



WE ARE **NATUREMETRICS**, DELIVERING

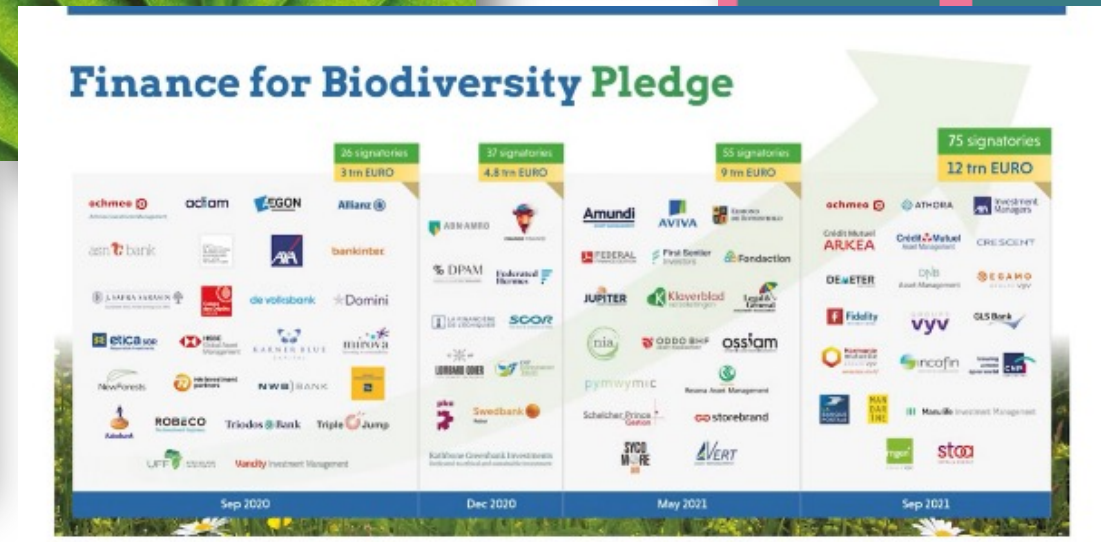
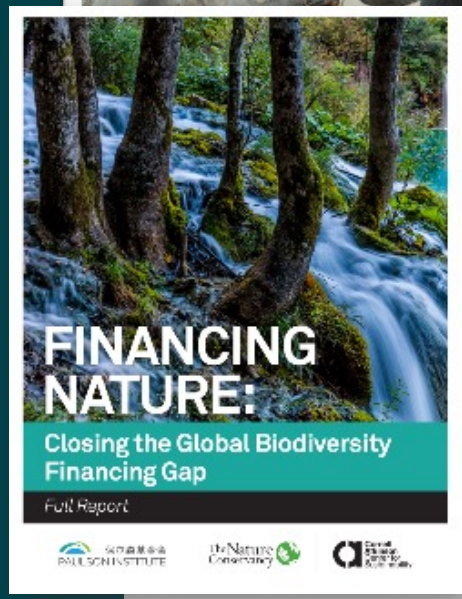
DNA-based Biodiversity Monitoring

Dr Sam Lacey,
Business Development Director



@NatureMetrics

In the last year business, governments and finance woke up to **the need to invest in the protection and restoration of nature** because it **underpins the global economy**



BUT nature based solutions are **not always good for biodiversity**

We need a way to **differentiate NBS** that are **good for nature**, from those that are not



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Science & Environment

Climate change: Planting new forests 'can do more harm than good'


By Matt McGrath
Environment correspondent
22 June 2020



Children planting trees in Ethiopia, a country which has embraced new forests as part of its climate plan

Rather than benefiting the environment, large-scale tree planting may do the opposite, two new studies have found.

