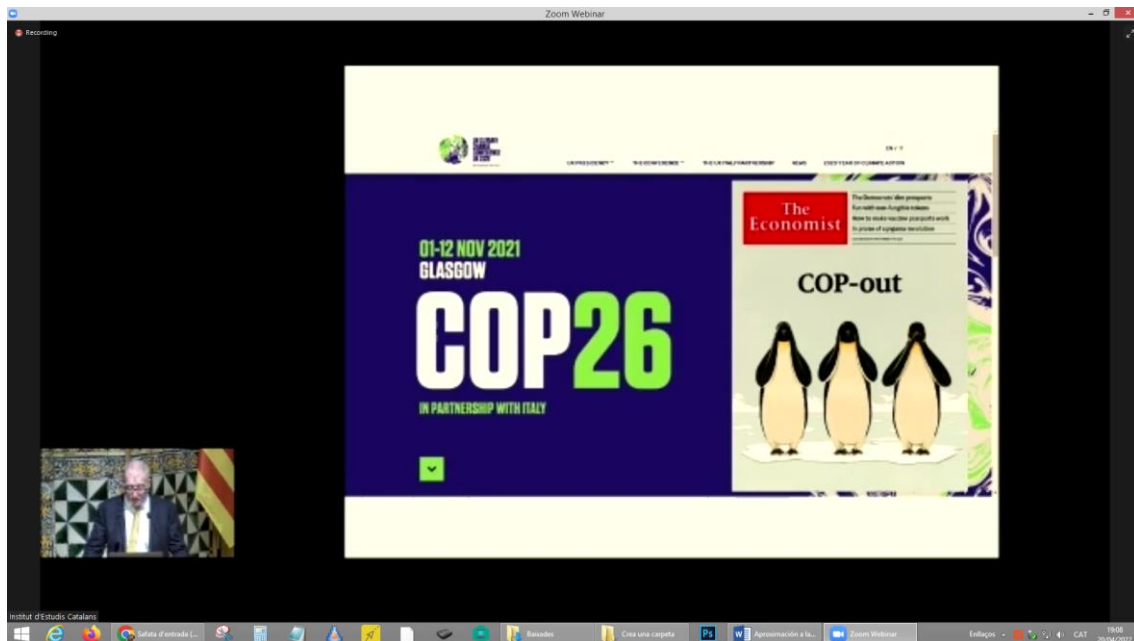
CODE RED FOR HUMANITY

DAILY EXPRESS

PM: WAKE UP TO RED ALERT ON CLIMATE CRISIS

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Gaining ground...

FUTURE DUBAI

1. Waterfront
2. Waterfront City
3. Palm Jumeirah
4. Arabian Canal
5. Al Maktoum airport
6. Palm Jumeirah
7. Al Maktoum airport
8. Dubai Mall
9. The World
10. The World
11. The World
12. The World

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remote sensing

Mapping trajectories of coastal land reclamation in nine deltaic megacities using Google Earth Engine

Shihong Geng, "Baihan Chen, Xuefei Li, Michael T. Mouw, Yiting Fan, Chen, Abhishek, Sengupta, Na Zhang

Tracking or losing ground? Tracking Asia's hunger for 'new' coastal land in the face of sea level rise
Shihong Geng, "Baihan Chen, Xuefei Li, Michael T. Mouw, Yiting Fan, Chen, Abhishek, Sengupta, Na Zhang

Shanghai Incheon

Sea level index
High
Low

cm/year

Sentinel 2 False Color Composite (SR11)

Land subsidence
Profile line

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a

World map showing coastal land reclamation sites. Key locations include: Long Beach, San Juan, Cartagena, Lima, Montevideo, Port Elizabeth, Adelaide, Sydney, Maputo, Luanda, Jeddah, Conakry, Lomé, Dakar, Shanghai, Tianjin, Osaka, Taipei, Jakarta, Singapore, Kochi, Chennai, Doha, Helsinki, Copenhagen.

