

Potential Impacts of Geoengineering on Ecosystems

Report from the IGBP Workshop

....+ some rambling thoughts of mine...

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Climate Change & Sustainable Futures
University of Exeter

IGBP Meeting on Ecosystem Impacts of Geoengineering 31st Jan-2nd Feb, 2011



International Geosphere-Biosphere Programme presents

Symposium on Ecosystem Impacts of Geoengineering

January 31, 8:30am-8:30pm

Scripps Forum, Scripps Institution of Oceanography

Lots of UK Involvement in Symposium on Day 1:

8:45am Introduction to Geoengineering

Naomi Vaughan, *University of East Anglia*

10:15am Coffee

10:45am Impacts of Geoengineering on Ocean Ecosystems

Chair: **John Shepherd**, *University of Southampton*;
Peter Liss, *University of East Anglia*

1:30pm Impacts of Geoengineering on Land Ecosystems

4:00pm Impacts of Geoengineering on Biodiversity

Phil Ineson, *University of York*

7:00pm Open Discussion on Geoengineering Impacts

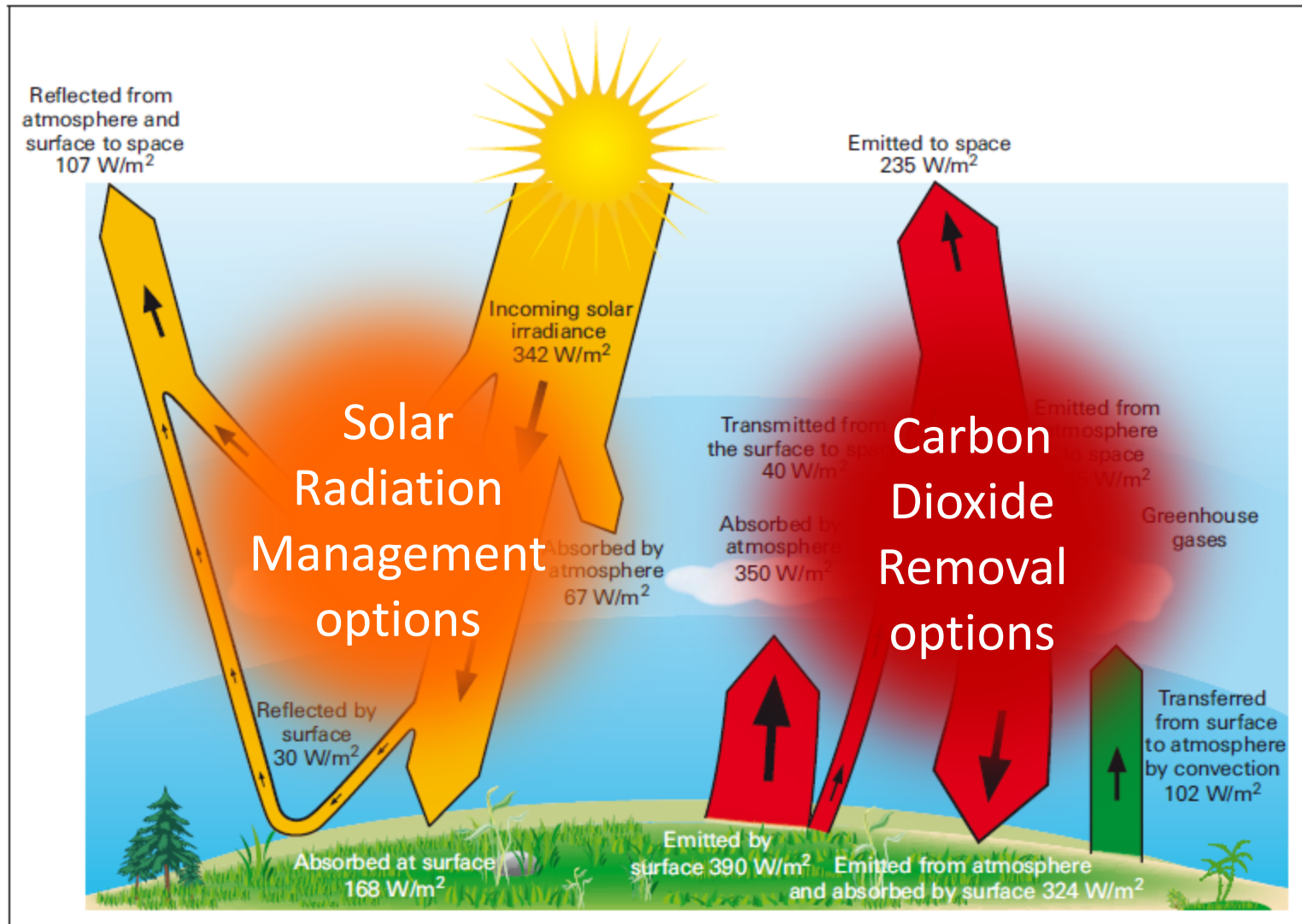
Moderators: **John Shepherd** and Rob Jackson

