

Monitoring biodiversity in the Cairngorms National Park

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Cairngorms
National Park

Pàirc Nàiseanta a'
Mhonaidh Ruaidh



Why do we need a Nature Index?

- Scottish Biodiversity Strategy (SBS) aims to halt loss of biodiversity in Scotland by 2030, and restore ecosystems by 2045
- SBS highlights imperative to robustly monitor change
- SBS also explicit in the role of national parks as exemplars of ecosystem restoration
- The Cairngorms Nature Index (CNI) is therefore the tool which will baseline the health of our major ecosystems and monitor effectiveness of conservation action over time



CNPA targets for ecosystem restoration

- By 2045
 - 35,000Ha of new native woodland
 - 38,000Ha of peatlands restored
 - 70% of rivers in good ecological condition
 - 50% of the park in active restoration management
- Nature Networks
- Nature Action Plan – species recovery and habitat enhancement
- We need to know if we are moving things in the right direction!



How will the CNI work?

- Indices will be compiled for six major ecosystems within the CNP
 1. Freshwater
 2. Mires and wetlands
 3. Montane
 4. Woodlands
 5. Managed uplands
 6. Managed lowland grasslands



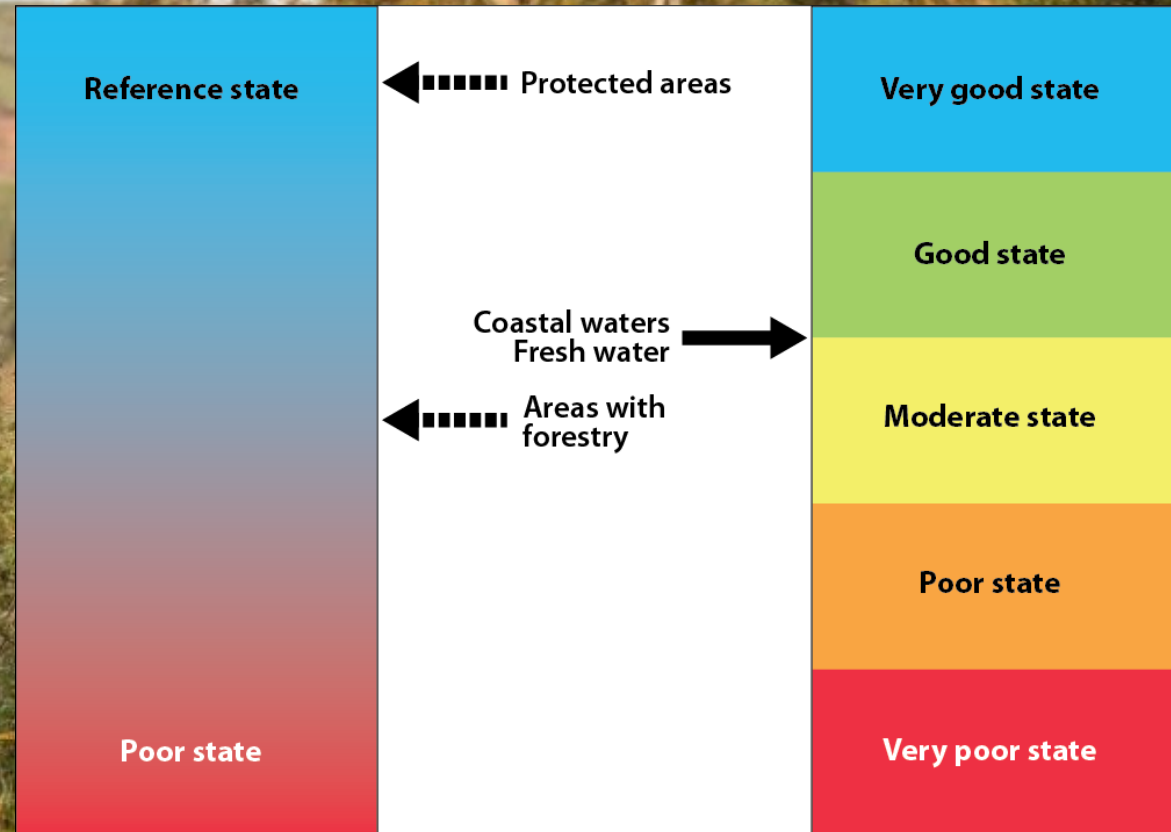
How will the CNI work?

- Weighted average of scaled indicators
- Indicators are typically species/ assemblages representing the diversity of an ecosystem
 - Multiple trophic levels
 - Taxonomically representative
 - Common and rare species
 - Keystone species
 - Species or habitat features that are sensitive to different environmental pressures
- Each indicator is given a value between 0 and 1, scaled against a reference value
- Values based on monitoring data, modelled outputs or expert assessment



How will the CNI work?

