IEA Bioenergy

Task 38: Climate change effects of biomass and bioenergy systems

Annette Cowie

NSW GOVERNMENT Primary Industries

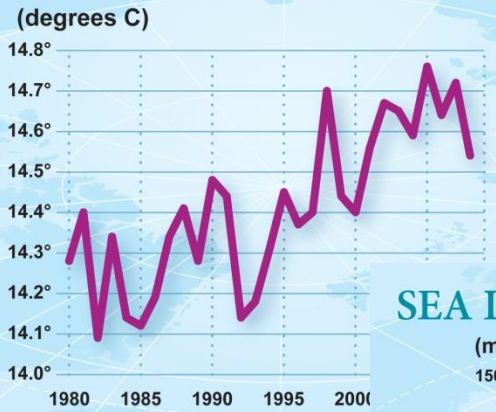
IEA Bioenergy

IEA Bioenergy Task 38

"Climate change effects of biomass and bioenergy systems"

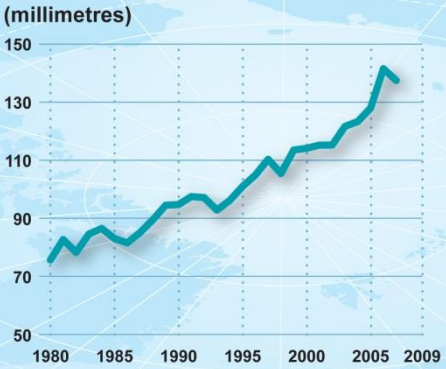
- Leader: Annette Cowie
- Operating agent: Stephen Schuck
- Participants: Australia, Brazil, France, Finland, Germany, Norway, Sweden, USA

GLOBAL AVERAGE TEMPERATURE



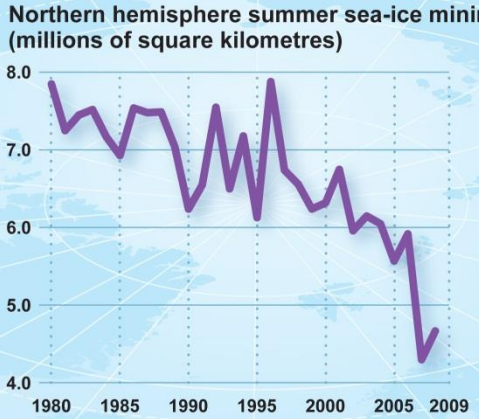
Source: NASA

SEA LEVEL



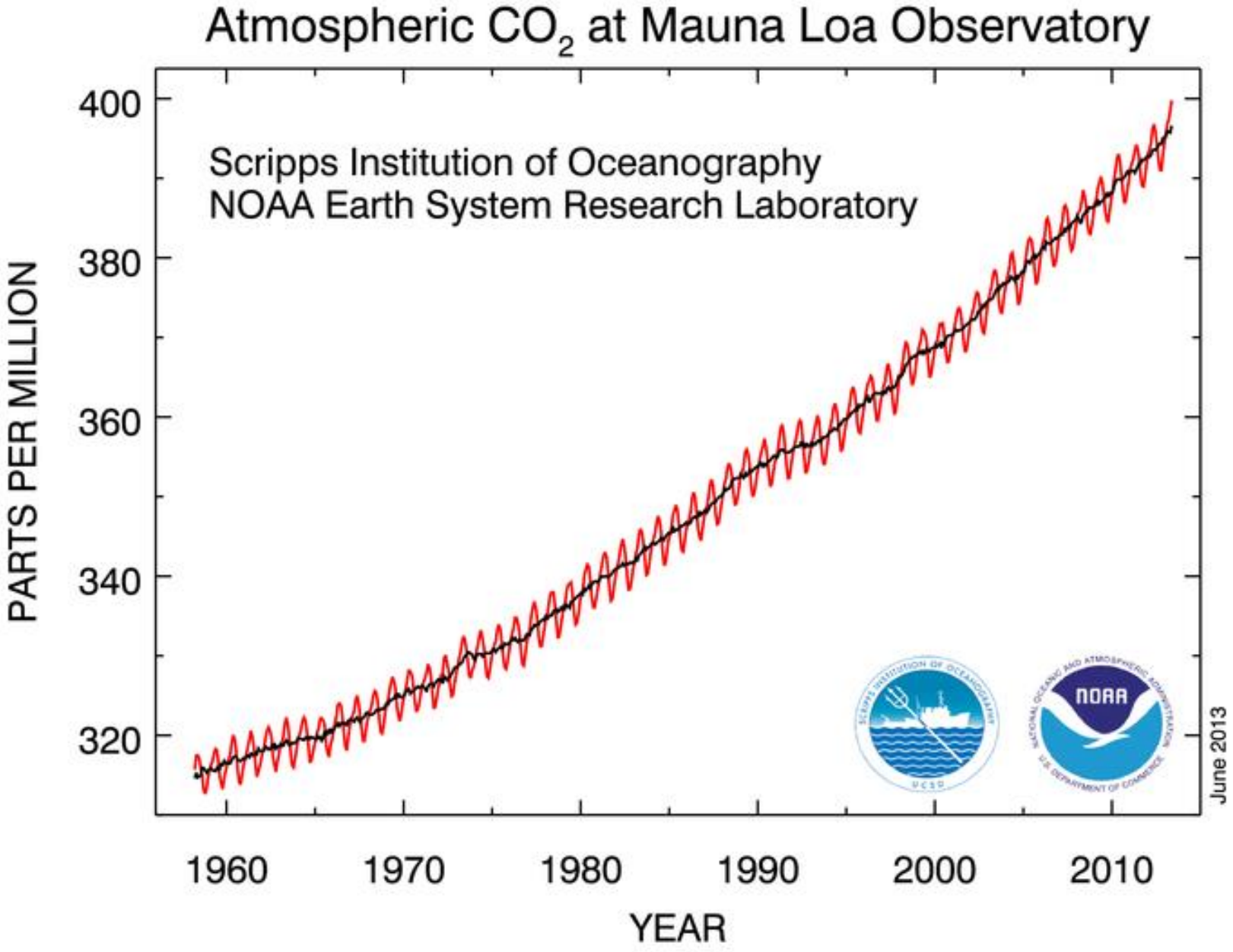
Source: Church and White global mean sea-level reconstruction
using data from the Permanent Service for Mean Sea Level, Prou
Oceanographic Laboratory, Natural Environment Research Coun

ARCTIC SEA-ICE COVER



Source: NOAA

GLOBAL CHANGE IGBP International Geosphere-Biosphere Programme


Atmospheric CO_2 at Mauna Loa Observatory
Scripps Institution of Oceanography
NOAA Earth System Research Laboratory
PARTS PER MILLION
400
380
360
340
320
1960
1970
1980
1990
2000
2010
YEAR
June 2013

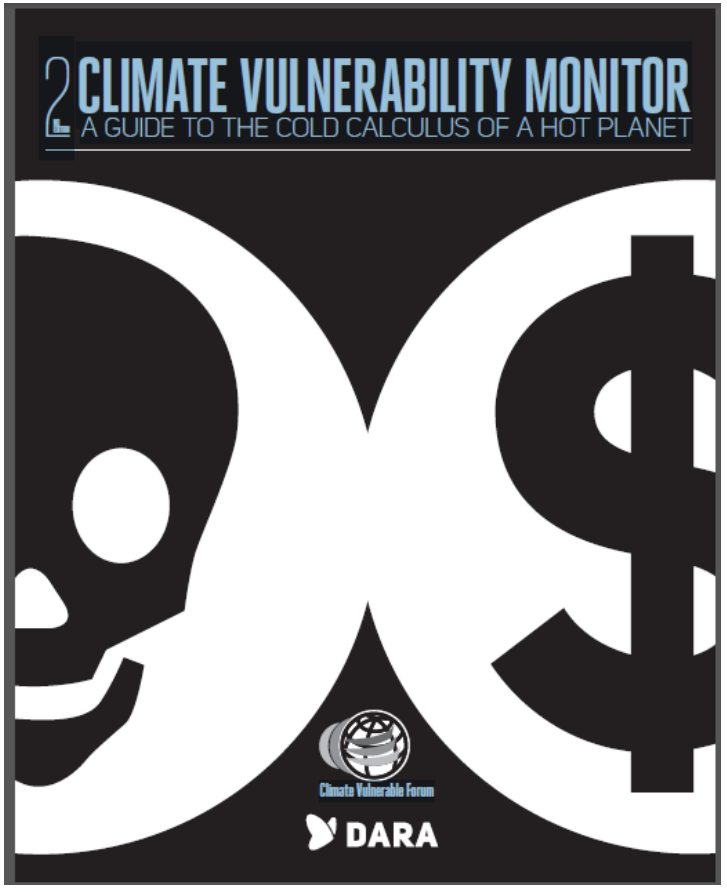
Costs of climate change

In 2010, climate change cost:

- 700 billion USD
  - 0.9% global GDP
- 400,000 deaths per year – 90% children

Climate change + Carbon economy

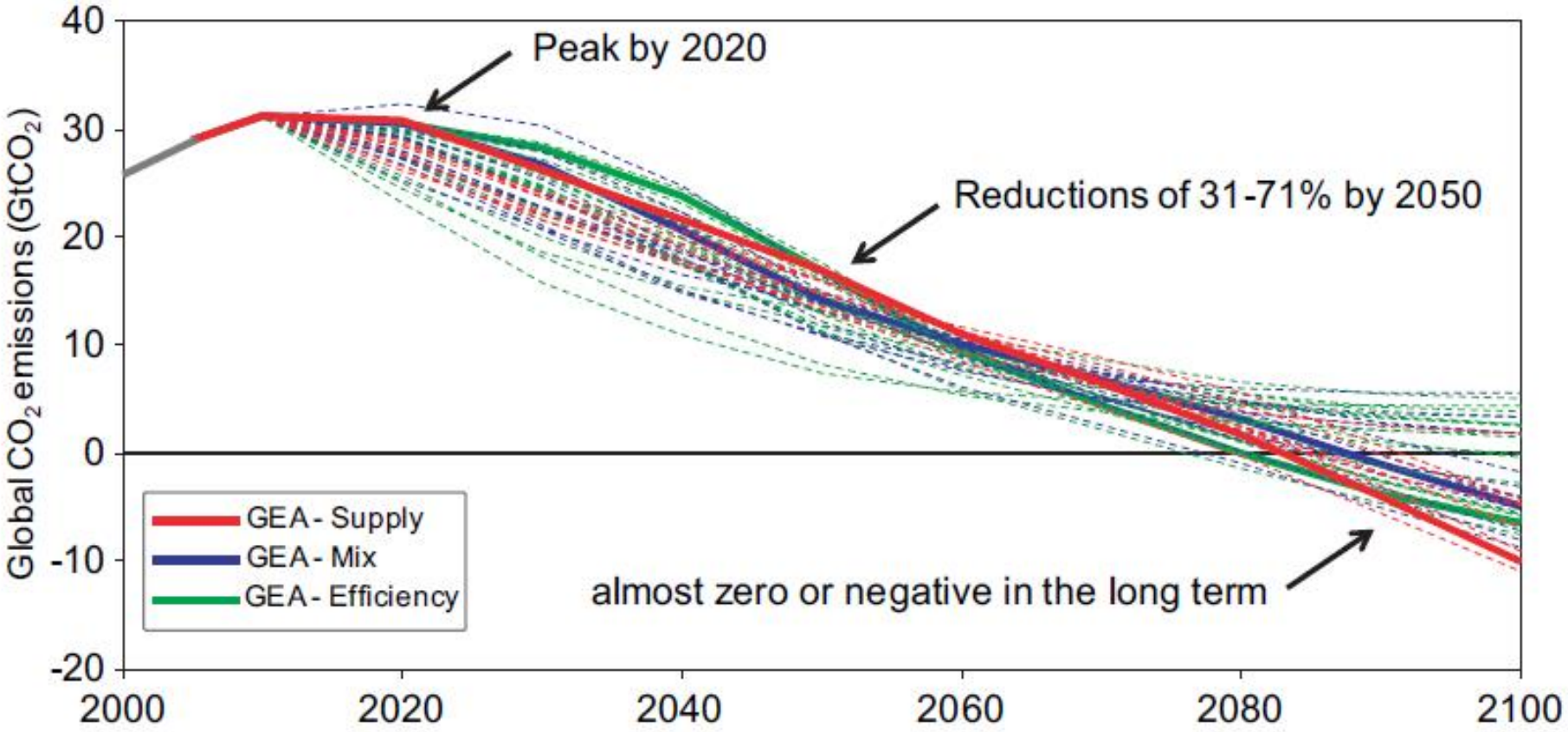
- costs 1.2 trillion USD
- kills 4.975 million



DARA, 2012

Too late for **2° C**

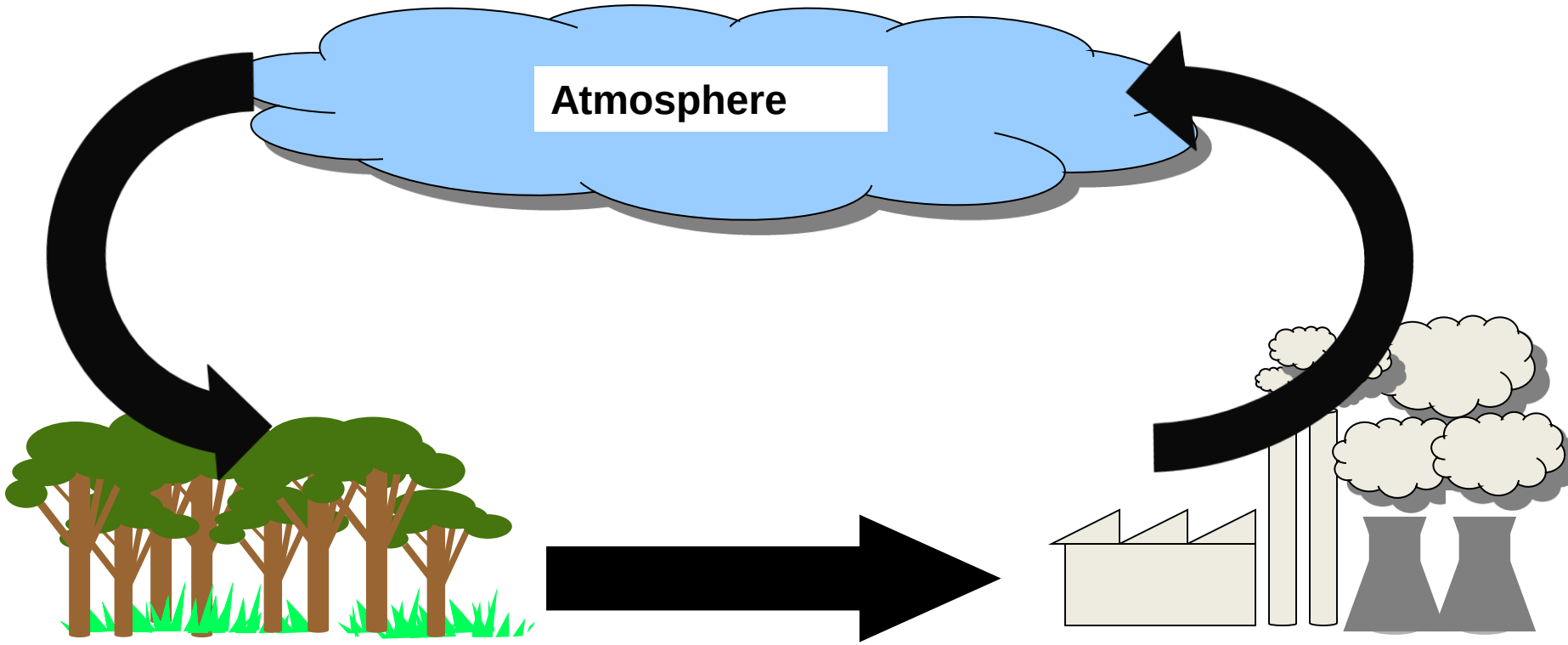
- 2° C: target of the Copenhagen Accord to avoid catastrophic outcomes
- Already increased by 1 degree
- At least 0.5 degree unavoidable
- Without immediate and drastic action we cannot meet the 2° C target



Global Energy Assessment 2012

Negative emissions options

- Afforestation, soil carbon management
- Enhanced weathering
- Direct air capture
- Ocean fertilisation
- "BECCS" –
  Bioenergy+ Carbon Capture &Storage
- GEA, IPCC AR5: relying on BECCS to provide "negative emissions"
- IPCC AR5: Technical potential for forest bioenergy in 2050: 50-100 EJ



Bioenergy – “carbon neutral”

(nearly)

