



Department
for Environment,
Food & Rural Affairs

DNA|COE

Strategy for the Defra Group DNA Centre of Excellence

2025 to 2028

July 2025



We are responsible for improving and protecting the environment. We aim to grow a green economy and sustain thriving rural communities. We also support our world-leading food, farming and fishing industries.

Defra is a ministerial department, supported by 34 agencies and public bodies.



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Purpose

The Defra Group DNA Centre of Excellence (CoE) champions the uptake of genetic methods for environmental monitoring and ensures Defra Group has the right tools and infrastructures to successfully implement them.

Genetic technologies can transform the way we monitor and manage our environment. They provide more complete information on species compared to traditional survey and are progressively becoming more cost effective. However, their potential is not always well understood, and their application could become fragmented across Defra Group without centralised coordination. The Centre of Excellence draws together technical expertise from across Defra Group to improve the alignment and consistency of genetic approaches used across our business and beyond. Our work aims to improve the quality, coherence and value of the genetic samples and data we collect – ensuring it is fit to inform environmental management and regulation, and to enhance Defra's ability to meet strategic priorities.

Defra's priority outcomes include ensuring nature's recovery – through clean, healthy, biologically diverse seas and resilient ecosystems, and enabling nature positive development. The DNA Centre of Excellence supports innovative approaches to measuring, monitoring, valuing, and restoring nature. This includes considering opportunities for genetic approaches and technologies to contribute to the Government's growth mission. As we contribute to building infrastructures for public use such as standardised and open-source bioinformatics pipelines, there is opportunity to facilitate aligned use of genetic technologies across sectors including as environmental consultancy, nature markets and green finance, as well as regulation.

Vision and primary objective

- Realise the potential of genetic technologies to help us understand and manage our changing environment and support improvements in regulatory systems.
- Tackle barriers to change and lead the building of skills, capability and confidence in genetic technologies to nurture the culture required for successful deployment.

About this strategy

We have used the term 'genetic' in this paper to describe a range of relevant DNA, environmental DNA (eDNA) and RNA-based technologies.

This strategy covers the period from 2025 to 2028 which spans a significant funding period. Some of the objectives included require activities over a longer time frame to be fully effective. This strategy has been developed collaboratively between members of the DNA CoE Working Group from Defra, Cefas, NE, EA, FR, JNCC, Kew (see below). It is supported by an operational/work plan (for internal use by Defra Group only).

DNA Centre of Excellence Working Group

The DNA CoE was formed in 2018. Our Working Group acts as a focal point for scientific representation across Defra Group in the use of genetic technologies for environmental monitoring.

The Working Group includes members from core Defra and the Public Sector Research Establishments:

- Natural England (NE)
- Forest Research (FR)
- Environment Agency (EA)
- Centre for Environment, Fisheries and Aquaculture Science (Cefas)
- Joint Nature Conservation Committee (JNCC)
- Royal Botanic Gardens, Kew (Kew)
- Animal and Plant Health Agency (APHA)

Individuals from each of these organisations provide expert advice across the breadth of environmental monitoring programmes both in operation and those being developed. Our members also include innovation and monitoring leads from core Defra, including major programmes (e.g. Natural Capital Ecosystem Assessment).

A secretariat and appointed staff exist within core Defra, and chairperson within Cefas.

Strategic Priorities for 2024-2028

In 2024, the DNA Centre of Excellence gathered evidence to identify research areas that best support the delivery of Defra priorities. We consulted with a wide range of Defra policy areas and major programmes. With the Working Group, we developed priority areas and sought feedback from Defra's Science Advisory Council. Three workstreams were identified for delivery by the Centre of Excellence: Innovative Research and Development, Harmonisation, and Infrastructure. Within each workstream, priority cross-cutting projects were identified by the Working Group during a series of future thinking workshops. The rationale and main aims of each workstream are:

1) Research to support development of novel technologies and metrics, with wide relevance to Defra Group

Although genetic technologies and their applications for environmental monitoring are rapidly advancing and being used to varying degrees, they are not yet widely operational across Defra-Group. An R&D programme has been prioritised to shape these new advances for public sector use. We aim to support genetic method and metric development for cost- and time-efficient robust environmental monitoring. We will:

- Support the development of biodiversity and ecosystem health metrics for the terrestrial, freshwater, and marine environments via genetic techniques.
- Explore the use of novel sensors and biomarkers, and advance use of metabarcoding and bioinformatics to monitor biodiversity and environmental change across ecosystems. This includes technology transfer from related areas including bio-surveillance and microbial forensics, as well as the potential to combine genetic technologies with complimentary monitoring technologies. See Annex I for a list of CoE funded research and development projects, and links to their publications.