- A reference condition is required to monitor change over time
- Methodology of setting reference condition must be consistent so indicator values can be compared
- Indicator values are aggregated for each ecosystem to give an index for each reporting period
- 0.7 is considered to be 'good ecological condition'



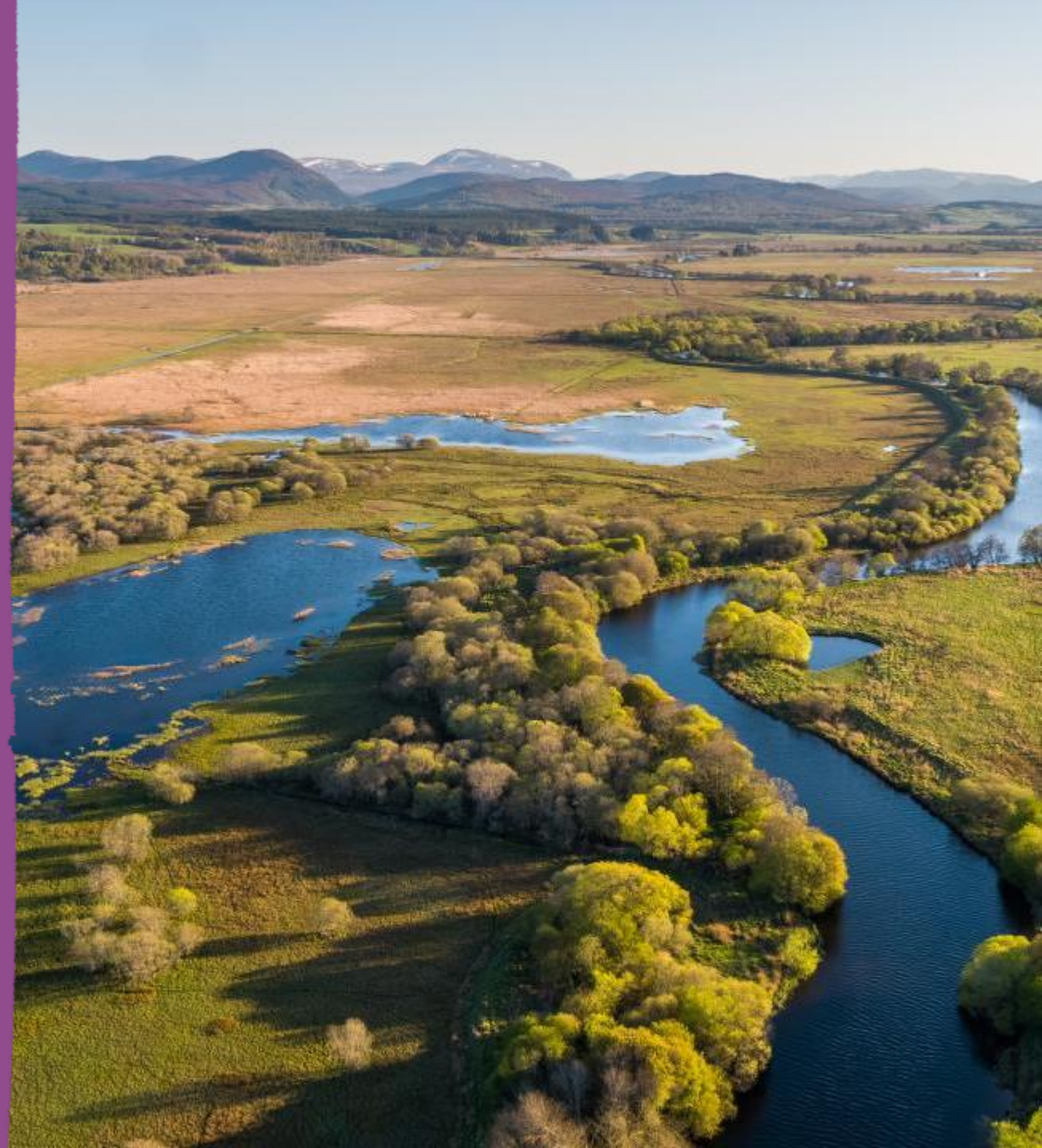
Interpreting index values

- Overall ecosystem trends can mask responses of individual indicators
- High index value do not necessarily mean that threats to ecosystem health are low
- Low index values may not yet reflect the positive influence of conservation management
- Individual index values are therefore not reflective of health & functionality... it is the direction of travel (trend) that signifies success of conservation action



