Sensing the Forest

UAL Workshop

May 14, 2025

Materials

Outline

- **9.30am-10am** Sensing the Forest project
- **10am-11.30am** Dendrophone
- **11.30am-11.45am** Break
- **11.45-12pm** The streamers (a quick introduction)
- **12pm-1pm** DIY tree talker
- **1pm-1.30pm** Final thoughts/ideas

AHRC
Sensing the Forest
Project overview


Sensing the Forest:
Let the Forest Speak
how can the use of artistic and community science research methods help to inform and educate people about climate change?
sensing the forest

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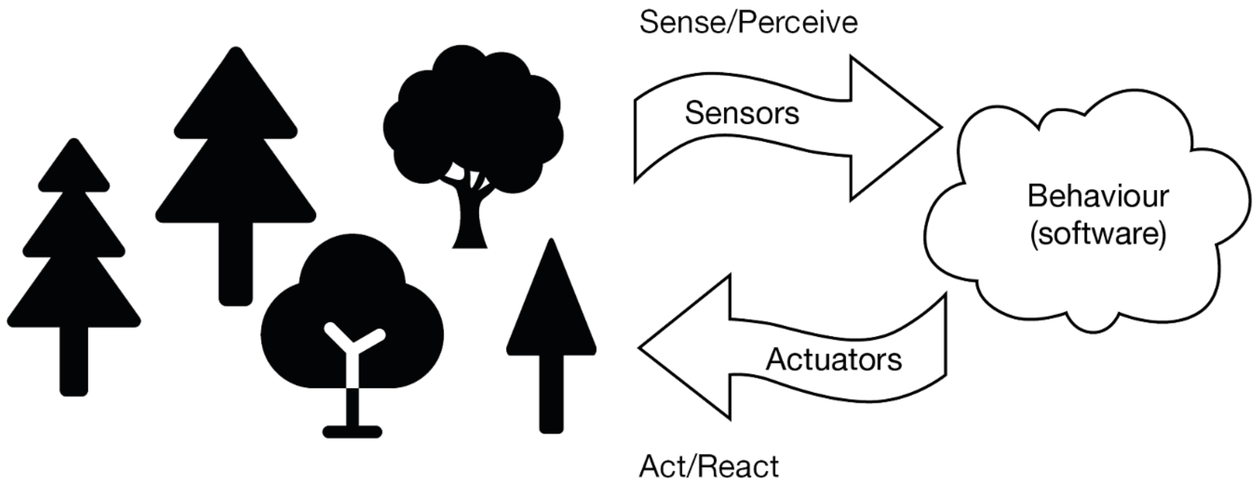

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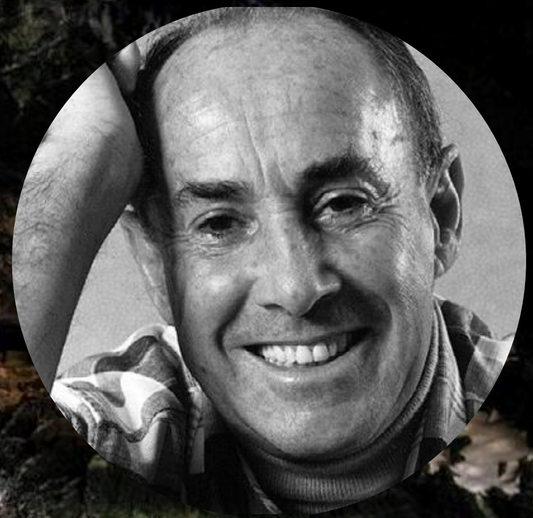

Nature and artistic creation in harmony

César Manrique

Jameos del Agua

StF Team

The team (1/3)

Dr Anna Xambó (PI)
Senior Lecturer in Sound and Music Computing, QMUL

Dr Luigi Marino
Research Fellow in Sound and Music Computing, QMUL

Dr Peter Batchelor (CI)
Senior Lecturer in Music, Technology and Innovation, De Montfort University

Dr Michael Bell (CI)
Climate Scientist, Forest Research

Dr Georgios Xenakis (CI)
Senior Climate Scientist, Forest Research

Hazel Stone National Curator of Contemporary Art, Forestry England

Dr Krishna Nama Manjunatha (CI)
Senior Lecturer in Micro and Nano Electronics, De Montfort University

Ashok Karavadra
Senior Technician, De Montfort University

Nick Wardlaw
District Recreation Manager, Forestry England

Danielle Grimsey
Visitor Services Manager, Alice Holt, Forestry England

Max Gravestock
Site Manager, Alice Holt, Forestry England

Johana Knowles
Visitors Services Officer, Alice Holt, Forestry England

The team (2/3)

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Dr Matthew Wilkinson
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Director of MTI^2,
De Montfort University

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Partners

UKRI Arts and Humanities Research Council

Queen Mary University of London

centre for digital music

DE MONTFORT UNIVERSITY LEICESTER

MTI2 INSTITUTE FOR SONIC CREATIVITY

Forest Research

Forestry England

Collaborators

freesound

Locus Sonus Vitae ESAAIX

UNIVERSITY OF SURREY

EE

DigitalOcean

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WP1

Artistic audio ecology intervention concerning forests and climate data

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Objectives

Objective 1 (WP1): Artistic audio ecology intervention concerning forests and climate data *(18.9.2023-29.6.2025)*.

To make a one-year on-site and online artistic intervention in a UK-based forest using live scientific data and fostering acoustic ecology experiences. This objective relates to making an artistic intervention in the Alice Holt forest in Hampshire, UK in collaboration with Forest Research (FR) and Forestry England (FE).

Understanding Alice Holt's data and place

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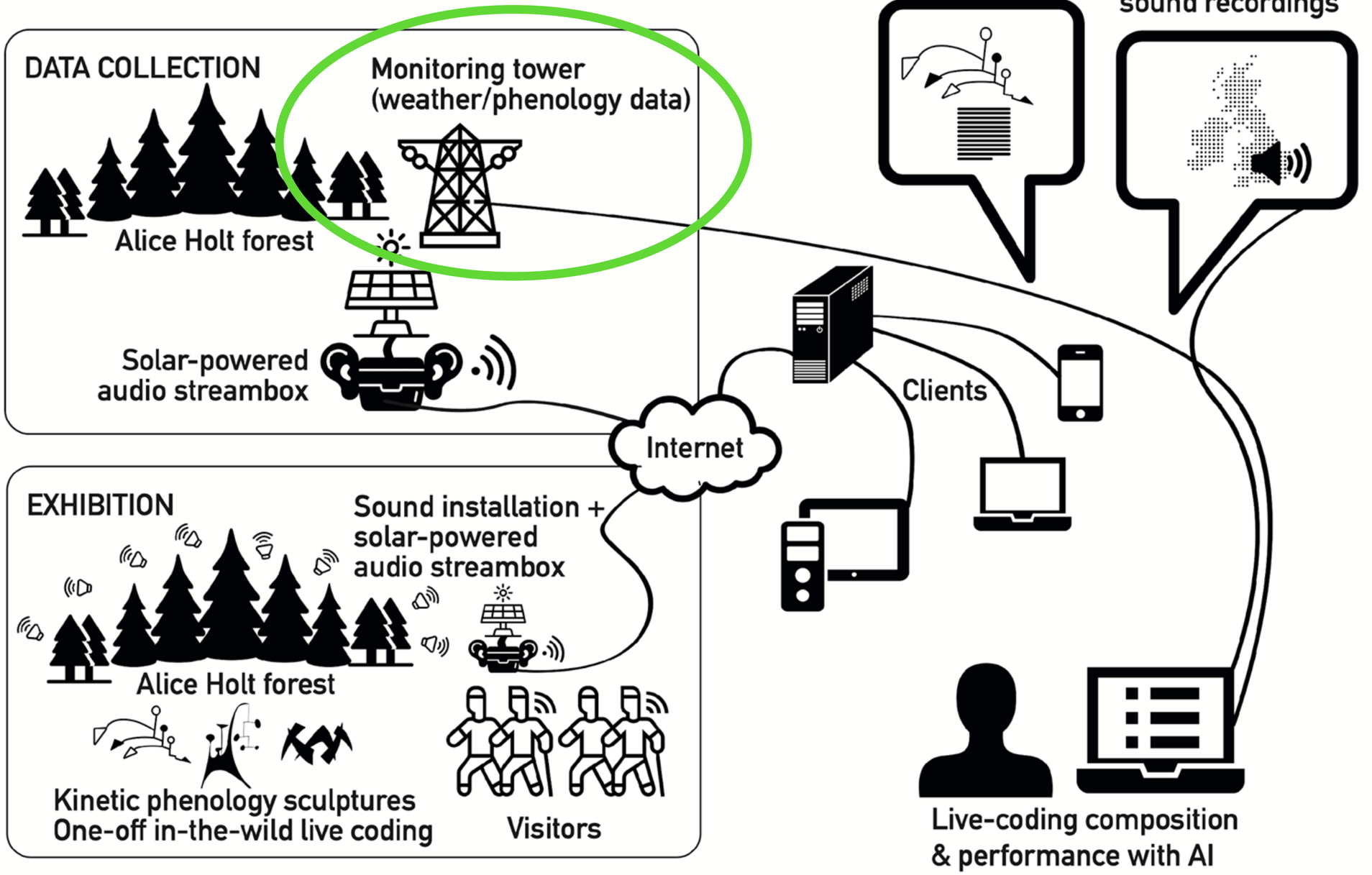
https://sensingtheforest.github.io/2023/11/22/an-introduction-to-alice-holt-forest/

Forest Intervention WP1



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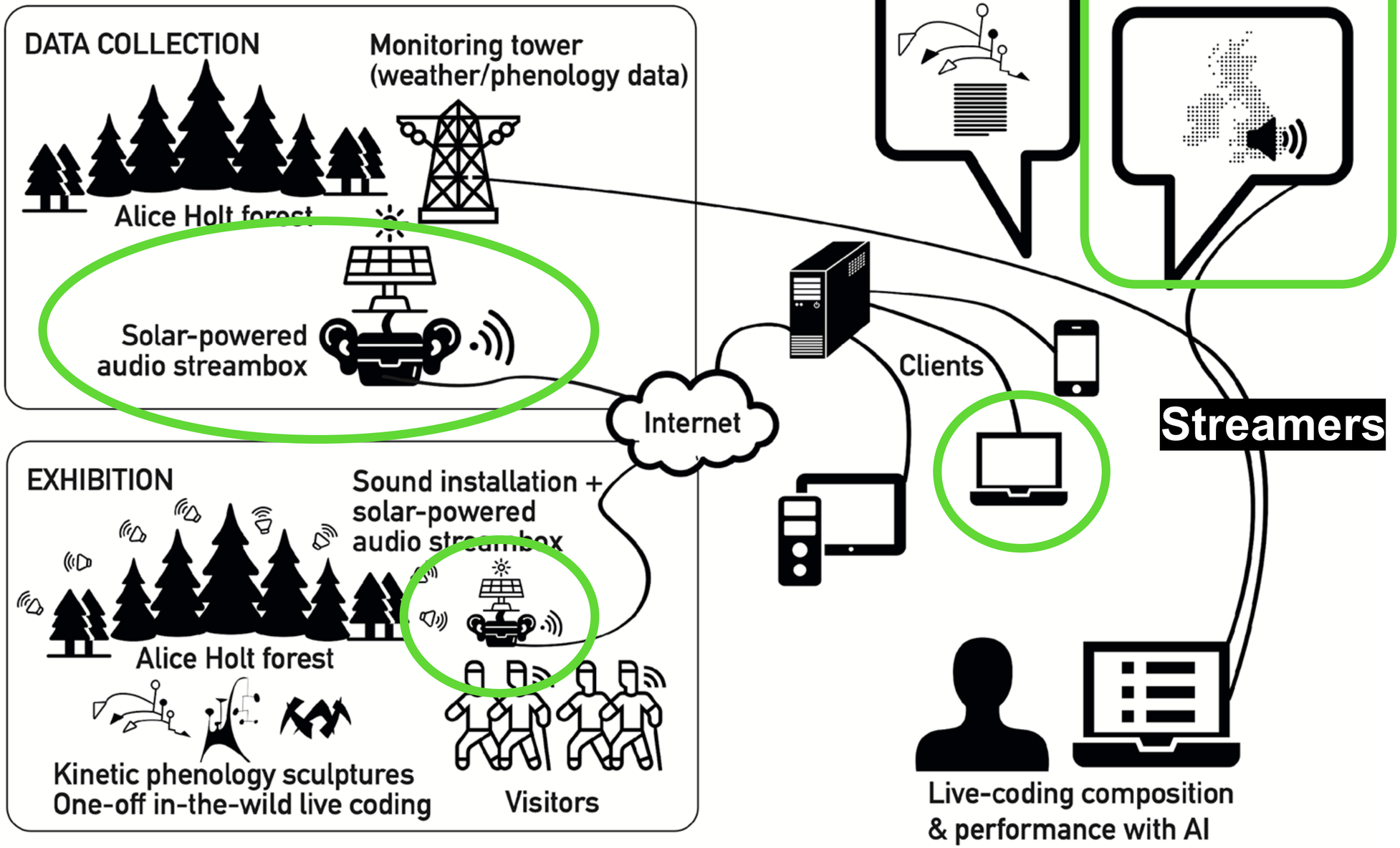
Forest Intervention WP1



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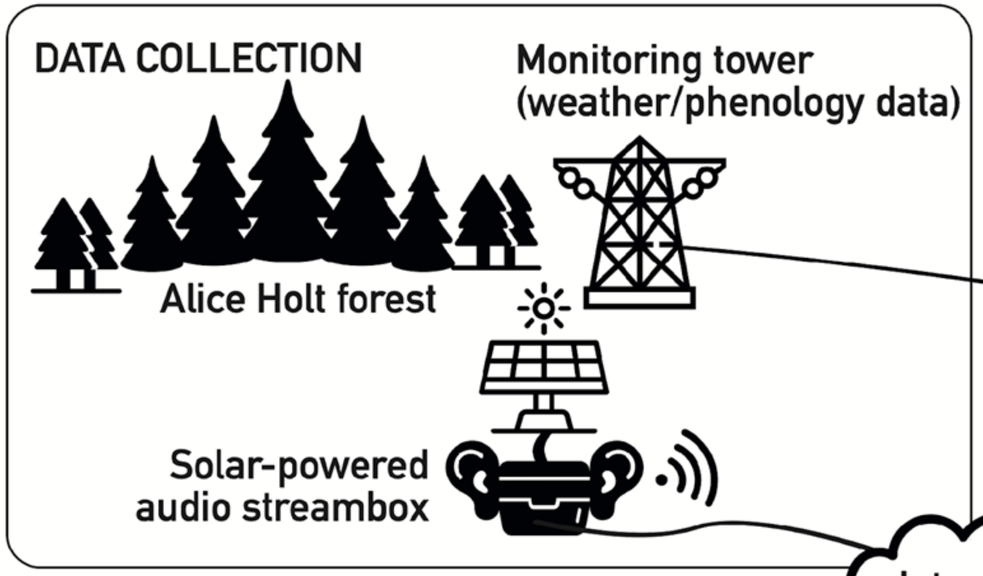
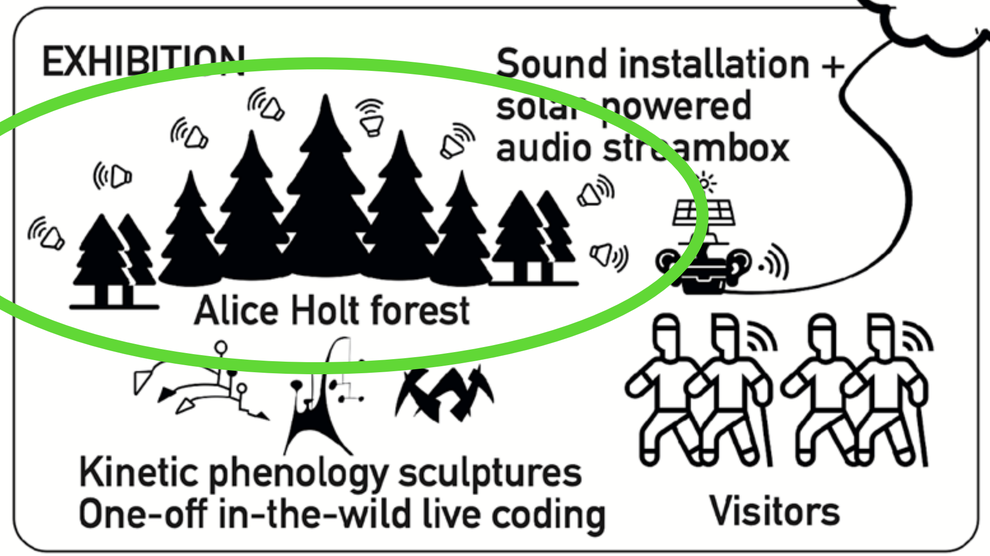
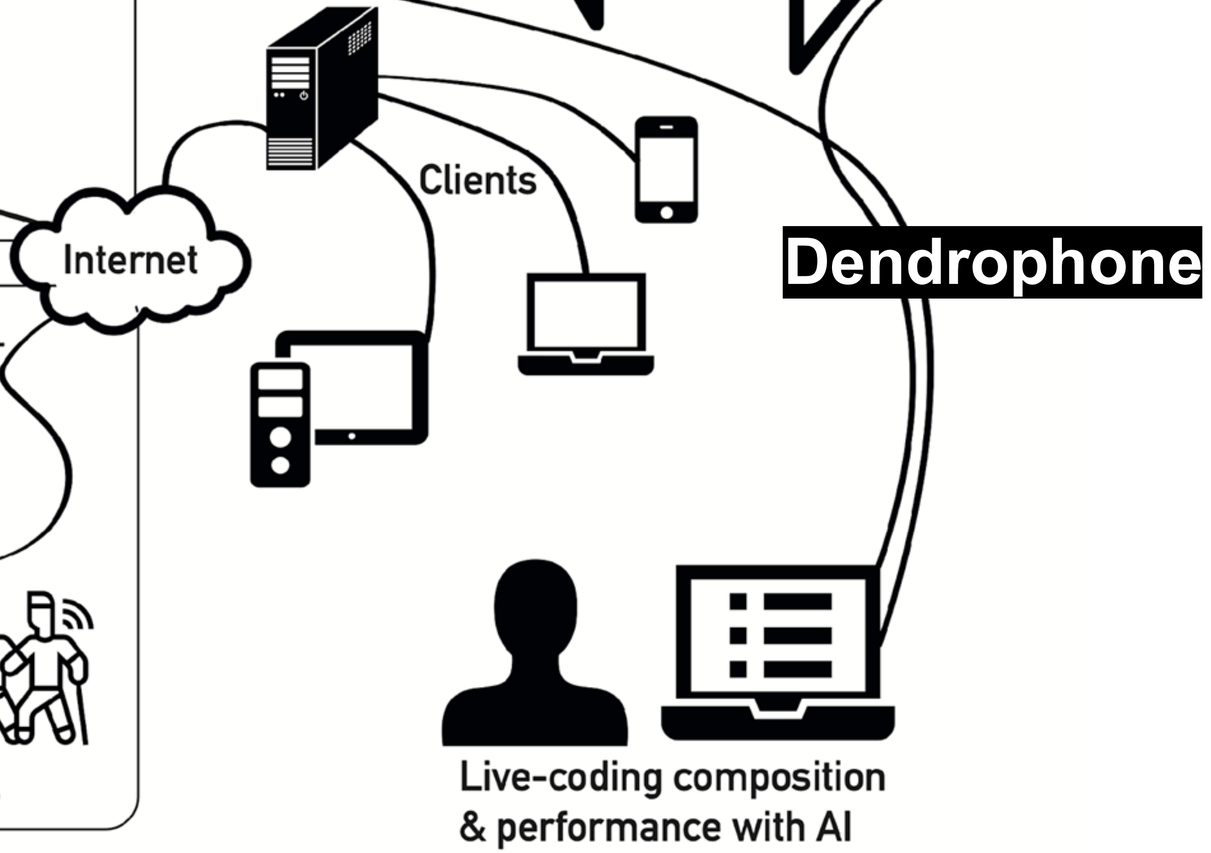
Forest Intervention WP1







