Akvatisk biota og klimaendringer – et nordisk perspektiv

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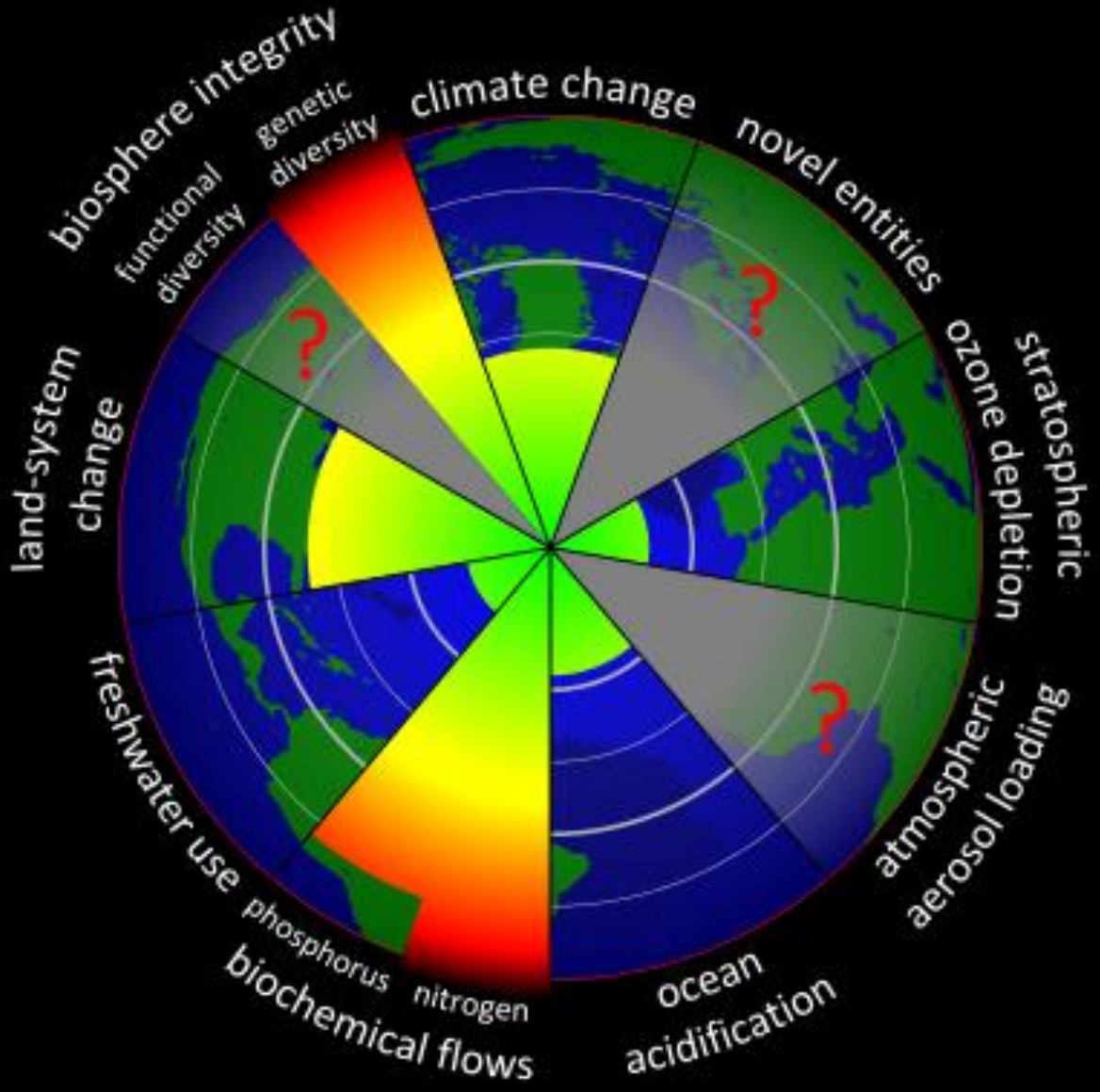
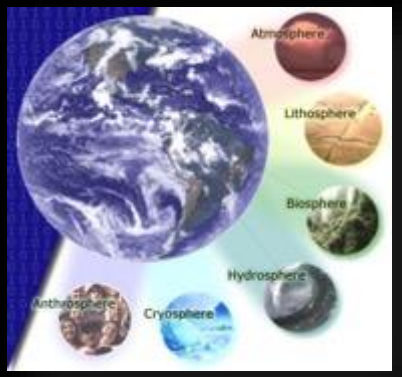
Planetens tålegrenser



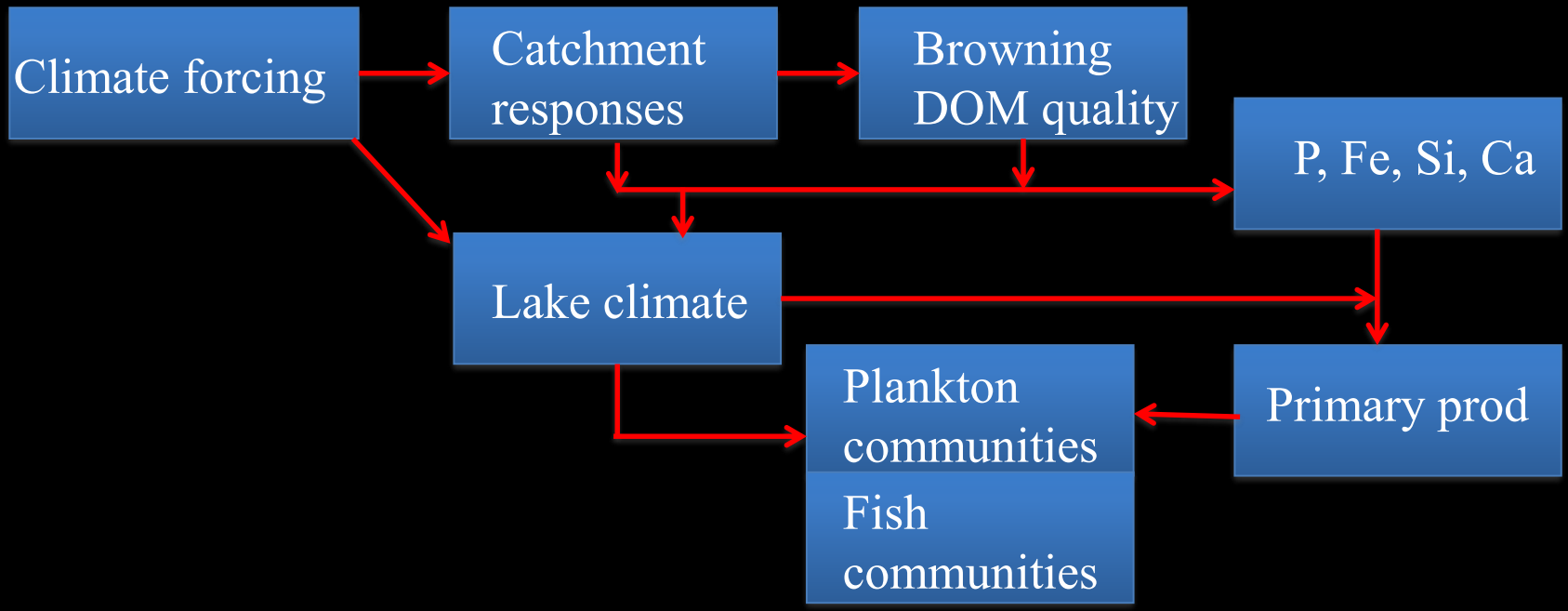
Biogeochemistry of the Anthropocene Visjon



