

Bumps and Holes! How to turn the free-range into a biodiverse Walhalla?

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Summary

In this article (and research report), attempts are made to obtain answers and describe findings regarding whether biodiversity in the free range can be increased. Literature describes that the well-being of the chickens is enhanced by a free range. Additionally, the design of a free range seems to have an impact on the number of chickens going outside and the distance they cover and move within the free range. Through discussions with various agricultural entrepreneurs, it was concluded that the continuous provision of grass, bushes, or other plant-based ground cover is a utopia. The disappearance of ground cover begins beyond the first meter past the free range openings and gradually expands during a laying cycle. Solutions such as stones or other non-natural materials only shift the problem. During my scholarship, I experimented with increasing biodiversity by seeding herbs across the entire free range. Furthermore, we will be planting trees (walnuts, sweet chestnuts, and hazelnut trees). These will be planted close to the hatches to encourage the chickens to venture further and faster into the free range. We are also experimenting with placing straw bales. These straw bales provide distraction but may also serve as ground cover. From the perspective of regenerative agriculture, we hope that the straw and trees will improve soil structure. We anticipate that this will make the soil more fertile, promote the growth of a variety of plants, and further increase biodiversity.

Introduction

The distressing sight of our free range transformed into a sandbox full of holes and bumps led me to formulate my research question for my Nuffield scholarship: "Can the degraded sandbox be turned back into an appealing free range for the chickens, or better yet, can it be improved into a more nature-inclusive and biodiverse free range?"

For decades, the agricultural land around the poultry farm of the (century-old) family business Tomesen was planted with crops such as corn, grains, potatoes, or rapeseed, following a system of small-scale crop rotation. In 2019, the two-story free-range barn was renovated to house chickens that could also roam outdoors. The agricultural land was designated as the free range, marking a transition from varying crop cultivation to permanent grassland. Surprisingly, the municipal process resulted in reclassifying the previously extensive agricultural land as intensive livestock farming.

The farmland became permanent grassland, serving as the free range. In addition to the grassland, the premises also include 'groves' planted after the construction of the A18 highway in 1979 and woodlands established in 2012 and 2020. Theoretically, it is an ideal setting for the chickens. However, the chickens are not the sole inhabitants of this free range. For the past 15 years, 10 beehives and 8 Black Welsh Mountain sheep have been permanent residents, contributing to shaping the landscape. During the planting of the woodlands, consideration was given to providing forage for the bees. Additionally, part of the farmland always served as grazing land for the sheep. It became evident quickly that the sheep couldn't consume all the grass, leading to the introduction of Dutch 'Brandrode' cattle to assist them.

From a landscape perspective, the farm is surrounded by a highway, an industrial area, and a residential neighbourhood, making it an intensive operation in a multifunctional environment. To ensure the farm's sustainability, recent efforts have focused on more environmentally friendly production, including the installation of solar panels and the renovation of barns to meet the 'Beter Leven' animal welfare quality mark. Emphasizing eco-friendliness, surplus bread is fed to the chickens, and paper trays for the eggs are reused.

The free range enhances the well-being of the chickens by providing 'living space' and by reinforcing (enabling) their natural behavior: foraging for food, taking dust baths, and finding entertainment through scratching. However, if the environment transforms into a sandy plain, does this principle still hold? If biodiversity 'disappears' along with the grass cover, how does it impact the well-being of the chickens?



Problem Statement/Research Question

In recent years, the Netherlands has faced a housing order for free-range chickens due to repeated outbreaks of avian influenza. During this confinement, it was observed that the outdoor space for the chickens turned lush and green, with the grass thriving. Beyond the aesthetic appeal of a beautiful and natural environment, there arose a desire to make the farm more sustainable and biologically balanced. Currently, there is ongoing debate about the natural responsibility of intensive livestock farming and its associated biodiversity in the Netherlands. This led to the question and research desire of whether the various interconnected interests could be combined in a research project. This culminated in the research question: "How can the intensive free range be designed to be more nature-inclusive, thereby increasing biodiversity?" Could I create a kind of free range paradise with enough biodiversity for our hobby animals to graze on?

