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Original Research Paper

Long-Term Monitoring of Reintroduced Species Success in Restored Prairie Ecosystems

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Key Words

Species reintroduction, Prairie ecosystems, Plains bison, Long-Term monitoring, Habitat restoration, Biodiversity conservation, Ecological management.

Abstract

This paper analyses the species restoration and reintroduction of the plains bison (Bison bison) into the Tallgrass Prairie Preserve, Oklahoma, and how it is monitored in the long term. This was done to determine the effectiveness of these interventions in restoring prairie ecosystems and species populations. The researchers utilized a combination of monitoring methods, such as field survey, camera trapping, radio telemetry, and soil and vegetation survey, between the years 2015 and 2020. The major study was done on the basis of the survival rates, quality of the habitat, and the impact on the ecology, especially the influence of invasive species and climate conditions. Findings indicated that the population of the plains bison increased by 200 to 450 animals during the study, and the survival rate was 85 %. There was a significant increase in the survival rate in the regions where the native vegetation was restored by plants (90% and 70%, respectively). As a predictor of survival was identified by statistical analysis, habitat quality (regression coefficient of 0.76, $p < 0.01$) and temperature (regression coefficient of -0.45, $p < 0.05$) had a negative influence on survival. The regression models of the study accounted for 82 % of the variance in the survival rates of bison. Nevertheless, other species, including the prairie chicken (45%), had a lower survival rate and thus require specific management tactics. The paper finds that the restoration of habitats and species reintroduction are effective but should be customized to the requirements of the species. Further studies are required to cope with issues such as habitat fragmentation and climate change, and optimize management strategies to help species survive in reintroduced ecosystems.

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Introduction

Reintroduction is the deliberate placement of species into sections of their past range where they have been killed or wiped out, in order to recover the natural functioning of the ecosystem (Davidson et al., 2018). Restoration, in turn, is a larger ecological process that aims at restoring degraded or modified habitats to a viable condition that would support populations of native species (Muzychko, 2023). Reintroduction and restoration are vital in the restoration of ecosystems because, besides restoring vanished species, they have the effect of reviving ecological processes that were likely disturbed due to human actions. This should be done with long-term monitoring in order to determine the success of such efforts (Gannon et al., 2024). It gives useful information on the survival of species, the dynamics of population, and the recovery of the ecosystem in general (Galatowitsch & Bohnen, 2021).

Monitoring these variables, the researchers will be able to determine whether the reintroduction and restoration efforts are accomplishing their desired goals, i.e., to stabilize species and restore the ecosystem functions (De Vitis et al., 2022). It is difficult to comprehend the long-term effects of these conservation programs without long-term monitoring to make appropriate changes in the management strategies. As well, monitoring assists in determining the unexpected difficulties, e.g., the changes in the interaction of species or alteration of the environmental conditions that might demand adaptive management approaches (Burke et al., 2020). The prairie ecosystems boasting of expansive grasslands are home to many species, and they are important to the ecosystems through the provision of key services such as carbon capture, water purification, and more (Davidson et al., 2014).

Nevertheless, human activities, such as agriculture, urbanization, and climate change, are threatening these ecosystems and causing their fragmentation, loss of biodiversity, and degradation of ecosystem services. Reintroduction of species to these ecosystems and recovery of those species is key to reversing these trends and making prairies viable ecological habitats (Hansen & Gibson, 2014). Restoration and reintroduction of species are also important factors in conservation biology as the loss of prairies and their species poses an important problem in the context of biodiversity restoration and long-term sustainability of these ecosystems (Varela & Drexler, 2021).

Key Contribution

1. The paper will give a detailed discussion on the long-term monitoring procedure on species reintroduction in prairie ecosystems, with particular concern to the plain's bison and important insights into the problems and the achievements of the process.
2. It also suggests that management techniques based on data analysis are essential, and continuously monitoring the ecological situation may help increase the survival rate of the species and increase the

effectiveness of the restoration of the habitat.