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BIODIVERSITY, CONSERVATION

Replanting Monoculture Plantations Are Not Reforestation Projects

BY ARJEN VRIELINK | AFRICA AMERICAS ASIA EUROPE | AUG 9TH 2021 | 5 MINS



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Environment

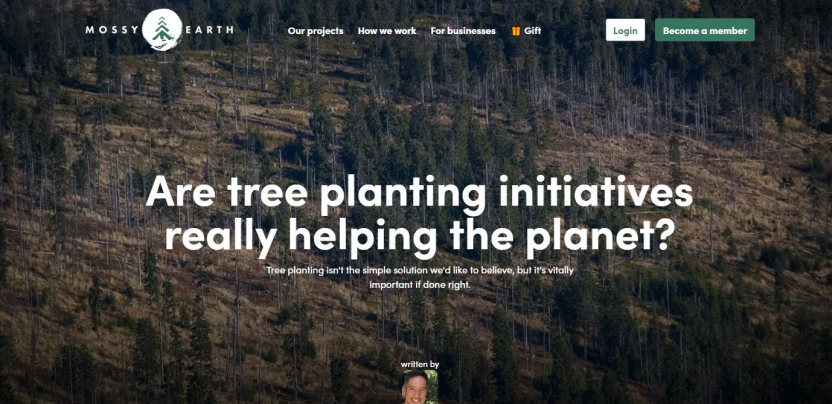
Tree-planting projects may not be so green

- Knock-on effect thwarts carbon offsetting plan
- Attempts to undo CO2 damage a short-term fix

James Randerson, science correspondent
Fri 23 Dec 2020 00:03 GMT

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Brides and grooms do it. Transatlantic travellers do it. And you might even be getting it for Christmas. Neutralising your carbon emissions is becoming the must-do activity for the eco-conscious citizen. But now an international team of scientists has raised an unexpected objection: some tree-planting projects may, they suggest, be doing more harm than good.




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Are tree planting initiatives really helping the planet?

Tree planting isn't the simple solution we'd like to believe, but it's vitally important if done right.

