

Connecting Software & Electronic Engineers with Nature

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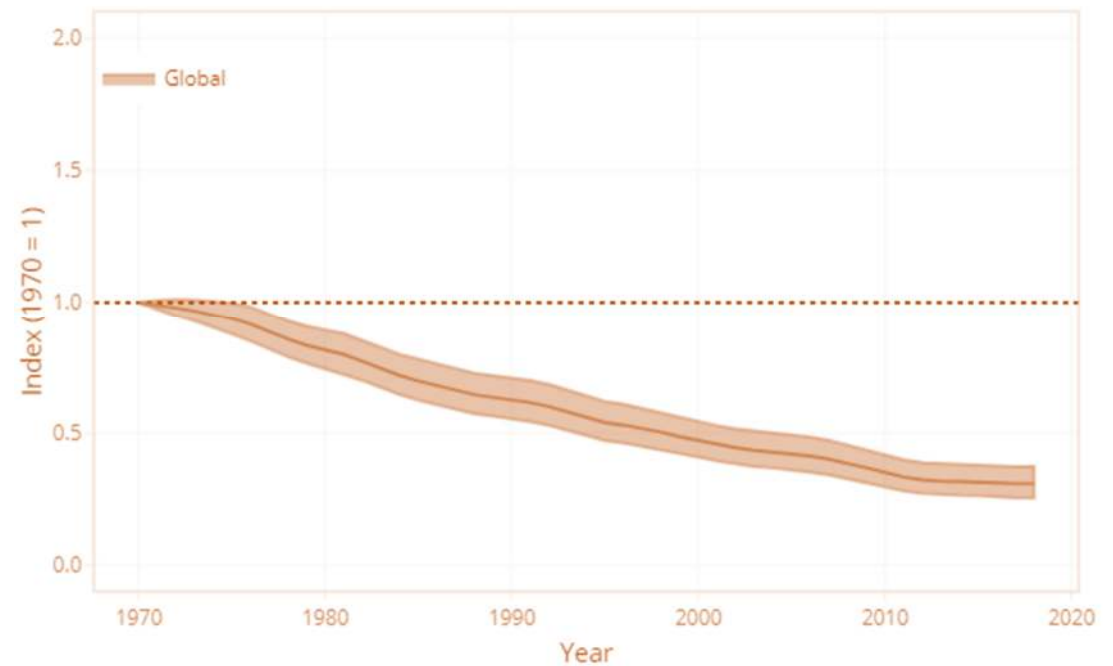


