ARISE:
An Infrastructure for Dutch Biodiversity – A Fungal Contribution

Dr. Hazal Kandemir

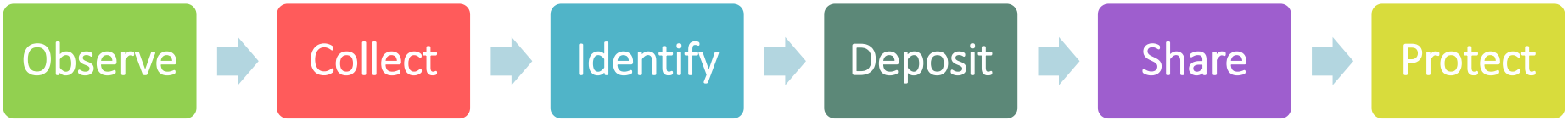
WESTERDIJK
FUNGALBIO
DIVERSITY
INSTITUTE

h.kandemir@wi.knaw.nl

What is ARISE?

Authorative and **R**apid **I**dentification **S**ystem for **E**ssential Biodiversity Information

Aims to build an infrastructure to identify and monitor all multicellular biodiversity in the Netherlands.



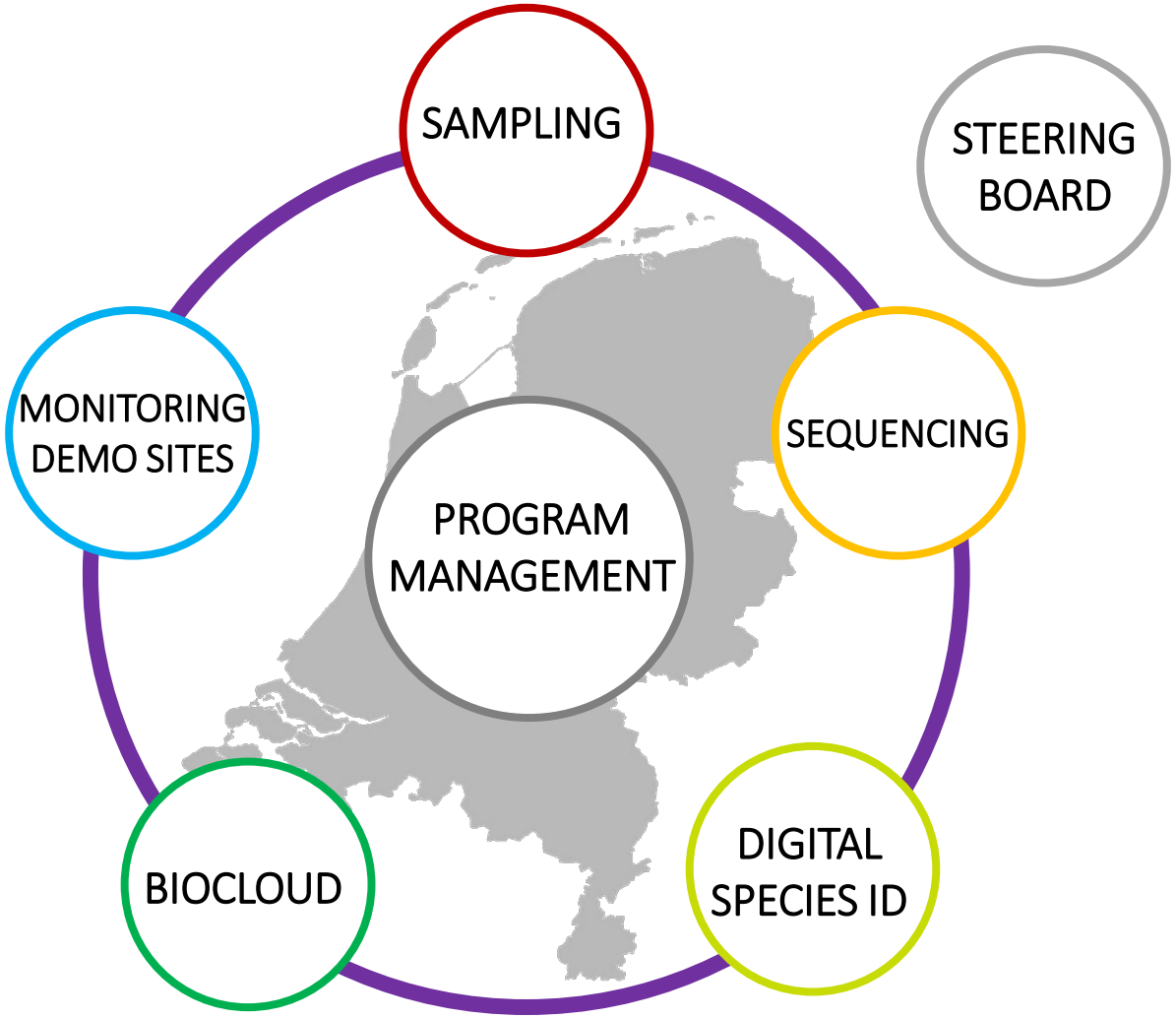
Organization

Naturalis Biodiversity Center

WESTERDIJK FUNGALBIO DIVERSITY INSTITUTE

UNIVERSITEIT TWENTE.

