Winds of change

Charting a pathway to practical monitoring using airborne eDNA

Dr Erin Hahn (she/her)
Australian National Wildlife Collection

Co-authors: Rachel Tulloch, Clare Adams, Matthew Barnes, Elizabeth Clare, Henrik C. van de Ven, Andrew Cridge, Francisco Encinas-Viso, Kristen Fernandes, Dianne Gleeson, Erin Hill, Anna Hopkins, Anna Kearns, Gracie Kroos, Anna MacDonald, Francesco Martoni, Angela McGaughran, Todd McLay, Linda Neaves, Paul Nevill, Andrew Pugh, Kye Robinson, Fabian Roger, Tracey Steinrucken, Mieke van der Heyde, Cecilia Villacorta-Rath, Jenny Vivian

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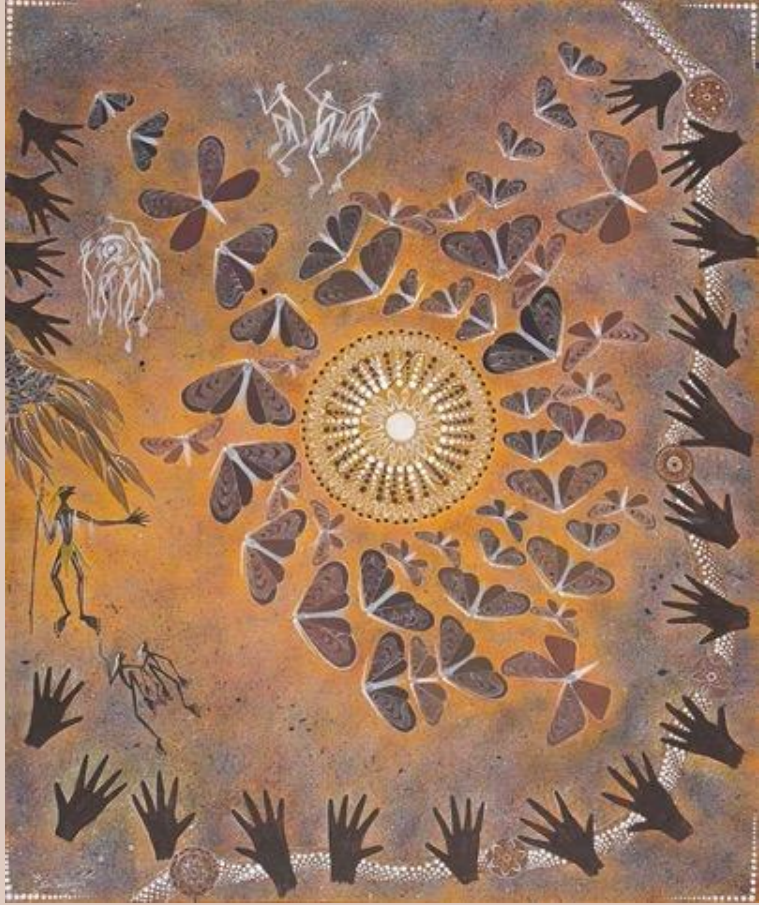
I acknowledge the
Ngunnawal and **Ngambri** people as
the Traditional Owners of the land
upon I live, work and play.



Kicked out of Parliament
Jim “Boza” Williams, Ngambri elder (2015)