written by





Biodiversity is complex

Wildlife

Hard to observe

Small Things

Hard to identify

Biodiversity

Drives ecosystem
functions and
resilience

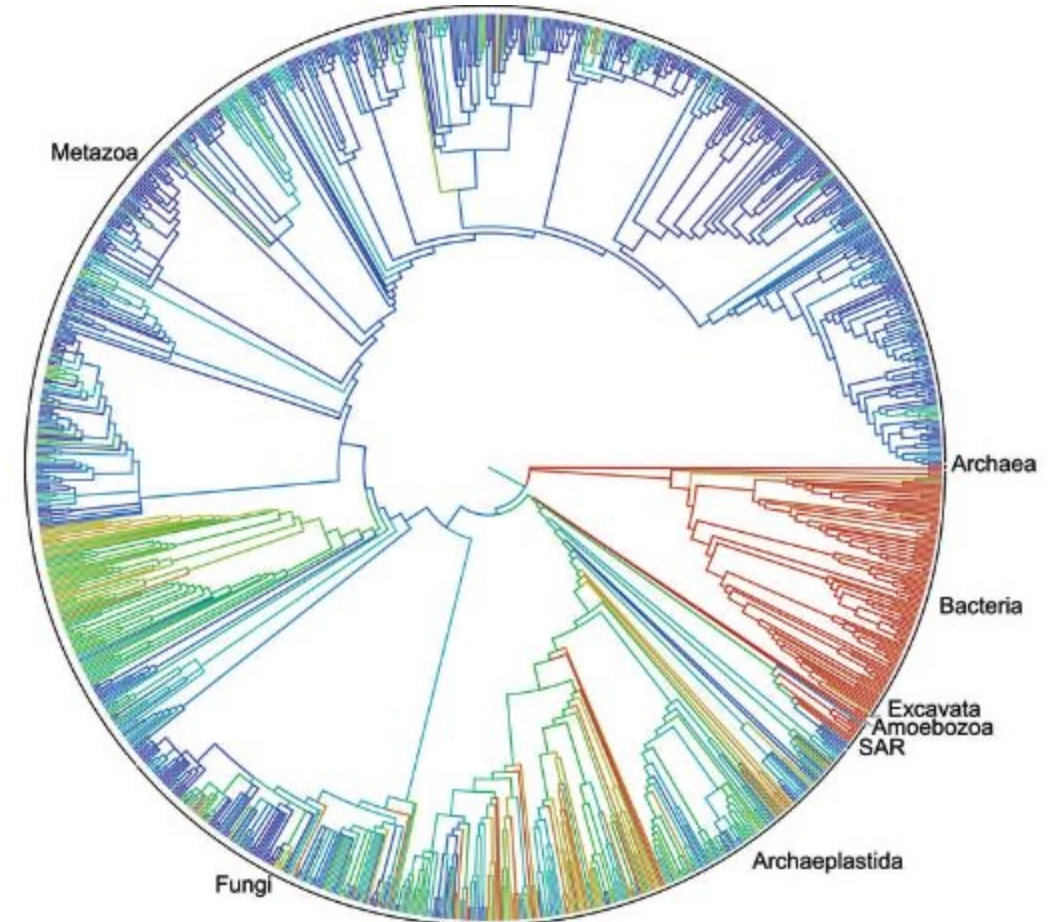
Biodiversity has a measurement problem

Biodiversity is much more **complex** than carbon

Traditional biodiversity monitoring is **time consuming, expensive** and returns **limited results**

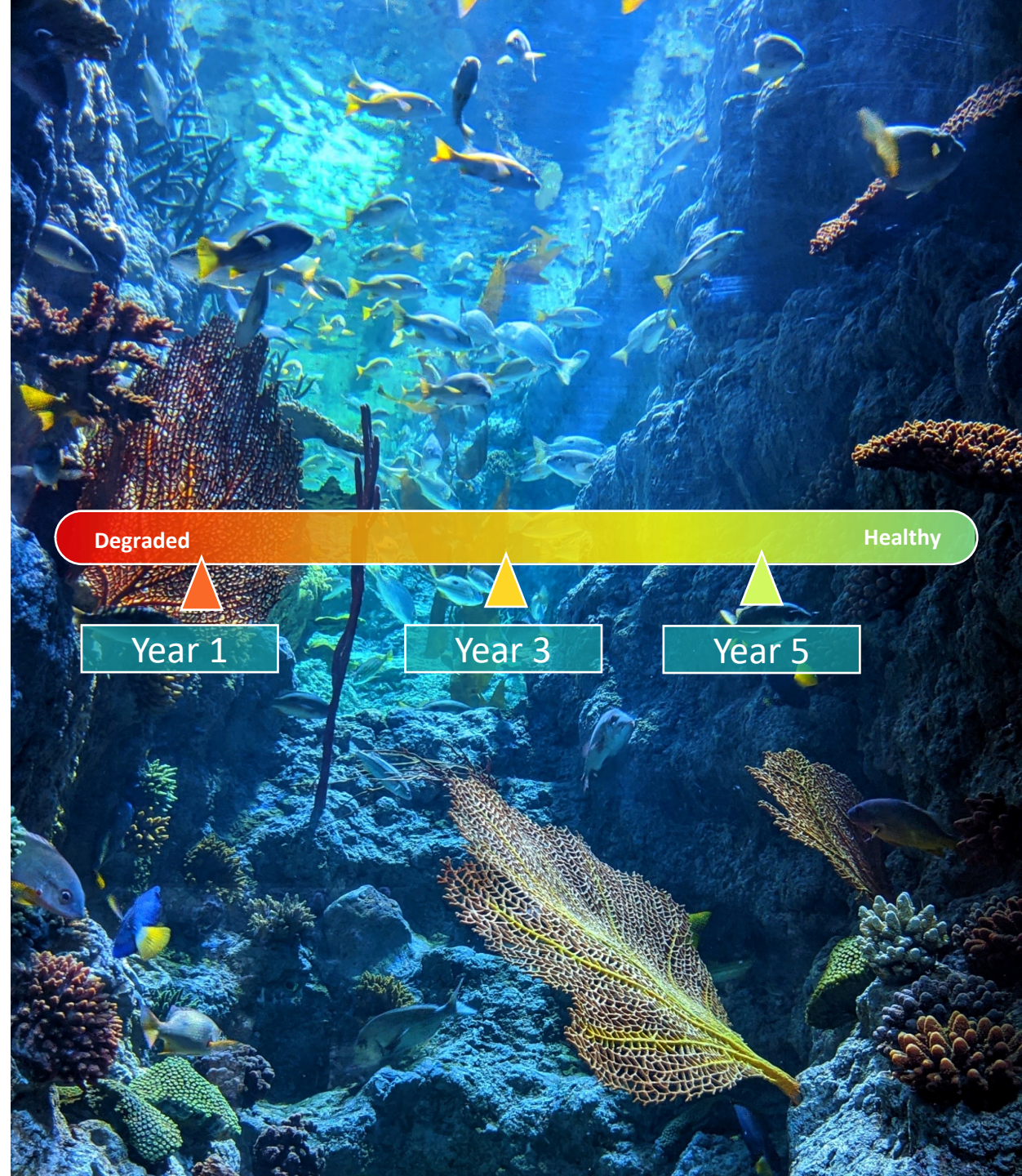
The market is relying on **proxies, not measuring biodiversity outcomes**