Area (ha)

- >12800
- 6300 - 12800
- 1700 - 6300
- 550 - 1700
- 1 - 550

Ocean

East Asia

Inset map of East Asia showing: Dalian, Rizhao, Ningbo, Haikou, Taipei, Zhuhai, Osaka.

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Singapore Rotterdam Dubai Lagos

Barcelona Saint Petersburg Shanghai Brisbane

Reclaimed land 2000-2010 Reclaimed land 2011-2020

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Enllaços

19:12 20/04/2022

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Economic development: industry, ports, airports

www.aesys.com

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Commercial and residential development: 'prestige'



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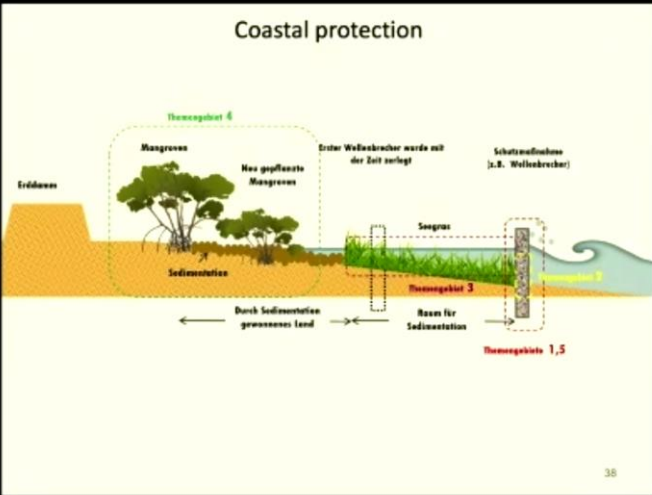
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Coastal protection



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Environmental conservation ('ecological civilization')



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What about impacts?

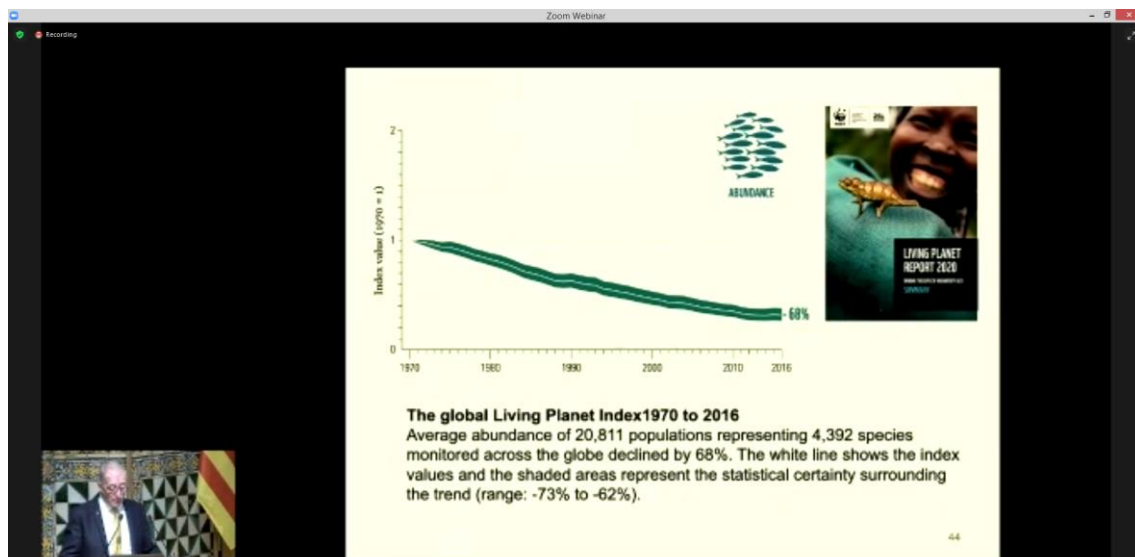


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Zoom Webinar

Biodiversity crisis

Introduction

Are we there yet?