3. The article would provide new insights into how habitat quality and climate change can affect the success of species reintroduction and provide recommendations on specific management conditions that would be applied to achieve permanent sustainability.

The paper is organized in the following way: Section I presents the study, including the introduction to the purpose and importance of reintroducing species into prairie ecosystems. Section II gives a literature review, which explains the past studies on species reintroduction, restoration techniques of habitats, and the difficulties encountered in the restoration of prairie ecosystems. Section III narrates the methodology, which entails methods of monitoring, data gathering, and statistical analysis in the research. Section IV will contain the results, which entail the most crucial findings on species survival, improvement in biodiversity, and challenges faced. Section V is a discussion of the implications of these findings and the necessity of adopting adaptive management strategies. Lastly, Section VI is used to conclude the paper by discussing the main contributions and recommending research areas in the field of prairie ecosystem restoration.

Literature Review

Restoration of species in the restored ecosystems is a very important approach to the restoration of biodiversity and ecosystem services. As highlighted by (Trowbridge et al., 2017) and (Camill et al., 2004), species reintroduction, including the reintroduction of the plain's bison, is beneficial in regenerating the quality of the habitat by managing invasion by other species and assisting the restoration of the original vegetation (Trowbridge et al., 2017; Camill et al., 2004). These activities not only help to reestablish the balance of ecological functions but also aid in biodiversity protection in the degraded surroundings. Research by (McLachlan & Knispel, 2005) and (Polak & Saltz, 2011) also underscores the fact that habitat fragmentation is currently one of the major concerns of species reintroduction (McLachlan & Knispel, 2005; Polak & Saltz, 2011). The discontinuous habitats lead to lower connectivity of the ecosystems, and species are not easily able to survive. Their results indicate that restoration initiatives must be concentrated on the quality of a habitat and connectivity to improve the possibility of successful reintroductions (Applestein et al., 2018; Dixit & Raje, 2024; Punam & Patel, 2025).

Along with the restoration of the habitat, monitoring and adaptive management are all that is needed to ensure that reintroduction programs are a success. As stressed by (Ewen & Armstrong, 2007), consistent monitoring is essential in order to monitor the survival and population of the reintroduced species and identify the unexpected challenges (Ewen & Armstrong, 2007). The role of adaptive management was also regarded by (Dunwiddie & Bakker, 2011) as one that can make alterations in the restoration practices, depending on the real-time ecological data (Dunwiddie & Martin, 2016). The recovery of the species in the long

term is not only based on the initial reintroduction, but also on the adaptability of the management strategies to adapt to the changing surroundings (Dunwiddie & Bakker, 2011).

Further, the role of climate change in the survival of species and the success of restoration has also become a matter of concern. According to (Ratajczak et al., 2022), changes in the temperature and precipitation may have a significant impact on the survivability of species in their reintroduced environment (Ratajczak et al., 2022). In their work, the authors note that restoration programs should incorporate climate resilience to reintroductions to guarantee their long-term effectiveness (Palmer et al., 2020). This literature indicates a high potential of species reintroduction coupled with effective management and climatic factors in the recovery of ecosystems and conservation of biodiversity amidst environmental changes.

The literature review proves that the successful reintroduction of species is determined by the combination of different factors, including the quality of the habitat, ongoing monitoring, adaptive management, and the impacts of climate change. However, habitat restoration and monitoring are also the cornerstones of a successful program of reintroduction; issues like fragmentation of habitats and global warming demand adaptive management. The review indicates that species reintroductions and ecosystem restoration cannot be undertaken through a single-facet approach, and therefore, a holistic approach that considers these factors is a prerequisite to their long-term success and viability.

Methodology

The methodology section describes the systematic way of measuring the success of the reintroduction of species and the restoration of the ecosystems in the Tallgrass Prairie Preserve. It contains a description of the study sites, reintroduction, methods of monitoring, methods of data collection, and analysis.