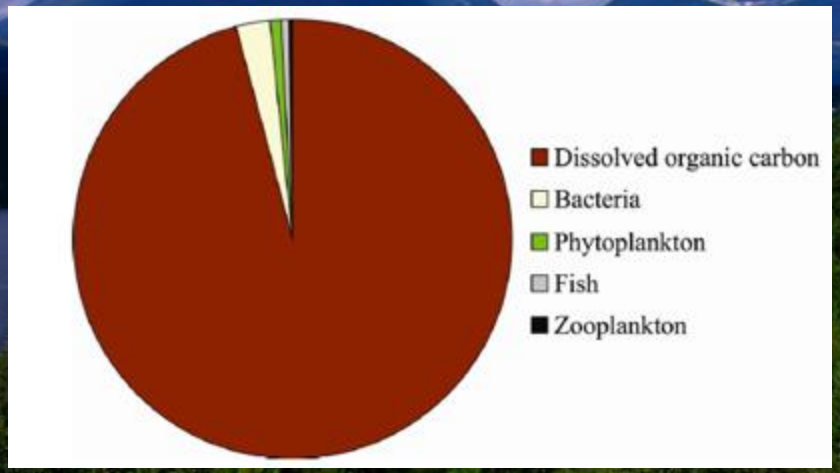
Visjon: Forstå og forutsi hvordan menneskelig aktiviteter påvirker Jordens natur og miljø

- Vår forståelse av klimasystemet og de biogeokjemiske kretsløp har klare begrensninger
- En grunnleggende forståelse av de biogeokjemiske kretsløpene av karbon og andre essensielle grunnstoffer, er viktig både for å kunne ta i bruk de riktige tiltakene for å begrense klimaendringer og samfunnets tilpasning til klimaendringer
- En tverrfaglig og flerfaglig tilnærming mellom biologi, geofag, kjemi og andre naturvitenskapelige disipliner er nødvendig for å løse de naturvitenskapelige utfordringene i dette fagfeltet
- *Biogeochemistry for the Anthropocene (CBA)* har som ambisjon å bygge et nasjonalt kompetansesenter og en internasjonal node for kobling av klima og biogeokjemisk sykluser til effekter på naturmiljøet.

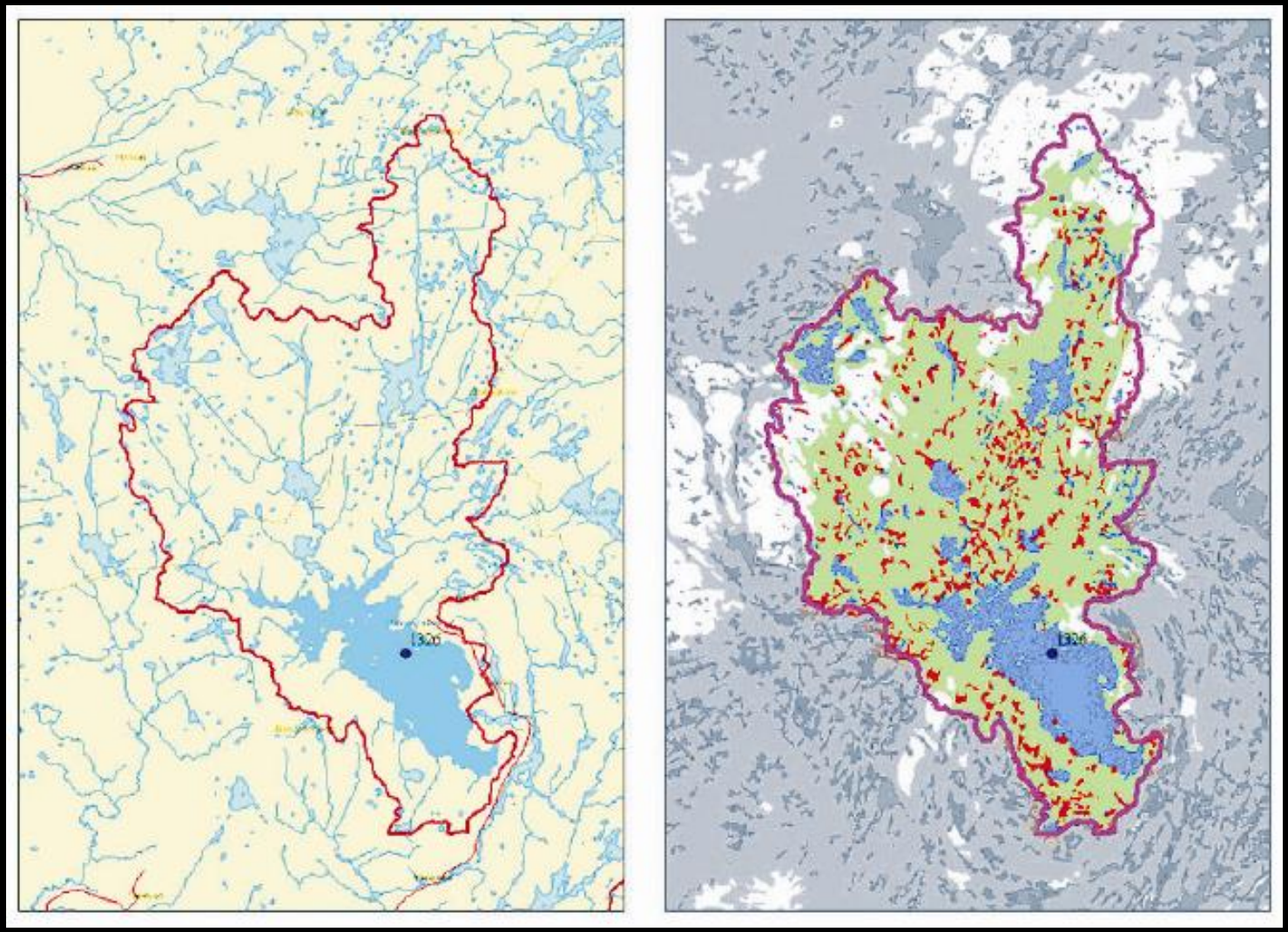
Ting henger sammen…



Innsjøen speiler ikke bare himmelen -
men nedbørfeltet

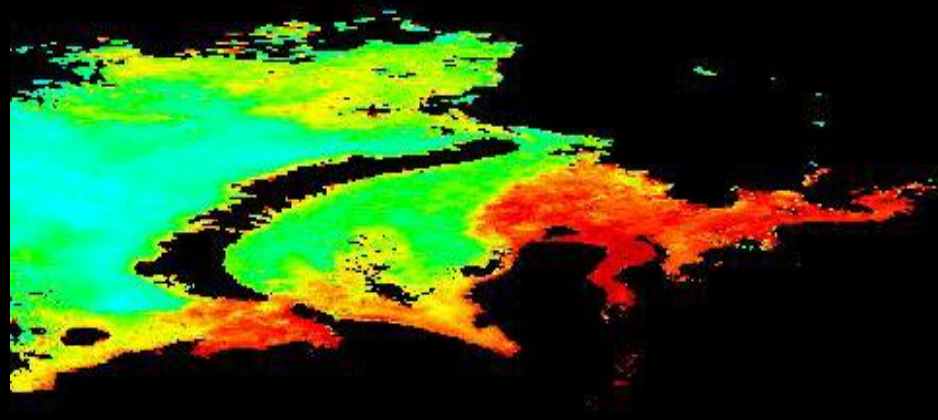


Lake gives the fingerprint of catchments– and give early warnings about catchment changes