Footprints of the Anthropocene

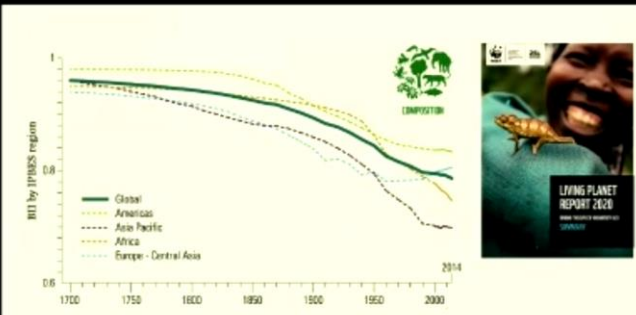
- climate
- landforms
- **biodiversity**
- hazard & risk

IGU and the Anthropocene

Conclusions

Zoom Webinar

Recording



The Biodiversity Intactness Index (BII)
Estimates how much originally present biodiversity remains on average across the terrestrial ecological communities within a region. It focuses on the effects of land use and related pressures, which have so far been the dominant drivers of biodiversity loss

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Challenges	Limitations
1. Inadequate national policy responses	The majority of national targets in NBSAPs across different countries are not well aligned with the Aichi Targets. Efforts to embed commitments into legal and policy instruments for effective implementation of the Aichi Targets are broadly lacking across countries.
2. Funding shortages	Biodiversity financial resources have been inadequate at all levels.
3. Science-policy knowledge gaps	Knowledge gaps exist in social sciences and transdisciplinary research, and in the integration of scientific, indigenous and local knowledge, limiting the understanding of the conditions, synergies and trade-offs among conservation efforts. Lack of existing indicators hinders measuring and tracking progress towards the Aichi Targets.
4. Imperfect review mechanisms	The performance of specific parties' implementation of obligations under the CBD and the global targets is rarely reviewed by the COP.

Xu et al., 2021

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Hazard and risk



Introduction


Are we there yet?

