Data in the Wild:
Designing for the Realities of Fieldwork

DNB311 | Industrial Design Capstone
Django Cole Stegman

AI & Authenticity Statements

AI Use Statement

I have utilised Generative AI in this report, using Claude and Atlas.ti, to assist in various ways. The way I have used AI includes:

- *Using Claude in order to receive feedback on clarity, flow and structure of writing.*
- *Atlas.ti was used when completing the thematic coding process for both interviews and survey, and the inbuilt AI coding tool was used. All coding completed by this AI tool was thoroughly reviewed and edited afterwards.*

No images have been generated through the use of AI.

Django Cole Stegman
n11497394
13/09/2026

Authenticity Statement

This is to certify that to the best of my knowledge, the content of this report is my own work. This report has not been submitted for any subject or for other purposes. I certify that the intellectual content of this report is the product of my own work and that all the assistance received in preparing this report and sources have been acknowledged.

Django Cole Stegman
n11497394
13/09/2026

Table of Contents

- Chapter 1 - The Topic 4-10
- Introduction 5
- Background 6
- Becnhmarking 7-10

- Chapter 2 - The Research 11-18
- Research 12
- Analysis & Findings 13-18

- Chapter 3 - Discussion Design Implication 19-22
- Discussion 20
- Design Implications 21
- Conclusion 22

- References 23

- Appendix A - Consent & Participation Forms 24-28

- Appendix B - Data 29-39

Django Cole Stegman

Executive Summary

This report aims to investigate current ecological surveying methods, with the aim of identifying impactful opportunities for design intervention within this process. Primary research was conducted through semi-structured interviews with qualified ecologists along with an online survey, supplemented by a review of survey techniques such as quadrat and transect sampling and existing research on this topic. Findings outlined that while existing field survey methods and equipment are mostly functional and viewed in a positive light, the data handling process is a significant frustration point. Ecologists often rely on multiple recording methods at once, often re-entering the same data in paper, mobile apps, and spreadsheets. There is also a strong want for automation, particularly around data input and reporting. This was not addressed within existing examined literature, which focused primarily on survey methodology rather than data input and processing. This report identifies key problems and design opportunities focused on integrating and automating the data handling process, rather than redesigning already effective field methods. These findings inform a clear design direction of this project.

4557 Words

Chapter 1
The Topic

Introduction

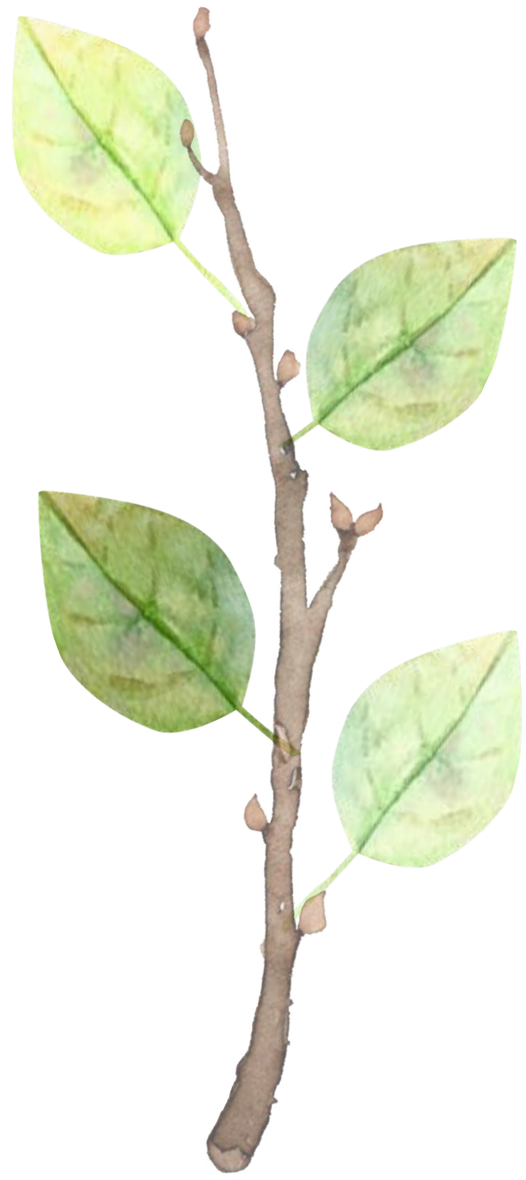
Ecology is the scientific study of how all living organisms interact with each other and the surrounding physical environment. Ecologists play a vital role in the conservation and restoration of the environment, doing so by aiding rare or endangered species, restoring damaged or degraded land and protecting natural spaces among many other things. An important component of ecological science is the gathering of various categories of field data through various surveying methods. Ecologists employ a large variety of survey methodologies to gather data to inform information such as species population and abundancy, habitat biodiversity, emerging local climate patterns and much more. These surveys are often aimed at either flora (vegetation) or fauna (wildlife). While this report will have a heavier focus on flora surveying methods, fauna surveys will be discussed at some points due to method crossovers and method re-evaluations.

How might ecological surveying methods be altered to both streamline and improve the effectiveness of data collection and processing?

The aim of this project is to explore how a targeted design intervention could positively affect the field of ecological/environmental science. The purpose of this report is to gain a clear understanding of the design topic, and to explore potential friction points and design opportunities. This will be done by incorporating various research methodologies employed simultaneously to concept development.

Project Structure

Secondary Research



Primary Research

Discussion

Design Implications

Background

In this section of the research report, an in-depth review of existing research on ecological surveying techniques will be conducted. Key concepts will be broken down and examined, with a dissection of suitability, performance and other relevant factors that affect the effectiveness of these techniques. This review will utilise academic and reputable sources to build a base level of understanding to inform the remainder of this project.

Literature Review

Ecological surveying is utilised to determine the population size, density and location of plant-life within a habitat or eco-system, and how these factors change over time. This surveying has been in practice for decades as it is a vital component of maintaining local environmental health.

Perhaps the most common approach is quadrat or transect sampling (Sorrells & Glenn, 1991). In quadrat sampling, a square (often made of pvc pipes grid string) is laid on the ground, with the ecologist recording plant presence within the quadrat (Using Quadrats, n.d.). This is usually accomplished by a visual estimation of the percent of ground each species within the square covers (De Stefano et al., 2021). Similar to quadrat sampling, transect sampling involves the surveyor laying out a 100 meter straight line, and recording plant presence along the line (Caratti, 2006). Quadrat and transect sampling methods are very often utilised simultaneously, or even combined with quadrats being used at set intervals along a transect line. Other variations of these methods exist (Ecological Sampling - Ecosystems and Habitats - KS3 Biology - BBC Bitesize, 2023).