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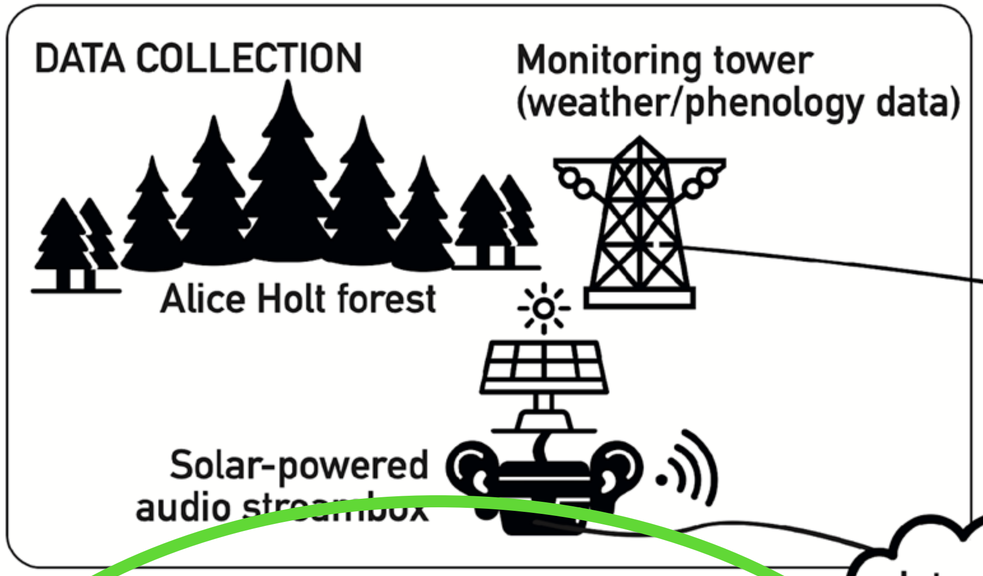
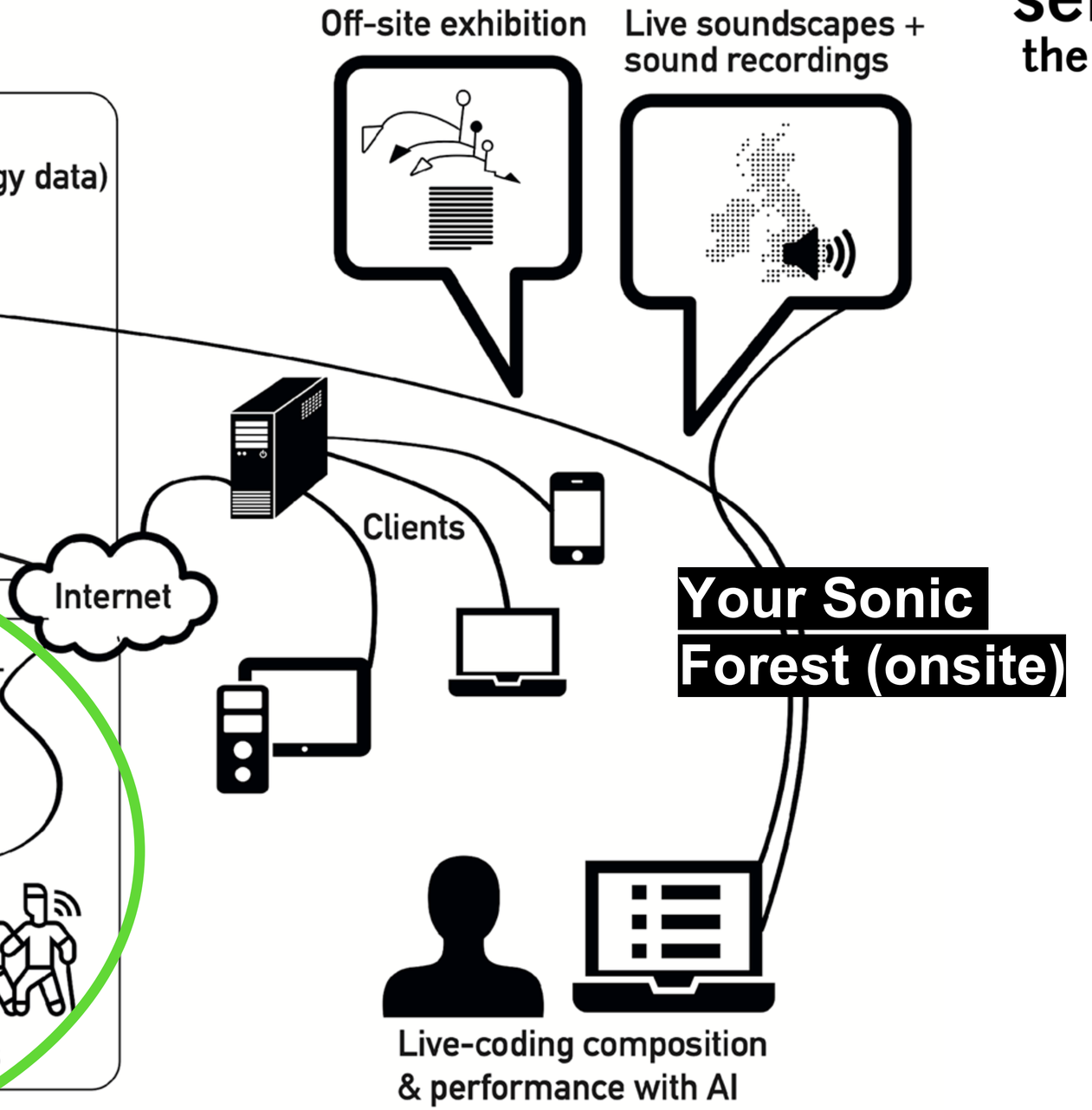
Forest Intervention WP1





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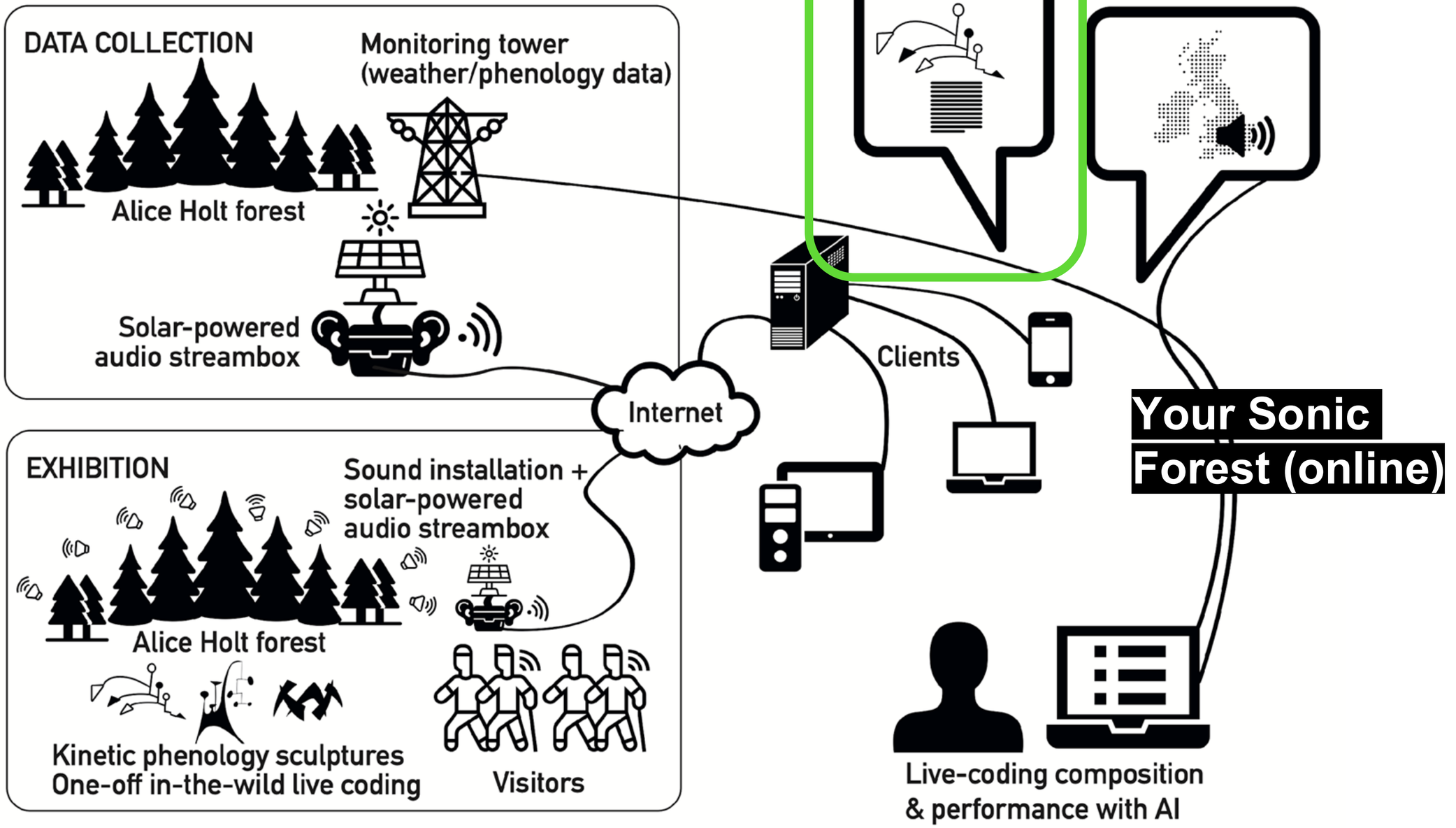
Forest Intervention WP1



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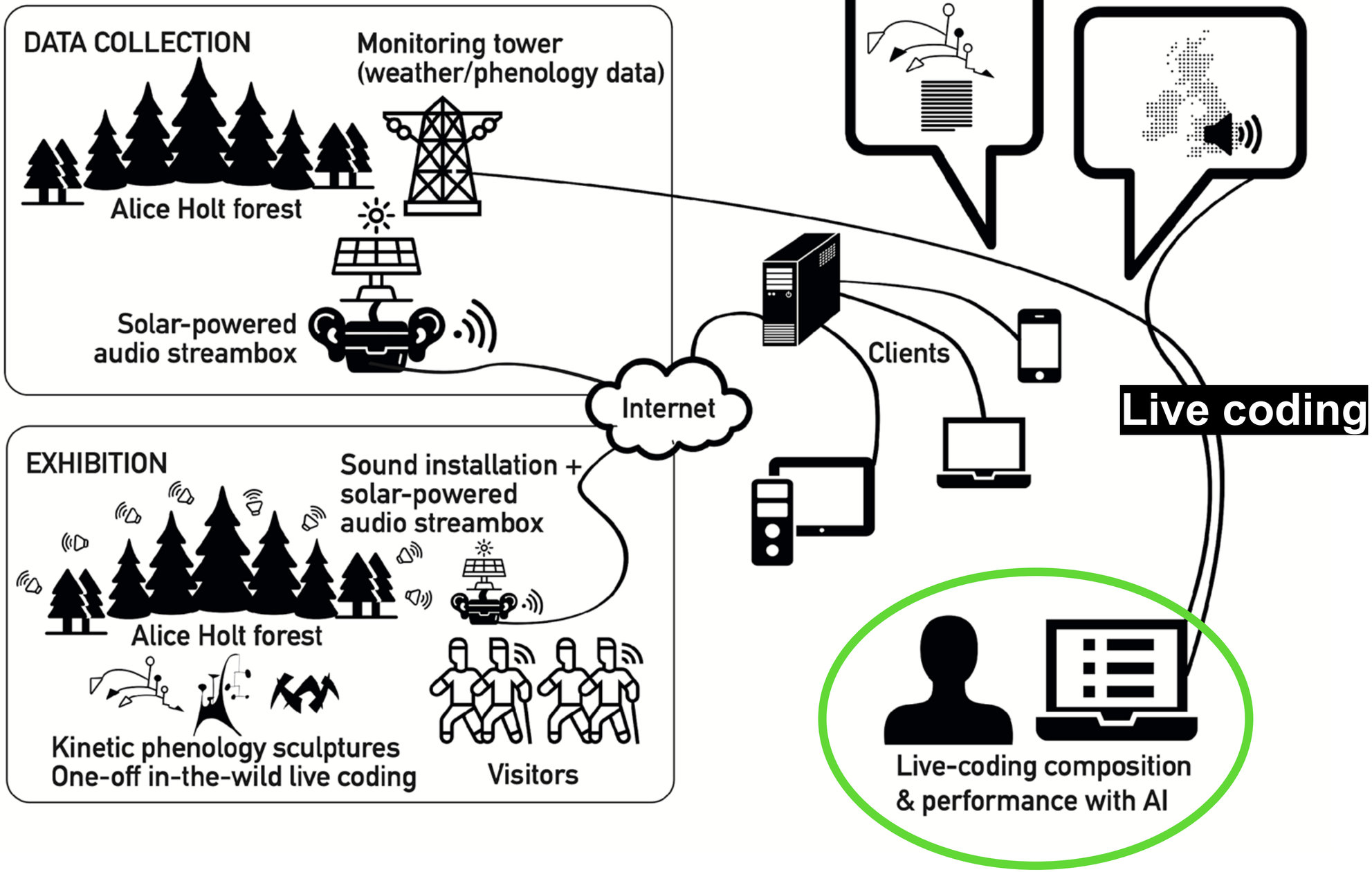
Forest Intervention WP1



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WP2

Community science intervention with forests and climate data

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Objectives

Objective 2 (WP2): Community science intervention with forests and climate data *(10.6.2024-11.5.2025)*.

To develop an in-house Internet of Things (IoT) prototype to measure variables related to tree stress, such as sap flow, air temperature, humidity and soil moisture to be piloted using community/citizen science methodologies connected to web applications for data analysis, visualisation and sonification. This objective relates to building a low-cost take-home prototype, inspired by commercial and expensive tree-talkers, to be used as a community/citizen science kit.

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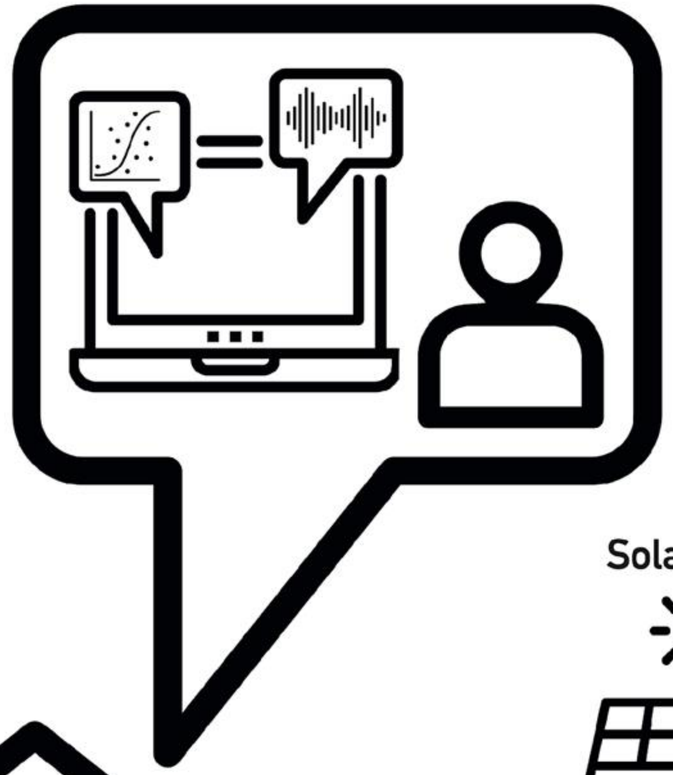
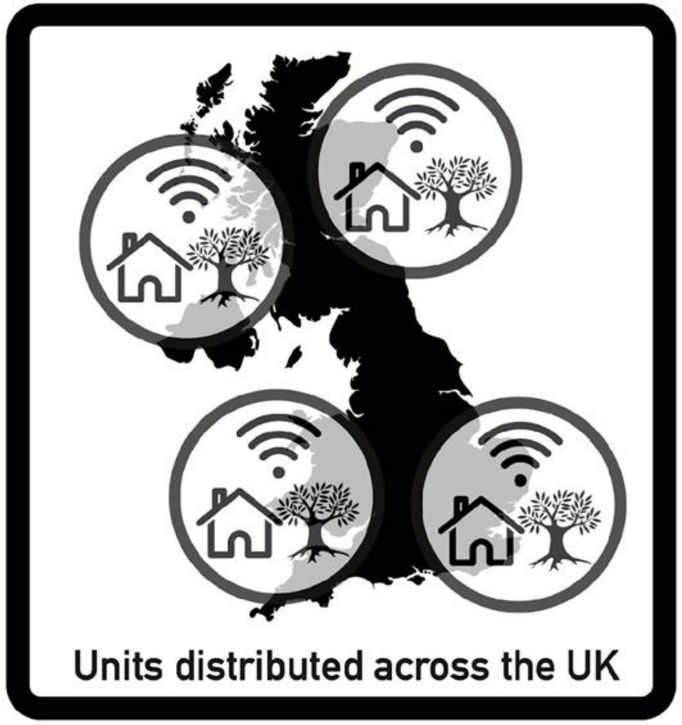
Understanding Northern Station's data and place

https://youtu.be/Axs6DDR2PuM

Prototype WP2

Dedicated web app (analysis, visualisation, sonification)





Units distributed across the UK

Solar panel

Household with Wi-Fi extender/powerline adapter

Box with RPi and sensors
(air temperature, soil moisture, sap flow)

Garden tree

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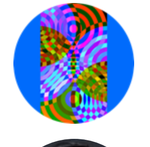

WP1
Summer School

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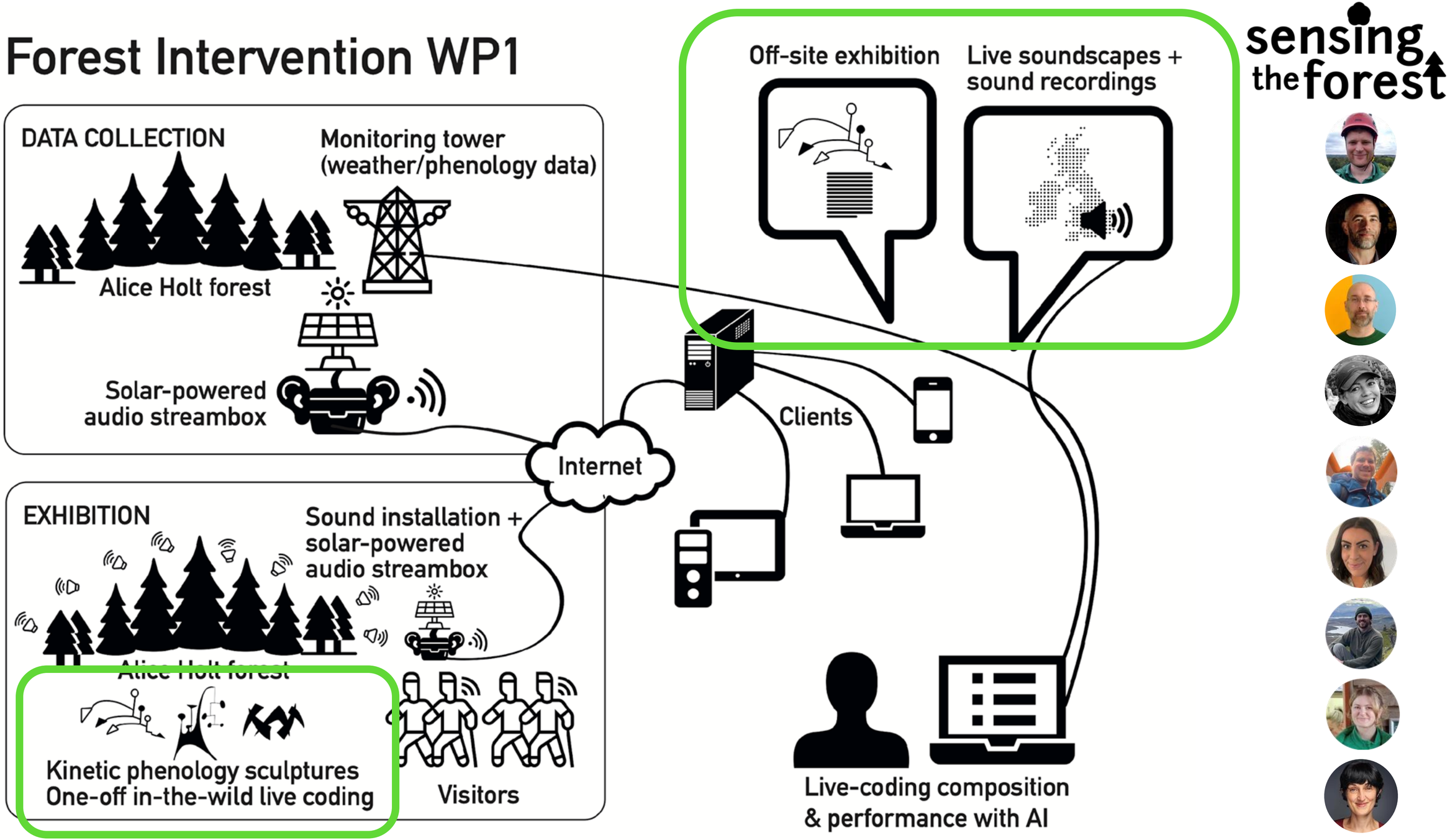
Forest Intervention WP1



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the forest
Summer school: Invitation to explore how can artistic interventions raise awareness about the place, the data, and climate change.

Summer school

Concept

- **Open call** to select 10 proposals (Dec 2023 - Jan 2024) ***sensingtheforest.github.io/summer-school/***
- 4 months of **online training/mentoring** (Feb-May 2024).
- **2 days (19-20 June) in Alice Holt to set up** (1 days) and exhibit (0.5 day) your installation (physical version).
- **Online presence** of the exhibits for 1 year (digital version).

Summer school

Programme: Online (6h, 1h per session) — February-May 2024

- **Day 1 (15/2/24)**: Introductions, share projects/interests.
- **Day 2 (29/2/24)**: Nick Wardlaw (Forestry England) / Michael Bell (Forest Research) presentation: Alice Holt.
- **Day 3 (21/3/24)**: Peter Batchelor (DMU) presentation: Installation art.
- **Day 4 (11/4/24)**: Hazel Stone (Forestry England) / Johana Knowles (Forestry England): Design recommendations.
- **Day 5 (2/5/24)**: Pitch your idea + feedback.
- **Day 6 (23/5/24)**: Luigi Marino (Queen Mary University of London): Aesthetic Considerations. Initial prototypes + feedback.

Summer school

Programme: Onsite: (2 days, all-day session) — 19-20 June 2024

- **Day 1 (June 19, 2024):**
  - Fieldwork/exhibits location + Hands-on (morning).
  - Setting-up (afternoon).

- **Day 2 (June 20, 2024):**
  - Final setting-up/preparations (morning).
  - Launch of the exhibition (11.00-15.00, open event).
  - Closing (afternoon).