Diversity drives ecosystem function and resilience



Investors need clarity

- For the private sector to **value** and invest in something, they need an **objective, verifiable measure** of its **quality**
- Conservation and restoration require *outcome* metrics
- Biodiversity is a **big data** problem
- How to convert **complexity** into something **simple, universal and meaningful?**



Why is eDNA transformational?

Comprehensive: eDNA captures everything in one sample from microbes to megafauna

Scalable: Cost-effective relative to traditional approaches and enables consistency when sampling whole landscapes.

Accessible: Anyone in the world can collect a sample – don't need experts

Objective: Standardised processes produce replicable results independent of expertise

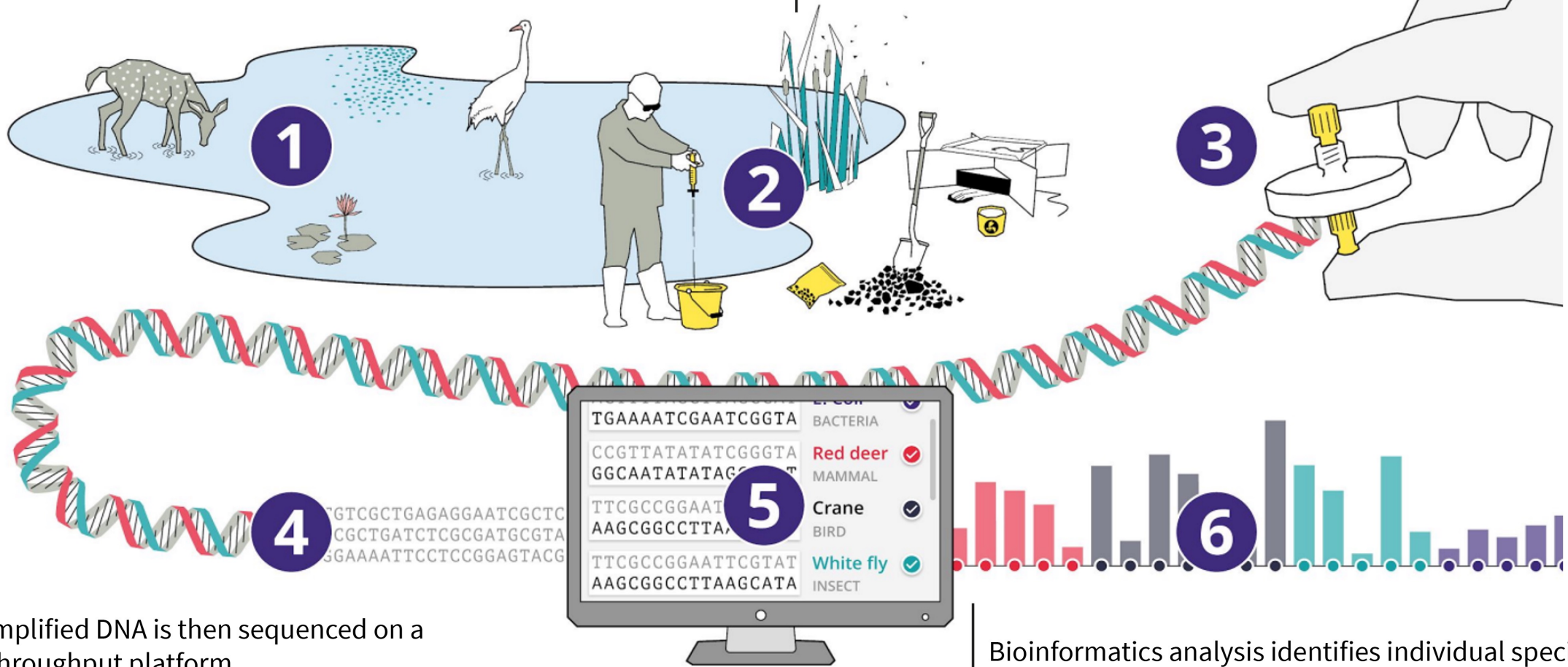
Verifiable: eDNA samples can be stored for independent verification of outcomes, thus establishing the credibility of claims.