As well as this, ecologists often conduct manual species counts, utilizing a marking tape and some form of counting aid, the surveyor walks through the designated area, marking each target species with a tape and adding it to the count. Often, the surveyor will also carry a GPS to mark exact locations of the target species, which helps provide a distribution map.
There are also plotless techniques, which designate a point within the specified area, and measure the distance of individual plants from the specified point. This helps with determining species density, although this method may not be accurate for cover data (Sorrells & Glenn, 1991).



Fig 01: Quatratic Surveying (Betts Ecology and Estates, n.d.)

In Summary

Various methods of surveying are commonly used by ecologists to determine population size, density and health of plant-life within a habitat. Most techniques are suited to a different data field and thus vary in which data they gather. The quadrat and transect techniques are most commonly used, and gather data revealing the density and cover percentage within a specified area. Manual species counts aim to provide precise numbers and maps for the tracking of specific species. And finally plotless methods are used to figure out species density in a larger area, by measuring distance from a specified point.

Benchmarking

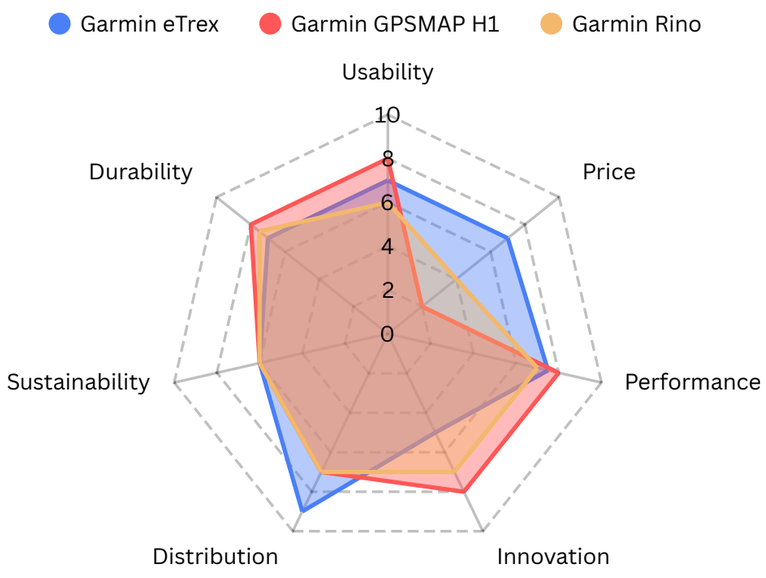
Within this section, existing survey equipment will be outlined and examined. A thorough criterion will be applied to these products and utilised to determine the overall effectiveness and viability of these products. As well as this, several existing survey methodologies will be examined to determine the strengths and weaknesses of each technique.

Existing Products

Ecological surveyors currently utilize a large range of specialized methods and equipment to gather data. The variety of these tools is due to the variety of methods employed in gathering data. Due to the variety of both methods and equipment, this report will examine and benchmark over three categories, these being GPS units, eco-acoustic recorders and then surveying methods, which will be assessed against an alternate criterion.
The GPS units and eco-acoustic recorders will be marked against criteria examining usability, durability, sustainability, distribution, innovation, performance and price. The criteria is a 1-10 scale, with 1 being the lowest possible score.

GPS Units

GPS units are a commonly employed tool utilized by field ecologists as they allow the user to mark the exact point of a sample, quadrat or transect. As well as this, by collating GPS data, ecologist are able to transform points of individual organisms into distribution maps, which display population density and habitat spread. It should be noted that all selected units are of the Garmin brand. This is due to the widespread agreement that Garmin generally produces the most reliable and affordable units according to ecological forums. The following table and graphs mark three GPS units against a set criterion.



	Garmin eTrex	Garmin GPSMAP H1	Garmin Rino
Photo			
Price	($249)	($1149)	($949)
Total	48.5/70	47/70	44.5/70

Fig 02: GPS Unit Benchmarking

As seen to the left, the Garmin eTrex scores the highest on this criteria, although it notably scores lowest in innovation as it lacks specialist features such as the H1s voice control (Hazzard, 2026) or the Rinos two-way radio (Pizzata, 2022). The Rino is a specialized GPS that is also a pairable two-way radio, meaning both that communication is easier in the field, but also that if injured, a user can contact their field partner and be easily located through the GPS features. The eTrex is the most affordable of the three and the most widely accessible, meaning it is an easy entry point that performs its required job to a high degree. All of the examined units score somewhat low in sustainability. This is a design oversight, as these GPS are utilized by environmental scientists who very likely weigh sustainability highly when considering options. Utilising sustainable materials and design practices is a must when designing for the environment.

Eco-Acoustic Recorders

Eco-acoustic recorders are another tool used often in ecological surveying, however in this instance the purpose is for the gathering of acoustic data supplied by fauna, rather than sampling of flora. Eco-acoustics have been chosen for benchmarking for two reasons. First, for the dependance ecologists have on these tools for monitoring the activity of bats, birds, frogs, insects and other wildlife. And second, eco-acoustic technology has the potential of being integrated into other surveying methods, which will be discussed in a later section of this report. Below are the table and graphs displaying the devices performance against the criteria.