Footprints of the Anthropocene

- climate
- landforms
- biodiversity
- **hazard & risk**

IGU and the Anthropocene

Conclusions



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Erfurt, Germany



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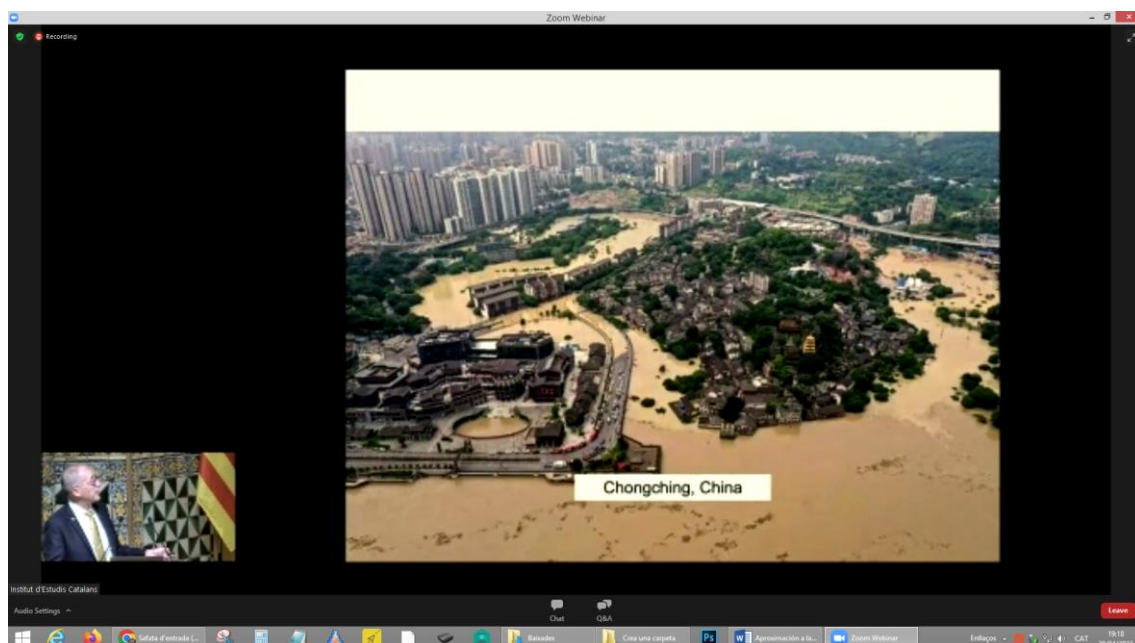