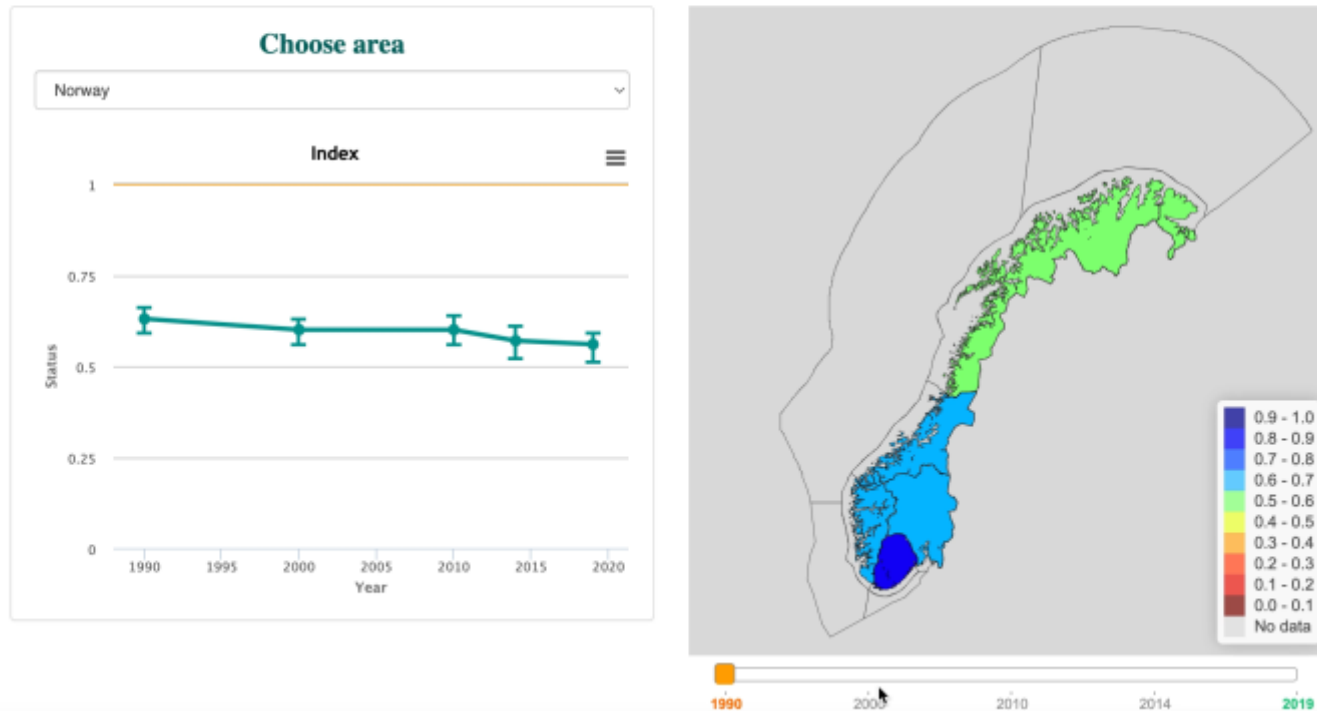
Norwegian Nature Index

- The CNI is consistent with the approach developed by Norwegian Institute for Nature Research (NINA) for the Norwegian Nature Index (NNI)
- The NNI has been running since 2010
- The NNI has also been adopted through REDD initiatives for application in Costa Rica and Indonesia
- <https://www.nina.no/english/Biodiversity/The-Norwegian-Nature-Index>



The Nature Index for the mountain ecosystem is in slight, but steady, decline since 1990. The negative population trends of rodents, willow grouse and rock ptarmigan contribute to this pattern, whereas for example wild and domesticated reindeer populations show positive trends since 2000. A thematic index of alpine passerine birds indicates a relatively stable state for this group of bird species. Among the predators, the wolverine population is increasing slightly, although still far below the reference condition. In contrast, the golden eagle shows stable close-to-reference index levels. Climate change and land use are the main pressures with negative effects on the mountain ecosystem biodiversity.

- Spatially explicit
- Changes in values over time can be visually displayed



Norwegian Nature Index – Mountain ecosystem



Ecosystem

Mountain

Organism group: Bird

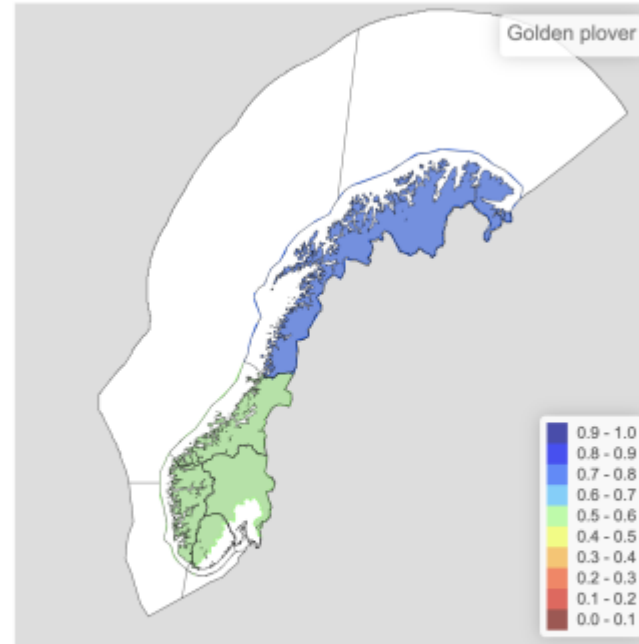
The golden plover breeds commonly in open heath areas in the mountains, as well as sparsely in heather moors along the coast and forest bogs in inner parts of Østfold and Akershus.