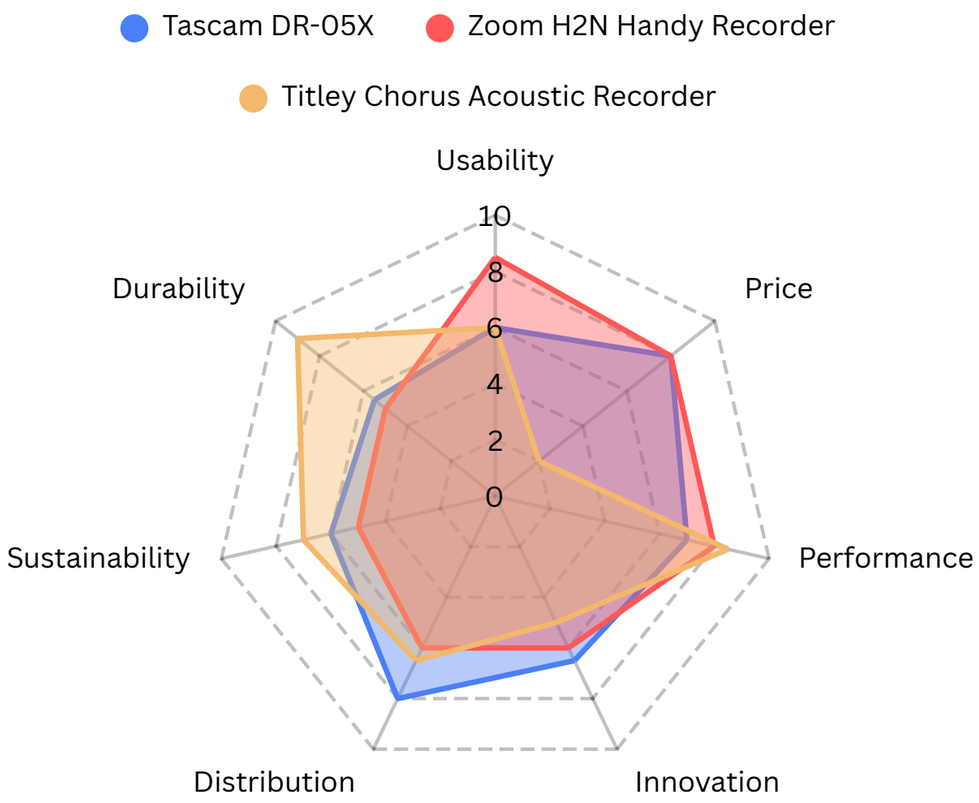


Fig 03: Eco-Acoustic Recorder Benchmarking

	Tascam DR-05X	Zoom H2N Handy Recorder	Titley Chorus Acoustic Recorder
Photo			
Price	8 ($220)	8 ($230)	2 ($799)
Total	47/70	46.5/70	44/70

The Tascam DR-05X scores highest, with the best score in innovation and distribution. The DR-05X includes many features not found in the other two recorders (Isaac, 2022), such as instant recording into new files and mono-recording. As well as an abundance of features, the DR-05X is the cheapest and most accessible device. Notably, while the Tascam scores highest in innovation, it still does not score highly in innovation. This highlights a potential opportunity in exploring eco-acoustics as potential innovative interventions. The Titley Chorus is an overnight recording acoustic sampler (batdetectors, 2022), and while it does not score highly in innovation, it scores very highly in performance.

Ecological Surveying Methods

Ecologists deploy a variety of methods when gathering field data for both flora and fauna surveys. Examining commonly employed methods is an important step when considering the strengths and weaknesses of these approaches, and how a design intervention may improve efficiency. As surveying methods are not products, they have been graded on a separate criteria on a scale of 1-10. The categories are as follows: data field, equipment burden, procedure complexity, time/effort, flexibility and data input complexity.

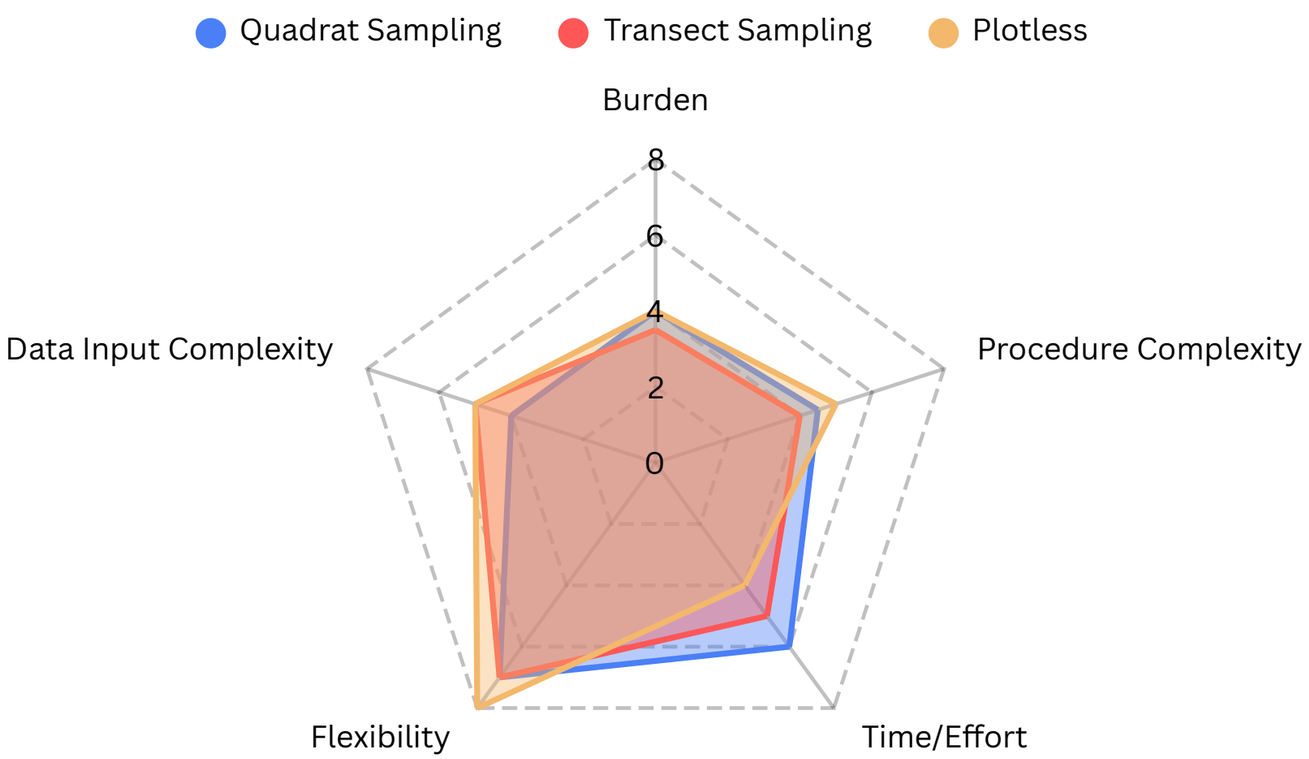


Fig 04: Surveying Methods Benchmarking

	Quadrat Sampling	Transect Sampling	Plotless
Photo			
Total	26.5/50	24.5/50	26/50

The intent of this particular set of benchmarking is to not necessarily compare them to one another – as they are intended for different data fields- but to examine the strengths and weaknesses of the methods. Examining these methods has revealed that all three of these surveying methods score low on burden, complexity and data input complexity. This shows that there is significant room for design intervention in each one of these methods, perhaps looking into modularity or design for disassembly to ease burden, or integrated technology to improve data input efficiency.

Benchmarking Summarised

By examining products and methods employed in the collection of ecological data, a clearer understanding of expectations in terms of overall quality have been outlined. Categories benchmarked are GPS units, eco-acoustic recording devices and flora surveying methods (against an alternate criteria. The Garmin eTrex was the highest scoring GPS unit. Despite its lack of innovative features, the eTrex scored best in terms of distribution and price, while also scoring very highly in effectiveness. None of the GPS units received a high score in terms of sustainability, which likely clashes against the values of the targeted user base. From among the eco-acoustic recorders, the Tascam DR-05X scored best, again due to accessibility. It is noted that while the DR-05X received the highest mark for innovation, it was still not a high score, revealing the potential to rethink the ways acoustic devices are utilized or designed. The flora surveying methods were assessed against an alternate criteria, and were not benchmarked against one another. Rather, the strengths and weaknesses of each method were explored to reveal potential design opportunities to improve efficiency. Each method scored undesirably in equipment burden, time/effort and data input complexity. These weaknesses lead to potential interventions such as modularity, design for disassembly or integrated technology.