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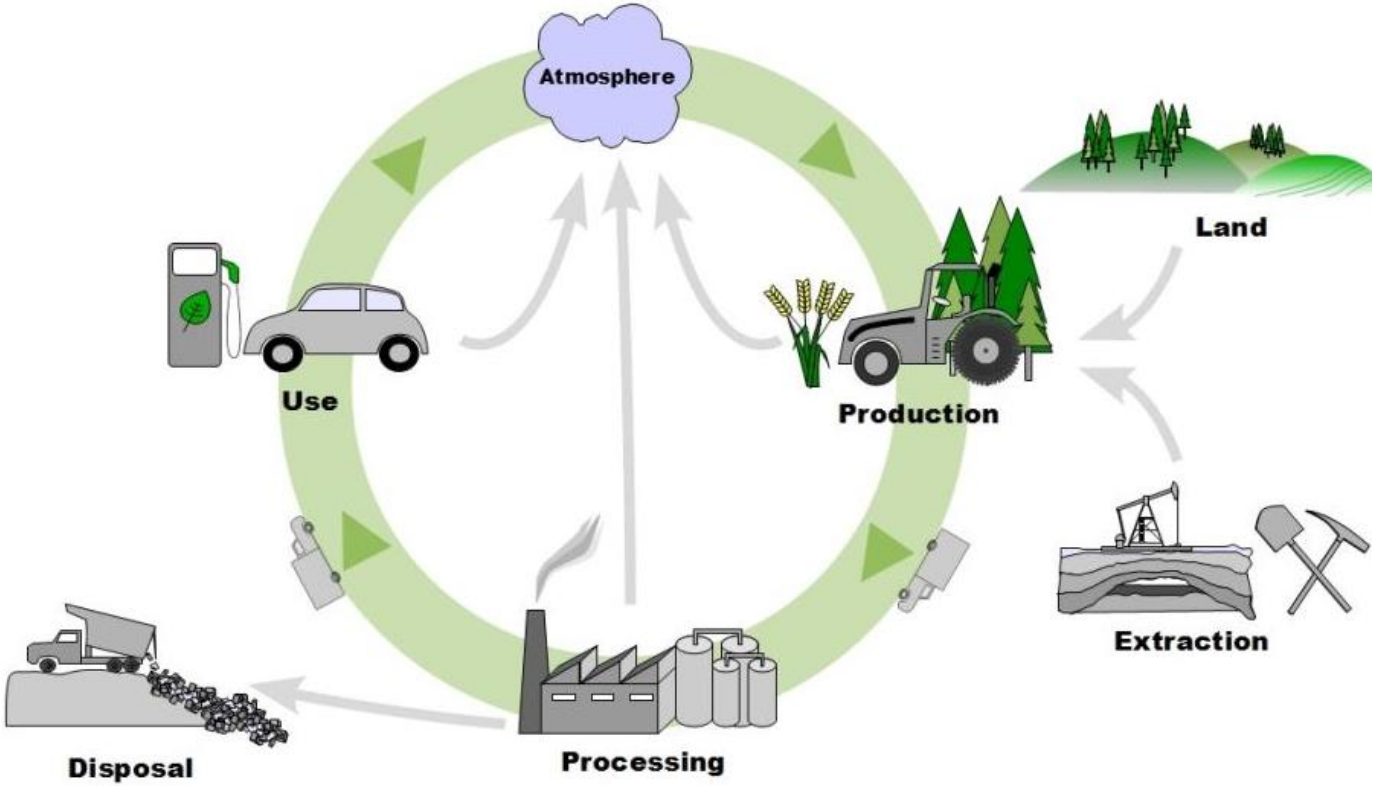
Objectives

- Promote sustainable bioenergy that contributes to climate change mitigation
  - Guide decisions on best mitigation options
- Refine, demonstrate and promote standard methods to document climate impacts of bioenergy
  - “standard methodology” for calculating life cycle climate impacts
  - Assess new issues, technologies and topics that emerge;
- Promote international scientific exchange amongst experts
- Contribute to policy development

Not carbon neutral because:



- Production chain emissions
- Non-CO_2 GHGs
- C stock change in biomass, soil, (direct effects, may involve dLUC)
- C stock change in biomass or soil thru ILUC
- Albedo and other biophysical effects on climate

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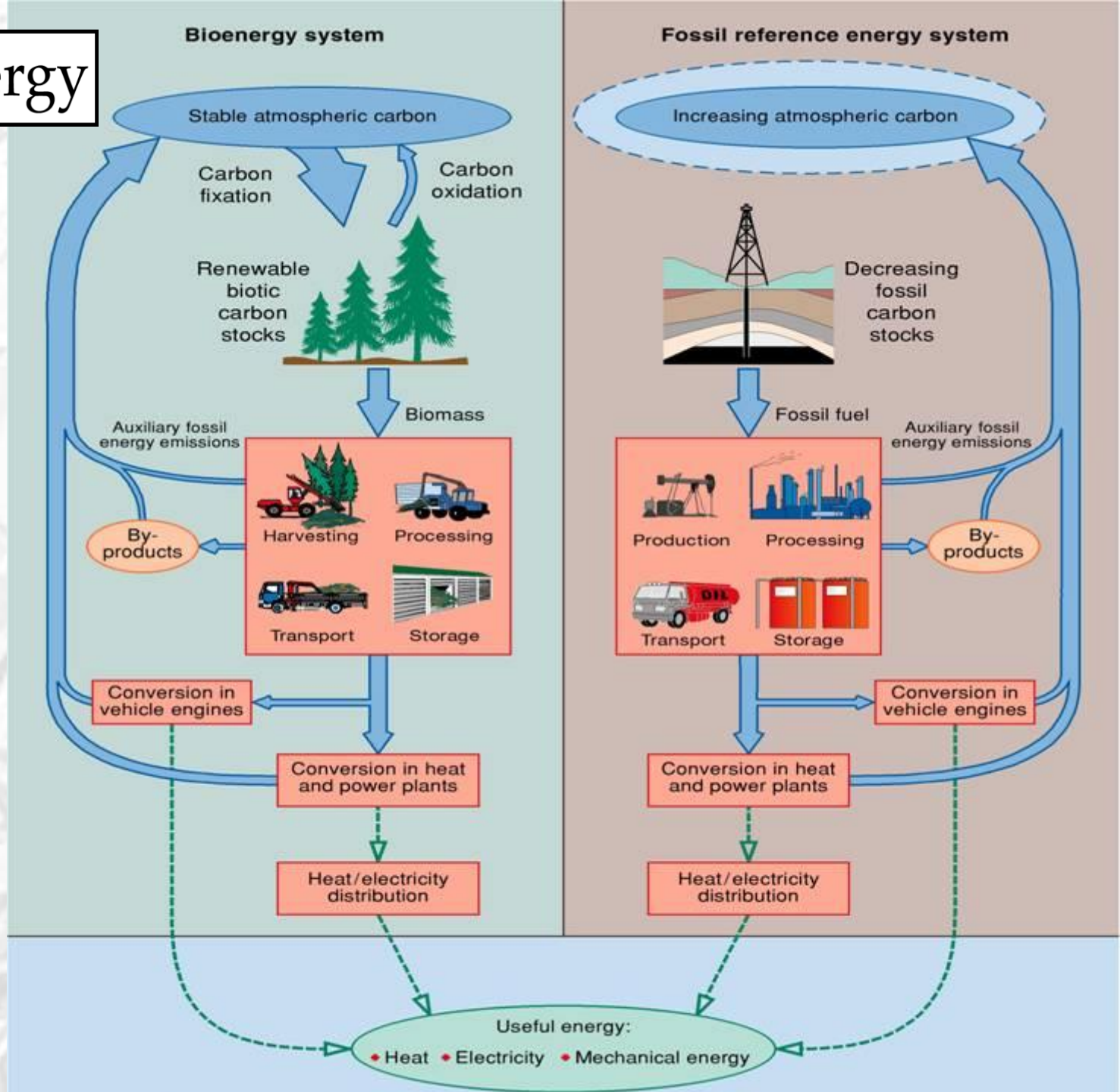
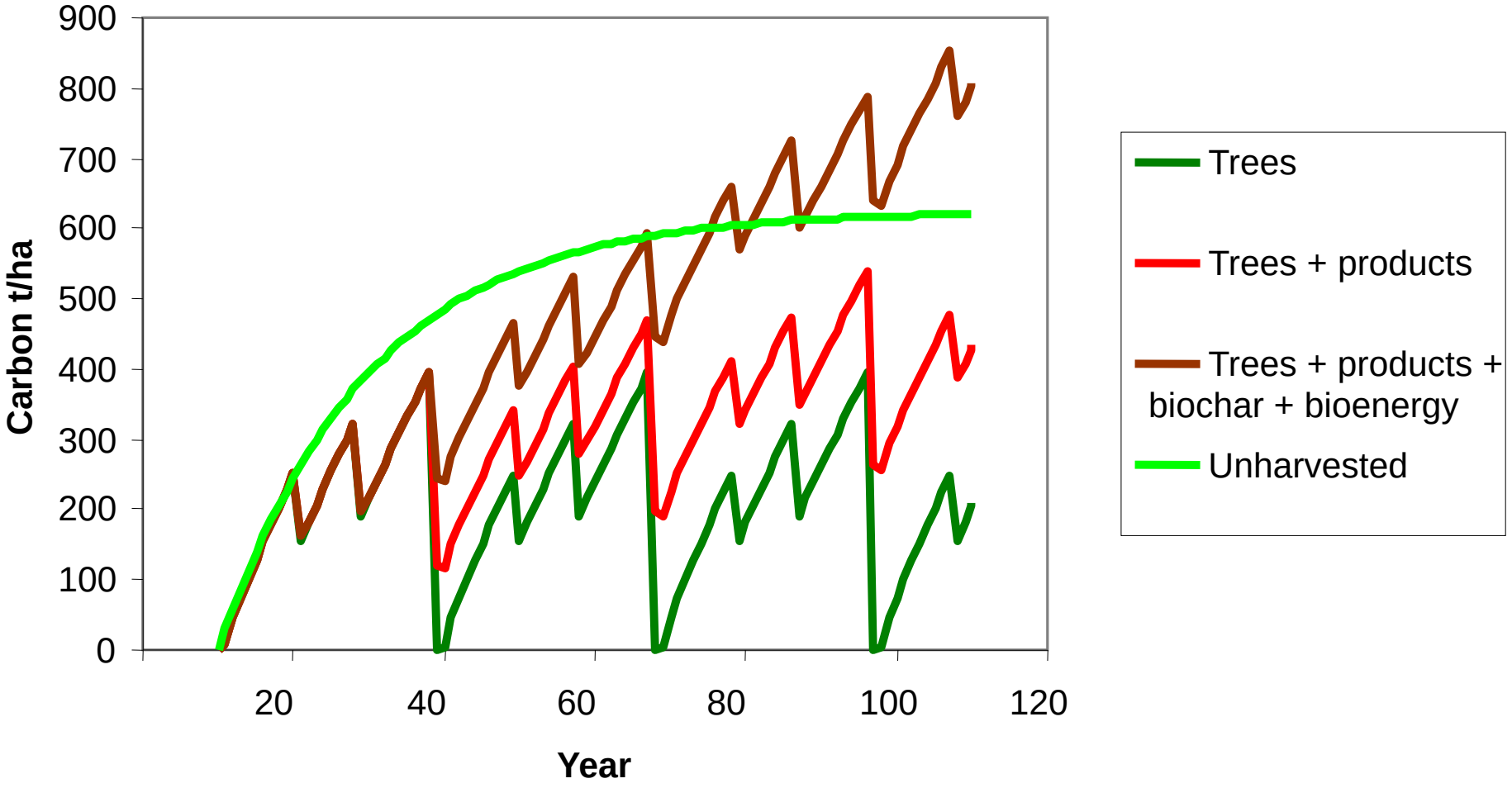
Task 38



