

# **PROJECT PLAN**

*Development of a citizen science platform for biodiversity on equine yards*

## **PREPARED FOR**

Prof. Dr. Inga A. Wolframm (commissioner)

Debby Gudden (internship coach)

## **PREPARED BY**

Lara Heric

[lara.heric@hvhl.nl](mailto:lara.heric@hvhl.nl)

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## Summary

The urgency of addressing the climate crisis, characterized by adverse weather, biodiversity loss, and deteriorating water and air quality, underscores the need for innovative solutions to mitigate its effects and adapt to changing environmental conditions. Nature, particularly small landscape features (LFs), holds significant potential in mitigating climate change effects and conserving biodiversity.

Despite successful research highlighting the biodiversity potential of equine farms, challenges persist due to the complexity of research designs. There is a recognized need for a new medium to facilitate information exchange between researchers and citizens for future projects.

To address these challenges, this project aims to modify and improve an existing survey used in a pilot study in the Netherlands to create a data gathering tool for a citizen science platform. The platform will collect information on equine yard characteristics and landscape features, aiming to engage users effectively and support data collection and analysis.

Utilizing expert knowledge and experience in platform creation and publication, the project will employ software tools like VisualStudio Code and Chat GPT for coding and ensuring platform functionality. Additionally, consideration will be given to server availability and domain hosting to ensure wide accessibility within the equestrian sector.

In summary, this project seeks to fill the gap in understanding and promoting biodiversity conservation in equine farms through the development of a citizen science platform, ultimately contributing to the broader efforts in mitigating the effects of the climate crisis and fostering sustainable environmental practices.

# 1. Introduction

The climate crisis, characterized by various factors such as adverse weather, biodiversity loss, decreased water and air quality, has reached a critical juncture prompting scientists to consider announcing a new epoch, the Anthropocene era, to signify humanity's profound impact on Earth's ecosystem (Pathak et al., 2022; Lin et al., 2022; World Health Organization, 2021; Rosol et al., 2023). This underscores the urgent need for innovative solutions to mitigate the effects of climate change and assist society in adapting to evolving environmental conditions.

Nature itself can serve as a powerful tool to mitigate climate change effects through ecosystem services, including the incorporation of small landscape features (LFs) (Pathak et al., 2022). LFs, defined as small fragments of non-productive natural or semi-natural vegetation in agricultural landscapes, offer numerous functional and culturally significant benefits (Czúcz, Baruth, Angileri, et al., 2022; Czúcz, Baruth, Terres, et al., 2022). Examples of LFs include trees, hedges, ponds, and stone walls, which provide shelter for animals, prevent soil erosion and flooding, enhance water and air quality, and facilitate carbon sequestration. Consequently, LFs are crucial instruments for biodiversity conservation (Biffi et al., 2022a; Birkhofer et al., 2015; Czúcz, Baruth, Angileri, et al., 2022; Estrada-Carmona et al., 2022; Jeanneret et al., 2003; Oreszczyn & Lane, 2000; Withaningsih et al., 2022).

Nearly half of the EU landscape is dedicated to agriculture, prompting initiatives aimed at environmental preservation and biodiversity enhancement. Notably, the Common Agricultural Policy (CAP) focuses on increasing the quantity and quality of LFs in agricultural landscapes (Czúcz, Baruth, Angileri, et al., 2022).

However, horse husbandry has often been overlooked in ecological transitions within agriculture, presumably because it does not yield products for human use or consumption in many cases (Bomans et al., 2011; Rzekęć et al., 2020). In the Netherlands alone, approximately 230,000 hectares of land are occupied by the equine sector. Consequently, Wolframm et al. (2024) investigated the potential of Dutch equine farms in fostering biodiversity through the quantification of small landscape features. Their study revealed that equine farms already surpass the target goals set by CAP, indicating significant potential to contribute to biodiversity conservation through the incorporation of LFs.

## **2. Problem**

Irregardless of the high responses, the research design of Wolframm et al. (2024) was considered complex. Conducting citizen science with a survey of 100+ question was a significant risk. However, the success of the study opened up various opportunities for researchers to continue investigating the biodiversity potential and the significance of LFs on equine farms. Thus, there is a recognized need for a new medium, such as a citizen science platform, to facilitate information exchange between researchers and citizens for future projects.

### **3. Project design**

For the purposes of this project an existing survey, which was used to carry out a pilot study on the topic in the Netherlands, will be modified and improved to the extent in which it can be used for the creation of a data gathering tool, that will be incorporated in the citizen science platform.

The existing survey included a total of 152 questions, which were split into two parts. In the first part, participants were asked to provide information on whether the yard was privately or commercially owned, the general geographic location (i.e. region), size of the property, designation (i.e. type of agricultural activities allowed); soil type, number of horses kept on the property. For the second part, participants were asked to provide information on the presence and, where applicable, size of landscape features present, as well as other biodiversity enhancing attributes. Participants were also encouraged to provide additional qualitative detail, if known, such as plant taxa, and were given the opportunity to upload a photo.

The contents of the survey will be integrated into the platform in a way to ease the provision of data for the user as well as to also aid the commissioner with the data analysis later on. The revised survey will likely be designed in the form of a (web) application, with a linked database where the collected information will be stored.

