

éclairaire

Effects of climate change on air pollution impacts
and response strategies for European ecosystems



Mark Sutton

Centre for Ecology & Hydrology, Edinburgh

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ÉCLAIRE objectives

- To provide robust understanding of air pollution impacts on European land ecosystems including soils under changing climate conditions.
- To provide reliable and innovative risk assessment methodologies for these ecosystem impacts of air pollution, including the economic implications, to support EU policy.
- Focus on O₃ and N, and where relevant their interactions with VOCs, aerosols and S.

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Main Elements

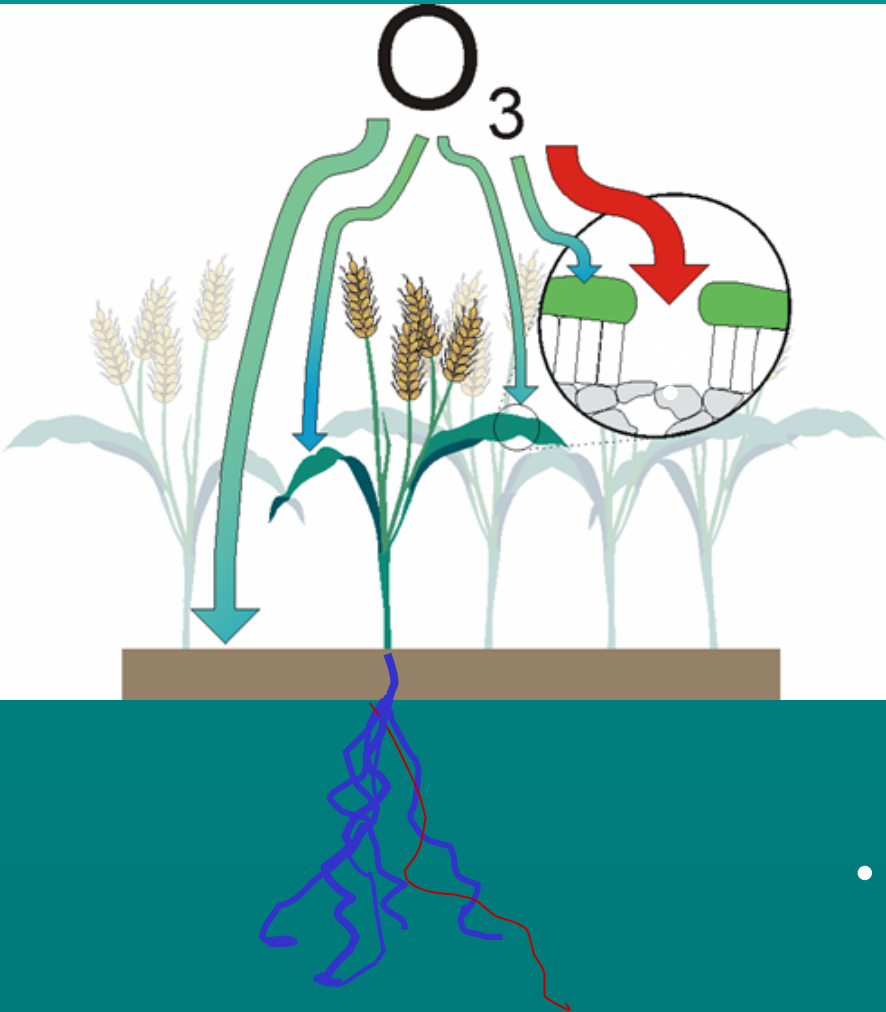
- Climate change effects...
 - **Fluxes**: Alteration of biogenic/agricultural and other emissions, air chemistry, transport distance and deposition.
 - What is the net effect on aerosol?: precursors, volatile aerosol, less scavenging.
 - **Vulnerability**: Alteration of ecosystem responses, including critical thresholds and pollutant interactions
 - **Response strategies**...

ÉCLAIRE linking communities

- Nitrogen and Ozone communities
- Experimentalists, modellers and economists
- Local, regional and global communities
- E.g. IGBP-iLEAPS, INI, CLRTAP, ICP-Vegn, TFIAM etc etc.

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Ozone – what do we need to understand?