Potential mitigation through wood products and bioenergy



Manomet Center for Conservation Sciences JUNE 2010 NCI-2010-03

NATURAL CAPITAL INITIATIVE AT MANOMET REPORT

BIOMASS SUSTAINABILITY AND CARBON POLICY STUDY

CONTACT IN

Manomet C

Bioenergy

a carbon accounting time bomb

BirdLife INTERNATIONAL · EUROPEAN ENVIRONMENTAL BUREAU · TRANSPORT & ENVIRONMENT

Biomass better than coal? War over carbon accounting erupts

In Washington, the Environment Working Group has released a study that claims the impacts of the American Clean Energy and Security Act (ACESA)—which has already passed the House of Representatives—would require the equivalent of cutting between 18 and 30 million acres by 2025, and up to 50 million acres by 2030.

"From Maine to Washington state, from Ohio to Florida," the EWG report says, "electric utilities have been embracing "biomass power" as a way to reduce dependence on coal and other fossil fuels and to meet ambitious goals for limiting greenhouse

CLIMATE CHANGE

Fixing a Critical Climate Accounting Error

Timothy D. Searchinger,[1]* Steven P. Hamburg,[2]* Jerry Melillo,[3] William Chame
Petr Havlik,[5] Daniel M. Kammen,[6] Gene E. Likens,[7] Ruben N. Lubowski,[2] Micha
Michael Oppenheimer,[1] G. Philip Robertson,[8] William H. Schlesinger,[7] G. Davi

Rules for applying the Kyoto Protocol and national cap-and-trade laws contain a but fixable, carbon accounting flaw in assessing bioenergy.

The accounting now used for assessing compliance with carbon limits in the

not count changes in emis
use when biomass for energ

Kyoto context

- Bioenergy treated as CO_2 neutral in energy sector
- Assumes C stock changes included in LULUCF
- Assumes fossil energy inputs in energy sector
- Assumes non-CO_2 included in agriculture
- Correct where these assumptions are valid

But

  - Only Annex I countries covered
  - Most countries didn't count forest C stock change in KP-CP1 (but will in CP-2)

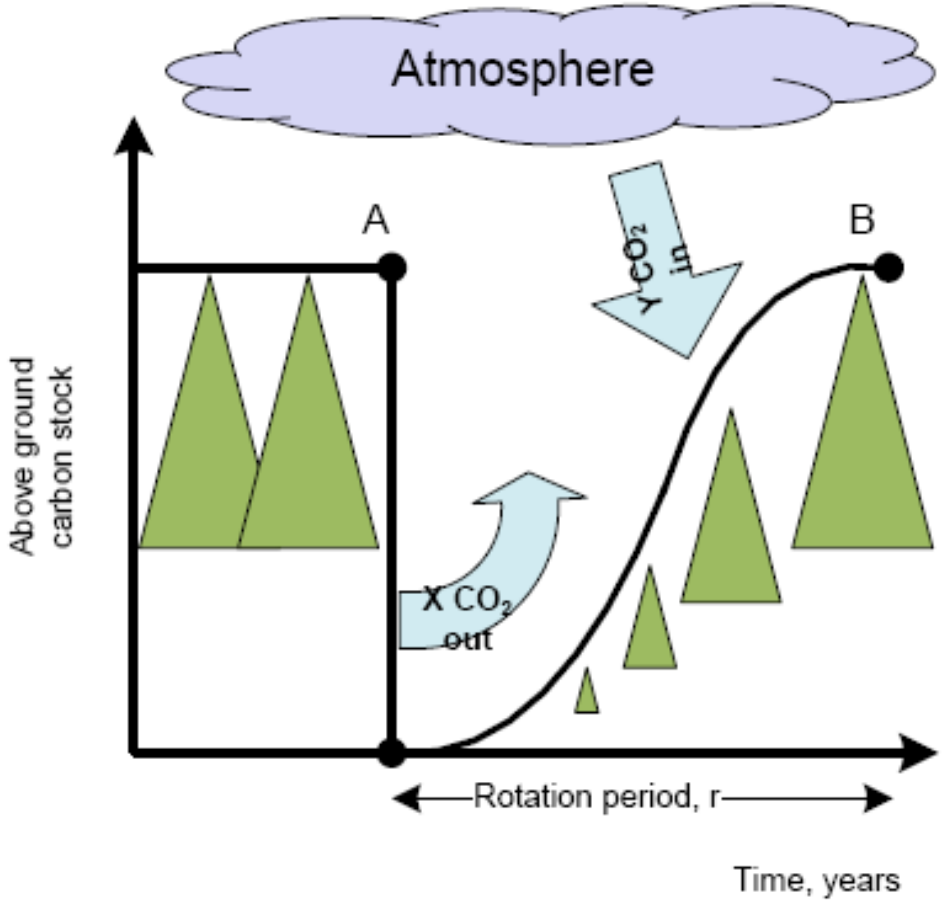
Could:

- limit C neutral status to sources that meet assumptions
- Use other policy measures