The platform's visual and functional design will draw upon existing data related to similar citizen science platforms. This approach aims to both engage users effectively by leveraging readily available design patterns and align with the commissioner's project vision. The platform will facilitate user data input and provide essential support throughout the data collection and analysis phases of their research.

The goal of using a compelling User Interface (UI) design based approach when building the platform, is to facilitate an increased rate of completed survey's and thus create an opportunity for the commissioner to conduct research more effectively.

It can be said that designing a functional data gathering platform is the main goal of this internship project. The result will, therefore, be a physical product in the form of a website or web application which will be considered intellectual property of the commissioner.

## **4. Facilities**

The project entails the utilization of expert knowledge and experience in the creation and publication of (research-oriented) platforms to facilitate the design and implementation of the web application.

To support the coding process for the platform/application, software tools and applications like VisualStudio Code and Chat GPT will be employed. VisualStudio Code or VS Code is a cloud based platform that simplifies the writing and storing of code and which supports different programming languages. Chat GPT on the other hand will be facilitated for checking the code and ensuring the code is bug free and functional.

Additionally, consideration is given to the availability of a server and domain where the web application can be published and made accessible to the public, ensuring its wide usability within the equestrian sector, specifically among private and commercial equestrian yards.

## 5. Schedule

The project is planned to be carried out within a 20 week period of time. In order to achieve that, an action plan with clear objectives and actions was formed to keep track of the project's overall progress throughout the weeks (see table 4).

*Table 1: Estimated project schedule.*

<b>Week</b>	<b>Objective</b>	<b>Actions</b>
<i>Week 1</i>	Write project plan	<ul style="list-style-type: none"> <li>• Reading research/articles</li> <li>• Making a detailed outline for the project.</li> <li>• Meeting with mentors/supervisors.</li> </ul>
<i>Week 2</i>		
<i>Week 3</i>		
<i>Week 4</i>		
<i>Week 5</i>	Research / gathering knowledge	<ul style="list-style-type: none"> <li>• Reviewing literature and existing knowledge on platforms/applications for data gathering and storing.</li> </ul>
<i>Week 6</i>		
<i>Week 7</i>	Meet with experts	<ul style="list-style-type: none"> <li>• Meet with VHL's ICT personnel as well as external ICT professionals.</li> <li>• Arrange a mentor/guide for implementing the technical aspects of the project.</li> </ul>
<i>Week 8</i>	Make a design / outline of the program	<ul style="list-style-type: none"> <li>• Create an outlined design of the structure of the application using software such as Canva and/or Adobe Illustrator.</li> </ul>
<i>Week 9</i>	Coding the program	<ul style="list-style-type: none"> <li>• Writing the code for the program.</li> <li>• Ensuring the technical feasibility of the code through periodic testing and occasional meetings with ICT professionals.</li> </ul>
<i>Week 10</i>		
<i>Week 11</i>		
<i>Week 12</i>		
<i>Week 13</i>		
<i>Week 14</i>		



<i>Week 15</i>	Testing and improving the program	<ul style="list-style-type: none"> <li>• Extensive testing of the program's functionality.</li> <li>• Looking for bugs and ensuring the safety of the application from a cyber security point of view.</li> </ul>
<i>Week 16</i>		
<i>Week 17</i>	Arranging the domain and server for publishing the platform	<ul style="list-style-type: none"> <li>• Meet with VHL's ICT personnel to discuss possibility of making the program available online.</li> <li>• Deciding on a domain name for the application.</li> </ul>
<i>Week 18</i>		
<i>Week 19</i>	Writing the project report and platform maintenance	<ul style="list-style-type: none"> <li>• Condensing the process of creating the application into a document.</li> <li>• Testing the capabilities of the program before/after its publication through the use of a sample group.</li> <li>• Maintenance of the program's code and functionality.</li> </ul>
<i>Week 20</i>		

## 6. References

- Biffi, S., Chapman, P. J., Grayson, R. P., & Ziv, G. (2022). Soil carbon sequestration potential of planting hedgerows in agricultural landscapes. *Journal of Environmental Management*, 307, 114484. <https://doi.org/10.1016/j.jenvman.2022.114484>
- Birkhofer, K., Diehl, E., Andersson, J., Ekroos, J., Fröhlich-Müller, A., Machnikowski, F., Mader, V. L., Nilsson, L., Sasaki, K., Rundlöf, M., Wolters, V., & Smith, H. G. (2015). Ecosystem services—current challenges and opportunities for ecological research. *Frontiers in Ecology and Evolution*, 2. <https://doi.org/10.3389/fevo.2014.00087>
- Bomans, K., Dewaelheyns, V., & Gulinck, H. (2011). Pasture for horses: An underestimated land use class in an urbanized and multifunctional area. *International Journal of Sustainable Development and Planning*, 6(2), 195–211. <https://doi.org/10.2495/SDP-V6-N2-195-211>
- Czúcz, B., Baruth, B., Angileri, V., Prieto Lopez, A., & Terres, J. M. (2022). *Landscape features in the EU Member States A review of existing data and approaches*. <https://doi.org/10.2760/101979>
- Czúcz, B., Baruth, B., Terres, J. M., Gallego, J., Hagyo, A., Angileri, V., Nocita, M., Soba, M. P., Koebler, R., & Paracchini, M.-L. (2022). *Classification and quantification of landscape features in agricultural land across the EU A brief review of existing definitions, typologies, and data sources for quantification*. <https://doi.org/10.2760/59418>
- Lin, L., Yang, H., & Xu, X. (2022). Effects of Water Pollution on Human Health and Disease Heterogeneity: A Review. *Frontiers in Environmental Science*, 10. <https://doi.org/10.3389/fenvs.2022.880246>
- Oreszczyn, S., & Lane, A. (2000). The meaning of hedgerows in the English landscape: Different stakeholder perspectives and the implications for future hedge management. *Journal of Environmental Management*, 60(1), 101–118. <https://doi.org/10.1006/jema.2000.0365>
- Pathak, A., Hilberg, L., Hansen, L., & Stein, B. (2022). Key Considerations for the Use of Nature-Based Solutions in Climate Services and Adaptation. *Sustainability*, 14(24), 16817. <https://doi.org/10.3390/su142416817>