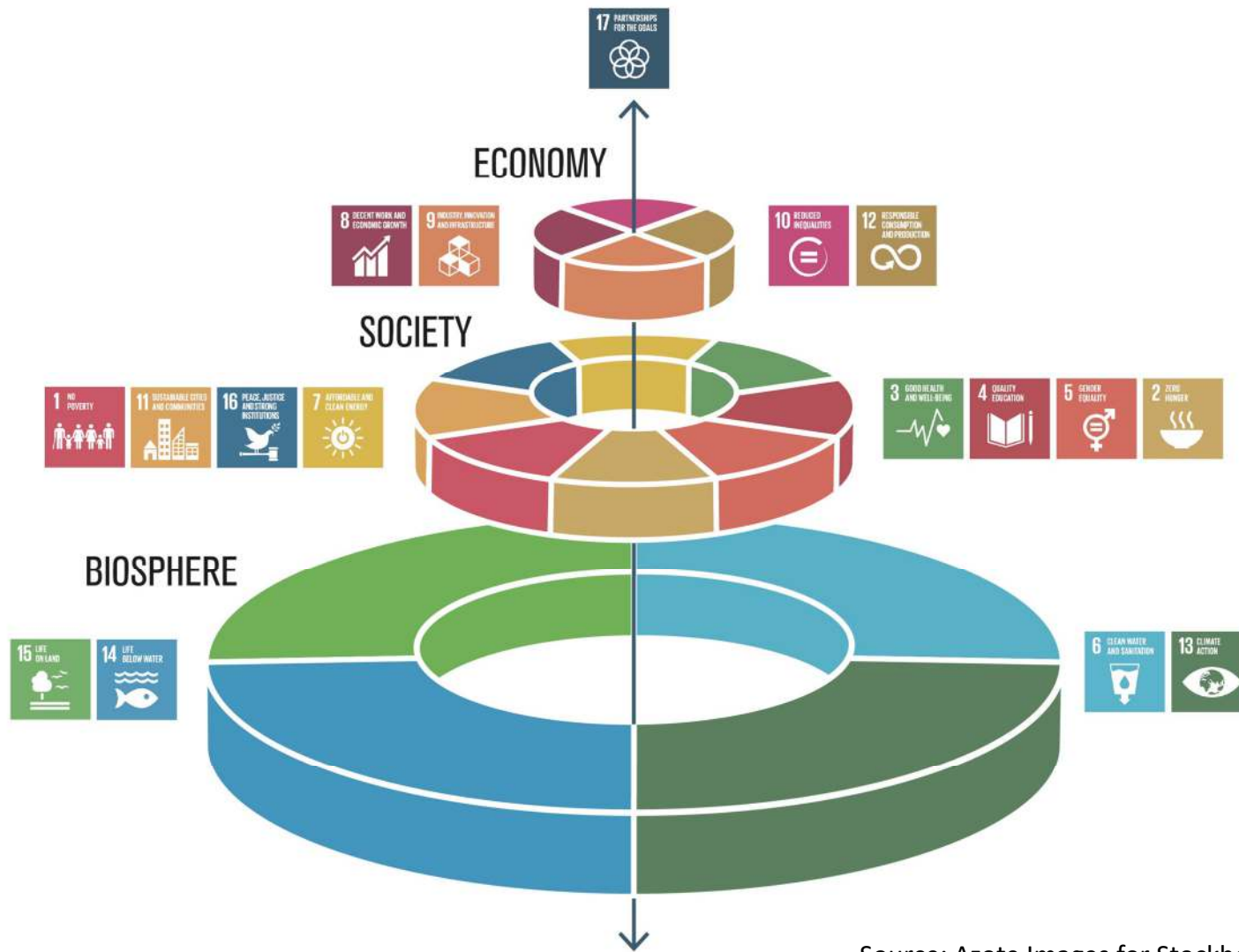


What is the Problem?

/ Globally, monitored populations of birds, mammals, fish, reptiles and amphibians have declined by 69% since 1970.

/ Living Planet Index, livingplanetindex.org.





Source: Azote Images for Stockholm Resilience Centre, Stockholm University.

A blurred, warm-toned photograph of a person working at a desk with electronic equipment, overlaid with a semi-transparent white box containing text.

What can Software and Electronic Engineers do?

Noticing

“.. higher levels of nature connectedness benefit both people and the environment, promoting pro-nature conservation actions, pro-environmental behaviors, and greater personal well-being..”

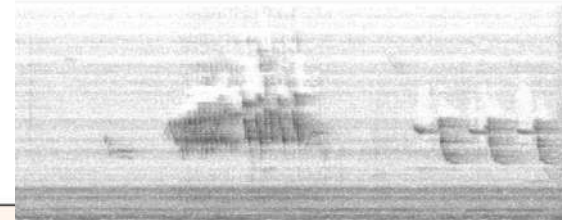
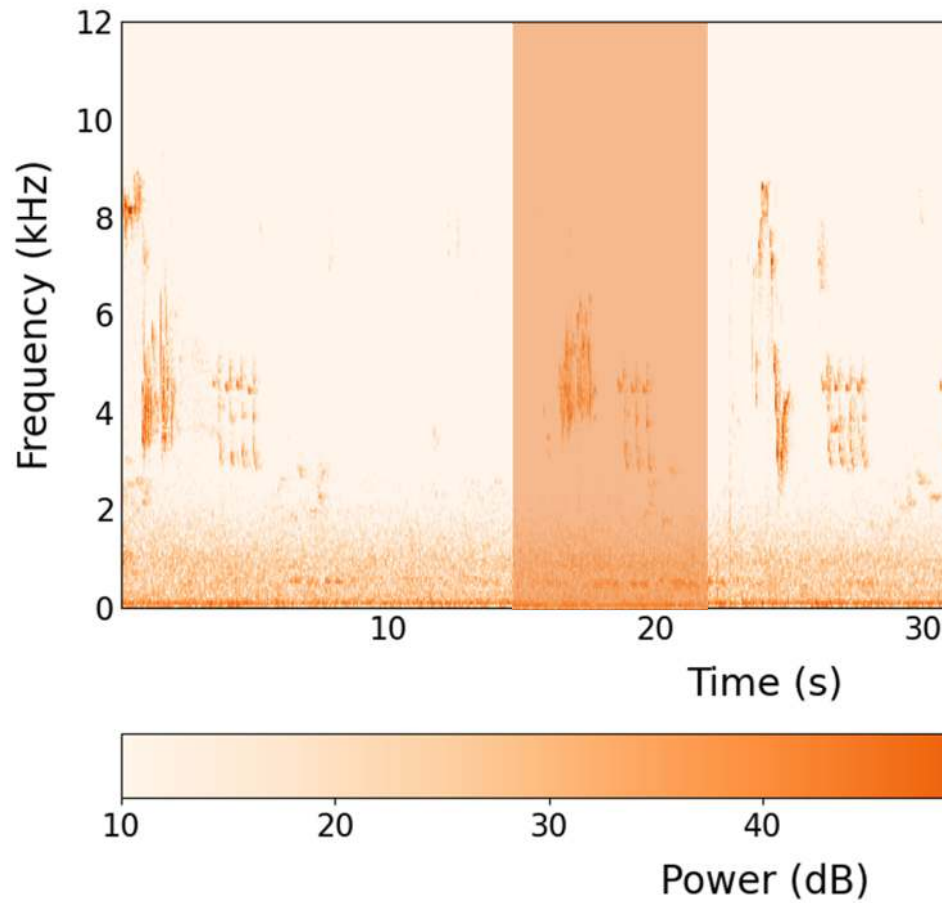
Miles Richardson, Iain Hamlin, Carly W. Butler, Rory Thomas, and Alex Hunt. Actively Noticing Nature (Not Just Time in Nature) Helps Promote Nature Connectedness. *Ecopsychology*. Mar 2022. 8-16.
<http://doi.org/10.1089/eco.2021.0023>