UNIVERSITEIT VAN AMSTERDAM



Monitoring demo sites team

Amsterdam city and ARTIS Royal Zoo

Nieuw Land National Park

Loobos and De Hoge Veluwe National Park

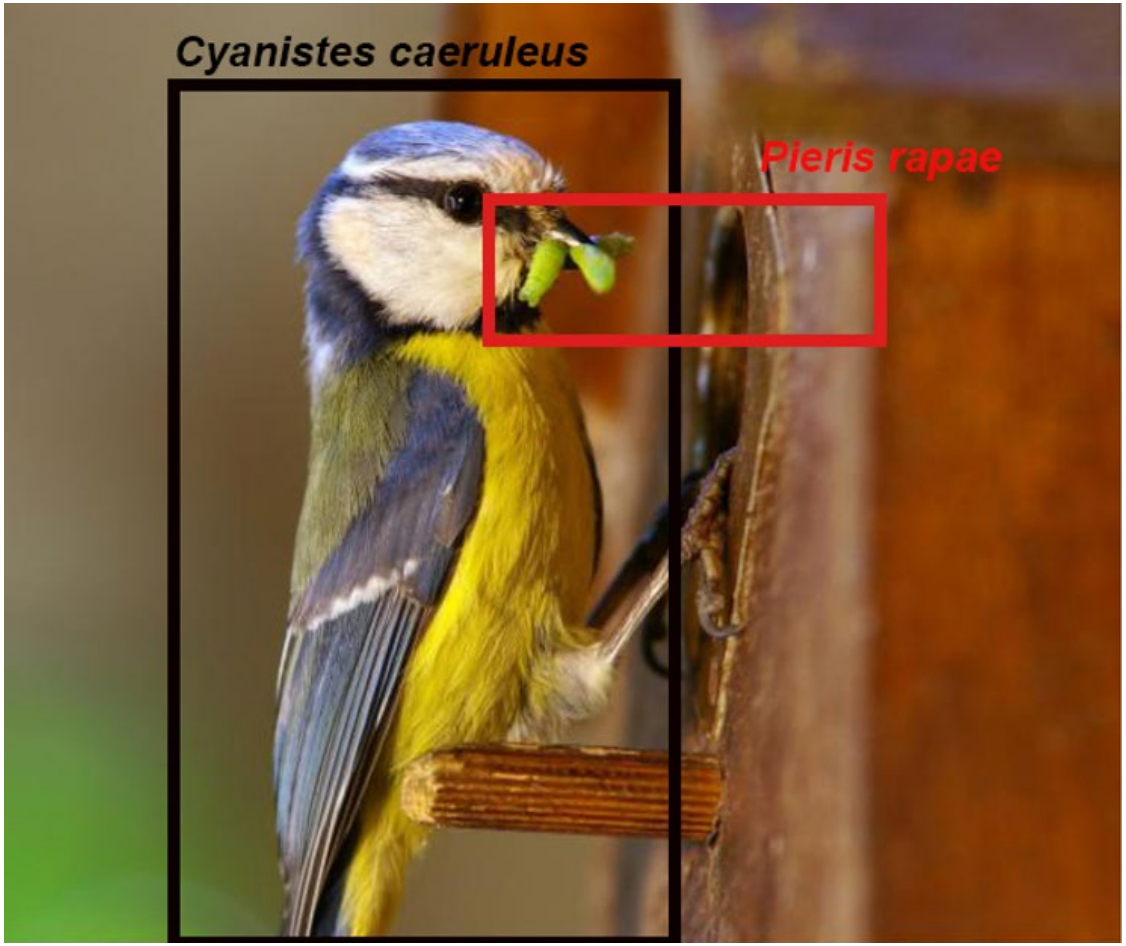
Enschede, University of Twente campus

…establishes various digital sensors to be able to monitor biodiversity, biomass and movement of the species across space and time

Sampling team

…provides the samples from the field to the laboratories and into the collections

Digital species ID team

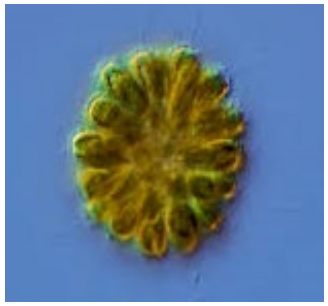


…builds tools and services to support development and deployment of AI algorithms to detect, identify and track the animals in diverse environments

Sequencing team

- Aims to sequence 350,000 specimens
- to cover at least 95% of all Dutch species