Specifically, at the beginning of my Nuffield scholarship, I posed the question: Is it possible to design the free range to be more nature-inclusive, thus increasing biodiversity?



Research Methodology Used

The research methodology employed involves searching for relevant literature, gaining testable experiences through travel, engaging in observational discussions with fellow poultry farmers, conducting research on the farm itself, and integratively evaluating the experienced answers, insights gained, and potential innovations.

Results

In this research, various research methods were employed to determine/practically test whether the biodiversity of the free range can be effectively improved/enhanced. Below, the results of the different research methods will be described. Firstly, we will delve into what is known in the relevant literature about biodiversity in a free range. Then, the risks of diseases will be outlined. Several (concrete) solutions will be identified, and finally, solutions from regenerative agriculture and agroforestry will be explained/considered as opportunities.

Free ranges and Biodiversity

The search for information, articles, and experiences on increasing biodiversity in free ranges yielded minimal information. The animal welfare organization notes that chickens provided with more space, enrichment materials, and physical opportunities to express their natural behaviour have a 'better

life.' They can move inside and outside; in the morning, the shutters open, and they have about 4 square meters per chicken of space. Chickens are originally forest animals, and they are unlikely to use a large, open field due to the threat of predators. To encourage chickens to use the free range effectively, additional sheltered areas are needed. Claire Bonnefous et al. (2022) note in their research that many chickens stay close to the barn and do not use the entire free range if there isn't sufficient shelter in the form of trees, bushes, or hiding spots. Consequently, if many chickens stay close to the barn, the first meters are intensively used, leading to damaged areas near the free range openings. As a solution to disperse chickens throughout the entire free range, they suggest offering not only plantings but also bales of alfalfa or insect larvae spread in the free range. The conclusion is that there is more information available on free ranges and how they allow chickens to express their natural behaviour with sufficient shelter, but there is scarce information on the correlation with biodiversity.

To clarify the relationship with a biodiverse environment, it is sensible to further describe the combined role with biodiversity. Wageningen University & Research (WUR, www.wur.nl, 2023) defines biodiversity as encompassing all species of plants, animals, and microorganisms, along with the vast genetic variation within those species and the variation in ecosystems from meadow to wetland, river to sea, and forest to residential area. Almost everything we eat can be directly or indirectly traced back to biodiversity – whether wild or domesticated. The Food and Agriculture Organization (FAO) estimates that globally, three-quarters of all agricultural crops depend on pollinators such as (wild) bees, bumblebees, and hoverflies. Additionally, most of our building materials, medicines, and industrial raw materials are derived from or via biological resources. Various forms of tourism, sports, and leisure activities also depend on nature, meaning that biodiversity represents a significant added/economic value, emphasizes Jones-Walters (www.wur.nl, 2023).

Biodiversity involves both the chickens and the plants and insects they enjoy eating. Chickens like to forage in grass, eat the grass, and search for insects. To attract and feed enough insects (and ensure good insect biodiversity), sufficient food sources in the form of flowering plants should be present. Ideally, this food for insects should come from native plants. Many insects, birds, and butterflies in the Netherlands are less focused on seeds and fruits of exotic plants. Native insects have co-evolved for centuries with plants that traditionally occur in the Netherlands. These plants have also adapted better to our environment, making them more resilient to our climate and therefore stronger and less prone to diseases.

Not only do chickens consume insects above ground, but they also seek and eat worms, various larvae, and other insects below the surface. Scratching and pecking by chickens lead to pits and mounds. As a result, both plants and their roots are disturbed and/or damaged. Scratching and pecking are natural behaviors for chickens, providing them with a desirable meal as well as movement and distraction. As this behavior is rewarding, it is perpetuated and results in the decrease of grassland over the course of a cycle. The boundary between sand and grass continues to shift, along with the biodiversity. In this case, what remains is bare clay soil. The first meters after the hatches are the most intensively used by the chickens. They need to traverse this area to enter and exit the barn, and chickens that prefer staying close to the barn will mainly reside here. The initial part of the free range is thus intensively used, and this is where the grass boundary disappears first. Additionally, this area is where most droppings will occur. In addition to the disappearance and degradation of biodiversity, the soil is also disrupted by a relatively disproportionate amount of manure. This is detrimental to the recovery of plants and soil life.