Chapter 2
The Research

Research

In the following section of this report, research methodologies and tools used in the writing of this report will be examined, with explanations on how and why these methods and tools were applied, and how the resulting data was analysed. Two primary methods of research were conducted, these being industry professional interviews to gather primary qualitative data, and online surveys for a mix of qualitative and quantitative data. To support this, secondary research was applied to supplement initial gaps in knowledge, providing a strong foundation for this research report.

Interviews

Industry professional interviews were conducted as a primary source of information for this report and the resulting design. A semi-structured format was chosen for these interviews, as this allows for natural flow and follow-up on points of interest, while also ensuring similar content was covered across both interviews. Interview participants were recruited via personal connections, including a colleague from a bush regeneration company. Each interview was roughly guided by ten questions in order to prompt thoughtful conversation. These interviews were recorded using the voice memo app on an iPhone, with transcripts copied across after, ready for analysis.

Two interviews were conducted with qualified ecologists to gain a clear understanding of existing ecological surveying methods and the data handling processes involved. Equipment used in both field surveys and data processing/analysis was also explored. Interviews also surfaced friction points commonly experienced in this process, in both surveying methods and tools used. Participants were asked if they had any suggestions on how ecological surveying processes might be improved.

Surveys

An online survey consisting of ten questions was also used as an alternate method of gathering primary information to compliment the depth of the professional interviews with a broader reach and sample size. This survey consisted of multiple choice, checkbox, long response text, and linear scale formatted questions. A multi-format type survey was selected as it affords a mix of qualitative and quantitative data to be examined. This survey was created and run using Google Forms.

The survey was distributed through online ecological forums, ecologist Facebook groups and directly to personal connections. Seventeen online survey participants were recruited from these sources. This survey covered professional background, data types and equipment used in fieldwork, data collection methods, current frustrations, and desired improvements to processes and equipment.

In Summary

By combining both professional interviews and online surveys, two primary research methods provided a strong pool of data for later analysis. Interviews offered in-depth insights into individual experiences and thoughts on current ecological data collection methods, while the survey provided a larger sample size to offer larger trend insights. This combination allows for in-depth analysis and informs later design direction.

Analysis & Findings

Within the analysis and findings section of the report, data analysis methods and tools will be thoroughly discussed, followed by an in-depth review of the results from the conducted research. Key relevant findings will be clearly outlined for further breakdown and discussion.

Interviews

Interview transcripts were analysed through thematic coding via Atlas.ti, as coding allows qualitative data to be organized into structured and comparable categories (Ahmed et al., 2025). An initial round of ai assisted coding was completed to identify recurring statements and concepts across both of the two interviews, producing a set of seven codes and a large number of sub-codes. After this, these sub-codes were then reviewed, edited and merged to combine very similar or duplicate sub-codes into a smaller set. The codes were next categorized into three larger overarching themes or groups. The groups are data practices, survey experience and design implications. These groups of data were next manually input into a hierarchy or tree chart to easily view importance of sub-codes. Findings are detailed below.

Theme One: Data Practices

The first theme to be analysed is Data Practices, which encompasses the codes of data collection, data recording and data processing. Within these codes are a total of eighteen sub-codes. By conducting a conceptual analysis, it can be seen that the sub-code Surveying & Fieldwork (code: Data Collection) is mentioned the most at 33 times in total between both interviews. While this is a clear indication of the importance of field surveys the gathering of data, it is not a novel finding, as this is largely self-evident. Next in line of importance, according to conceptual analysis is Technology & Tools (code: Data Collection) with 29 total mentions. This stresses the fact that in-field equipment, both digital and physical, are highly important to the data collection process. During the interviews, tools such as quadrat squares, eco-acoustic recorders and data collation software/tools were frequently mentioned. Notably, quadrat squares were often referred to in a positive light, whereas data collation software was cast negatively, Eco-acoustics were neutral. Other notable sub-codes with high mentions are data transfer, storage & output with 17 mentions and media capture with 11.