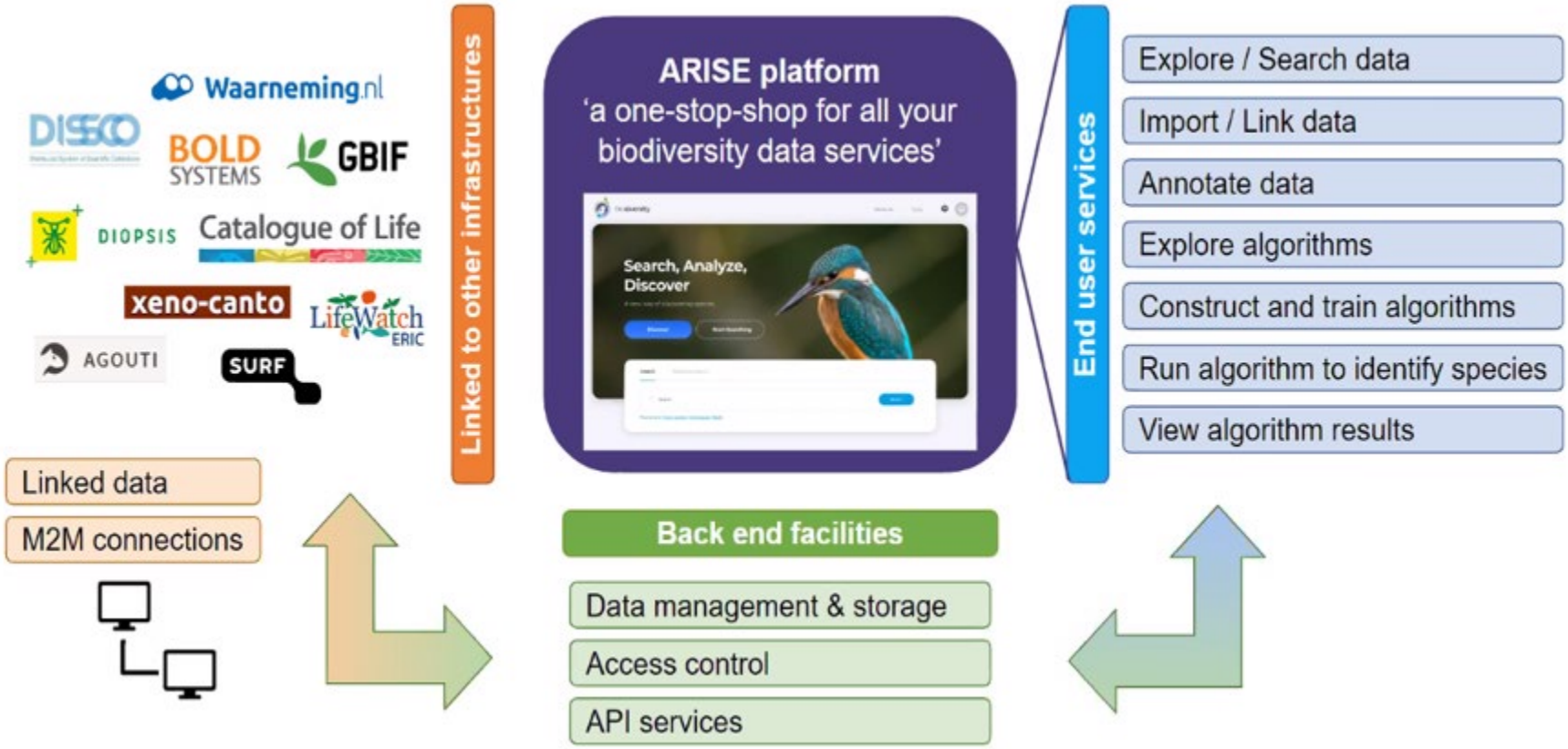




- ✓ Efficient
- ✓ Fast
- ✓ Low-cost
- ✓ Standardized
- ✓ (semi) automatic
- ✓ Transparent methods
- ✓ Less plastic

…extracts and sequence DNA for all the specimens and processes the bioinformatic analyses of the sequence data

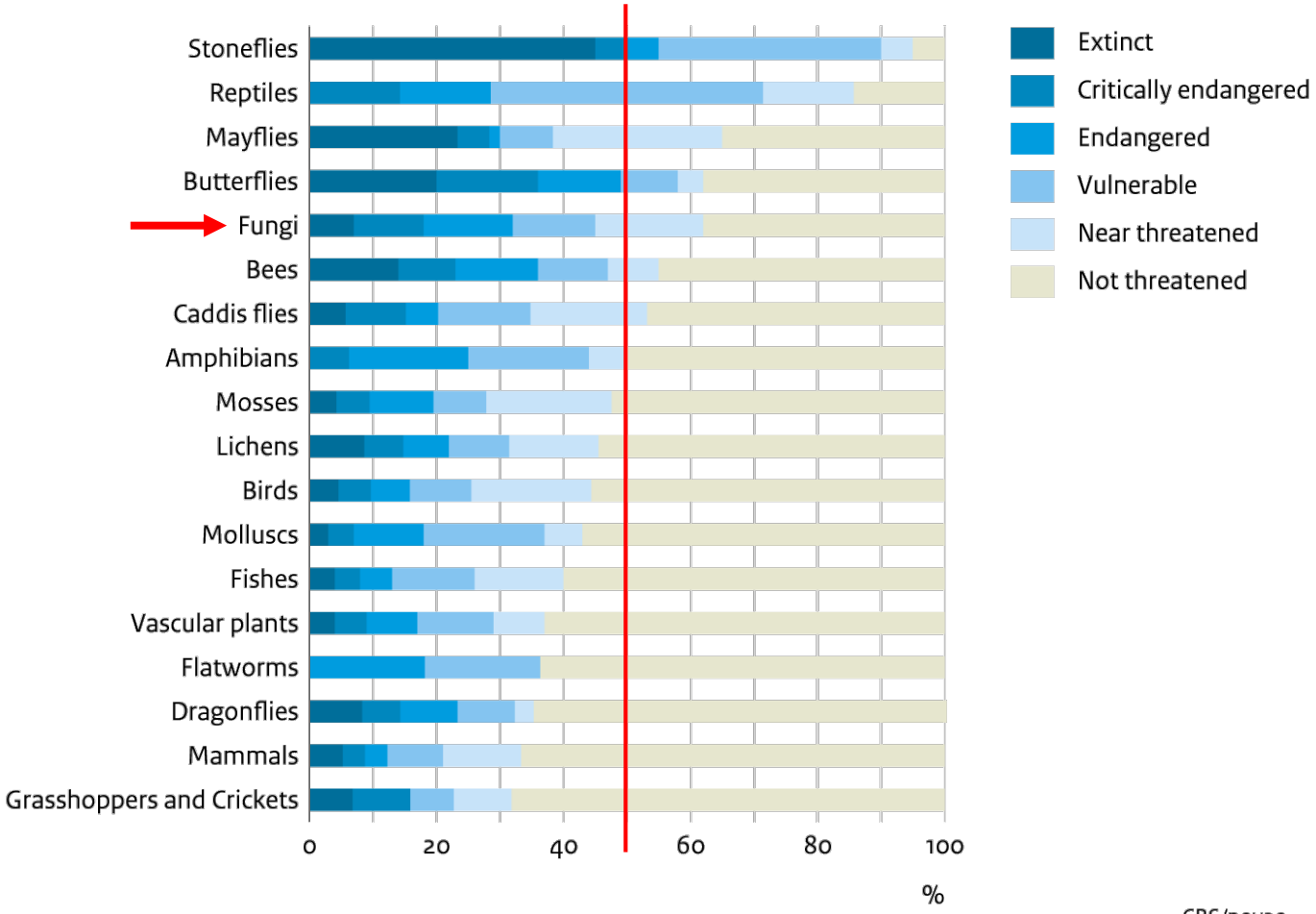
Biocloud



"…builds an infrastructure of the entire ARISE program including facilities for data management, storage, digital object identification and integration services between the ARISE and the outside world."