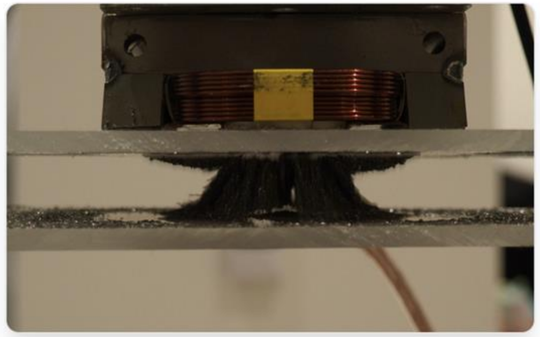
Meet the Artists - Bardia Hafizi

Meet the Artists - Ed Chivers

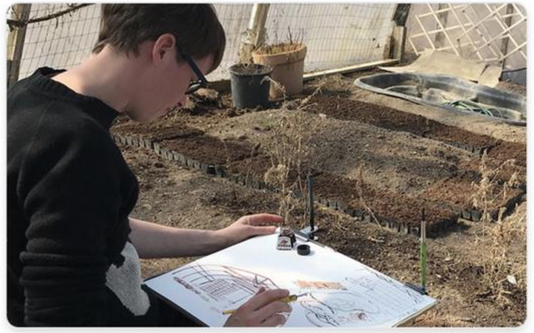
Meet the Artists - Qianyi Rose Sun

Meet the Artists - Gabrielle Cerberville

Meet the Artists - Austin Blanton



Meet the Artists - Miles Scharff



Meet the Artists - Kate Anderson

Meet the Artists - Jordan Juras

Meet the Artists - Rosa Sungjoo Park

Meet the Artists - Beccy Abraham

sensingtheforest.github.io/tags/meet-the-artists

Your Sonic Forest

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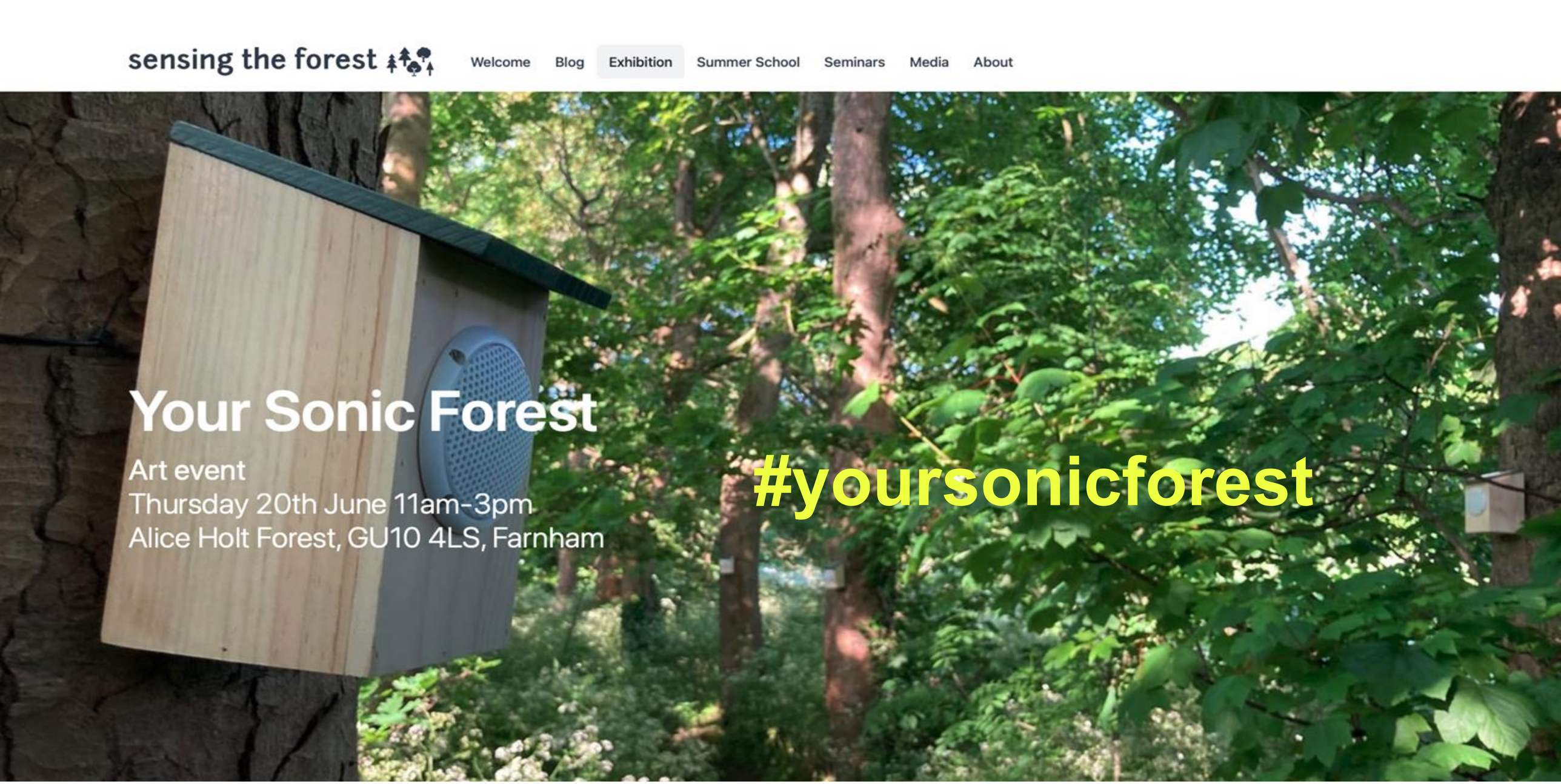

sensingtheforest.github.io/exhibition/


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sensingtheforest.github.io/exhibition/

Pre-tasks

Watch: Your Sonic Forest: The Exhibition.

Read: Lindborg, P., Lenzi, S., and Chen, M. (2023). Climate data sonification and visualization: An analysis of topics, aesthetics, and characteristics in 32 recent projects. Frontiers in Psychology, 13, p.1020102.

Bring a laptop with Pure Data installed. => Not required, but advised as a follow-up task.

Warm-up Activity

After watching the video…

List themes, metaphors or topics that can help us talk about forests and climate change

Extinction of Species/Habitat

What happens if/when biodiversity collapses in the natural word? Will forests become tree museums? (Ed Chivers)

This theme involves the loss of biodiversity and the degradation of ecosystems. As species disappear and habitats are destroyed, the ecological balance that sustains forests is disrupted, which in turn affects the climate and vice versa.

· Mighty Oak
· Tree Museum
· Tread(Lightly)

Tree as an Antique

Trees are your best antiques (Alexander Smith)

This theme focuses on trees as historical artefacts that are also fragile in the face of modern environmental threats. This perspective acknowledges the longevity and role of trees and can also draw attention to the urgent environmental changes threatening them. Trees can be seen not only as relics of the past but also as symbols of what could be lost if climate change continues progressing.

· Mighty Oak
· The Walking Tree
· A Tree Listens to Itself

Making Visible the Invisible

If a tree falls in the forest there are other trees listening (Peter Wohlleben)

This theme exposes hidden environmental processes and highlights ecological interdependencies that tend to be unnoticed. This can help raise awareness of the natural world and help people understand the invisible impacts of climate change.

· Dendrophone
· Tree Museum
· Tread(Lightly)
· Resonant Groove
· A Tree Listens to Itself
· Leaves Echo
· In Touch

Rhizomatic Interconnections/Communities

The trees soon revealed startling secrets. I discovered that they are in a web of interdependence, linked by a system of underground channels, where they perceive and connect and relate with an ancient intricacy and wisdom that can no longer be denied. (Suzanne Simard)

As we sense a tree, the city turns into our forest, and the forest becomes our city (Bardia Hafizi)

In this theme, the concept of rhizomatic interconnections is drawn from Deleuze and Guattari's philosophical framework, described as a non-hierarchical, decentralised way of thinking about systems, communities, and relationships. Here, the emphasis lays on how trees and ecosystems are interconnected in ways that resemble rhizomes, with multiple, non-linear relationships of exchange, support, and communication.

· Dendrophone
· The Walking Tree
· A Tree Listens to Itself
· Leaves Echo
· In Touch

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Human-Environment Interactions/(Re-)Connecting with the Environments

I hope my piece might engage the audience with climate change, by giving consideration to their own connection to the forest environment, specifically the Oak tree (Kate Anderson)

I aim to create an immersive experience that invites participants to actively engage with their surroundings (Rosa Sungjoo Park)

In this theme, the human-environment interactions are seen as a mechanism to (re-)connect with the environment and promote environmental consciousness. This theme involves human interaction with nature as a way to raise awareness of ecological concerns such as climate change by interacting with augmented natural systems that can help us interpret the state of forests and the broader environment.

· Within and Between
· Dendrophone
· Mighty Oak
· Tread(Lightly)
· A Tree Listens to Itself
· Leaves Echo
· In Touch

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Tree as a Cybernetic System

A cyborg is a cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction (Donna Haraway)

Is this cybernetic tree a contradiction, or can technology live in peace with the forest, and even help it thrive? (Austin Blanton)

In this theme, the tree is seen as a cybernetic system, which blends the boundaries between humans, machines, and the political/social implications of technology. The tree represents a fusion of the organic and the mechanical that transcends traditional boundaries, in which the lines between the natural and the artificial are blurred. This challenges established hierarchies and offers new possibilities for understanding social and political relationships in the context of a forest.

· The Walking Tree
· Resonant Groove
· A Tree Listens to Itself

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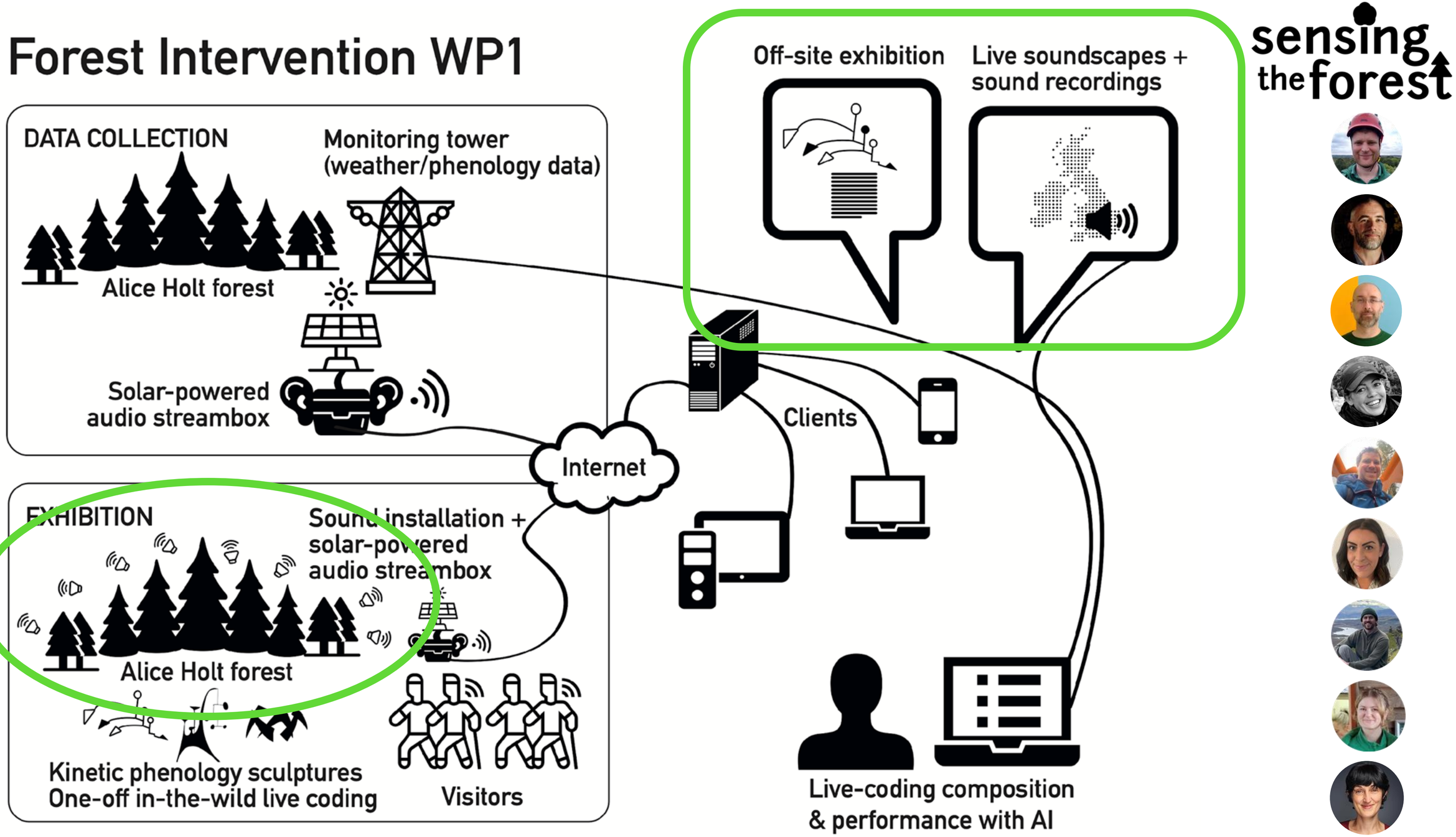
WP1

Customised data logger

+ Featured sound installation: Dendrophone

Forest Intervention WP1



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Featured sound installation

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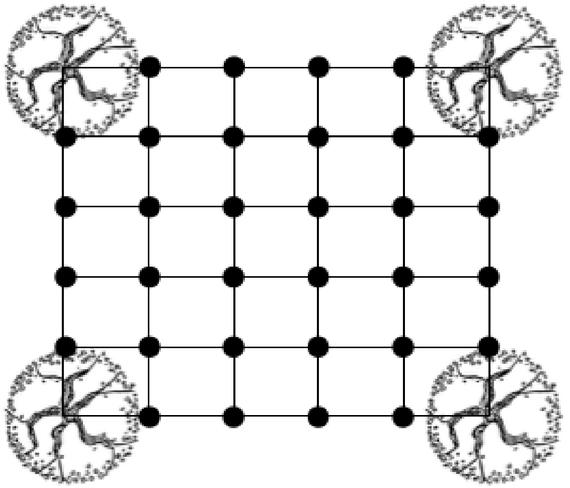
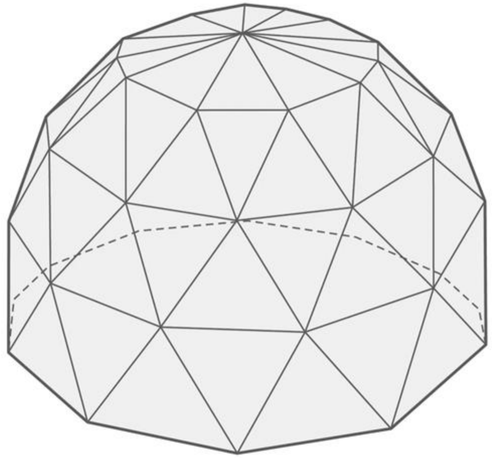
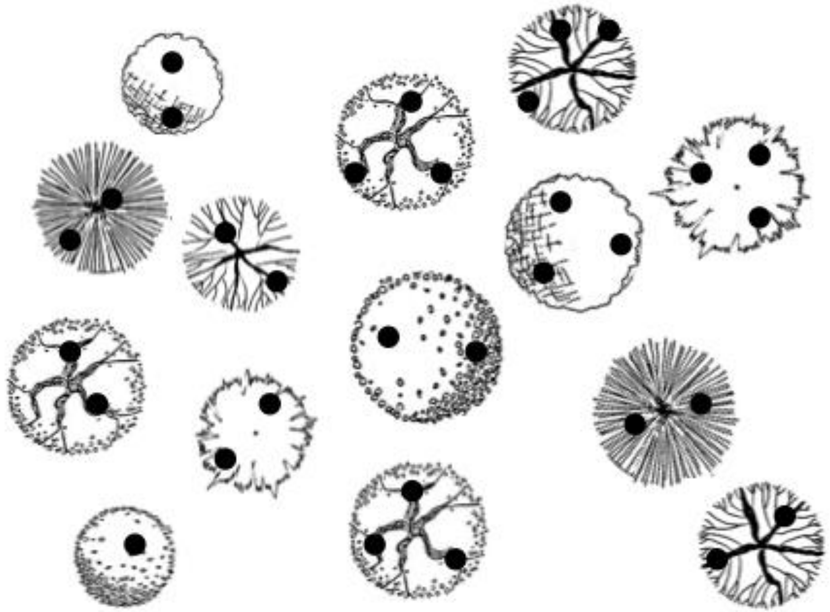
- multi-channel installation (spatial)
- one year duration (technical / aesthetic)
- autonomous system | self-sustaining | low impact
- robust but affordable / reproduceable (DIY)
- respond to data: real-time environmental
- public!







sensingtheforest.github.io/exhibition/your-sonic-forest-data-logger-mike-bell-and-catrina-james/

Customised data logger

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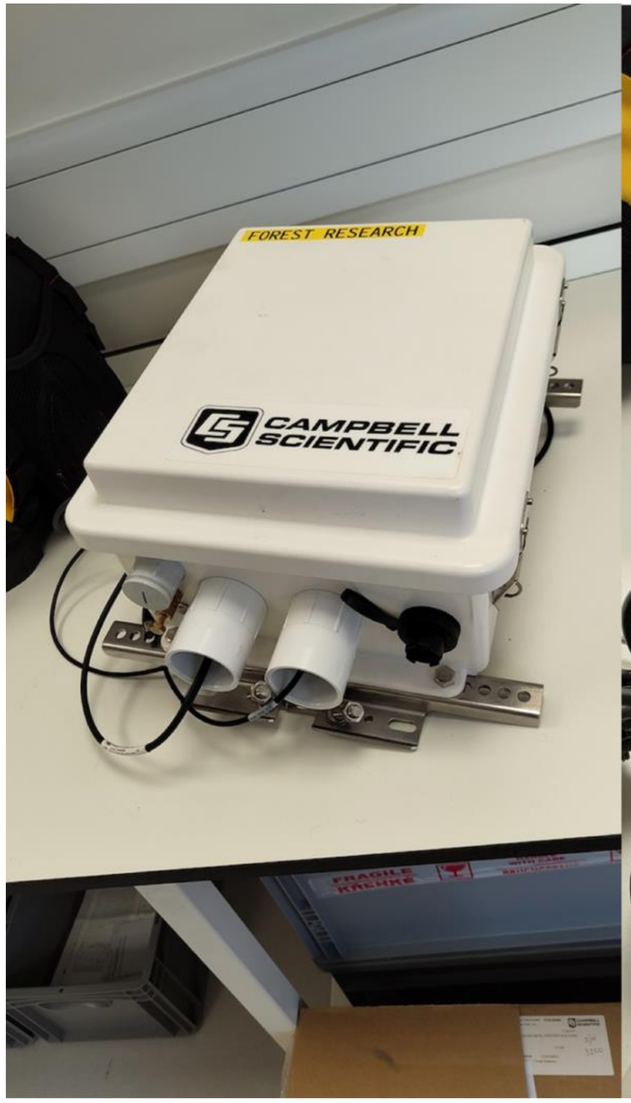
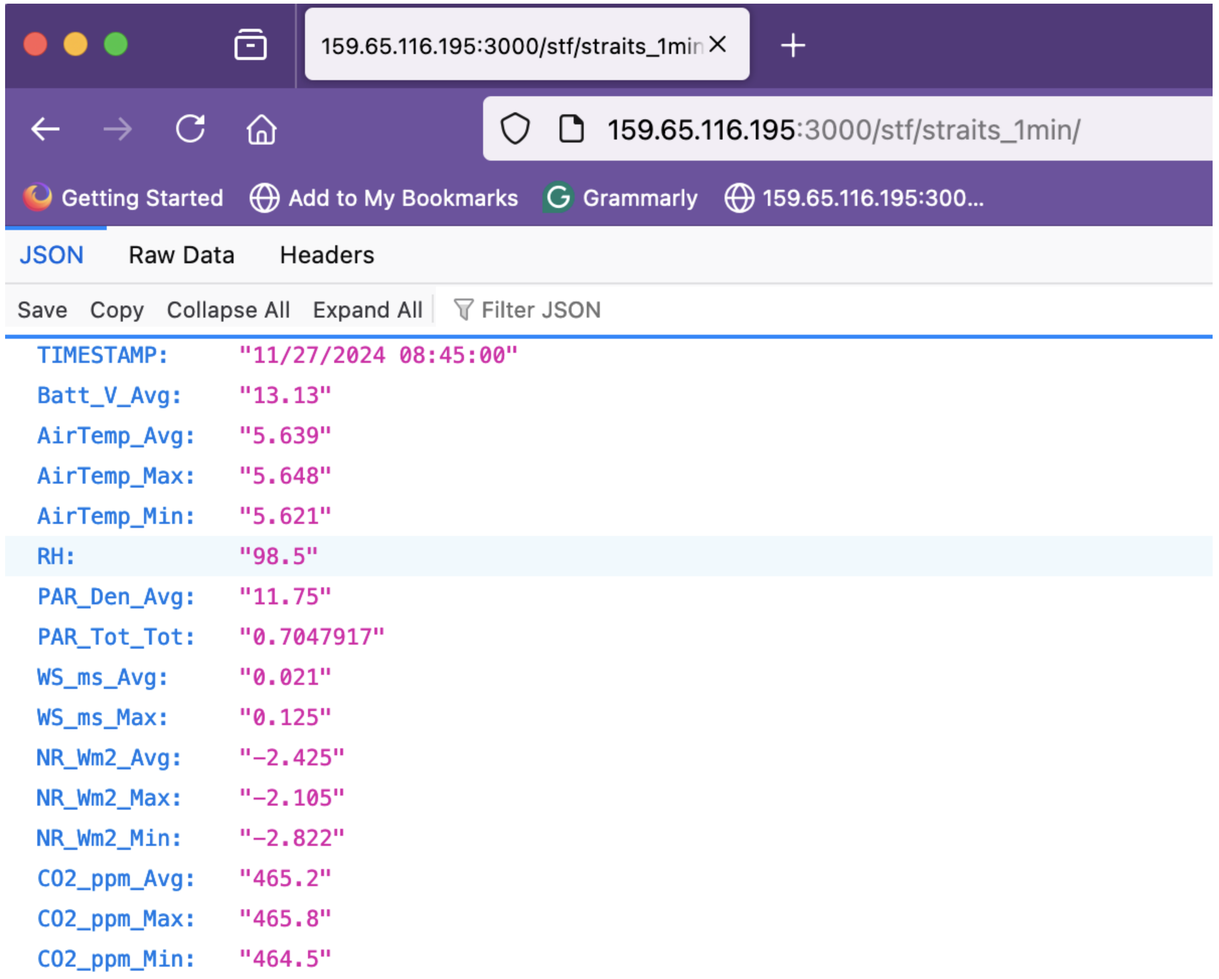