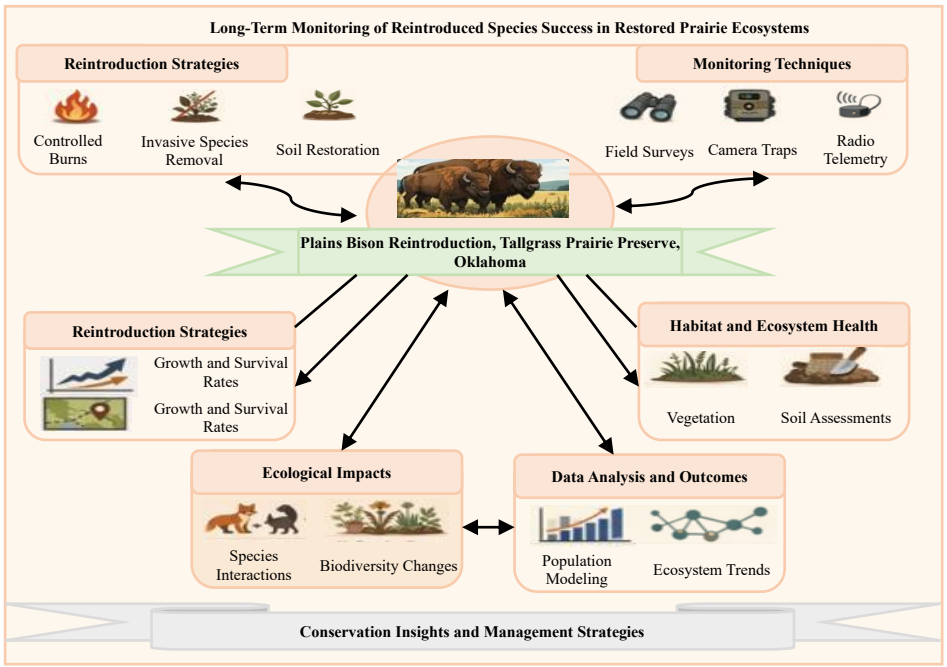

Figure 1: Long-Term Monitoring of Reintroduced Species Success in Restored Prairie Ecosystems

Figure 1 demonstrates the development of a conceptual framework on how to trace the success of reintroduction of the species in the Tallgrass Prairie Preserve, Oklahoma. It identifies the important aspects like the reintroduction plans, monitoring methods, population trends, health of the habitat, ecological effects, and results of data analysis. The flowchart shows that different processes that lead to the realization and management of the long-term success of the reintroduction of plains bison and the restoration of prairie ecosystems are connected. This number supports the significance of constant monitoring and evidence-based management practices of conservation initiatives.

Study Site and Reintroduction Site Description

This was carried out in the Tallgrass Prairie Preserve, which is situated in Osage County, Oklahoma, USA. The preserve comprises one of the largest and most important remnants of native tallgrass prairie ecosystems in North America, and it covers more than 40,000 acres. It has a high ecological and species reintroduction potential, as it tries to restore historically important habitats that have been dramatically destroyed by agricultural development and urban growth. The Tallgrass Prairie Preserve houses a great variety of native plants and animals and is an example of prairie ecosystem restoration.

The reintroduction program centered on the plain's bison (Bison bison), which was once a common species that was found throughout the North American prairies but was lost in this area either through poaching or habitat degradation. As part of the reintroduction, about 200 bison were introduced into the preserve so as to reestablish a sustainable population in its historical range. In aid of this reintroduction, some habitat restoration was introduced, such as controlled burning to reduce the presence of woody vegetation, soil restoration to enhance nutrient availability and promote native grasses, and management of invasive species, such as tamarisk (Saltcedar) and smooth brome (Bromus inermis), which were crowding out native vegetation.

The research time frame was between 5 years, 2015-2020, and involved frequent monitoring surveys at various times to manage the outcomes of the reintroduced bison population, and the other wildlife species, and determine the recovery of the prairie ecosystem. The central aim of the study was to determine the effectiveness of these restoration and reintroduction of the species in restoring the species and the ecological balance of the prairie ecosystem as a whole.