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Indicator

Golden plover



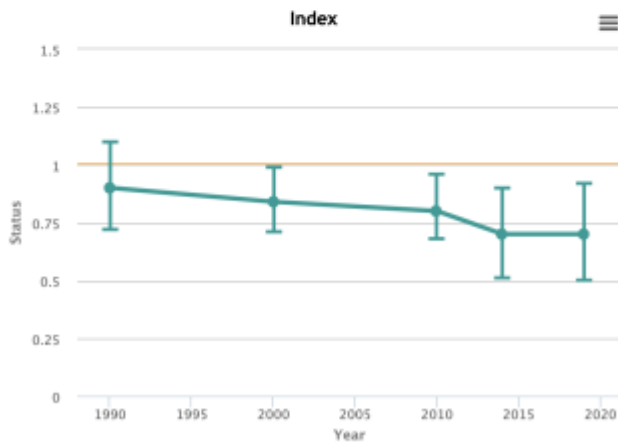
Move slider to see development over time



Expert(s):

Hans Christian Pedersen, NINA
John-Atle Kålås, NINA
Bård Stokke, NINA
Markus Israelsen, NINA

Explanation of graph:



- Spatially explicit
- Changes in values over time can be visually displayed
- Individual indicators can be interrogated
- Pressures attributed to indicators can highlight drivers of trends

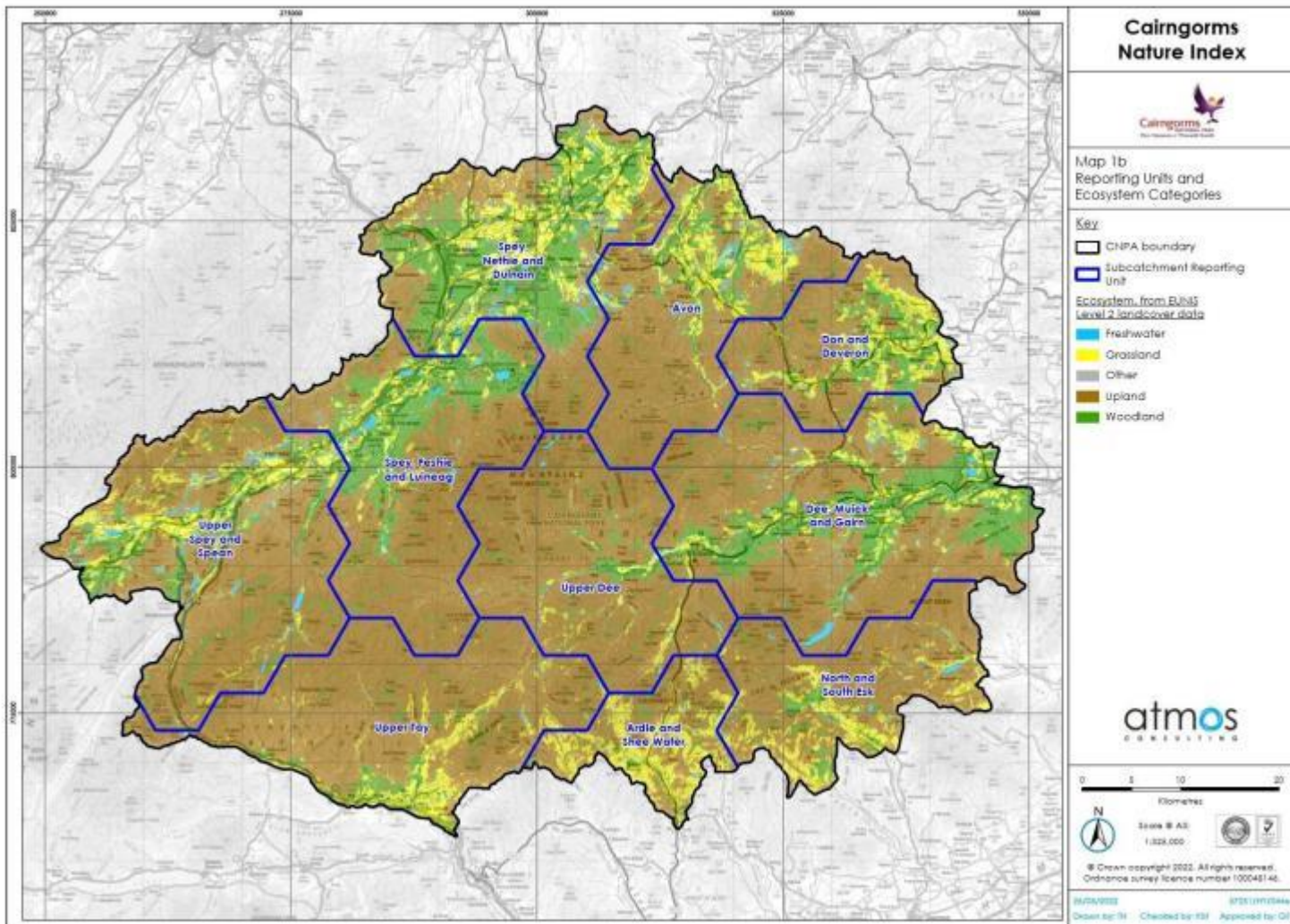
Norwegian Nature Index – Mountain ecosystem



Where are we with developing the CNI?

