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Status and Challenges of Monitoring Biological Sinks

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An ecosytem researcher's view at potential inclusion of sinks in ETS – no recommendation will be given

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Why biological sinks are so particular?

In contrast to other sectors dealing with mainly one-directional emissions, biological sinks are part of a natural cycle with short-term and long-term components

Selected essentials of the terrestrial carbon cycle :

- **Biological sinks are relevant and seen in the atmosphere**
- **The atmosphere does not see stocks but fluxes**
- **Biological sinks and historical changes in land use**
- **Soils are the main reservoir of biological sinks**
- **Any soil carbon stock change is relevant**
- **Any terrestrial sink may easily turn into a source**

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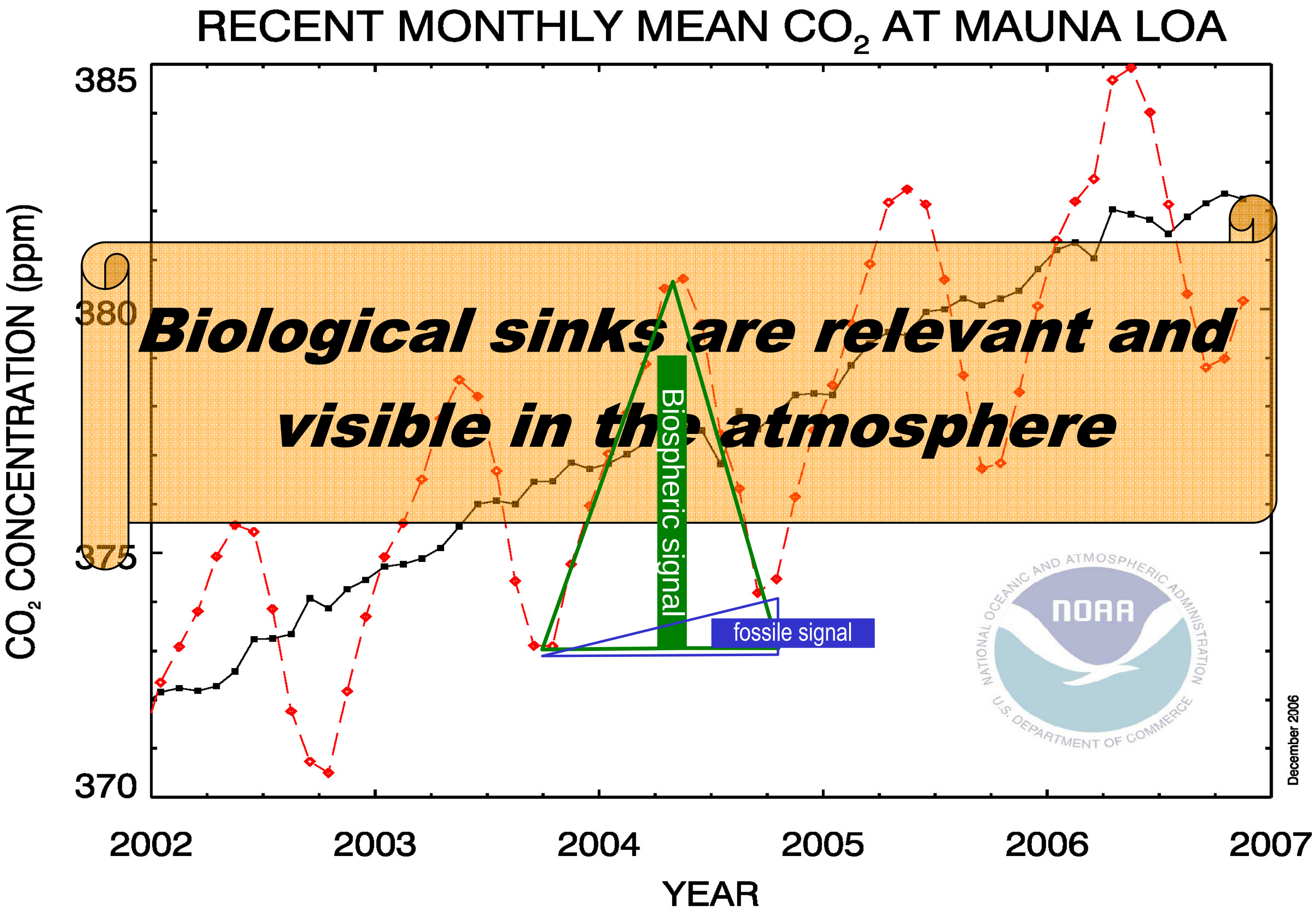
Other essentials will not be discussed, e.g.,