Campus Walk



Merlin Woods



BEST MATCHES

-  European Robin
-  Great Tit
-  Eurasian Blackbird
-  Common Wood-Pigeon

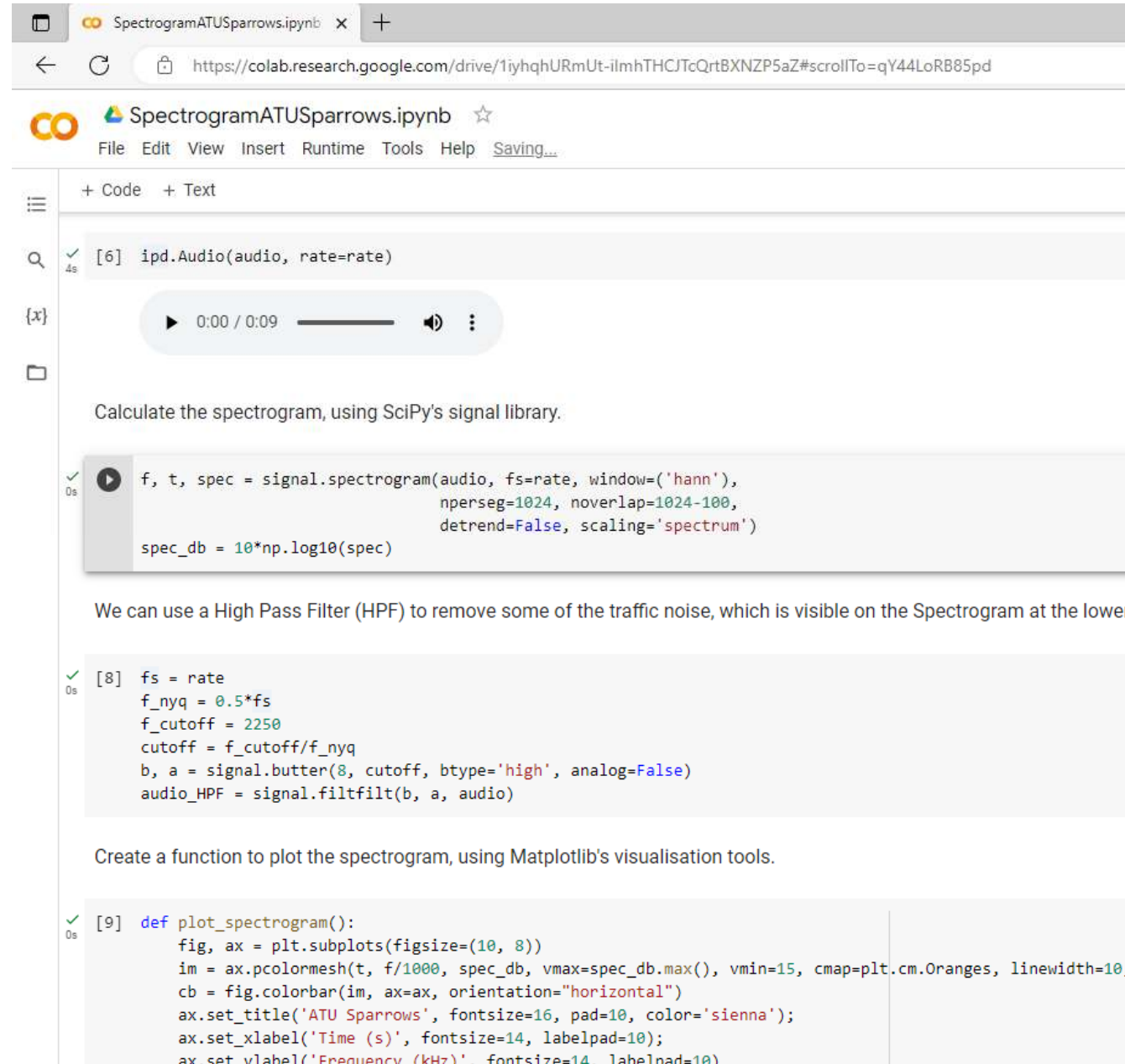
*Merlin screenshot
(TheCornellLab)*



00:22.00

/ Module: Digital Signal Processing.