Environmental DNA (eDNA) sampling

eDNA from cells, mucus, faeces, from all taxa living in and around water is captured in a simple filter

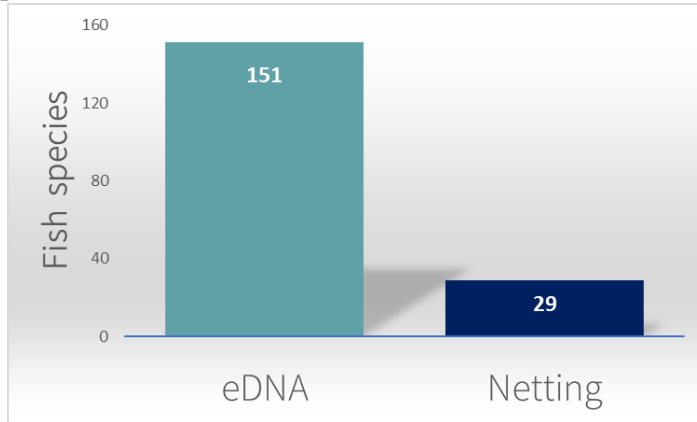
DNA is extracted from the filter in the lab and the DNA from the target groups is amplified



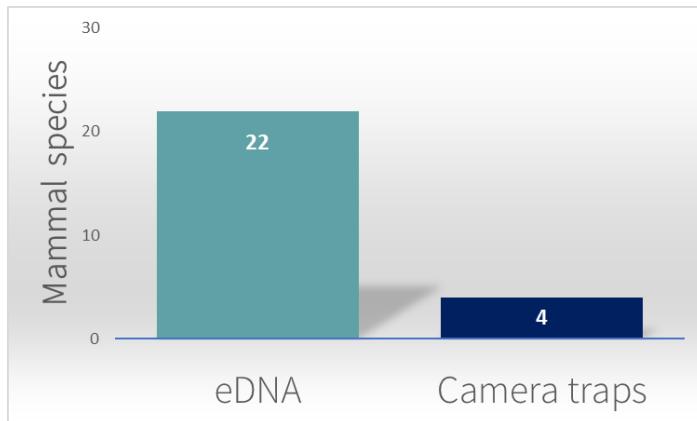
The amplified DNA is then sequenced on a high-throughput platform

Bioinformatics analysis identifies individual species and determines sample diversity

Site based comparison of methods



Fish
5 x more
species than
netting



Mammals
5 x more
species than
camera traps



Conventional vs. eDNA EIA - Peru



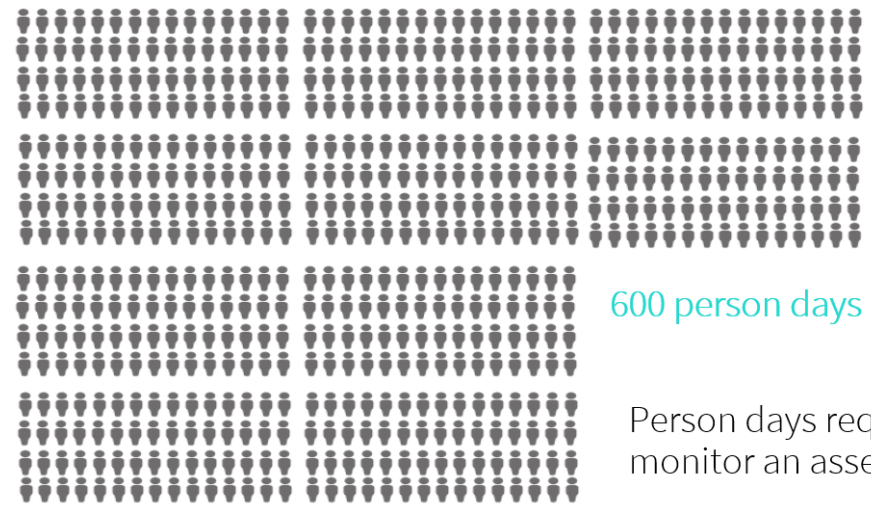
At 2 river sites and 10 stream sites,
the client compared aquatic eDNA
with the netting process



Conventional Methods



eDNA



600 person days



50 person days*

*note does not include lab time

Person days required in remote field station to monitor an asset in the Peruvian Amazon

Overall

27 x more species per unit sampling effort

The academic literature provides extensive evidence of how effective eDNA is compared to traditional techniques in marine, freshwater and terrestrial environments...