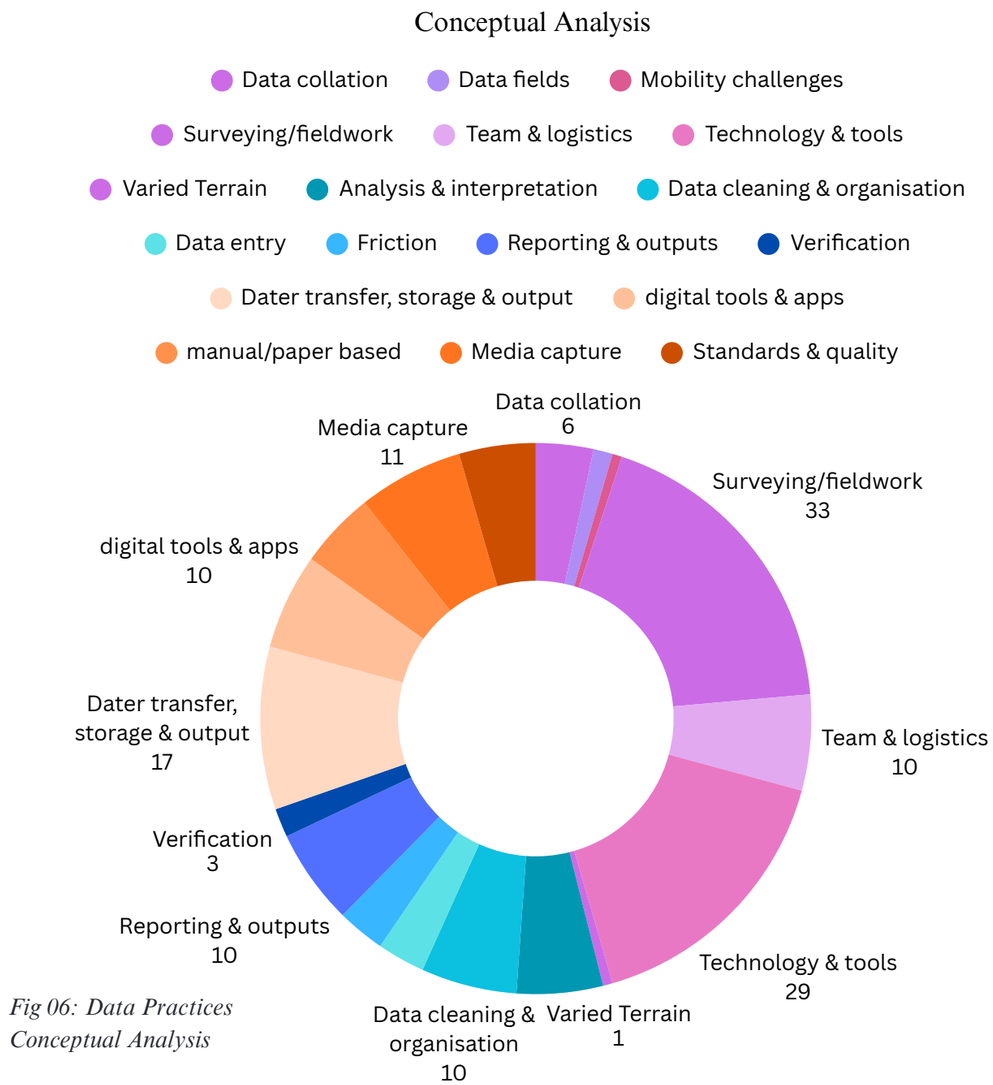


Fig 06: Data Practices Conceptual Analysis

Theme Two: Ecological Survey Experience

The Survey Experience theme includes the codes survey challenges, efficiency vs accuracy and survey success criteria. There are a total of 12 sub-codes. Again, a conceptual analysis was applied to this code group, with the sub-code automation & speed (code: Efficiency vs Accuracy) receiving the most mentions with 16 in total. This highlights the demand for automation and a streamlined overall process of ecological surveying. It should be noted that automation particularly was mentioned often when discussing data input and report writing. Accuracy & error management (code: Efficiency vs Accuracy) was mentioned 6 times in total yet still stands out as very important when considering the use of automated tools.

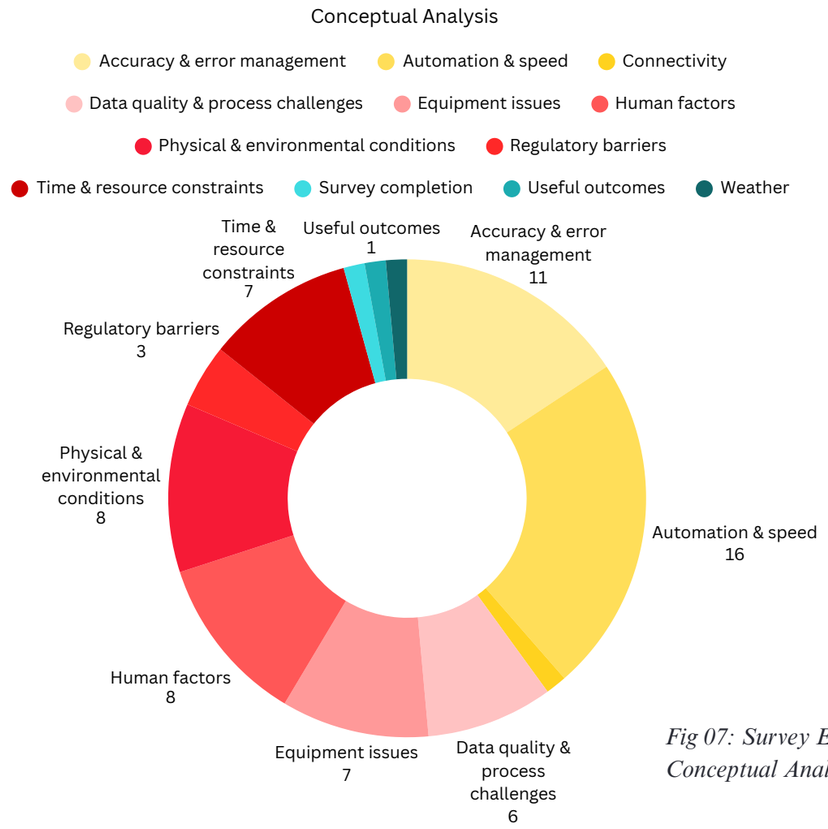


Fig 07: Survey Experience Conceptual Analysis

Theme Three: Design Implications

The Design Implications theme includes mentions of potential design interventions, or elements that may impact the success of a design intervention. This theme contains only one code, that being Design Interventions. Within this code are five sub-codes. Mentioned most is sub-code physical & hardware design. This indicates the importance of physical tools used in the field. Commonly mentioned are quadrat squares, GPS units, anabat acoustic recorders, phones (camera and note taking) and notebooks. Process efficiency is mentioned 8 times, while both digital/software interventions and user experience are mentioned 7 times each. By looking at this data set as a whole, a clear picture of what intervention is wanted/needed by ecologists emerges. Whether the intervention be through digital or physical means (or both), it must improve the efficiency of ecological data collection and be provide an easy to understand and rewarding experience to the user.

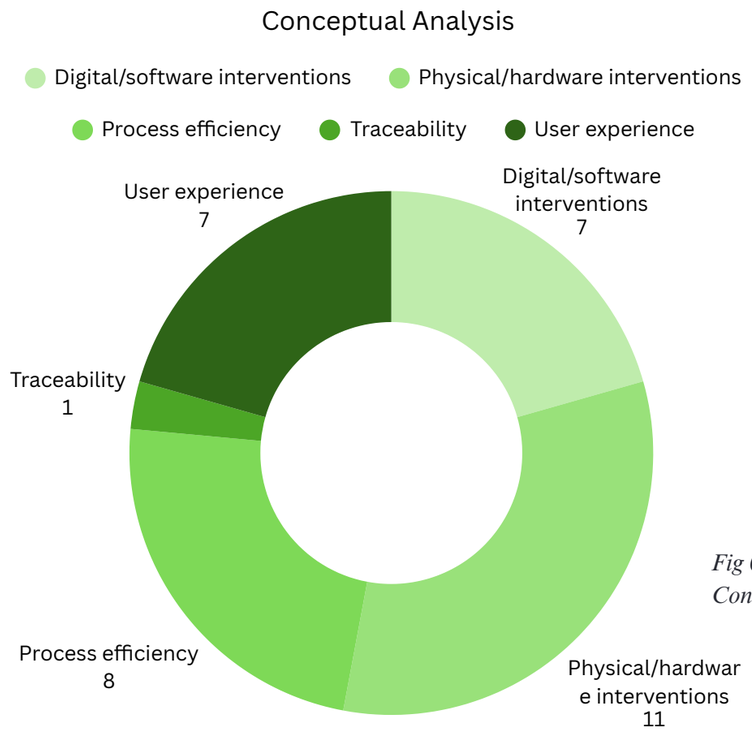


Fig 08: Design Implications Conceptual Analysis

Relevant Findings: Interview

Through closeup examination of individual themes within a larger codebook, key implications can be clearly outlined to inform design direction. To begin with, fieldwork itself is not necessarily something that requires intervention, data collection, recording, handling and processing are where many inefficiencies reveal themselves. This indicates that a successful intervention should consider the entire journey of the data, not just collection. Secondly, automation is something ecologists want, but it needs to be accurate and have error management functionality. Finally, perhaps the most successful design intervention will integrate physical field tools with digital tools. Current methods split data collection, recording and processing into separate stages, meaning there is an opportunity of combining these stages into one streamlined and efficient process.