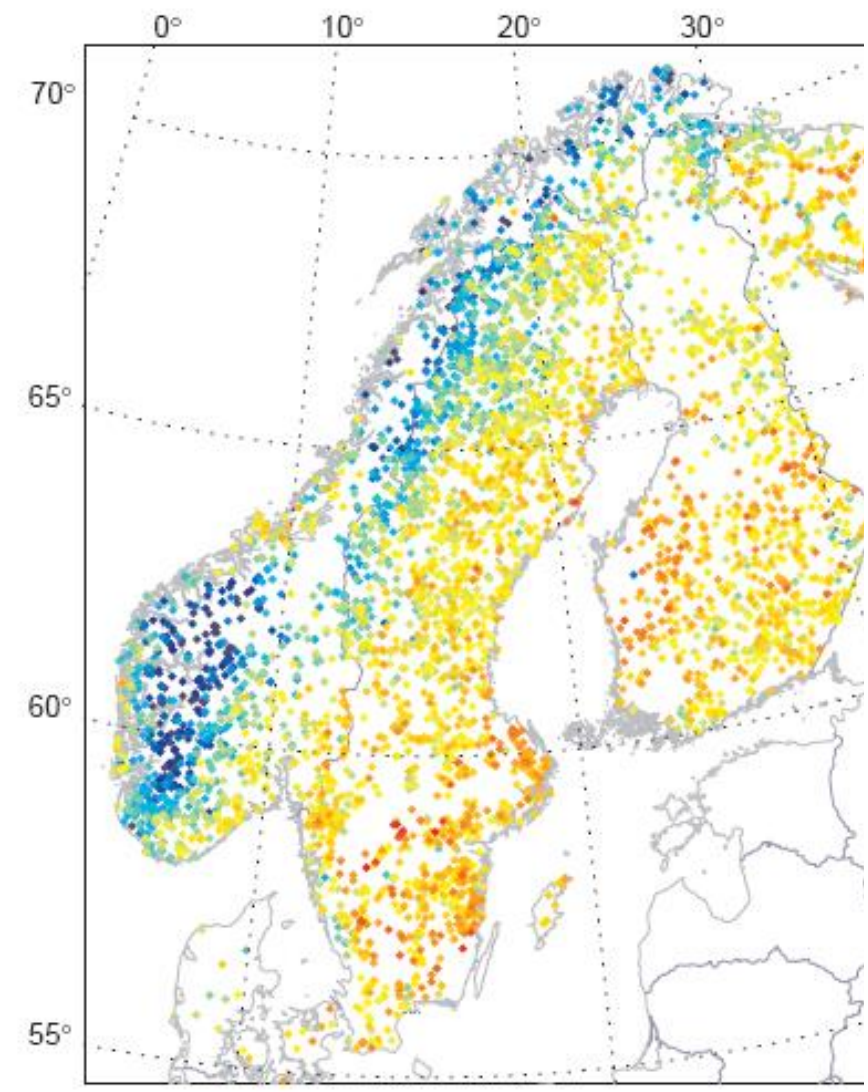
Kobling land – kyst - vannkvalitet

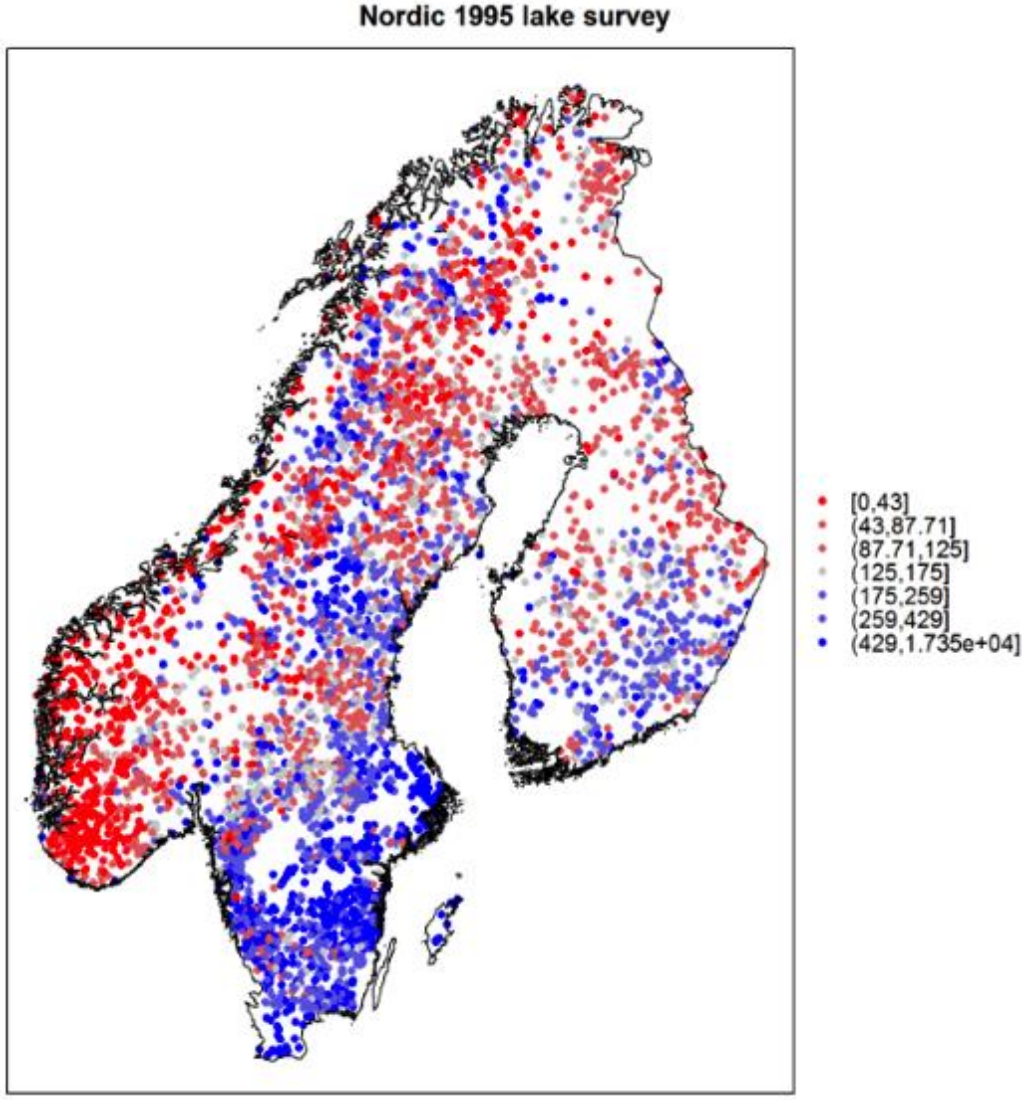
- Transport av partikler og løst karbon – tilslamming, redusert lys, økt eksport av N, P, Si og Fe
- Temperatur og nedbør avgjør stofftransport til hav
- Eksport av uorganisk karbon, viktig for havets bufferkapasitet