/ Screenshot: Google Colab Python Notebook.



The screenshot shows a Google Colab Python Notebook titled "SpectrogramATUSparrows.ipynb". The browser address bar shows the URL: <https://colab.research.google.com/drive/1iyhqhURmUt-ilmhTHCJTcQrtBXNZP5aZ#scrollTo=qY44LoRB85pd>. The notebook interface includes a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", "Help", and "Saving...".

The notebook content is as follows:

- Cell [6]: `ipd.Audio(audio, rate=rate)`. This cell contains an audio player interface showing a duration of 0:00 / 0:09.
- Text: "Calculate the spectrogram, using SciPy's signal library."
- Cell [7]:

```
f, t, spec = signal.spectrogram(audio, fs=rate, window=('hann'),
                                nperseg=1024, noverlap=1024-100,
                                detrend=False, scaling='spectrum')
spec_db = 10*np.log10(spec)
```
- Text: "We can use a High Pass Filter (HPF) to remove some of the traffic noise, which is visible on the Spectrogram at the lower frequencies."
- Cell [8]:

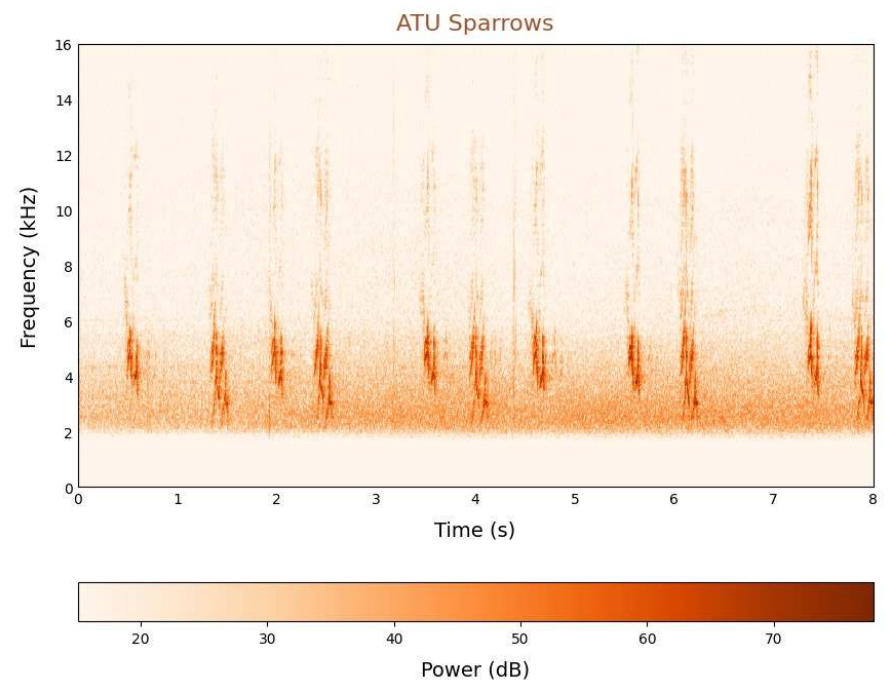
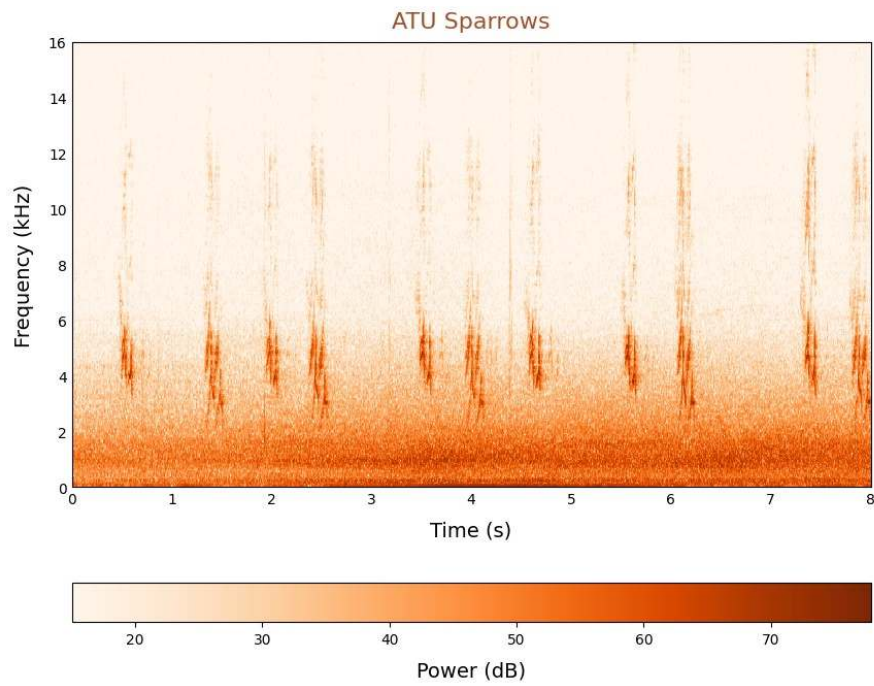
```
fs = rate
f_nyq = 0.5*fs
f_cutoff = 2250
cutoff = f_cutoff/f_nyq
b, a = signal.butter(8, cutoff, btype='high', analog=False)
audio_HPF = signal.filtfilt(b, a, audio)
```
- Text: "Create a function to plot the spectrogram, using Matplotlib's visualisation tools."
- Cell [9]:

```
def plot_spectrogram():
    fig, ax = plt.subplots(figsize=(10, 8))
    im = ax.pcolormesh(t, f/1000, spec_db, vmax=spec_db.max(), vmin=15, cmap=plt.cm.Oranges, linewidth=10)
    cb = fig.colorbar(im, ax=ax, orientation="horizontal")
    ax.set_title('ATU Sparrows', fontsize=16, pad=10, color='sienna');
    ax.set_xlabel('Time (s)', fontsize=14, labelpad=10);
    ax.set_ylabel('Frequency (kHz)', fontsize=14, labelpad=10)
```

