

# éclairaire

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



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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 O<sub>3</sub> and N, and where relevant their interactions with VOCs, aerosols and S.

# Main Elements

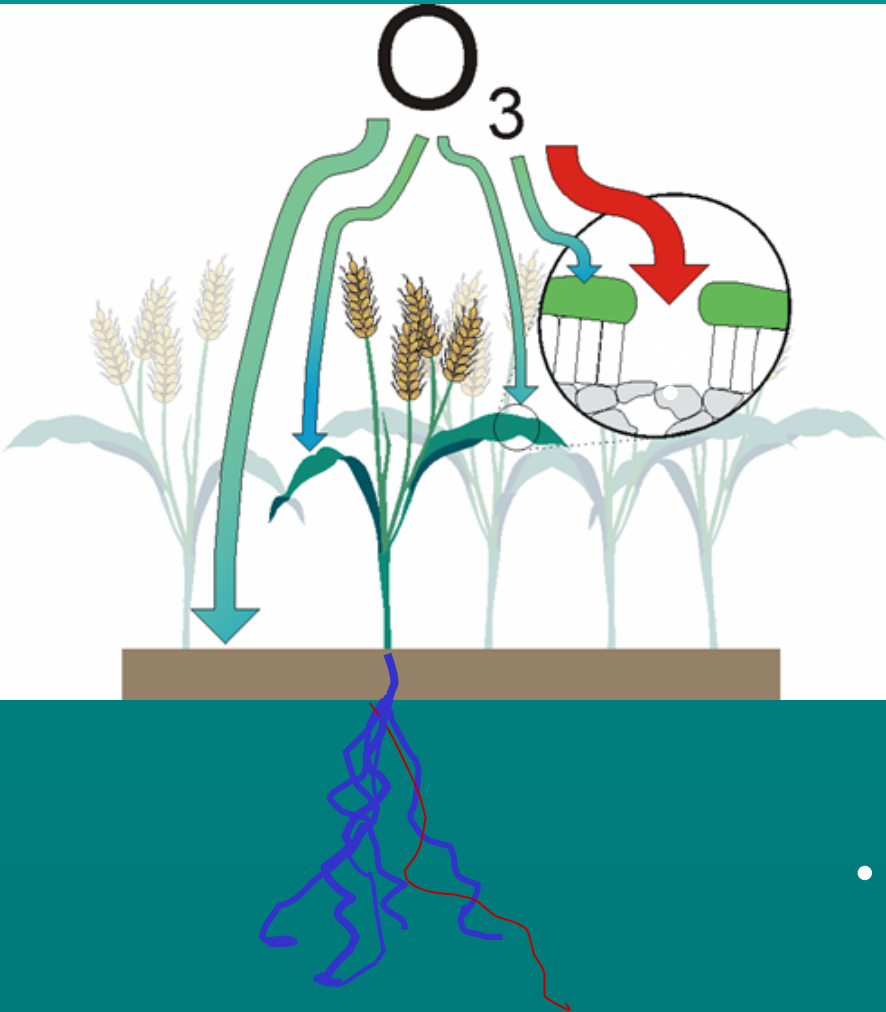
- Climate change effects...
  - **Fluxes**: Alteration of biogenic/agricultural and other emissions, air chemistry, transport distance and deposition.
  - What is the net effect on aerosol?: precursors, volatile aerosol, less scavenging.
  - **Vulnerability**: Alteration of ecosystem responses, including 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, CLRRTAP, ICP-Vegn, TFIAM etc etc.