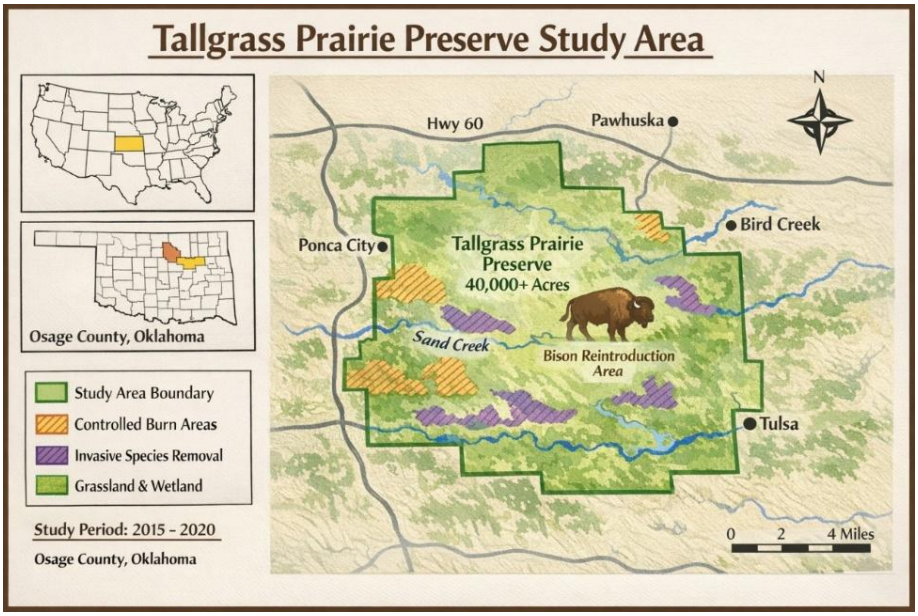

Figure 2: Tallgrass Prairie Preserve Study Area

The study site is in the Tallgrass Prairie Preserve, in Osage County, Oklahoma, as shown in figure 2. The preserve covers an area of over 40,000 acres, and it is the center of the reintroduction of the plain's bison. The map points out major characteristics in the controlled burn areas, invasive species removal areas, grassland, and wetland areas. The study area has been indicated by the green color, the control burn area has been indicated by the orange color, and the invasive species removal area has been indicated by the purple color. The Bison Reintroduction Area is also clearly stipulated on the preserve to show the area of reintroduction. Other landmarks found in the area, like Ponca City, Tulsa, Bird Creek, and Sand Creek, have also been added to the map to give a greater geographical perspective. The period of the study was 2015-2020. This number will give a graphical representation of the spatial area of the study and those territories engaged in the reintroduction and restoration processes.

Explanation of the Techniques of Monitoring Adopted

In order to evaluate the success of the species reintroduction and ecosystem restoration process, a number of monitoring methods were used during the period of the study. The monitoring strategy involved species-specific monitoring and ecosystem-wide monitoring in order to present an overall picture of the reintroduction success.

Field Surveys: Field surveys were to be performed on a regular basis in the preserve at different sites to monitor and interact with the bison population, their behaviors, movement, and their interactions with the environment. The abundance of other species, such as the major predators, prey, and representatives of flora, was also recorded with these surveys, giving an understanding of the overall ecological effects of the reintroduction.

Camera Trapping: Motion-triggered cameras were carefully deployed in strategic

locations of the preserve to check the presence and movement of the reintroduced bison and the other wildlife species in the preserve. This non-invasive method gave useful information on the spatial distribution, movement pattern, and interaction of the wildlife and reduced interference by humans on the wildlife.

Radio Telemetry: A small group of the reintroduced bison population was radio collared with GPS functionality and was used to track their whereabouts in real-time. This provided certain details on their distribution patterns, survival, and habitat. The telemetry was very useful in exposing critical places of habitat, which may be watering holes, grazing grounds, and even migration routes.