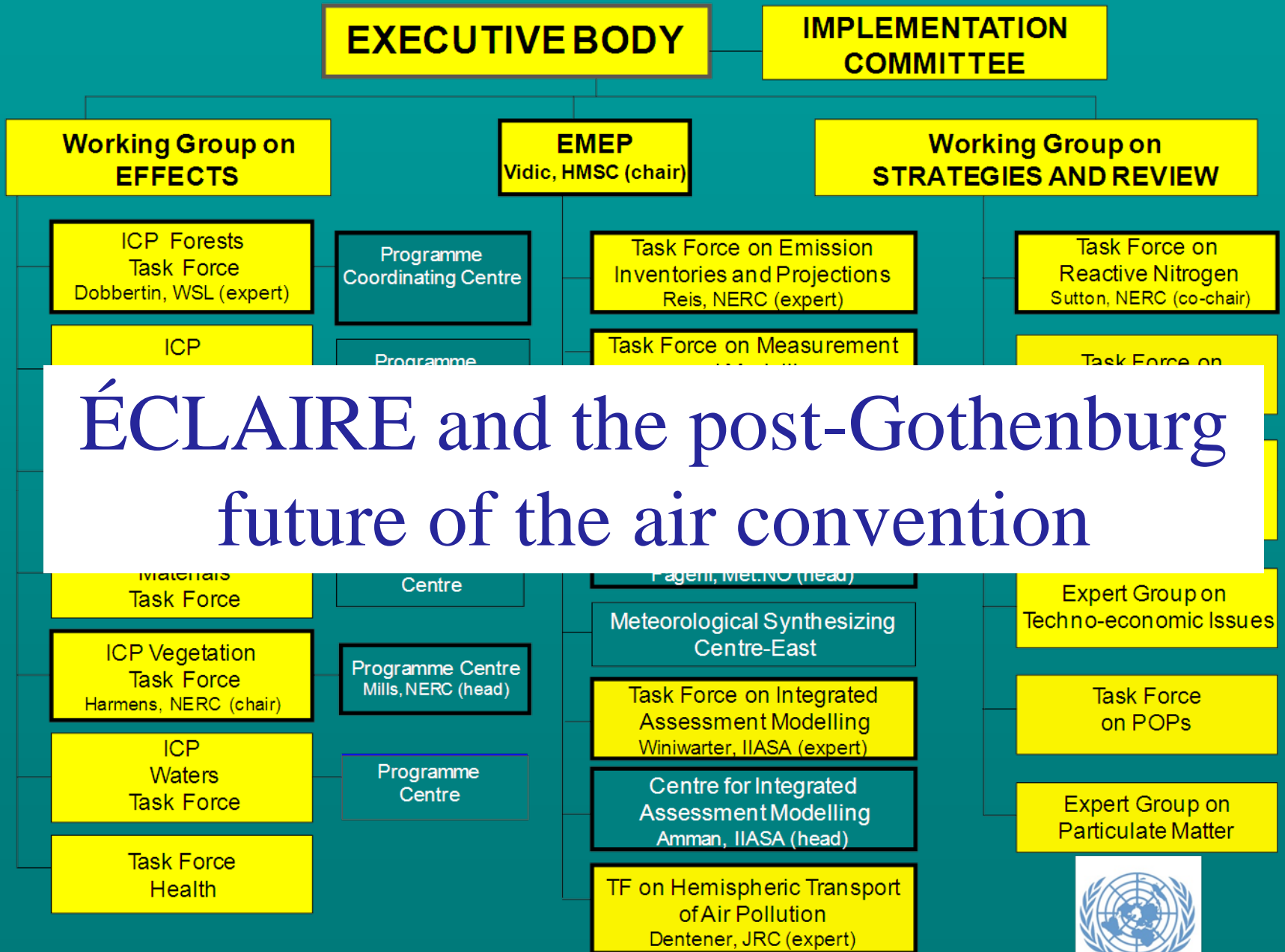


How do we know how much O₃ gets into the plant and how much impacts on the plant?

Depends on:

- Dry deposition (currently assumed to be constant but is it?)
- Stomatal functioning (e.g. DO₃SE model, O₃ effect on g_s?)
- BVOC emissions (currently not modelled)
- Detoxification within leaf (unrealistically assumed to be constant)
- What are implications for C budget (plant/soil/atmosphere)?

