Livestock Trail Length Over Time

Ryan Olsen

ES751 Advanced GIS

Spring 2023, Dr. Sleezer

Purpose

The purpose of this project is to see if meaningful changes to terrain caused by livestock can be detected and quantified using publicly available imagery. This would be useful to justify further research on a topic, to 'find if there is a there there'.

Data Collection

All imagery and shapefiles used are publicly available on Kansas Data Access & Support Center (DASC) and the Butler County Kansas GIS page. The following imagery tiles and shapefile were downloaded from DASC (click to download):

1985 Butler NHAP Imagery
1991 Butler DOQQ Imagery
2005 Butler NAIP Imagery
2021 37096-H5 NG911 Imagery
2021 37096-G5 NG911 Imagery
Tiger 2020 Counties

Download the following shapefile from the Butler County GIS page (click to download):

Property Ownership Boundaries

Data Creation

Areas of interest

Import and project the Property Ownership Boundaries into the desired projection, for this project NAD_1983_2011_Kansas_LCC was used throughout.

The areas of interest are the NE¼ S. 13, T. 24 S., R. 7 E. and SW¼ S. 13, T. 25 S., R. 7 E.. Those are quarters of sections QuickRefID R2829 and R3002 in the Property Ownership Boundaries (projected) shapefile; they were selected and exported to a north_section_of_interest and south_section_of_interest shapefile.

Because the actual area of interest is a quarter section, the polygon vertices were used to calculate a center point and midpoints along each side section. These coordinates were used to create a new polygon shapefile that is equal to a quarter section and saved as north_quarter and south_quarter. The Microsoft Excel files used for the calculation is available here (Google Drive)L https://tinyurl.com/2p8fz5ba.

In order to make digitization and final map production easier, a ¼ mile buffer was created around each quarter section to clip rasters to. The temporary layers feature of QGIS was used to do this for each quarter shapefile, they were named north_buffer and south_buffer. For the south quarter the NG911 tiles needed to be merged

Rasters

Each raster was imported and reprojected (warped) to *NAD_1983_2011_Kansas_LCC*. The projected rasters were clipped using the appropriate *buffer* layer. The NG911 tiles needed to be merged as the border of each runs through the south area, a merge was performed then the resultant raster was clipped. All clipped rasters were saved to their own folder and placed in an appropriate year/section group in QGIS.

Digitization

The digitization process started by creating a new polyline shapefile with a single real number field with a precision of 2, and in the *NAD_1983_2011_Kansas_LCC.* projection. A set of rules for digitization were devised to maintain consistency throughout the different types and resolutions of imagery. The rules were as follows:

1. Only trails that could be seen at 1:500 scale or larger could be digitized.
    a. Zooming in was allowed for detail but if there was any question on the visibility of the trail the image was returned to 1:500 and any sections of the polyline that represented a trail that could not be seen were deleted.
2. Despite livestock use of pasture roads, these were not digitized and not effort was made to determine if trails existed before the road.
3. Parallel trails that remain parallel from one point to another were not digitized
4. Trails were not digitized to the center of a destination such as a gate or mineral tub, trails stopped at the edge of the high traffic area.
5. If a trail had a ≥90° turn or a sharp corner it was not digitized at a continuous trail.
6. Streambeds were not digitized.

The shapefile was given a default value of *$length*, this is to tell QGIS to calculate the length of the trail in meters when the feature is completed.

This process was repeated for the remaining eleven rasters.

Shapefiles for trails and quarters of interest are available here (Google Drive):

North quarter: https://tinyurl.com/mrxa4chw
South quarter: https://tinyurl.com/4hvum3fa

Analysis

To analyze the total length of the trails, each shapefile was exported to a comma separated value (.csv) file. The csv files were opened in Excel to calculate statistics. The Excel file is available here (Google Drive): https://tinyurl.com/4ccbf2jf

The above linked Excel file was used to calculate more statistics than ultimately used. The original intent was to determine if there are differences in the lengths of individual trails between cattle and horses. The additional statistics were not used due to variability between the same quarter from one raster to the previous or next and the quality of the rasters.

A graph was prepared to visualize the difference in total trail length. A higher resolution is available here (Google Drive): https://tinyurl.com/ykk9e84r.