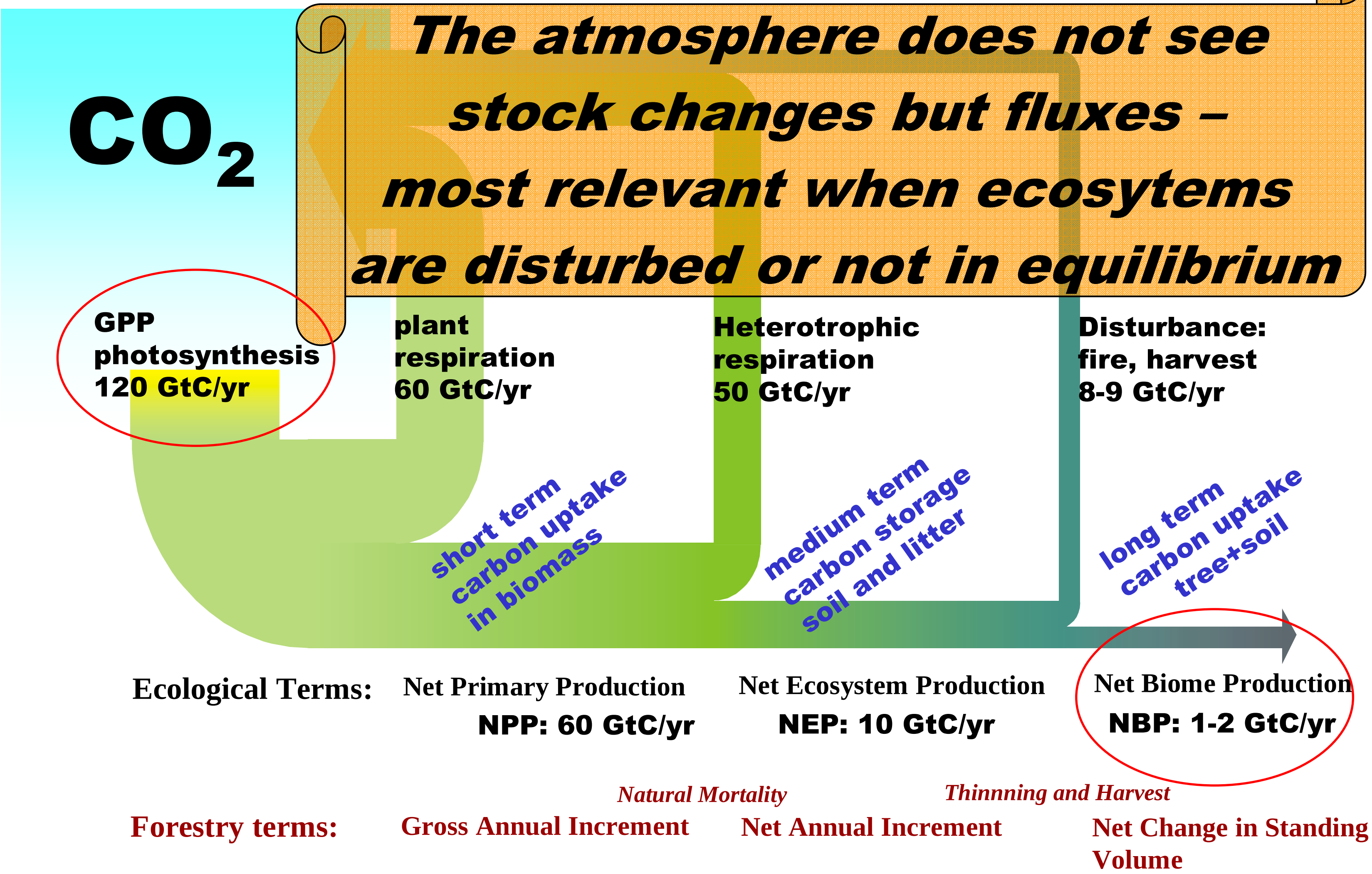
- **Feedbacks with other GHGs and the N-cycle,**
- **Role of management changes and disturbances,**
- **Global C-cycle hot spots,**
- **Carbon in agriculture,**
- **Afforestation and radiative balance/albedo**
- **Biological sinks and biodiversity**