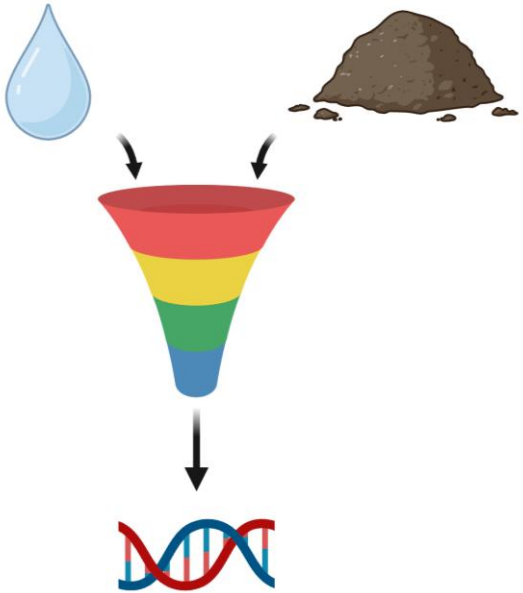
MOLECULAR ECOLOGY RESOURCES

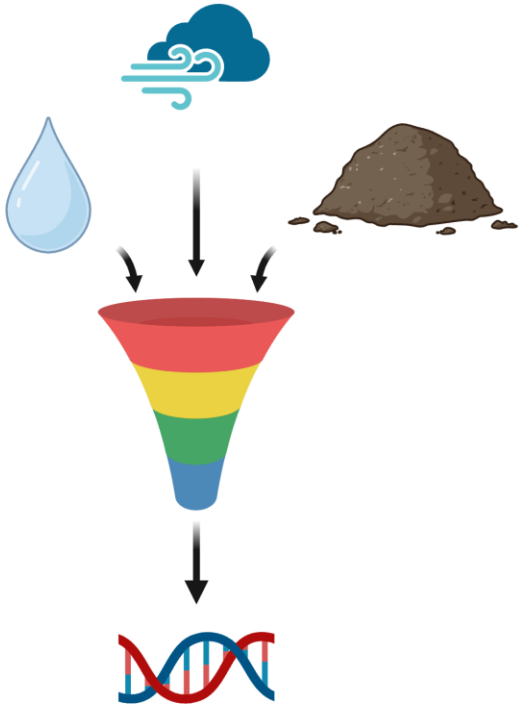
INVITED TECHNICAL REVIEW | Open Access

Macrobial airborne environmental DNA analysis: A review of progress, challenges, and recommendations for an emerging application