Rosol, C., Schäfer, G. N., Turner, S. D., Waters, C. N., Head, M. J., Zalasiewicz, J., Rossée, C., Renn, J., Klingan, K., & Scherer, B. M. (2023). Evidence and experiment: Curating contexts of Anthropocene geology. *The Anthropocene Review*, 10(1), 330–339. <https://doi.org/10.1177/20530196231165621>

Rzekęć, A., Vial, C., & Bigot, G. (2020). Green assets of equines in the European context of the ecological transition of agriculture. *Animals*, 10(1). <https://doi.org/10.3390/ani10010106>

Withaningsih, S., Parikesit, P., Malik, A. D., & Rahmi, M. A. (2022). Analysis of the Structure and Ecological Function of an Extreme Landscape in a Tropical Region of West Java, Indonesia. *Forests*, 13(1), 115. <https://doi.org/10.3390/f13010115>

Wolframm, I., Heric, L., & Allen, A. M. (2024). Green treasures: Investigating the biodiversity potential of equine yards through the presence and quality of landscape features in the Netherlands. *PloS One*, 19(4), e0301168. <https://doi.org/10.1371/journal.pone.0301168>

World Health Organization. (2021). *WHO global air quality guidelines. Particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxid.*

# Annex 1: Platform design mockup

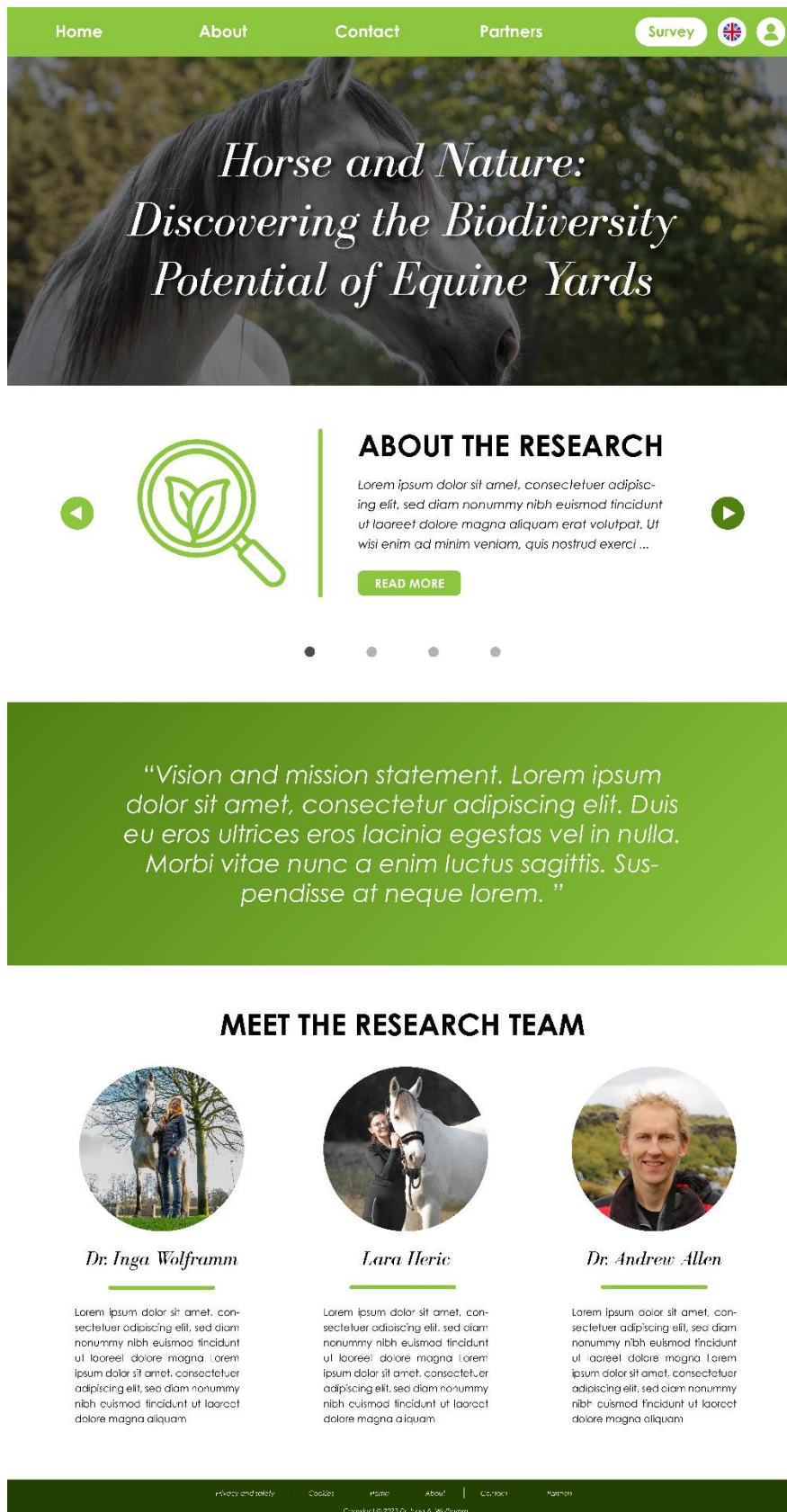


Figure 1: Mockup of the platforms visual design

## **Annex 2: Platform content - LF definitions and descriptions**

### ***What are landscape features (LFs) and what is their role in our environment?***

Landscape features (LFs) can be described as non-productive sections of agricultural land, that can be found in the form of natural elements such as hedges, ponds, and trees, but also semi-natural elements such as stone walls and fences. Landscape features were historically integral to farming. Their traditional roles included timber supply, crop and livestock shelter, and land separation. While modern agriculture reduced their significance, certain functions like erosion control and biodiversity support persist. These features provide essential ecosystem services:

- improved air and water quality
- carbon sequestration - capturing and storing CO<sub>2</sub> from the atmosphere,
- and climate resilience - the ability to withstand and adapt to the adverse effects of climate change.

In addition, they directly benefit nearby agricultural fields by providing habitats for beneficial organisms, enhancing crop productivity, and improving soil quality. Moreover, certain landscape features possess cultural significance in specific regions. In summary, LFs play a multifaceted role, offering environmental and agricultural advantages while preserving cultural heritage.

### ***Classification of functional landscape features***

Functional landscape features (FLFs) can be divided into four depictive subcategories. These categories, formally identified as 'FLF classes,' encompass woody features, grassy features, wet features, and stony features.