- A pilot has been developed using the freshwater ecosystem
- Next steps, currently underway, will be to produce indices for the remaining 5 ecosystems
- Selection of indicators and setting of reference levels to be undertaken in collaboration with an advisory group
- CNI published by end of 2024, with web-based portal to display results

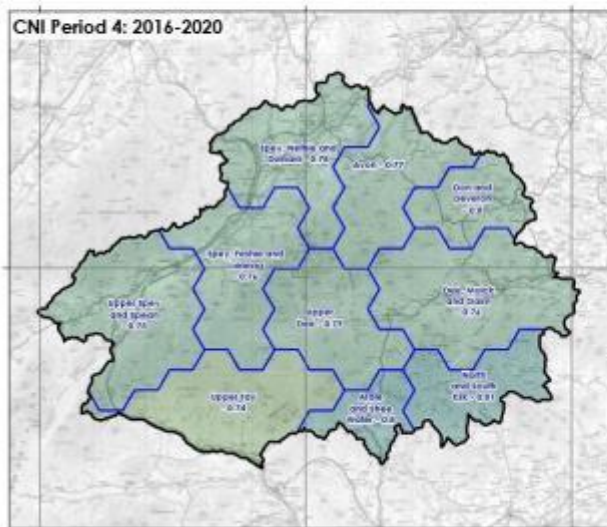
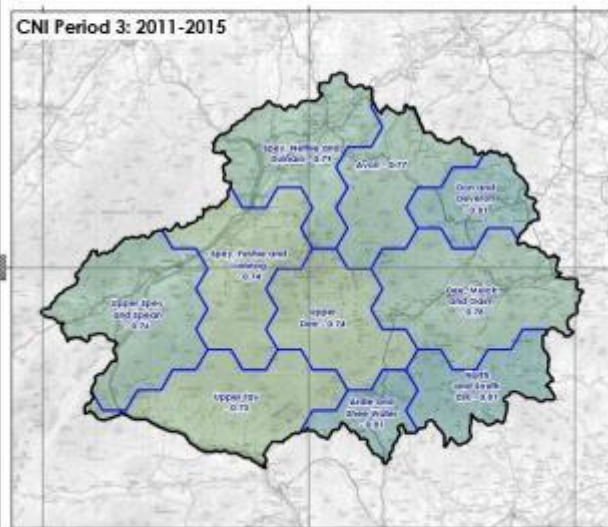
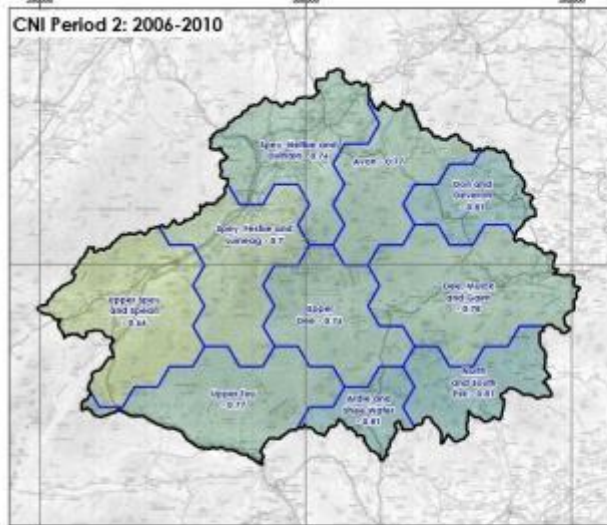
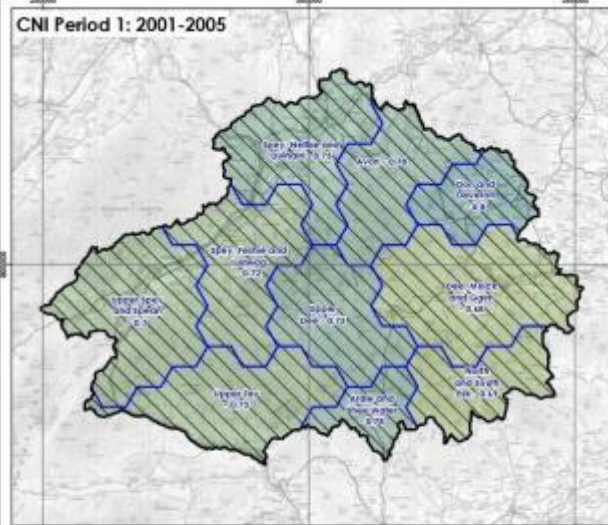