Environmental DNA

Open Access

Dedicated to the study and use of environmental DNA for basic and applied sciences

SPECIAL ISSUE ORIGINAL ARTICLE | [Open Access](#) | 

Comparing environmental DNA metabarcoding and underwater visual census to monitor tropical reef fishes

Andrea Polanco Fernández  Virginie Marques, Fabian Fopp, Jean-Baptiste Juhel, Giomar Helena Borrero-Pérez, Marie-Charlotte Cheutin, Tony Dejean, Juan David González Corredor ... [See all authors](#) ▾

First published: 02 October 2020 | <https://doi.org/10.1002/edn3.140> | Citations: 16

Ecology and Evolution

Open Access


ORIGINAL RESEARCH | [Open Access](#) | 

Meta-analysis shows that environmental DNA outperforms traditional surveys, but warrants better reporting standards

Julija Fediajevaite, Victoria Priestley, Richard Arnold, Vincent Savolainen 

First published: 18 March 2021 | <https://doi.org/10.1002/ece3.7382> | Citations: 6

SECTIONS

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Abstract

1. Decades of environmental DNA (eDNA) method application, spanning a wide variety of taxa and habitats, has advanced our understanding of

ORIGINAL ARTICLE

WILEY

eDNA metabarcoding outperforms traditional fisheries sampling and reveals fine-scale heterogeneity in a temperate freshwater lake

Rebecca R. Gehl  | Wesley A. Larson  | Kristen Gruenthal  |
Nicholas M. Sard  | Yue Shi 

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eDNA sampled from stream networks correlates with camera trap detection rates of terrestrial mammals

Arnaud Lyet  [Loïc Pellissier](#), [Alice Valentini](#), [Tony Dejean](#), [Abigail Hehmeyer](#) & [Robin Naidoo](#)

RESOURCE ARTICLE

WILEY 

Environmental DNA enables detection of terrestrial mammals from forest pond water

Masayuki Ushio  ^{1,2,3,4} | Hisato Fukuda ⁴ | Toshiki Inoue ⁴ | Kobayashi Makoto ⁵ |
Osamu Kishida ^{5,6} | Keiichi Sato ⁷ | Koichi Murata ^{8,9} | Masato Nikaido ¹⁰ |
Tetsuya Sado ¹¹ | Yukuto Sato ¹² | Masamichi Takemita ¹³ | Wataru Iwasaki ¹³ |
Hiroki Yamaruka ^{4,14} | Michio Kondoh ⁴ | Masaki Miya ¹¹