Dutch Biodiversity

Percentage of threatened and extinct species per species group in The Netherlands, 2019

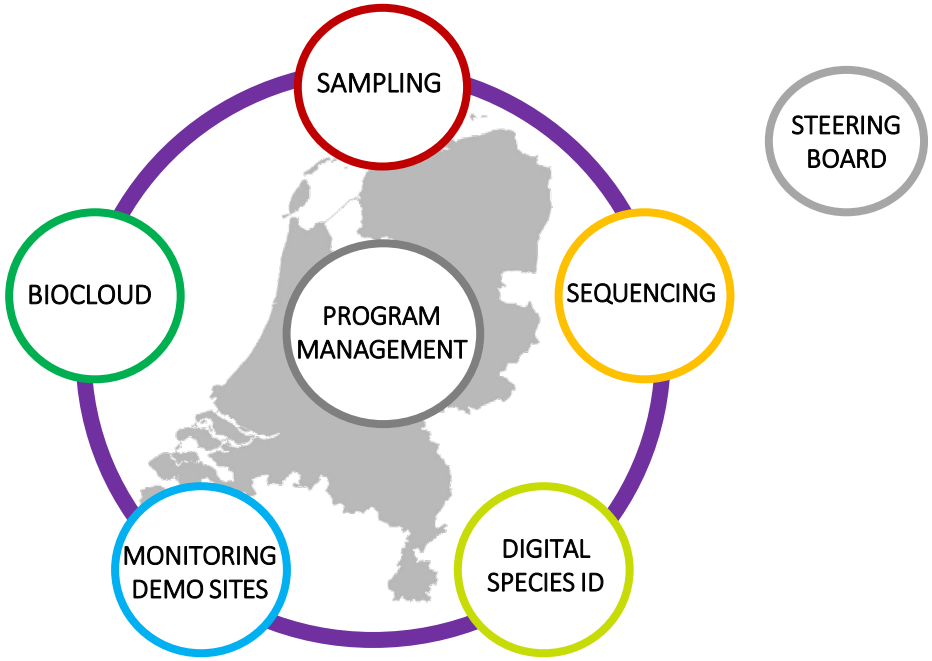


Source: Species organizations, WUR

CBS/nov20
www.clo.nl/en105217

Westerdijk Institute (WI) & ARISE

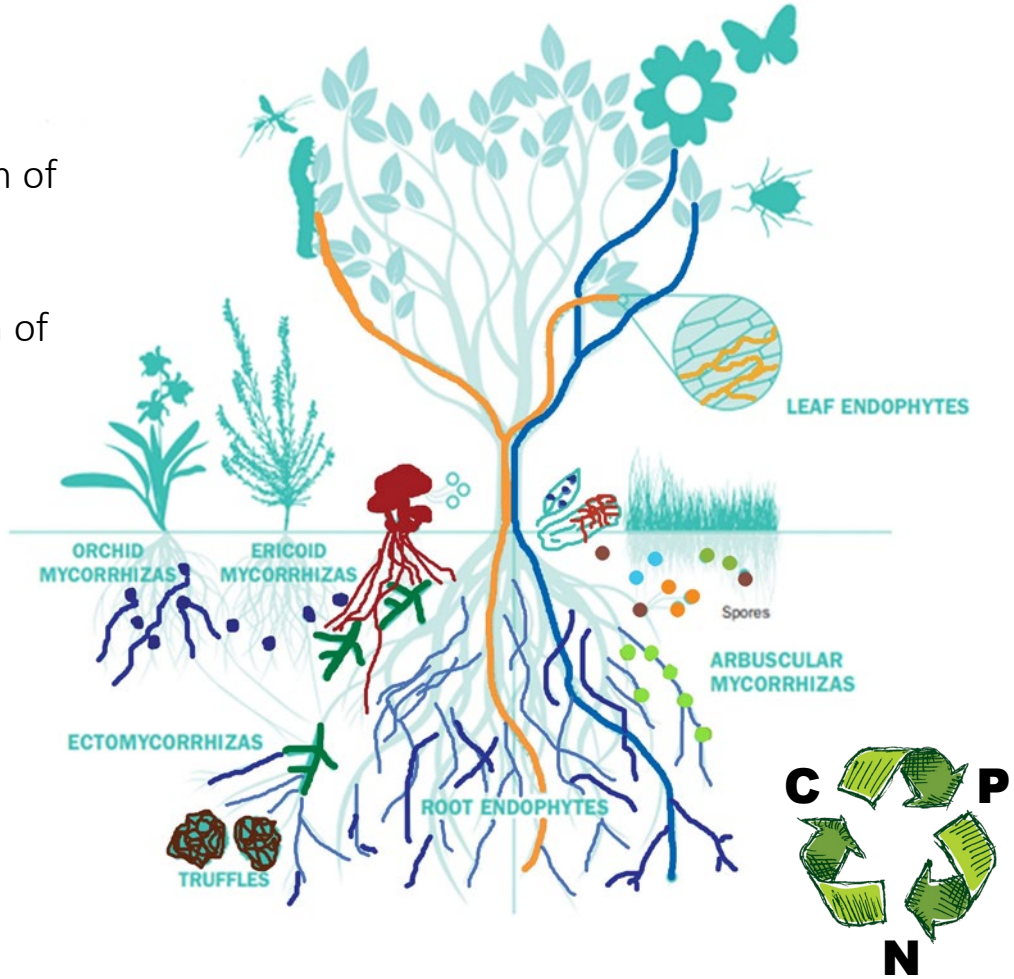
- Pedro Crous
- Ewald Groenewald
- Gerard Verkleij
- Duong Vu
- Hazal Kandemir
- Margarita Hernández
- Marjan Vermaas
- Noa van Dam



- Main aim is to provide an up-to-date reference database and tools for fast and reliable species identification
- Main interest is Dutch soil fungal biodiversity

Why soil fungi?