- Tessellated hexagons (100) divided into 10 reporting units (sub-catchment)
- Index values are compiled on 5yr cycle

Cairngorm Nature Index – Freshwater outputs





Cairngorms Nature Index

Map 8a
Freshwater Ecosystem
- Modelled Values

Key

- CNPA boundary
- Subcatchment Reporting Area
- Area with limited data coverage or higher level of imputations

Median Indicator Value
per subcatchment reporting area

- 0.00 - 0.05
- 0.06 - 0.10
- 0.11 - 0.15
- 0.16 - 0.20
- 0.21 - 0.25
- 0.26 - 0.30
- 0.31 - 0.35
- 0.36 - 0.40
- 0.41 - 0.45
- 0.46 - 0.50
- 0.51 - 0.55
- 0.56 - 0.60
- 0.61 - 0.65
- 0.66 - 0.70
- 0.71 - 0.75
- 0.76 - 0.80
- 0.81 - 0.85
- 0.86 - 0.90
- 0.91 - 0.95
- 0.96 - 1.00

atmos CONSULTING

0 10 20 40
Kilometers

Scale @ A3:
1:700,000

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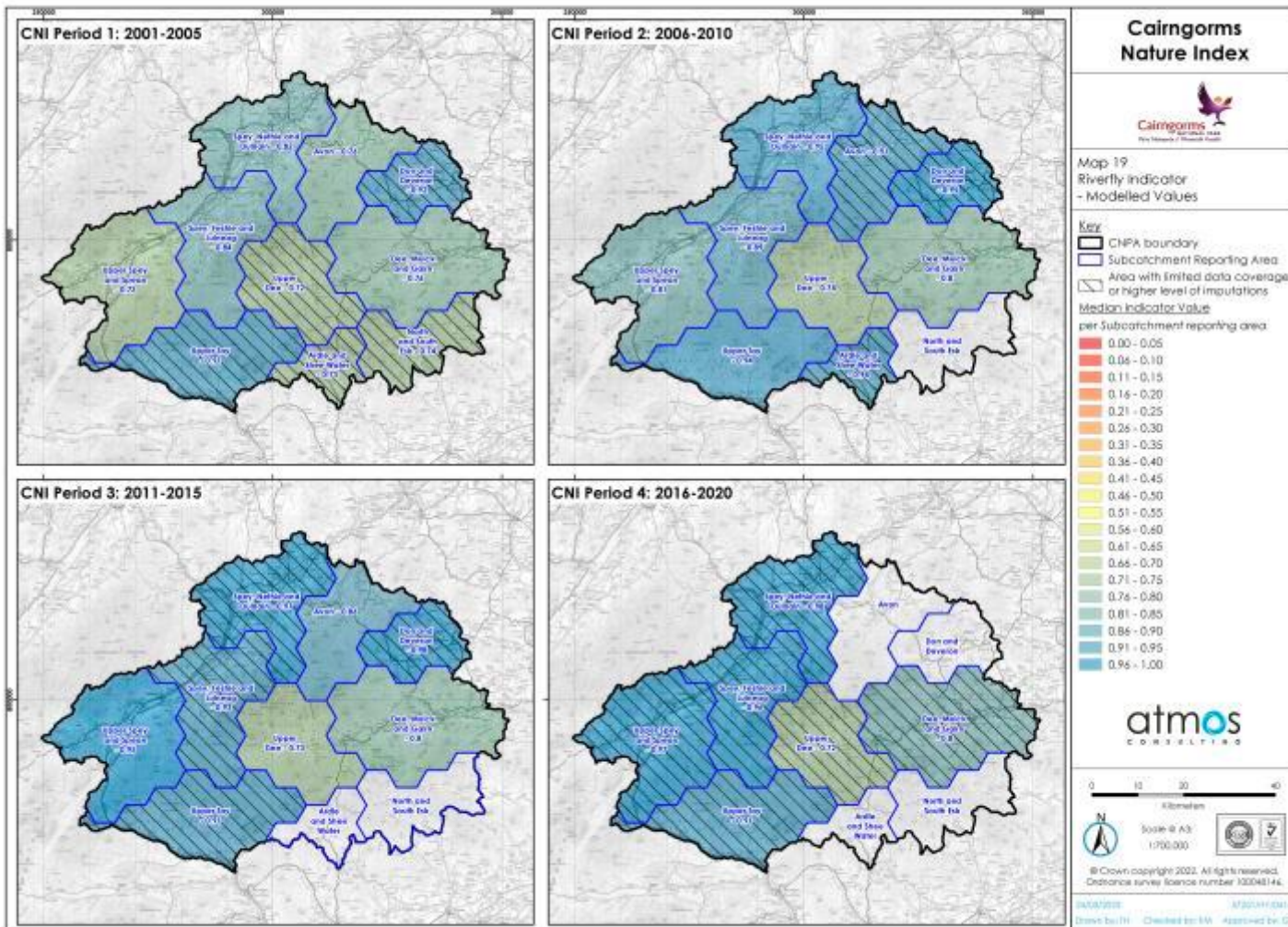
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- Ecosystem index values show little change and the freshwater ecosystem is in good ecological condition (index value >0.7)

