National Ecosystem Monitoring Network (NEMN) Ireland under the National Emissions Ceilings Directive

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ICP Forests Expert Panel Soil & Soil Solution, 8–12 March 2021

National Emissions Ceilings Directive

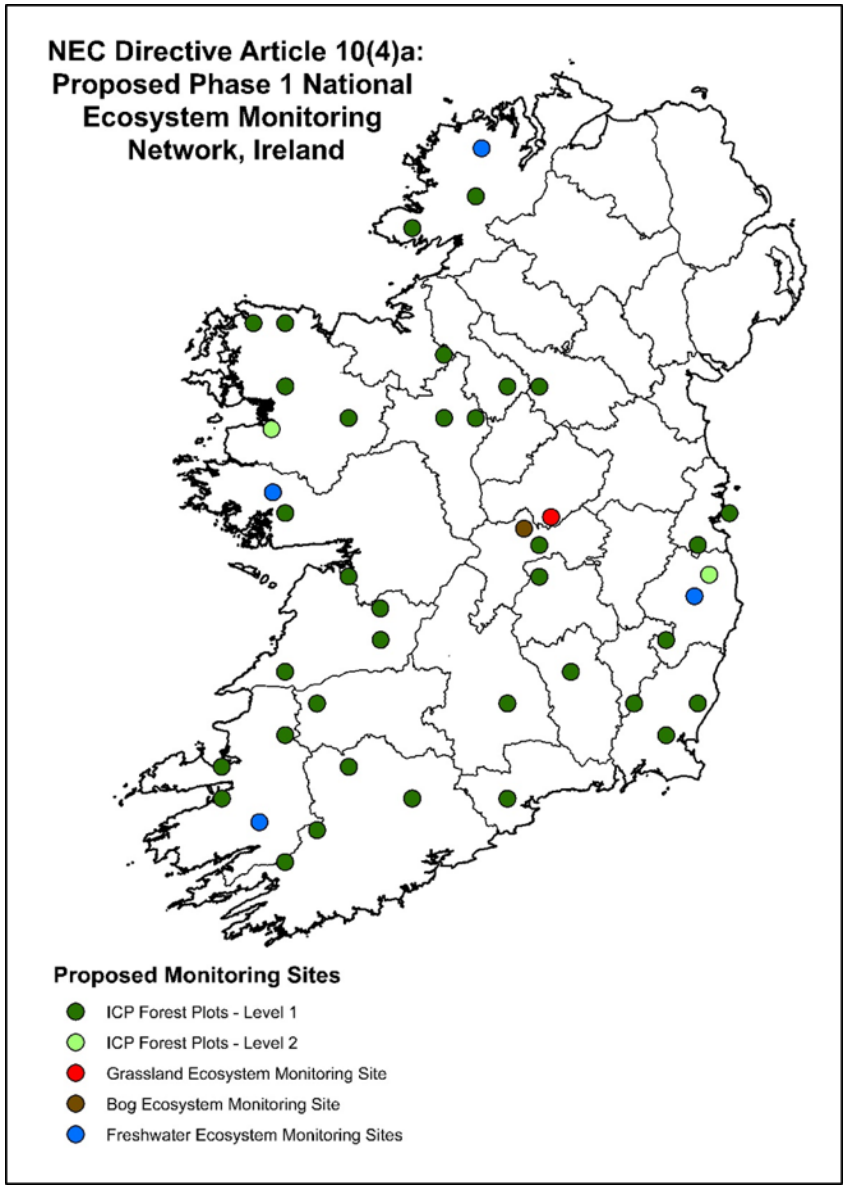
National Ecosystem Monitoring Network (NEMN) - Ireland

- New **long term** sites
- Monitor:
  - **ecological impacts** of **air pollution**
  - **concentration** and **deposition** of pollutants
- Network must be;
  - **Representative**
  - **Cost-effective**
  - **Risk based**
- **Four-year** reporting cycle
- **Improve** from cycle to cycle