Biological sinks and the atmosphere



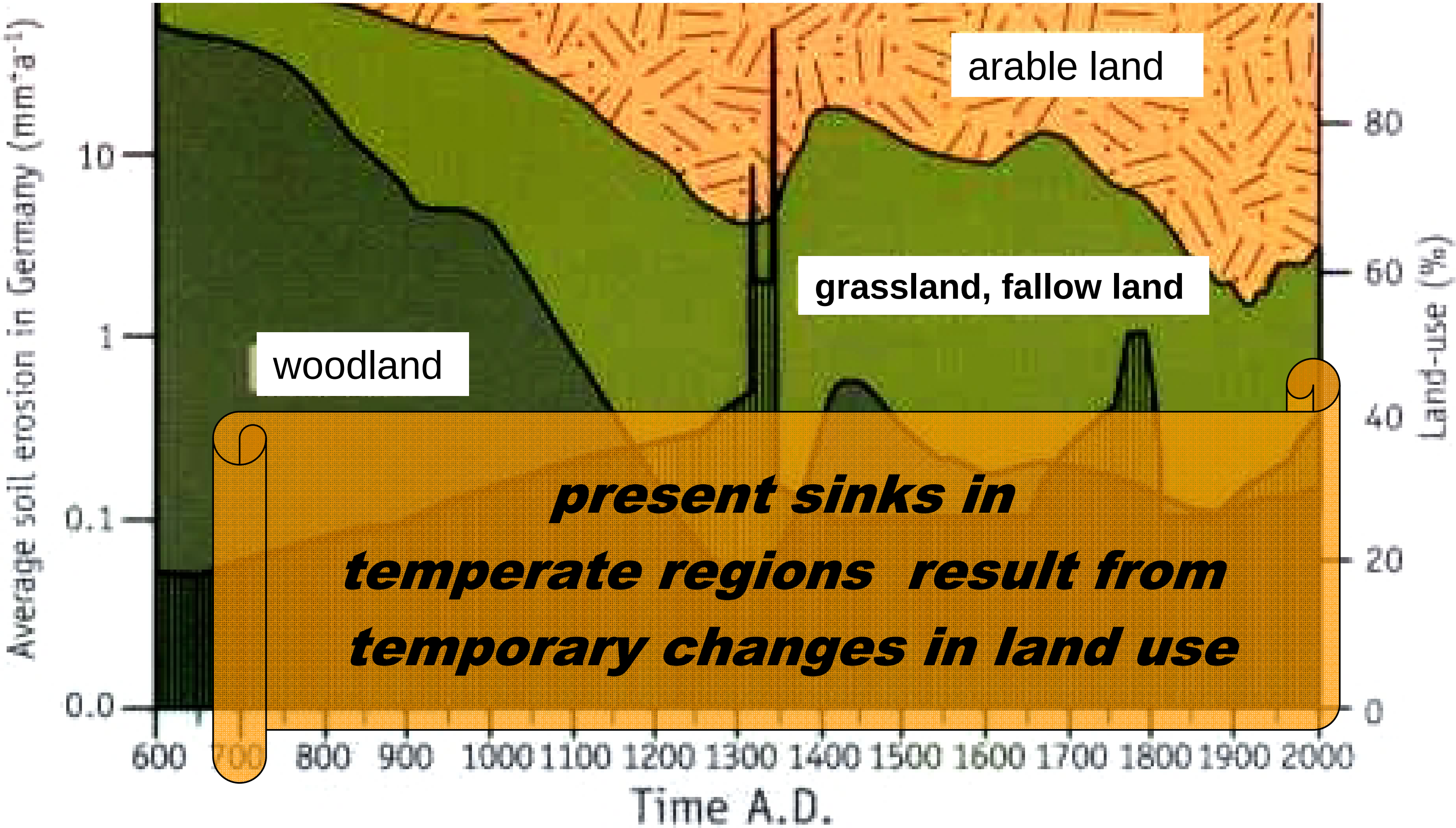
Biological sinks are relevant and visible in the atmosphere