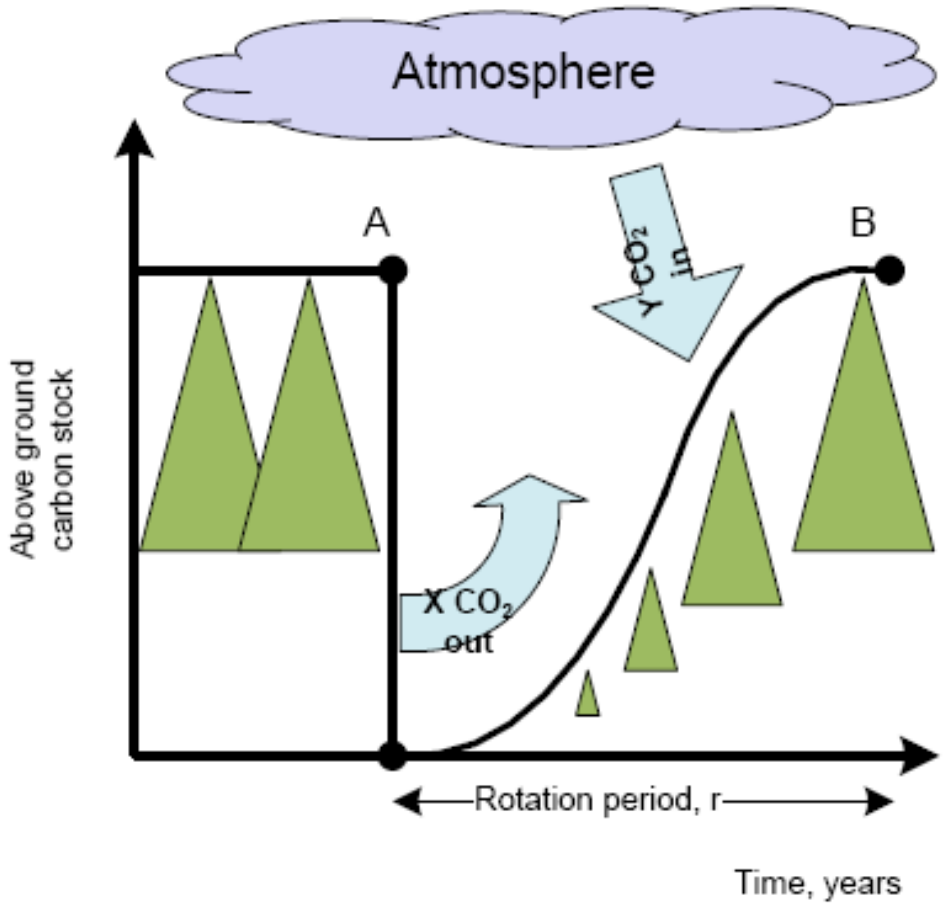
Calls to revoke carbon neutrality, and count as for fossil emissions

Bioenergy

- Carbon neutral?
  - Maybe nearly
- Climate neutral?
  - Not if you start with existing forest

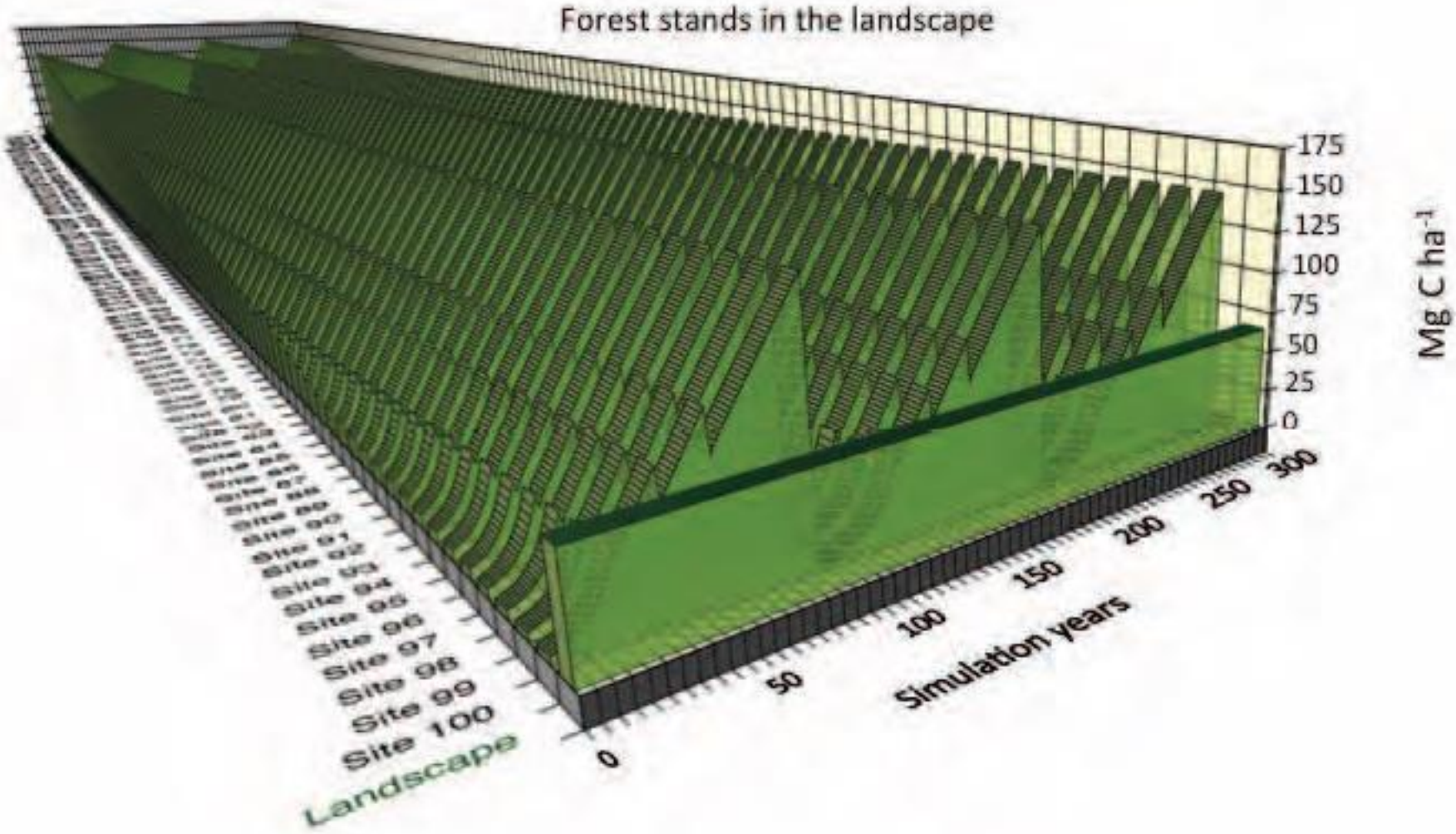


Spatial scale?