Woody features, classified as one of the Functional Landscape Feature (FLF) classes, encompass various elements that are vital in agricultural landscapes. These elements include isolated trees, tree lines along avenues, hedges, woody strips, trees grouped together, field coppices, and riparian woody vegetation. These features play a significant role in the landscape by offering shelter, aesthetic appeal, and important habitat for wildlife. For instance, hedges serve as windbreaks and habitat for small animals, while isolated trees provide shade and habitat for

birds. These woody elements contribute both to the ecological balance and the cultural character of agricultural regions.

Grassy features encompass various elements in agricultural landscapes. These elements include grassy strips, field margins, embankments, buffer strips, and grassed 'thalweg' areas. Grassy features serve multiple purposes, such as preventing soil erosion, providing habitat for pollinators, and enhancing water quality by filtering runoff. For instance, field margins can act as wildlife corridors, while buffer strips along water bodies help reduce pollution. Overall, grassy features contribute to both the ecological and functional aspects of agricultural landscapes.

Wet features encompass elements related to water bodies within agricultural landscapes. These elements include inland channels of freshwater, small standing water bodies like natural or man-made ponds, and ditches. Wet features serve various ecological roles, such as providing habitats for aquatic species, supporting water quality, and assisting in flood control. For instance, ponds offer breeding grounds for amphibians, while ditches help manage water flow in fields. In an agricultural context, these features play a vital role in promoting biodiversity and managing water resources, aligning with the broader ecosystem services framework.

Stony features encompass elements related to the presence of stones or rock formations within agricultural landscapes. These features include dry stone walls, terrace elements, rock outcrops, and both natural and artificial stone stacks. Stony features serve diverse purposes, such as providing structural support, delineating boundaries, and contributing to soil quality. For example, dry stone walls act as traditional field boundaries and enhance soil drainage, while rock outcrops may serve as unique habitats for certain plants and wildlife. In an agricultural context, these features play a role in both land management and cultural heritage preservation, making them significant components of the landscape.