IGBP Meeting :

Conclusions Relevant to Research

- *Research to provide the knowledge on which to base informed decisions on Geoengineering is needed*
(no moratorium on Geoengineering research)
- *The research that is needed to address the ecosystem impacts of Geoengineering is many cases similar or complementary to that needed on the impacts of climate change, and mainstream ecological research.*
(added value of existing research)
- *Some Geoengineering methods will purposefully target altering ecosystems – such as Ocean Fertilization, whereas others may have inadvertant effects on ecosystems*
(direct and indirect effects on ecosystems)

Climate Energy Balance



Impacts of Geoengineering on Ecosystems

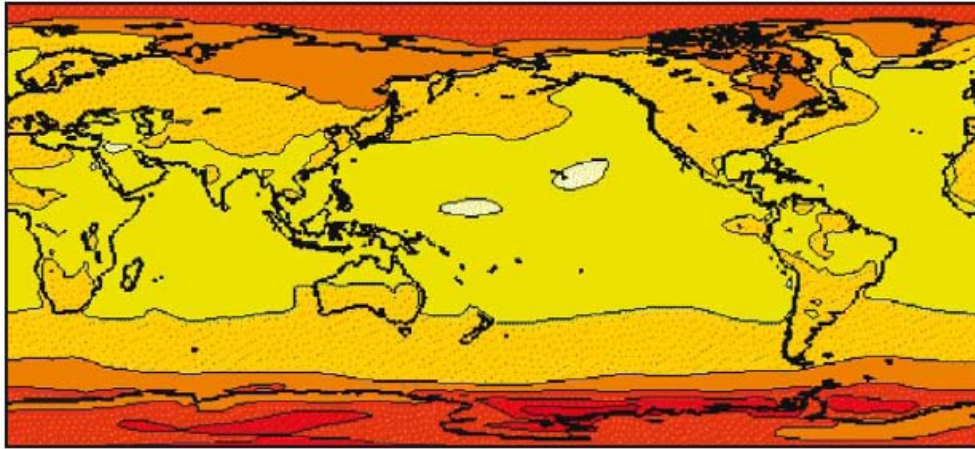
- Impacts arising from direct modification of ecosystems for geoengineering (e.g. ocean fertilization, forestation, biochar) - mainly applies to CDR
- Impacts of residual climate change - applies to SRM only.

How large is the residual climate change?

*...and what would the effect of this be on
Ecosystems and Ecosystem Services?*

New Geoengineering-specific Questions

(a)