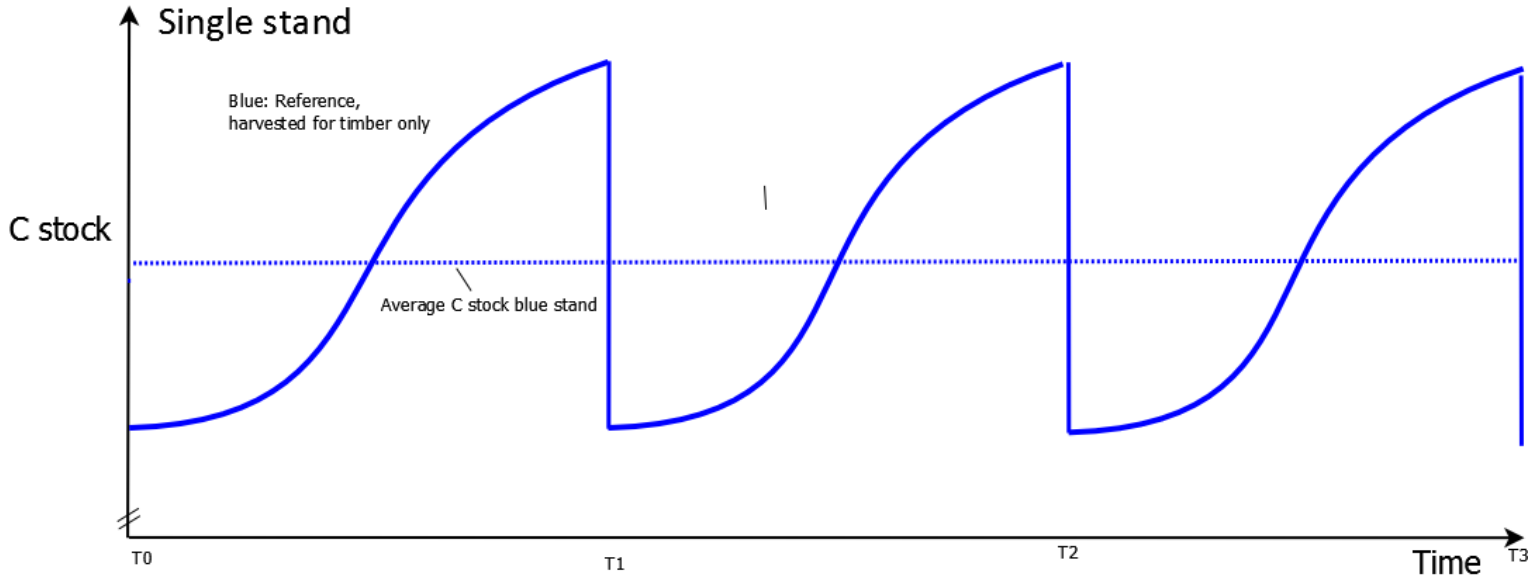


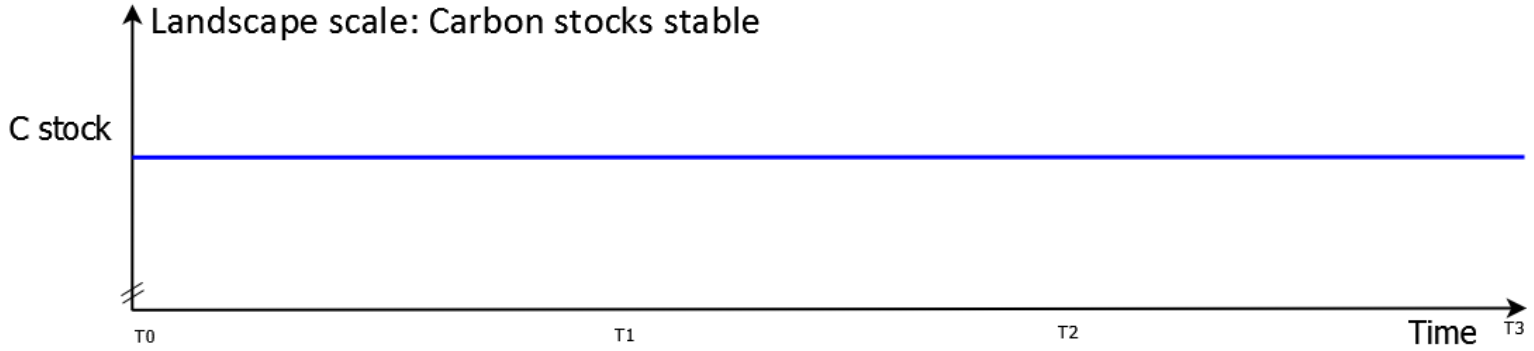
F Cherubini NTNU

Spatial scale?



Berndes et al 2011


Single stand
Blue: Reference,
harvested for timber only
C stock
Average C stock blue stand
T0
T1
T2
Time
T3


Landscape scale: Carbon stocks stable
C stock
T0
T1
T2
Time
T3

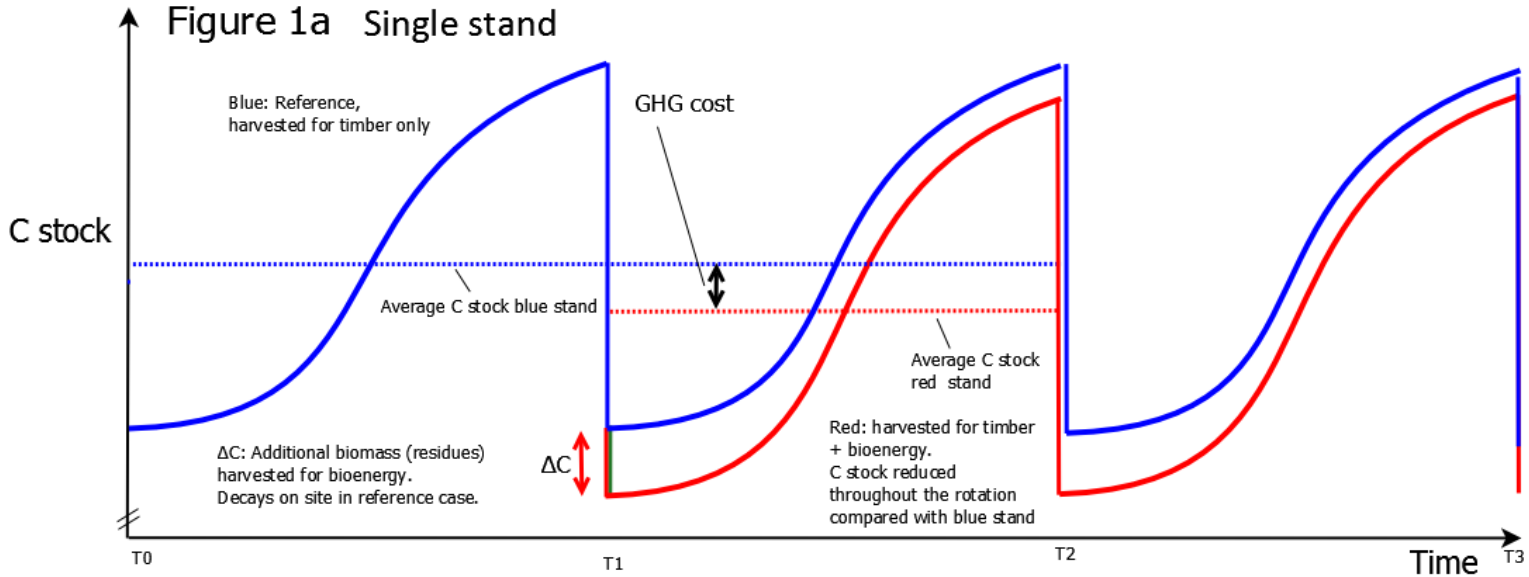


Figure 1a Single stand
C stock
Blue: Reference,
harvested for timber only
GHG cost
Average C stock blue stand
Average C stock
red stand
ΔC: Additional biomass (residues)
harvested for bioenergy.
Decays on site in reference case.
ΔC
Red: harvested for timber
+ bioenergy.
C stock reduced
throughout the rotation
compared with blue stand
T0
T1
T2
T3
Time

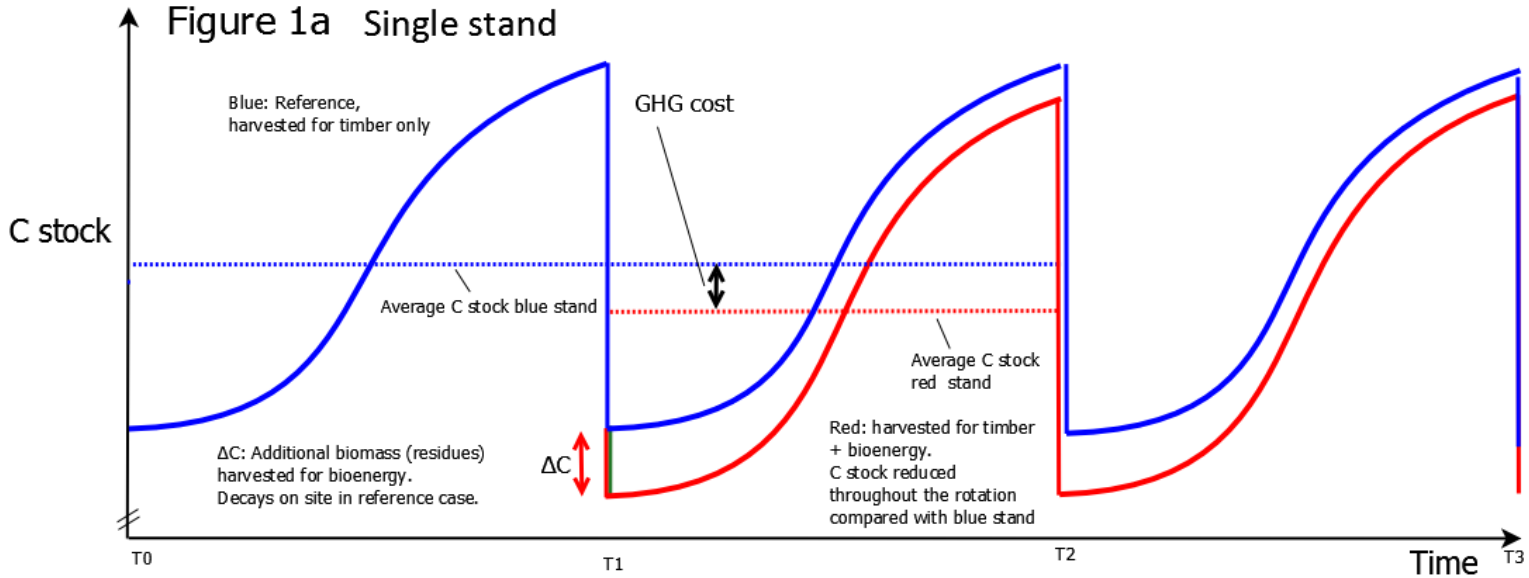
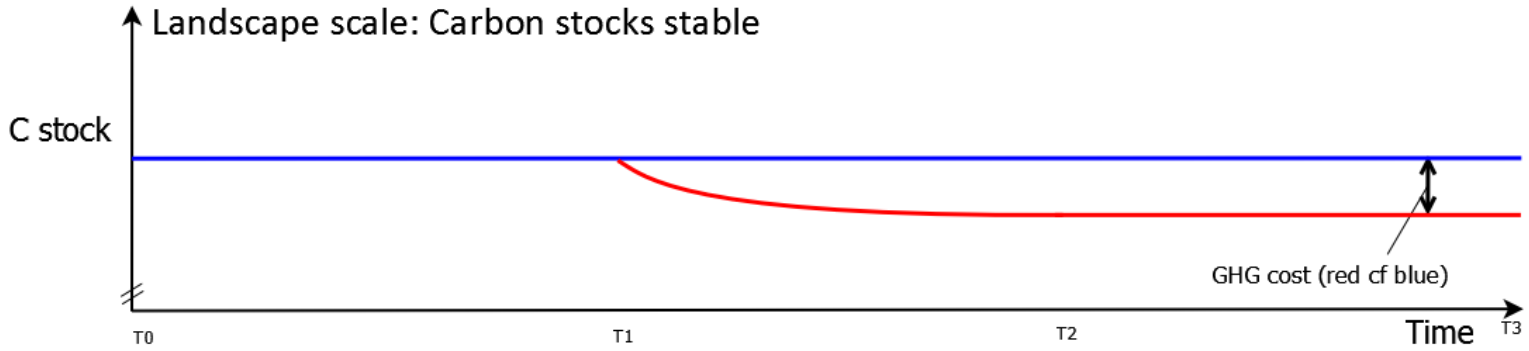