***Description of individual landscape features and their significance***

*Woody features*

<p><b>Solitary tree</b></p>	<p>A solitary tree is an individual tree standing apart from dense forests, adding aesthetic appeal to the landscape. It offers shade, shelter for wildlife, and helps control erosion. These trees may hold cultural or historical significance and serve as landmarks. Additionally, they contribute to carbon sequestration and can act as windbreaks, protecting crops and</p>
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	structures. Solitary trees play a pivotal role in enhancing the environment's beauty and functionality while often carrying unique cultural or ecological value.
<b>Monumental tree</b>	A monumental tree is a large, often ancient tree cherished for its cultural, historical, and ecological value. These trees serve as iconic landmarks, beautify landscapes, and provide habitat for wildlife. They also offer environmental benefits like carbon sequestration and soil erosion prevention. Monumental trees educate, inspire, and connect people to nature and their cultural heritage, making them significant landscape features that bridge the past and present while promoting conservation efforts.
<b>Pollard tree</b>	A pollard tree is a tree intentionally pruned to head height or above to protect it from browsing livestock. This practice encourages the growth of new branches, creating a unique, knobby appearance. Pollard trees serve various purposes: safeguarding trees from livestock, promoting straight branch growth for timber, adding visual interest to landscapes, providing wildlife habitat, preserving cultural traditions, and controlling soil erosion. Their distinctive appearance and multifunctional role make them significant landscape features with historical, cultural, and ecological value.
<b>Tree lane</b>	A tree lane is a line of evenly spaced trees along a road or pathway. It enhances the landscape's beauty, provides shade and cooler temperatures, reduces wind and noise, and serves as wildlife habitat. Tree lanes often hold historical and cultural significance and act as landmarks for navigation. They contribute to property values and create inviting spaces for outdoor activities, making them valuable and versatile landscape features.
<b>Tree avenue</b>	A tree avenue is a striking landscape feature consisting of two parallel rows of trees, meticulously designed for both beauty and function. These avenues create an elegant and shaded pathway, offering comfort to pedestrians and travellers. They often hold historical and cultural importance, symbolizing heritage and serving as landmarks. Additionally, tree avenues help organize spaces, aid navigation, provide habitat for wildlife, and promote social activities, making them valuable and multifaceted landscape elements.
<b>Fruit orchard</b>	A fruit orchard is a cultivated area with fruit-bearing trees, grown primarily for fruit production. Orchards provide a sustainable source of fresh fruits, enhance landscape beauty with colourful blooms and ripe fruits, and offer recreational opportunities like fruit picking. They also support local biodiversity and have educational and cultural significance. Commercial orchards contribute to the economy and provide employment, making them valuable and versatile landscape features.
<b>Hedgerow</b>	A hedgerow is a dense row of shrubs or small trees that serves various landscape purposes. It delineates boundaries, provides windbreak and erosion control, offers wildlife habitat, and enhances privacy and aesthetics. Hedgerows often have historical and cultural significance and play a role in carbon sequestration. These versatile features contribute to the biodiversity and overall health of landscapes, both in rural and urban settings.
<b>Clipped hedge</b>	A clipped hedge is a meticulously pruned row of shrubs or small trees, known for its precise and well-maintained appearance. It serves several landscape purposes, including defining boundaries, providing privacy, and adding aesthetic charm. These hedges are often shaped into geometric or formal designs, offering screening from noise and unsightly views while enhancing the overall beauty and structure of outdoor spaces. They can also act as windbreaks and habitat for wildlife, making them valuable additions to landscapes.
<b>Woody strip</b>	A woody strip is a narrow planting of trees and shrubs within a landscape, serving multiple purposes. It acts as a windbreak, preventing soil erosion and providing a buffer against strong winds. Woody strips also foster biodiversity by offering habitat for wildlife, improve aesthetics with seasonal foliage and flowers, and provide privacy and noise reduction. Additionally, they create favorable microclimates, sequester carbon, and can be valuable in

	agricultural settings. These strips are versatile and contribute to both ecological health and the visual appeal of landscapes.
<b>Permanent woodpile</b>	A permanent woodpile is a deliberately arranged stack of wood logs or branches, typically placed in a specific location within a landscape. These landscape features serve multiple purposes, including providing a readily accessible source of firewood for heating or cooking, supporting biodiversity by creating habitats for insects and small animals, and enhancing the overall aesthetics of the landscape. Permanent woodpiles can also contribute to sustainable forestry practices by utilizing fallen or excess wood from tree maintenance or timber harvesting activities, thereby reducing waste and promoting responsible land management.
<b>Field coppice</b>	A field coppice is a landscape feature where trees or woody shrubs are regularly cut back to the ground, promoting new growth. It serves various purposes, including providing a sustainable source of wood, fostering biodiversity, controlling erosion, and offering cultural and aesthetic value. Field coppices also aid in carbon sequestration, act as windbreaks, and provide shelter for crops and livestock, making them versatile and ecologically valuable components of the landscape.
<b>Riparian woody vegetation</b>	Riparian woody vegetation refers to the plant life, including trees and shrubs, that naturally grows along the banks of rivers, streams, or other water bodies. These vegetation zones play a crucial role in maintaining the health and stability of aquatic ecosystems. They help prevent soil erosion, filter pollutants from runoff, provide habitat for wildlife, regulate water temperature, and contribute to overall water quality. Additionally, riparian woody vegetation enhances the scenic and recreational value of landscapes while promoting biodiversity and supporting ecological balance in riparian environments.
<b>Woody strip</b>	A woody strip is a narrow planting of trees and shrubs within a landscape, serving multiple purposes. It acts as a windbreak, preventing soil erosion and providing a buffer against strong winds. Woody strips also foster biodiversity by offering habitat for wildlife, improve aesthetics with seasonal foliage and flowers, and provide privacy and noise reduction. Additionally, they create favourable microclimates, sequester carbon, and can be valuable in agricultural settings. These strips are versatile and contribute to both ecological health and the visual appeal of landscapes.