To stimulate, increase, protect, and strengthen biodiversity, a different form of agriculture is needed. Agriculture should focus on soil life, general soil function, biodiversity, and the landscape; in other words, nature-inclusive agriculture. As described on the nature-inclusive agriculture portal, an alternative or different form of agriculture requires an integrated approach, where the entrepreneur optimally utilizes and cares for the natural environment, integrating it into agricultural management. In conclusion, it can be stated that if native nature can redevelop and/or partially stabilize, biodiversity will increase, enhancing the (natural and species-specific) behavior of chickens. However, the biggest challenge in this scenario is that chickens, with their natural and species-specific behavior, actually damage and undermine biodiversity, or in other words, they scratch and peck to the point of depleting and self-protectively emptying their own living space.

Risks of Disease

A shift in farm management could potentially enhance the well-being of chickens through altered practices. However, epidemiologist Armin Elbers (in the magazine 'Boerderij') points out the following: "Ideally, you simply don't want the avian influenza virus to come near the barn. This can be achieved by making the landscape around the barn less attractive to wild waterfowl, the carriers of the virus. If you take this idea to the extreme, you want the environment around a poultry barn to become a kind of desert where no other agricultural activities take place. But that cannot happen easily; ditches are needed for water drainage, grassland for cows, and other crops for humans and livestock. Well-being versus welfare. For the welfare of the chickens, contact with other birds would be minimized by keeping the free range as simple as possible."

In M. Bestman's research, it is described that fewer birds of species posing a risk for avian influenza are observed in free ranges where at least 8% of the surface is covered with trees or bushes. However, it is mentioned that more research is needed on the likelihood of contact between chickens and wild birds. Based on previous experiences, it can be concluded that in our situation, where we are surrounded by a residential area, an industrial area, and a highway, the environment may be less attractive to (wild) waterfowl. However, this does not provide complete assurance. In an attempt to make it even less attractive for (wild) waterfowl and thereby prevent disease for our animals, planting bushes and trees seems to be an important solution.

Possible Concrete Solutions for the Free range

Rotational Grazing for Chickens: Rotational grazing involves periodically rotating the areas available to chickens, resulting in not all free-range land being constantly accessible to them. The animal welfare encourages greening the free range for the benefit of chickens. However, implementing rotational grazing may mean that not all areas on the farm can be rotated. Compliance with regulations regarding the required space for chicken passages must be maintained.

Planting Miscanthus: M. Bestman suggests planting miscanthus as chickens do not consume it, it grows quickly, providing protection for the chickens. Additionally, it has high biomass production, making it suitable as livestock feed or an energy crop for sustainable energy production. However, miscanthus is not a native plant, conflicting with the vision of using native plants and trees.

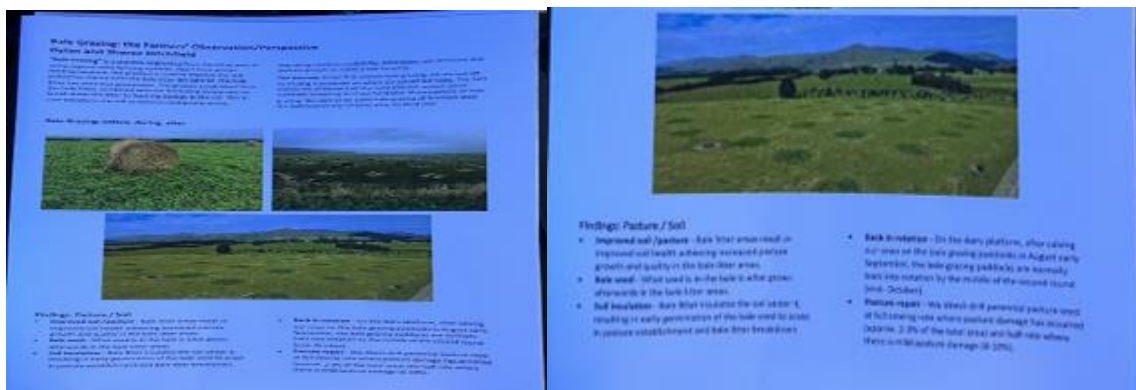
Use of Stones or Grass Pavers: During visits to poultry farms in England and Wales, it was observed that they often use large stones and rubble just outside the barn. They also tend to use grass pavers to prevent chickens from scratching away the roots. However, applying grass pavers throughout the entire free range might be necessary, and it's noted that chickens tend to start scratching and digging where the stones or concrete end.