Key fluxes in the terrestrial carbon cycle



Land-use change and soil erosion in Germany (without Alps)

(from IGBP 2003)



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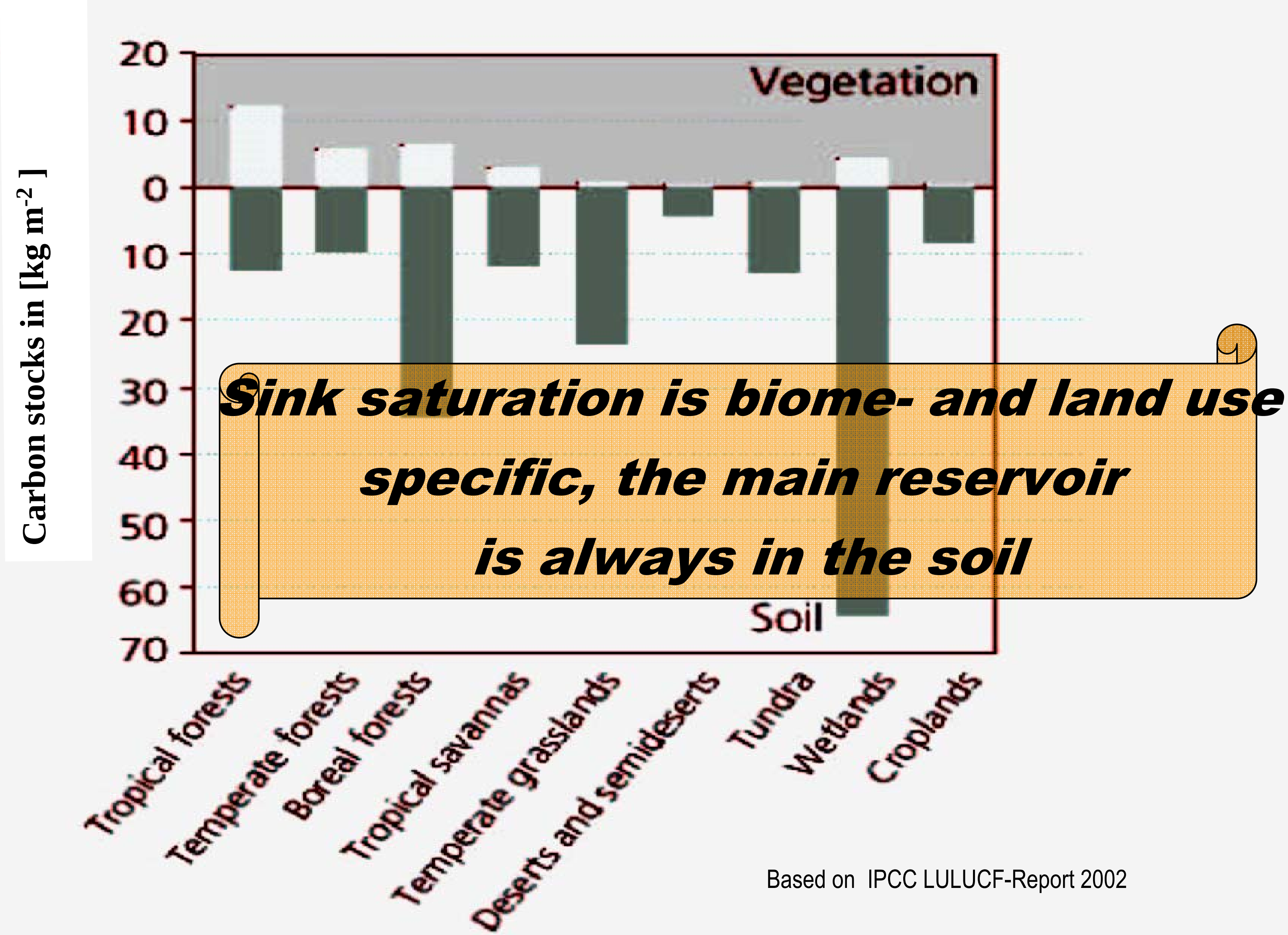
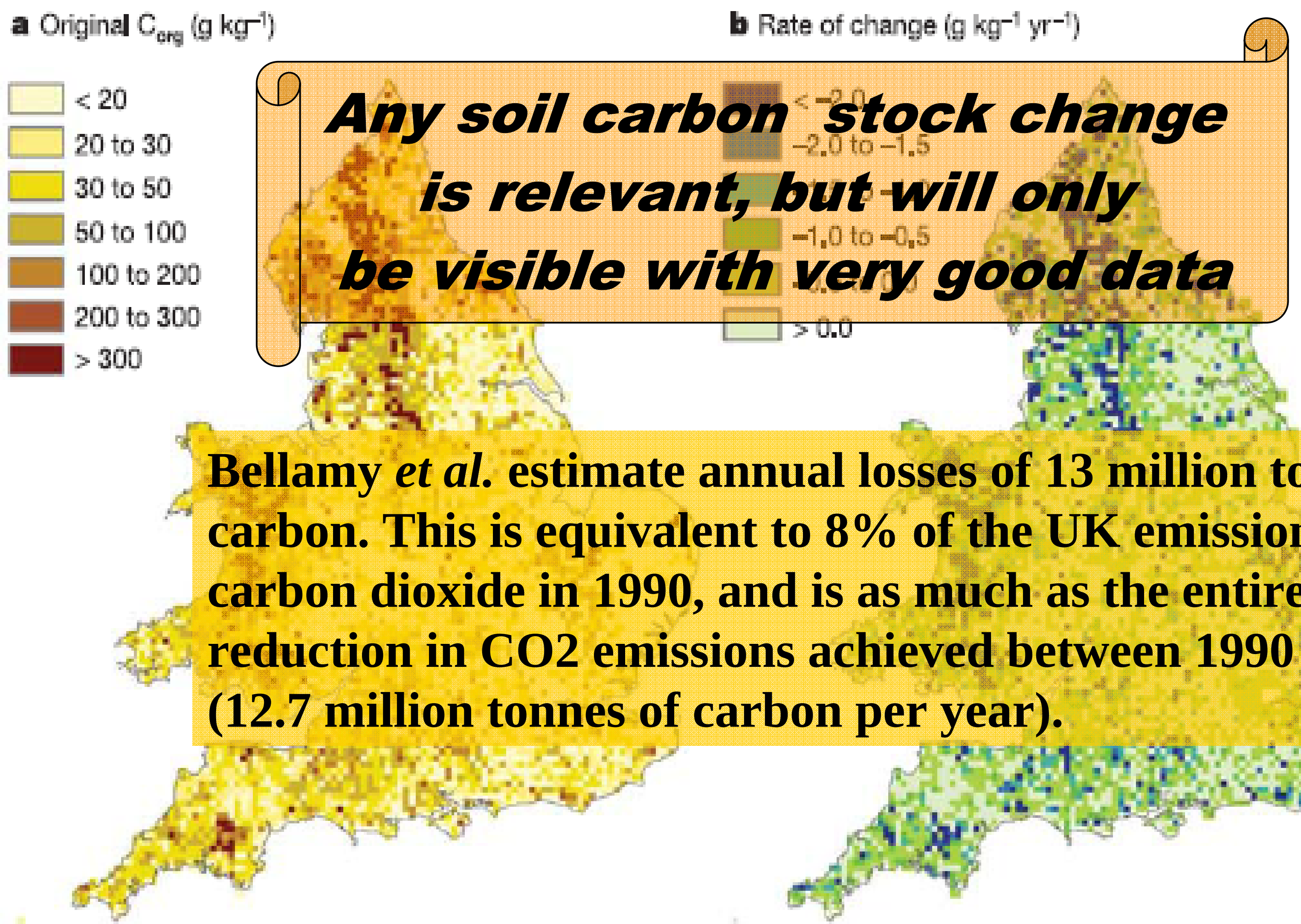
Carbon stocks in global ecosystems