Survey

Online survey results were analysed through two primary techniques as they contain both qualitative and quantitative data types. Quantitative data contained within the online survey can be split into nominal and ordinal data types. Results were analysed by examining summarized data through suitable charts and graphs and then utilizing univariate analysis to outline variable distribution within a category (Canova et al., 2017), and bivariate principles to examine relationships between categories. Qualitative data was once again coded with Atlas.ti to outline recurring themes. Findings are outlined below.

Quantitative Analysis

Quantitative data gathered from survey responses was analysed using univariate techniques, which revealed several important points. First, Excel is used by nearly all participants (94.1%), but paper (64.7%) and phone apps (76.5%) are both used extensively. These numbers overlap as the participants could select multiple, which indicates that most ecologists are employing two or more tools in combination. This suggests that ecologists may be re-recording data across multiple methods, perhaps moving data from paper into excel. This supports a design opportunity with a focus on integrating data collection, recording and processing into a streamlined process.

Survey equipment satisfaction ratings are middling, with no participants reporting either 1 (lowest) or 5 (highest). This likely means that while existing equipment is mostly functional, it is not innovative or explorative. When reviewed alongside qualitative data, quadrat squares are most often referred to positively, while data input and processing software is usually referred to negatively. This suggests that while the equipment satisfaction is middling, not every piece of equipment is mediocre, and some tools are consistently underperforming. This distinction is critical for design direction, as it indicates that efforts should focus more data input and processing tools over physical equipment like quadrats which are largely viewed in a positive light.

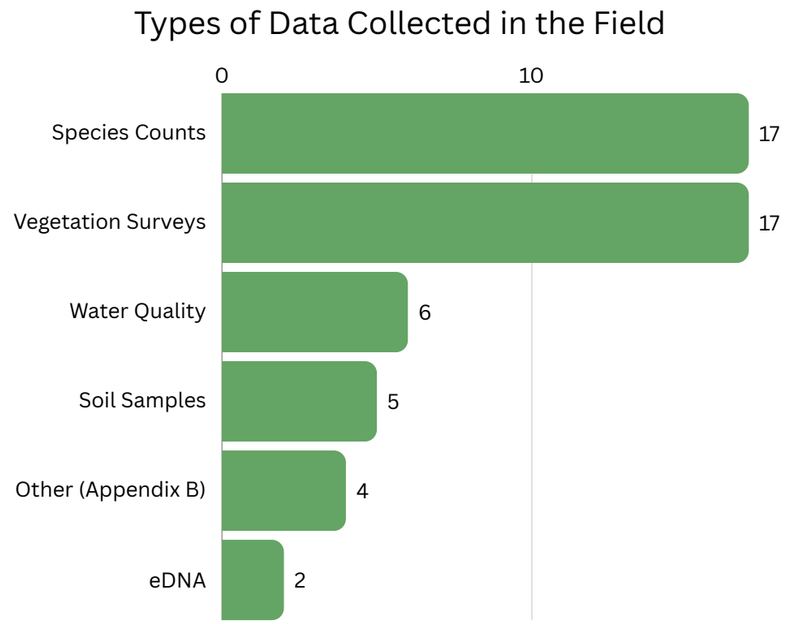


Fig 09: Data Fields Chart

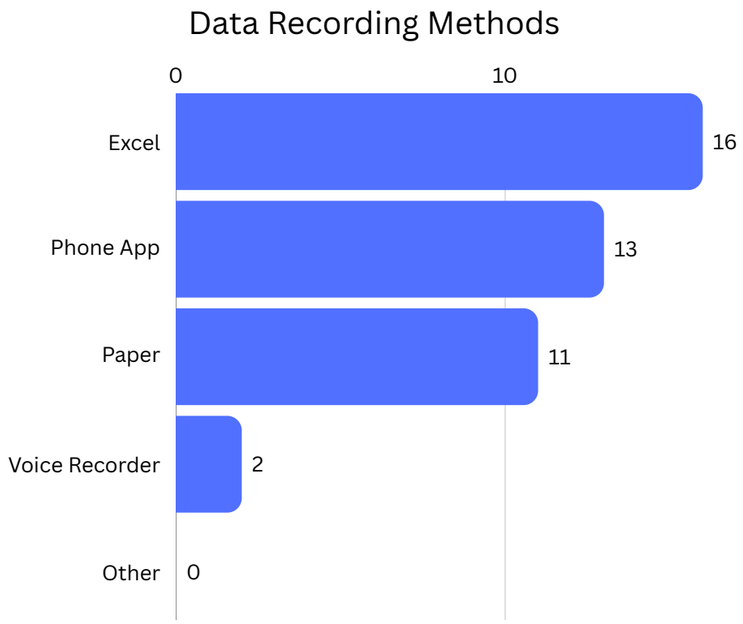


Fig 10: Data Recording Methods Chart



Fig 11: Equipment Satisfaction Chart

Qualitative Analysis

Text responses were coded and categorized into the same three themes used in the interview codebook in order to maintain consistency. The categories are Data Practices, Survey Experience and Design Implications. Each of these thematic categories were exposed to conceptual analysis to outline commonly mentioned sub-codes. This outlines important takeaways from the text responses of the online survey. First, Quadrat squares were mentioned 15 times out of 17 responses to data collection tools. This means that 88.2% of participants use quadrat squares during field surveys. This presents a significant proportion, but quadrats were only mentioned twice when in the design suggestions section - and were not mentioned negatively at any instance. This indicates that while the majority of ecologists use quadrat squares in the field, they don't find them frustrating to use or transport. GPS units were mentioned 7 times when participants were asked to list tools commonly used in data collection, showing that 41.2% of respondents often use GPS units. A similar pattern emerged with the GPS units, which were mentioned twice in design interventions, both times as part of an integrated device. Data input and processing were brought up many times when talking of process frustrations and design interventions. Mentions of integrated devices using voice input and data recording provided valuable insights into potential design solutions.