**éclair**e

# Ozone – what do we need to understand?

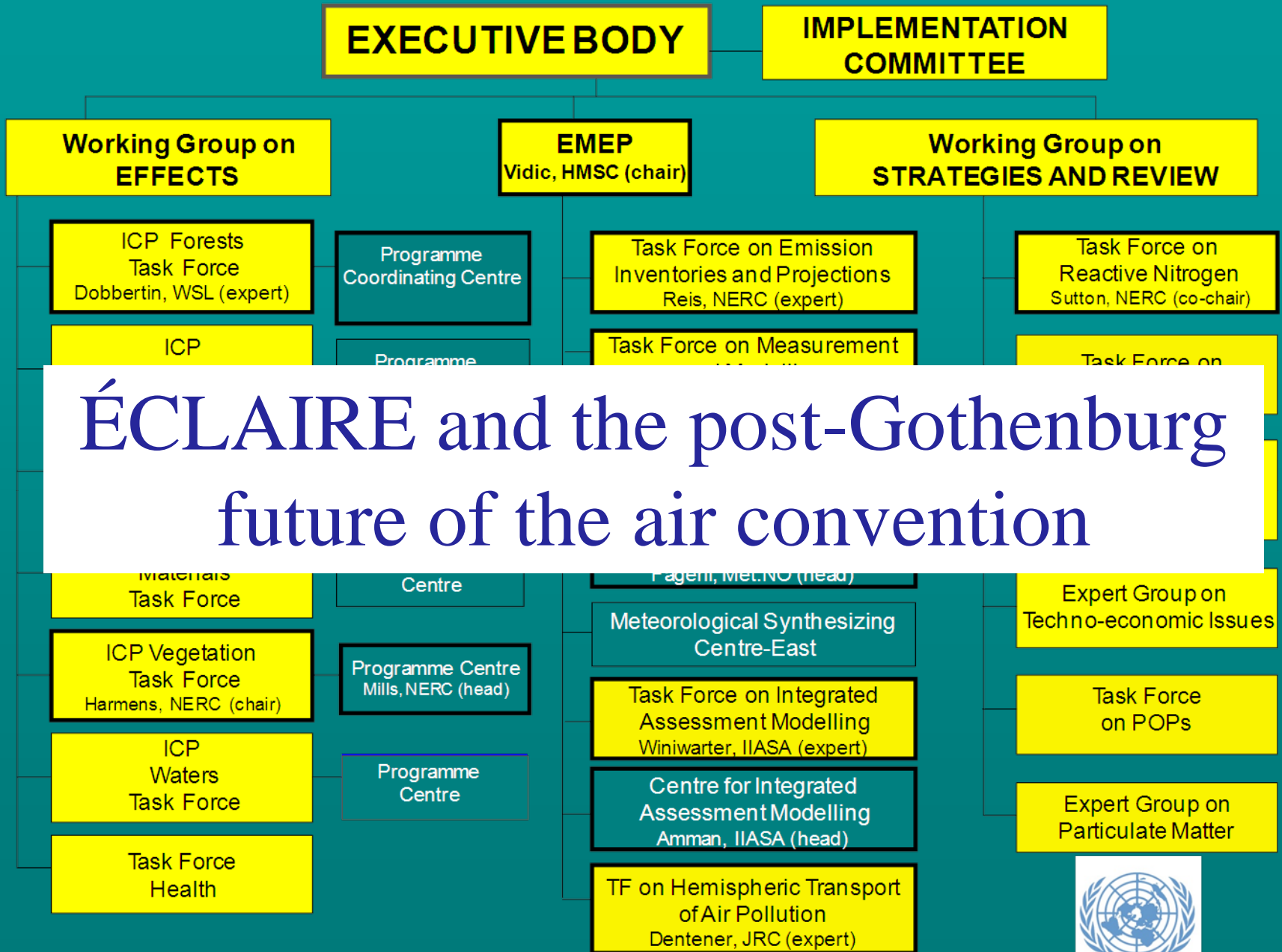


How do we know how much O<sub>3</sub> gets into the plant and how much impacts on the plant?