ÉCLAIRE and the UNECE CLRTAP



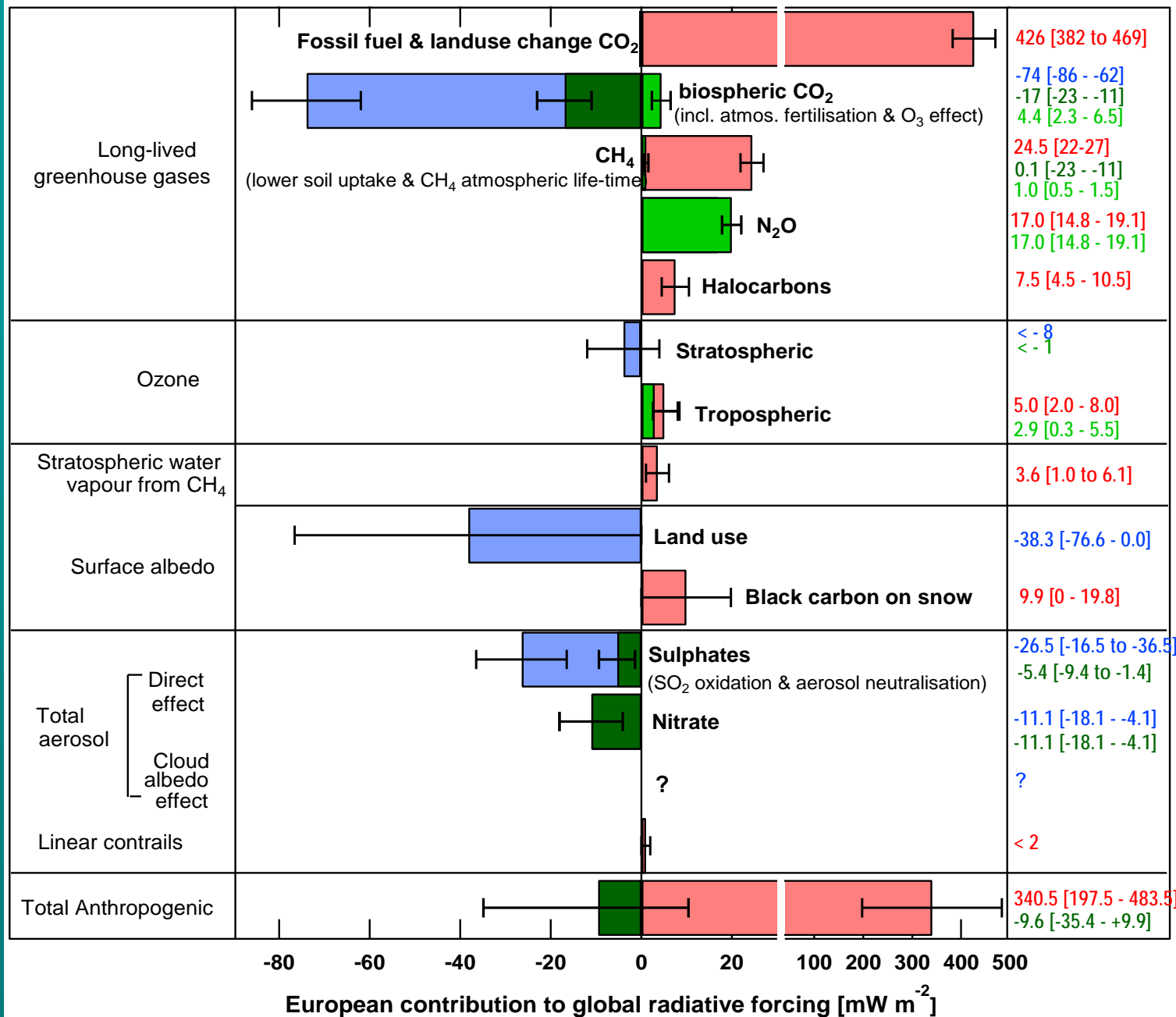
ÉCLAIRE and the post-Gothenburg future of the air convention



Integrating issues

- What is the net effect of nitrogen oxides emissions on crops and forests? (N fertilization effect vs O_3 toxic effects, vs aerosol light scattering effects)
- Are there synergistic effects of O_3 & nitrogen?
- How damaging is NO_y deposition vs NH_x deposition? Can we set different critical loads?
- How do dose response relationships differ under climate change?