Innovation with a Rotating Grass Bin: A Nuffield scholar from New Zealand proposed a creative solution involving a kind of vertical farming installation for the initial meters of the barn. This would allow for easier rotational grazing as the 'grass bin' could be exchanged, providing the grass a chance to regrow. Additionally, the bins would receive nutrients from the chicken droppings. While creative, it's deemed financially unfeasible.

Seeding Herbs: Conversations with colleagues and experts, both domestic and international, highlighted herb seeding as a potential solution. Herbs often have deeper roots, forming a symbiotic relationship with the soil life. Planting a mix of herbs in the free range, such as mugwort, wormwood, sorrel, lovage, goosefoot, and burnet, is recommended in the poultry handbook (Groot M. 2017). These herbs are known to be natural remedies against worms, and chickens can eat them as needed when scattered among the grass. Other trees and herbs/plants like willow, plantain, black currant, and turmeric can also have anti-inflammatory properties and serve as a food source for (honey) bees and other animals/insects.

Regenerative Agriculture

The exploration of a greener and more biodiverse free range led to visits to farms practicing regenerative agriculture. This method focuses on improving soil quality and includes practices such as reduced or no tillage, the use of cover crops, crop rotation, and the use of compost instead of synthetic fertilizers. These practices aim to maintain or increase biodiversity in the soil. The visited farms primarily focus on rotational grazing. In one instance in New Zealand, the farm grew cabbage in areas where cows stayed during the winter. The leftover crop residues served as new food for the soil. Cows lying in the hay covered the soil effectively, and the trampled hay stimulated beneficial organisms, enhancing the nutrient cycle. This improved soil health, resulting in reduced compaction, increased water infiltration, decreased runoff, higher worm populations, and improved soil structure.