Based on IPCC LULUCF-Report 2002

Carbon losses from all soils across England and Wales 1978-2003
(Bellamy et al., Nature Sep 2005, based on ca. 6000 samples, 0-15cm

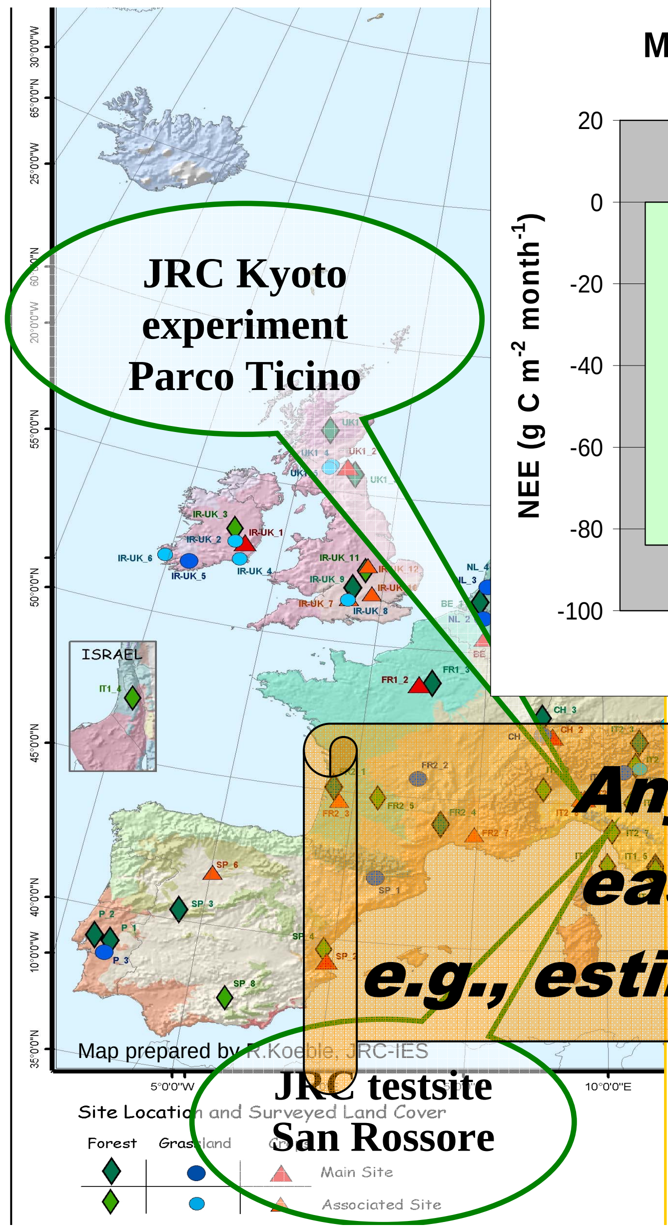


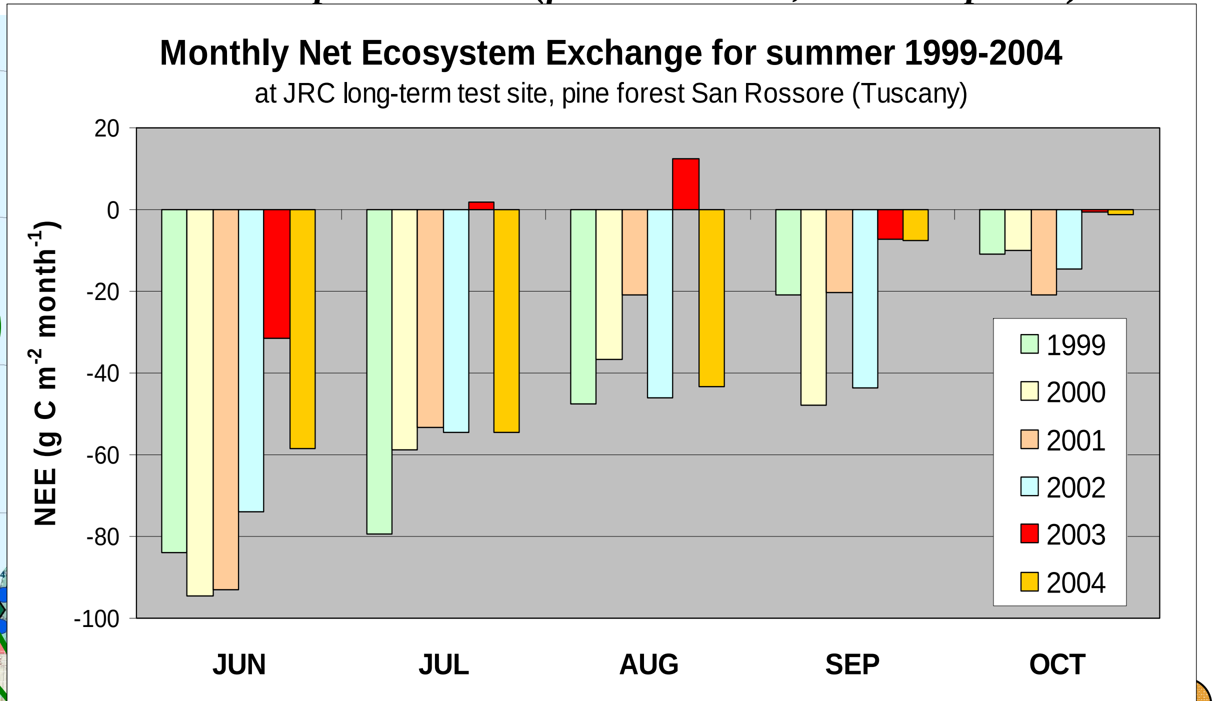
Any soil carbon stock change is relevant, but will only be visible with very good data