MONITOR (Art. 9) and **REPORT** (Art. 10): **Negative impacts** of **air pollution** on ecosystems (acidification, eutrophication, and ozone damage)

NEMN - First submission

- Sites proposed, 1-July 2018
- First submission of **historical** data 1-July 2019
- Data submitted for 6 sites;
  - **2 ICP Forests** 1987 - 2017
  - **4 ICP Waters** 1990 - 2018
- **No data** available for proposed:
  - Bog site
  - Grassland site
  - 35 ICP Forests Level I sites
- Next submissions, 2022, 2023

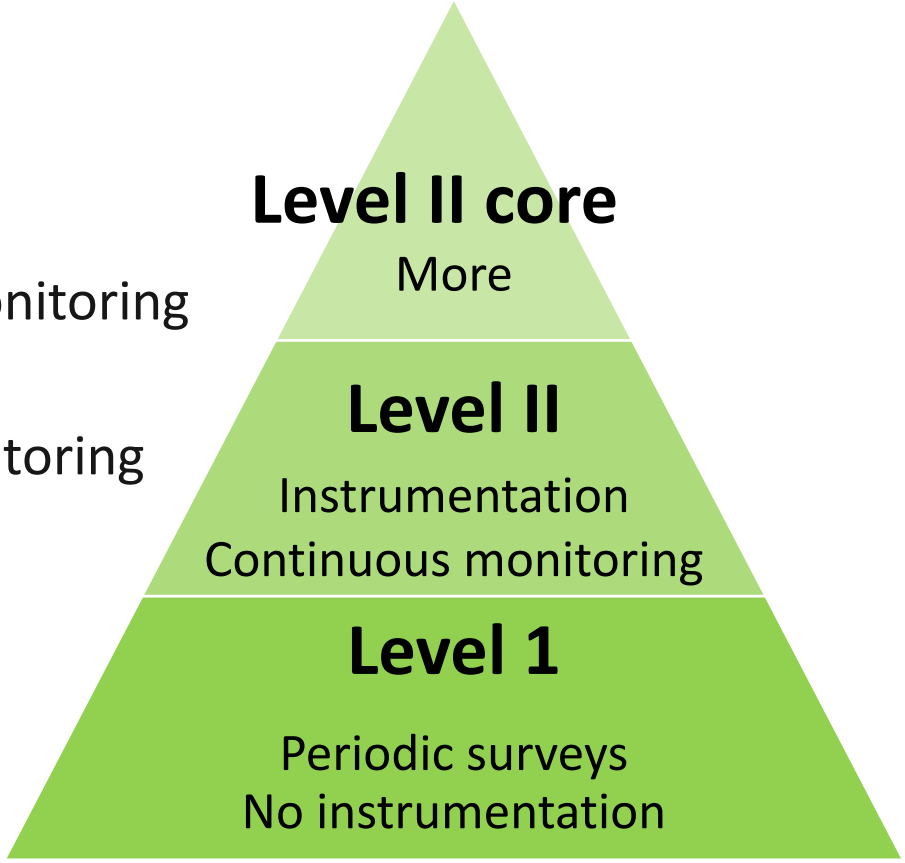


Feedback from Europan Comission

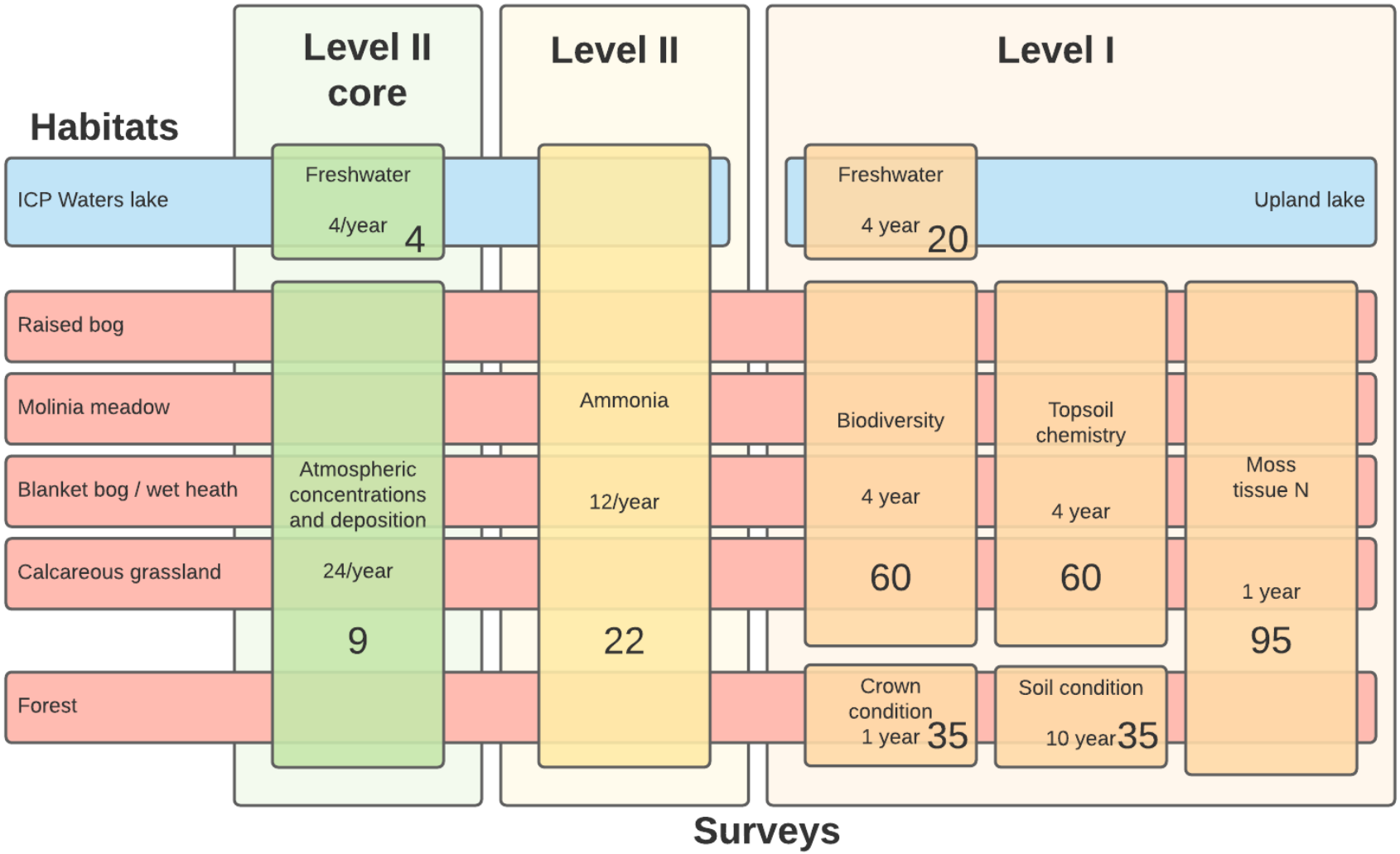
- EC feedback, 2018:
  - Include **more terrestrial ecosystems**:
    - Moors and bogs
    - Semi-natural grasslands
  - **More monitoring** on selected sites
- EC feedback, 2019 expand with:
  - Heathlands
  - Bogs
  - Acid sensitive grasslands

NEMN – Structure

- **Level II core** – Full air quality monitoring
- **Level II** – Just NH_3 monitoring
- **Level I** – Biodiversity & soil monitoring



National Ecosystem Monitoring Network Ireland Structure



Surveys to be incorporated into NEMN

- NATURA 2000 sites monitored by National Parks and Wildlife Service (NPWS) under Habitats Directive (92/43/EEC) every 6 years
  - NEMN has a 4-year cycle
- 4 ICP Waters Level II lakes, EPA
  - Add atmospheric monitoring
- *2 ICP Forests Level II sites, UCD*
- 35 ICP Forests Level I, DAFM
- *20 Upland lakes, NEMN Level, Trent University in Canada*