Customised web server & web client in PureData



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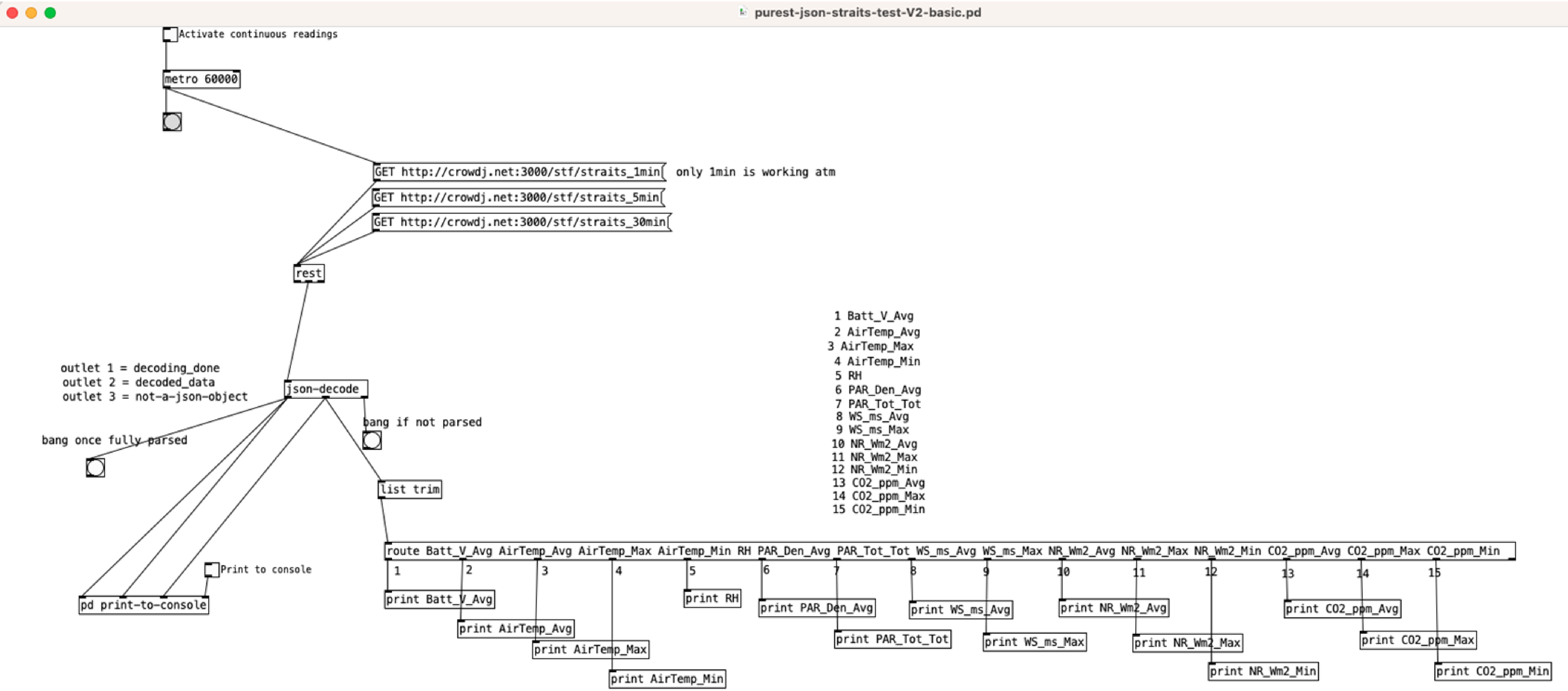

Customised web server & web client in PureData

0 TIMESTAMP Time of producing the JSON file with the below information. Format: DD/MM/YYYY HH:MM:SS

1 Batt*V*Avg

Air temperature

2 AirTemp_Avg - average value for the frequency measured (e.g. 1min) of air temperature in degrees celsius

3 AirTemp_Max - max value for the frequency measured (e.g. 1min) of air temperature in degrees celsius

4 AirTemp_Min - min value for the frequency measured (e.g. 1min) of air temperature in degrees celsius

Relative humidity measures water vapor relative to the temperature of the air (actual amount of water vapor in the air compared to the total amount of vapor that can exist in the air at its current temperature).

5 RH - relative humidity measured as % saturation ** Photosynthetically active radiation (PAR)** Solar radiation from 400 to 700 nanometers used by the photosynthetic organisms for the process of photosynthesis (active radiation).

6 PAR*Den*Avg - average value for the frequency measured (e.g. 1min) of the flux density in umol/s/m^2

7 PAR*Tot*Tot - total flux over period (mmol/m^2)

Wind speed (anenometer) measures the speed of the wind.

8 WS*ms*Avg - average value for the frequency measured (e.g. 1min) of wind speed in metres per second

9 WS*ms*Max - max value for the frequency measured (e.g. 1min) of wind speed in metres per second

Net radiation measures the balance between incoming and outgoing radiation under outdoor conditions

10 NR*Wm2*Avg - average value for the frequency measured (e.g. 1min) of net radiation in watts per square metre

11 NR*Wm2*Max - max value for the frequency measured (e.g. 1min) of net readiation in watts per square metre

12 NR*Wm2*Min - min value for the frequency measured (e.g. 1min) of net readiation in watts per square metre

Carbon dioxide (CO2) concentration measure the level of CO2 as a percentage of a volume of air

13 CO2*ppm*Avg - average value for the frequency measured (e.g. 1min) of CO2 concentration in parts per million

14 CO2*ppm*Max - max value for the frequency measured (e.g. 1min) of CO2 concentration in parts per million

15 CO2*ppm*Min - min value for the frequency measured (e.g. 1min) of CO2 concentration in parts per million

Willows Green Trail
Alice Holt Forest

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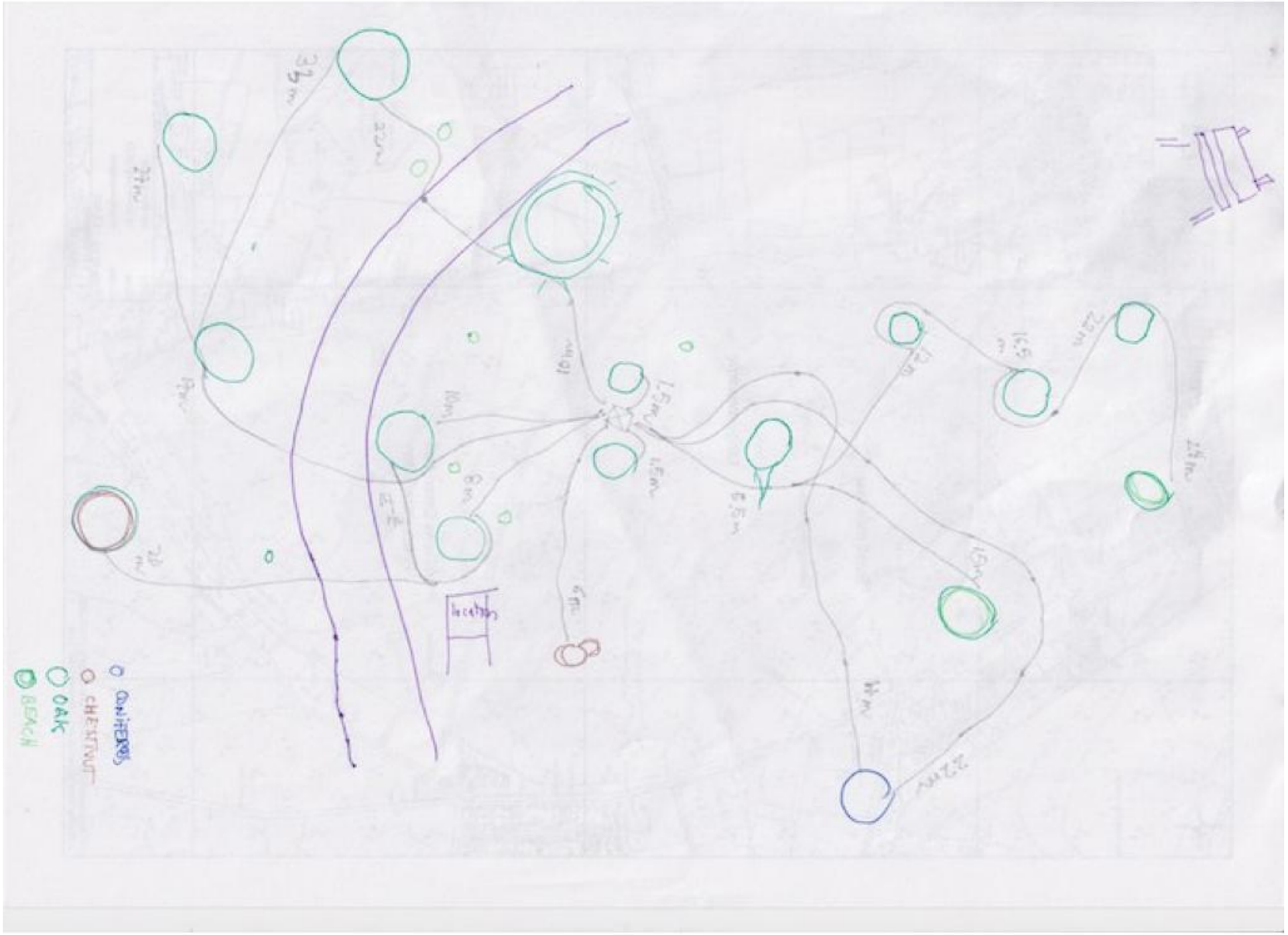
Dendrophone Site
Alice Holt Forest

sensing the forest

sensing the forest



Measurement Sketches

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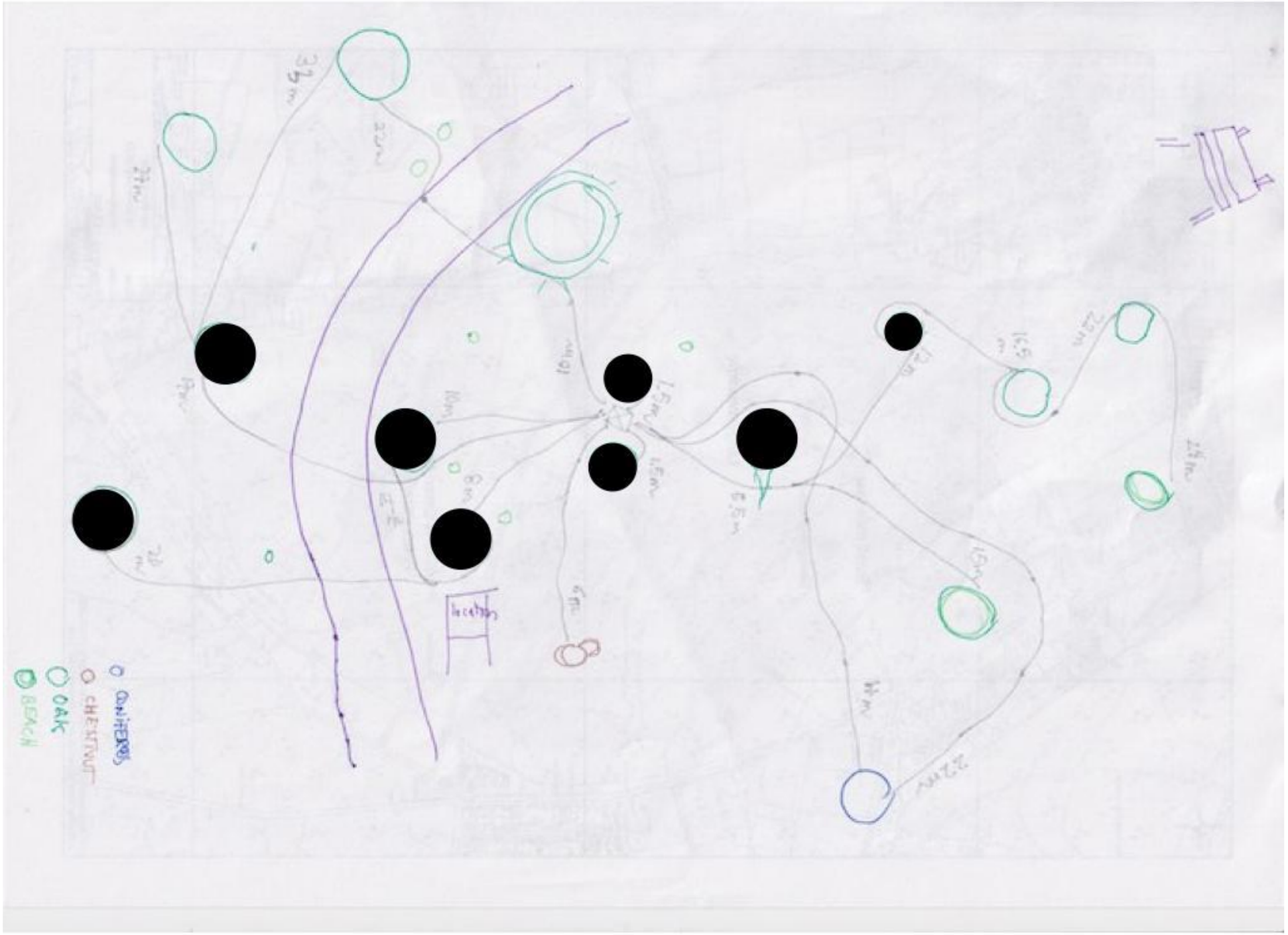

Tree ‘hosts’

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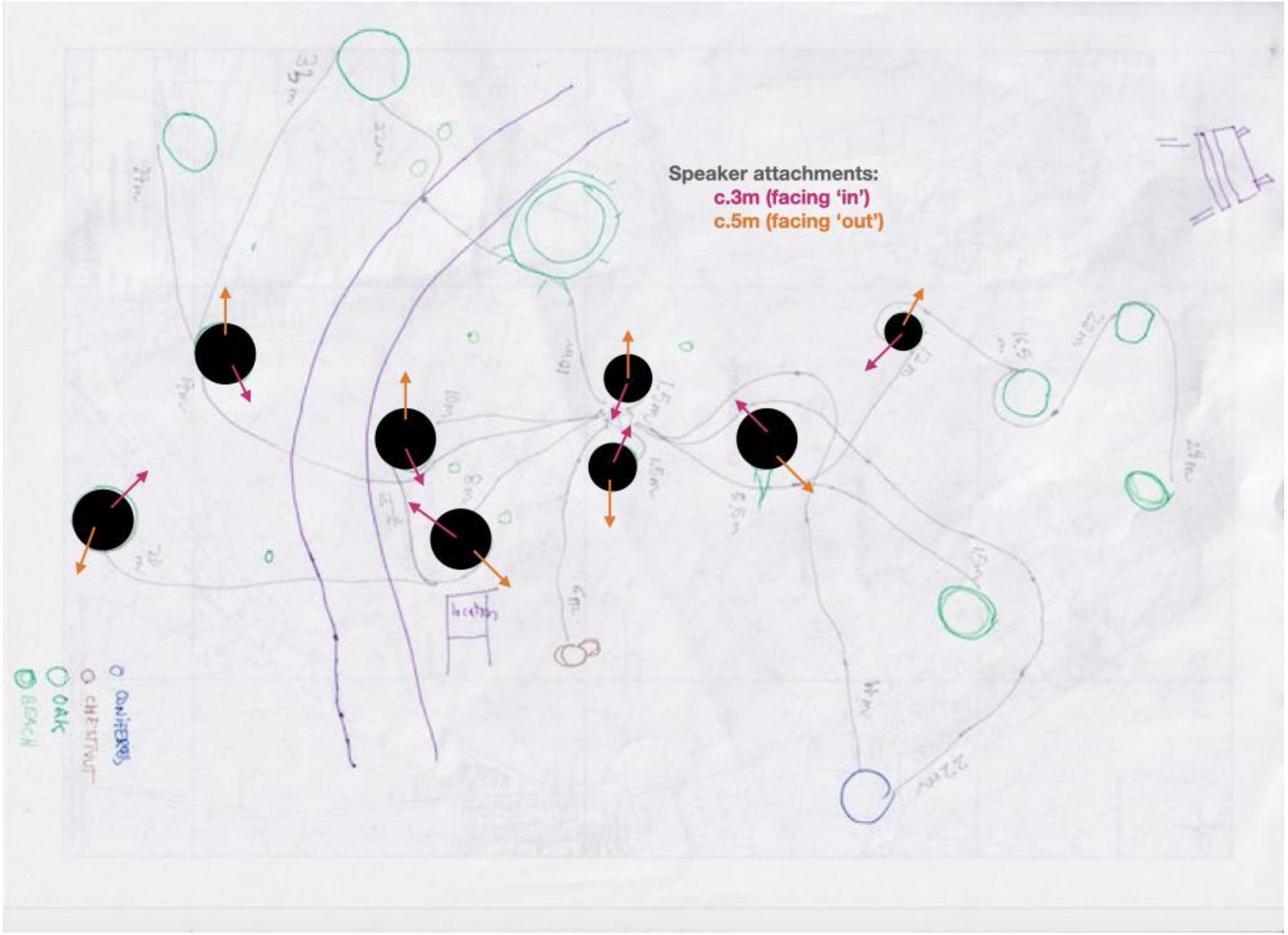

Speaker Orientation

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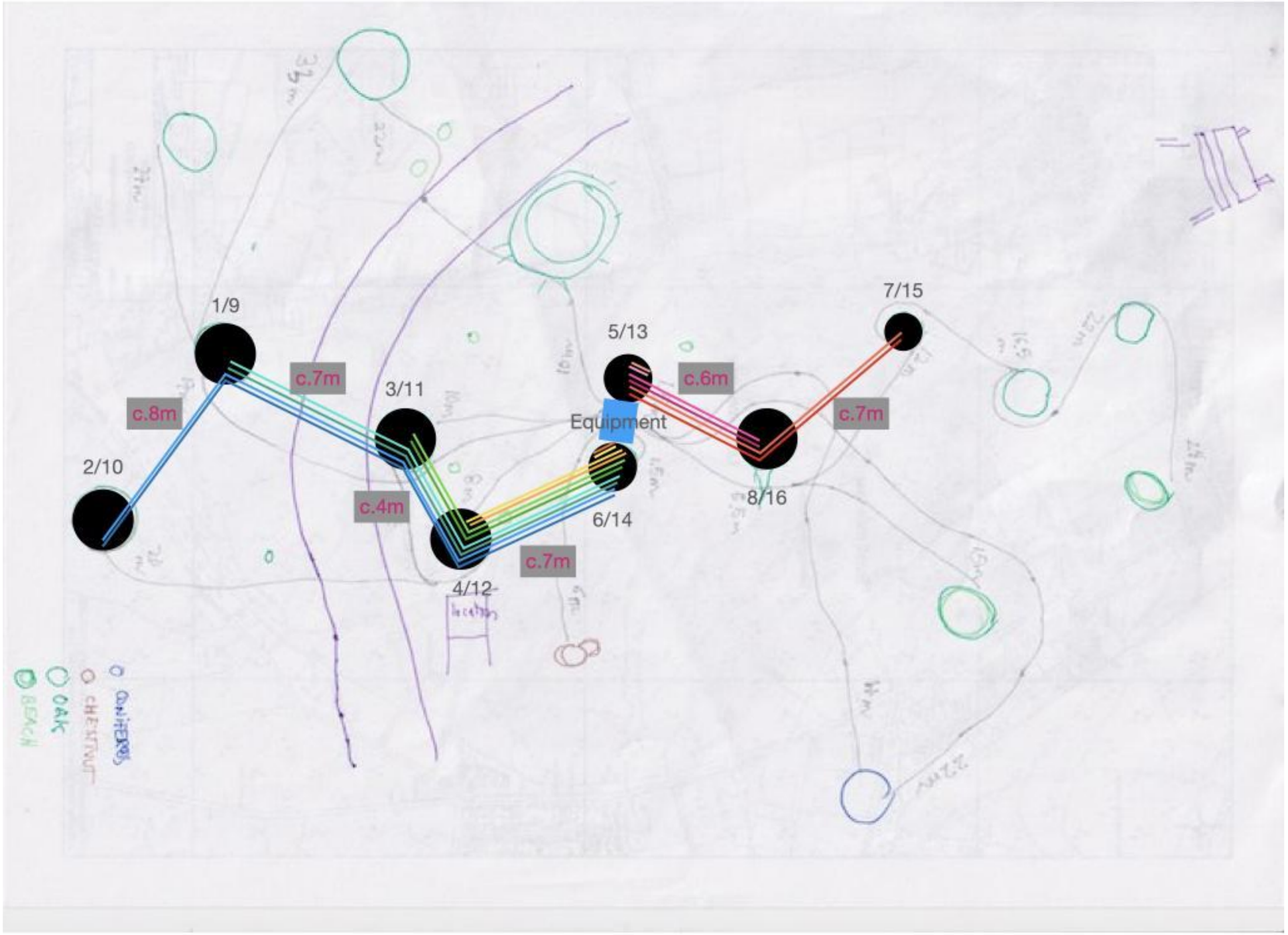
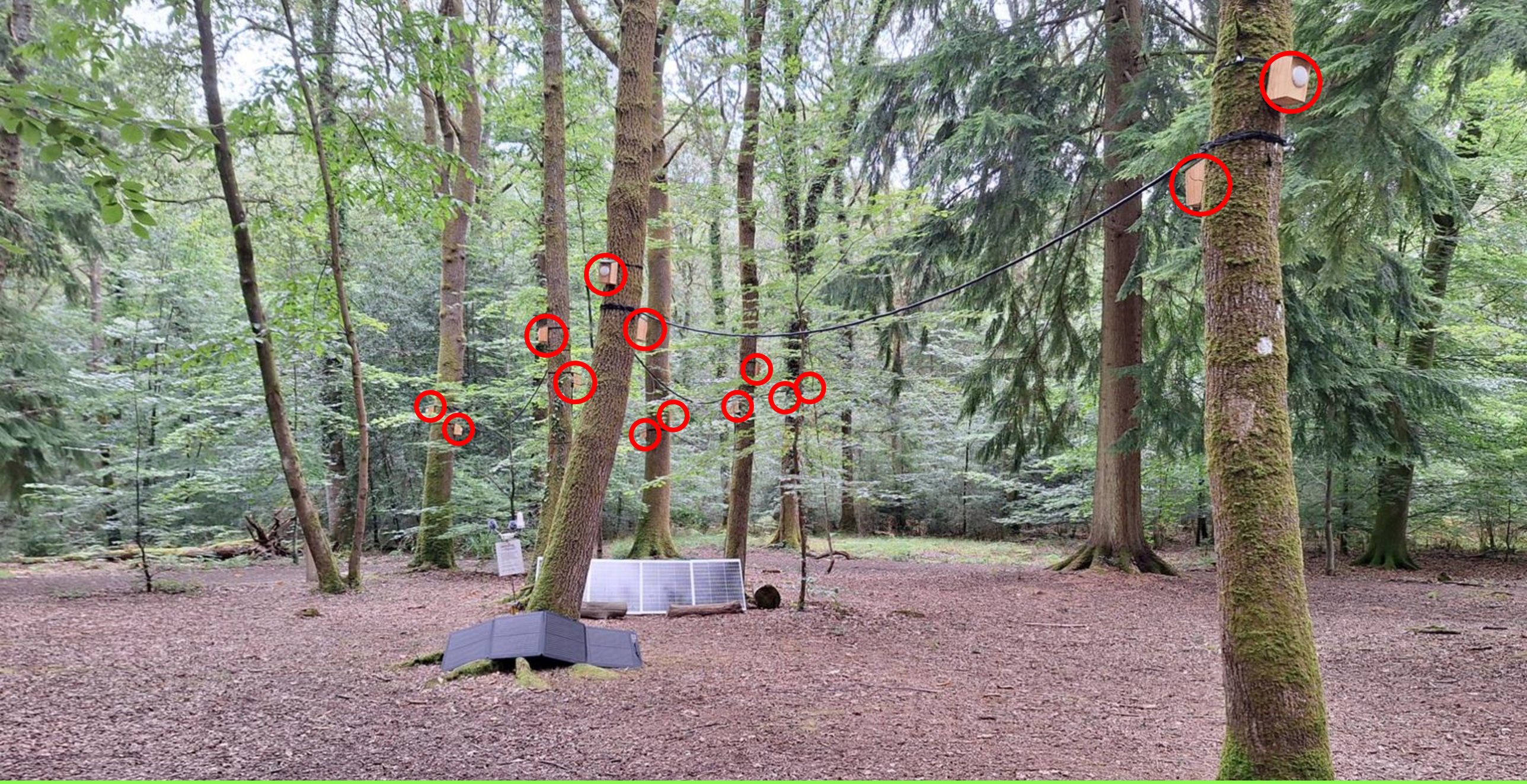