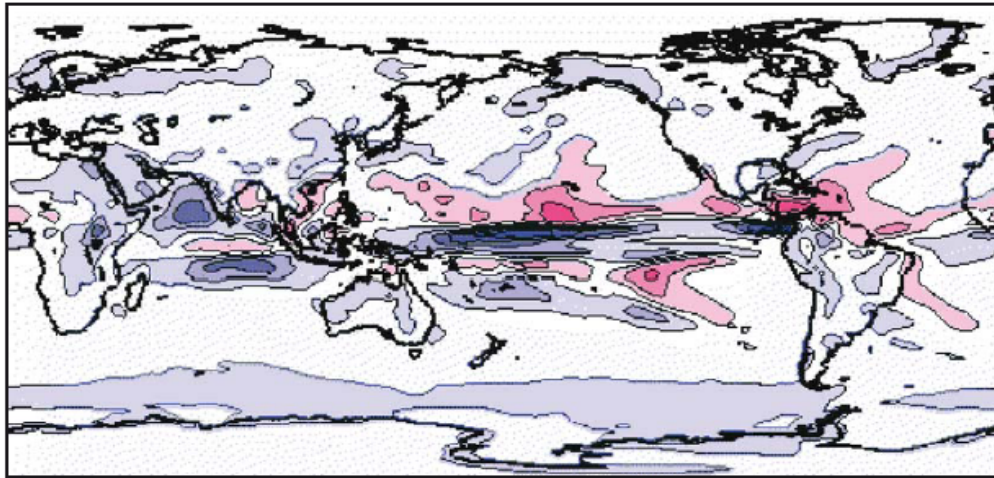


2xCO₂

**2xCO₂ +
Compensating
reduction in
SW radiation (-1.84%)**

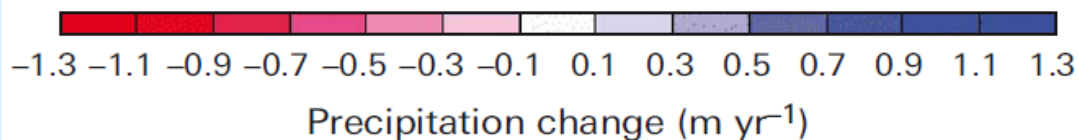


(a)



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Impacts of Geoengineering on Ecosystems

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- Impacts of residual changes in atmospheric CO₂ (e.g. CO₂ fertilization of plant growth, ocean acidification) – applies to SRM only.

**How do the
(likely) positive effects of CO₂ on
land ecosystems**

compare to the

**(likely) negative impacts of CO₂ on
ocean ecosystems ?**

Synthesis of existing research ?

Impacts of Geoengineering on Ecosystems

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- Impacts of changes in quantity and diffuse-fraction of sunlight - applies to some SRM methods.

How would ecosystems be affected by changes in the sunlight they receive ?