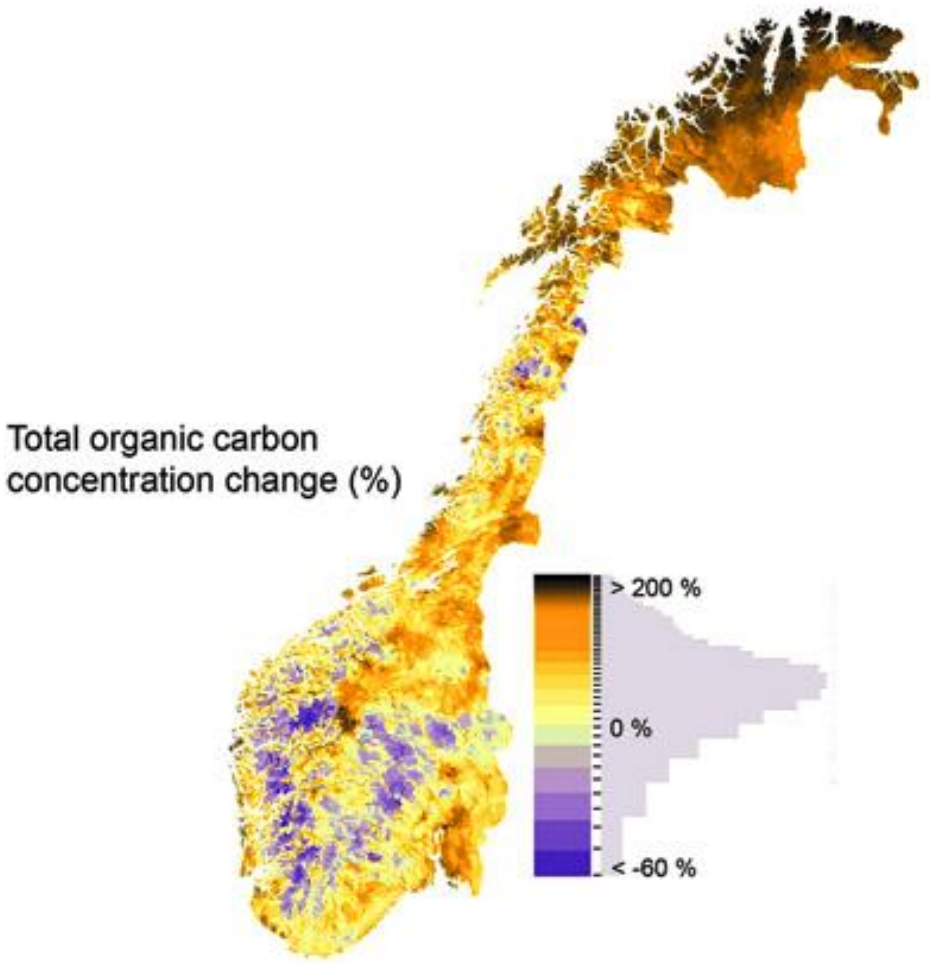
Satelite readings of transport of humic substances and nutrients from Ob and Yenisey to the Arctic Sea. Red: DOC, yellow and green: chlorophyll

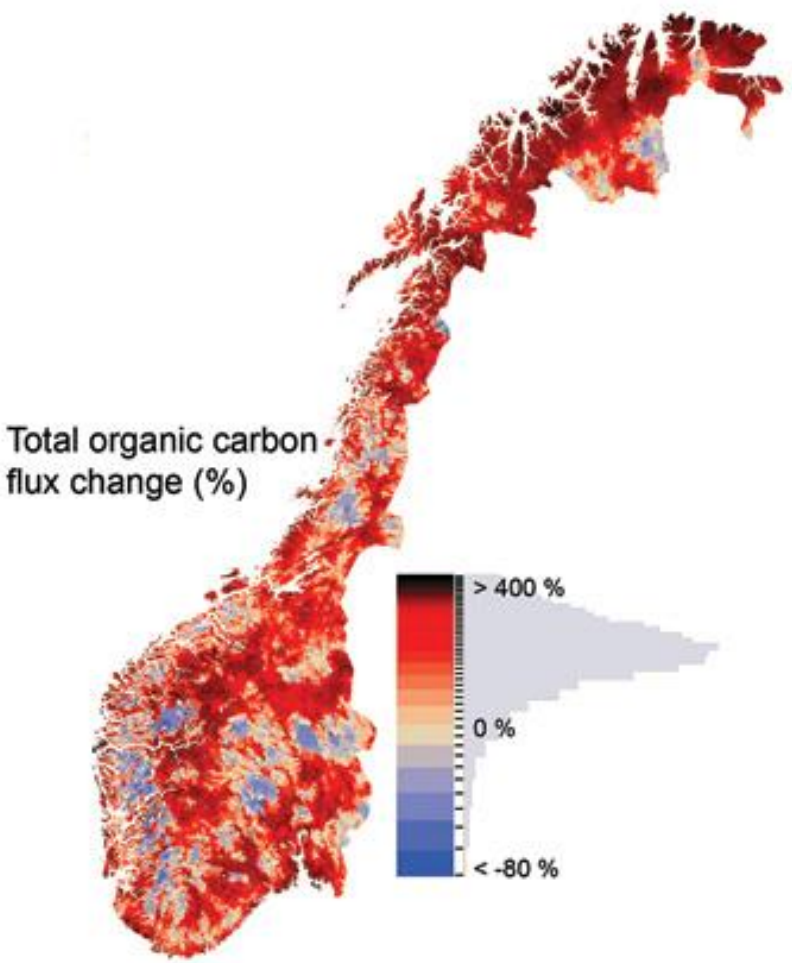
Storskala endringer av ferskvann, brunere og mer kalkfattig vann





Nedskalerte 2 ^{o}C scenarier





- TOC increase in 70 % of catchments
- Median TOC increase with 65 %

- TOC export increase with 28 % (2.4 – 3.1 g C m^{-2} yr^{-2})

Brunere vann påvirker lys og produksjon

Ecosystems (2014) 17: 1040–1052
DOI: 10.1007/s10021-014-9776-2

ECOSYSTEMS

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The Absorption of Light in Lakes: Negative Impact of Dissolved Organic Carbon on Primary Productivity

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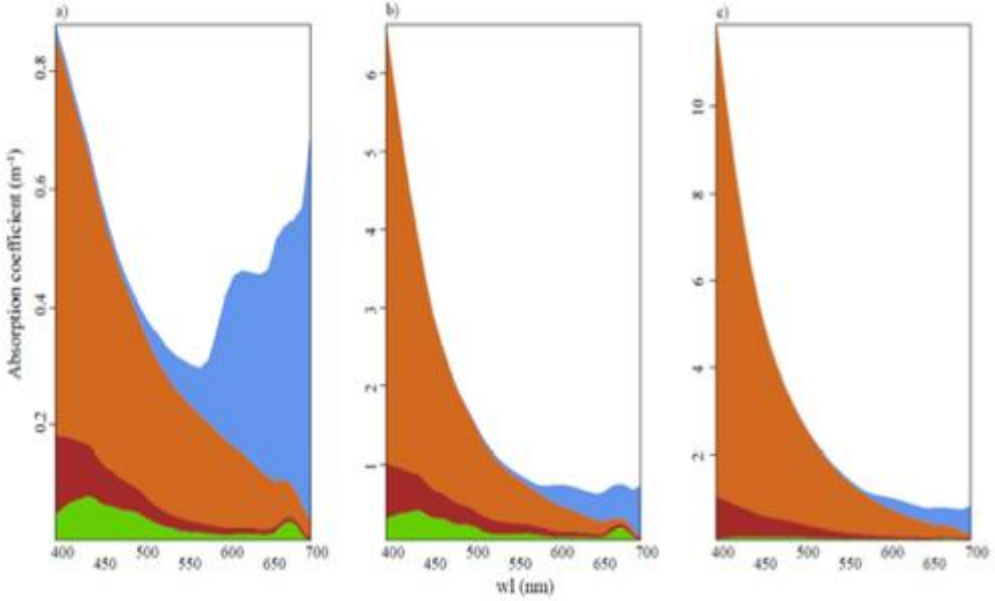