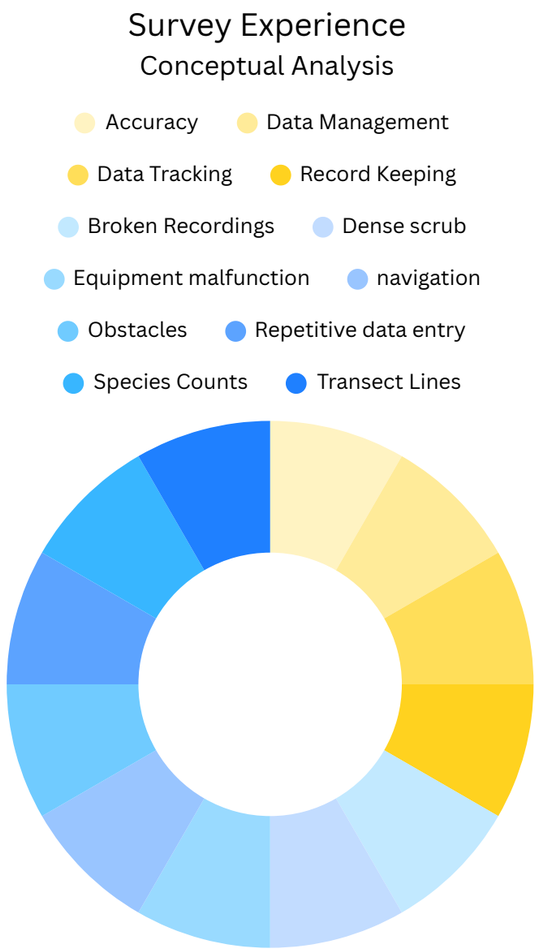


Fig 12: Survey Experience Conceptual analysis 2

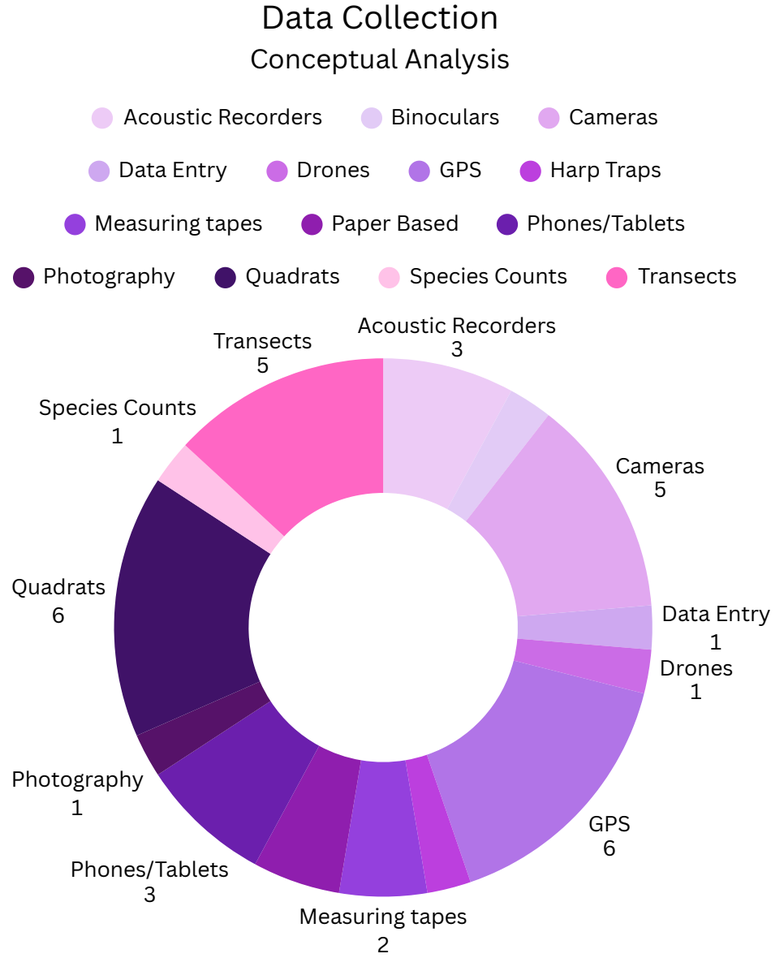


Fig 13: Data Collection Conceptual analysis 2

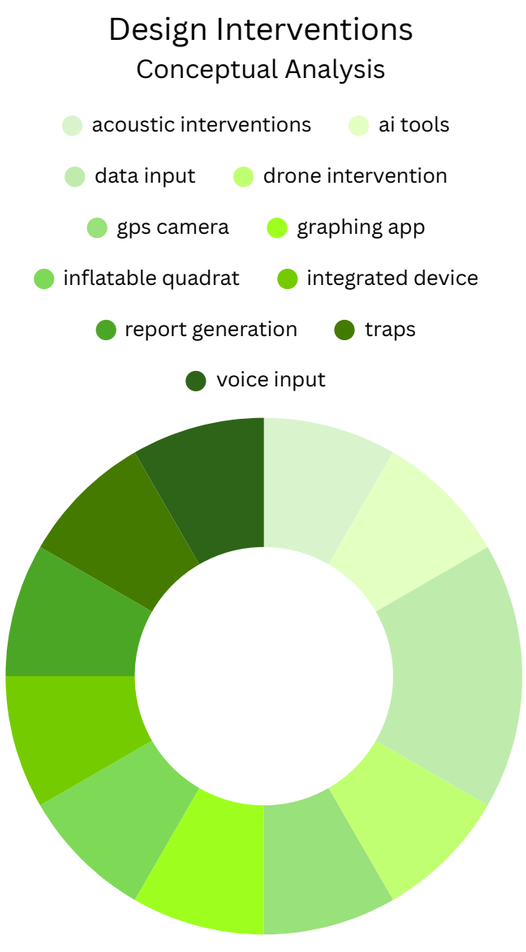


Fig 14: Design Interventions Conceptual analysis 2

Relevant Findings: Survey

Findings from this survey indicate that ecologists often use two or more data recording methods in combination, with Excel, phone apps and paper all being used consistently, suggesting that data is often re-recorded through multiple methods instead of one time. Equipment satisfaction ratings were middling, with no participants rating either extreme, indicating that current equipment is functional but not innovative. However, this satisfaction was not evenly distributed across all tools. Quadrat squares were viewed positively and were rarely raised in design suggestions, while data input and processing tools were mostly viewed negatively and often mentioned in relation to process frustrations. Quadrat squares were also the most commonly used data collection tool, used by 88.2% of participants, which suggests that this is an already well-functioning piece of equipment and requires no re-design. This held true for most other physical tools. Together, these findings suggest that design efforts should prioritise data input, recording, and processing over physical field tools.



Chapter 3
Discussion and Design Implication

Discussion

The findings of this research suggest that while existing ecological survey techniques such as quadrat or transect sampling are both suitable and functional, the data collection and handling workflow – recording and processing – is a large frustration point to many ecologists and bottlenecks the efficiency of the entire process.

This aligns closely with reviewed literature, which confirmed a heavy reliance on tools such as quadrat squares and GPS units (Sorrells & Glenn, 1991), both of which were identified as highly important to current surveying methods. However, the reviewed literature focused almost exclusively on survey techniques and methods alone, with little mention of data recording or processing – a vital component of the ecological surveying process. This presents an apparent gap, in that existing research addresses ecological surveying, but excludes the tools and workflows of data handling.