Depends on:

- Dry deposition (currently assumed to be constant but is it?)
- Stomatal functioning (e.g. DO<sub>3</sub>SE model, O<sub>3</sub> effect on g<sub>s</sub>?)
- 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



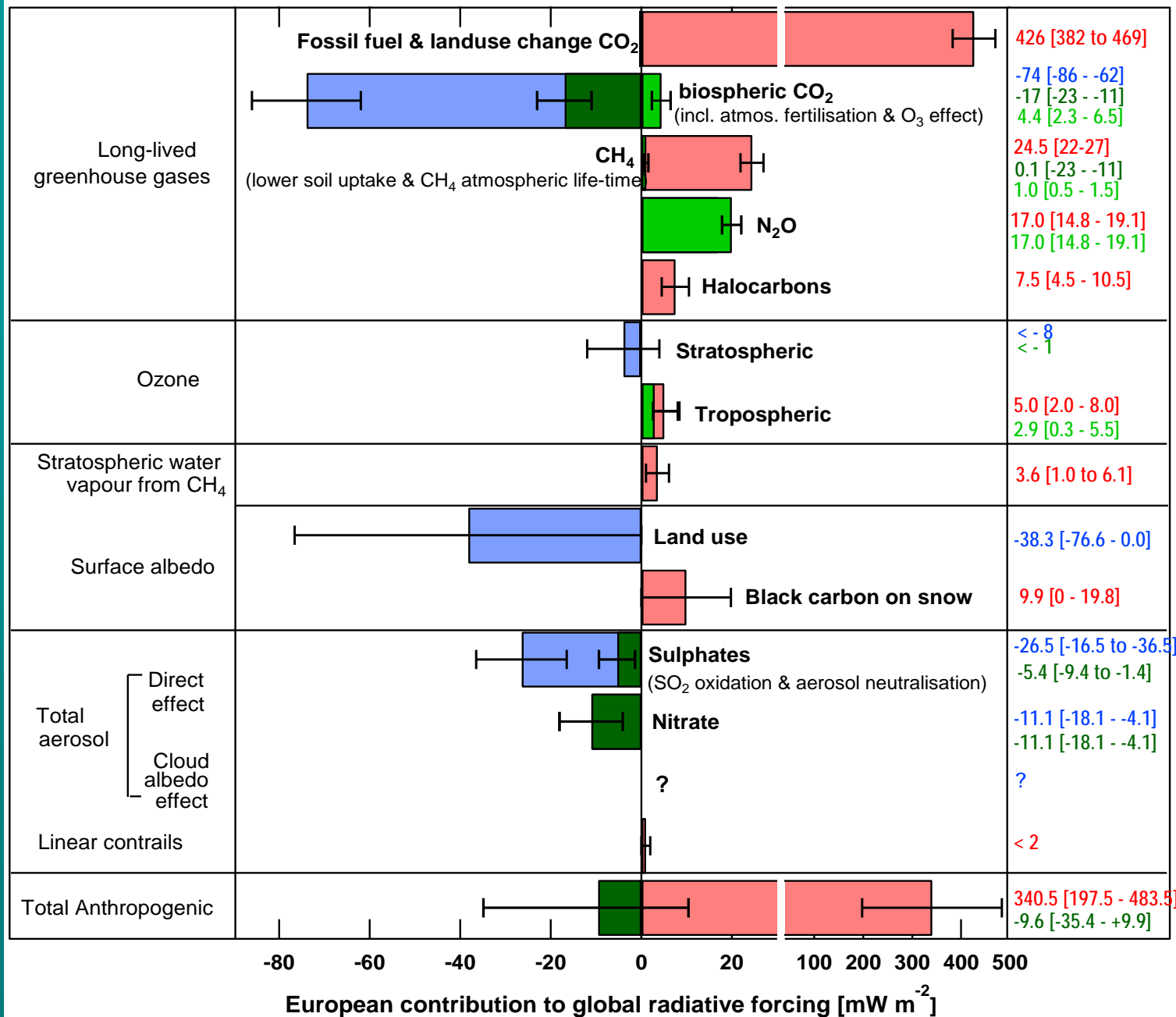
ÉCLAIRE and the post-Gothenburg future of the air convention