ECOLOGY LETTERS

Ecology Letters, (2014) 17: 36–43 doi: 10.1111/ele.12201

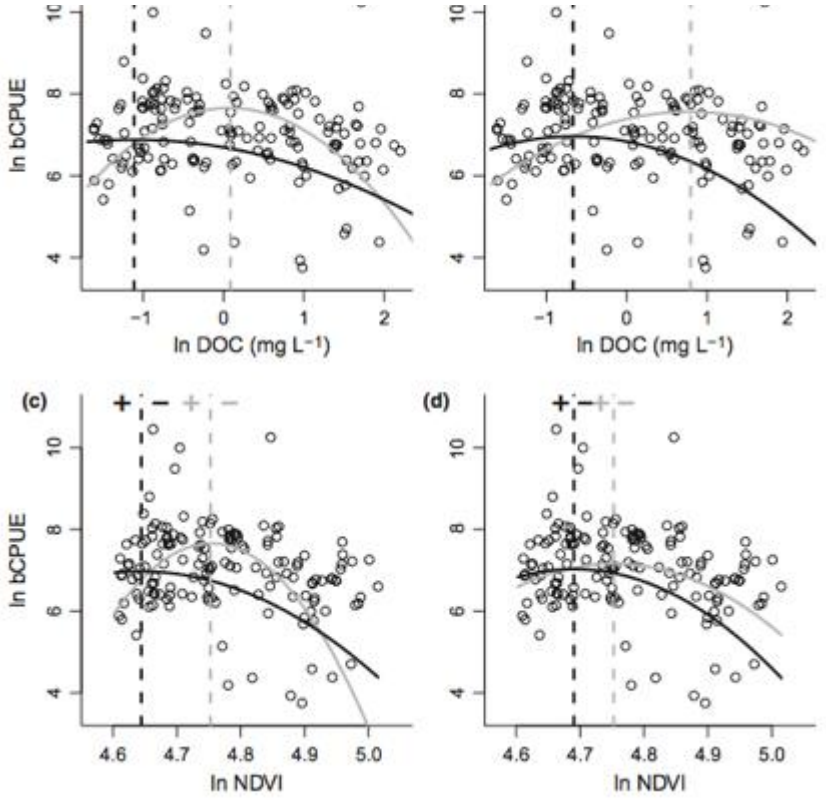
LETTER

Unimodal response of fish yield to dissolved organic carbon

Anders G. Finstad,[1]* Ingeborg P. Helland,[1] Ola Ugedal,[1] Trygve Hesthagen[1] and Dag O. Hessen[2]

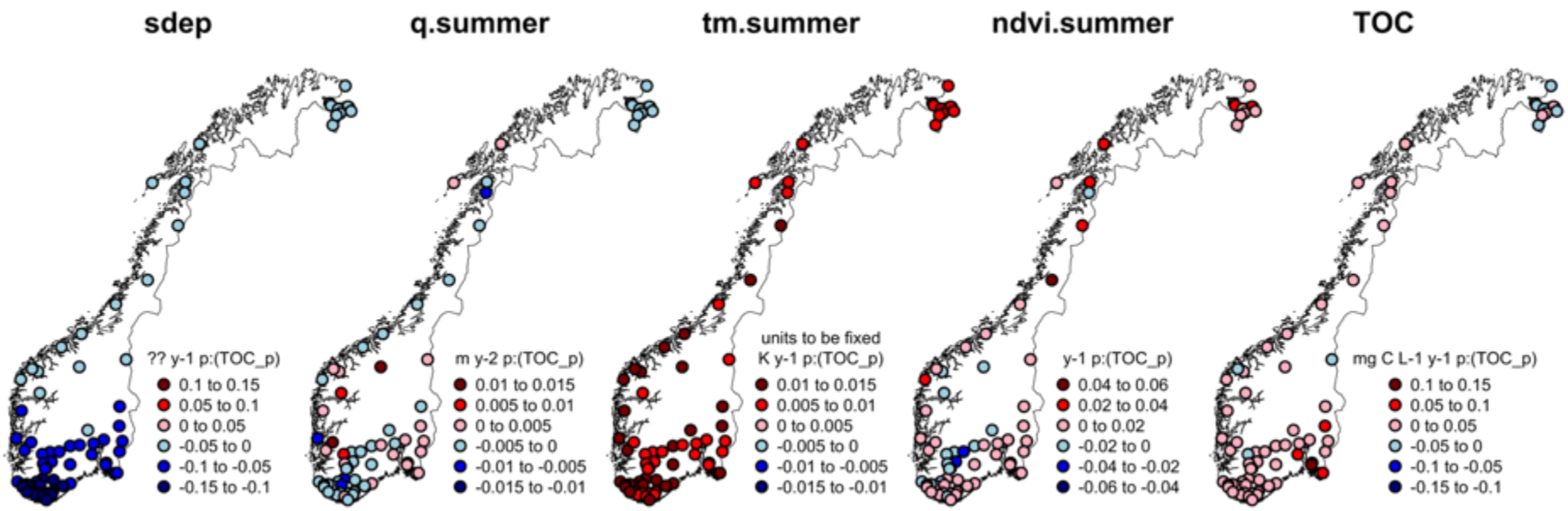
Abstract

Here, we demonstrate a contrasting effect of terrestrial coloured dissolved organic material on the secondary production of boreal nutrient poor lakes. Using fish yield from standardised brown trout gill-net catches as a proxy, we show a unimodal response of lake secondary productivity to dissolved organic carbon (DOC). This suggests a trade-off between positive and negative effects, where the initial increase may hinge upon several factors such as energy subsidising, screening of UV-radiation or P and N load being associated with organic carbon. The subsequent decline in production with further increase in DOC is likely associated with light limitations of primary production. We also show that shallow lakes switch from positive to negative effects at higher carbon loads than deeper lakes. These results underpin the major role of organic carbon for structuring productivity of boreal lake ecosystems.



Noen åpenbare tidstrender; redusert forsuring, klima/hydrologi & "greening" resulterer i "browning"

30-y trends for 77 catchments: Strong decline in Sulfate deposition, mixed for runoff, strong increase in summer temperature, modest increase in NDVI and strong increase in TOC ("browning")