MOLECULAR ECOLOGY

Molecular Ecology (2021) 32, 109–120

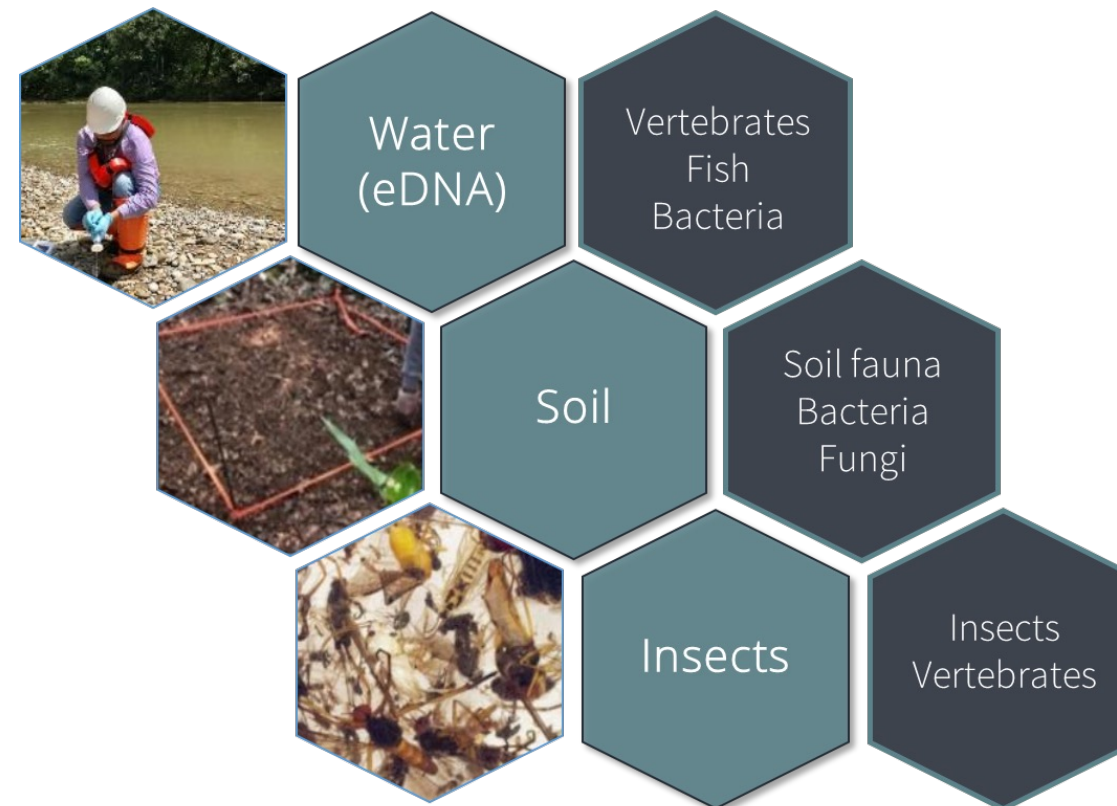
doi: 10.1111/mec.15828

Next-generation monitoring of aquatic biodiversity using environmental DNA metabarcoding

ALICE VALENTINI,^{1*} PIERRE TARRIET,^{1,2} CLAUDE MAUDU,³ RAPHAËL CIVADE,⁴ JESGER HERDER,^{5*} PHILIP FRANCIS THOMSEN,^{6,7} EVA BELLEMMAIN,^{8*} AURÉLIEN BERNARD,⁹ ERIC COMSAC,^{1,2} FRÉDÉRIC BOYER,^{1,2} COLINE GABORIAUD,^{8*} PAULINE JEAN,^{8*} NICOLAS FOULET,^{1,2} NICOLAS BONET,^{8,9} GORDON H. COPP,^{10,11} PHILIPPE GENIEZ,⁸ DIDER PONT,⁸ CHRISTINE ABGILLIER,^{1,2} JEAN-MARC BAUDON,^{1,2} TIFHAÏNE PÉROUX,^{1,2} ALAIN J. CRIVELLE,^{1,2,3} ANTHONY OLIVIER,^{1,2,3} MANON ACQUERBERG,^{1,2} MATTHIEU LE BRUN,^{10,11} PETER B. MÖLLER,^{12,13} GISE WILLENSEY¹⁴ and TONY DEJEAN^{1*}

DNA METABARCODING

Quickly & cheaply generate species lists from complex samples containing the DNA of many species