2) Improving alignment and consistency of approaches via the harmonisation of methods, and a knowledge hub

Currently, as new genetic technologies and analyses are being developed for environmental monitoring purposes, an abundance of different methods are being used. The lack of standardisation of approaches hinders the generation of reliable and consistent data, limiting interoperability and confidence in results. To move towards operational use, we need to document methods and processes accurately, extract best practice and minimum data standards, and understand complementary approaches. We will:

- Facilitate a coherent approach to the methodological application of genetic techniques for environmental monitoring.
- Develop open-source computational pipelines to standardise genetic analyses, for example the EMBRACE project (box 1).

3) Ensuring Defra Group infrastructures are fit for purpose to enable effective use of our physical and digital genetic assets, including providing public access where appropriate

Defra Group must establish appropriate physical and digital infrastructure to support the execution of methods and analyses for generating genetic based metrics. This workstream reviews and improves our current digital infrastructures, and seeks to add value to existing stored samples, and the UK's national collections. We will:

- Improve our genetic data in accordance with Q-FAIR (quality – findable, accessible, interoperable, and reusable) principles.
- Facilitate use of Defra Group's physical infrastructure including national collections and stored physical genetic resources to increase value and impact, for example The Fungarium sequencing project (box 2).

Enabling Activities

The strategic priorities above will be supported by enabling activities, which promote an outward facing approach to our work through **effective communications**, and **collaborative working with partners and stakeholders**. These activities are essential to realise the CoE objective of building capability and confidence in genetic technologies. They will improve value for money and allow our work to provide benefits to the wider environmental monitoring community. We will:

- Promote and raise awareness of the DNA CoE's shared objectives and activities to increase visibility and build relationships with internal and external organisations and networks with aligned aims.
- Work in partnerships to advance genetic research and facilitate knowledge sharing.

Defra's genetic interests beyond DNA CoE scope

Whilst Defra Group has a broad range of interests in genetic technologies and their applications, the CoE's scope is focused on monitoring **biodiversity and ecosystem health**.

- Wider issues around **biosecurity** and the monitoring of pests and pathogens are coordinated via Defra's Policy Response and Resilience Unit, and within relevant PSREs such as Cefas and APHA.
- Defra's interests in **genetic modification, gene editing** and digital sequence information are handled by the Genetic Resources and Genetic Modification teams.
- Food safety and **authenticity** applications are considered within our agri-food science programme in partnership with the Food Standards Agency.

- Genetic technologies are also used for **forensic applications** in tackling illegal wildlife trade (JNCC and Defra's Illegal Wildlife Trade Team), and livestock theft (APHA).

The CoE interacts with these teams and has a coordinating role to ensure join up on cross-cutting issues.

Box 1. EMBRACE: Enhancing Molecular Biodiversity Records to Assess Changes in the Environment

EMBRACE is developing an open access bioinformatics platform, for standardized analysis of DNA-based biodiversity monitoring across government, academia, and the wider DNA community. This work will ensure eDNA data products are comparable by eliminating the significant variability that arises from non-standard approaches to data analysis.

- Working in collaboration with key UK regulatory, conservation, and green finance organisations to develop, validate and deploy a reproducible and open ('white box') environmental DNA data processing and analysis platform such that the value of environmental DNA sequence data is maximised.
- Creating a workflow for use by a diverse sector, thus facilitating the creation of a national DNA biodiversity monitoring network by streamlining, and standardising the analysis of DNA data from terrestrial, freshwater, estuarine, and marine habitats in a harmonised and reproducible manner, leading to enhanced ecological insights, improved management of natural capital and benchmarks for nature-based financial investments.

Delivery by the [European Bioinformatics Institute](#) and [UK Centre for Ecology & Hydrology](#) between July 2025 and March 2029.



Box 2. The Fungarium Sequencing Project

Fungi are an essential part of our ecosystem and play a vital role in maintaining life on earth. Our fungarium sequencing project is sequencing the UK's world leading fungal collections at Kew, Natural History Museum, and Royal Botanic Gardens Edinburgh to unlock and harness their potential to enhance our biosecurity, medicinal needs, agriculture and environmental restoration. The expected outputs include:

Genetical characterisation of at least 7,000 type specimens of fungi - creating a reference database that will allow scientists and businesses to identify plant and animal pathogens, new invasive species in the UK and help identify the unnamed fungal diversity in soils.

Establishment of a next generation –omics methodology for large scale fungarium sequencing, with new protocols and pipelines made publicly available.

Improved fungal diagnosis and disease surveillance by setting up the basis for a properly curated database of fungal sequences from reference material, especially type collections. We will provide a user-friendly interface for rapid DNA sequence ID.

Delivery by [Royal Botanic Gardens, Kew](#) and the [Natural History Museum](#) between April 2024 and March 2028.