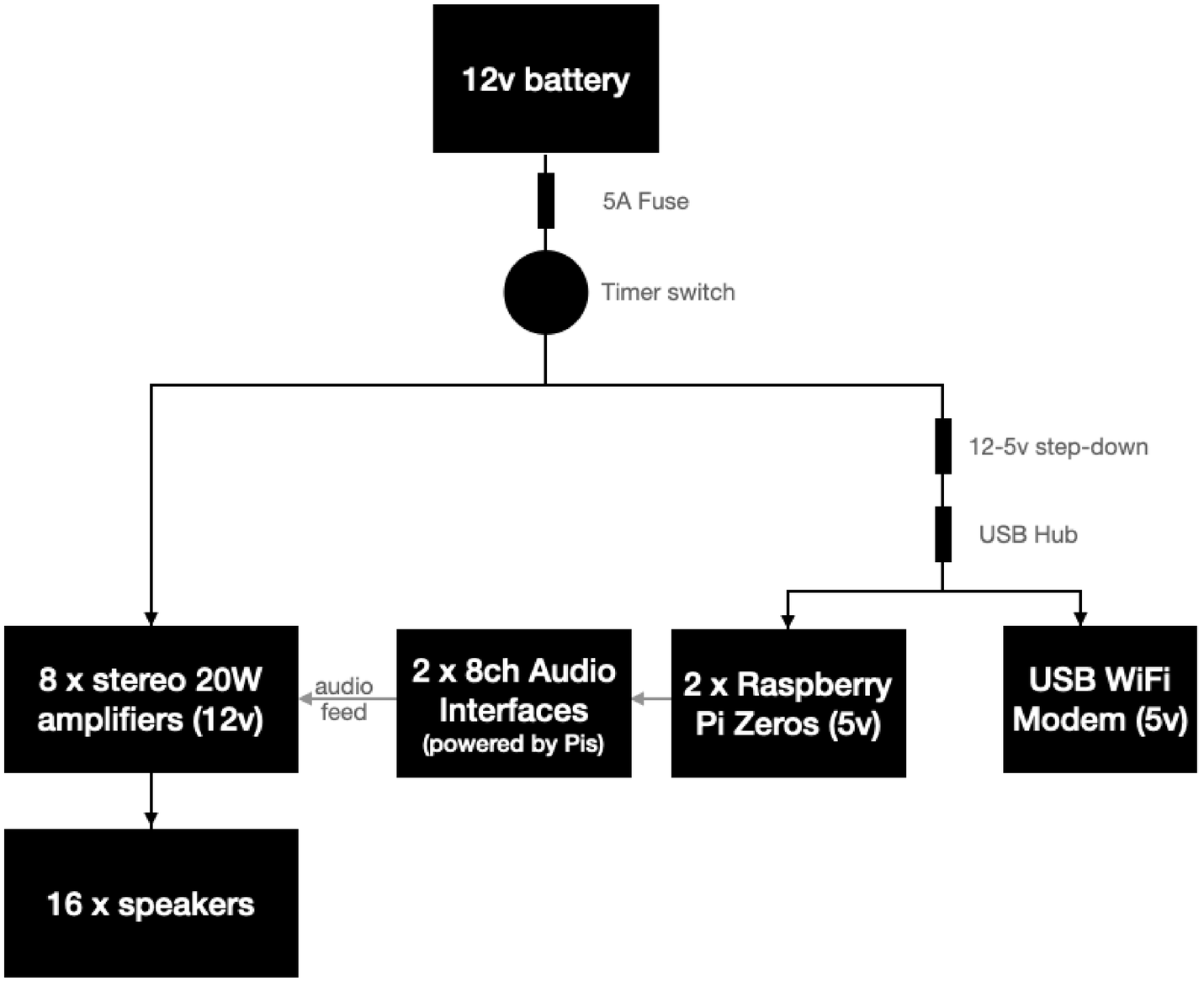
Speaker Wiring

sensingtheforest.github.io/exhibition/your-sonic-forest-dendrophone-peter-batchelor/



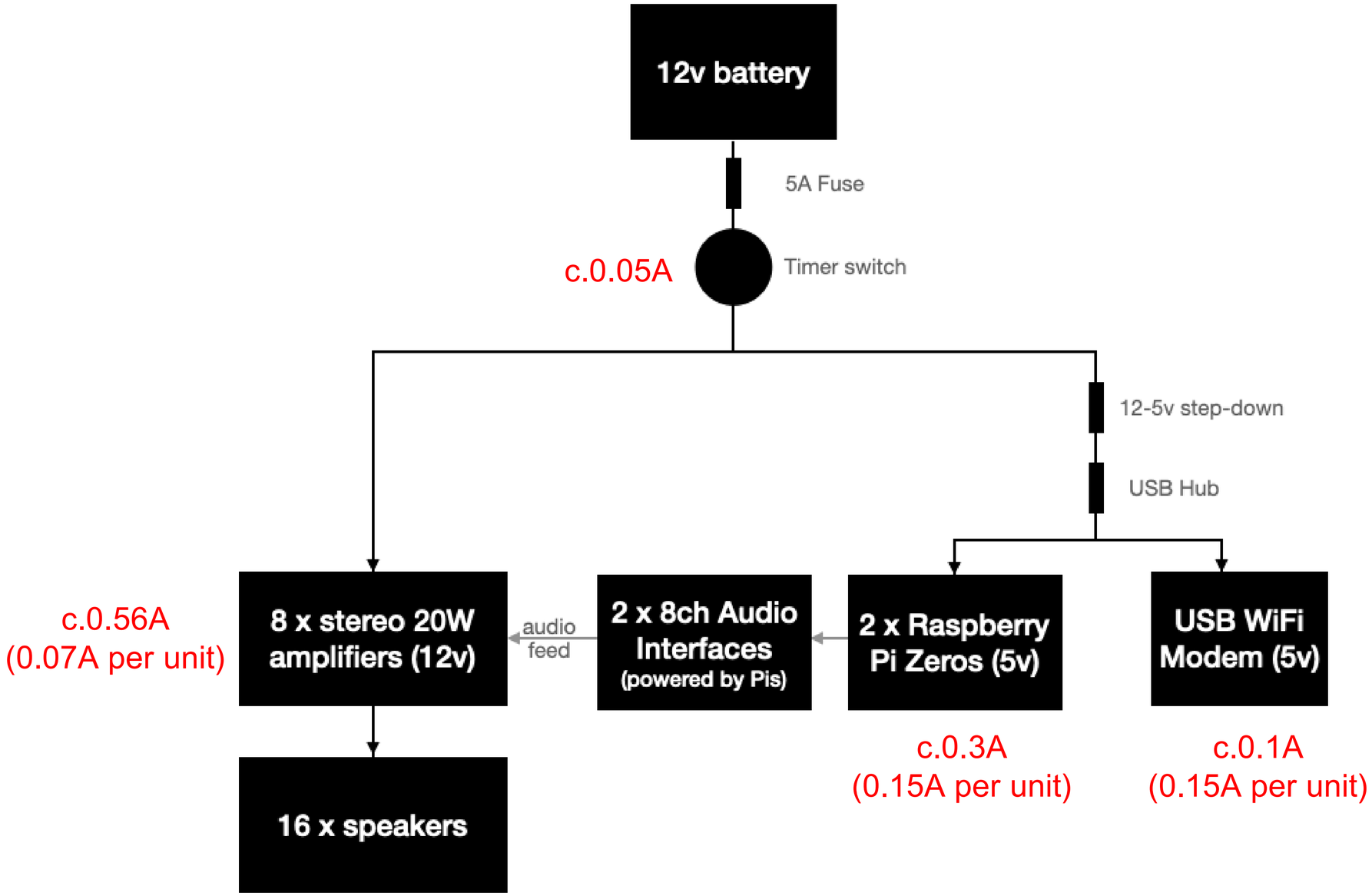
sensingtheforest.github.io/exhibition/your-sonic-forest-dendrophone-peter-batchelor/

Equipment Schematic



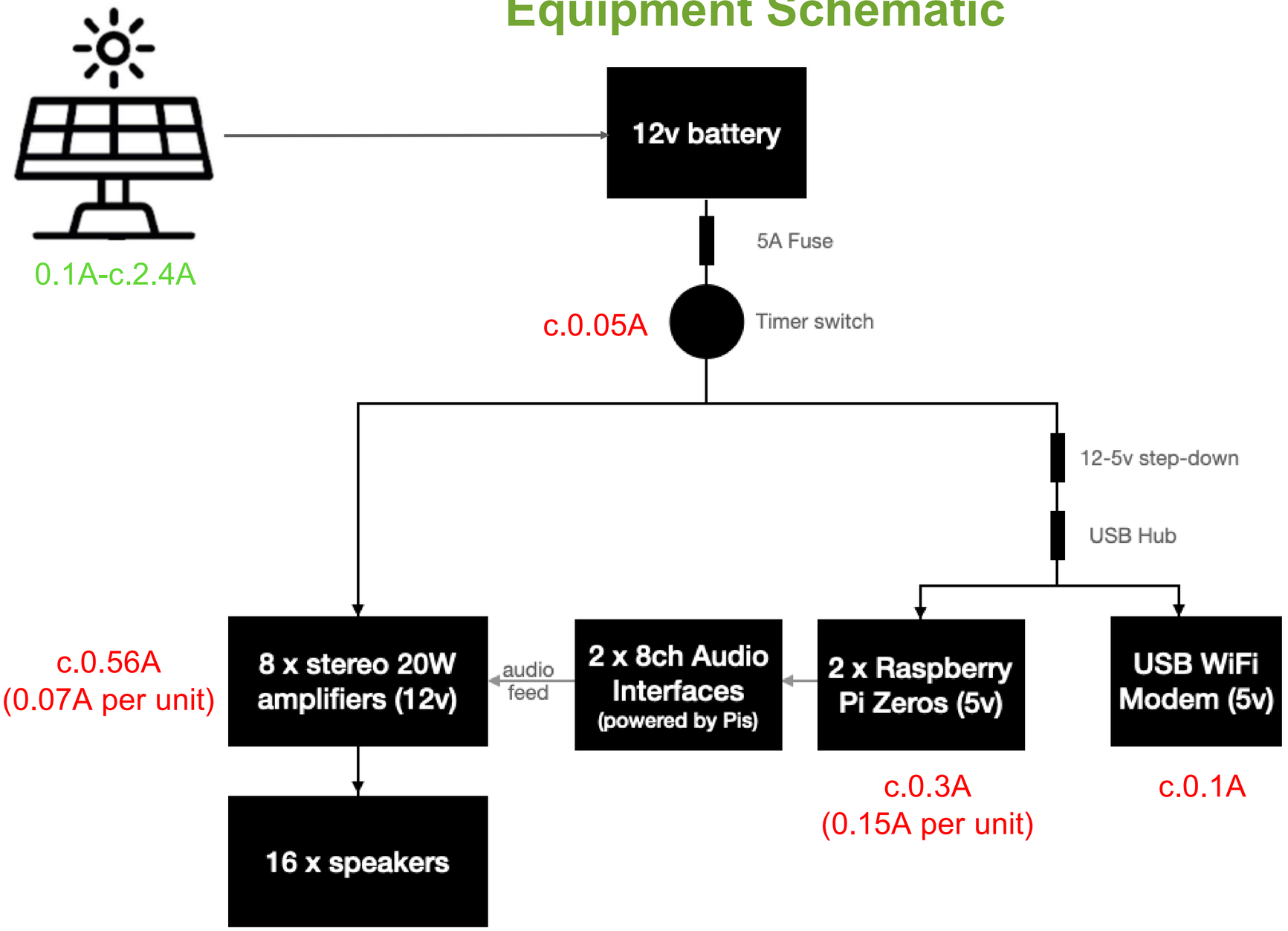
Equipment Schematic

sensing the forest



Overall Draw: c.1A

Equipment Schematic

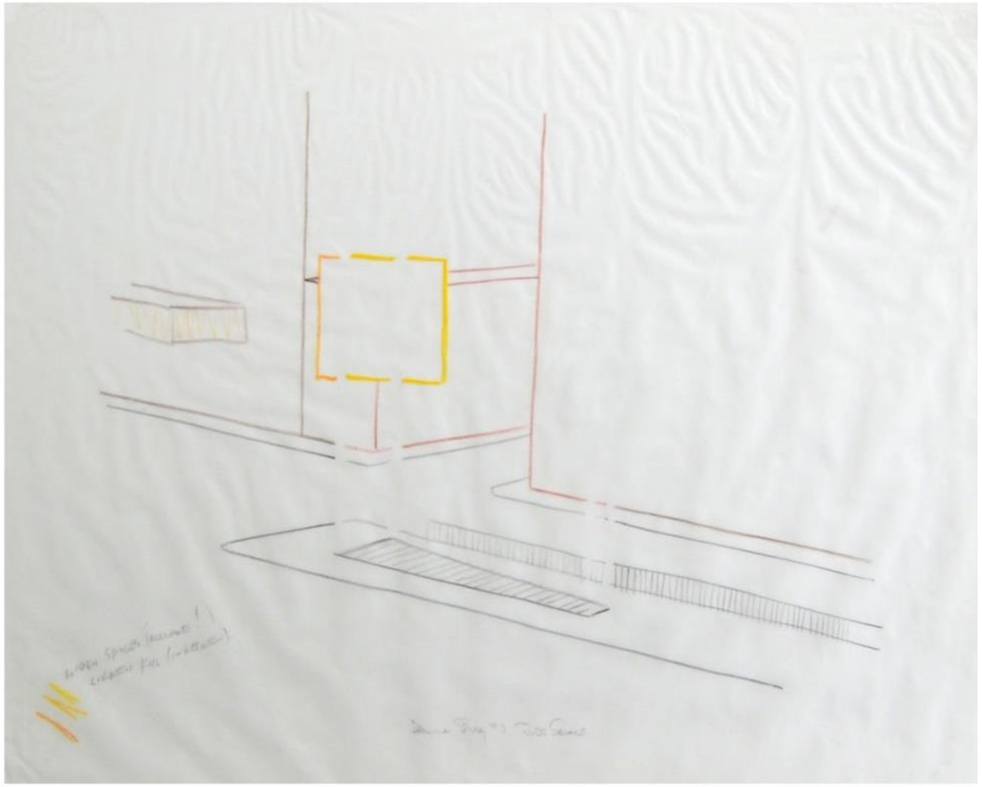


Overall Draw: c.1A


sensing
the forest


ECO-WORTHY


sensing
the forest



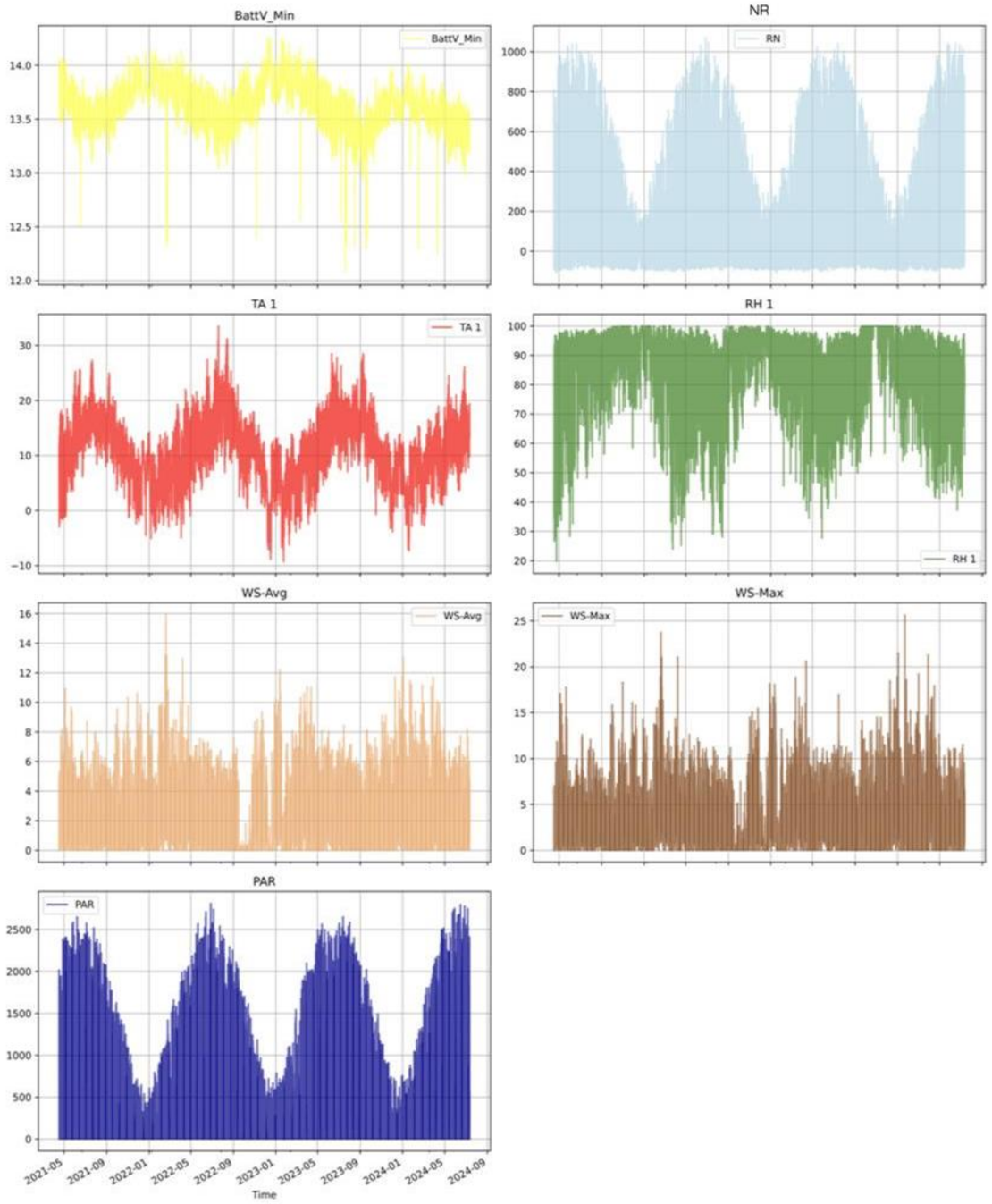
Max Neuhaus, Time Square, 1992.

The piece isn’t meant to startle, it’s meant for people who are ready to discover. In fact, I never do a work where everybody stops and notices it, I want at least 50% of the people to walk through it without noticing it.

Most of the people who don’t know what it is take it as a beautiful anomaly that they found ... something inadvertent that they take as their own. I think that by not claiming it myself I allow them to claim it.