- ✓ Soil structure formation and modification of habitats
- ✓ Regulation of diseases, pests and growth of other microorganisms
- ✓ Regulating of the balance of carbon and nutrients
- ✓ Protection against root pathogens
- ✓ Stabilization of soil organic matter and decomposition of residues



<2% of the global fungal species are described
<5% of soil fungi are culturable

Giri et al. 2005; Blackwell 2011
Žifcáková et al. 2016; Frac et al. 2018

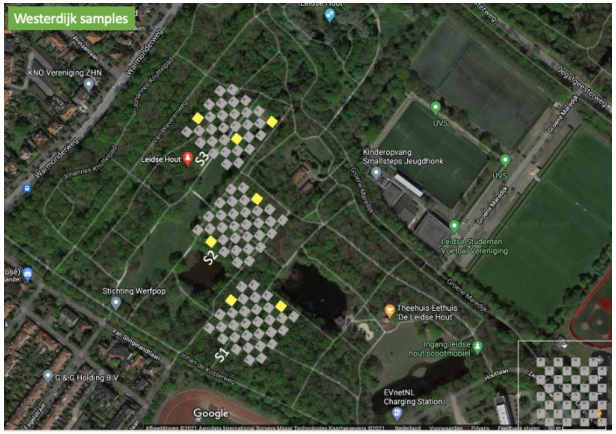
Sampling team - ARISE

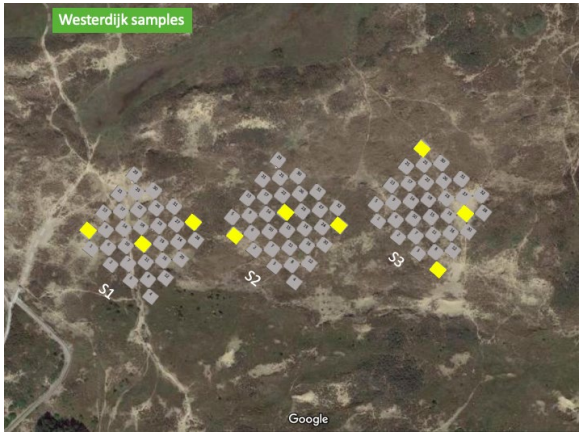
Pilot project: Metabarcoding *vs.* Barcoding cultures

- Soil-DNA extraction protocol: BOMB Beads
- Detect all species from one sample
- Standard database: UNITE
- Useful for ecological studies
- Different taxonomic units e.g. OTU, BIN, and ESV.
- Short(er) run time

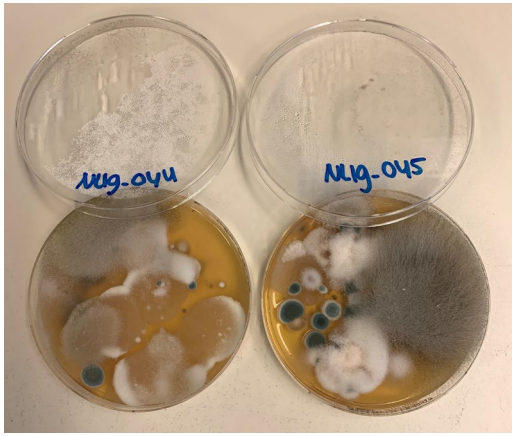
- Not applicable for taxonomic studies
- Not applicable for further analyses such as bioactive compound search

