What is the Nature Index?

The Nature Index is **not** a model for biodiversity.

As the title suggests,

*The Nature Index: A General Framework for Synthesizing Knowledge on the State of Biodiversity*

It is a tool to **synthesize the existing knowledge** on the state of biodiversity in any ecosystems.
What is the Nature Index?

The Nature Index is an ecological equivalent of a stock market index.

It is a weighted average of scaled indicators:

- Indic. 1
- Indic. 2
- Indic. 3

Scaling

State 1

State 2

State 3

Averaging

Nature Index

WEIGHT

WEIGHT

WEIGHT
What is the most reliable source of information on biodiversity?

Ecologists
Where is located this information?

In their brain, and in their computer.

How is it communicated to society?

Through diverse reports, publications, medias...

The integrated picture might be hard to get...
The Nature Index is a tool to achieve this synthesis

It collects information from ecologists, stores it, synthesizes and communicates it.
Which type of information the NI collects?

Sample Data
- Model output
- Satellite observations
- Expert opinion
- Lack of knowledge

The NI is **not bounded by a particular Method, Model, Data type, Scale, Ecosystem, ...**

All kind of information should be recorded while keeping track of the **source.**
The most important things you need to implement the Nature Index are:

- A panel of ecologists
- A database with online interface where the expert will enter information
- A set of rules to compile, aggregate, and display the information in a relevant way

preferably organized in **groups dedicated to a given ecosystem** (~ 1 expert panel per LCEU)
Resources needed to implement the Nature Index in a country

Minimum is 2 peoples:

**Quantitative ecologist** that will organize the expert panels, explain how to document indicators, supervise data collection, and produce the main results.

**Informatician** that will sustain the database

Optional but useful competences:

- Networking & Communication, GIS, Environmental management
The expert panel is the core of the Nature Index

It is the expert panel that will:

- Decide on the **Indicator list**, 
- Produce the **reference levels** associated to all indicators, 
- **Enter the data**, 
- Suggest the way indicators should be aggregated to produce relevant "thematic indices".
Documenting the NI database is **EASY** and **QUICK**

Link to the input database
In Norway, **150 experts** spread across **9 major ecosystems** documented more than **300 indicators** at the scale of **~430 municipalities**…

May appear a bit overwhelming… The Nature Index will also work within a **more modest setting**.
How to combine these informations?

3 slides on METHODS
The mathematical structure of the Nature Index: a **weighted average**...

4 axes:

- $i$ - indicators,
- $j$ - major ecosystems
- $k$ - municipality
- $t$ - time

$$NI_t = \sum_{ijk} S_{ijkt} W_{ijkt}$$

The average can be made across any combinations of these 4 axes, it is to the experts to decide on combinations that **make sense**.
States are calculated by scaling indicators by their reference value:

The reference is a value that either correspond to high biodiversity, or minimal extinction risk for the indicator.

All States are dimensionless numbers, expressed on a 0-1 scale.
The **weighting system**: combining **States** together.

Across **major ecosystems**: → Equivalence between major ecosystems

Across **indicators**: →
- 50% of weights: "Extra-representative" indicators
- 50% of weights: equal participation of the functional groups

Across **municipalities**: → Weights per municipality area

[www.nina.no](http://www.nina.no)
So, what kind of results can you expect from such framework?

**MAPS** of ecosystem condition

**TRENDS** of condition change

**MAPS** showing local **TRENDS**

**THEMATIC INDICES** highlighting specific themas:

- ecosystem characteristics,
- specific services,
- environmental pressures,
MAPS of ecosystem condition

a) ocean bottom 2010
b) ocean pelagic 2010
c) coast bottom 2010
d) coast pelagic 2010
e) open lowland 2010
f) mires and wetlands 2010
e) freshwater 2010
f) forest 2010
g) mountain 2010

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TRENDS of change in condition

In Norway, most ecosystems are in a fairly good state. Some are significantly threatened. Small signals of remediation have been reported.
MAPS of TRENDS

NI changes 1990-2010

with p.values

No Value
0.3:0.4
0.2:0.3
0.1:0.2
0.05:0.1
0.05
-0.05:0
-0.1:-0.05
-0.2:-0.1
-0.3:-0.2
<0.3

No Value
>0.9

0.1-0.9

<0.1
Combining NI to socio-economic information

Freshwater

Nature Index

Log (population density)
THEMATIC INDEX on an ecosystem characteristic: the **FOOD WEB STRUCTURE**

Fishing down the food web:

d) thematic index on trophic groups of pelagic systems

![Graphs showing changes in trophic groups of pelagic systems from 1990 to 2010](image-url)
THEMATIC INDEX on an ecosystem pressure: Acidification in freshwater

Group all indicators sensitive to acidification:

1990

2010

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THEMATIC INDEX on an ecosystem service: “Small game” populations

Willow Ptarmigan  Rock Ptarmigan

Touristic asset
THEMATIC INDICE on an ecosystem service: “Small game” population

This only represent the service capacity, not its actual use.
THEMATIC INDEX on Lack of Knowledge

Number of documented indicators for a given Ecosystem (Freshwater)
THEMATIC INDEX on Lack of Knowledge

Number of documented indicators across ecosystems, with information source
Joint reporting on ecosystem Condition and Extent

Nature Index

Extent

- coastal waters
- fresh water
- open lowland
- forest
- mire-wetlands
- mountain
- snow, ice and glacier
- arable land
- urban and built-up areas, industry
The public will be able to consult the NI result

Link to the public output website (in development)
The Nature Index within the SEEA ecosystem accounting framework
Structural differences between SEEA and NI

The Nature Index structure is more flexible, able to adapt to many different contexts.
The **Nature Index** within the **SEEA ecosystem accounting framework**
What role for the **Nature Index** in an **ecosystem accounting** framework?

A very effective tool to account for **ecosystem condition at the EAU scale**.

The NI has **not been designed** to focus on ecosystem services. But:

a) **Thematic indices** focusing on some services can be created

b) When specific measures of ecosystem services have been obtained, they can be incorporated within the NI for comparison.

In a nutshell, the NI can be used as a **general interface to store and display information on physical accounting at the EAU scale**.

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In the future...

Training courses will be organized, where guidelines for implementing the NI will be given, and where the database will be shared for free.

Ready in the next 2-3 months.
Thanks for your attention, and time for questions!
Example of calculation:

Weights are defined according to a sequential process.

A) Consider a set of indicator value in the same municipality, same major habitat and same trophic group:

B) NI Value within a municipality and a major habitat:

C) NI Value within a municipality:
Simple average between all major habitats present and documented in the municipality. (equivalence between all major habitats)

D) NI Value within a county:
Weighted average per municipality area

Example: \[0.62 \times 150 + 0.67 \times 120 + 0.53 \times 80 + 0.71 \times 140 + 0.74 \times 180]/670 = 0.67

Some steps can be dropped to get more specific information

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The NI does not require that all information should be traced back to the BSU scale.

The NI allows each ecosystem to change in area to some extent. Dramatic reduction in areas are captured as reduced ecosystem condition.