## 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

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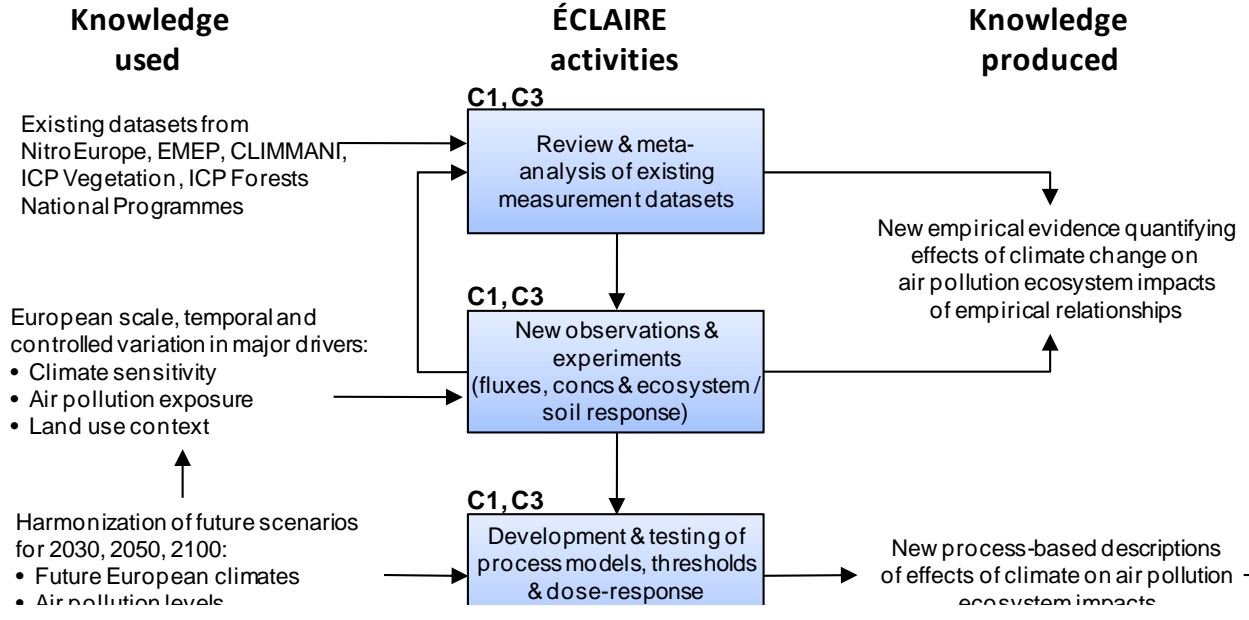