Italics = long-term data; no current monitoring

NEMN Level I & II: Selecting habitats and sites

Selecting habitats sensitive to air pollution, in particular N deposition and gaseous ammonia, of conservation importance in Ireland

We recommend including five new habitats, 15 sites per habitat, surveyed every 4 years:

- Raised Bog
- Blanket Bog
- Wet Heath
- Calcareous Grassland
- *Molinia* Meadow

Other networks will provide sites and data for Forests and Freshwaters

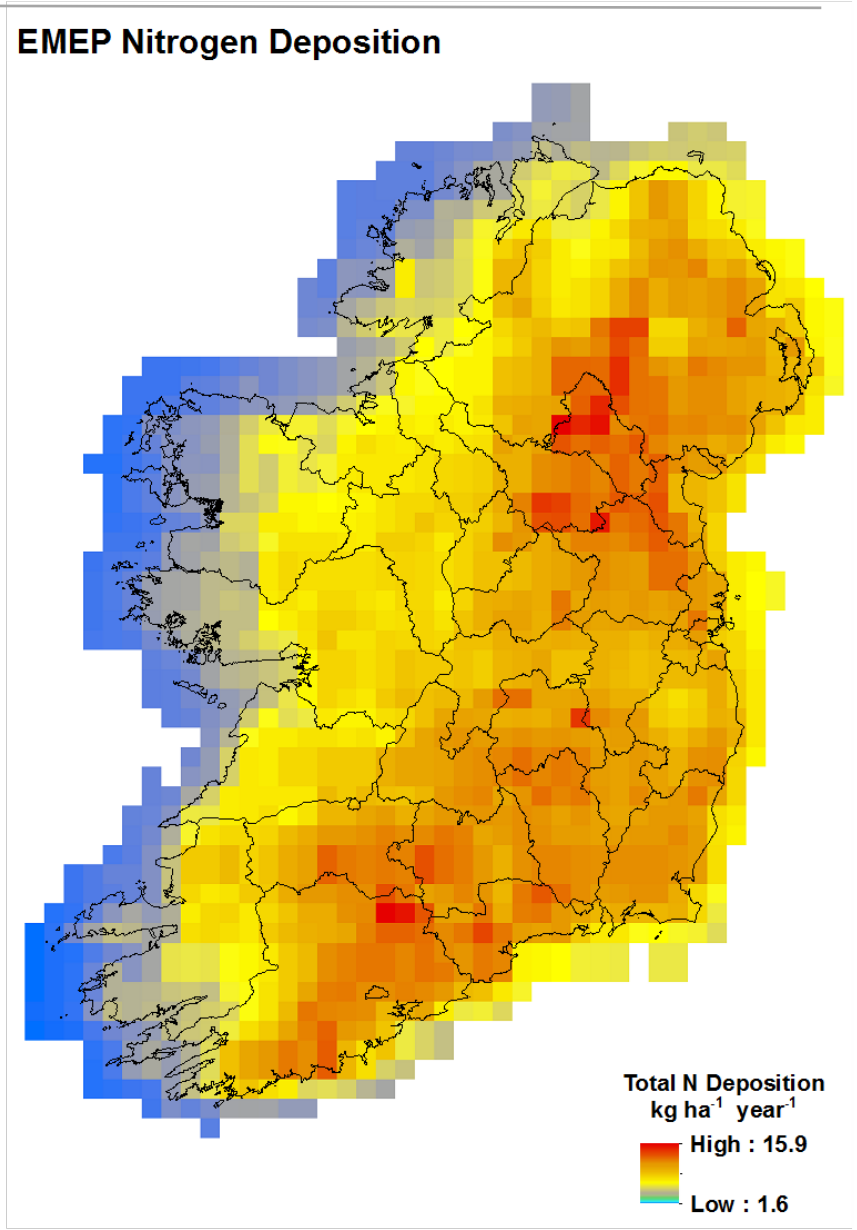
NEMN Level I: **Risk-based approach to site selection**