Effect of nitrogen emissions on European radiative balance



The European Nitrogen Assessment

Sources, Effects and Policy Perspectives

Edited by

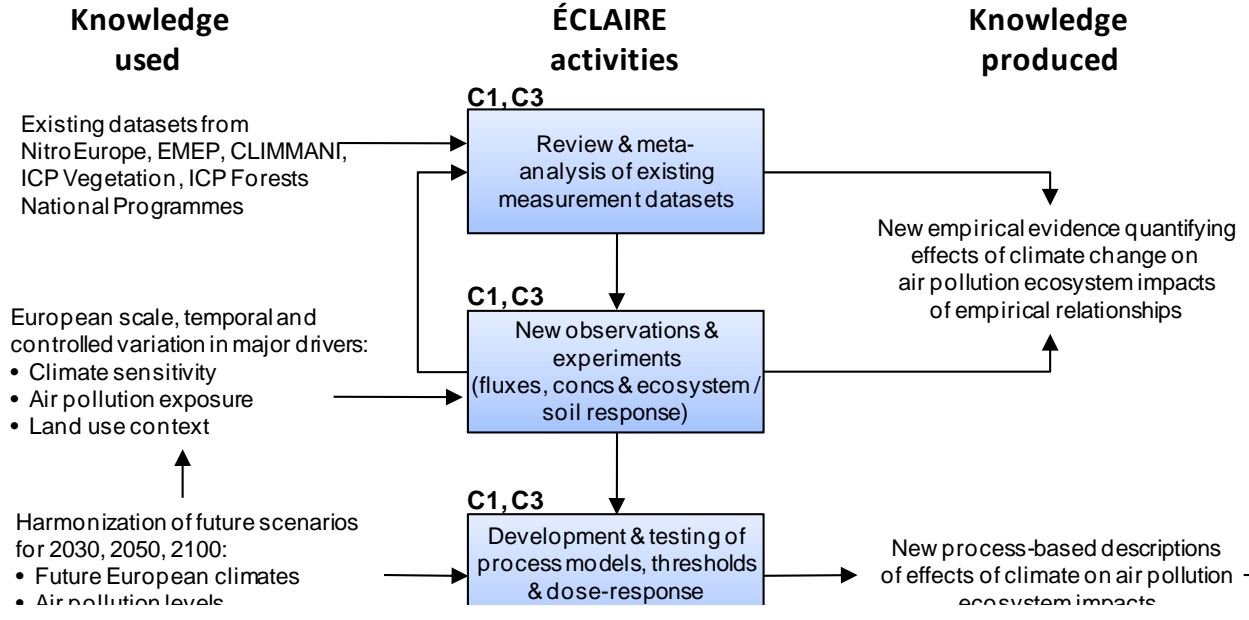
Mark A. Sutton
Clare M. Howard
Jan Willem Erisman
Gilles Billen
Albert Bleeker
Peringo Grennfelt
Hans van Grinsven
Bruna Grizzetti



