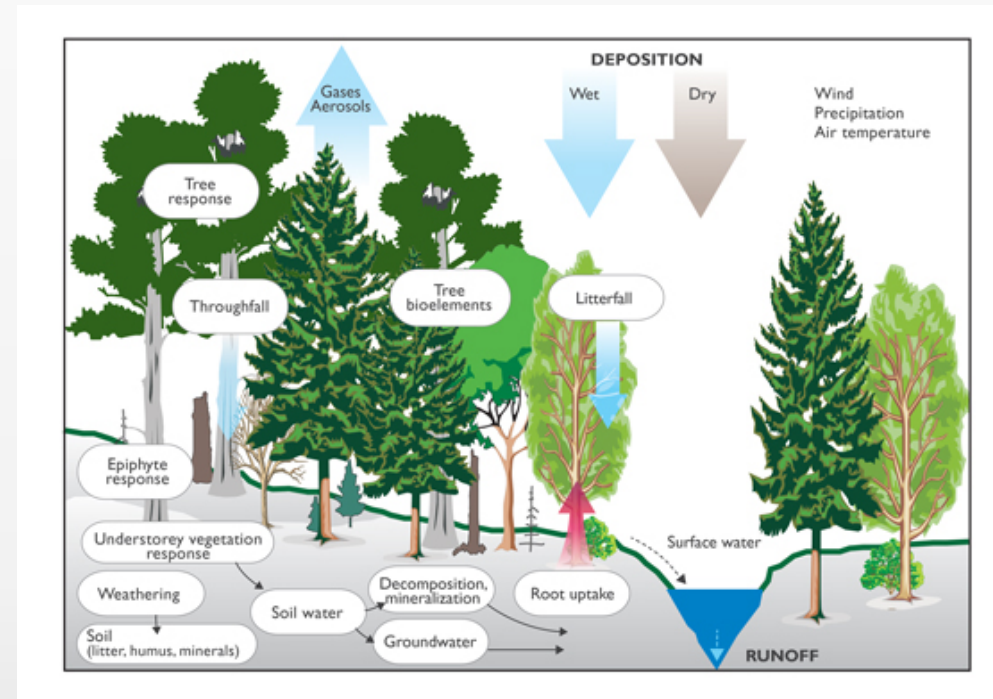




# ICP Integrated Monitoring of Air Pollution Effects on Ecosystems – ICP IM

U. Grandin, S. Valinia and M. Forsius





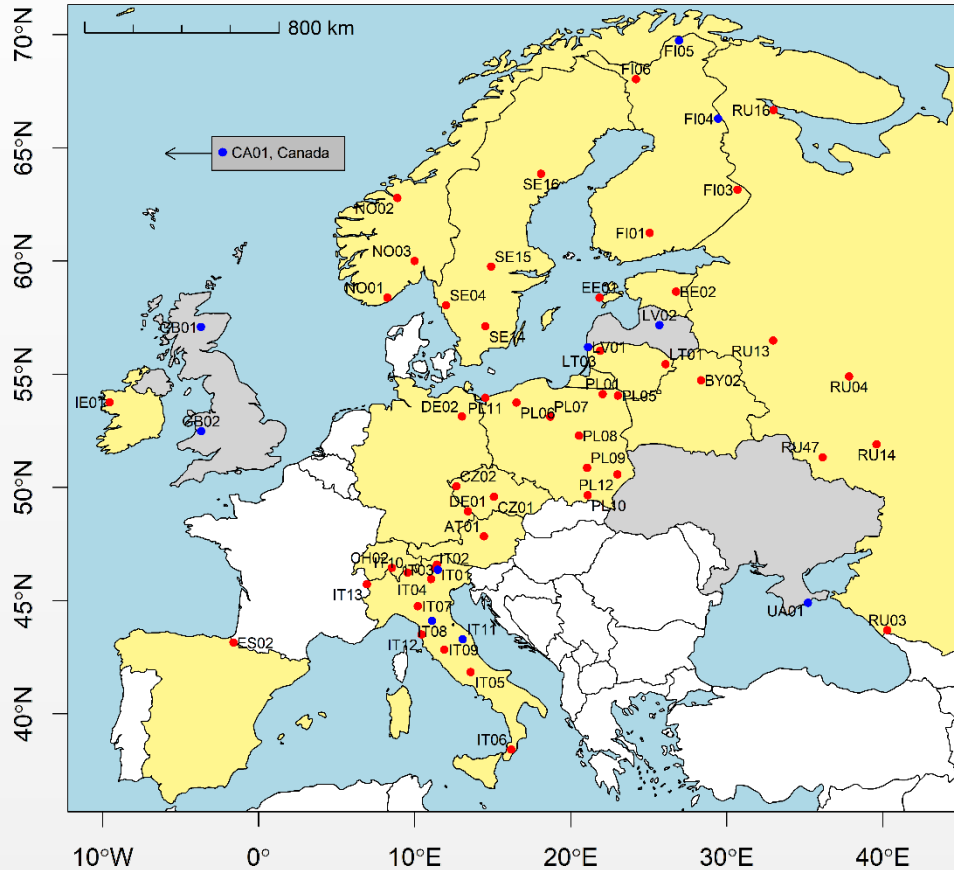
# ICP Integrated Monitoring

## Main objectives of ICP IM:

- Long-term **monitoring of** biological, chemical and physical state of ecosystems, to...
- provide an **explanation of changes** in terms of **causative environmental factors**, including:
  - natural changes,
  - air pollution and
  - climate change, to...
- **provide a scientific basis for emission control.**
- **Develop and validate models** for the simulation of ecosystem responses to e.g. **estimate responses** and to make **regional assessments.**



# Integrated monitoring sites, 2020



15 active countries

48 active sites

Discussion about new site in the UK


- Active site
- Inactive site
- Country with current data reporting
- Country without current data reporting



# Summary of recent activities

## Top three scientific papers in priority topics areas

Contents lists available at ScienceDirect



Science of the Total Environment

journal homepage: [www.elsevier.com/locate/scitotenv](http://www.elsevier.com/locate/scitotenv)

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Assessing critical load exceedances and ecosystem impacts of anthropogenic nitrogen and sulphur deposition at unmanaged forested catchments in Europe


ARTICLES

<https://doi.org/10.1038/s41559-020-1176-8>

nature ecology & evolution