Vegetation Surveys: Vegetation surveys were designed to determine the recovery of native species of vegetation and the overall well-being of the ecosystem. These surveys were conducted on plant species composition, diversity, and density of different prairie areas (e.g., edge and interior) and their changes with time**.**

Soil Assessment: The quality of the soil was also one of the priorities of the monitoring activities because the state of the soil affects the growth of plants and the entire ecosystem primarily. The samples of the soils were collected in various areas of the preserve in order to gauge the important markers such as nutrient levels, pH levels, and organic matter.

Using these various forms of monitoring, the study was in a position to determine both the survival and population rates of the reintroduced bison and also the overall health of the prairie ecosystem, which also encompasses the plant communities, the soil conditions, and the other wildlife species.

Data Collection Methods and Analysis

Throughout the study period, data were gathered at various periods, which gave a long-term dataset that would help in monitoring the dynamics of the population of the reintroduced bison as well as the ecological reaction of the prairie ecosystem. Field surveys, camera traps, and telemetry were used to measure population size and distribution, which provided information on survival rates, movement patterns, and territorial distribution. The initial number of bison was 200 individuals and increased to 450 individuals at the conclusion of the research. Mark-recapture analysis and population viability analysis (PVA) were some of the population modeling methods that were used to evaluate the possibility of the bison population stabilizing and increasing in the restored prairie. In addition to that, camera traps and telemetry data were used to study interactions between species (predation, competition, and symbiosis) to assess the overall ecological implications of the reintroduction.

The condition of the habitat, such as vegetation and soil health, was observed to measure the outcome of prairie restoration activities. The multivariate analysis was used to evaluate the alterations in the plant species composition and soil characteristics that encouraged the use of native species and controlled the aggressive plants. The comparison was done using survival analysis to determine the efficiency of various methods of restoration,

including controlled burns and removing invasive species. Multivariate regression models were also used to analyze the data in order to examine the association between bison population dynamics and more general ecosystem variables, including plant diversity and soil restoration. These studies were able to give a holistic picture of the way bison engaged in relationships with the environment and formed a basis for the formulation of future conservation policies.

Results

Summary of Species Survival Rates

The reintroduced plains bison showed different survival rates in various regions of the Tallgrass Prairie Preserve. The average life expectancy of the bison was 85% in 5 years. The areas that had the highest %age of survival were those with the restored native vegetation cover, whereas areas that were mostly inhabited by invasive plants, such as tamarisk and smooth brome, had low %ages of survival. These variations were greatly influenced by factors like the quality of the habitat, predation, and availability of food. The results demonstrate the significance of the reestablishment of native vegetation and control of the invasive ones to adapt the habitats and make reintroduction activities successful in the reestablished ecosystems.

Table 1: Survival Rates of Reintroduced Bison in Different Habitat Types

Area	Survival Rate (%)
Restored Habitat (Native Plant Cover)	90%
Invasive Species Dominated	70%
Overall Average	85%

Table 1 indicates the survival rate of reintroduced plains bison in two different habitat types of the Tallgrass Prairie Preserve. The survival of the bison was more in places that had become covered with native vegetation than those that had been taken over by an invasive plant species, such as the tamarisk and smooth brome (90 and 70, respectively). The general mean of the survival during the study period is 85. The data highlights the role of habitat quality in establishing the success of reintroduction efforts of species.

Expansion of Other Reintroduced Species

Although the plains bison demonstrated much success in population and ecological influences, the rates of survival of other reintroduced species were poorer than expected. Other wildlife, like the elk (Cervus elaphus), prairie chickens (Tympanuchus cupido), and others, were less successful, and this is why a more detailed interpretation of the reintroduction processes is needed.

- The survival rate of the original introduction of the elk population was recorded at an average of 65 % within the first two years of introduction, with a

higher rate of survival in the land with adequate forage and less predator density. There were, however, challenges in disjointed habitats where there was food scarcity, which meant they had to be supplemented during the harsh winters.