Sites should be:

- Representative of N risk
- Take account of co-correlated or modifying factors
  - Rainfall, S, O_3, management, size

Selection

- 15 per habitat
- Balanced across N deposition gradient and rainfall
- Stratified selection process
- Practical considerations
  - Links to other networks, inclusion of key Level II sites



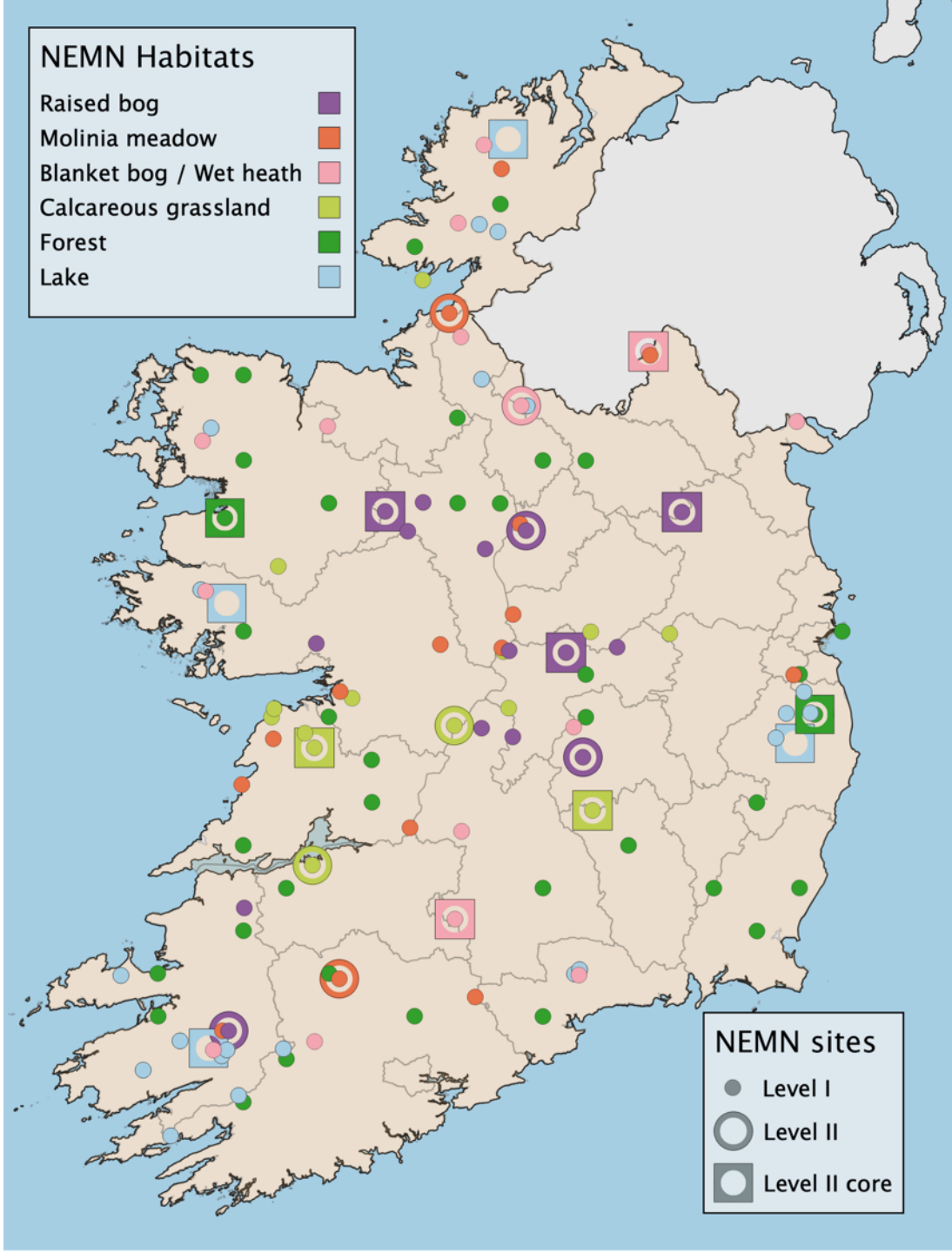
NEMN: **Proposed sites**

Level I:

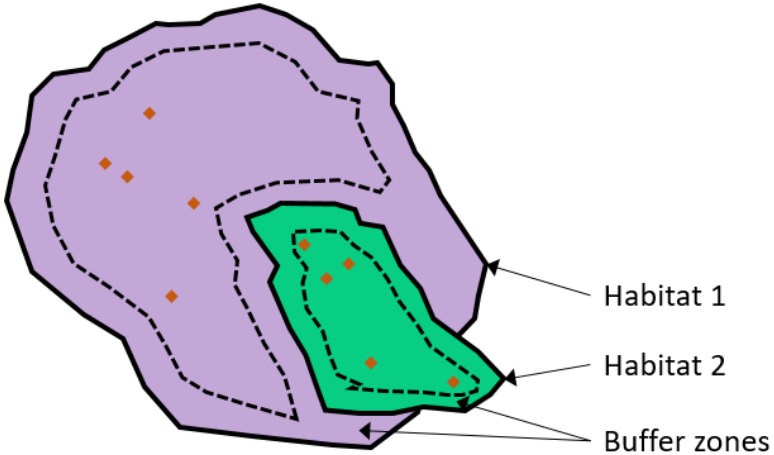
- **64** Terrestrial habitats
- **35** ICP Forests Level I
- **20** Upland lakes

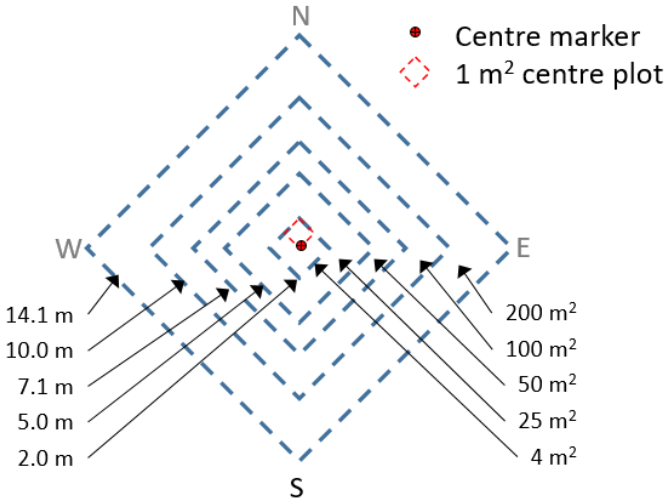
Level II (core)

- **4** (4) ICP Waters sites
- **2** (2) ICP Forests sites
- **3** (2) Raised Bogs
- **4** (2) Calcareous Grasslands
- **3** (2) Blanket Bog / Heath / Molinia Meadow



NEMN Level I: Biodiversity and soil monitoring





- We recommend marked permanent sampling points monitored every 4
- Five points per habitat for Bulk soil: Soil pH, organic C and N (g 100 g^{-1})
- Moss tissue %N, preferably *Hylocomium splendens* or *Pleurozium schreberi* for acidic habitats; *Pseudoscleropodium purum* for calcareous habitats
- *But not*: soil solution; horizon-based sampling; other optional parameters

Air quality and deposition monitoring (Level II)