[Check for updates](#)

**Replacements of small- by large-ranged species scale up to diversity loss in Europe's temperate forest biome**




nature COMMUNICATIONS

ARTICLE [Check for updates](#)

<https://doi.org/10.1038/s41467-020-17171-y> OPEN

Meta-analysis of multidecadal biodiversity trends in Europe

Francesca Pilotto  et al.#



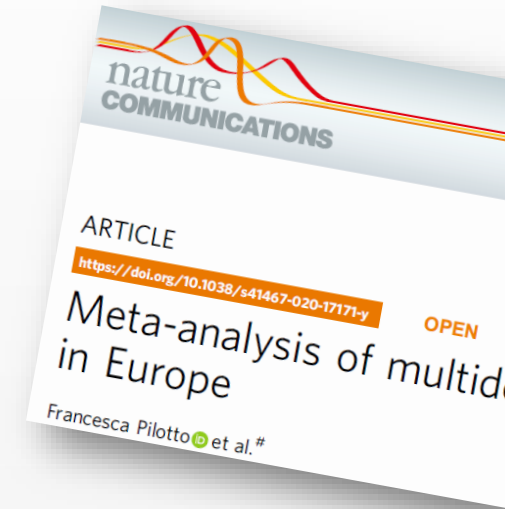
# Meta-analysis of multidecadal biodiversity trends in Europe

Pilotto et al., Nature Communications. 2020, 11:3486

- 161 long term abundance datasets. Mainly LTER data, but some IM datasets
- 6 200 marine, freshwater and terrestrial taxa

## Main results:

- Biodiversity changes at local scale are often complex and cannot be easily generalized to larger scales
- Increases in richness and abundance with increasing temperature and naturalness





# Replacements of small- by large-ranged species scale up to diversity loss in Europe's temperate forest biome

Staude et al., *Nature Ecology & Evolution*. 2020, 4:802-808

- 68 vegetation re-survey studies of semi-natural forests in Europe, some IM sites

## Main results:

- Among the herb-layer species, nitrogen deposition accelerates:
  - the extinctions of small-ranged, nitrogen-efficient species and
  - the colonization by broadly distributed, nitrogen-demanding species including non-natives.
- May explain the directional replacement of small-ranged species within sites and thus explain patterns of biodiversity change across spatial scales. (but see previous slide!)