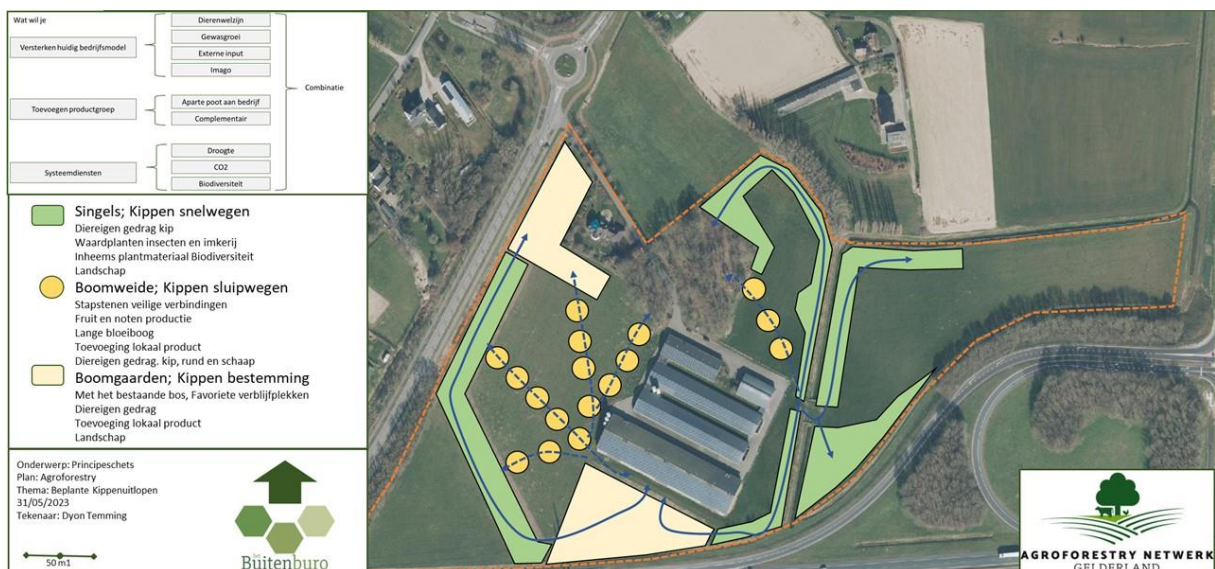


Another visited farm in the Netherlands focuses on herb seeding and rotational grazing for cows. A key principle is keeping the soil covered at all times. Heavy machinery such as tractors is rarely used, as it tends to compact the soil. Before cows are introduced to a new pasture, herb seeds are manually spread. In practice, the weight of the cows pushes the herbs into the soil as they stand or lie on them. Regenerative agriculture, in practice, involves no or minimal soil disturbance, which aligns with the management of the free range, given it's permanent grassland. However, the large number of chickens scratching the soil makes holistic grazing, a central aspect of regenerative agriculture, unrealistic. Nevertheless, considering regenerative principles, it might be explored whether artificial ground cover could be implemented using natural materials. For instance, the first meters of free range could be sprinkled with straw and straw bales. Chickens could then scratch and peck at the straw bales, slowly breaking them apart, creating ground cover. This cover would protect the soil from depletion and be absorbed by organisms in the soil.



Agroforestry

Agroforestry presents opportunities for a dual-purpose in the free range. Trees and shrubs serve multiple functions: enhancing chicken well-being and health and offering economic benefits. Additionally, it makes the free range more enticing for chickens to explore further. This helps distribute the manure pressure across the free range. Furthermore, agroforestry can protect chickens from bird predators, reducing costs associated with predation. Planting trees and shrubs also benefits the soil, influencing water management and creating a microclimate that affects soil life. Additionally, chickens tend to cause less damage to trees and shrubs through their foraging behaviour. Following discussions with the Agroforestry Network Gelderland, it was decided to plant part of the free range. The plan involves planting native species such as hazelnut, sweet chestnut, and walnut.



Conclusions

In conclusion, maintaining the greenery in the free range proves to be quite a challenge. While preserving and rapidly restoring grass seems not to be straightforward, it does not mean that biodiversity cannot be increased for the benefit of all farm animals. The results of the described quest for an ideal and sustainable layout of the free range include seeding herb-rich grassland, planting trees/shrubs, and adopting a regenerative approach to the soil/grassland. It is an ongoing task and

quest to strive for a respectful business operation on "that small piece of Doetinchem." In the spring of 2023, the grassland was enthusiastically overseeded. At that point, it became apparent that agriculture is indeed a different ball game than poultry farming. In the fall, it was concluded that only a small percentage of herbs had sprouted. It turned out that fall seeding would have been more effective. Additionally, sowing on clay soil proved challenging. On to a new attempt in the fall of 2023.



The second outcome revealed in this study is the planting of (even) more trees. Currently, 20% of the free range consists of shrubs and young trees. It is observed that these are positioned too far from the hatches, making it seemingly challenging for the chickens to be enticed to these spots. They must first traverse a bare area to reach the (protective) bushes, which our chickens are not fond of. However, when sheep or cows graze on that grass, the chickens venture further into the denuded areas through the livestock. Therefore, there is a desire to plant a part of the grassland with trees. Besides providing safety for the chickens, it is a pleasant side effect that these trees will bear fruits for bee feed (and honey!). The honey and fruits can be harvested and locally marketed. In this endeavor, the aim is to work future-oriented and holistically. Planting trees benefits nature, chicken safety, and research suggests that a free range with trees is not appealing to waterfowl, which are the primary carriers of the avian influenza virus. Moreover, these trees contribute not only to nature and humanity but also attract new consumers with their fruits, providing a local product. The company becomes more integrated into a human-plant-and-animal-focused cycle with business opportunities based on respect for our (biological) environment.