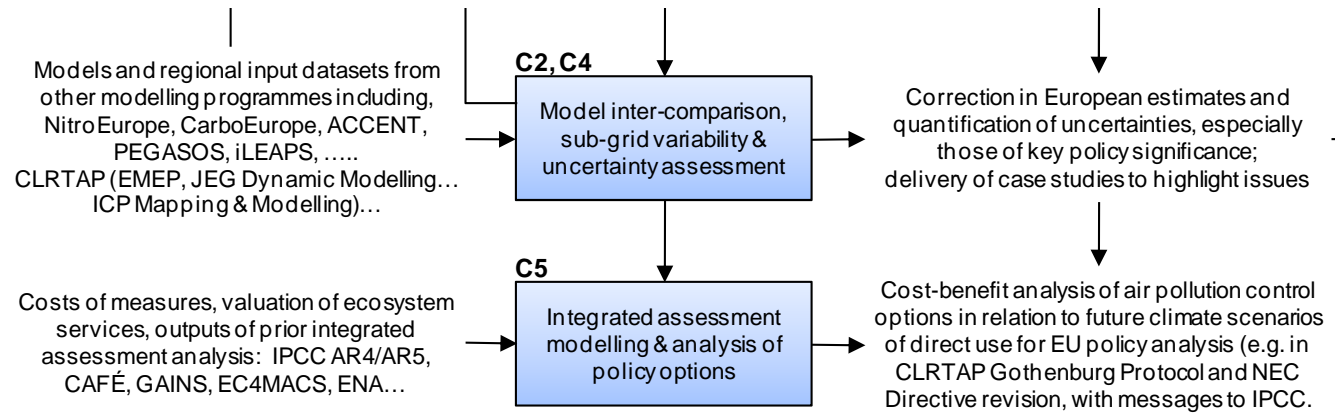


# ÉCLAIRE Delivery Path

Integration of scientific communities, datasets and models



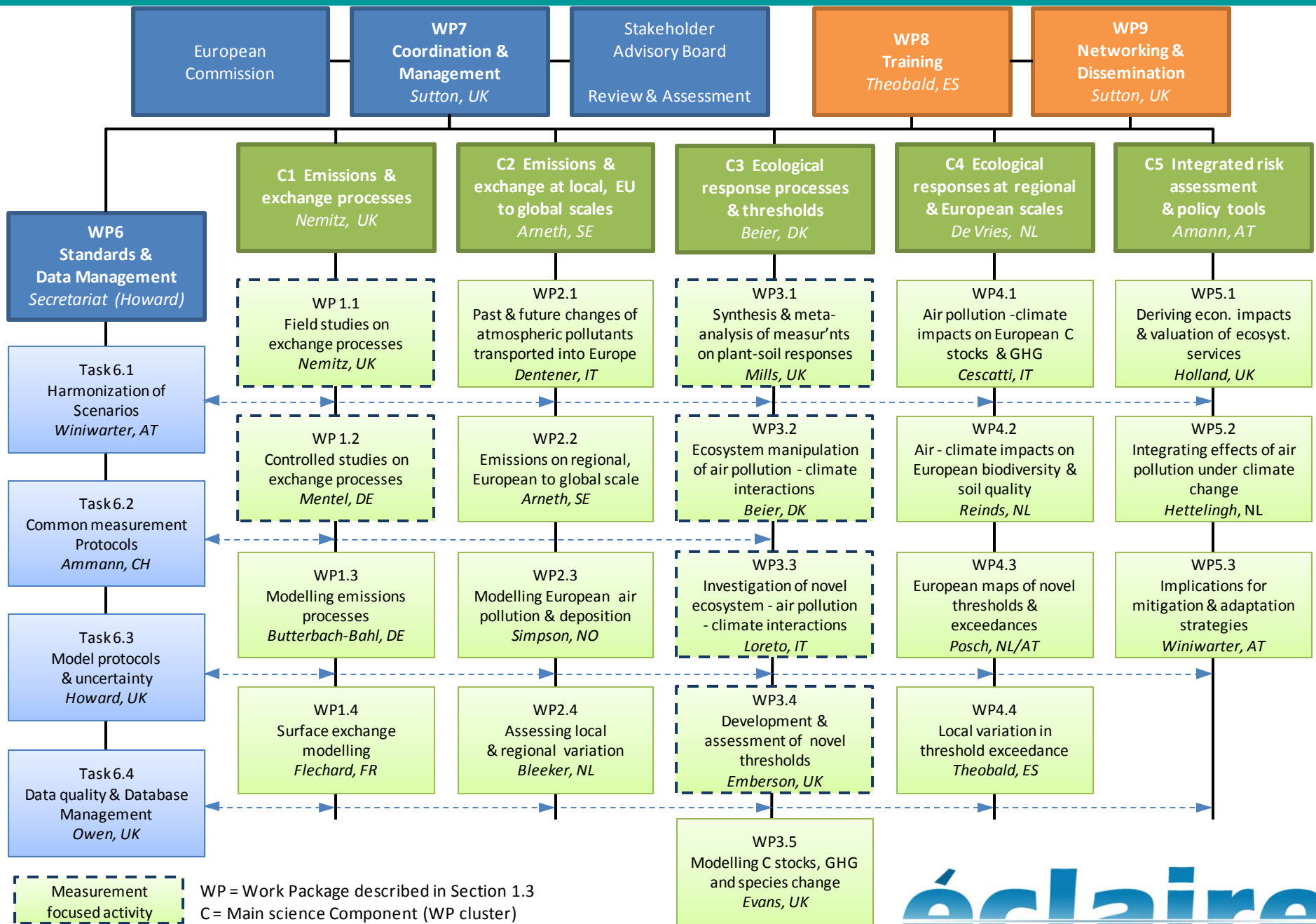
## Input to the EU Air Quality Stakeholder Expert Group