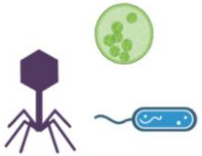
Mark Johnson, Matthew A. Barnes

First published: 08 August 2024 | https://doi.org/10.1111/1755-0998.13998

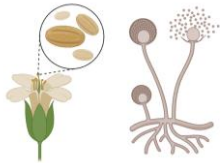




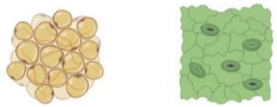
Microorganisms

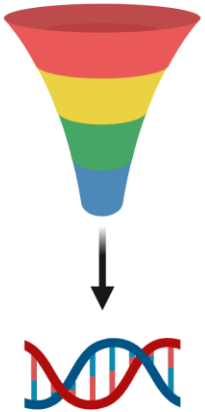


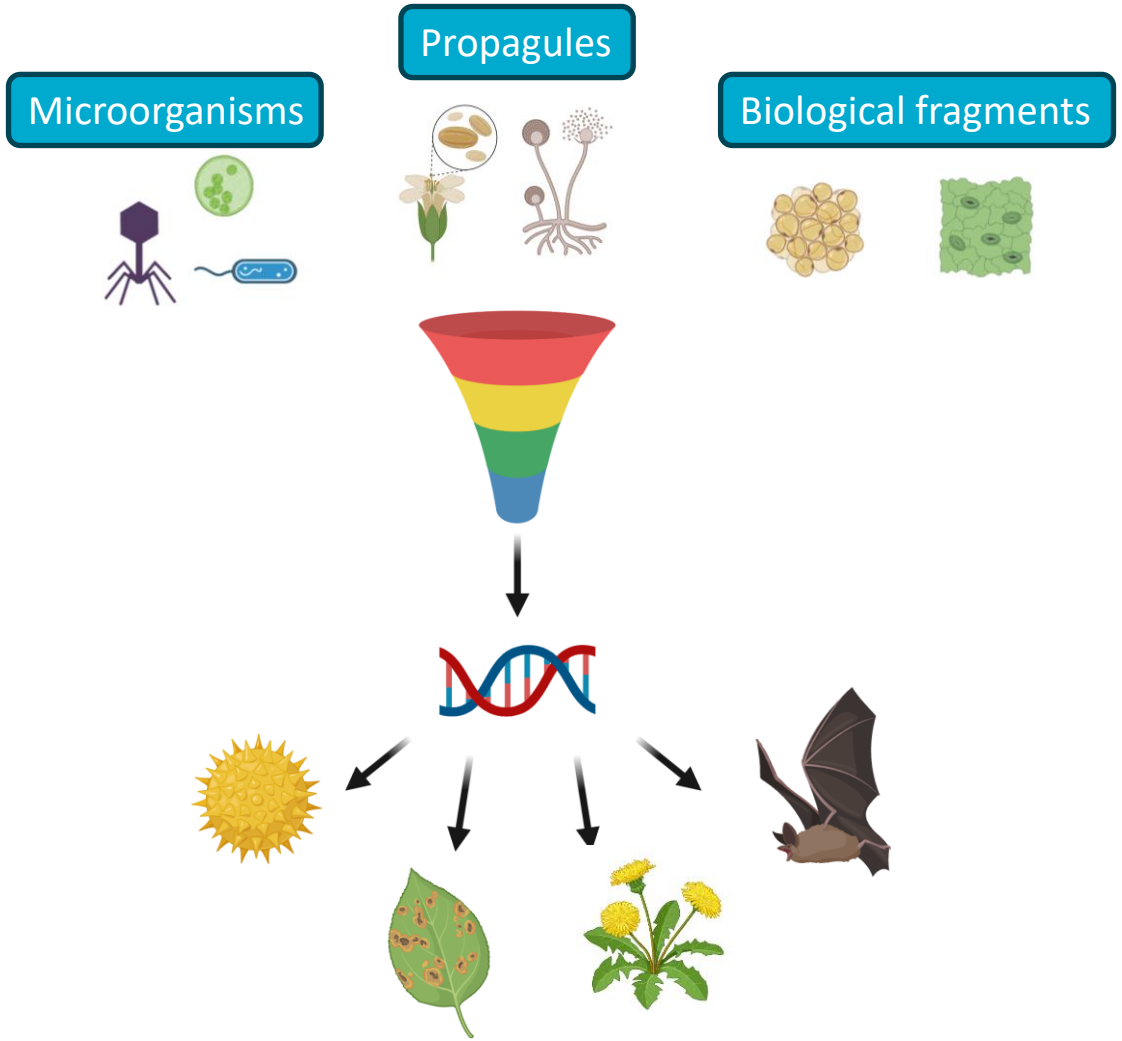
Propagules



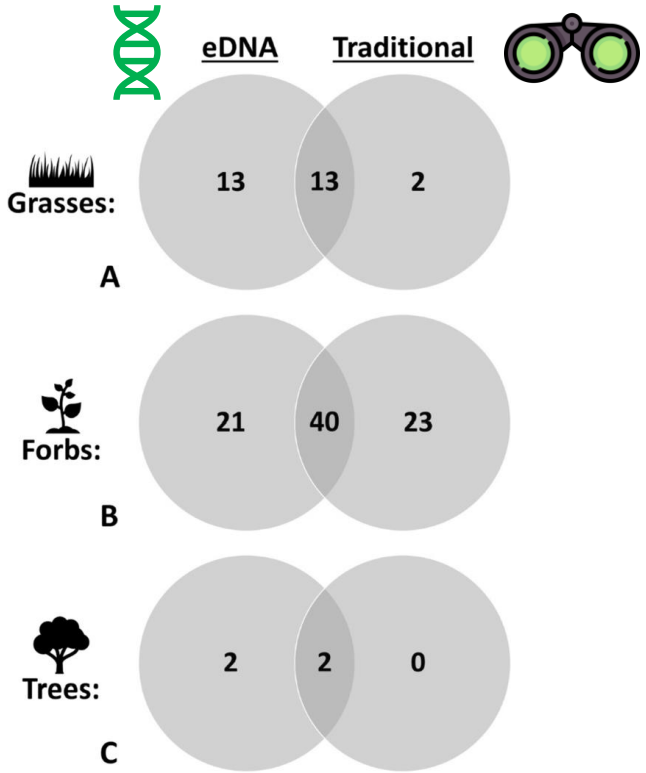
Biological fragments





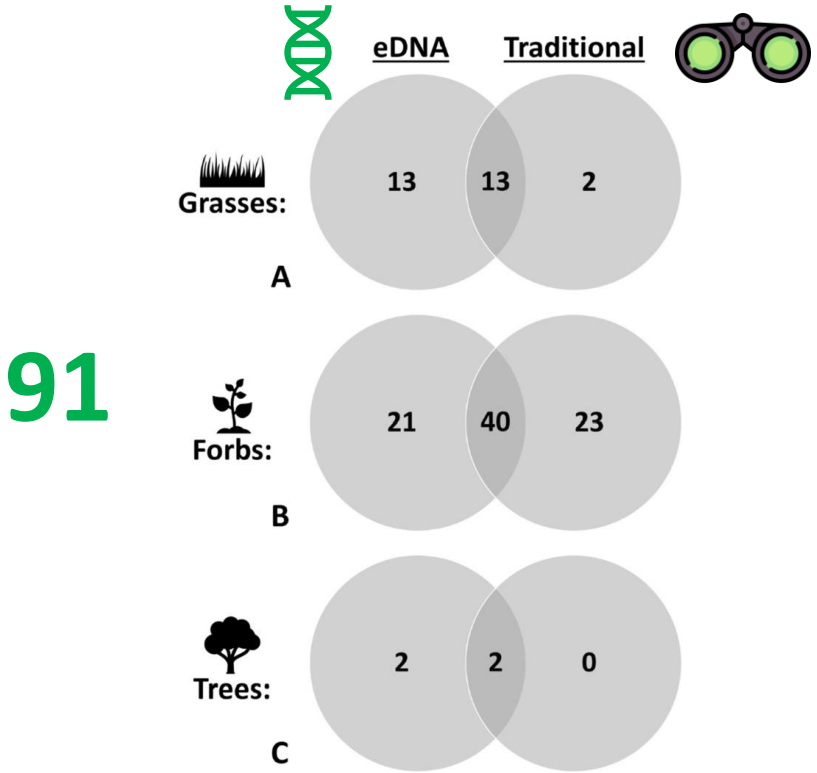

Microorganisms
Propagules
Biological fragments

Sampling plant DNA from air



Johnson et al (2021) *BMC Ecology and Evolution*
Photo credit: Mark Johnson

Sampling plant DNA from air



91

80

Johnson et al (2021) *BMC Ecology and Evolution*
Photo credit: Mark Johnson

Sampling animal DNA from air

Clare et al (2021) *PeerJ*
Photo credit: Beth Clare

Sampling animal DNA from air

Clare et al (2021) *PeerJ*
Photo credit: Beth Clare

Clare et al (2022) *Current Biology*
Photo credit: Beth Clare

Sampling DNA from air

Lynggaard et al (2022) *Current Biology*
Photo credit: Christian Bendix


DNA

Can airborne eDNA support ecological monitoring?

AirDNA mini-Conference – 3-4 June 2024


Beth Clare


Matt Barnes


Fabian Roger


Dianne Gleeson

MULLIGANS FLAT
WOODLAND SANCTUARY

Conference Recording

+ 27 AUS & NZ speakers

~100 attendees (50 in-person; 50 online)

30 institutions (AUS/NZ/Japan/S. Korea/Canada/USA/Denmark/Switzerland)

Talk Highlights

Conference Recording

Monitoring Applications

Biodiversity

Fungal pathogens

Weeds

Animal pests

Allergens

Postdoc, Harry Eyck – CSIRO – **ECR Talk Prize Winner!**
”Assessing the potential for airborne eDNA for targeted weed detection”

Talk Highlights

Conference Recording

Collection Methods

Active pumps

Passive

Existing infrastructure

Spider webs

Bee hives

PhD student, Josh Newton - Curtin
”Spider webs capture environmental DNA from terrestrial vertebrates”