Indicators included	Indicators not included... yet
Fish barriers	Osprey
Fish ecology (salmonids)	Diver sp.
Benthic macroinvertebrates	Dragonfly assemblage
Macrophytes	Amphibians
Water chemistry	Invasive/Non-native Species
Water flow	Physical condition
Water temperature	Snowbed cover
Otter	
Water vole	
Beaver	
Freshwater pearl mussel	
Riverfly assemblage	
Water bird assemblage	

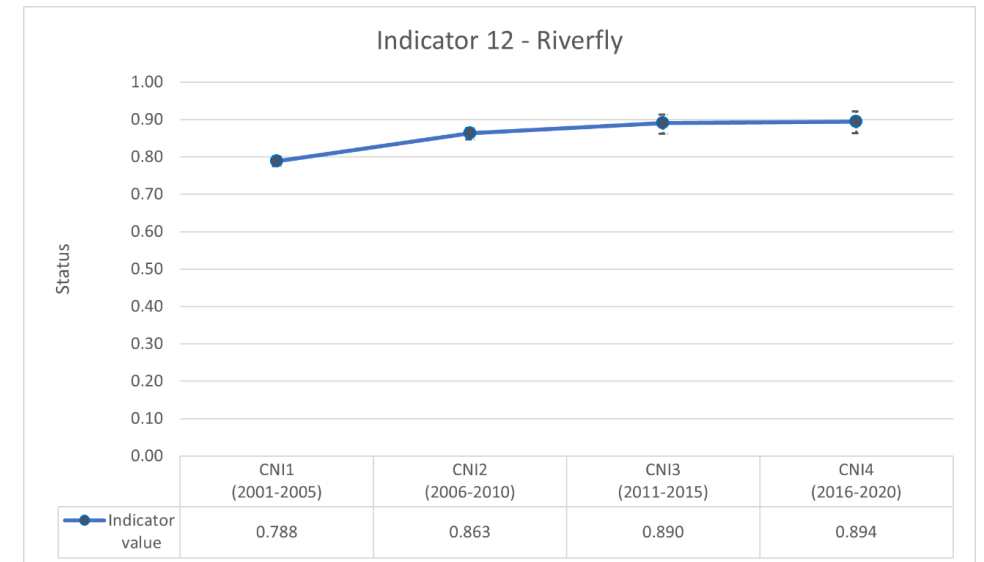
Cairngorm Nature Index – Freshwater outputs