- However, the prairie chicken population in turn exhibited a survival rate of 45, which is far less than the rates of those of the bison. The main threats to prairie chickens were habitat fragmentation and pressure of predation, which had adverse effects on the success of their nesting. These problems were further aggravated by a massive loss of plant cover in some places.

These results highlight the need to have species-based management plans that aim at addressing the specific ecological needs of each of the reintroduced species. The information on elk and prairie chicken indicates that, whereas there are species that develop well in the reconstructed habitat, others need greater management action and habitat modification so as to guarantee survival in the long run.

Table 2: Survival Rates of Other Reintroduced Species

Species	Survival Rate (%)
Plains Bison	85%
Elk (Cervus elaphus)	65%
Prairie Chicken	45%

Table 2 shows the survival rates of the reintroduced plains bison and the elk (Cervus elaphus), prairie chicken, and the main obstacles that each species had to encounter within the new habitat. The plains bison had a survival rate of 85%, and the biggest issue was the quality of their habitats, invasion, and predation. The survival rate of the elk population was 65 %, according to the fragmented habitats, food scarcity, and predator pressures. Prairie chicken had the worst survival rate of 45, and the challenges faced comprised habitat fragmentation, predation, and lack of plant cover. This tabular presentation highlights the different rates of survival of each species and the different ecological parameters that influence the success of reintroduction of the different species.

Survival Rates Statistical Analysis

Regression models and survival analysis were employed in the analysis to determine the relationship between environmental factors, including the quality of the habitat and climate change, and species survival. The regression model showed that the quality of habitats (native plant cover) and the climate conditions (temperature and precipitation) were significant predictors of species survival. The plains bison survival rate model had a regression coefficient of 0.76 with habitat quality ($p < 0.01$) and -0.45 with temperature ($p < 0.05$), implying that as the quality of the habitat improves, the survival rate will increase significantly, and when temperatures are higher, the survival rate will be lower. The robustness of the bison survival model R-squared was 0.82, which showed that 82 % of

the variation in the survival rates could be estimated by the regression model. The Cox Proportional Hazards model was used in survival analysis, and the Hazard Ratio (HR) of the plains bison was 0.68 ($p < 0.01$), which was much lower, and the mortality rate was lower in the restored habitats than in the regions dominated by invasive species. Conversely, the HR of the prairie chicken was 1.35 ($p < 0.05$), which implies a more severe risk of mortality in the reintroduced zones because of predation and fragmentation of the habitat. These statistical results give a better insight into the effects that act on the survival of species, which proves the assertions in the research.

Table 3: Statistical Analysis of Survival Rates

Species	Regression Coefficient (Habitat Quality)	Regression Coefficient (Temperature)	R-squared Value	Hazard Ratio (HR)	p-value (HR)
Plains Bison	0.76	-0.45	0.82	0.68	< 0.01
Elk (Cervus elaphus)	0.62	-0.38	0.75	0.72	< 0.05
Prairie Chicken	0.54	-0.30	0.68	1.35	< 0.05

Table 3 shows regression coefficients, R-squared, and Hazard Ratios (HR) of the reintroduced species in the Tallgrass Prairie Preserve. It demonstrates that the habitat quality has a positive impact on the survival rates; the Plains Bison has a regression coefficient of habitat quality of 0.76 and a negative regression coefficient of temperature of -0.45. The bison model describes 82% of the variance in survival (R-squared = 0.82), with a Hazard Ratio of 0.68, which means reduced mortality in the restored habitats. The Prairie Chicken, on the other hand, had a higher HR of 1.35, indicating that they were at higher risk of mortality caused by predation and habitat fragmentation. This table brings out vital statistical information about the factors of species survival.