Original



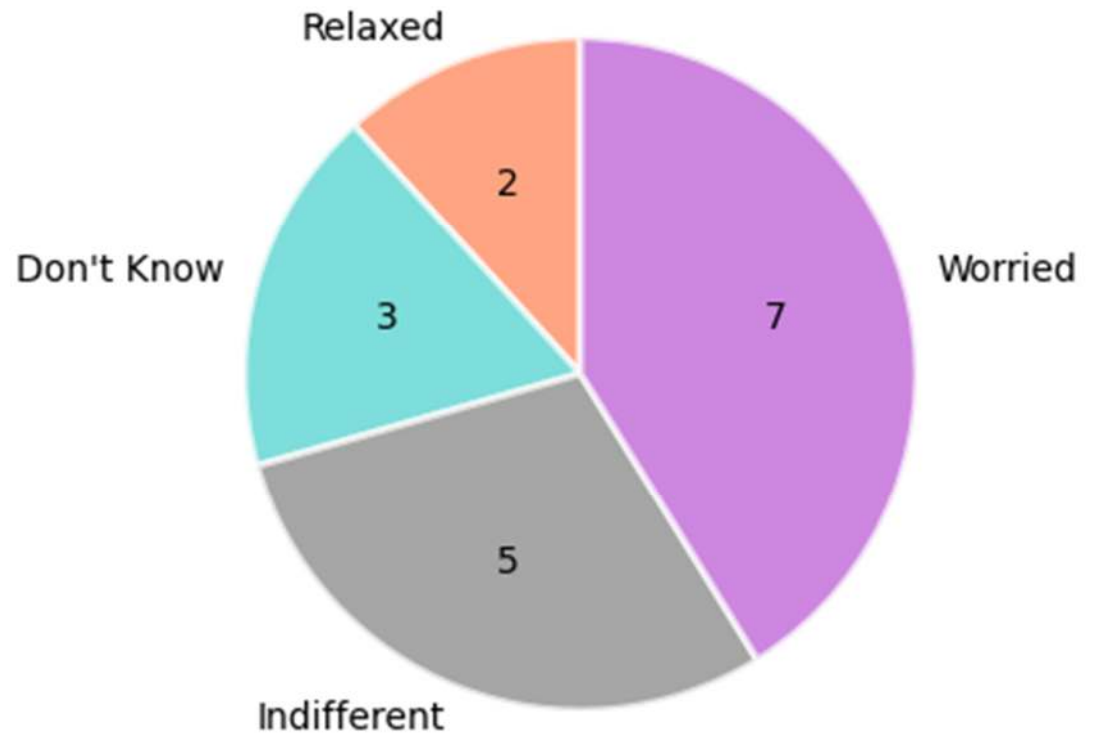
After HPF



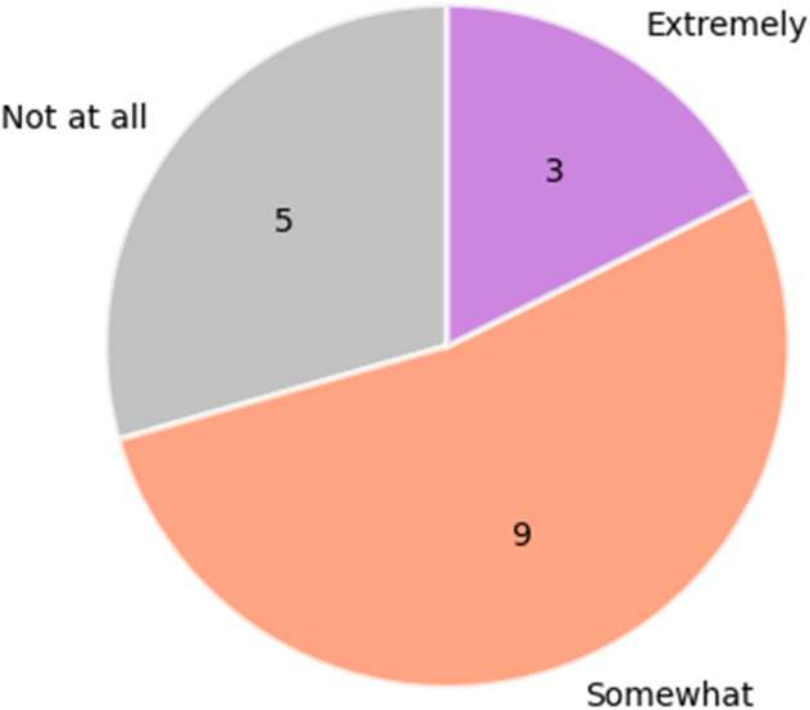
/ Rubric

Requirement	≥ 80	≥ 70	≥ 60	≥ 50	≥ 40	< 40
Technical & academic content, including relevant concepts, mathematics, algorithms, and their use & explanation.	Excellent	Excellent	Very good, relevant content	Good content	Satisfactory	Insufficient
	Technic	Technic	One or more areas for further demonstration	Limited demonstration	Limited demonstration	Largely insufficient
	Demonstrating	Demonstrating	Demonstrating very good content	One or more areas for further demonstration	Many areas for further demonstration	Insufficient
	Very good	Very good	Content stated or repeated	Demonstrating content	Demonstrating content	Content stated
Spectrogram examples and analysis.	New birdsong recorded.	New birdsong recorded.	New birdsong recorded.	Birdsong recorded.	Birdsong recorded.	Insufficient
	Presented with additional analysis and insight beyond that demonstrated in class.	Presented with additional analysis and insight beyond that demonstrated in class.	Presented with additional analysis and insight beyond that demonstrated in class.	Presented	Presented	In-class