Figure 1a Single stand
Blue: Reference,
harvested for timber only
GHG cost
C stock
Average C stock blue stand
Average C stock
red stand
ΔC: Additional biomass (residues)
harvested for bioenergy.
Decays on site in reference case.
ΔC
Red: harvested for timber
+ bioenergy.
C stock reduced
throughout the rotation
compared with blue stand
T0
T1
T2
Time
T3


Landscape scale: Carbon stocks stable
C stock
GHG cost (red cf blue)
T0
T1
T2
Time
T3

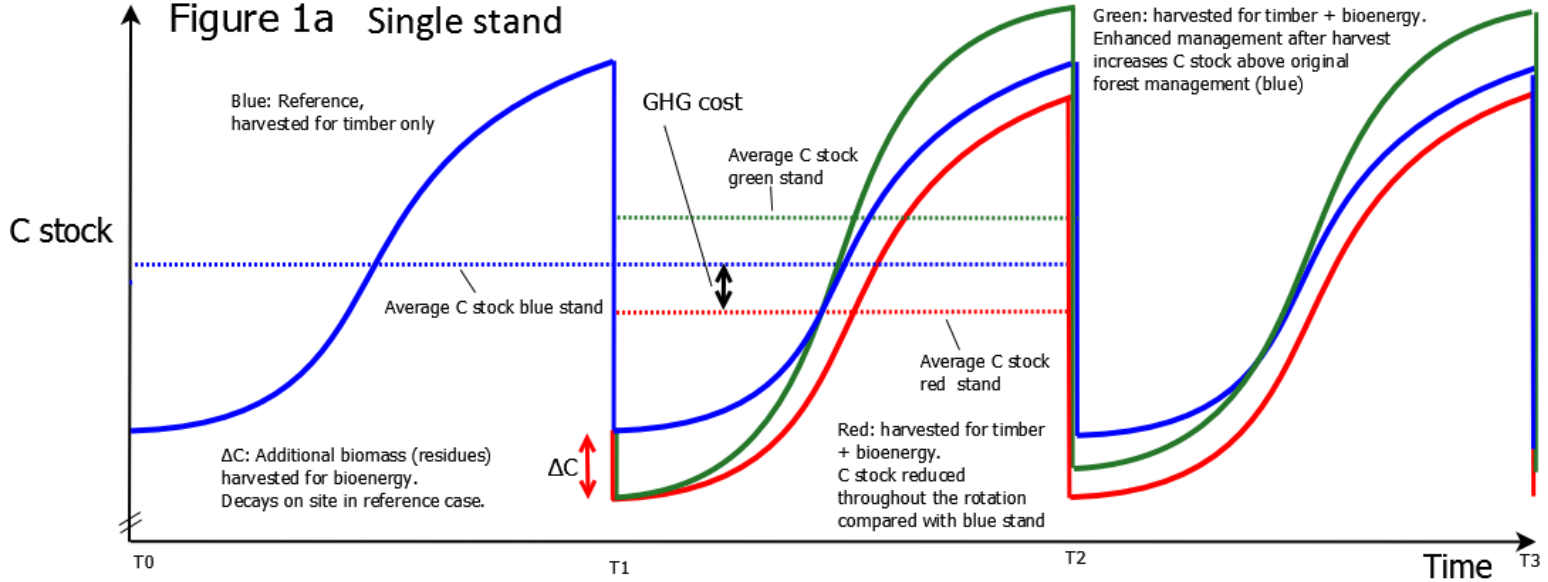


Figure 1a Single stand
Blue: Reference,
harvested for timber only
GHG cost
Average C stock
green stand
Green: harvested for timber + bioenergy.
Enhanced management after harvest
increases C stock above original
forest management (blue)
C stock
Average C stock blue stand
Average C stock
red stand
ΔC: Additional biomass (residues)
harvested for bioenergy.
Decays on site in reference case.
ΔC
Red: harvested for timber
+ bioenergy.
C stock reduced
throughout the rotation
compared with blue stand
T0
T1
T2
Time
T3

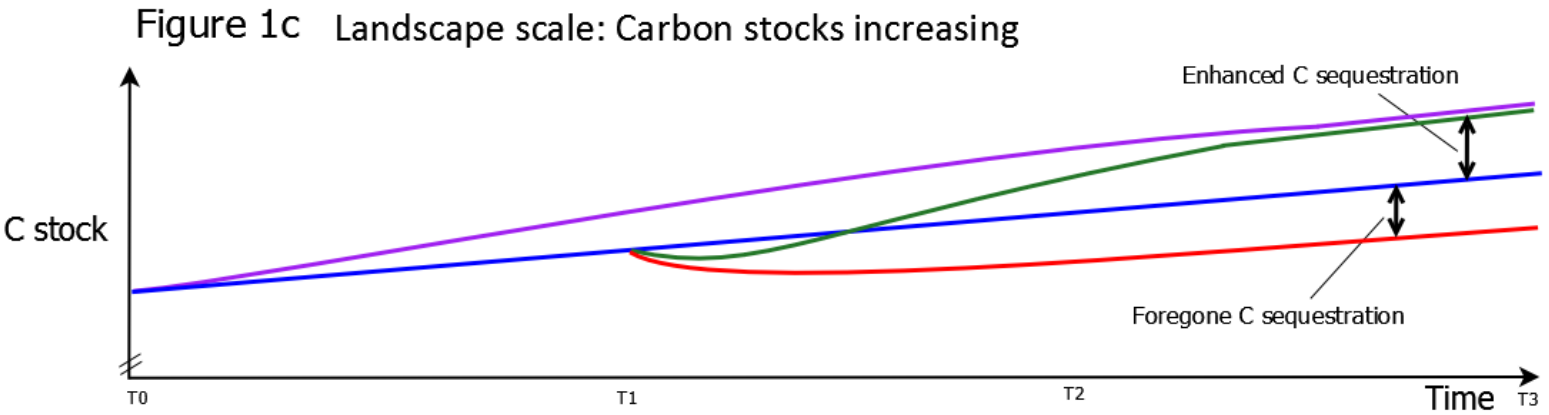
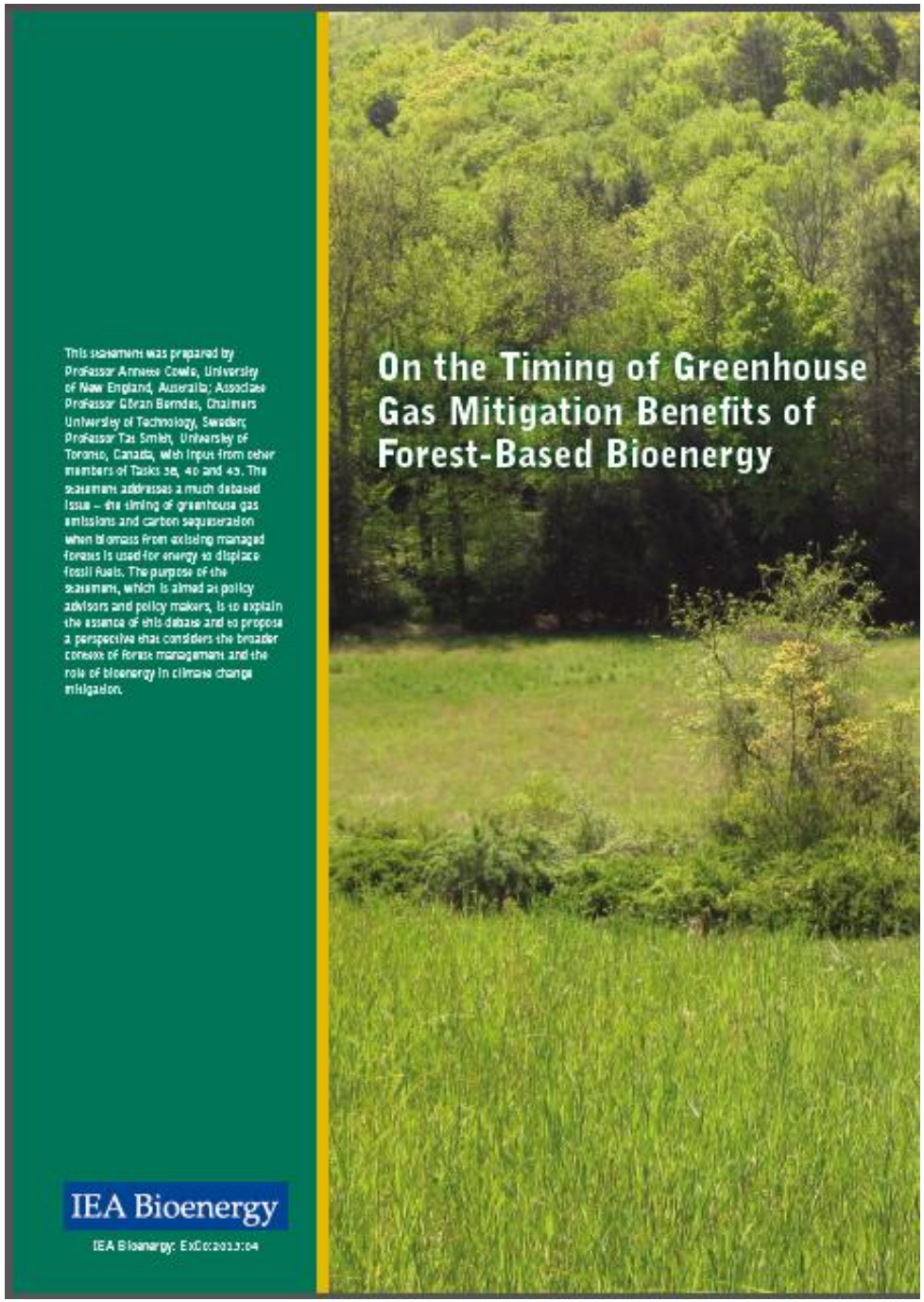