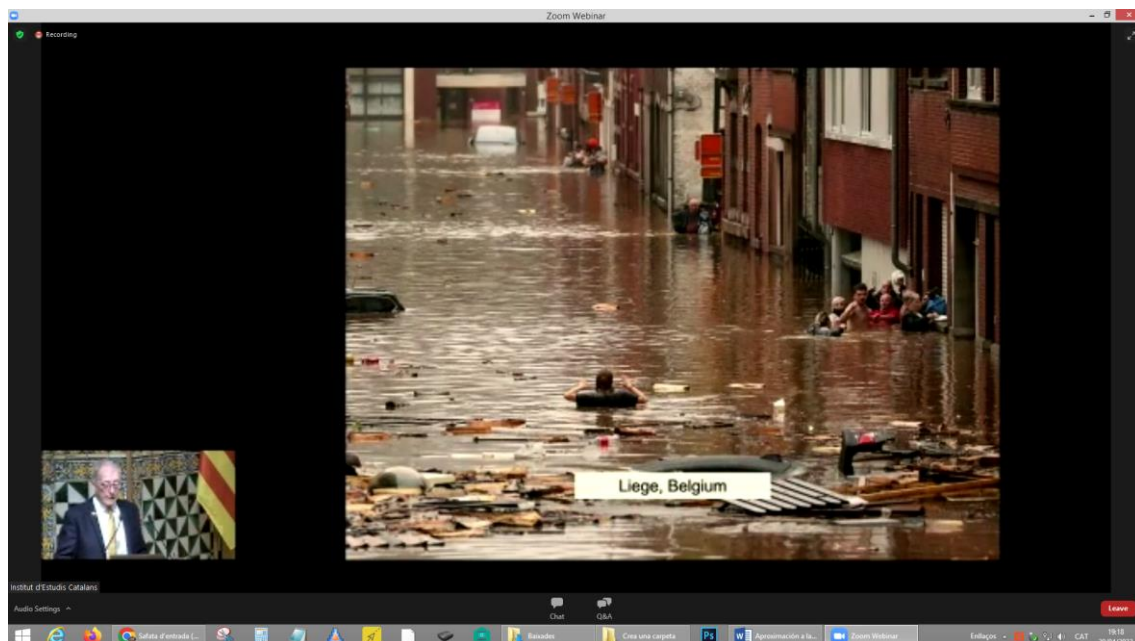
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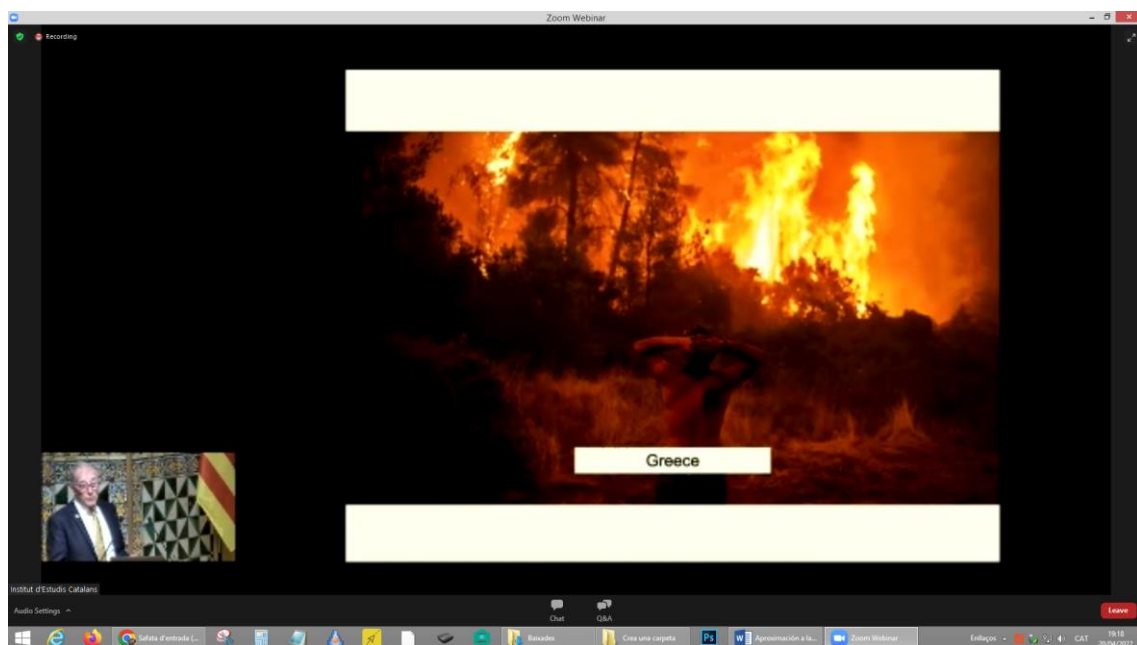
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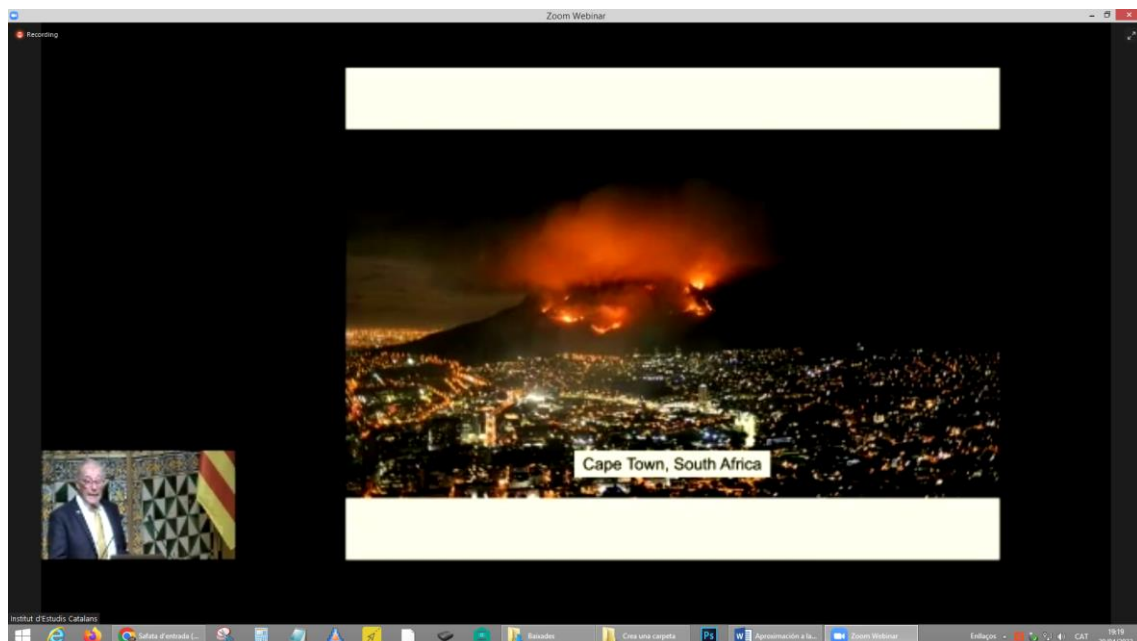
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Cendrero et al 2021