LETTER

Centennial-long trends of lake browning show major effect of afforestation

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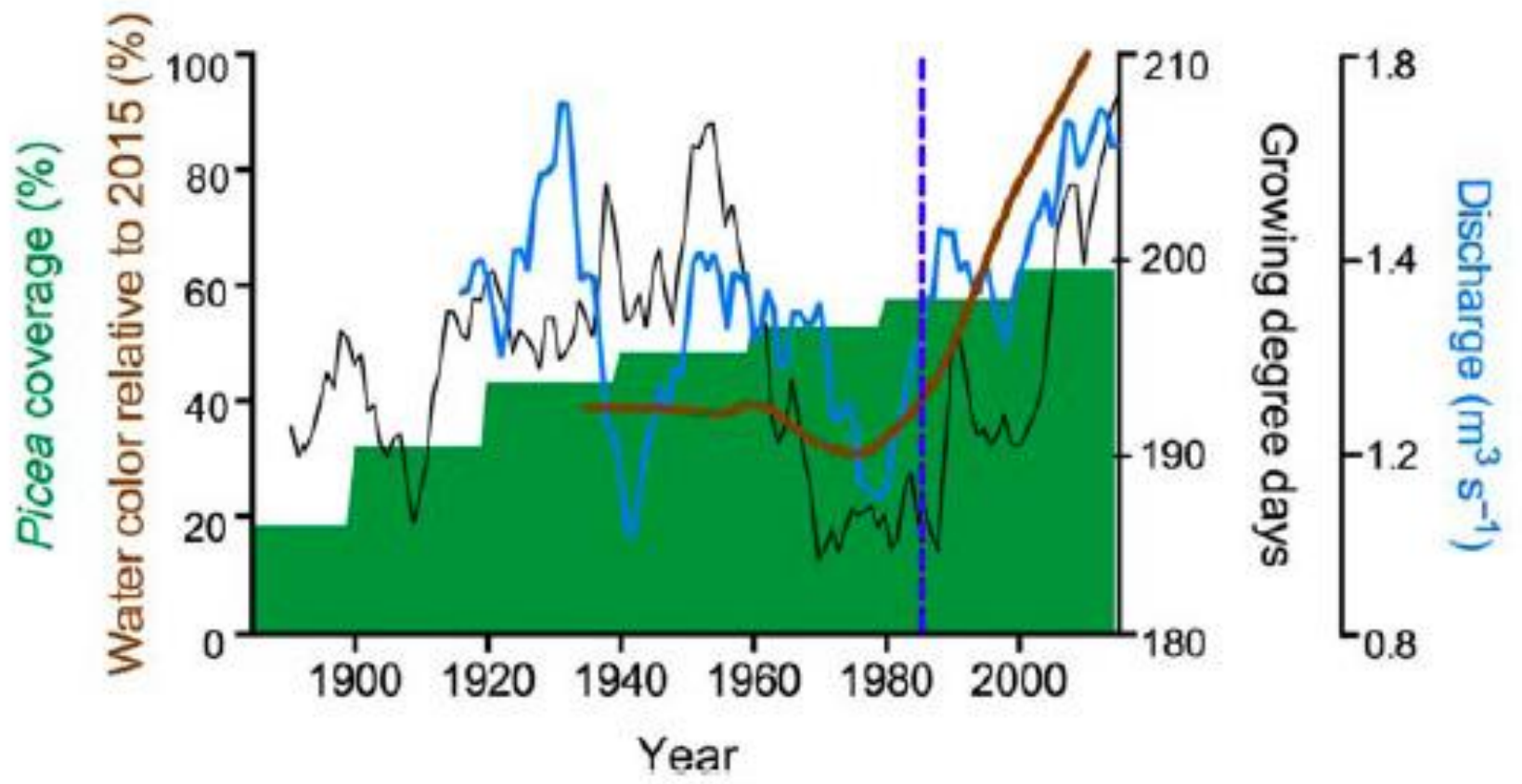
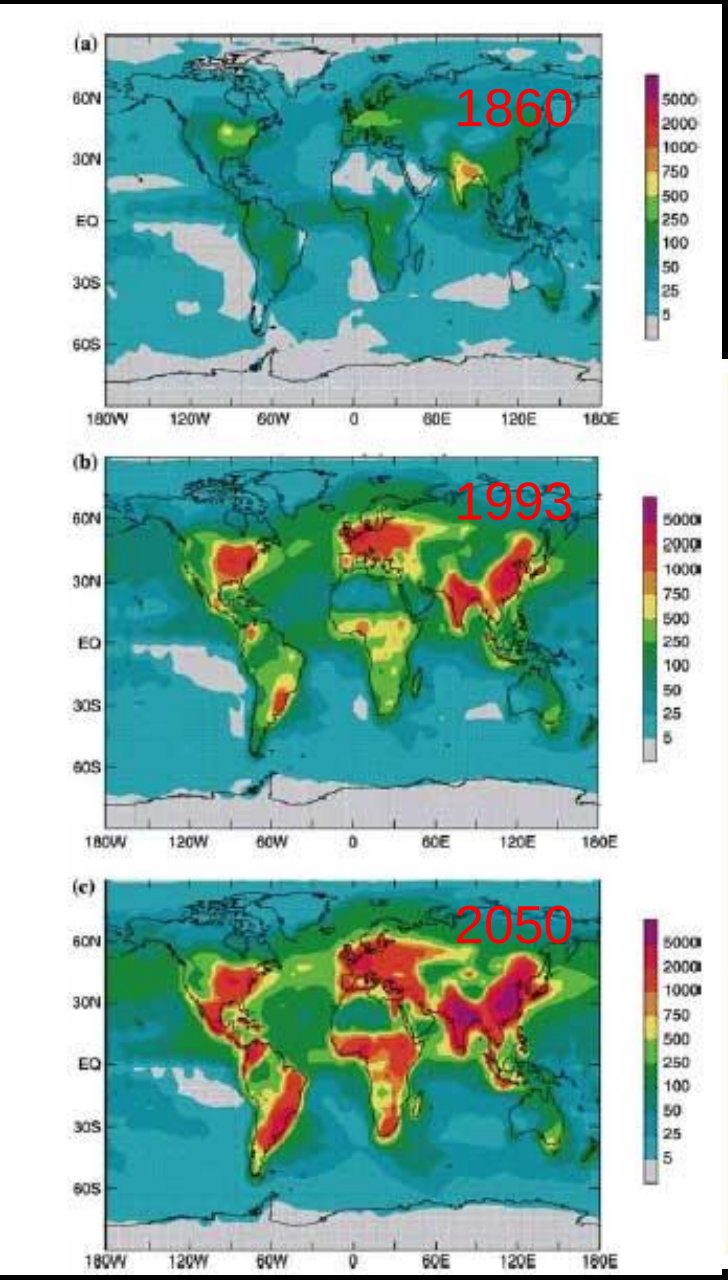
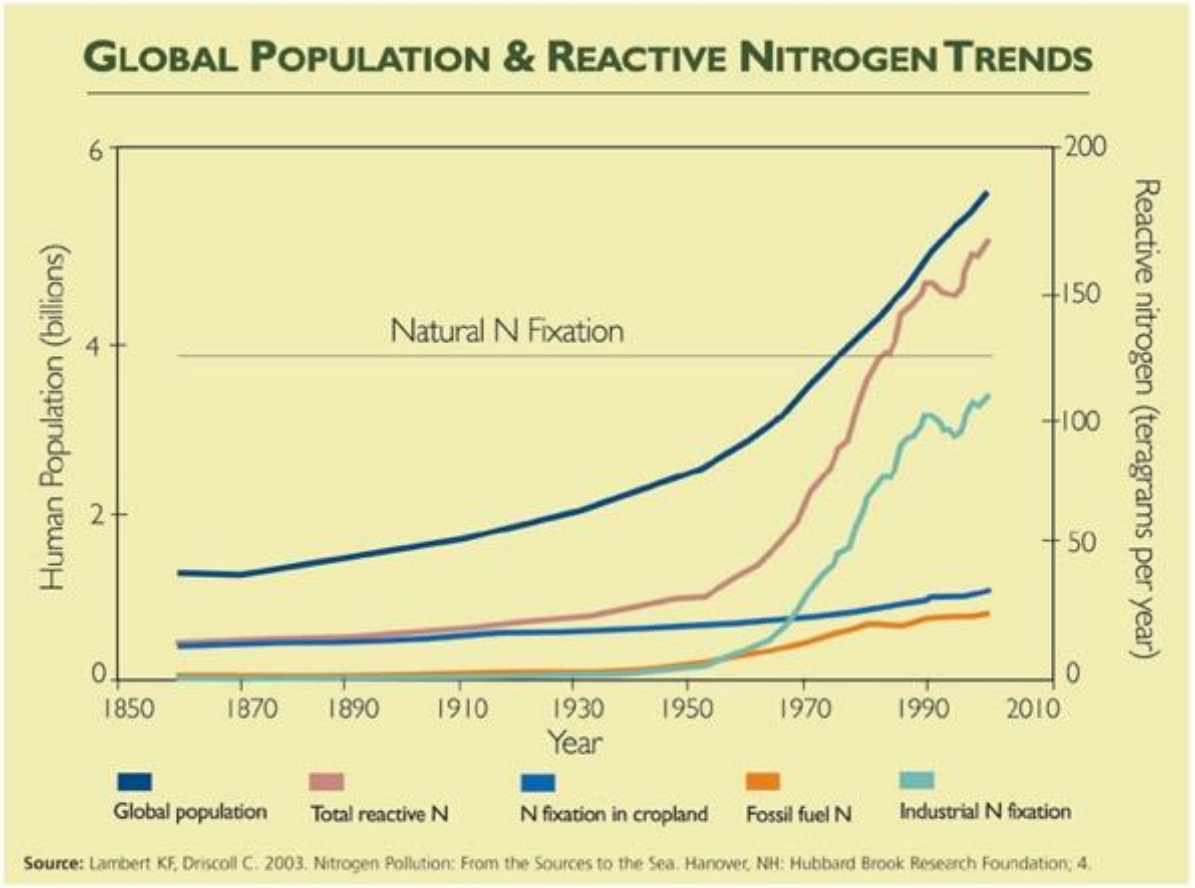
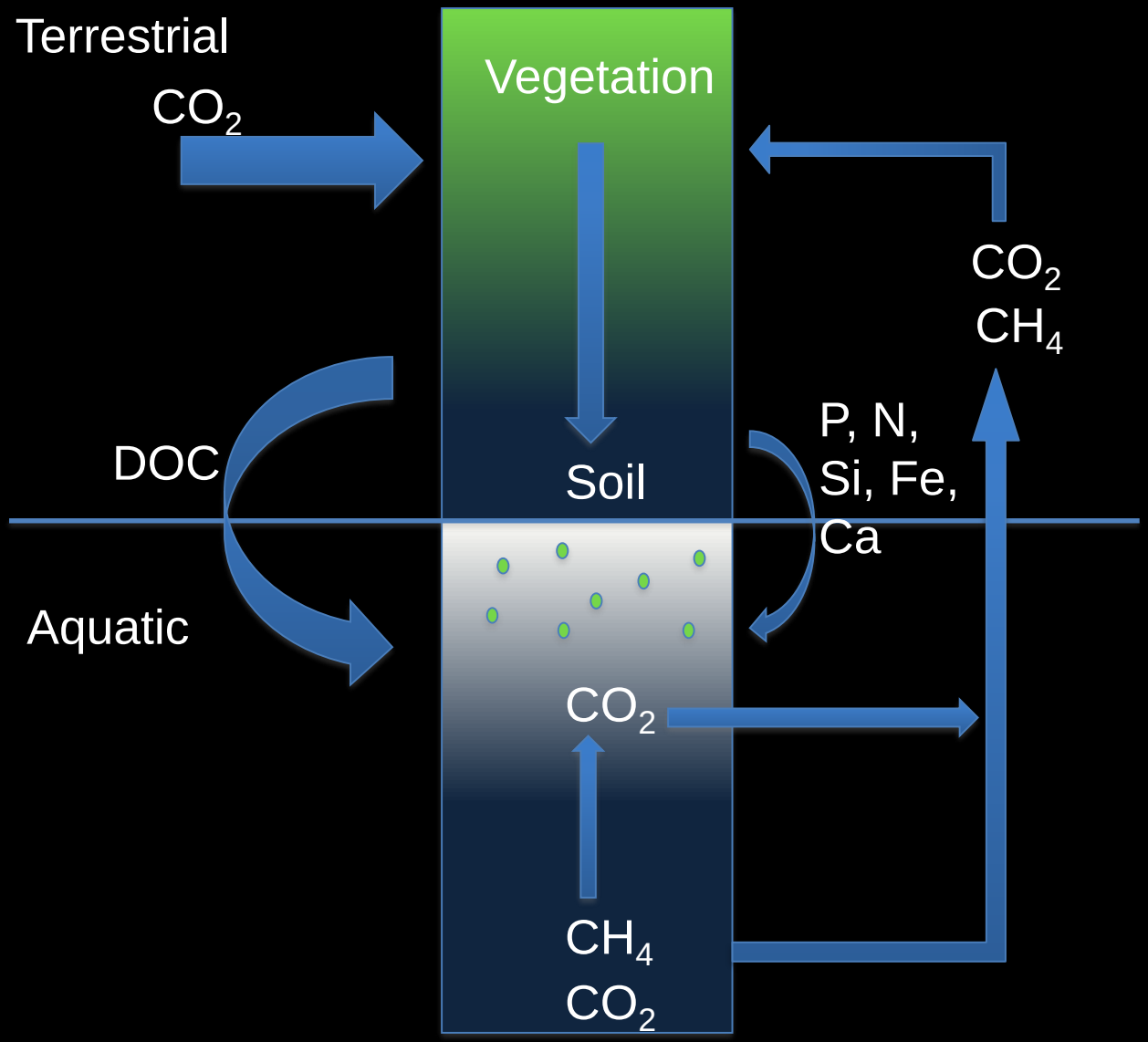