	Exploration of additional analysis and insight beyond that demonstrated in class.	Exploration of additional analysis and insight beyond that demonstrated in class.	Limited exploration of additional analysis and insight beyond that demonstrated in class.	Limited	Lacking	Mostly
Jupyter Notebook presentation.	Excellent readability.	Excellent readability.	Very good readability.	Reasonable readability.	Adequate readability.	Poor readability.
	Good readability.	Good readability.	Good referencing.	Satisfactory readability.	Referencing	Insufficient
	Limited, relevant and targeted use of Markdown	Limited, relevant and targeted use of Markdown	Limited, relevant and targeted use of Markdown	Over-reliance on text	Over-reliance on text	Mostly
	Good use of Markdown	Good use of Markdown	Limited use of Markdown	Limited use of Markdown	Limited use of Markdown	Mostly

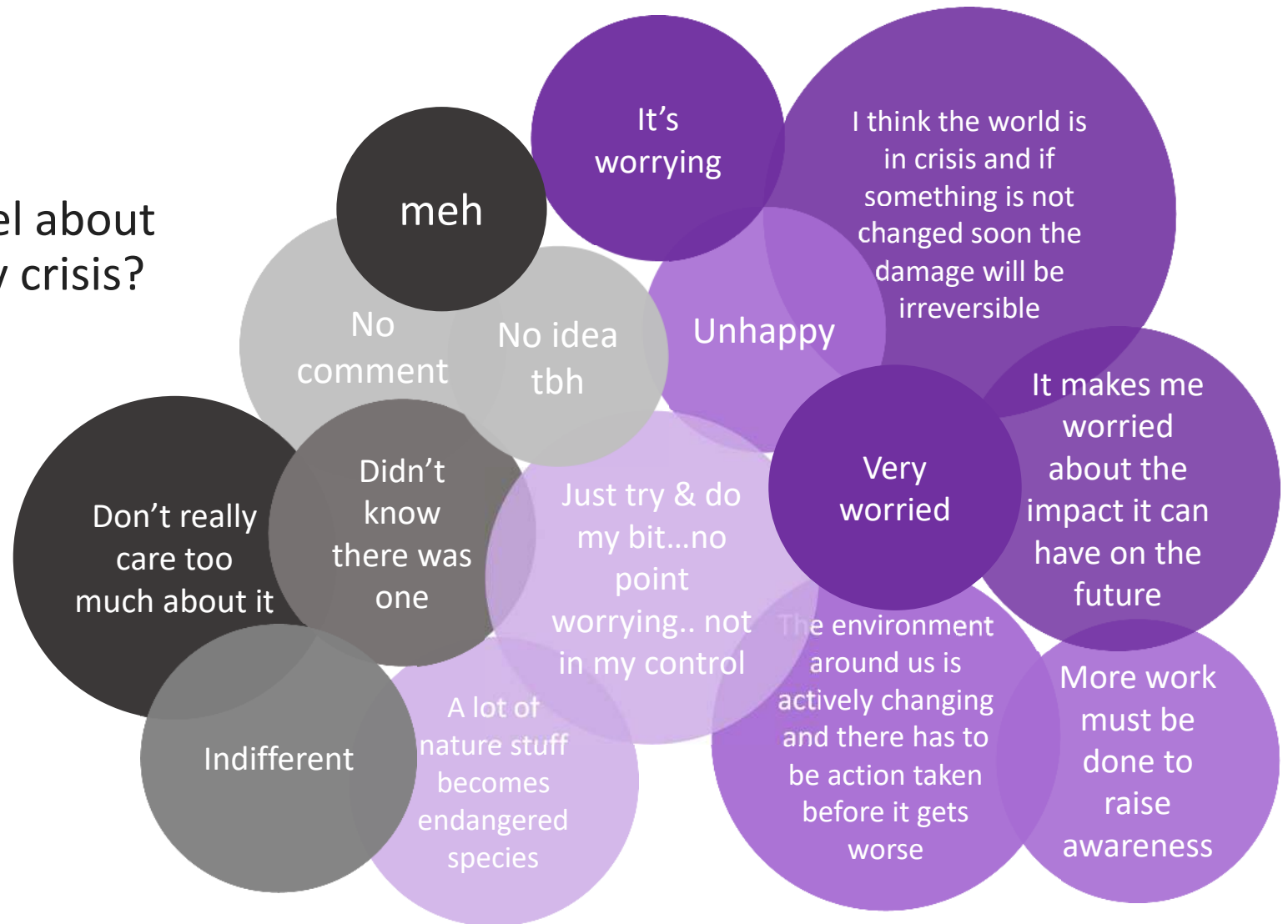
/ When you think about your future and sustainability, which of the following words best describes how you feel?