ASIA

No. Disasters

year

No. Disasters

GDP

$L = 0.965$
 $NP = 0.984$

The data gathered and results obtained through comparison and correlations with the indicators used, point to human-driven changes in land surface (geomorphic change) as a more significant driver than climate change (also human-driven).

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Human Sustainability PERSPECTIVE

Anthropocene risk

Pedro W. Kien, Victor Salas, Michelle Dyer, Nathaniel Matheson, Carl Haber, Magnus Nyström and Sarah E. Cornell

Cross-scale integration
• Changing the basis of risk prediction

Vulnerability

Hazard

Anthropocene risk

Exposure

Global social-ecological connectivity
• Changing the foci of risk

Anthropogenic changes
• Changing the baseline of hazards

Simulated change at 2 °C global warming

Precipitation

Simulated change at 2 °C global warming

Soil moisture

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Hazard and disaster risk in the Anthropocene...



- Overall premise: hazard and disaster risk has accelerated
- Events once thought 'extreme' in terms of frequency and magnitude now occur annually or seasonally
- 'Non-extreme' events can have catastrophic consequences because a) more people exposed, b) society has produced its own risks
- Events cascade and impacts evolve from local to regional
- Inequality accentuates vulnerability
- Some examples...

10-year event
Frequency and increase in intensity of extreme temperature event that occurred once in 10 years on average in a climate without human influence

Future global warming levels
1950-1999 Present 1.5°C 2°C 4°C

Event	1950-1999	Present	1.5°C	2°C	4°C
Heat	1.5	2.5	3.5	4.5	5.5
Cold	1.5	0.5	0.5	0.5	0.5

Intensity increase

Event	1950-1999	Present	1.5°C	2°C	4°C
Heat	1.5	2.5	3.5	4.5	5.5
Cold	1.5	0.5	0.5	0.5	0.5

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Compound disasters




March 11th 2011




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IGU/UGI and the Anthropocene



Introduction

Are we there yet?

Footprints of the Anthropocene

- climate
- landforms
- biodiversity
- hazard & risk

IGU and the Anthropocene

Conclusions

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The special 'advantage' of Geography

- A holistic and integrating science that holds the human-environment relationship is at its core
- Geography has a long history of effective contributions to:
 - Hazard and risk research
 - Human impact studies
 - Earth system science
 - Remote sensing and GIS
 - Environmental history
 - Landscape studies
- Geography: "the science for sustainability" (Meadows, 2020)
- "...the discipline that reaches the parts that others cannot reach" (Castree, 2015)

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Geography and the Anthropocene

- A fundamentally *geographical* concept – humans/nature/space
- Not all geographers can/should embrace it and the trend for physical geographers in particular to engage elsewhere is a concern
- A research agenda that sees society as an 'add-on' to environmental science is doomed to failure
- Society cannot simply be a 'new column in the bookkeeping of big corporations (Bonneuil & Fresco, 2016)
- Need to embrace multiple representations of the human-environment relationship – and of the Anthropocene
- Recognize that landscapes are socio-biophysical entities that represent power relations, colonialism etc. as much as hydrology, geomorphology etc. (Lave et al., 2014)

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IGU Commissions and Task Forces

<https://igu-online.org>

C20.01 African Studies	C20.24 History of Geography
C20.02 Agricultural Geography and Land Engineering	C20.25 Islands
C20.03 Applied Geography	C20.26 Korea
C20.04 Biogeography and Biodiversity	C20.27 Land Degradation and Desertification
C20.05 Cartography	C20.28 Landscape Analysis and Landscape Planning
C20.06 Coastal Systems	C20.29 Land Use and Land Cover Change
C20.07 Global Region Environments	C20.30 Latin American and Caribbean Studies
C20.08 Cultural Approach in Geography	C20.31 Local and Regional Development
C20.09 Dynamics of Economic Spaces	C20.32 Migration, Urbanization, and Regional and Local Responses
C20.10 Environmental Evolution	C20.33 Mediterranean Basin
C20.11 Gender and Geography	C20.34 Modelling Geographical Systems
C20.12 Geographical Education	C20.35 Mountain Studies
C20.13 Geography of Information Science	C20.36 Political Geography
C20.14 Geography of the Future Earth: Coupled Human-Earth Systems for Sustainability	C20.37 Population Geography
C20.15 Geography of Governance	C20.38 Research Methods in Geography
C20.16 Geography of Information, Innovation and Technology	C20.39 Sustainability of Rural Systems
C20.17 Geography of Tourism, Leisure, and Global Change	C20.40 Topography (jointly with ICA)
C20.18 Heritage	C20.41 Transport Geography
C20.19 Languages, Culture and Society (jointly with ICA)	C20.42 Urban Commission: (Re)Thinking urban and the urban: from the global to the local
C20.20 Global Change and Human Mobility	C20.43 Water Sustainability
C20.21 Global Understanding	C20.44 Informality, Social Change, and Development
C20.22 Health and Environment	C20.45 Sustainable and Sustainable Task Force
	T20.01 Climate Change Task Force
	T20.02 Housing and Early Career Geographers Task Force