Figure 1c Landscape scale: Carbon stocks increasing
Enhanced C sequestration
C stock
Foregone C sequestration
T0
T1
T2
Time
T3



Timing statement published by ExCo

Authors:

Annette Cowie, Göran Berndes, Tat Smith and others from Tasks 38, 40 and 43

http://www.ieabioenergy.com/publications/on-the-timing-of-greenhouse-gas-mitigation-benefits-of-forest-based-bioenergy/

IEA Bioenergy

- Biomass for energy is usually one of several products from a managed forest
- Forest C stocks fluctuate (at the stand level) over time and space - a forest is a mosaic of age classes
- Forest C stock across the estate
  - May be increasing or decreasing or stable
  - A function of management and natural factors

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- Compare bioenergy and reference C stock to determine GHG cost
- Loss in C stock can be minimised by investment in intensive forest management
- GHG cost is an investment in establishing renewable energy system

IEA Bioenergy

Joint workshop

- Joint meeting IEA Bioenergy Tasks 38, 40, 43 with JRC, EEA
- 19-20 May 2014, Copenhagen
- Objectives:
  - Focus on scientific/technical dialogue
    - discussion amongst scientists
    - clarify the various viewpoints, discuss the basis for each,
    - consider the implications for realistic potential for bioenergy, and
    - plan joint activities to further scientific understanding.

- Workshop statement at www.ieabioenergy-task38.org/workshops/copenhagen2014/

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Workshop statement

- Consequential approaches are required for policy development
  - Include all affected industries
  - Indirect market effects: iLUC, rebound
  - Assess at scale relevant to purpose
  - Compare with multiple alternative reference scenarios (not just one BAU)
- Conventional attributional approach may be adequate for policy implementation
- Simplified “go/no-go” lists may be devised in future through risk-based approach – needs research

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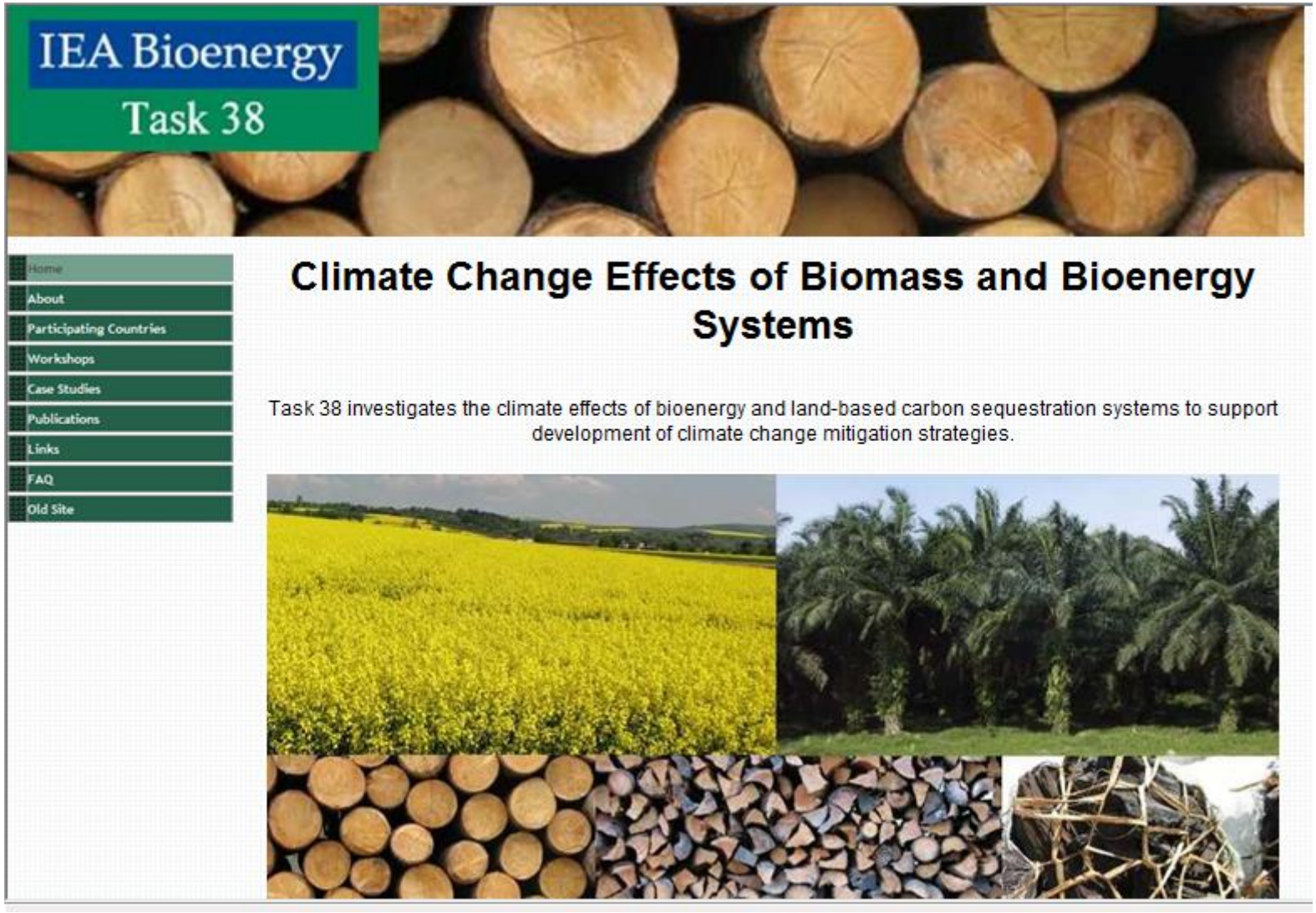
Current activities

- Papers on:
  - Reference system
  - Climate metrics
  - Timing of climate effects
  - Updated standard methodology
- Policy briefs on these papers
- Work with other Tasks:
  - algal biofuel LCA review
  - comparison of GHG tools for biofuels
  - input to joint project on mobilising sustainable biomass supply chains

Web site: www.ieabioenergy-task38.org



IEA Bioenergy Task 38

Climate Change Effects of
Biomass and Bioenergy Systems

www.ieabioenergy-task38.org

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