### Grassy features

<b>Grassy strip</b>	A grassy strip is a linear area mainly covered in grasses, typically found at field edges or between different land types. These strips serve multiple crucial purposes in the landscape. They act as protective buffers, reducing the flow of pollutants into nearby water bodies and safeguarding water quality. Additionally, they provide habitat for various wildlife, fostering biodiversity in agricultural areas. Grassy strips also serve as windbreaks, mitigating soil erosion and offering shelter for crops and livestock. Beyond their practical functions, these strips enhance the landscape's aesthetics and contribute to ecological balance and sustainable farming practices.
<b>Field margin</b>	A field margin is a narrow, uncultivated strip of land at the edge of a cultivated field or agricultural area. These margins act as buffers between farmland and natural habitats, providing shelter and food for wildlife. They support diverse plant species, attracting various animals and insects, contributing to biodiversity. Field margins also aid soil and water conservation and enhance the landscape's visual appeal by breaking up large agricultural fields.
<b>Forage wall</b>	A forage wall is a landscape feature commonly made of stacked hay or straw bales, primarily serving as a convenient feed source for farm animals, especially during the winter. These walls also act as windbreaks, protecting both livestock and crops from harsh winds and potential



	erosion. In some cases, they may store agricultural materials and add visual interest to rural landscapes, occasionally holding cultural or historical significance.
<b>Flowering strip</b>	A flowering strip is a linear planting of native or wildflowers within a landscape, primarily serving as essential habitat for pollinators like bees and butterflies. These strips not only enhance biodiversity by attracting various wildlife but also prevent soil erosion with their root systems. They add visual beauty to landscapes, offer educational and recreational opportunities, and promote sustainable landscaping practices. Additionally, they indirectly benefit nearby agricultural areas by enhancing crop pollination, making them valuable landscape features for both ecological health and aesthetics.
<b>Embankment</b>	An embankment is a raised mound of earth or other materials often constructed along bodies of water, roads, or railways. These landscape features serve various purposes, including flood control, erosion control, providing level surfaces for transportation infrastructure, reclaiming land from water bodies, and enhancing aesthetics. Embankments can also act as noise barriers, create recreational spaces, and offer visual screening in urban environments. They are versatile landscape features essential for managing water and improving the functionality and appearance of outdoor spaces.
<b>Buffer strip</b>	A buffer strip is a planted area alongside water bodies like rivers and lakes, consisting of trees, shrubs, or grasses. Its primary purposes include improving water quality by filtering pollutants, preventing soil erosion, providing habitat for wildlife, mitigating floods, enhancing landscapes, and supporting climate resilience. These landscape features are essential for safeguarding water ecosystems, reducing pollution, and fostering biodiversity while also offering recreational and aesthetic benefits.
<b>Grassed 'thalweg'</b>	A Grassed 'thalweg' refers to a vegetated strip along the lowest part of a valley or drainage channel, typically featuring grass or herbaceous vegetation. Its primary purpose is to control erosion and manage water runoff by stabilizing the soil and absorbing excess water. This landscape feature also contributes to biodiversity by providing habitat for various plant and animal species. Additionally, Grassed 'thalwegs' can enhance the aesthetics of the landscape, particularly in rural areas, adding greenery and natural beauty to the surroundings.
<b>Monocultural grassland</b>	A monocultural grassland is a landscape dominated by a single type of grass, primarily used for agricultural purposes like livestock grazing and forage production. These grasslands provide food for animals, help stabilize soil to prevent erosion, and offer spaces for recreational activities. However, they often have lower biodiversity than natural grasslands and can require sustainable management to minimize environmental impacts.
<b>Herbaceous grassland</b>	An herbaceous grassland is a landscape dominated by non-woody plants, known for its rich biodiversity, wildlife habitat, carbon sequestration, and scenic beauty. These areas support a wide range of plants and animals, making them crucial for conservation, research, and recreation. Herbaceous grasslands also contribute to carbon storage, helping combat climate change. They may have agricultural uses such as livestock grazing or hay production. Preserving and sustainably managing these landscapes is vital to safeguard their ecological and aesthetic value.

## Wet features

<b>Pond</b>	A pond is a small, calm body of water that serves as a vital landscape feature. Ponds support diverse ecosystems, offering habitat for various aquatic life forms and contributing to biodiversity. They also help regulate local water cycles, enhance aesthetics, and provide recreational opportunities like fishing and boating. Ponds can improve water quality, making
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	them valuable for managing resources and supporting scientific research. Additionally, they hold cultural and artistic significance, enriching both natural landscapes and human experiences. Proper management is crucial to preserve their ecological and recreational value.
<b>Ditch</b>	A ditch is a narrow channel dug into the ground, serving various essential purposes. It manages water by preventing flooding, aiding irrigation, and controlling runoff to prevent soil erosion. Ditches also play a role in land demarcation, habitat creation, and supporting infrastructure. They have historical and cultural significance, representing ancient water management systems in some cases. Overall, ditches are versatile landscape features crucial for water management, soil conservation, and land use planning.
<b>Stream</b>	A stream is a natural flowing watercourse, smaller than a river, with numerous vital roles in the landscape. It serves as a source of freshwater for drinking and irrigation, supports diverse aquatic ecosystems, and improves water quality downstream. Streams offer recreational activities and scenic beauty, hold cultural significance, and may even contribute to clean energy through hydroelectric power generation. Proper management is essential to preserve their ecological and practical functions while enhancing the landscape's aesthetics.
<b>Wetlands</b>	Wetlands are low-lying areas with water, serving as vital landscape features. They foster biodiversity, control flooding, and filter pollutants to enhance water quality. Wetlands offer recreational opportunities, mitigate climate change, and hold cultural significance. They also serve as educational resources and, in some cases, contribute to agriculture. These diverse functions make wetlands essential for ecosystems and human well-being, emphasizing the importance of their conservation and responsible management.