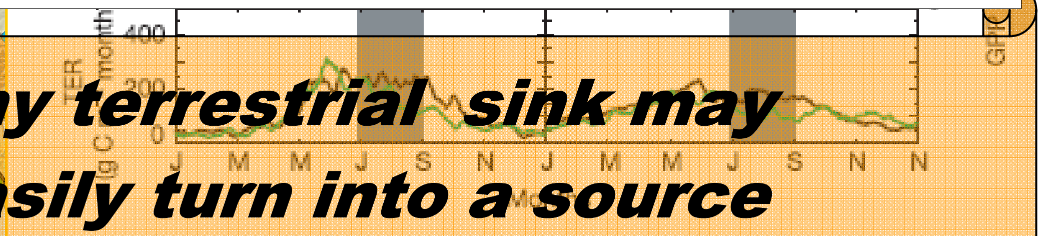
Bellamy *et al.* estimate annual losses of 13 million tonnes of carbon. This is equivalent to 8% of the UK emissions of carbon dioxide in 1990, and is as much as the entire UK reduction in CO2 emissions achieved between 1990 and 2002 (12.7 million tonnes of carbon per year).

The dry and hot summer 2003 at flux sites of JRC within the CARBOEUROPE network

Example San Rossore Pine Forest summer 2003 compared to 2002 (from Ciais et al., Nature Sep.2005)







Any terrestrial sink may easily turn into a source
e.g., estimated 0.5 Gt in Europe 2003

Figure 1 | Observed climate and ecosystem CO_2 fluxes during 2002 and [illegible] forest in France (Hesse) and a southern evergreen pine forest site (San Rossore) in northern Italy. a, Climate fields. b, Ecosystem CO_2 fluxes. A five-day running average was applied to the original half-hourly flux and temperature data to remove diurnal variations. Precipitation values are monthly averages. Data for 2002 are in black and for 2003 in colour. The July to August period is shaded in grey.

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Conclusion from selected essentials:

- **Biological sinks and the atmosphere:** ⇨ *sinks are relevant, but the atmosphere does not care if CO_2 reduction is from reduced fossil emission, reduced deforestation or from increased sink*
- **The atmosphere does not see stock changes but fluxes:** ⇨ *monitoring, uncertainty, eventual bias due to non-reporting*
- **Soils are the main reservoir of biological sinks, any soil carbon stock change is relevant:** ⇨ *monitoring, uncertainty*
- **Biological sinks and historical vs. targeted changes in land use:** ⇨ *additionality – factoring out is an issue*
- **Any terrestrial sink may easily turn into a source:** ⇨ *permanency*

Monitoring biological sinks is a tough job, esp. with regard to changes of belowground carbon stocks

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Conclusions

- Biological sinks and their conservation deserve highest attention to achieve the two degC goal
- Current monitoring/reporting of biological sinks may not be adequate to always guarantee accurate estimates (subject to "practicability/ availability of data", voluntary setting of "direct human induced")
- Biodiversity helps biological sinks and *viceversa*
- Most likely, a focus of eventual sinks in ETS would be on CDM ⇨ look at consistency / complementarity with ongoing discussion on REDD
- The scientific challenge: to further develop the conservativeness methodology, to allow easier estimation and at the same time to guarantee that sinks are never overestimated

Thanks for your attention!