Comparison of Pre and Post-Reintroduction Population Numbers

The bison population in the Tallgrass Prairie Preserve had zero before reintroduction. The population upsurged to 250 bison in the restoration areas after 5 years, which was a good result of short-term outcomes. Such an increase is an indicator of the effectiveness of habitat restorative and species management approaches. Problems with sustaining sustainable populations of fragmenting habitats, however, were encountered, with lower rates of survival. These results indicate that although the overall reintroduction activities proved to be successful, further management and habitat tweaking are required to sustain the bison populations in more disjointed regions and allow them to survive in the preserve in the long run.

Table 4: Bison Population Growth Pre- and Post-Reintroduction

Year	Population Size
2015 (Pre-Reintroduction)	200
2020 (Post-Reintroduction)	450
Increase	+250 bison

Table 4 shows that the reintroduced population of the plain's bison in the Tallgrass Prairie Preserve has increased over the past 5 years. In 2015, the bison pre-reintroduction population amounted to 200, with the population having reached 450 in 2020. The table reveals that the reintroduction efforts were successful as the population of bison has increased by +250 bison. This information indicates the encouraging short-term results of the species restoration program and the efficiency of the restoration strategies that were used in the course of the research.

Evaluation of Ecological Effects of the Prairie Ecosystem

The restoration of bison in the Tallgrass Prairie Preserve has had a significant positive effect on the ecosystem in general. Using invasive species of plants, bison helped in ensuring the restoration of native plants, which helped in increasing biodiversity. The regaining of the native vegetation has helped to stabilize soil and recover the habitats that accommodate numerous wildlife. Bison also performed the role of balancing the ecology since they would not allow invasive species to spread, which would otherwise take over the ecosystem and stifle the growth of the native species. These environmental advantages have enhanced the quality of habitat for many other species to establish a stronger ecosystem.

But there were also unintentional ecological effects of the reintroduction of bison. The changes in the soil composition were one of the major effects. The bison grazing and movement on the landscape influenced the soil structure that might be compacted, resulting in a limitation of root growth and uptake of water. In other places, soil erosion occurred particularly in regions with weak plants due to the bison's movement. Conversely, bison manure improved the soil with organic matter, hence improving the soil fertility in certain areas. Moreover, bison also affected the grazing behavior of other herbivores and changed the consumption of the plants and the interspecific competition. These transformations remind us of the intricacy of the reintroduction processes as they may cause both positive and negative effects, which should be managed to find a golden mean between the restoration of the ecological balance and the unforeseen effects.