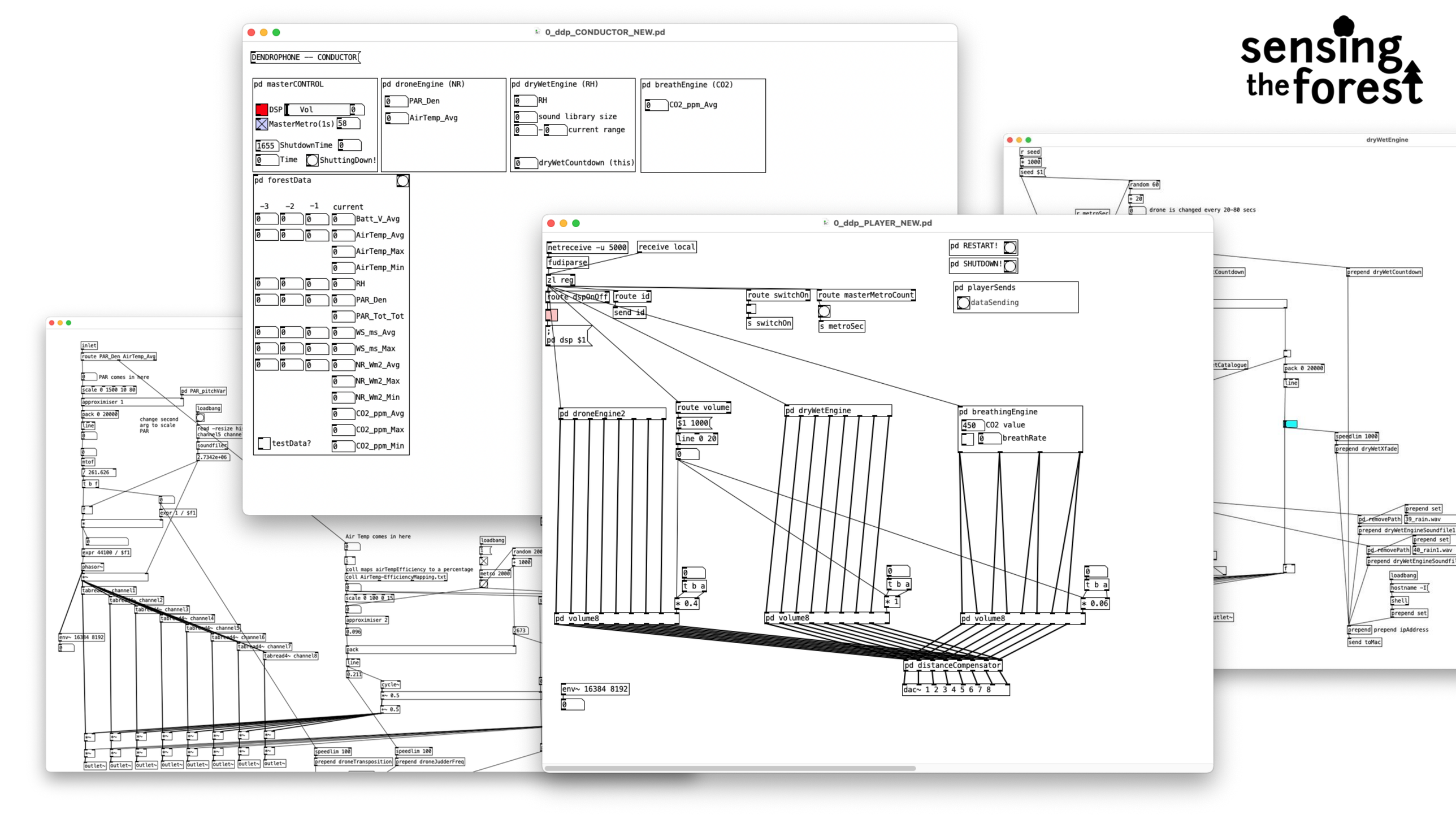
Max Neuhaus


sensing
the forest

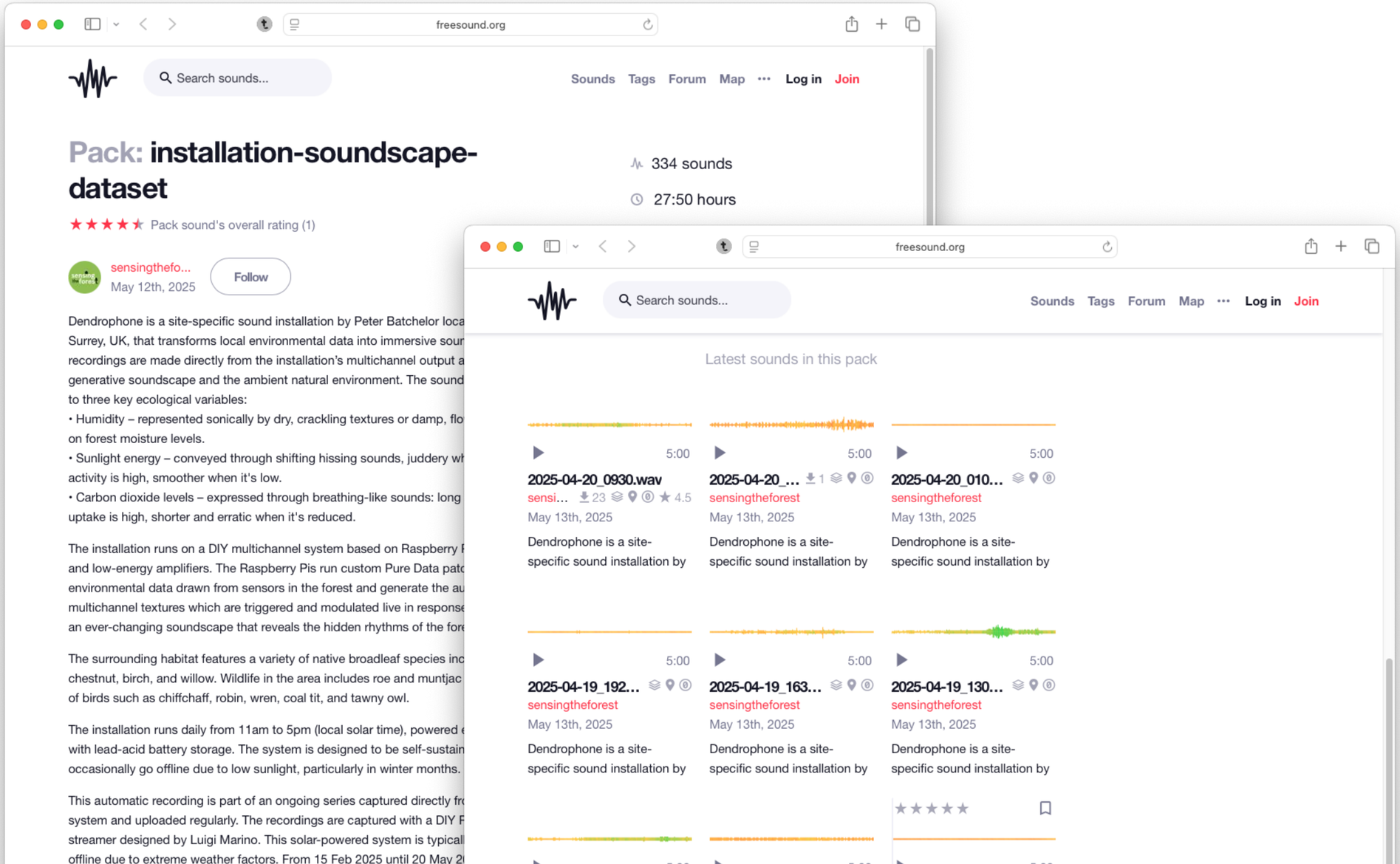


DATA & Mappings

- **Relative Humidity** — mapped to multichannel soundscapes suggestive of forest ‘dryness’ vs ‘wetness’
- **PAR & Temperature**— mapped to drones which suggest ‘energy’ / photosynthesis activity
- **CO2** — mapped to ‘breathing’ sound — slower breathing = greater CO2 uptake


sensing the forest
0_ddp_CONDUCTOR_NEW.pd
DENDROPHONE -- CONDUCTOR
pd masterCONTROL
DSP
Vol
MasterMetro(1s)
ShutdownTime
Time
ShuttingDown!
pd droneEngine (NR)
PAR_Den
AirTemp_Avg
pd dryWetEngine (RH)
RH
sound library size
current range
dryWetCountdown (this)
pd breathEngine (CO2)
CO2_ppm_Avg
pd forestData
current
Batt_V_Avg
AirTemp_Avg
AirTemp_Max
AirTemp_Min
RH
PAR_Den
PAR_Tot_Tot
WS_ms_Avg
WS_ms_Max
NR_Wm2_Avg
NR_Wm2_Max
NR_Wm2_Min
CO2_ppm_Avg
CO2_ppm_Max
CO2_ppm_Min
testData?
0_ddp_PLAYER_NEW.pd
netreceive -u 5000
receive local
fudiparse
zl reg
route dspOnOff
route id
send id
route switchOn
route masterMetroCount
s switchOn
s metroSec
pd RESTART!
pd SHUTDOWN!
pd playerSends
dataSending
pd dsp $1
pd droneEngine2
route volume
$1 1000
line 0 20
pd dryWetEngine
pd breathingEngine
450 CO2 value
breathRate
pd volume8
pd distanceCompensator
dac~ 1 2 3 4 5 6 7 8
env~ 16384 8192
dryWetEngine
drone is changed every 20-80 secs
prepend dryWetCountdown
pack 0 20000
speedlim 1000
prepend dryWetXfade
prepend dryWetEngineSoundfile1
prepend dryWetEngineSoundfile
pd removePath
39_rain.wav
40_rain1.wav
loadbang
hostname -I
shell
prepend ipAddress
send toMac
inlet
route PAR_Den AirTemp_Avg
PAR comes in here
scale 0 1500 10 80
pd PAR_pitchVar
approximiser 1
pack 0 20000
change second arg to scale PAR
soundfiler
mtof
/ 261.626
t b f
expr 44100 / $f1
phasor~
tabread4~ channel1
tabread4~ channel2
tabread4~ channel3
tabread4~ channel4
tabread4~ channel5
tabread4~ channel6
tabread4~ channel7
tabread4~ channel8
Air Temp comes in here
coll maps airTempEfficiency to a percentage
coll AirTemp-EfficiencyMapping.txt
scale 0 100 0 15
approximiser 2
pack
cycle~
speedlim 100
prepend droneTransposition
prepend droneJudderFreq
outlet~

Freesound


freesound.org
Search sounds...
Sounds Tags Forum Map ... Log in Join
Pack: installation-soundscape-dataset
334 sounds
27:50 hours
Pack sound's overall rating (1)
sensingthefo...
May 12th, 2025
Follow
Dendrophone is a site-specific sound installation by Peter Batchelor loca
Surrey, UK, that transforms local environmental data into immersive sour
recordings are made directly from the installation's multichannel output a
generative soundscape and the ambient natural environment. The sound
to three key ecological variables:
• Humidity – represented sonically by dry, crackling textures or damp, flo
on forest moisture levels.
• Sunlight energy – conveyed through shifting hissing sounds, juddery wh
activity is high, smoother when it's low.
• Carbon dioxide levels – expressed through breathing-like sounds: long
uptake is high, shorter and erratic when it's reduced.
The installation runs on a DIY multichannel system based on Raspberry P
and low-energy amplifiers. The Raspberry Pis run custom Pure Data patc
environmental data drawn from sensors in the forest and generate the au
multichannel textures which are triggered and modulated live in response
an ever-changing soundscape that reveals the hidden rhythms of the fore
The surrounding habitat features a variety of native broadleaf species inc
chestnut, birch, and willow. Wildlife in the area includes roe and muntjac
of birds such as chiffchaff, robin, wren, coal tit, and tawny owl.
The installation runs daily from 11am to 5pm (local solar time), powered
with lead-acid battery storage. The system is designed to be self-sustain
occasionally go offline due to low sunlight, particularly in winter months.
This automatic recording is part of an ongoing series captured directly fr
system and uploaded regularly. The recordings are captured with a DIY F
streamer designed by Luigi Marino. This solar-powered system is typicall
offline due to extreme weather factors. From 15 Feb 2025 until 20 May 2
freesound.org
Search sounds...
Sounds Tags Forum Map ... Log in Join
Latest sounds in this pack
5:00
2025-04-20_0930.wav
sensi... 23 4.5
May 13th, 2025
Dendrophone is a site-specific sound installation by
5:00
2025-04-20_... 1
sensingtheforest
May 13th, 2025
Dendrophone is a site-specific sound installation by
5:00
2025-04-20_010...
sensingtheforest
May 13th, 2025
Dendrophone is a site-specific sound installation by
5:00
2025-04-19_192...
sensingtheforest
May 13th, 2025
Dendrophone is a site-specific sound installation by
5:00
2025-04-19_163...
sensingtheforest
May 13th, 2025
Dendrophone is a site-specific sound installation by
5:00
2025-04-19_130...
sensingtheforest
May 13th, 2025
Dendrophone is a site-specific sound installation by

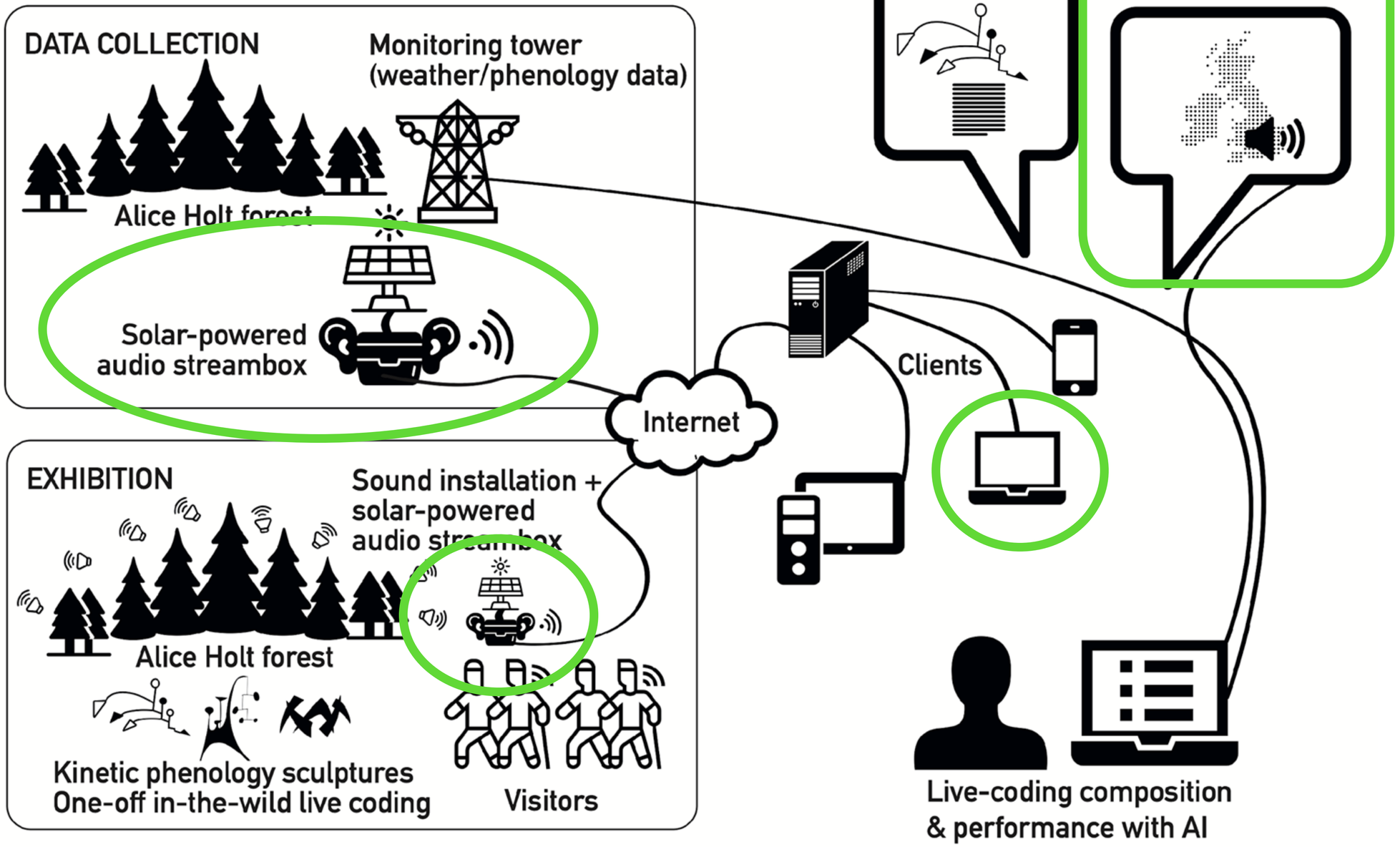
Activity 1
Sonification discussion

Break

sensing the forest

WP1
Streamers

Forest Intervention WP1



sensing the forest



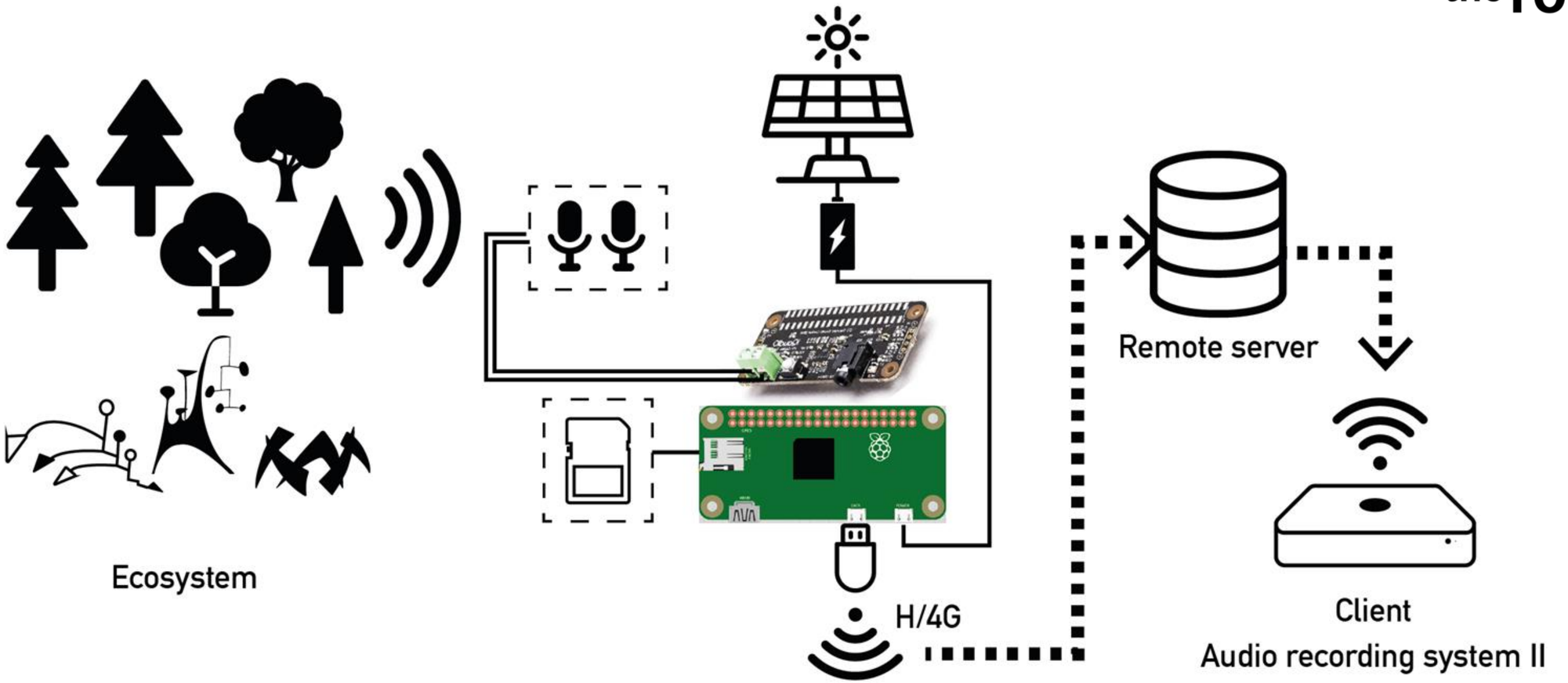






2x Audio streamers

sensing the forest



Streamers' updates

sensing the forest

- We started from the Locusonus streambox project https://locusonus.org/streambox/README.html
- Adjusted for the current standards we found now in the online community (Raspberry Pi, Darkice, Computer Music Tools)
- Added features specific to our project (solar crontab, safety measures, user independence)
- Eco-friendly design (3d printed PLA cases, beeswax for waterproofing, recycled battery protection boxes)
- Software release and 3d print models coming! (As soon as we are sure it survives into the wild…)