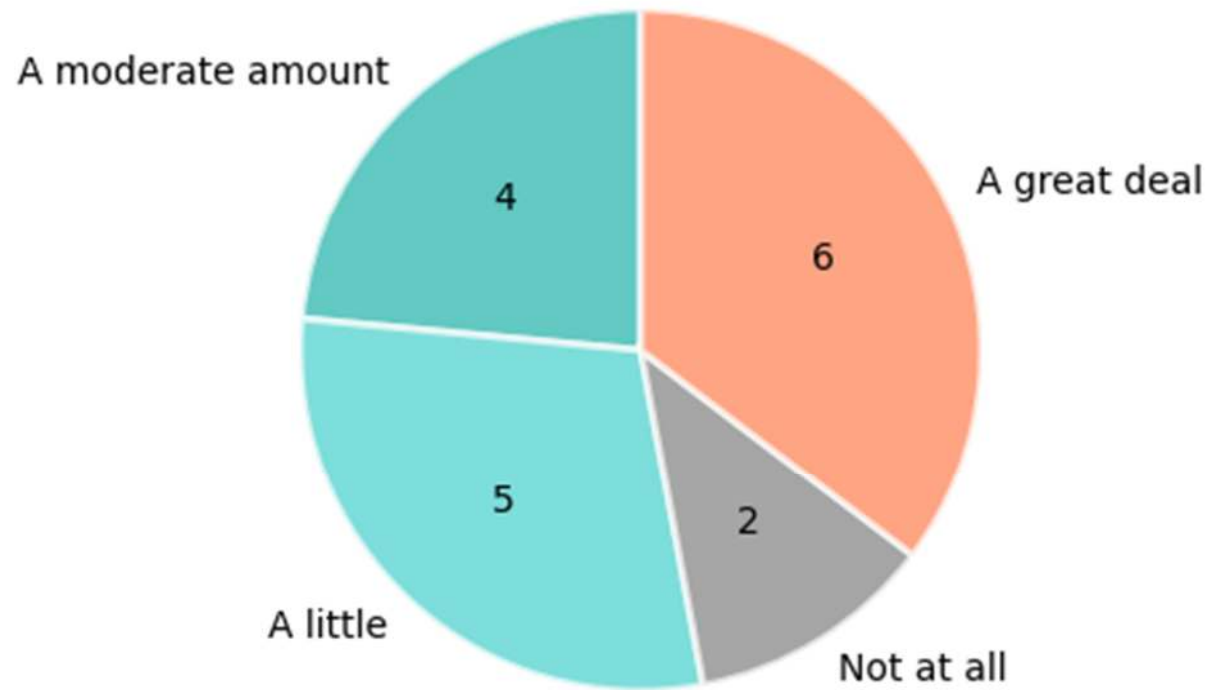
/ How important is the issue of biodiversity to you personally?