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IGU UGI

IGU Commissions with a focus on human-environment relations

- Geography for Future Earth: Coupled Human-Earth Systems for Sustainability
- Global Change and Human Mobility
- Land Use and Land Cover Change
- Sustainability of Rural Systems
- Water Sustainability
- Global Understanding
- Hazard and Risk
- Geomorphology and Society: Past, Present and Future (with IAG)

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Conclusions

- Increasing scale of human impact pushing the planetary boundaries
- The need for a response is increasingly urgent
- Need robust and reliable scientific understanding of processes
- Integrate earth system sciences with the SDGs towards transformation
- Alleviate inequities
- Geography: the discipline that integrates the natural and human sciences
- Engage with the IGU and its Commissions!
- We cannot wait for governments to respond - 'bottom-up' and 'grassroots' solutions are needed
- Can it be done?

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Zoom Webinar

Recording

Air pollution reduction and mortality benefit during the COVID-19 outbreak in China

THE LANCET

Chen K et al. 2020

Jan 5–20, 2020

Feb 10–March 14, 2020

Mean tropospheric nitrogen dioxide column density ($\mu\text{mol}/\text{m}^2$)

0 50 100 150 200 250 300 350 400 450 ≥ 500

2

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COVID-19

Rapid greening response of China's 2020 spring vegetation to COVID-19 restrictions: Implications for climate change

Fanxue Su^{1,2,3,4}, Donglei Fu^{1,2,3,4}, Fengqin Yao^{1,2,3,4}, Han Xiao^{1,2,3,4}, Tingting Pan^{1,2,3,4}, Yang Xue^{1,2,3,4}, Li Kang^{1,2,3,4}, Chengbo Zhou^{1,2,3,4}, Michael Meadows^{1,2,3,4}, Vincent Lyne^{1,2,3,4}, John P. Wilson^{1,2,3,4}, Xuemei Yang^{1,2,3,4}, Guohua Liu^{1,2,3,4}

A MSI in 2020 and 2019

Migration scale index

Jan. 20 Feb. 10 Mar. 02 Mar. 2

Jan. 23 Feb. 10 Feb. 20

2020 2019

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SCIENCE ADVANCES | RESEARCH ARTICLE

CORONAVIRUS

Rapid greening response of China's 2020 spring vegetation to COVID-19 restrictions: Implications for climate change

Feizhou Wu^{1,2,3,4}, Donglei Fu^{1,2,3}, Fenglin Yan^{1,2,3}, Han Xiao^{1,2,3}, Tingting Pan^{1,2}, Yang Xiao^{1,2}, Li Kang^{1,2}, Chenglin Zhou^{1,2}, Michael Madden^{1,2,3}, Vincent Looi¹, John P. Wilson^{1,2}, Hu Zhou^{1,2}, Xicun Yang^{1,2}, Guohua Liu^{1,2}

A MSI in 2020 and 2019

Migration scale index

Jan. 20 Feb. 10 Mar. 02 Mar. 2

Jan. 23 Feb. 16 Feb. 20

—2020 —2019

Earlier days

Greener percentage (%)

0 1000 2000 km

0 100 200 300

0 1000 2000 km

0 100 200 300

Fig. 3. Spatial distribution of earlier and greener spring in 2020 across China. (A) Earlier days. Green/red represents number of days earlier/later than the previous years (2015–2019). (B) Greener percentage (%). Green/red represents the percentage increase/decrease of LAI at base date compared to the previous 5 years (2015–2019).

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