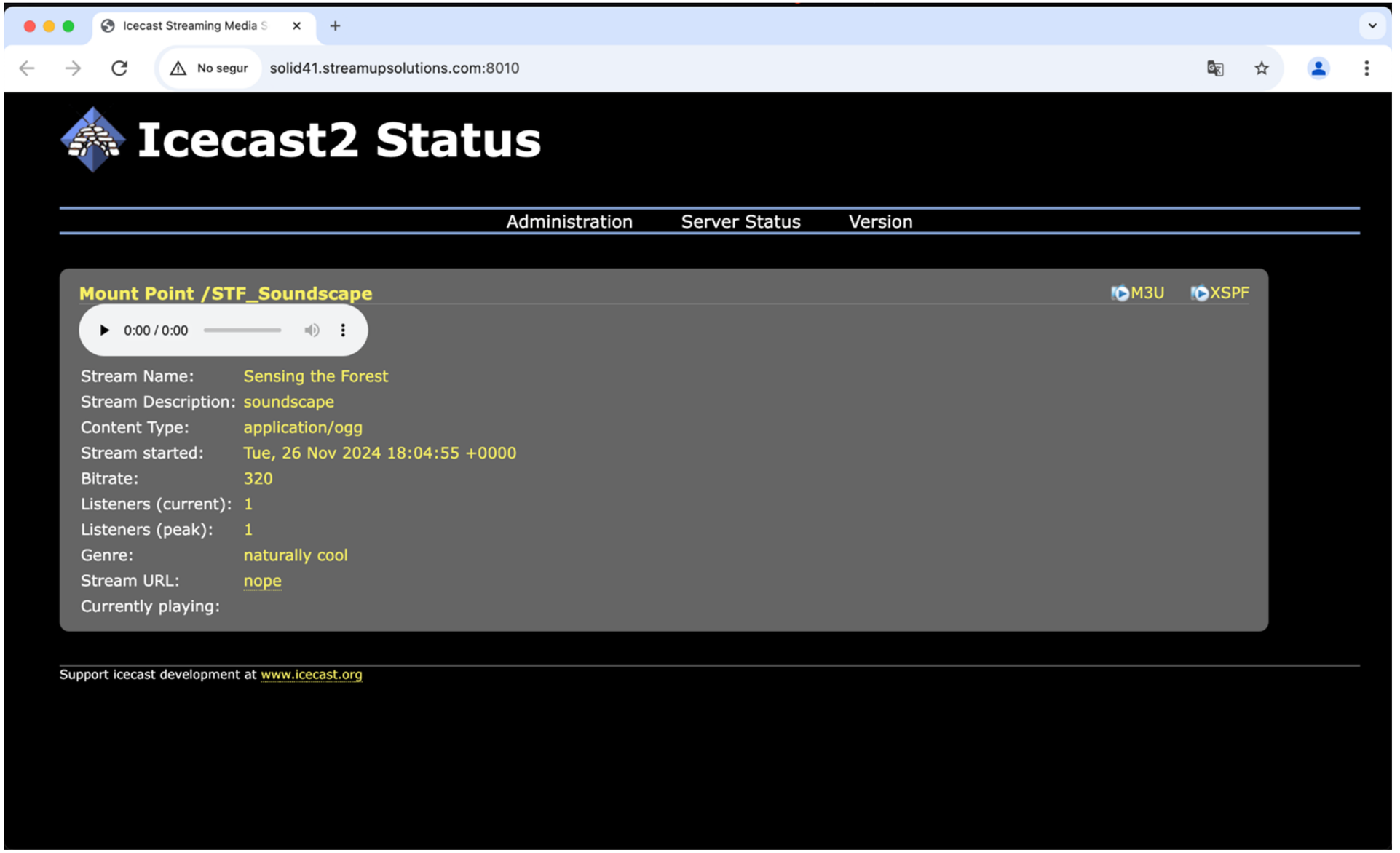

Map
Satellite
The Barn at Bury Court
Northbrook Park Wedding Venue
Wrecclesham
THE BOURNE
LOWER BOURNE
Waverley Abbey
Islamabad (Tilford)
Bourne Woods
Charles Hill
Charleshill
Lower Froyle
The Anchor Inn
Bentley
A31
A325
B3384
B300
Birdworld
Rowledge
Rural Life Living Museum
Tilford
Upper Froyle
Isington
Boundstone
The Reeds Rd
Tilford Rd
Hankley Common Golf Club
FROYLE
Blacknest Rd
Shortfield Common
Millbridge
Alice Holt Forest
Bucks Horn Oak
Blacknest
Blacknest Country Club
Dockenfield St
Frensham
Pitt Ln
Moat Pond
Hankley Common
London Rd
River Hl
Binsted
Holybourne
Batt's Corner
Frensham Great Pond
Dockenfield
Hay Place
Neatham
ALDI
Mill Ln
Frensham Country Pk
Rushmoor
Frensham Pond Hotel & Spa
High Thicket Rd
Wheatley
Frith End
Thursley Rd
Dyehou
Wyck
Country Market : Garden Centre, Farm Shop &...
Pitch Place
lf Course
Caker Ln
Forge Rd
Kingsley
Hadeeqatul Mahdi (Jalsa Salana UK)
Green St
Churt
GREEN CROSS
Sleaford
Oakhanger Rd
BARFORD
PGL Marchants Hill
Cain Manor
West Worldham
Hartley Mauditt
The Hange
Golf Club
Beacon Hill
Lindford
B3002
Headley
A3
sensingtheforest.github.io/listen/

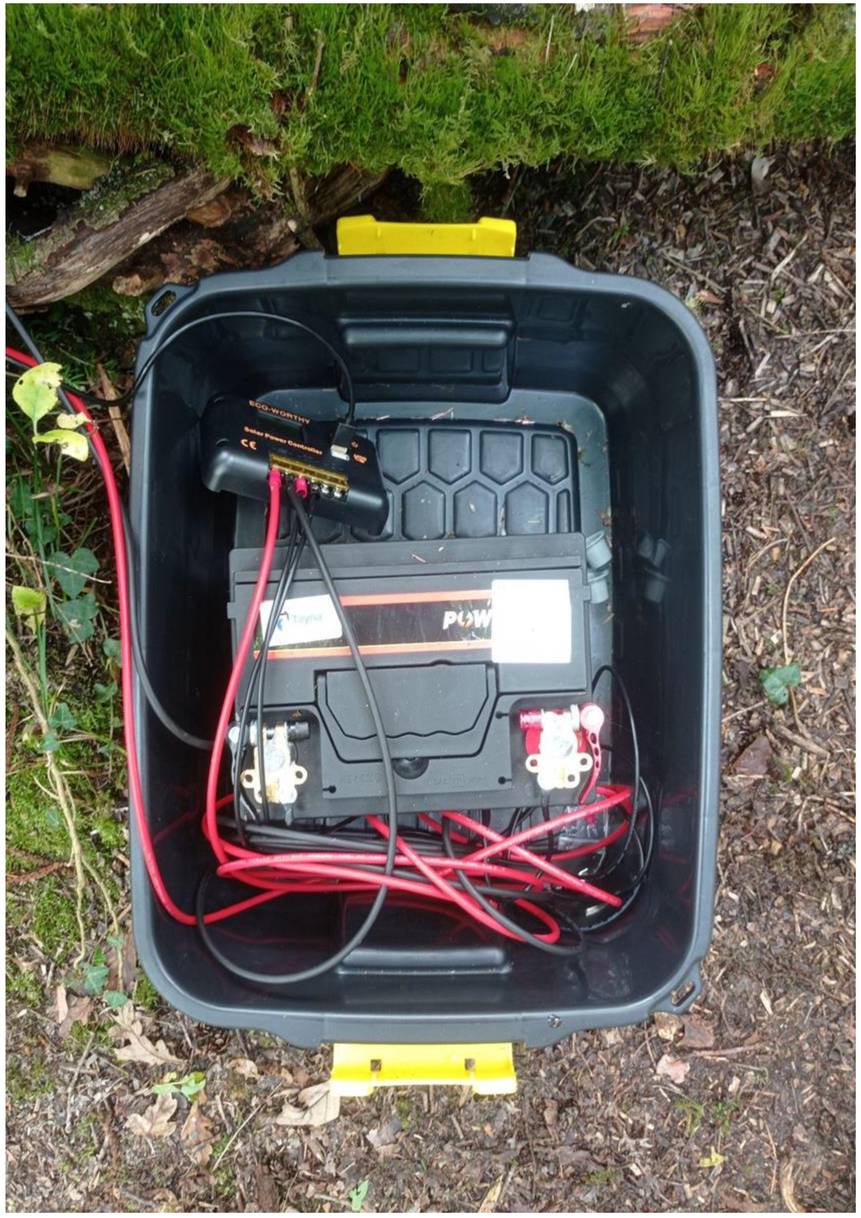
http://solid41.streamupsolutions.com:8010/ **(you can listen now)**

Web streaming - Soundscape

This is a solar-powered system, which means it sometimes goes offline

sensing the forest



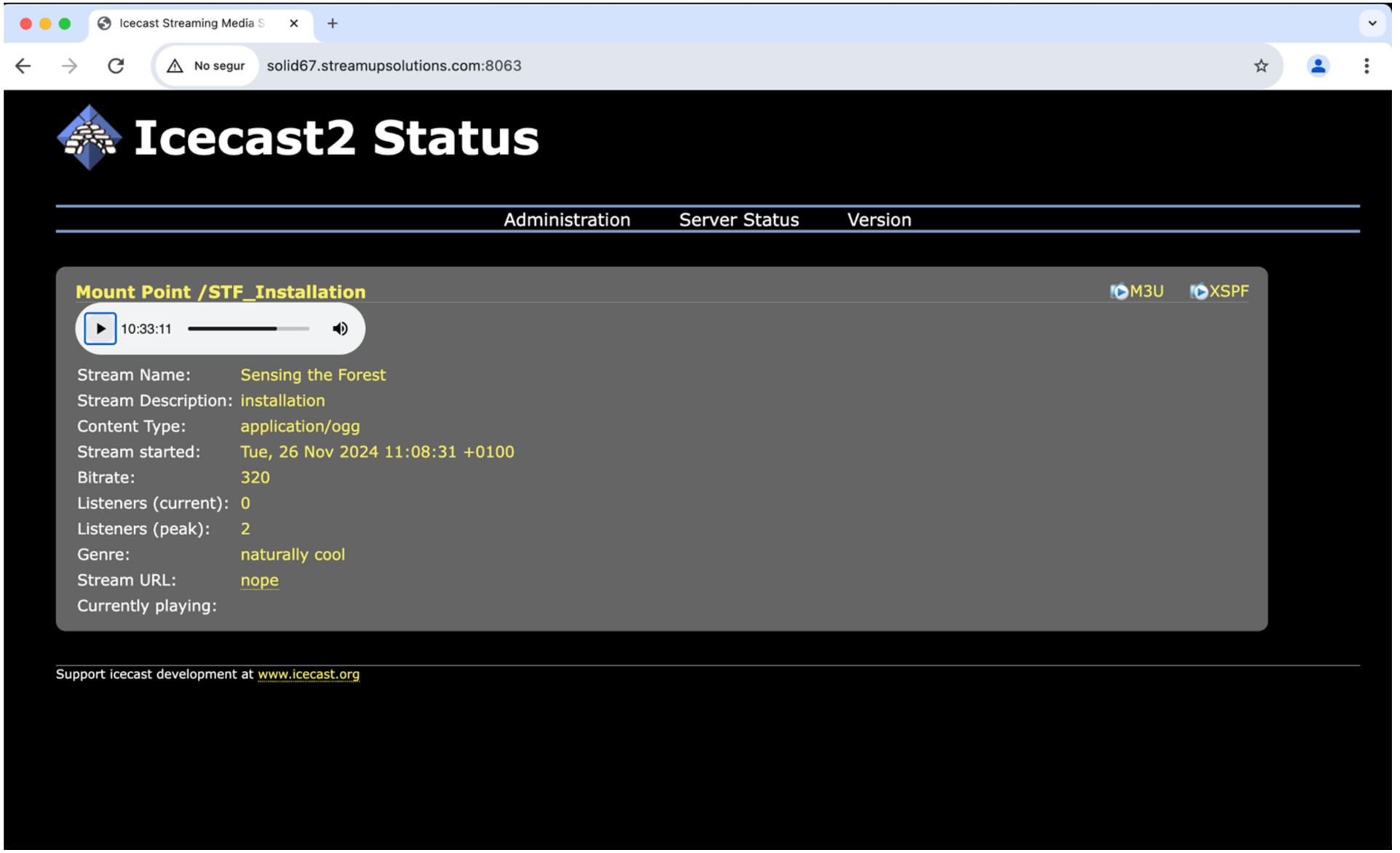


http://solid67.streamupsolutions.com:8063/ (you can listen now…)

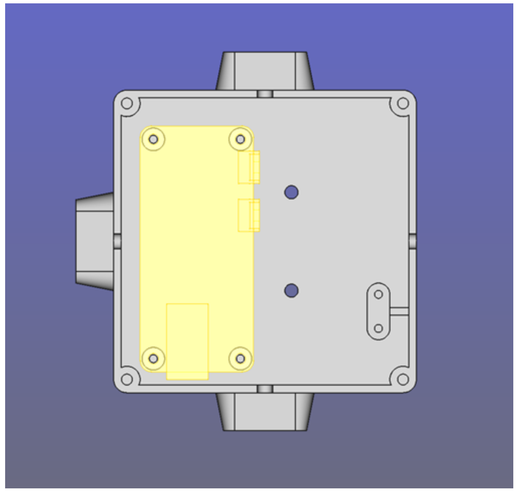
Web streaming - Installation

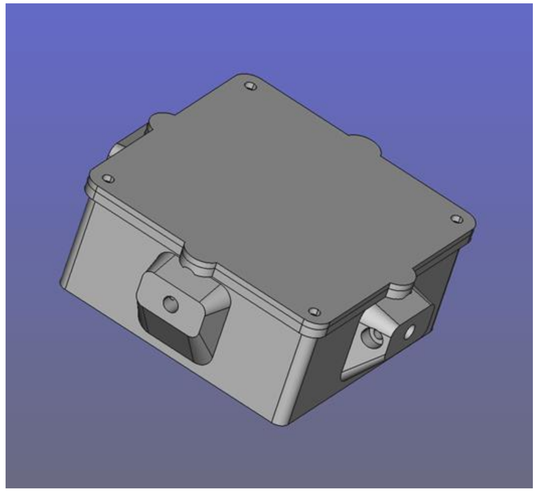
This is a solar-powered website, which means it sometimes goes offline

sensing the forest



- Designing for the forest isn’t easy!
- Solar power is a welcome and reliable solution for DIY projects that have no mains, but if you have no direct sunlight be ready for a bumpy ride…
- With DIY materials, sound quality is a complex matter.
- 3d printing if fun, affordable, and freeCAD is there for you to use it!





Streamers' Log

sensing the forest

27-Nov-2024 07:44:07 - status_darkice() - Darkice is running.
27-Nov-2024 07:44:07 - check_usb0_ip() - usb0 ip address: 192.168.225.39
27-Nov-2024 07:44:33 - record.sh - Recorded 2024-11-27_0739.wav
27-Nov-2024 07:44:33 - solar-crontab.py - Executed command for ratio 0.0 at time 07:39:33
27-Nov-2024 07:44:37 - status_darkice() - Darkice is running.
27-Nov-2024 07:44:37 - check_usb0_ip() - usb0 ip address: 192.168.225.39
27-Nov-2024 07:45:02 - battery.py - Battery Voltage: 12.35 V
27-Nov-2024 07:45:07 - status_darkice() - Darkice is running.
27-Nov-2024 07:45:07 - check_usb0_ip() - usb0 ip address: 192.168.225.39
27-Nov-2024 07:45:33 - solar-crontab.py - Sunrise: 2024-11-27 07:40:02+00:00, Sunset: 2024-11-27 16:02:05+00:00, Solar Noon: 2024-11-27 11:51:03+00:00
27-Nov-2024 07:45:33 - solar-crontab.py - Sleeping until next event in 14729.61874 seconds
27-Nov-2024 07:45:37 - status_darkice() - Darkice is running.
27-Nov-2024 07:45:38 - check_usb0_ip() - usb0 ip address: 192.168.225.39

CHIME ANNUAL CONFERENCE 2024

THE OPEN UNIVERSITY, MILTON KEYNES
1-2 DECEMBER 2024

Developing DIY Solar-Powered, Off-Grid Audio Streamers for Forest Soundscapes: Progress and Challenges

Luigi Marino[1] and Anna Xambó[2]

[1]Centre for Digital Music, Queen Mary University of London, London, UK, l.marino@qmul.ac.uk
[2]Centre for Digital Music, Queen Mary University of London, London, UK

***Abstract*— This project presents the ongoing development and challenges of building two permanent listening stations for one year located in the Alice Holt Forest in the UK using DIY practices and techniques.**

***Index Terms*—** acoustic ecology, DIY, solar power, soundscapes

I. INTRODUCTION

Sensing the Forest [1] is a project funded by the UKRI Arts and Humanities Research Council that aims to raise awareness among forest visitors/aficionados, artists, scientists, and the general public about the connection between forests and climate change.

As part of the project, we are developing two DIY solar-

- Planned future software release and 3D print models.

The streamers' mission is not only to stream live soundscapes of the forests 24/7/365, but also to create a selection of 5-minute daily recordings based on astral time. We chose astral time with all its additional challenges because nature, especially birds, does not follow our standard chronological time. The recordings will be shared with the community on the Freesound database [5]. We plan to make the year-long recordings available to artists for their practices and to scientists interested in looking for any potential connection between forest soundscape and climate change.

III. CHALLENGES

Designing for the forest presents many challenges. Solar

R E V E I L 2 0 2 5 S T R E A M S

sensing the forest

UTC
UTC +1

civil
twilight
04:53
sunrise
05:29

W

E

Alice Holt Forest

STF 2

Latitude: +51.167953543039886°
Longitude: -0.8389278909760689°

24/7 stream from a solar-powered DIY Raspberry Pi audio streamer designed by Luigi Marino.
The streamer uses two MEMS microphones connected directly to the Raspberry Pi, with no audio interface. It also builds a database of audio recordings captured at solar times—sunrise, solar noon, sunset, and during the night (between sunset and sunrise).
The primary tree species are oak, sweet chestnut, birch, and willow. Wildlife includes roe deer, muntjac deer, and various birds such as coal tit, long-tailed tit, blue tit, wren, robin, treecreeper, siskin, buzzard, and tawny owl.
From 11 am to 5 pm, the stream captures Pete Batchelor's installation Dendrophone.
This work is part of the Sensing The Forest project.

Live stream: solid67.streamupsolutions.com:8063

index

00:00

live stream (oga)

-7 -6 -5 -4 -3 UTC 1 2 3 5 7 8 9 10 12

https://streams.soundtent.org/2025/streams/utc1_-bdb0fd0f-4e5e-45d9-a967-d5b3ef37d7c9

R E V E I L 2 0 2 5 S T R E A M S

sensing the forest

UTC
UTC +1

civil
twilight
04:53
sunrise
05:29

W

E

Live stream: STF Soundscape

index

00:00

live stream (oga)

Alice Holt Forest

STF 1

Latitude: +51.18111040708432°
Longitude: -0.8332963647033798°

24/7 stream from a solar-powered DIY Raspberry Pi audio streamer designed by Luigi Marino.
The streamer uses two Rode Lavalier GO microphones with a Rode AI-Micro audio interface.
It also builds a database of audio recordings captured at solar times—sunrise, solar noon, sunset, and during the night (between sunset and sunrise).
The primary tree species is Corsican pine, planted as a crop in 1992. There are also mixed broadleaf species, including oak, sweet chestnut, birch, and willow. Wildlife includes roe deer, muntjac deer, and various birds such as coal tit, long-tailed tit, blue tit, wren, robin, treecreeper, siskin, buzzard, and tawny owl.
This work is part of the Sensing The Forest project.

-7 -6 -5 -4 -3 UTC 1 2 3 5 7 8 9 10 12

https://streams.soundtent.org/2025/streams/utc1_-a8d83b33-b71e-4c90-aaf4-0a6b4c4ef4ad

Coda / +1hr

LIVE NOW: off air

sensing the forest

Ravenglass Estuary, Cumbria, UK
Nephin National Park, Co. Mayo, Ireland
Soundctuary Cappaduff, Mountshannon, Clare, Ireland
Walkinstown, Dublin, Ireland.
Calke Abbey National Nature Reserve
Rochford, Tenbury Wells
Confluence of Rivers Avon and Leam, Warwick, Warwickshire, England
Open University, Walton Hall, Milton Keynes
Test site, Cork city
Energy World, Milton Keynes
Bryn Arw Woodland
Bryn Arw Common
Curraghbinny Woods, Cork
Coldfall Wood, Creighton Avenue, Muswell Hill, London N10
Kilburn, Northwest London
Garden Powerscroft Road, Hackney
Stave Hill Ecological Park, Rotherhithe, London
TUMP39 North Thamesmead London
Earley Chorus, Reading, UK
Loughborough Junction
Savernake Forest, Marlborough, Wiltshire
Alice Holt Forest
Alice Holt Forest
Glastonbury, Somerset, UK
Knepp Wildland, Knepp Estate, Dial Post, nr Horsham, West Sussex, RH13 8NN, UK
Ashmore Wood
The Sheds at Devils Dyke
waterhall
Stanmer Park, Brighton
Biosphere Reserve, Portugal
24 rue du Moulin 29790 PONT-CROIX
Boadilla del Monte
nha, Portugal)

UTC +1 | UTC +2

← WEST

RESET

EAST →

President Garden, Chaussée d'Anvers (CDA), Brussels North, Belgium

Stream by Caroline Claus

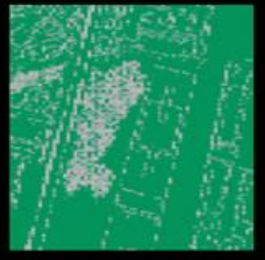
+50.865667°
+4.3581352°

UTC +2

Civil Twilight: 05:33

Sunrise: 06:10

Constructed or industrial (human-built, e.g. domestic spaces, buildings, factories)



A temporary live recording from the rooftop of a house on Antwerpsesteenweg (CDA) in Brussels' Northern Quarter, this stream listens to the sonic atmosphere of the nearby Presidential Garden—shaped by vegetation, weather, urban form, and traffic circulation both on the ground and in the air.

The private garden, situated on public land, is located within an area defined by a layered history of urbanism—from mid-20th-century office development and housing relocation to contemporary efforts focused on densification, mixed-use redevelopment, and ecological resilience. With its mature trees and dense vegetation, the garden operates as a sonic habitat that supports urban quality of life. It modulates perception and experience across the broader environment and landscape. The recorded sonic space reveals overlapping layers of urban sound—vegetation, infrastructure, architecture, and everyday use patterns.

Listening Notes

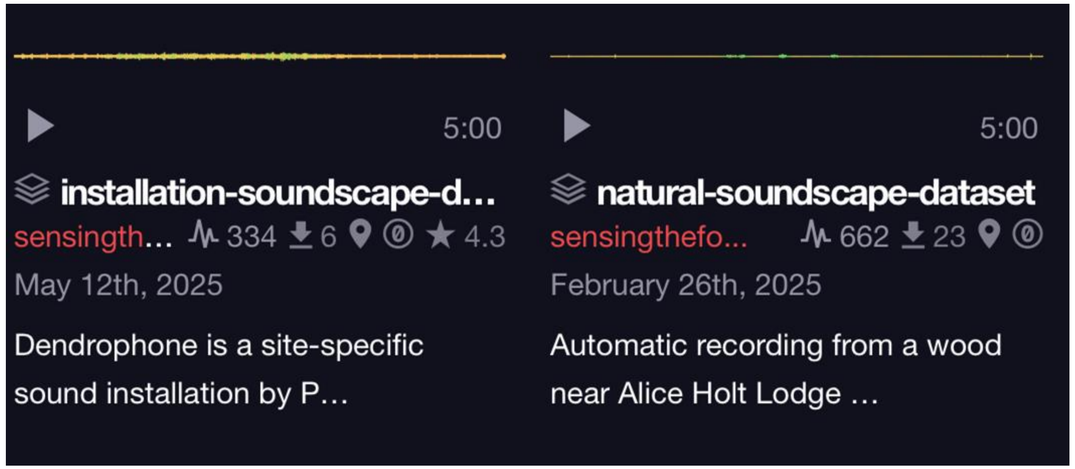
Tree Canopy Dynamics:
Birdsong marks spatial and temporal sonic thresholds, particularly audible during early morning and twilight. The movement of trees and bushes modulates sound through foliage rustle and wind interactions, creating shifting vibrational textures in the sonic field.

