Rock Movement on the Konza Prairie: Bison acting as Geomorphic Agents

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Introduction

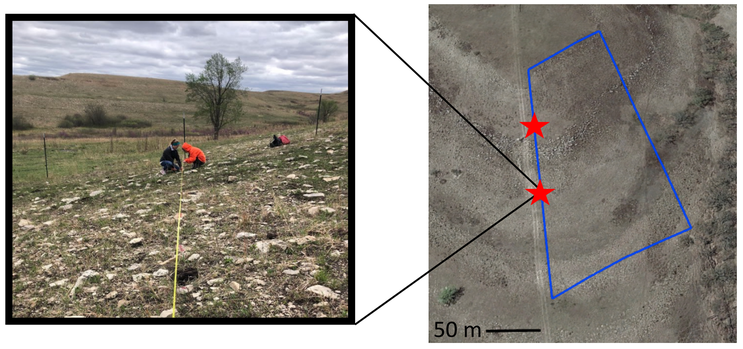
Bison are a driving force in grassland ecosystems and through extensive research, scientists discovered large herd movement and wallowing contribute to the erosion and movement of topsoil in prairie ecosystems (Jung, 2017). However, the disturbance of large rock fragments by bison in grassland settings has not been studied to such an extent. Understanding the impact bison have on a landscape is important due to their natural range over geomorphic timescales.

Our team wanted to answer the open question:

Do bison have a direct impact on the downslope movement of rocks on the Konza Prairie?

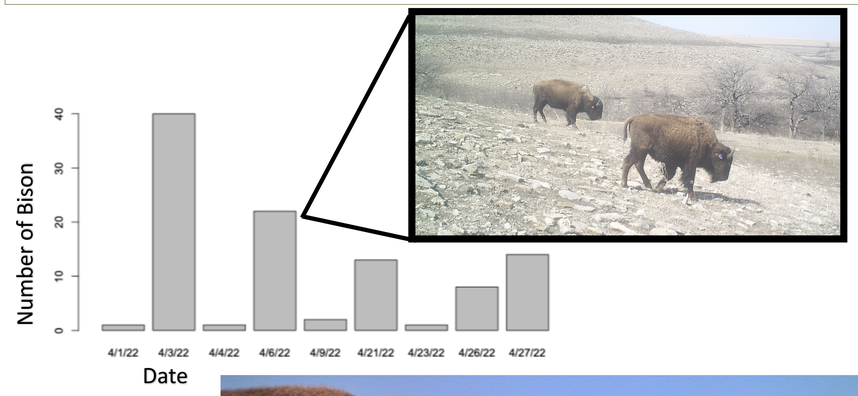
Study Site

When choosing a study site, we heavily favored locations where bison would frequently visit due to the limited time frame of our study. Recently burned grasslands are favored by ungulate grazers, such as bison, because of the nutritious plant matter that grows after burning (Raynor, et al., 2015). Areas near fence lines are also typically high-traffic areas for bison movement(Grudzinski et al., 2015). Our study site was located at the Konza Prairie Biological Station, Watershed N1A, 39.08859 N 96.59212 W. This location had been burned on March 2, 2022, and was located directly next to a fence line. Because of the attraction to recently burned ground, fence lines, and wallows present on the site the team concluded this location would likely be grazed by bison. Our chosen hillside is composed of layers of shale and limestone which creates a complex hillslope with flat benches and gentle slopes covered in limestone rock fragments. As a result of the multiple sub-slopes, we chose two monitoring sites within the large overall hillslope, one near the top of the hillslope and one near the bottom.



Methods

To monitor rock interaction the team placed trail cameras on fence posts present at the study site. At both the upper and lower locations 30 rocks were chosen at random. The rocks were painted with a red stripe on one side and a green stripe on the other side. At each site, rocks were placed in three parallel lines extending perpendicular from the fence line, red paint facing up. Over a 4-week period, the rocks were monitored bi-weekly and any movement was recorded. Along with movement, the 60 rocks used in the study and 200 random rocks from the surrounding hillslopes were measured and categorized by rock shape. The majority of rocks were in the cubic or rectangular clast.



Recording movement of rock #11 on Upper Site, 10 cm downslope

On April 27, 2022 the gamer cam at the upper site captured a bison standing over a marked rock (top) and then captured the rock rotated (bottom).

Rock Interaction

Of the 60 total rocks, 32 were recorded as being altered during the 4-week period.

$$\frac{32\ altered\ rocks}{60\ total\ rocks} = 0.54 \approx 54\%\ interaction$$

18 of 32 recorded rocks were at the upper site; 13 rocks moved up or down the slope, 1 rock moved laterally and rotated, and 4 rocks rotated. At the lower site 18 rocks exhibited movement; 10 rocks moved up or down the slope, 1 rock moved downslope and flipped, 1 rock flipped and rotated, and 5 rocks rotated. The recorded movement took place only in the last 2 weeks of the experiment.

Rock Movement over a four-week period in the Upper Site

Rows	Rock # with movement direction	Lateral Movement from Initial Position	Shape
Top	• Rock #3: Rotation • Rock #4: Positive • Rock #5: Negative • Rock #11: Positive	• Stationary • 5cm Down Slope • 2cm Up Slope • 10cm Down Slope	• Rectangular • Flat Rectangular • Cubic • Flat Rectangular
Middle	• Rock #4: Rotation • Rock #7: Negative • Rock #9: Positive • Rock #10: Rotation	• Stationary • 2cm Up Slope • 2cm Down Slope • Stationary	• Cubic • Cubic • Cubic • Circular
Bottom	• Rock #1: Positive • Rock #2: Positive • Rock #3: Positive • Rock #4: Positive • Rock #6: Positive • Rock#7: Positive • Rock #8: Positive • Rock #9: Rotation • Rock#10: Positive • Rock#11: Rotation Positive	• 32cm Down Slope • 5cm Down Slope • 6cm Down Slope • 5cm Down Slope • 3cm Down Slope • 6cm Down Slope • 5cm Down Slope • Stationary • 12cm Down Slope • 20cm Down Slope	• Rectangular • Circular • Cubic • Flat Rectangular • Rectangular • Circular • Rectangular • Circular • Rectangular • Circular

Conclusion

Our study site was frequented by bison and their interaction with rocks was visually captured. Interaction data recorded by the group concluded a 54% interaction rate with the monitored rocks. The natural movement of bison across grasslands plays a direct role in the movement of rocks across the landscape. From our data it can be reasonable to state, bison do act as geomorphic agents on the Konza Prairie.

Future Applications

Our data has only scratched the surface of the interaction bison have with rocks. Grasslands are found around the world and ungulates grazing across these ecosystems can change their natural state. To understand the full impact bison have on rock fragments future studies should consider a longer time frame for the study and at different locations further from fence lines.

Acknowledgements

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