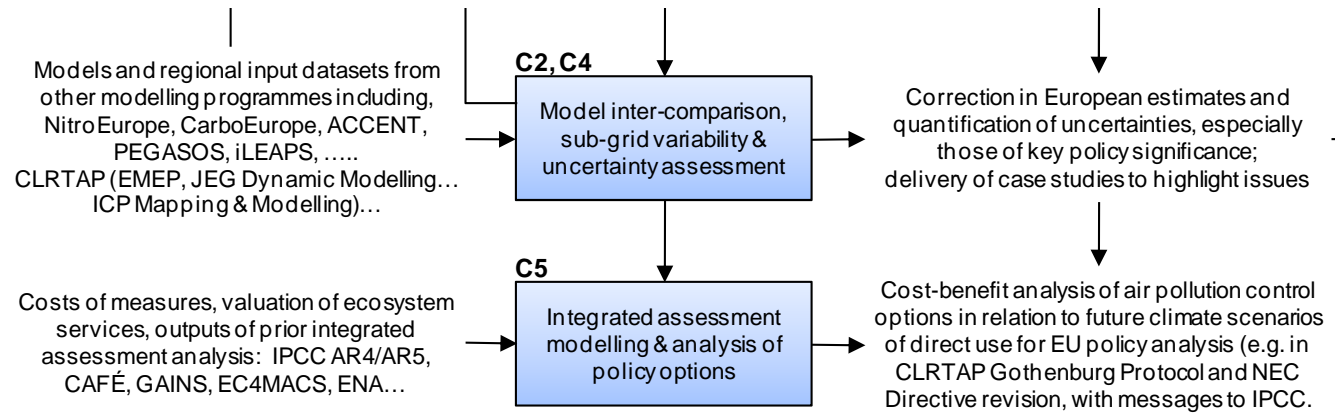


ÉCLAIRE Delivery Path

Integration of scientific communities, datasets and models



Input to the EU Air Quality Stakeholder Expert Group

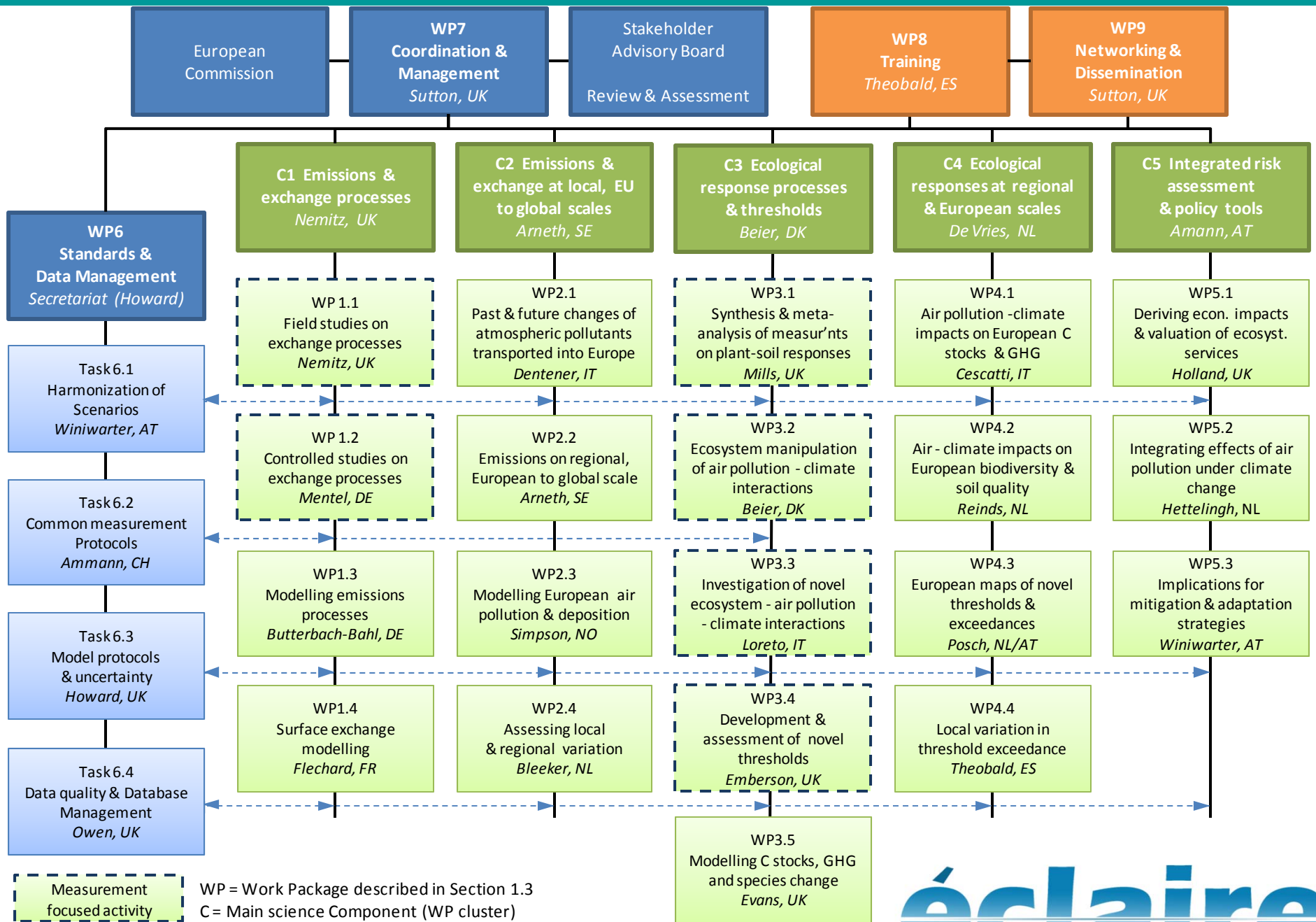


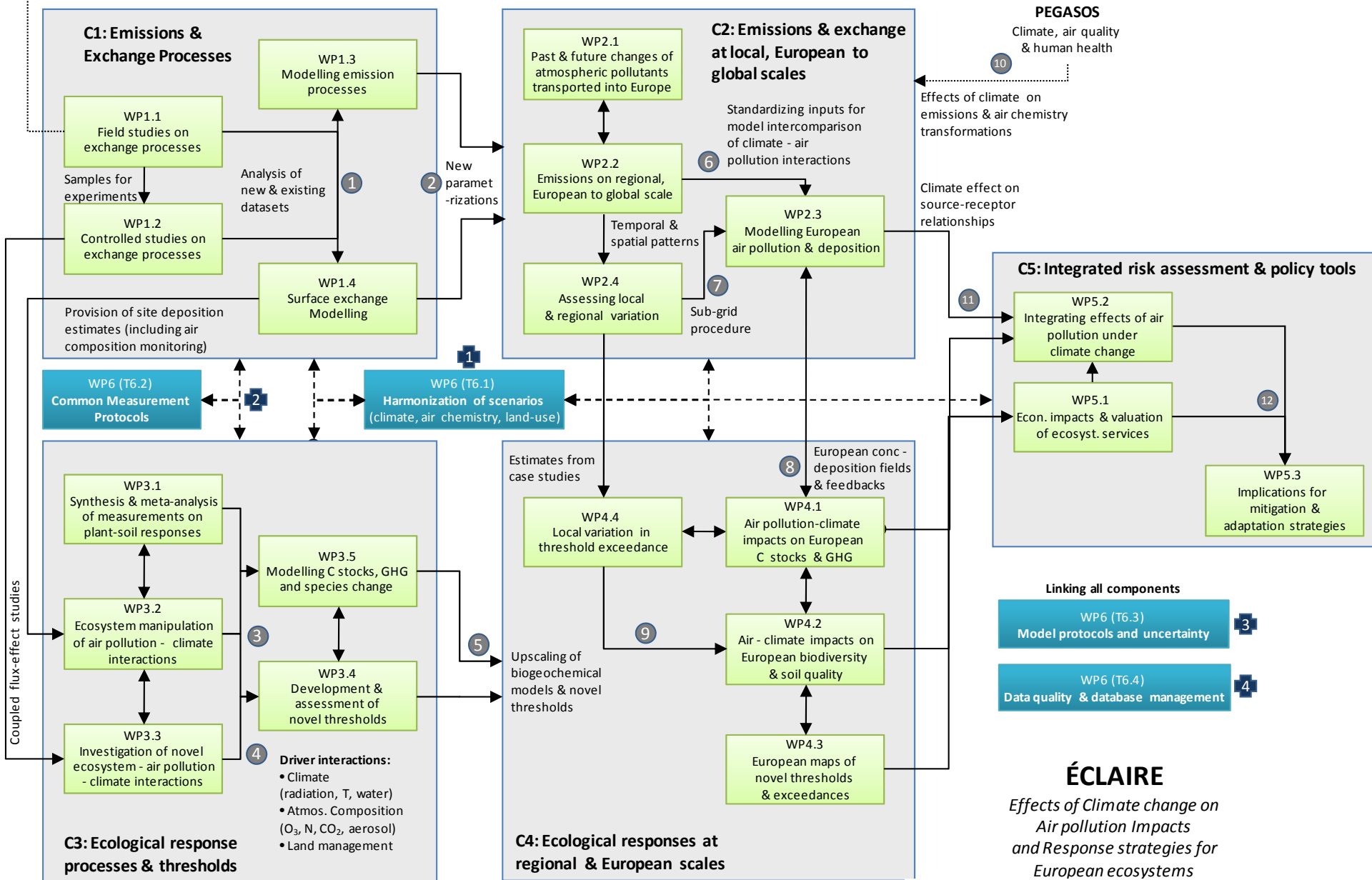
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Integration of scientific knowledge to address policy synergies and trade-offs

Next generation European air pollution mitigation & adaptation strategies under climate change