Nitrogensyklus i ubalanse …

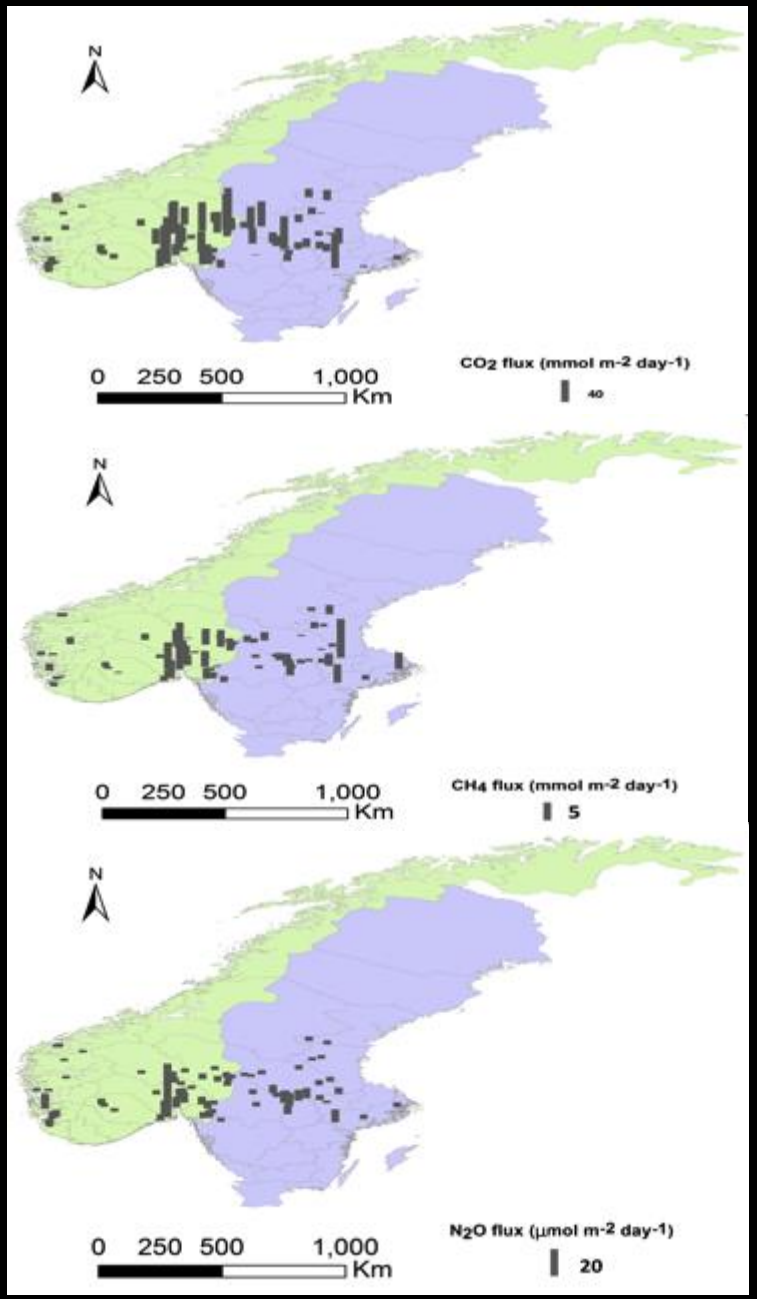





Terrestrial
CO_2
Vegetation
CO_2
CH_4
DOC
Soil
P, N,
Si, Fe,
Ca
Aquatic
CO_2
CH_4
CO_2