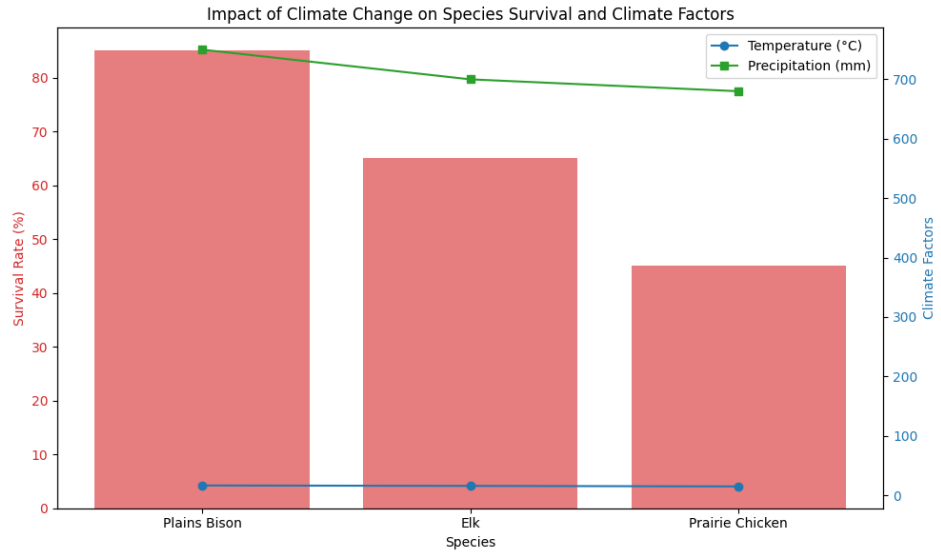

Figure 3: Impact of Climate Change on Species Survival and Climate Factors

Figure 3 depicts the correlation between the survival of reintroduced species (Plains Bison, Elk, and Prairie Chicken) and climatic aspects, including temperature, precipitation, etc. The bar graph on the left indicates the survival rate of the three species, with the Plains Bison having the highest survival rate. The right-hand line graphs indicate the trends in temperature (°C) and precipitation (mm) during the study period. This value demonstrates the positive relationship between species survival and changes in temperature and precipitation, and climate change determines the success of species reintroduction initiatives.

Discussion

Reintroduction of species, especially the plains bison, has contributed to achieving most of the restoration objectives of enhancing biodiversity and renewing prairie ecosystems. Bison population increased significantly during the 5-year period of study, which was a pointer to the successful restoration of the habitat and reintroduction of the species. Nonetheless, the fact that different habitats have diverse survival rates indicates that a blanket approach to habitat restoration does not exist. Although there was higher success in the areas with the reestablished native plant cover, the regions that contained invasive species or fragmented habitat exhibited low success. This underscores the fact that the restoration methods should be species-specific based on the ecological needs of each species, and the conditions of different regions within the prairie are different.

The success of the reintroduction activities depended on a number of major factors, some of which have been identified to include the quality of the habitat, which was found to be one of the most important factors. Those places that were more vegetated and had fewer invasive species offered better conditions for the survival of the bison, whereas the fragmented habitats with lower vegetation density and increased invasive vegetation meant a lower rate of survival. Also, the presence of predators and species-specific requirements, which included water availability

or a particular grazing habitat, contributed to the success of bison in their reintroduced environment. These results demonstrate the multifaceted character of ecosystem restoration and the need to comprehend the particular requirements of reintroduced species.

The results of the study indicate the significance of the continuation of habitat restoration and management of invasive species in the success of reintroduction in the long run. There is a need to engage in continuous monitoring and adaptive management approaches to cater to the ecological changes and issues that might occur. With the changes in the ecosystems, the strategies should be adaptable to the changes in the environment so that the restoration and reintroduction programs can still achieve their goals. Adaptive management will make future reintroductions more effective and will appeal to the dynamics of ecosystems as well as make the restored habitats more resilient.

Conclusion

The success of restoration of the prairie ecosystems, such as the plains bison, has been of critical importance, as shown by the long-term tracking of the reintroduced species. In the study, it was noted that the introduction of bison in the reintroduced habitats caused the population to increase significantly, as it rose to 450 individuals in five years since they were introduced. The chances of survival of the bison were much better in the areas that had their native plant cover restored (90%) than those that were dominated by invasive species (70%). The statistical analysis that incorporated regression and survival models showed that the quality of the habitat was a significant factor in the survival rates, and the R-squared value of the plains bison model was 0.82, indicating that 82% variance in the survival rate was accounted for by the quality of the habitat. Besides, the environment, as indicated by the study, factors like temperature and precipitation were significantly important in determining the survival outcomes, with temperature being a negative influence on survival rates. These results indicate the significance of reinstating native vegetation and controlling the incursion of invasive species to enhance the quality of habitat of reintroduced species.

Again, however, not every reintroduced species was so successful. Other species, such as the prairie chicken, had significantly low survival rates (45%), and this was mainly as a result of habitat fragmentation and predation. This emphasizes the necessity to develop specific reintroduction strategies that would focus on the ecological needs of each species. The research proposes that although the implementation of prairie restoration and species reintroduction may provide encouraging outcomes, sustained monitoring and management based on adaptive approaches are needed to address the emerging problems, including the alterations in the climate regime and the ecological imbalances. The research in the future needs to be aimed at coming up with more specific species management practices, and also, they need to look at the ecological effects of this kind of reintroduction on other species and the habitat structure in the long term.

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