## Stony features

<b>Dry Stone walls</b>	Stone walls, constructed by stacking stones, play diverse roles in the landscape. They mark boundaries, contain livestock, and prevent soil erosion. Additionally, these walls hold aesthetic and cultural value, contributing to a region's identity and history. They can also serve as habitat for small creatures and attract tourists and outdoor enthusiasts. Overall, stone walls are versatile landscape features with practical, cultural, and environmental significance.
<b>Terrace</b>	A terrace is a level platform built on sloping terrain using materials like stone or wood. It serves various purposes, such as preventing soil erosion, enabling agriculture on hilly landscapes, creating attractive garden spaces, managing water runoff, providing accessibility in urban areas, and enhancing landscape aesthetics. Terraces are versatile and valuable landscape features due to their ability to address practical needs while adding visual interest to the environment.
<b>Rock outcrop</b>	A rock outcrop is a geological formation where bedrock or rock layers are exposed on the Earth's surface. These outcrops are valuable for geological research, providing insights into Earth's history and processes. They also serve as unique habitats for specialized plants and animals, adding to biodiversity. Additionally, rock outcrops enhance the visual appeal of natural landscapes and may offer recreational opportunities like rock climbing. Some have cultural or historical significance to local communities, making them important features in both scientific and cultural contexts.
<b>Natural or artificial stone stacks</b>	Natural or artificial stone stacks are formations of rocks found in landscapes. They add visual appeal and cultural value to their surroundings. Natural stone stacks provide habitats for specialized plant and animal species adapted to rocky environments. Artificial stone stacks often hold cultural or artistic significance and are used for landscaping or decorative purposes. They may also serve as markers or wayfinding elements in outdoor areas. These stone stacks enhance landscape diversity, combining natural beauty with human creativity.

## Other features

<b>Birdhouse</b>	A birdhouse, or nest box, is a small human-made structure designed to provide shelter and nesting sites for birds. These features serve as valuable additions to landscapes, promoting bird nesting, aiding in wildlife conservation, enabling birdwatching, enhancing aesthetics, and even contributing to pest control by attracting beneficial bird species. Birdhouses are a charming and practical way to support local bird populations and improve the overall appeal of outdoor spaces.
<b>Bat box</b>	A bat box is a specially designed structure that serves as a roosting site for bats. These boxes are placed in outdoor settings to support bat populations, aid in insect control, enhance biodiversity, facilitate scientific research, and provide educational opportunities. By mimicking natural roosting sites, bat boxes contribute to bat conservation and the overall health of ecosystems.
<b>Insect hotel</b>	An insect hotel is a human-made structure designed to shelter and support beneficial insects and pollinators. These miniature landscape features enhance biodiversity, promote pollination, aid in natural pest control, serve as educational tools, and facilitate scientific research. They provide a habitat for various insects, including solitary bees, ladybugs, and beetles, contributing to a healthier ecosystem and offering opportunities for learning and research.
<b>Proven nesting site</b>	A proven nesting site refers to a specific location or habitat that has been confirmed as a successful nesting place for birds or other wildlife through documented evidence or observations. These landscape features play a vital role in supporting local wildlife populations by providing safe and suitable places for breeding and raising young. They contribute to biodiversity conservation, ecological balance, and the overall health of ecosystems by ensuring the survival of various species. Furthermore, proven nesting sites are valuable for research, monitoring, and conservation efforts aimed at protecting vulnerable wildlife species.
<b>Cluttered corner</b>	A cluttered corner in a landscape often refers to an area where various objects, vegetation, or structures gather somewhat haphazardly. While not always planned, cluttered corners can serve various purposes, including providing wildlife habitat, creating unique microclimates, enhancing biodiversity, adding visual interest, supporting education and research, and contributing to artistic expressions in garden design. These corners offer a diverse and dynamic element in the landscape with multiple potential benefits.

### ***Measurements and indicators for managing LF use in agricultural land***

Measuring landscape features (LF) in agricultural land offers valuable data that can have significant practical applications:

- *Informed Land Management:* Accurate LF data helps land managers and policymakers make informed decisions regarding land use and conservation. It provides insights into the state and distribution of these features, aiding in sustainable land management practices.
- *Biodiversity Conservation:* LF data contributes to biodiversity conservation efforts. Understanding the presence and quality of features like woody strips or wetlands allows for targeted conservation initiatives, ensuring the protection of vital habitats.