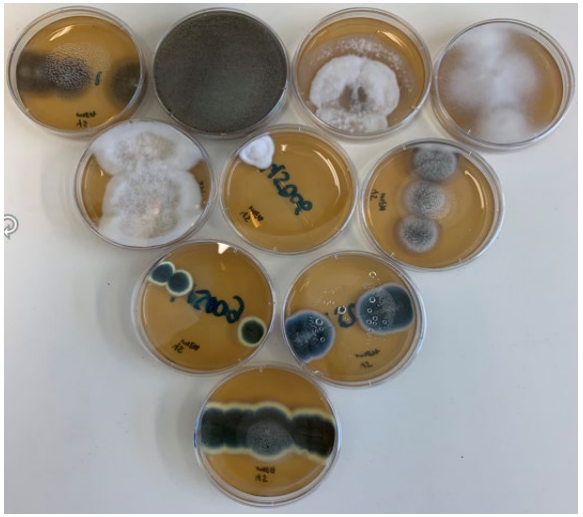
Sampling - WI





Lab process

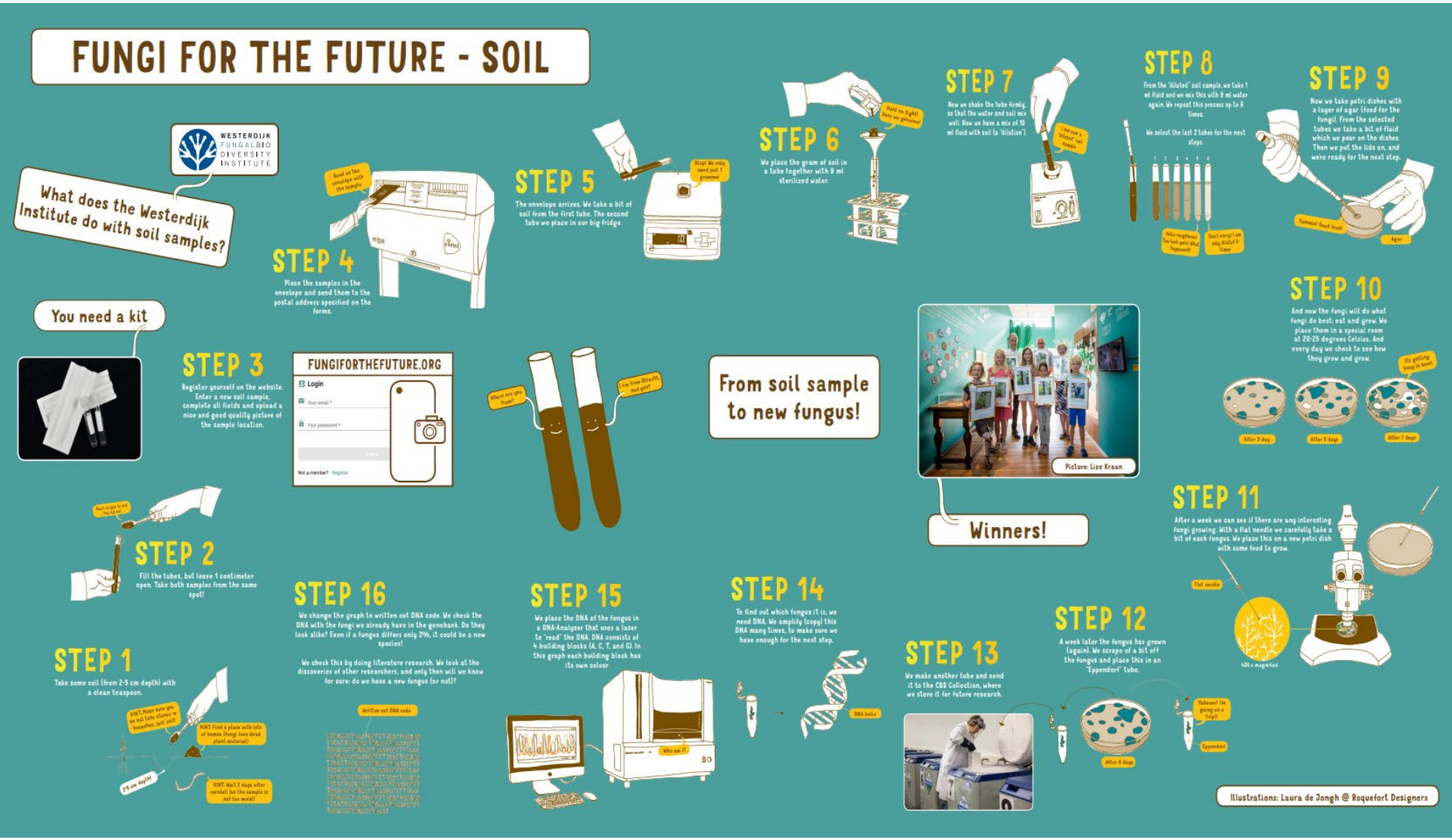




496

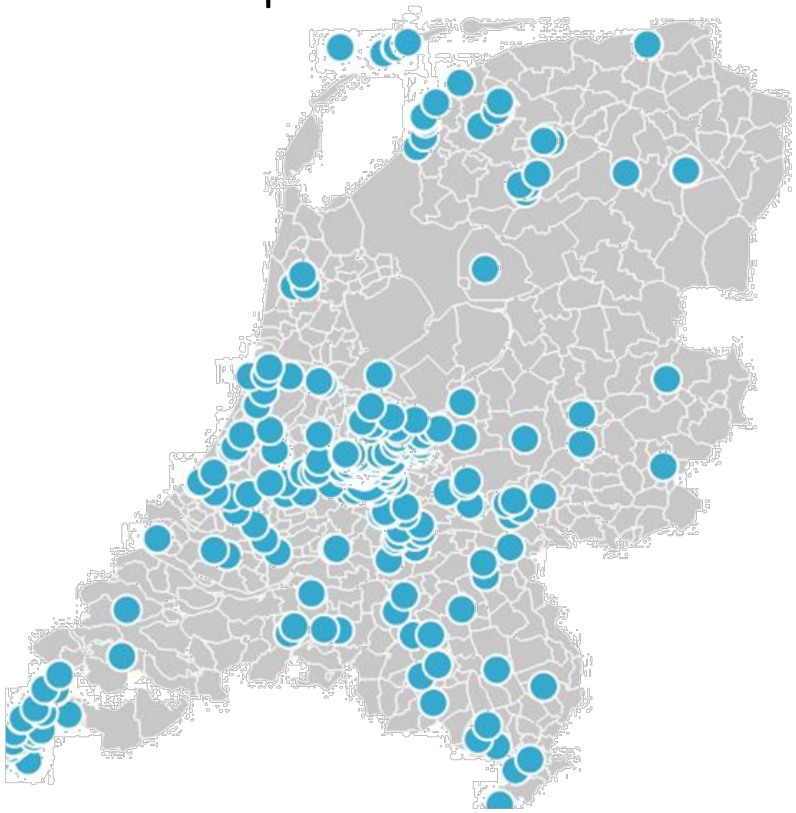
Fungal strains

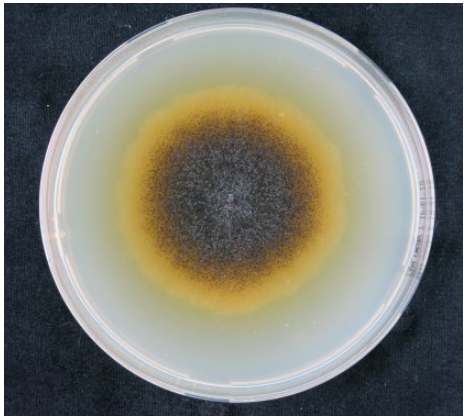
Citizen Science



Citizen Science (2017-2019)

390 soil sample





3850 Fungal strains

Fungal Planet description sheets - Persoonia

RESEARCH ARTICLE

Diversity of yeast species from Dutch garden soil and the description of six novel Ascomycetes

Marizeth Groenewald[1,*], Lorenzo Lombard[1], Michel de Vries[1], Alejandra Giraldo Lopez[1,2], Maudy Smith[1] and Pedro W. Crous[1,2,3]

FEMS Yeast Research, 18, 2018, foy076

doi: 10.1093/femsyr/foy076
Advance Access Publication Date: 17 July 2018
Research Article

Mycological Progress (2019) 18:1135–1154
https://doi.org/10.1007/s11557-019-01511-4

ORIGINAL ARTICLE

New plectosphaerellaceous species from Dutch garden soil

Alejandra Giraldo[1,2] · Margarita Hernández-Restrepo[1] · Pedro W. Crous[1,2,3]

MycoKeys 65: 49–99 (2020)
doi: 10.3897/mycokeys.65.47704
http://mycokeys.pensoft.net