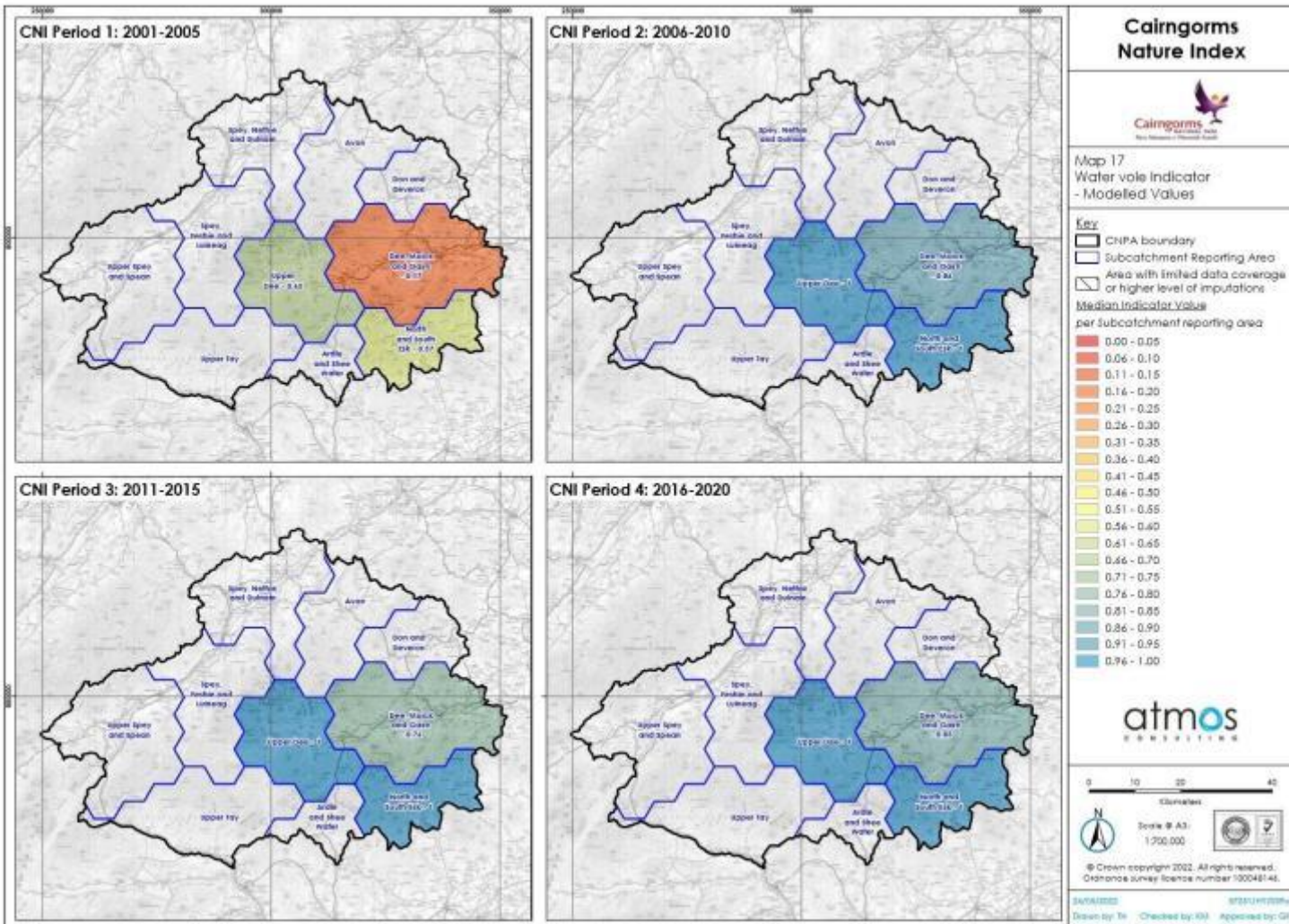
Riverfly assemblage

- Overall good ecological condition (>0.7)
- Slight increase in condition
- Spatial variation – improving condition in Spey catchment driving overall increased index values



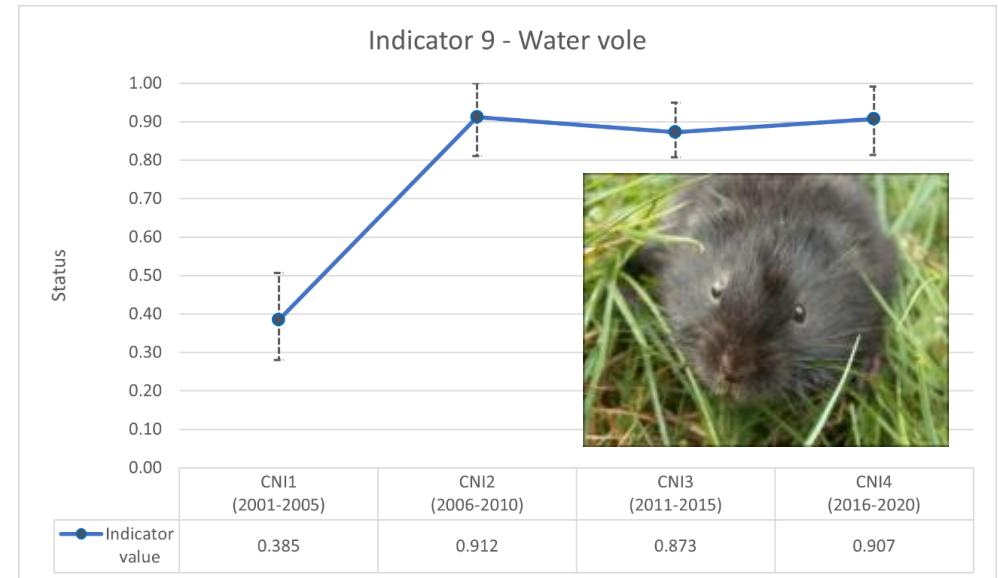
Cairngorm Nature Index – Freshwater outputs





Water vole

- Much improved condition between reporting periods 1 and 2
- Possible effect of mink eradication project, or artefact of sampling in period 1 being undertaken at low point in water vole population cycle



Cairngorm Nature Index – Freshwater outputs



What does the CNI need?

- **Data!**
- Principal limitation for the Nature Index
- Biological data is collected across many projects
- Usable data is not limited to specific surveys designed solely for CNI
- Usable data is not limited to simple abundance or diversity metrics
- Data quality and flows need to be improved to feed the CNI



Data opportunities?

- New technologies may offer substantial and sustainable data - earth observation, passive acoustic monitoring, eDNA
- eDNA could be applied to indicators where occupancy and/or diversity metrics provide a basis for condition eg.
 - i. Freshwater invertebrate assemblage;
 - ii. Occupancy of Freshwater pearl mussel;
 - iii. Soil biodiversity;
 - iv. Barcoding diets
- Provide large datasets, and with that some challenges



Nature Index use and opportunities

- Identify trends in ecosystem functionality over spatial and temporal scales
- Collaboration and shared vision, alignment with other initiatives
- Highlight uncertainties and research needs
- Promote and support biological recording – citizen science, estate staff, rangers
- Test and deploy new technologies to provide complementary or additional data
- Inspiring tool to promote and target conservation action





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Thank you for listening!