Talk Highlights

Conference Recording

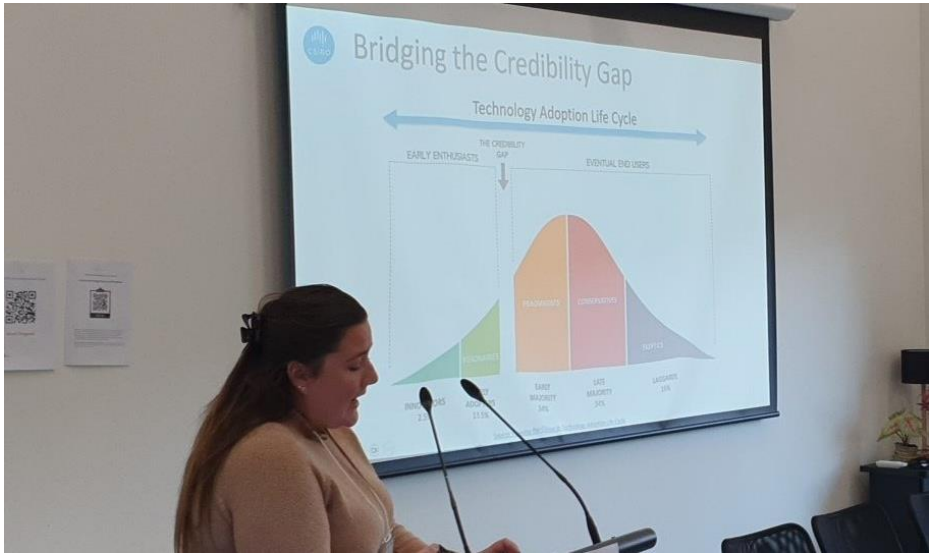
Parameter Testing

DNA dispersal

DNA persistence

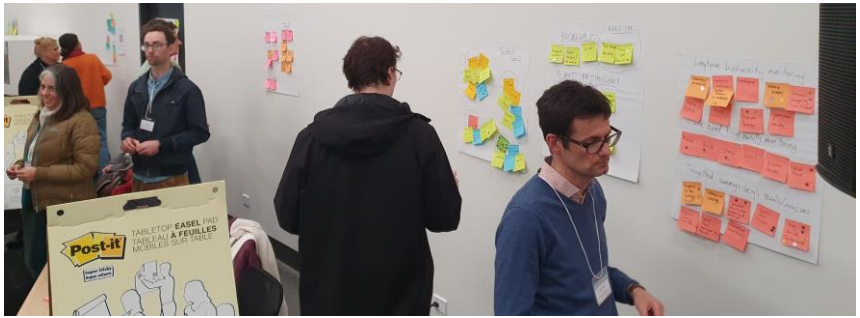
Sampling time

Material comparisons

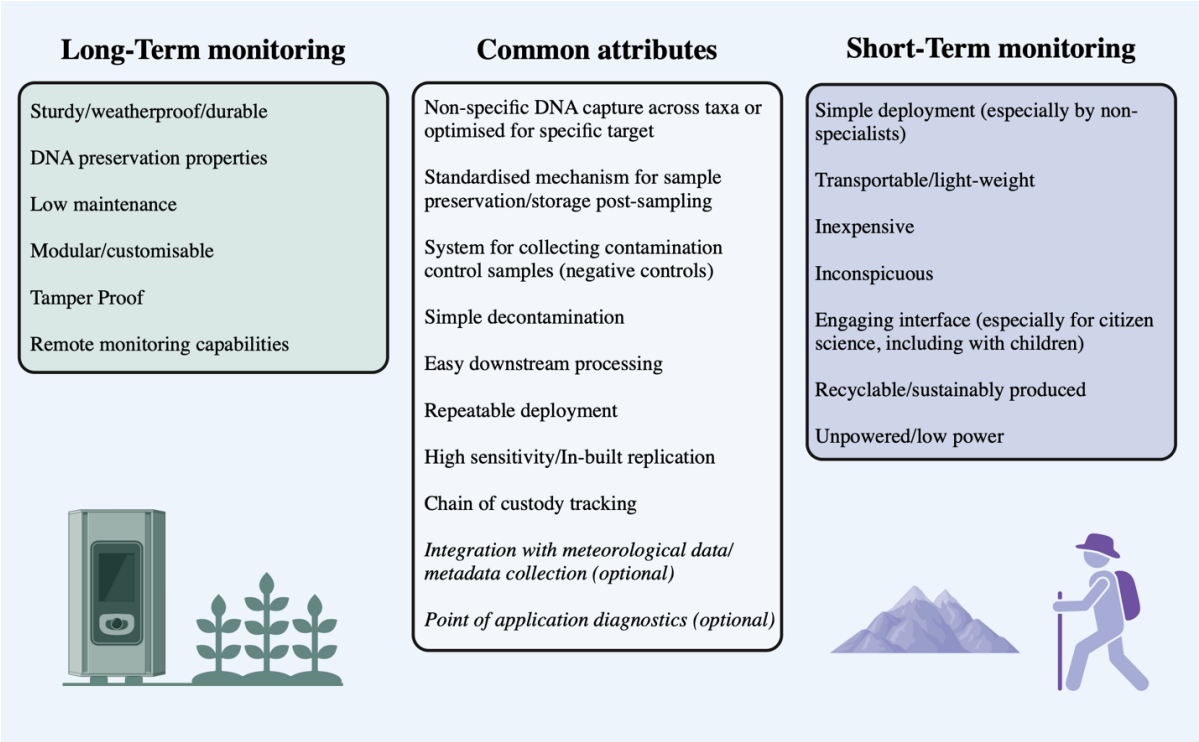


Research Technician, Rachel Tulloch - CSIRO
”Assessing airDNA: environmental influences and capture methods”

Workshop Activities



How do we collect airborne eDNA?



Tulloch et al. (2025) *Authorea*

What parameters need to be tested?

Sampling

Sampling platform
Sampling density
Replication
Sample preservation
Controls

Tulloch et al. (2025) *Authorea*

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Sensitivity
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Error estimation

Tulloch et al. (2025) *Authorea*

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UV irradiance
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Tulloch et al. (2025) *Authorea*

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Environmental

Weather
UV irradiance
Human activity

Species Ecology

Habitat
Behaviour
Life cycle
Mobility
Shedding rates

Tulloch et al. (2025) *Authorea*

Stakeholder engagement

- Align scientific goals to practical need
- Set realistic expectations
- Clear communication of goals
- Adherence to FAIR & CARE data principles

Global Indigenous Data Alliance