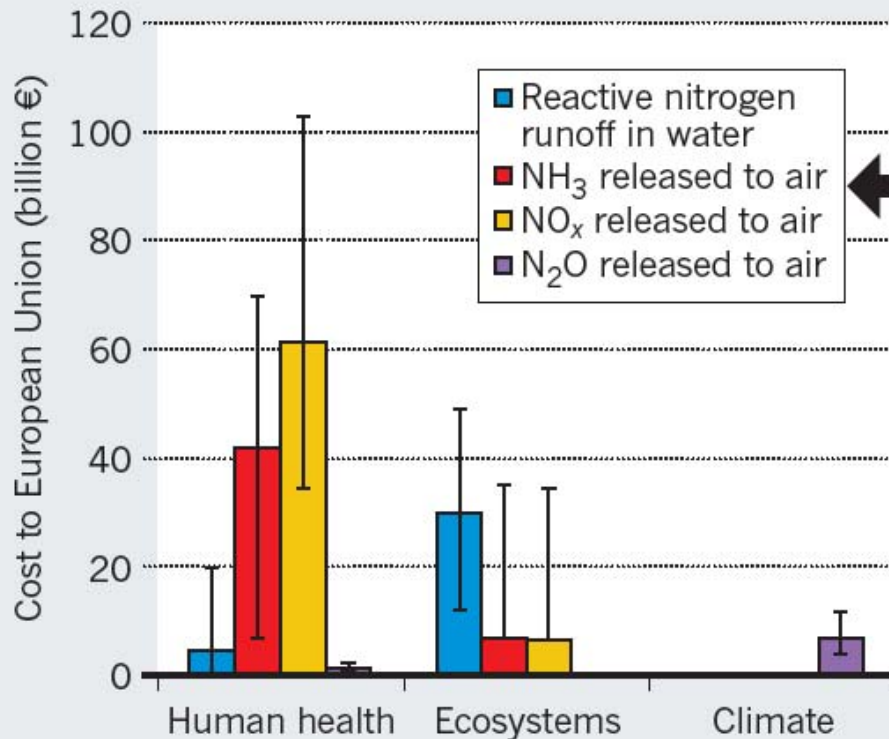
Major Risks and Opportunities

- Budget and ambition: exploit networking and national funding
- The power of common approaches: TFs on Common Measurement and Modelling Protocols
- Uncertainty: scientific and policy views

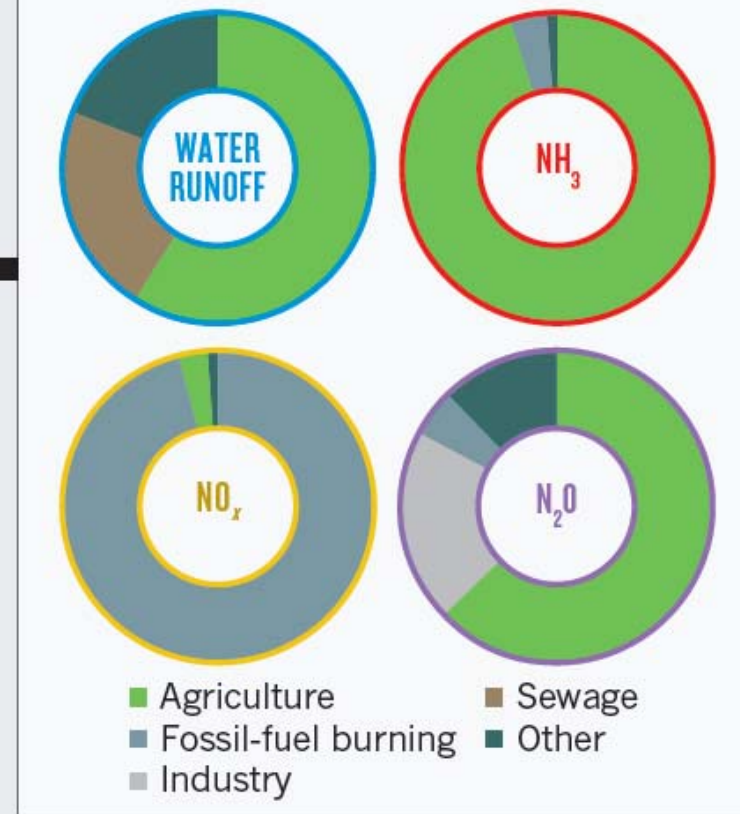
Nitrogen Damage Costs & Sources

DAMAGE COSTS OF NITROGEN POLLUTION

Agriculture and fossil-fuel burning load the environment with reactive nitrogen, affecting water, soils and air.



MAIN NITROGEN SOURCES



EU Damage cost: 70 - 320 billion €/ year

Sutton et al. *Nature* 14 April 2011

ÉCLAIRE Outlook

- Open to emerging issues
- Scientific challenges for integration
- Envisaging the outcomes now – imagine the press release – what do we need to get there?