- *Ecosystem Services*: These features play a crucial role in providing ecosystem services, such as pollination, water purification, and carbon sequestration. Measuring them helps quantify these services, highlighting their importance in agricultural landscapes.
- *Landscape Health*: Monitoring LF offers a way to assess the overall health and resilience of landscapes. Changes in the abundance or quality of these features can signal potential environmental issues, allowing for timely intervention.
- *Cross-Project Comparability*: A standardized approach to LF measurement enhances comparability across different projects and regions. This comparability enables researchers and policymakers to draw meaningful conclusions from diverse datasets.
- *Efficient Resource Allocation*: Data on LF distribution and quality assists in allocating resources efficiently. It ensures that conservation efforts and investments are directed toward areas with the greatest need or potential impact.
- *Ecological Research*: Researchers benefit from LF data to study ecosystem dynamics, habitat connectivity, and the impacts of land management practices. This information contributes to a deeper understanding of agricultural ecosystems.

In addition, indicators for measuring the quantity of landscape features include counting the number of specific features within an area, assessing their density (features per unit area), evaluating coverage (proportion of land area covered), measuring the length of linear features, calculating the area they occupy, determining their width or isolation, and, in the case of water bodies, assessing their volume. These indicators help gather quantitative data about landscape features, aiding in tracking changes, comparing regions, and making informed land management and conservation decisions.

In summary, measuring landscape features generates data that informs land management, supports biodiversity conservation, quantifies ecosystem services, monitors landscape health, enhances cross-project comparability, aids resource allocation, and advances ecological research. This data is essential for achieving sustainable and ecologically responsible agricultural practices.

### ***Potential of extensive LF implementation on equestrian yards***

Landscape features have been demonstrated to play a significant role in enhancing sustainability across societal, economic, and particularly environmental dimensions. Although

extensive research and literature have explored the agricultural benefits of landscape features, including their vital role within the sector, the incorporation of these features into horse-keeping practices is often overlooked. It is worth noting that landscape features hold substantial untapped potential and advantages for horse property owners and the equine industry at large.

While comprehensive research specific to landscape feature utilization on horse farms is lacking, an analysis of existing literature reveals potential advantages that can greatly benefit horse management and land management for horse property owners. These potential benefits encompass:

- **Welfare Management:** Landscape features can enhance equine welfare through the provision of shade and shelter by planting trees in paddocks, ensuring access to clean water from various sources (e.g., groundwater, water streams), offering quality grass and hay as well as increased turnout opportunities due to enhanced land management practices.
- **Facility Management:** Specific LFs contribute to natural pest control by providing shelter to beneficial bird species (e.g., by planting trees or creating organized nesting sites), facilitating better management of outdoor riding arenas by incorporating features that aid in runoff water drainage (e.g., ditches), thus preventing property flooding, and potentially enhanced safety for riders and horses through the use of hedges as an alternative fencing option.
- **Land Management:** Extensive use of LFs is proven to improve soil quality, promoting grass and crop growth, which ultimately results in more abundant pastures that can be utilized for extended periods during the year and potentially increasing hay production (especially valuable as quality hay becomes scarcer and more expensive). Additionally, enhanced soil retention capabilities reduce the risk of field and pasture flooding, ultimately minimizing losses.

Therefore, it can be stated that incorporating landscape features into horse farm management practices can yield substantial benefits, both in terms of equine well-being and the overall sustainability of horse-related operations.

### ***Barriers of standardising LF use on equine yards***

While the incorporation of landscape features (LFs) on equine yards holds significant promise for enhancing equine well-being and the sustainability of horse-related operations, several barriers stand in the way of their widespread adoption. These barriers encompass challenges related to awareness, financial considerations, land constraints, and the ongoing management and maintenance of LFs. Recognizing and addressing these obstacles is essential to unlock the full potential of LFs within the equine industry, ultimately benefitting both horses and their owners. Some noteworthy elements that could hinder the efforts of standardising the use of LFs on equine properties are:

- **Limited Awareness:** One of the primary barriers to standardizing LF use on equine yards is limited awareness within the equine industry regarding the potential benefits. Horse property owners may not be well-informed about the advantages of incorporating LFs into their management practices.
- **Financial Considerations:** The initial investment required for planting trees, establishing hedges, or constructing ditches and other LFs can be a financial barrier for some horse yard owners. While the long-term benefits are substantial, upfront costs may deter adoption.
- **Land Constraints:** Equine properties vary in size and layout. Some yards may have limited available land, making it challenging to incorporate certain LFs effectively. Smaller properties may need to prioritize which features to implement.
- **Maintenance and Management:** Properly maintaining and managing LFs require time and effort. For example, tree care, hedge trimming, and watercourse maintenance demand ongoing attention. Without dedicated resources and expertise, equine property owners may struggle to effectively manage these features.

In conclusion, standardizing the use of landscape features on equine yards holds immense potential for enhancing equine welfare, facility management, and land management. However, addressing barriers such as limited awareness, financial considerations, land constraints, and maintenance challenges is essential for the widespread adoption of these practices within the equine industry. Recognizing and overcoming these obstacles can lead to more sustainable and horse-friendly equine yards, essentially benefiting both the equine industry and the general society as a whole.