Extract total DNA from sample



Amplify & sequence DNA of target taxonomic group



Match sequences against reference libraries to identify



From proxies to
holistic,
objective,
verifiable,
biodiversity
data

Simplify
complexity,
don't bypass it

What gets
measured, gets
managed and
invested in

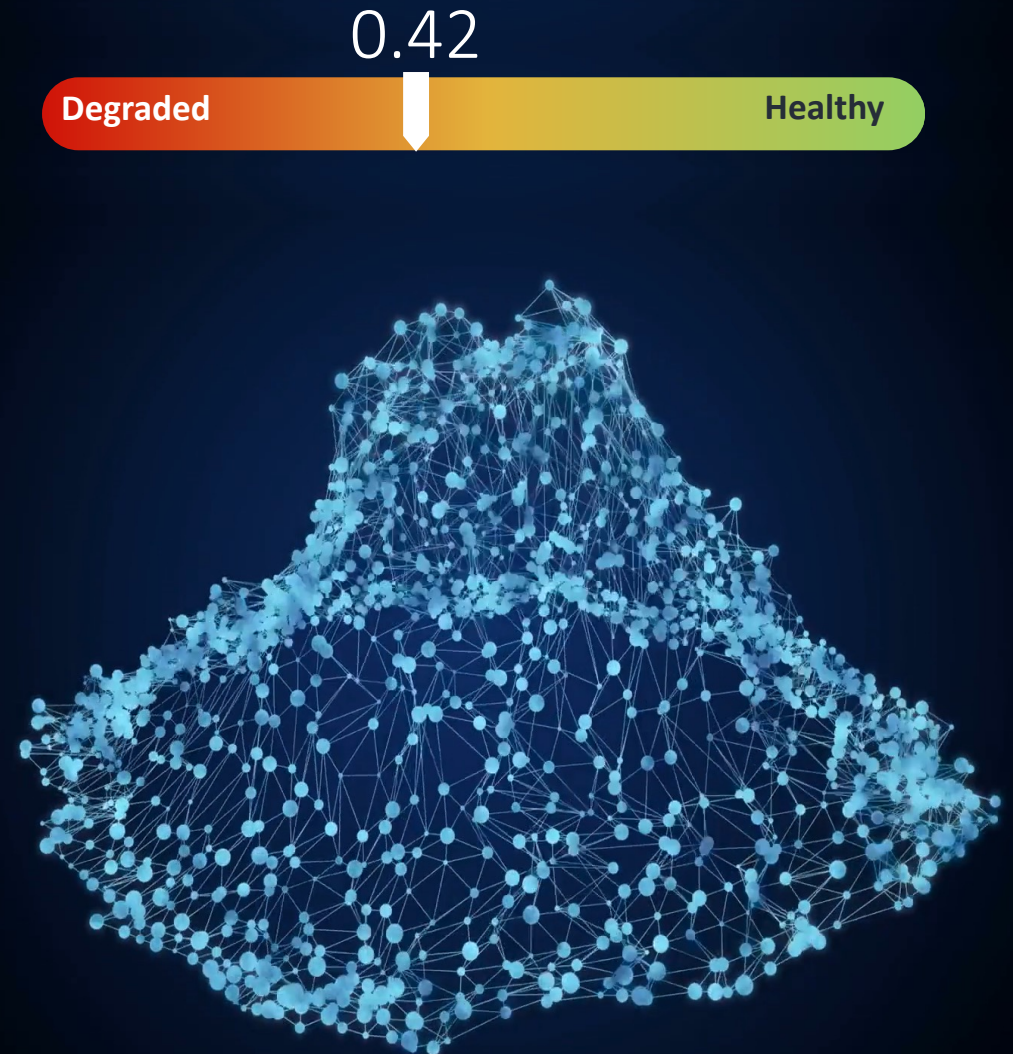


eDNA can be used to advance
biodiversity monitoring

Enhance – add species data
to existing habitat quality
measures

Calibrate – groundtruth
biodiversity proxies

Create – new biodiversity
metrics incorporating holistic
ecosystem health and
composition

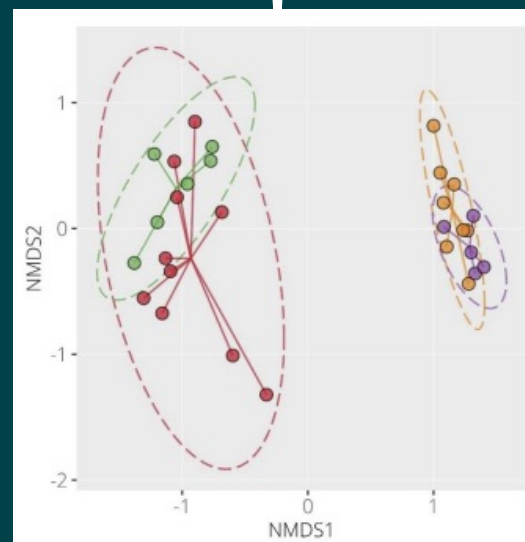




Target



Intervention site (grassland)



0.4



R&D - Machine learning classifier
Score the soil samples between 0 and 1
0 = very similar to target, 1 = very similar to grassland



THANK YOU FOR LISTENING



Email

Send our team an email at edna-lab@naturemetrics.co.uk



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