The final result is fundamentally a persistent experiment. By looking at the soil from a regenerative agriculture perspective, there is an attempt to restore the balance in soil life by promoting natural processes, giving soil life a new chance to recover. By placing straw bales in the first few meters of the stable, an attempt is made to create a ground cover. Chickens peck at the straw bales, loosen them, and the straw spreads across the soil. A pleasant side effect is that chickens are thus distracted. The straw then covers the ground. Chickens scratch and peck the straw apart, creating an organic upper layer of the soil. The ground cover, together with the trees/shrubs to be planted, is hoped to collectively contribute to the well-being of the soil. A healthy soil, with all its inhabitants, promotes plant growth, regulates carbon in the soil, maintains good water management, and sustains nutrient cycles. Plants naturally collaborate with fungi and bacteria to make nutrients from the soil or air available to the plant. Soil organisms like earthworms contribute to the processing of plant residues and the buildup of organic material in the soil, enhancing a good water management system. Of course, the soil also contributes to biodiversity.



Discussion

Maintaining the free range as a green space is not recommended or prescribed by any authority. It is even discouraged by an epidemiologist due to the potential attraction of birds that could transmit avian influenza. However, scientific research by M. Bestman contradicts this by suggesting that if a free range is planned with trees, it would actually deter waterfowl. On our farm, we choose to plant even more trees. We hope that this will provide more safety/protection for the chickens through shelter. We also hope that this will encourage the chickens to explore further into the free range, reducing the burden on the first few meters around the stable with the chickens' foraging, pecking, and digging behaviour. We have opted for fruit-bearing trees and aim to offer a local product in the future.

The increasing concern about declining biodiversity is echoed by various environmental and nature organizations. Agriculture has intensified and specialized in recent years, leaving less space for biodiversity. In the last few years, we have been trying to let go of these intensive thoughts. Is it possible to keep fewer chickens and still make the same profit? One of the first steps we took in this direction is to raise free-range chickens. We notice that the chickens do not use the entire free range, so we have started keeping sheep and cows to maximize the use of the grassland. A positive outcome is that the cows and sheep also provide some safety for the chickens. It is a healthy collaboration and optimal use of the land. Additionally, we aim to optimize the land by enhancing and increasing

biodiversity with plants, trees, and a regenerative farming approach. The driving force behind this is to create a future-proof farm for our children. Beekeeping plays a separate but significant role in the greening of our farm and the supply of honey as a local product.

A critical note is that investing in a 'green' biodiverse free range by planting herbs, shrubs/trees, or offering straw bales does not generate immediate returns. Some of this can be offset by agroforestry. We have now entered into a direct collaboration with Albert Heijn, and from now on, we produce in the free-range stable and one of the free-range barns for the 'Better for Nature & Farmer program.' We have reduced the occupancy in the respective stables by 15%, and for the free-range stable, there are additional criteria regarding the free range in the conditions. With this research report, we hope to have sufficient biologically responsible ammunition to further adjust the described free range within the 'better for the program' and ultimately establish a distinctive 'free-range model' and propose a potentially viable, biologically pure business model.

Recommendations

From this research report, it is clear that an intensive chicken farm can certainly increase biodiversity. In my opinion, increasing biodiversity by looking at the farm in a more nature-inclusive way is good for the image of the farm (licence to produce). Fellow poultry farmers who are interested in greening their free range could take a critical look at whether they can also increase biodiversity. This could include agroforestry, sowing herbs in grassland and creating wooded banks.

Towards the retail sector and in our case specifically Albert Heijn, the recommendation is to see if this step in increasing biodiversity fits into the 'Better for Nature & Farmer programme'. In doing so, the yield from agroforestry could be a good addition to their product range.

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