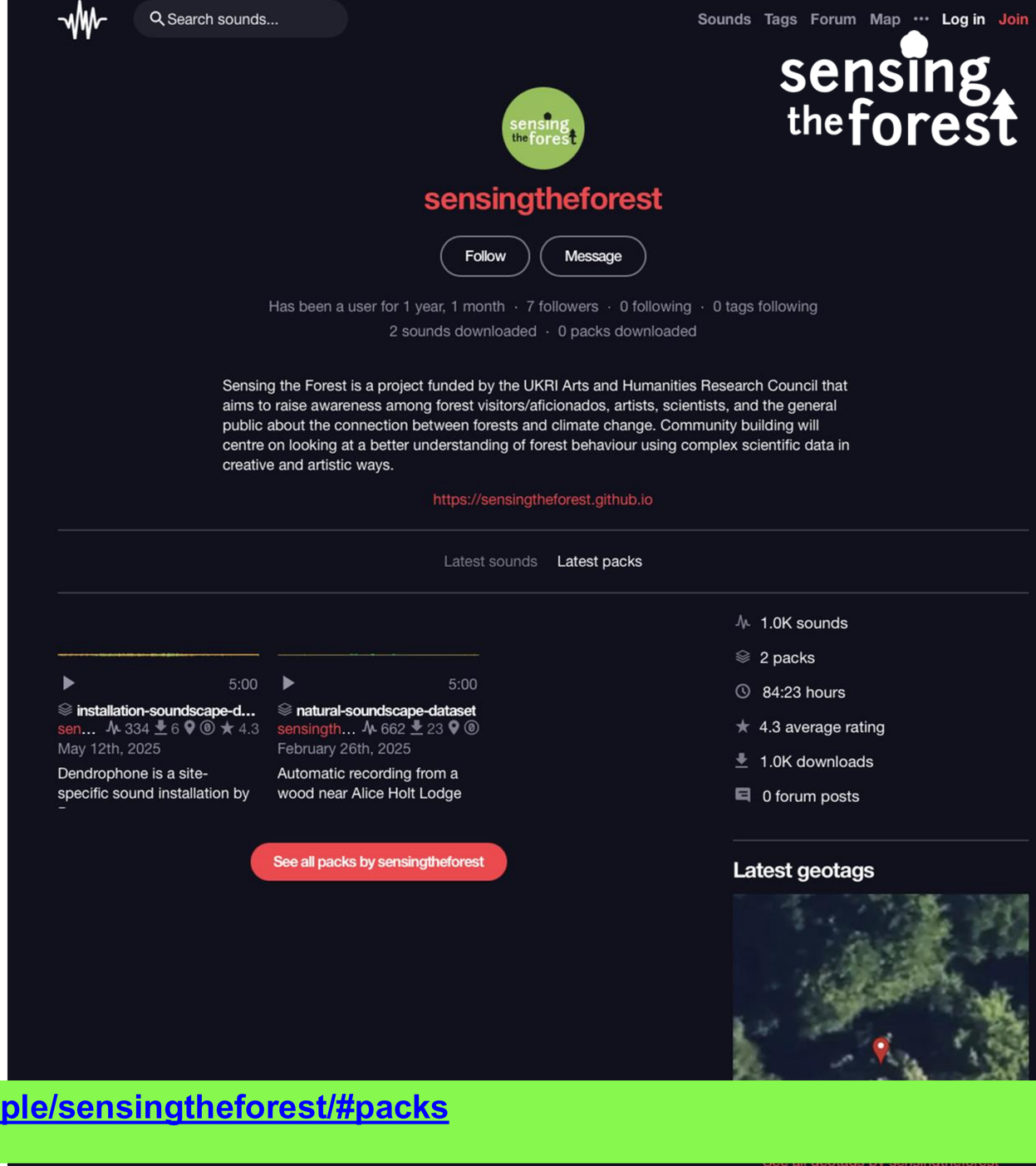
Infrastructural Vibrations and Mechanical Patterns:
Persistent low-frequency resonances from

View stream page

CHAT ↓

https://soundtent.org/reveil/#/

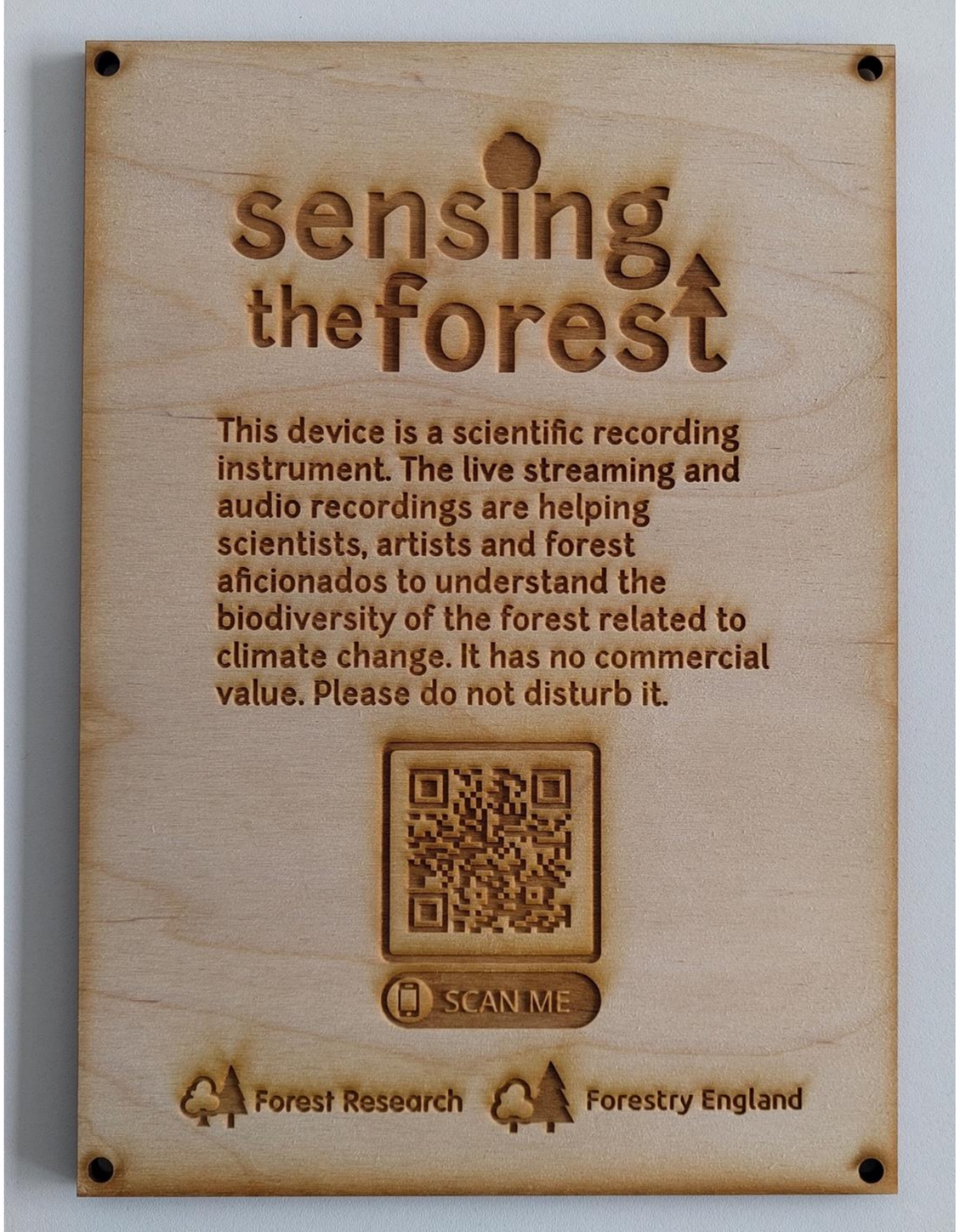




https://freesound.org/people/sensingtheforest/#packs

WP1
Next

sensing the forest


sensing the forest
This device is a scientific recording instrument. The live streaming and audio recordings are helping scientists, artists and forest aficionados to understand the biodiversity of the forest related to climate change. It has no commercial value. Please do not disturb it.
SCAN ME
Forest Research
Forestry England


Forestry England
sensing the forest
Let the Forest Speak using the Internet of Things, Acoustic Ecology and Creative AI


Forestry England
sensing the forest
Let the Forest Speak using the Internet of Things, Acoustic Ecology and Creative
Sensing the Forest at Alice Holt Forest
Sensing the Forest is a project funded by the UKRI Arts and Humanities Research Council that aims to raise awareness about the connection between forests and climate change using complex scientific data in creative and artistic ways.
You are encouraged to visit:
Dendrophone | Peter Batchelor: The forest 'speaks' environmental data through a multichannel soundscape.
Streamers | Luigi Marino: Two Internet radio stations bringing forest sounds to your electronic device.
Your Sonic Forest: An online exhibition with several installations that were presented at Alice Holt in June 2024.
Forestry England
Forest Research
Arts and Humanities Research Council
Queen Mary University of London
The Open University
Dendrophone
Peter Batchelor
Sound installation
August 2024 - August 2025
Dendrophone is an installation that turns hidden environmental data into an immersive sound experience.
Enjoy Dendrophone on-site at Alice Holt Forest until 25 August 2025, from 11.00-17.00 (London time).
What does it reveal about the forest climate?
Humidity: 'Dry' or 'wet' sounds mirror moisture levels on the forest floor.
Sunlight energy: Smooth versus juddering hissing sounds show how actively trees are processing sunlight.
Carbon dioxide levels: Breathing patterns illustrate how much carbon dioxide the forest is absorbing.
Experience Dendrophone online:


Forestry England
sensing the forest
Let the Forest Speak using the Internet of Things, Acoustic Ecology and Creative AI
Streamers
Luigi Marino
Two listening stations, one in a meadow near the large pond (Lodge Pond Trail), and the second near the permanent installation by Peter Batchelor (Willows Green Trail). The devices are simple internet radio transmitters that can be enjoyed by anyone with an internet connection.
Your Sonic Forest
Hear Nature Speak through Sound Installations in Alice Holt Forest / Online
sensing the forest
Let the Forest Speak using the Internet of Things, Acoustic Ecology and Creative AI

sensingtheforest.github.io/exhibition/your-sonic-forest-online-survey/

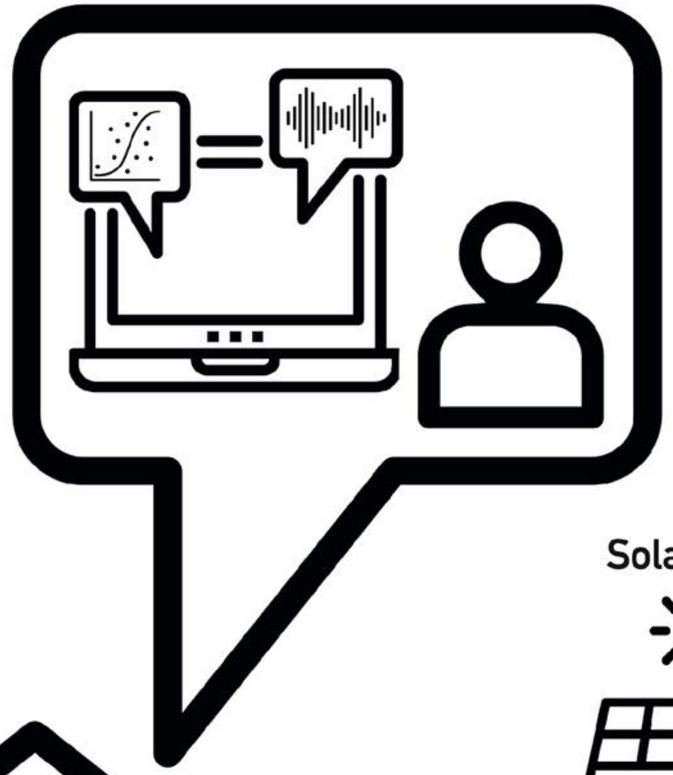
sensing the forest

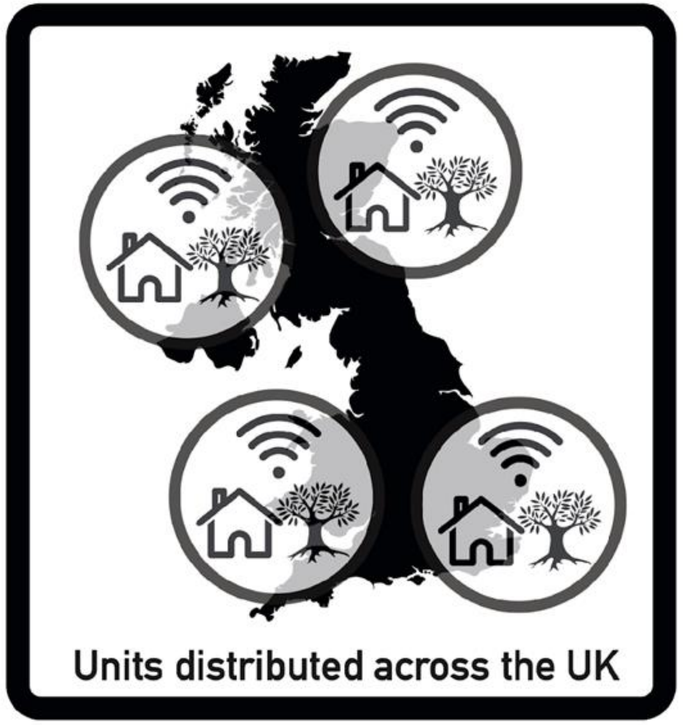
WP2

Community science intervention with forests and climate data

Prototype WP2

Dedicated web app (analysis, visualisation, sonification)





Units distributed across the UK

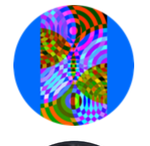
Solar panel

Household with Wi-Fi extender/powerline adapter

Box with RPi and sensors
(air temperature, soil moisture, sap flow)

Garden tree

sensing the forest



WP2
Hackathon

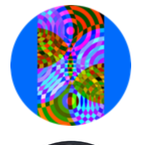
sensing the forest

sensing the forest



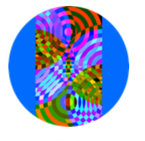







sensingtheforest.github.io/2024/11/12/hackathon-at-northern-research-station-edinburgh-day-1/

sensing the forest



sensingtheforest.github.io/2024/11/12/hackathon-at-northern-research-station-edinburgh-day-2/

Sensing the Forest Hands-on Demonstration: How a Tree Talker Works by George Xenakis

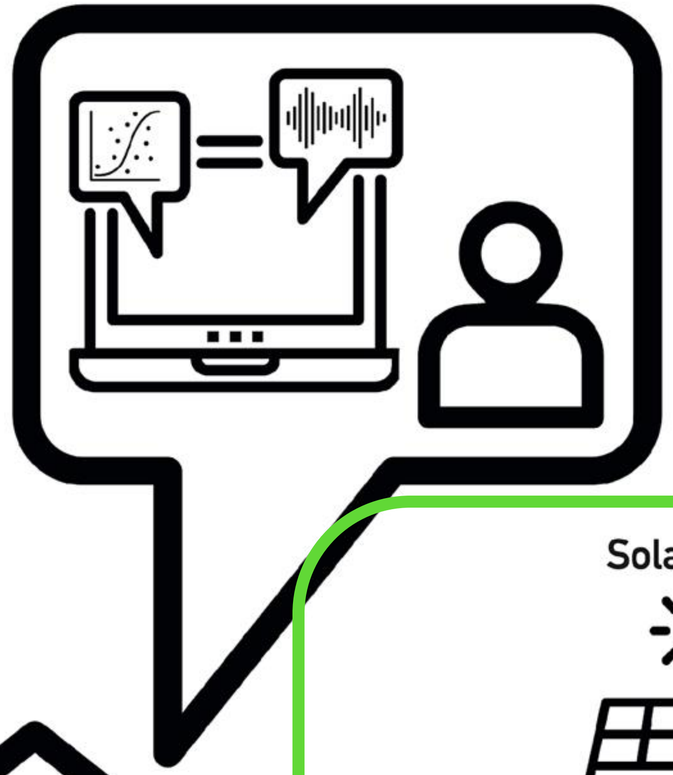
WP2

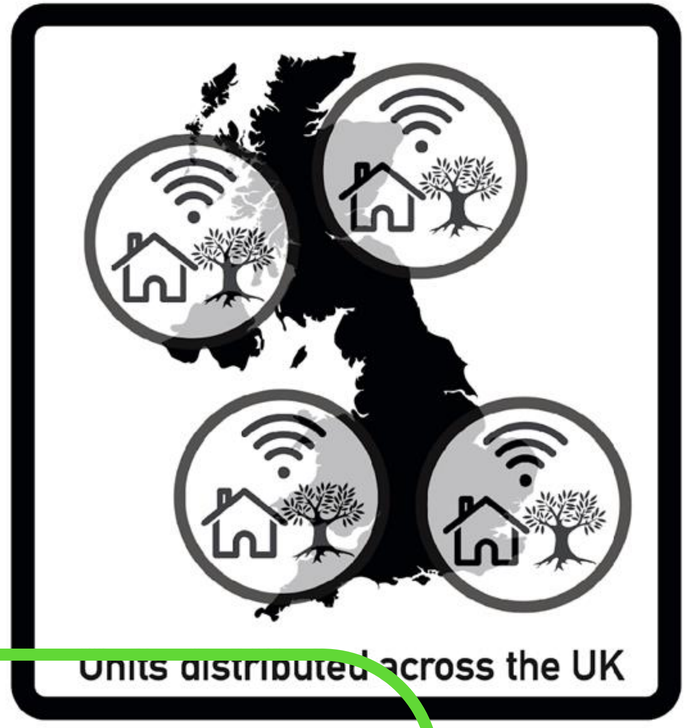
Tree talker (hardware)

sensing the forest

Prototype WP2

Dedicated web app (analysis, visualisation, sonification)





Units distributed across the UK

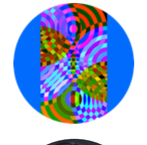
Solar panel

Household with Wi-Fi extender/powerline adapter

Box with RPi and sensors
(air temperature, soil moisture, sap flow)

Garden tree

sensing the forest



sensing the forest

https://sensingtheforest.github.io/2025/05/05/design-of-cost-effective-iot-dendrometer-sensor-for-environmental-monitoring/

Customised tree talker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{
  "timestamp": "2024-10-26 15:00:47",
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    "humidity": 53.24
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  "soil_moisture": -1
},
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http://159.65.116.195:3000/stf/northern/

WP2
Tree talker (software)

sensing the forest

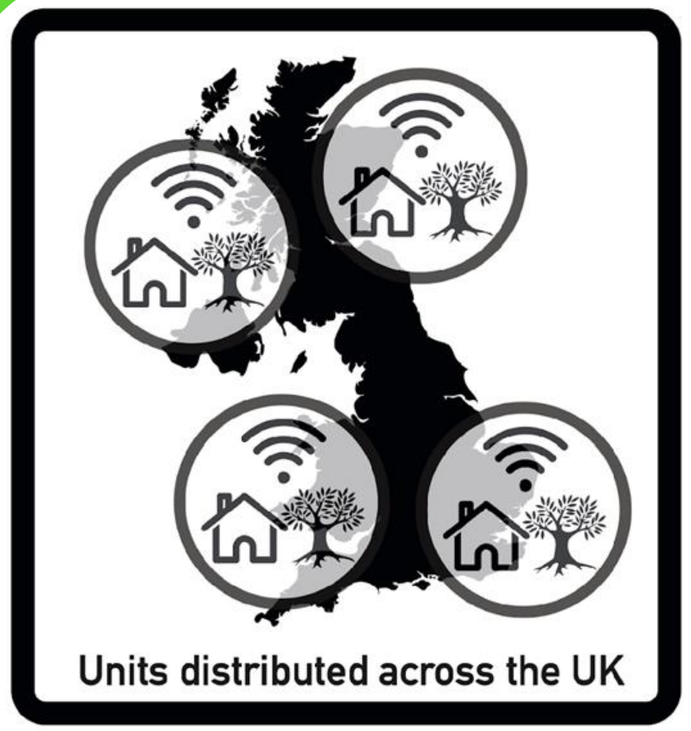
Activity 2
Sonification/ visualisation activity

WP2
Next

sensing the forest

Prototype WP2

Dedicated web app (analysis, visualisation, sonification)



Units distributed across the UK

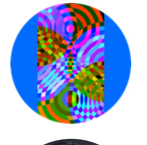
Solar panel

Household with Wi-Fi extender/powerline adapter

Box with RPi and sensors
(air temperature, soil moisture, sap flow)

Garden tree

sensing the forest



User study

Sensing the Forest at Northern Station: Participatory design of a tree talker prototype

6 participants

Test a custom-made tree-talker prototype from home

June-August 2025

We will meet online four times (1h/session) via a Zoom call with a group of six participants.

Gain essential insights that could shape the future implementation of the tree talker.

Final thoughts

List themes, metaphors or topics that can help us talk about forests and climate change

Thank you!

sensing the forest

Partners

UKRI Arts and Humanities Research Council

Queen Mary University of London

centre for digital music

De Montfort University Leicester

MTI² Institute for Sonic Creativity

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Forestry England

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