**Geoengineering-specific Question,
but relevant research already undertaken..**

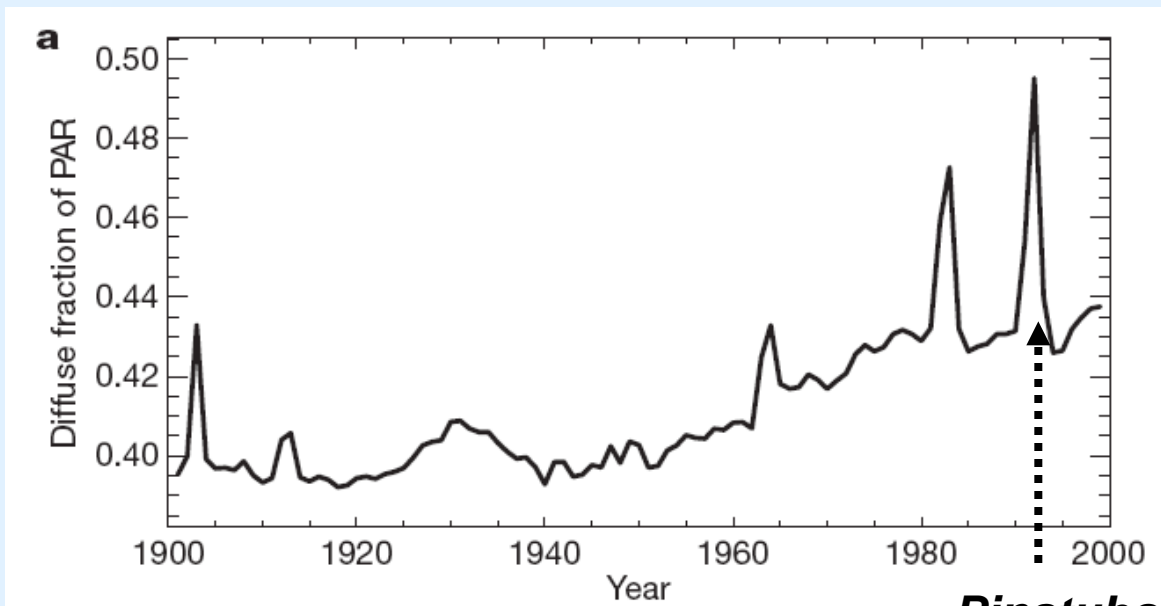
LETTERS

Impact of changes in diffuse radiation on the global land carbon sink

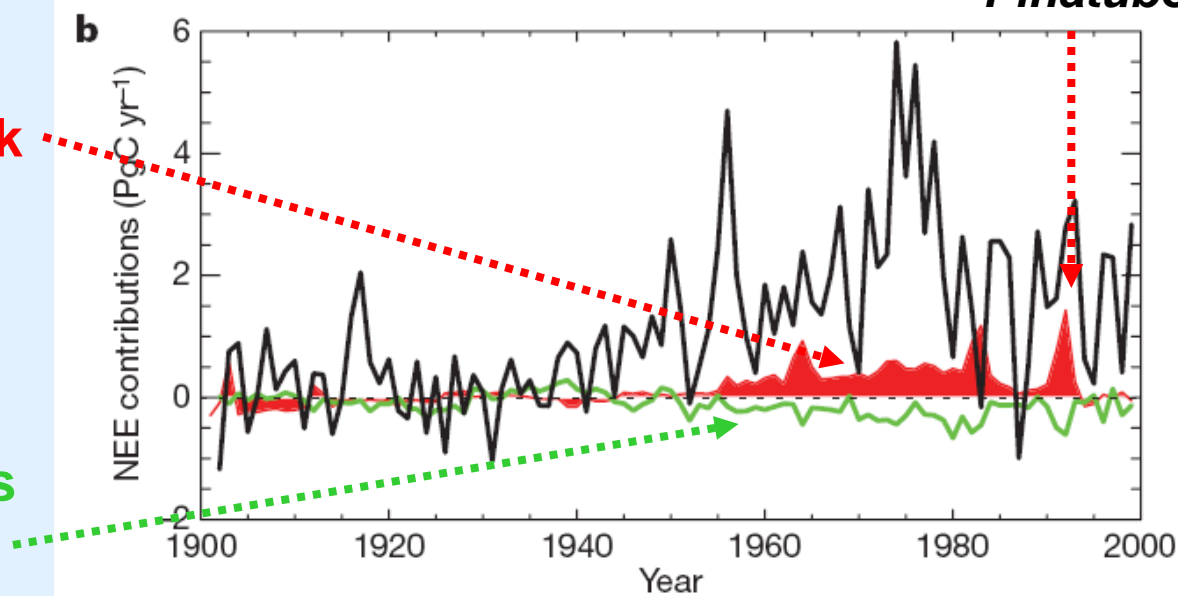
Lina M. Mercado¹, Nicolas Bellouin², Stephen Sitch², Olivier Boucher², Chris Huntingford¹, Martin Wild³
& Peter M. Cox⁴

Mercado et al., 2009

Impact of Diffuse PAR on the 20th Century Land Carbon Sink



Pinatubo



25% enhancement of 1960-1999 land carbon sink by variations in diffuse radiation

Partial offset by reductions in Total PAR

IGBP Meeting :

Conclusions Relevant to Research

- *International cooperation in the design and execution of research programmes would be highly desirable.*
(international collaboration)
- *Any Geoengineering-related research should be multi-disciplinary....Research in the natural sciences should be complemented with social science research to examine barriers and real and perceived risks.*
(multi-disciplinary research)
- *Geoengineering-related ecological research should be concentrated on those features of proposed methods which may have effects which are particularly large and/or uncertain.*
(focus new research on largest uncertainties)