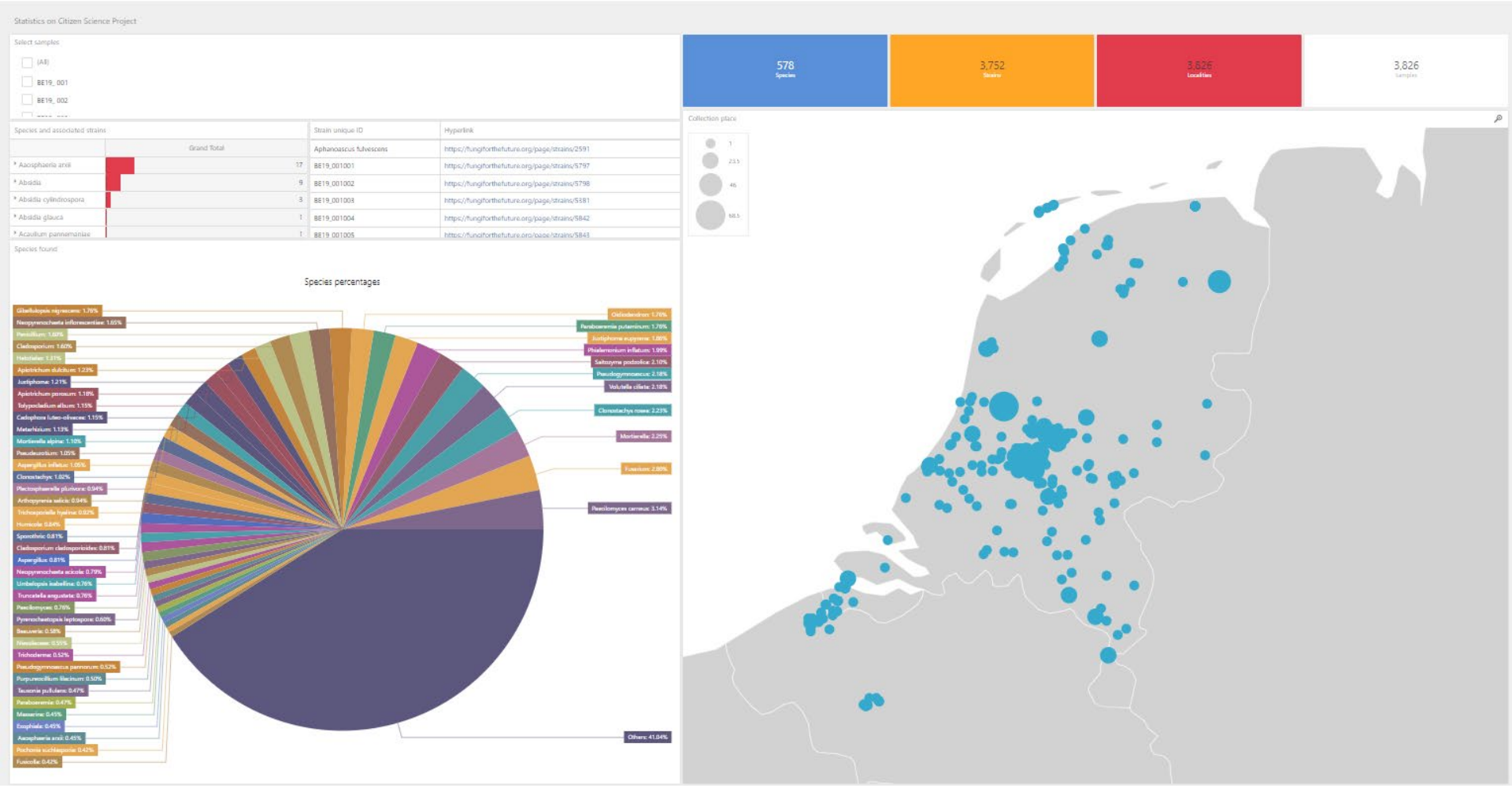
RESEARCH ARTICLE

A peer-reviewed open-access journal
MycoKeys
Launched to accelerate biodiversity research

Citizen science project reveals high diversity in Didymellaceae (Pleosporales, Dothideomycetes)

Lingwei Hou[1,2*], Margarita Hernández-Restrepo[3*], Johannes Zacharias Groenewald[3], Lei Cai[1,2], Pedro W. Crous[3,4]

Citizen Science database



www.fungiforthefuture.org

DNAbarcoder

available online at www.studiesinmycology.org

STUDIES IN MYCOLOGY 92: 1–20 (2019).

Large-scale generation and analysis of filamentous fungal DNA barcodes boosts coverage for kingdom fungi and reveals thresholds for fungal species and higher taxon delimitation

D. Vu[1*], M. Groenewald[1], M. de Vries[1], T. Gehrmann[1], B. Stielow[1], U. Eberhardt[2], A. Al-Hatmi[1], J.Z. Groenewald[1], G. Cardinali[3], J. Houbraken[1], T. Boekhout[1,4], P.W. Crous[1,5,6], V. Robert[1], and G.J.M. Verkley[1*]