# Assessing critical load exceedances and ecosystem impacts of anthropogenic nitrogen and sulphur deposition at unmanaged forested catchments in Europe

Forsius et al., *Science of the Total Environment*. 2021, 753:141791.

- Based on long term integrated data from 17 IM and eLTER catchments

## Main results:

- Novel techniques for presenting exceedances of critical loads (CL) and their temporal development
- Concentrations and fluxes of N and S in deposition and runoff have decreased as a response to decreasing emissions
- Most sites with higher CL exceedances showed larger decreases in both inorganic N and H<sup>+</sup> concentrations and fluxes in runoff
- Evaluation of effects of cumulative exceedance of the eutrophication CL
- Evidence of a link between CL exceedances and empirical impacts







# Activities on the 2020-21 CLRTAP work plan

## Scientific papers

WP Activity	Time frame	Responsible	Status
<b>1.1.1.15 Scientific paper on the impacts of internal catchment-related nitrogen parameters to TIN leaching</b>	2020	Programme Centre and NFPs	Draft MS
<b>1.1.1.16 Scientific paper on HM trends in concentrations and fluxes across ICP IM sites in Europe</b>	2021	Programme Centre and individual researchers	Draft MS
<b>1.1.1.17 Scientific paper on the effects of N enrichment on forest vegetation.</b> A co-operation between ICP IM and ICP Forests.	2020	ICP IM chairs	Draft MS





# Summary of recent activities

## Key reports in IM Annual Report – Scientific papers are in prep.

- Eklöf et al., 2020. Temporal trends and input-output budgets of heavy metals in ICP IM catchments
- Vuorenmaa et al., 2020. Long-term changes in the inorganic nitrogen output in European ICP Integrated Monitoring catchments – an assessment of the impact of internal nitrogen-related parameters and exceedances of critical loads of eutrophication.

## Other scientific paper

- Weldon & Grandin. Recovery in the epiphytic lichen community in the Swedish IM catchments, after the decrease in S deposition. Submitted MS



# Further development and the future

- Migration of IM database from Programme Centre (Finland) to Sweden
- Participation in the revision of the Gothenburg Protocol
- Continued work defining “IM light”, to enlarge the IM network. Other ecosystem types for biodiversity assessments. Also connected to the EU NEC Directive ([2016/2284/EU](#)) monitoring.
- Further work along with the Long Term Strategy, for example multiple stressors
- Increased cooperation and use of EMEP data in evaluations of IM data
- Participation in the development of the European LTER-network to an ESFRI Research Infrastructure ([www.lter-europe.net](http://www.lter-europe.net)).
- Invite more countries in Europe to join ICP IM



# ICP IM and the review of the Gothenburg Protocol

**WGSR conclusions** are in line with the ICP IM work plan and strategy of work coming years, for instance:

- *“An integrated approach to addressing air pollution through a **multi-pollutant, multi-effect approach**, that includes the potential interaction with **climate change**, the **nitrogen cycle** and **biodiversity**, that can achieve multiple goals and benefits, and avoid potential unintended consequences of proposed actions for other environmental problems”.*

Data from the ICP IM database are essential for the GP update, e.g.:

- *“Update of the **critical loads** for the analysis of the efficiency of policies;*
- *Effects of air pollution on **biodiversity** as a basis for critical levels/loads calculations;*
- *Accounting for linkages with **climate change** and land use in **effects indicators**”*



# Further development and the future

Mrs. Sirpa Kleemola will retire early 2021.

- IM data base manager
- Editor of IM Annual Report
- The point of stability in IM – been there from the beginning

We would like to express our deep gratitude for all the commitment and excellent work Sirpa has done for IM for several decades!







# Thanks for your attention



Gammtratten IM site SE16. Photo: Ulf Grandin.