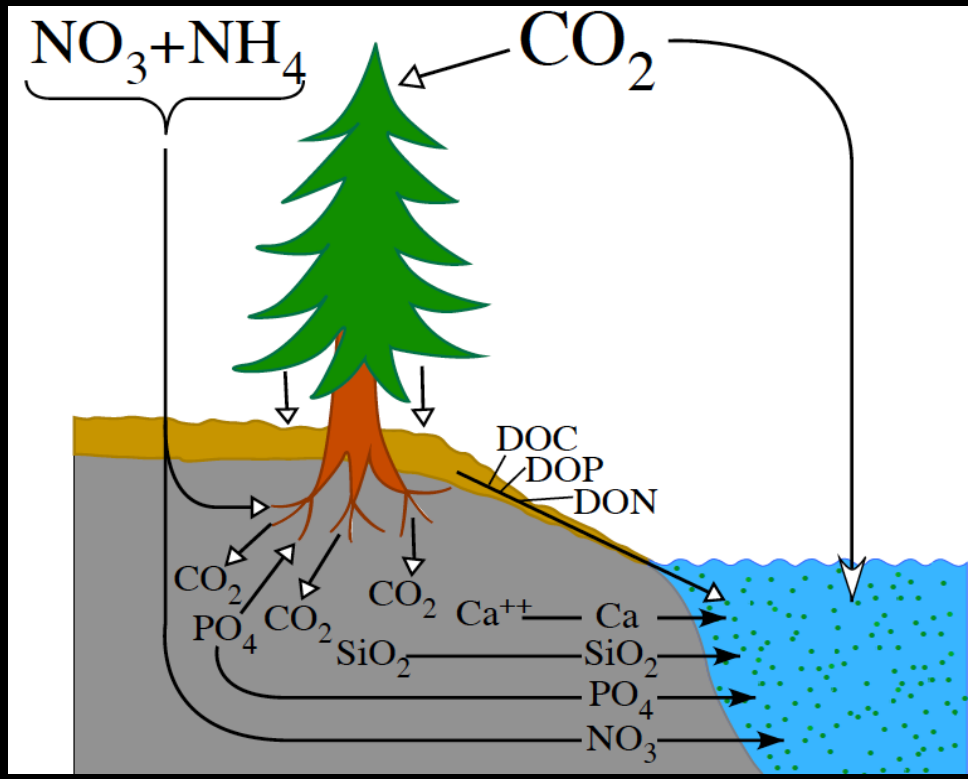
GHG avgassing påvirkes av TOC, P, N-deponering – og mikrobiologien

- TOC (and P) most important for CO_2
- P (and TOC) most important for CH_4
- N-deposition most important for N_2O

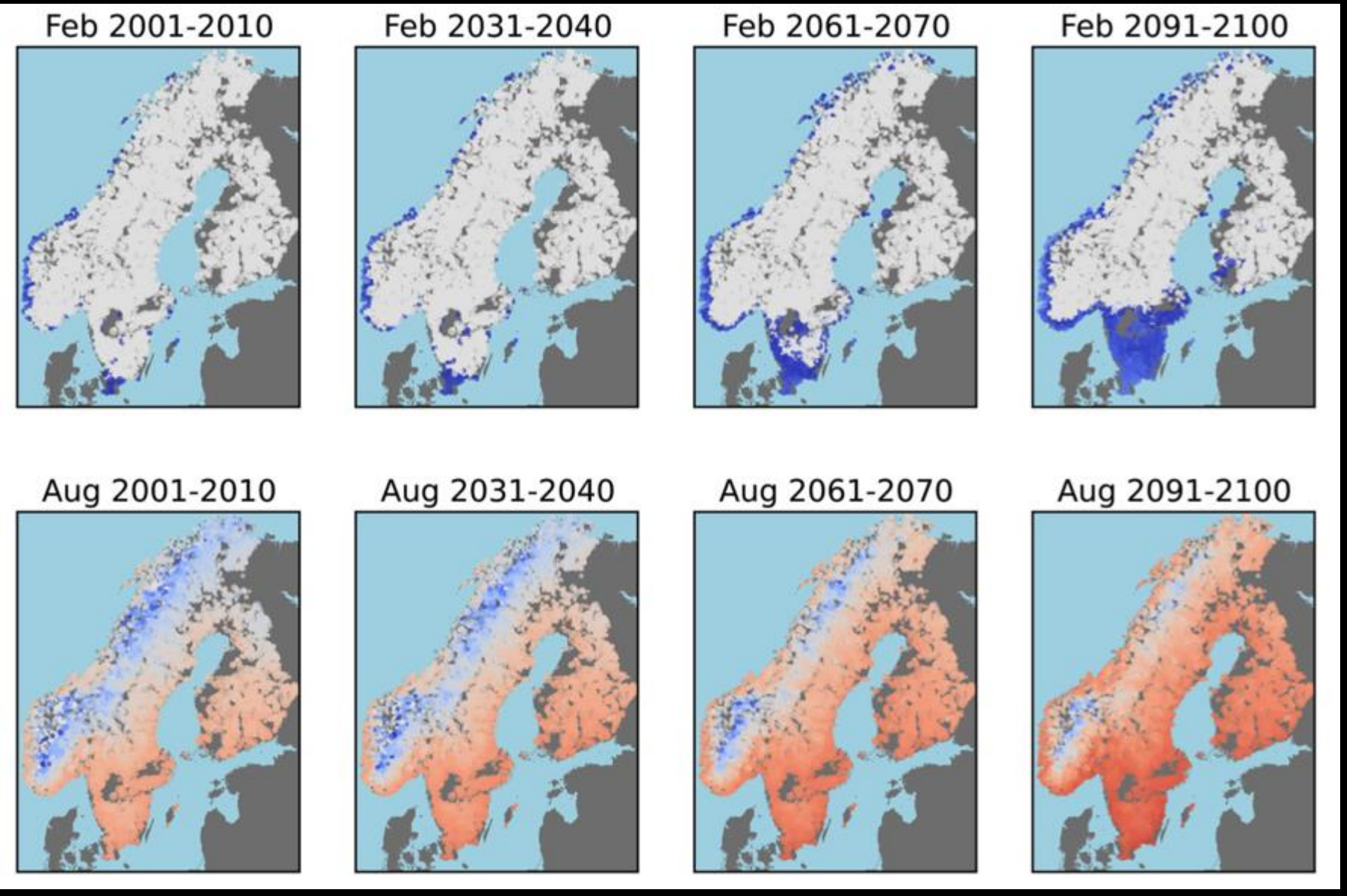


Klima-støkiometri tilbakekoblinger

- CO_2 and N-deposition promote vegetation
- Vegetation increase root mineralization plus DOC
- Increased mineralization may boost aquatic productivity and CO_2-uptake
- Different fluxes and fates for elements may change C:N:P:Si-ratios



Vannklima i endring



Alt i vann påvirkes av temperatur og hydrologi

- ... Vann fanger opp tidlige signaler fra nedbørfeltet mht endringer i jord, skog, avrenning
- Vann som homogent og integrerende medium er velegnet for å fange opp fysiske, kjemiske og biologiske effekter

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Lakes as sentinels of climate change

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