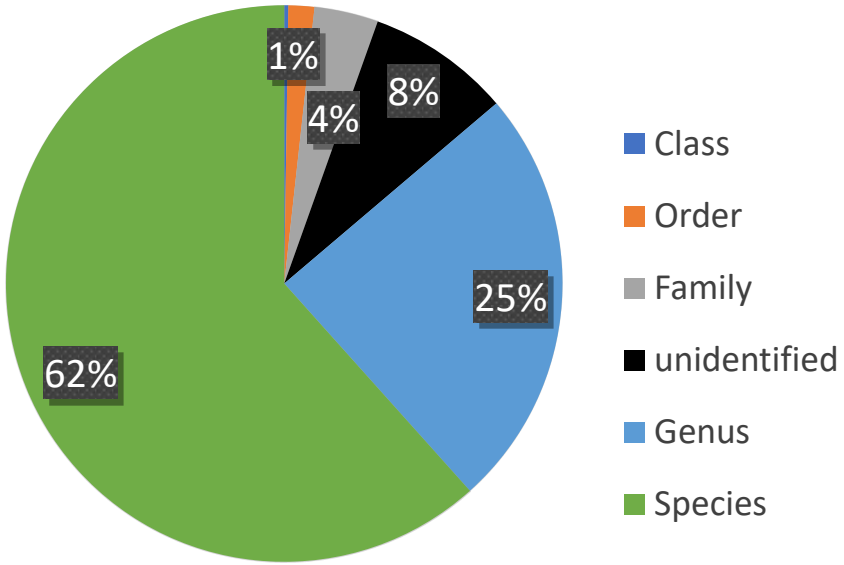
RESOURCE ARTICLE

MOLECULAR ECOLOGY RESOURCES WILEY

Dnabarcoder: An open-source software package for analysing and predicting DNA sequence similarity cutoffs for fungal sequence identification

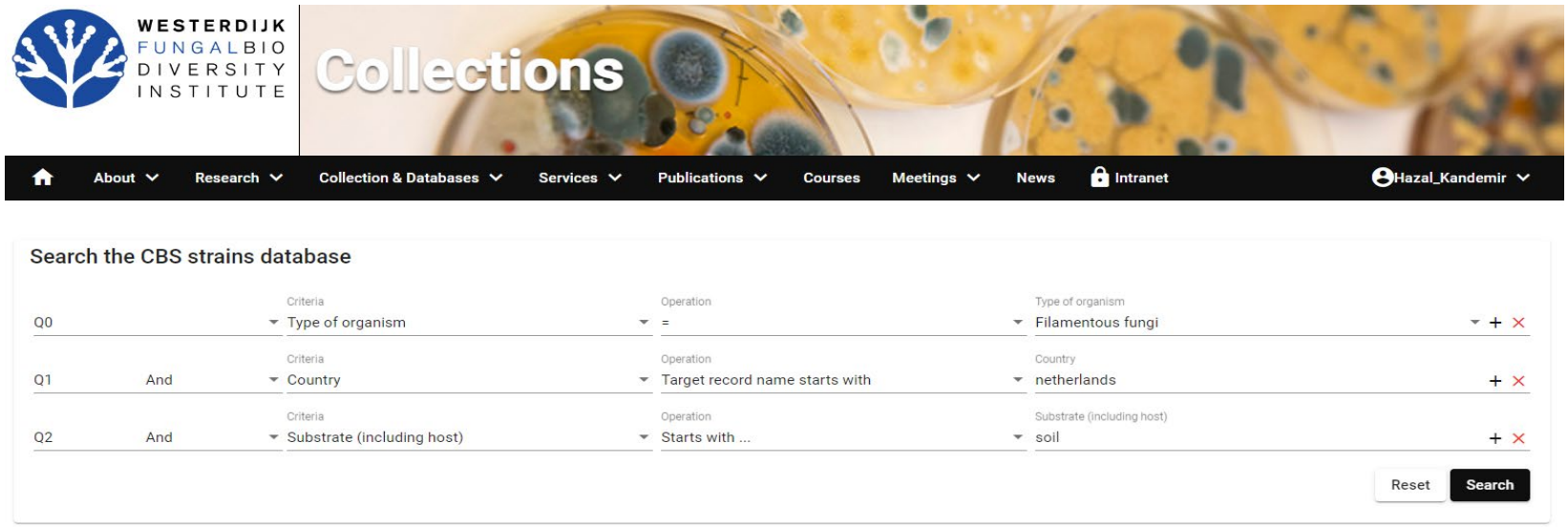
Duong Vu[1] | R. Henrik Nilsson[2] | Gerard J. M. Verkley[1]

Classification of the CS sequences



ID level	# sequences
Class	9
Order	58
Family	143
unidentified	321
Genus	946
Species	2372
Grand Total	**3849**

Sequencing - WI



~277 genera related to soil published

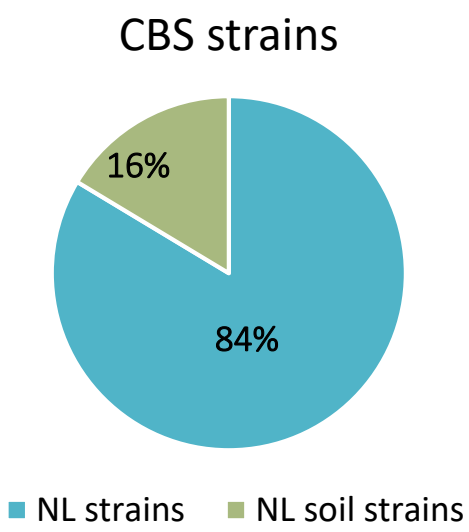
~34.000 strains from these genera

are in the CBS collection

~10.000 strains from soil

~1500 strains from Dutch soil

~8000 Dutch strains (filamentous fungi)



https://wi.knaw.nl/page/fungal_table

Future directions - WI

- Releasing barcode data for more species
- Providing an up-to-date reference database for (soil) fungi
- Overview of biodiversity in soil fungi in the NL
- Contribution to filling the gaps in the fungal taxonomy by describing new taxa
- “What is in there?” “What is its role?”
- Provoke an awareness on the importance of soil fungi

Thanks!

Westerdijk Institute ARISE team


Pedro Crous


Ewald Groenewald


Gerard Verkleij


Duong Vu


Margarita Hernández


Marjan Vermaas


Noa van Dam

WESTERDIJK FUNGAL BIO DIVERSITY INSTITUTE

Naturalis Biodiversity Center

UNIVERSITEIT TWENTE.

UNIVERSITEIT VAN AMSTERDAM

Marie Skłodowska-Curie Actions

This presentation benefitted from funding by the European Union's Horizon 2020 research and innovation program (RISE) under the Marie Skłodowska-Curie grant agreement No. 101008129, project acronym "Mycobiomics".

Funded by the European Union

www.arise-biodiversity.nl