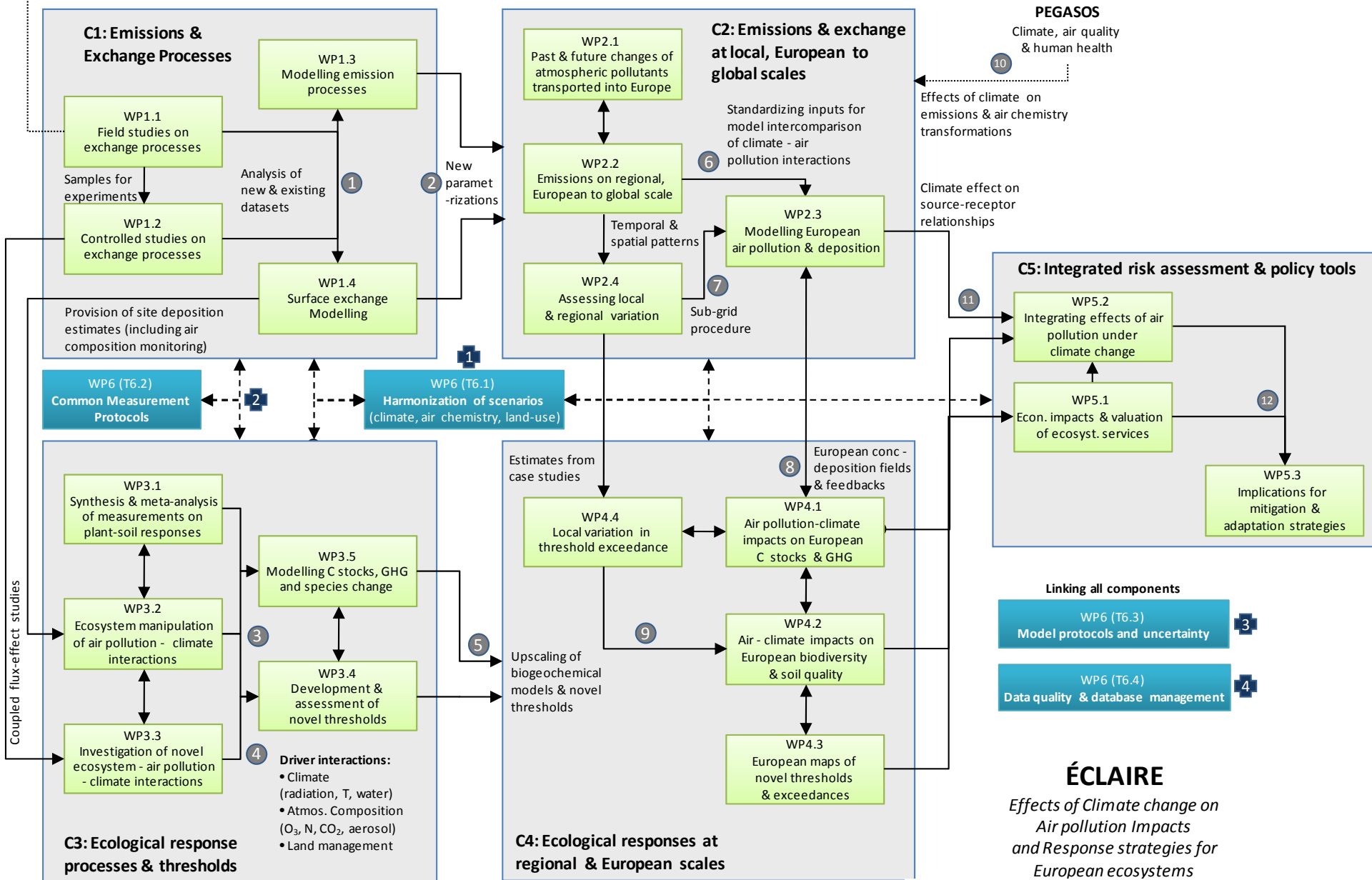


Integration of scientific knowledge to address policy synergies and trade-offs

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







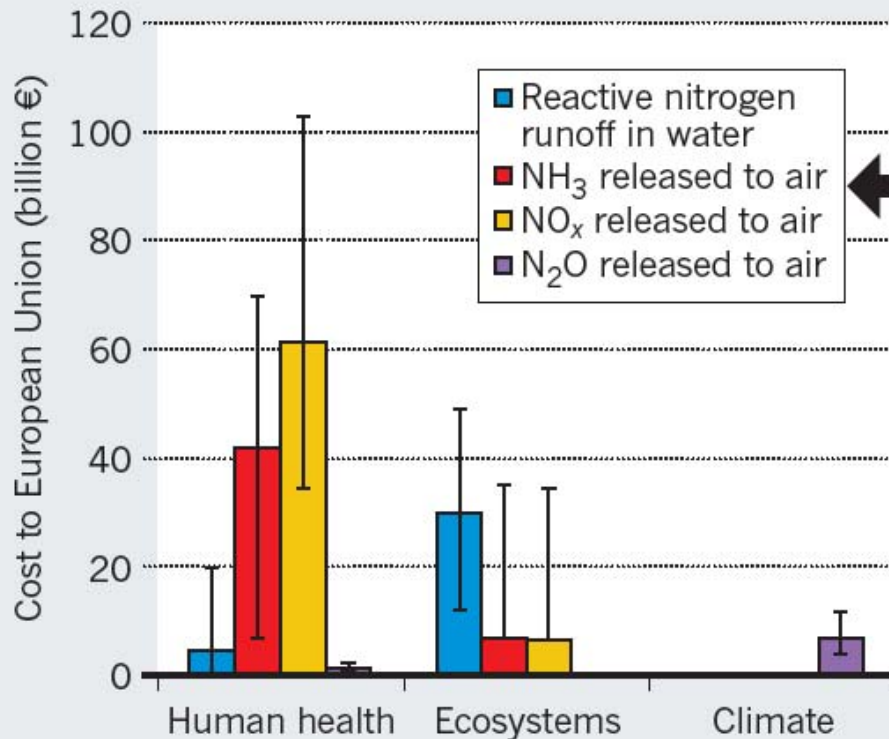