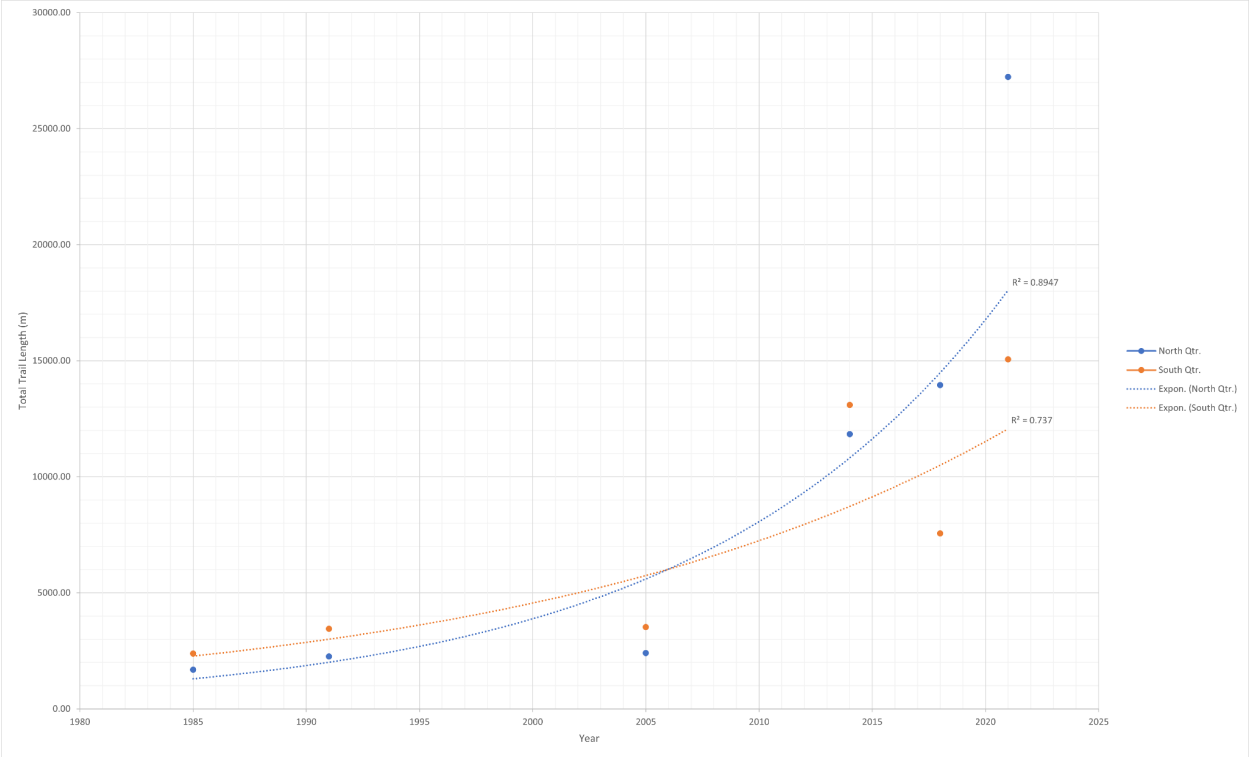

Figure 1. Livestock Trail Length Over Time. R. Olsen

Product

QGIS was used to create a final map that permits visualization of the differences in trails for the areas studied.

A higher resolution version of the map is available here (Google Drive): https://tinyurl.com/3rtz8u8h.

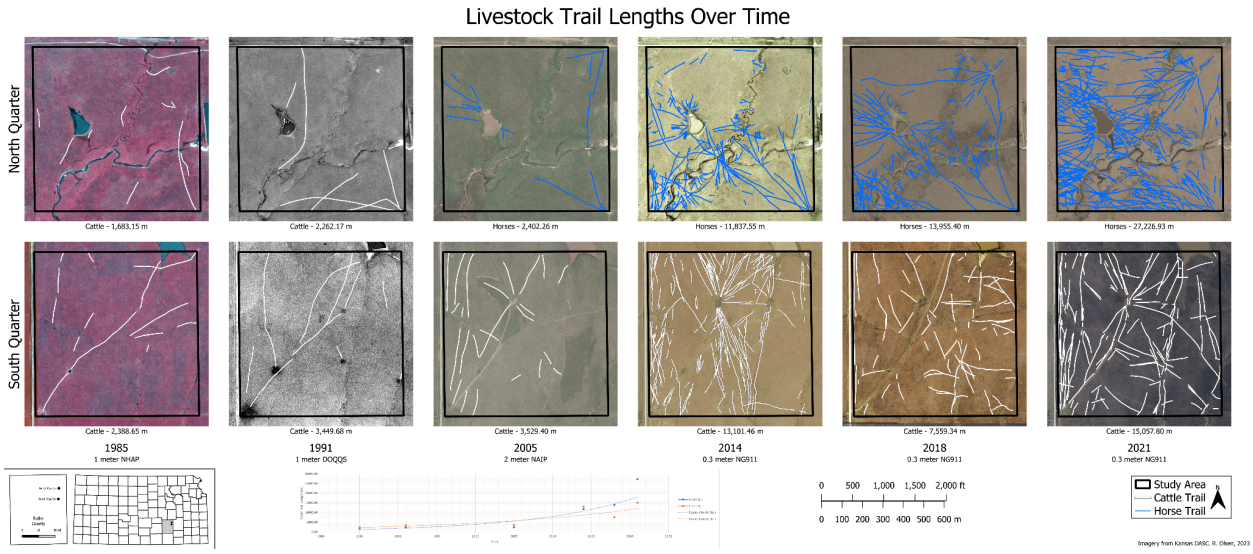

Figure 2. Completed map product of this project. R. Olsen

Conclusion

It does appear that wild horses create longer total trails, however there may be extenuating circumstances that may account for differences:

- Wild horses are not rotated to other pastures as often as cattle.
- Wild horses appear to make new trails rather than using existing ones.
- Differences in how the cattle and wild horses are managed.
- Modern wild horses are not native to the area.
- The 2018 drought, it does not appear that as many cattle were pastured that year while horses remained in the north quarter,
- The northern quarter does not appear to have been burned since wild horses were pastured there while the southern quarter was burned in 2021,

More study would need to be done to determine if there is a correlation over a wider area.

All shapefiles and other data generated by this project is available here (Google Drive): https://tinyurl.com/5xf2tyss.

References

Butler County GIS. Property Ownership Boundaries. Updated 02/27/23. https://www.bucoks.com/723/ESRI-Shapefiles-for-Download

Kansas Data Access & Support Center. GIS Resources. 2023. https://gisresources.kansasgis.org/pages/imagery

Kansas Data Access & Support Center. Tiger 2020 Counties. 2023. https://hub.kansasgis.org/maps/7e1658edde4a4880b30e103f289667ba