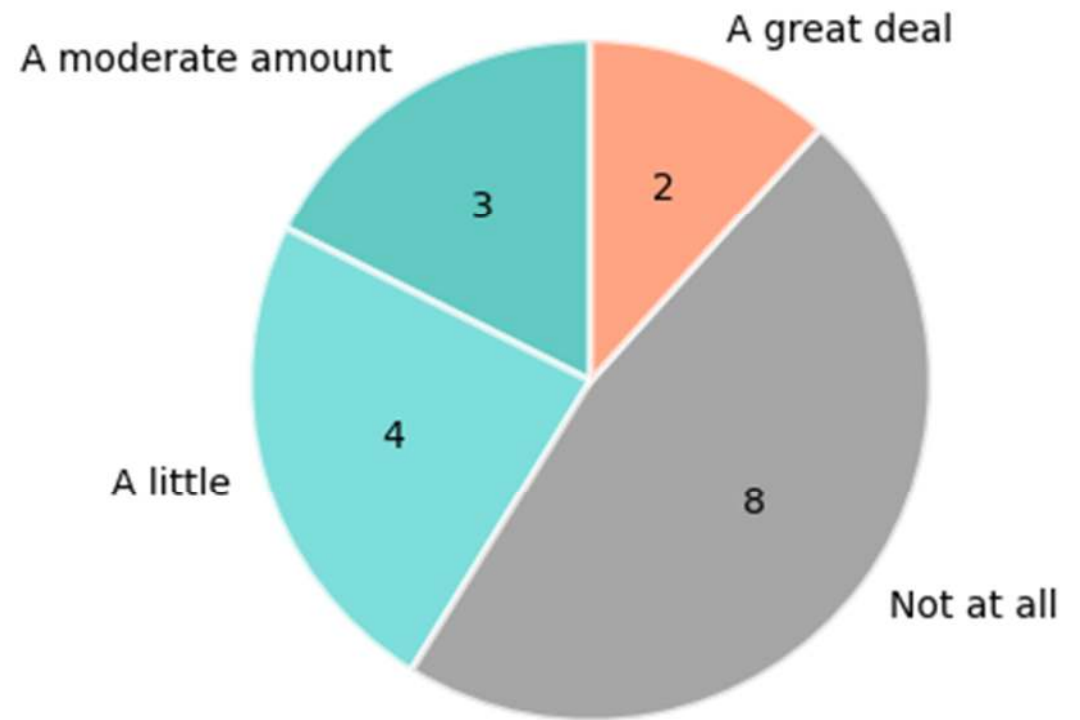
/ How do you feel about the biodiversity crisis?



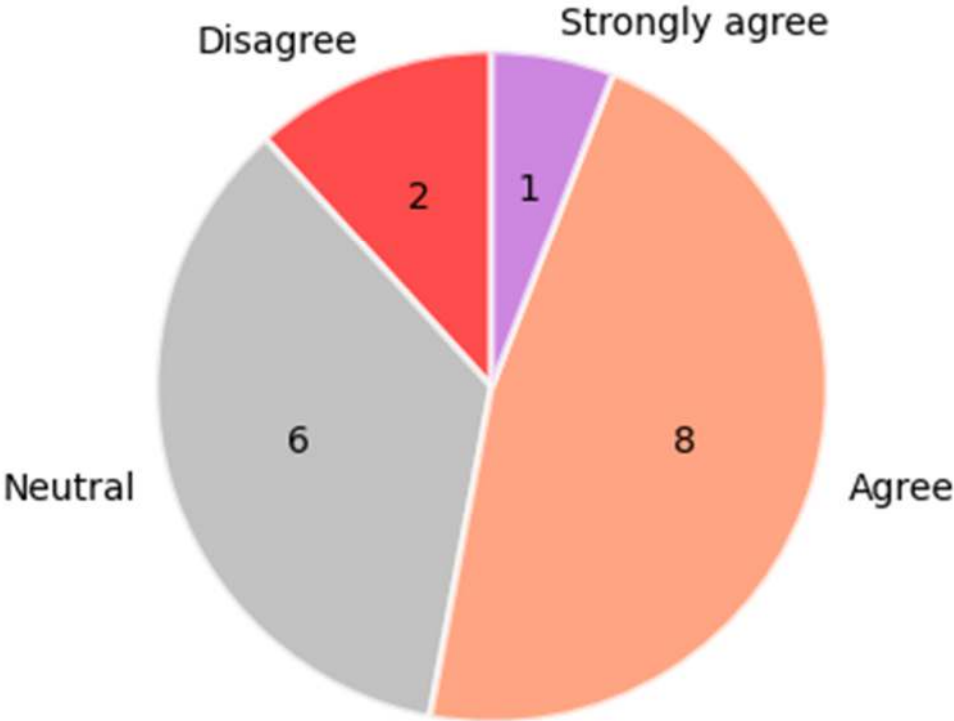
/ Do you think that noticing nature around you increases your personal sense of well-being?



/ Did engaging with birdsong through your project work affect your empathy for bird life on Earth?



/ Sustainability is something that I would like to learn more about.



Biodiversity starts in
the distant past and it
points toward the
future.

Frans Lanting