The research that has been conducted addresses this gap. Findings revealed that ecologists often use two or more data recording methods in combination, such as paper, phone apps or Excel. This indicates that ecologists are likely re-entering the data across multiple tools from paper or notes app to spreadsheet in a bottlenecked workflow, rather than a streamlined one. As well as this, while satisfaction levels of physical survey tools such as quadrat squares were consistently positive, data input and processing tools were often linked to user frustration. This was not discussed in the reviewed literature, which did not consider equipment satisfaction levels or process efficiency.

By identifying this gap between established survey techniques and the under-supported data handling, this research outlines new findings relevant to a design intervention with the purpose of improving or streamlining ecological surveying. Rather than redesigning effective tools like quadrat squares or transect lines, meaningful opportunities are centered around the data recording, input and processing stages of the ecological survey process.

Design Implications

Building on the identified gap between established ecological survey techniques and under-supported data handling processes, this section translates those findings into specific design problems and opportunities.

Design Problems

Several key design problems were identified through the analysis of interview and survey data, primarily in relation to how field data is recorded and processed once collected.

- Fragmented recording process: Most ecologists use two or more data recording tools/methods in combination with each other (Excel 94.1%, phone apps 76.5%, paper 64.7%) instead of a single integrated or streamlined system. This implies that data is often recorded once in the field via paper or a phone application such as notes, and then manually re-entered later into more formal spreadsheets, graphs and figures. By inputting data twice, this not only lengthens the process, but also increases the risk of error.

- Low satisfaction with data input and processing tools: While physical data collection and observation tools such as quadrats and transects were viewed positively, data input and processing tools were often linked to frustration in both interviews and surveys.

- Desire for automation: Interview analysis revealed a desire for automation around data input and report writing. This theme was the most mentioned sub-code across both interviews.

Design Opportunities

These outlined problems point toward several clear design opportunities, primarily focused on integrating and automating the data recording and handling process, not redesigning existing ecological surveying techniques.

- Integrated multi-functional equipment: Survey participants specifically made suggestions of integrating multiple pieces of equipment into a single integrated device, rather than relying on separate standalone equipment. This directly responds to the fragmented data recording process as mentioned above, as an integrated device could potentially reduce or eliminate data re-entry across multiple methods, therefore simplifying and streamlining the process.

- Voice input for hands free, streamlined data input: Research suggests that integrated devices incorporating voice input as a method of data recording without manual entry, therefore reducing reliance on paper based and phone-based note taking which later needs to be transferred into the necessary tables and figures.

- Automated data input and processing: As automation for data input and report writing was frequently mentioned during interviews, there is a strong opportunity to reduce manual and repetitive data handling tasks through automation, which directly addresses this frustration point.

Overall, these opportunities suggest that design direction should follow the path of a device/tool capable of capturing, consolidating and processing field data, therefore significantly reducing the repetitive admin work that ecologists are spending too much time on.

Conclusion

This research report examined the various methods, tools and problems of ecological surveying, with the aim of identifying and outlining opportunities for a design implementation. Through a combination of ecologist interviews and targeted online surveys, primary data was gathered directly from ecologists. This primary research was supported by secondary research such as literature reviews and benchmarking.

Findings revealed that while existing survey techniques are functional and generally viewed in a positive light, the data handling process is a large frustration point. Ecologists often rely on multiple data recording methods, effectively bottlenecking the efficiency and workflow of the process. It was found that there is an existing want for both integration and automation among survey participants and interviewees, mainly in relation to data recording and processing, therefore reinforcing that this is the biggest frustration point.

This was not addressed within the reviewed literature, showing a clear gap that this report addresses. In response to this gap, several design opportunities were identified, focused on integrating data capture methods and automating data recording and handling processes, while also considering further integration of other tools into a single piece of equipment.

These findings point to a clear direction for the design stage of this project, adressing the unmet needs of the ecological surveying process.

References

- Ahmed, S. K., Mohammed, R. A., Nashwan, A. J., Ibrahim, R. H., Abdalla, A. Q., Ameen, B. M. M., & Khdhir, R. M. (2025). Using thematic analysis in qualitative research. Journal of Medicine Surgery and Public Health, 6. https://doi.org/10.1016/j.glmedi.2025.100198
- batdetectors@gmail.com. (2022, February 10). Review: The New Chorus from Titley Scientific Part 1 Of 2. https://batdetecting.blogspot.com/2022/02/review-new-chorus-from-titley.html
- Betts Ecology and Estates. (n.d.). QUADRAT TALES. https://bettsecology.co.uk/insight/quadrat-tales
- Canova, S., Cortinovis, D. L., & Ambrogi, F. (2017). How to describe univariate data. Journal of Thoracic Disease, 9(6), 1741–1743. https://doi.org/10.21037/jtd.2017.05.80
- Caratti, J. F. (2006). Point Intercept (PO). Point Intercept, 164. https://www.fs.fed.us/rm/pubs/rmrs_gtr164/rmrs_gtr164_09_point_inter.pdf
- De Stefano, A., Fowers, B., & Mealor, B. A. (2021). Comparison of visual estimation and line-point intercept vegetation survey methods on annual grass–invaded rangelands of Wyoming. Invasive Plant Science and Management, 14(4), 240–252. https://doi.org/10.1017/inp.2021.36
- Ecological sampling - Ecosystems and habitats - KS3 Biology - BBC Bitesize. (2023, October 23). BBC Bitesize. https://www.bbc.co.uk/bitesize/articles/zndyf82#z4sqjsg
- Garmin GPSMAP 60CSX review - Maptoaster.com. (n.d.). Copyright (C) 2009 Integrated Mapping Ltd. https://www.maptoaster.com/maptoaster-topo-nz/articles/60CSx-review/garmin-gpsmap-60csx.html
- Hazzard, C. (2026, August 27). Garmin GPSMAP H1i Plus Review. HikingGuy. https://hikingguy.com/gear/garmin-gpsmap-h1i-plus-review/
- Isaac. (2022, July 9). Tascam DR-05X Review. Academic Transcription Services. https://weloty.com/tascam-dr-05x-review/
- Pizzata, T. (2022, July 19). Review: Garmin Rino 750 UHF/GPS. Sporting Shooter. https://sportingshooter.com.au/accessories/review-garmin-rino-750-uhf-gps/
- Scott, B. (2024, October 6). Zoom h2n Portable Recorder Microphone Review / Test — Podcastage. Podcastage. https://podcastage.com/rev/h2n
- Sorrells, L., & Glenn, S. (1991). Review of Sampling Techniques used in Studies of Grassland Plant Communities. Oklahoma Natural Heritage Inventory, 71, 43–45. http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.510.6756
- Using Quadrats. (n.d.). Field Studies Council. Retrieved September 4, 2026, from https://www.field-studies-council.org/resources/16-18-biology/fieldwork-techniques/vegetation-sampling/using-quadrats/