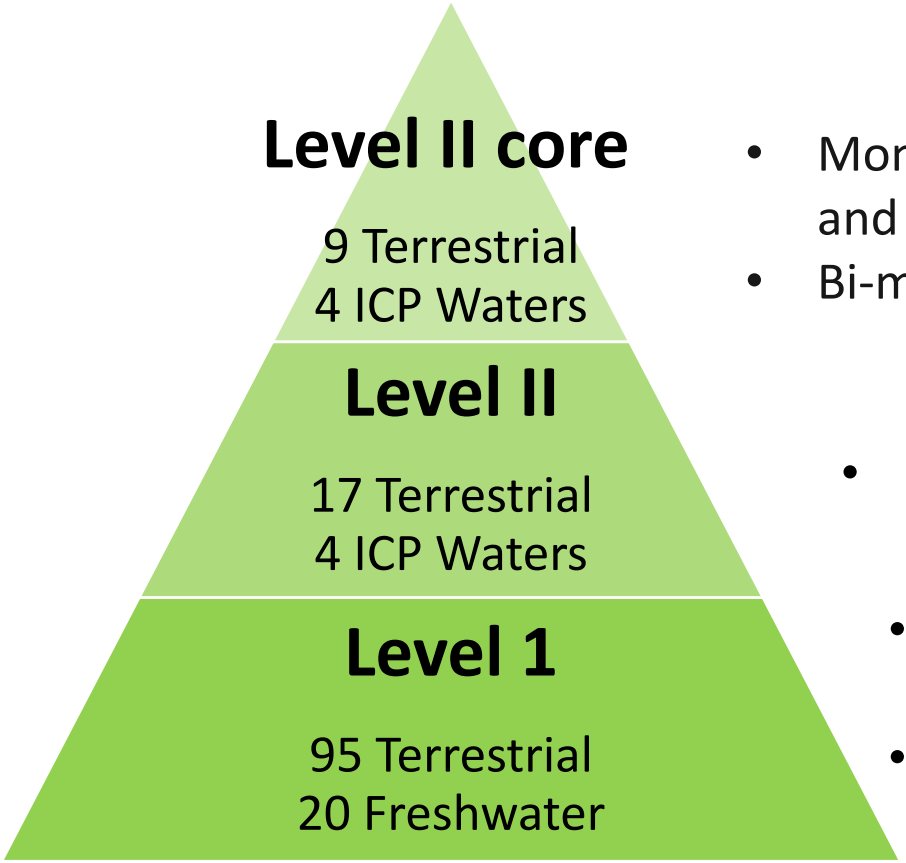
Gases	Wet deposition	Ozone POD_y	Carbon Flux
NH_3	H^+, NH_4^+, NO_3^- SO_4^{2-}, Cl^- Base cations	Ozone	Net C uptake
NO_x		POD_y	
SO_2			

Exceedance of critical levels / loads:

- Acidification
- Eutrophication

Exceedance of flux-based critical levels - ozone

Air pollution monitoring - tiered approach



Recommendations

- Monthly gases (NH_3, HNO_3, NO_2, SO_2) and aerosols (NH_4^+, NO_3^-, SO_4^{2-})
- Bi-monthly wet deposition

- Monthly NH_3

- Modelled concentrations and deposition
- Comparison with critical levels and loads

Complemented by data from existing networks:

- National ambient AQ network (NO_x, SO_2, O_3, $PM_{2.5}$)
- EMEP (TIN, TIA, NH_3*, wet deposition)
- Met Éireann (wet deposition)
- Teagasc (NH_3 flux) / ICOS (C flux)

Air and precipitation chemistry protocols

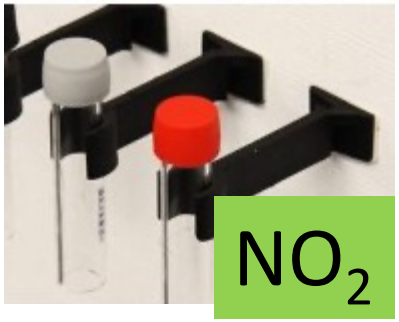
- Active methods with low power requirement
- Low-time-resolution methods
- Passive methods