UNESCO Citizen Science eDNA Expedition

Workshop Summary Manuscript

AUTHOREA

Winds of change: Charting a pathway to ecosystem monitoring using airborne environmental DNA

Rachel L. Tulloch[1], Clare I. M. Adams[2], Matthew A. Barnes[3], Elizabeth L. Clare[4], Henrik C. van de Ven[5], Andrew Cridge[6], Francisco Encinas-Viso[1], Kristen Fernandes[7], Dianne M. Gleeson[8], Erin Hill[9], Anna J. M. Hopkins[10], Anna M. Kearns[1], Gracie C. Kroos[11], Anna J. MacDonald[12], Francesco Martoni[13], Angela McGaughran[14], Todd G. B. McLay[1], Linda E. Neaves[15], Paul Nevill[16], Andrew Pugh[6], Kye J. Robinson[17], Fabian Roger[18], Tracey V. Steinrucken[19], Mieke van der Heyde[16], Cecilia Villacorta-Rath[20], Jenny Vivian[21], Erin E. Hahn[1*]

Southern eDNA Society Airborne eDNA Workshop Joint Statement

"Airborne eDNA analysis is a potentially powerful biomonitoring tool, however ***we must improve our understanding of airborne eDNA ecology, sampling strategy impacts, signal variability and sensitivity****. With validation, airborne eDNA tools may become standard in biodiversity, biosecurity and conservation applications."*

Conference Manuscript Co-authors

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Conference Recording

Look out for the Conference Paper Preprint!

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