# Major Risks and Opportunities

- 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

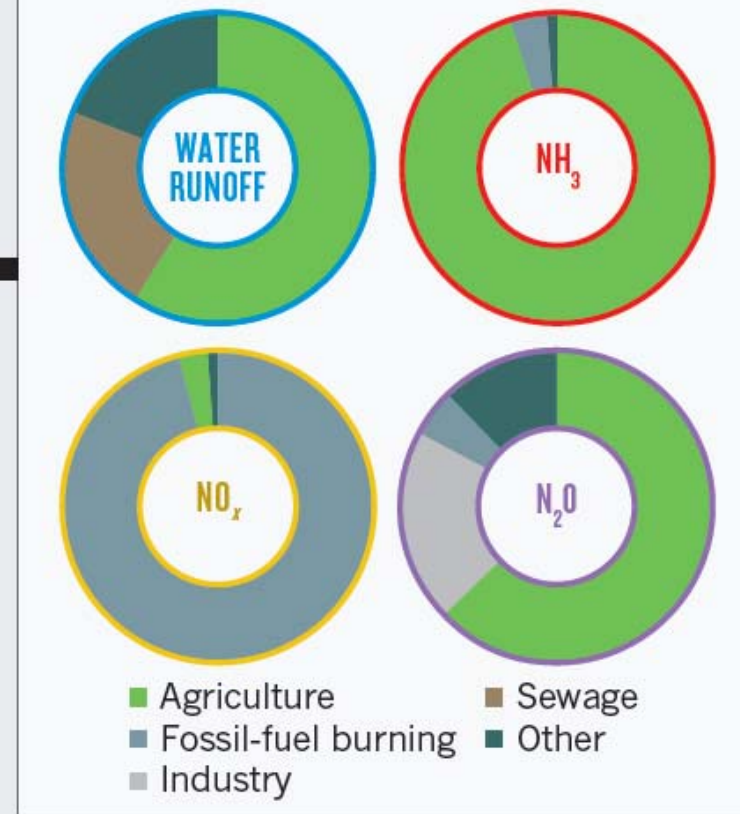
# Nitrogen Damage Costs & Sources

## 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?