Ions, elements, pH

Gases: NH_3, HNO_3, SO_2
Aerosols: NH_4^+, NO_3^-, SO_4^{2-}

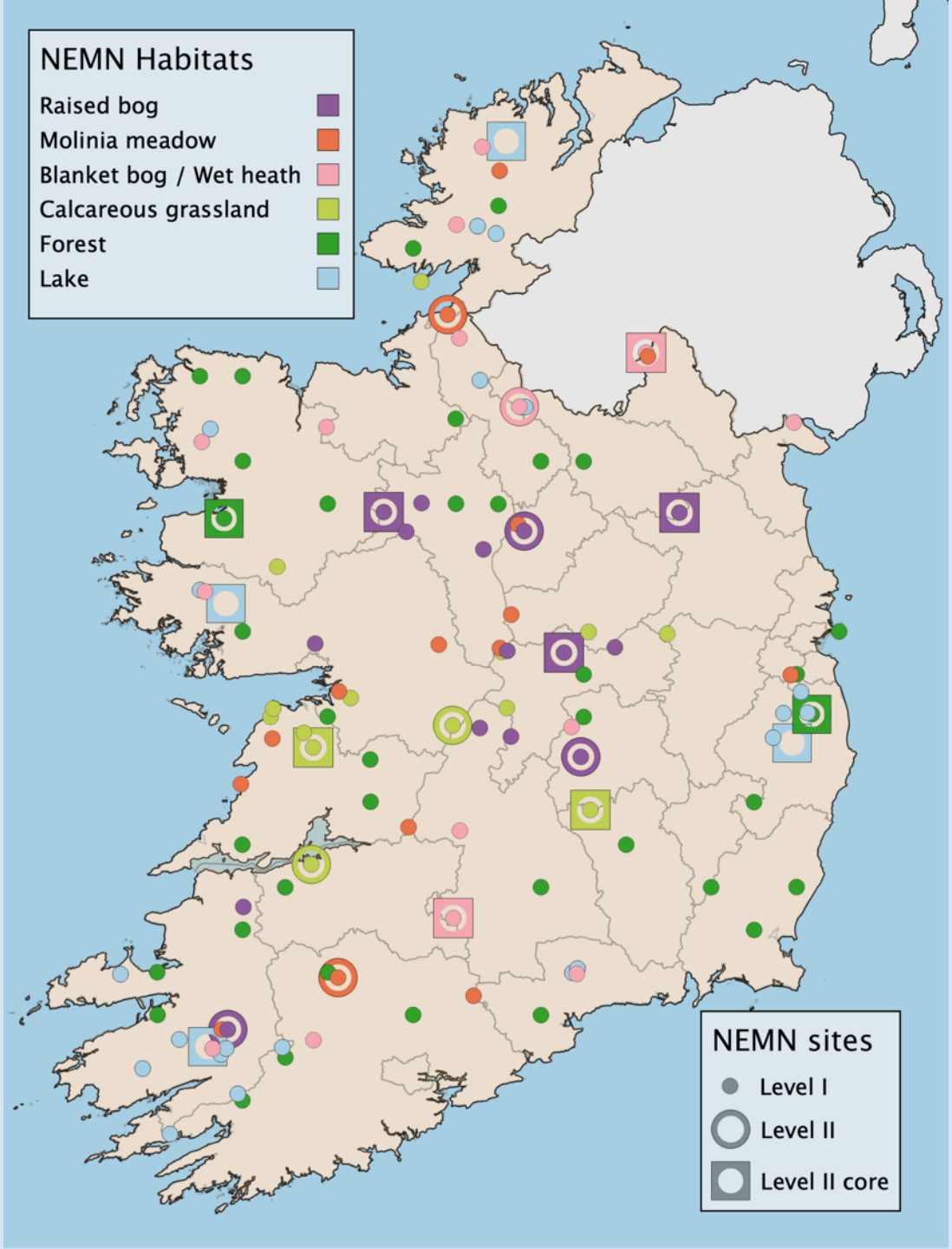
Bulk-precipitation
(/ forest throughfall)
collectors; two-weekly
or bi-monthly samples

ALPHA® sampler



Palmes-type
Diffusion Tubes

DELTA® denuder–
filter-pack method


NEMN Habitats
Raised bog
Molinia meadow
Blanket bog / Wet heath
Calcareous grassland
Forest
Lake
NEMN sites
Level I
Level II
Level II core

NEMN-Design Team

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