Appendix D:
Haskill Basin Carbon Storage

Forest Carbon Implications of Protecting Haskill Basin

Report for the Whitefish Climate Action Plan, March 2018

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Haskill Basin provides water, timber, wildlife habitat, and recreation opportunities for the city of Whitefish, MT. Plans to develop Haskill Basin were being considered until a partnership between state and federal governments, conservation organizations, F.H. Stolze Land and Lumber Company, and local voter support secured a 3,022 acre conservation easement in 2016. This deal ensures Haskill Basin will continue to be managed as a working forest, not developed. The Whitefish Climate Action Committee approached Tony Vorster, an ecologist at Colorado State University, to quantify the impact of preserving Haskill Basin on forest carbon.

To estimate the carbon impact of preserving Haskill Basin, Tony compared current forest carbon stores to those under a likely development scenario. Plans to develop Haskill Basin were similar to the neighboring Iron Horse development so Tony used Iron Horse's development patterns to define the hypothetical development scenario for Haskill.

Tony first mapped land cover in 1990 and 2016 (Figure 1). These maps were developed using aerial images[1,2] to identify past land cover at hundreds of points. This land cover reference data was used to classify Landsat satellite images[3] from 1990 and 2016 into four land covers: closed canopy forest, open canopy forest, nonforest (fields, water, etc.), and developed (housing, roads, etc.). As expected, land cover changed more in the Iron Horse development between 1990 and 2016 than Haskill Basin, particularly in the conversion from forested land covers to developed and nonforest land cover (Figure 2). 37% of the area in Iron Horse changed from forested land covers to developed or nonforest land cover, compared to 8% in the Haskill Basin.

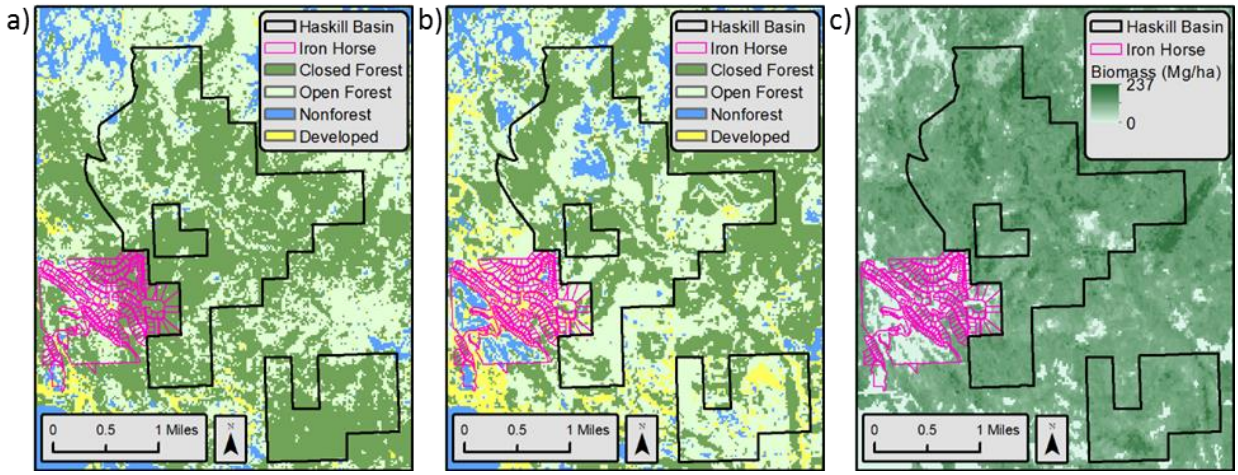

Figure 1. Maps showing land cover in (a) 1990 and (b) 2016 and (c) aboveground biomass in 2000[4].

Next, a biomass map was used to translate land cover change to forest carbon change. The National Biomass and Carbon Dataset[4] (NBCD) maps aboveground biomass as of 2000 across the U.S. Tony produced a third land cover map for 2003 to summarize biomass values, as this was the closest date to NBCD (2000) with the coincident aerial and satellite imagery needed to generate land cover maps. Average biomass values were extracted from NBCD for each land cover type and converted to carbon (half a tree's mass is carbon).

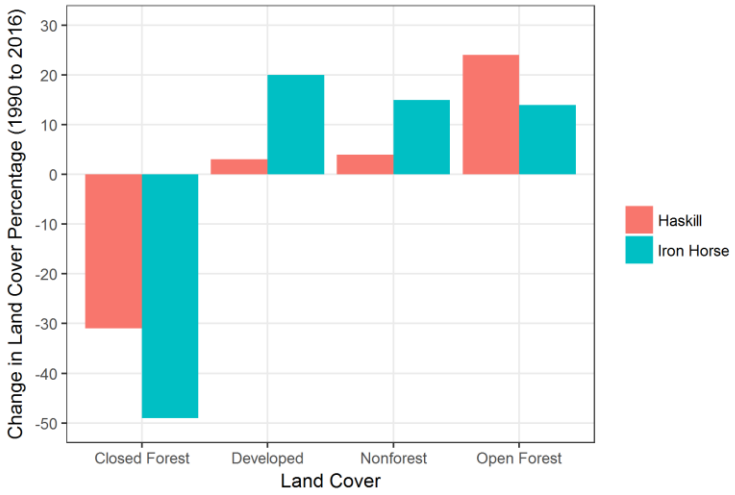

Figure 2. Comparison of the change in land cover (as percentage of total area) in Haskill Basin and Iron Horse. Negative values indicate a loss in that land cover between 1990 and 2016.

With information on the carbon stored by each land cover and how land cover had changed, Tony calculated that Iron Horse lost an average of 15 Mg/ha of aboveground forest carbon between 1990 and 2016 while Haskill Basin owned by Stoltze lost 7 Mg/ha. The difference between these scenarios (8 Mg/ha) multiplied by the area in Haskill Basin is the carbon retained in the forest by preserving this working forest. Had Haskill Basin followed a similar development path to Iron Horse, approximately 9,900 Mg less aboveground forest carbon would be stored in Haskill Basin.

Time and resources for this analysis were limited, so it was designed to utilize freely available data and efficient methods. Some noteworthy caveats and limitations to this study include:

- The study only considers aboveground forest carbon stored within the study area. It does not consider carbon stored in the soil or wood products, on or off site.
- National-scale biomass maps such as the NBCD can have significant errors when applied locally. As a quality check, Tony compared values from NBCD to another biomass map and found agreement. Local validation of the NBCD biomass map would give more confidence in the carbon calculations.
- It is possible that blocking development in Haskill Basin just displaced development to another area. This is not accounted for.

- Carbon stored in forests is still vulnerable to disturbance such as fire so this carbon savings should not be considered permanent.
- Visual inspection of the land cover maps indicates that the maps are generally accurate. There are some errors, however, so some of the land cover changes are artifacts of the land cover maps.

Given more time, resources, and data, there are several avenues for improving these estimates. Attributes more closely related to forest carbon, such as forest canopy cover, could be mapped instead of land cover. Or, optimally, biomass itself could be mapped in 1990 and 2016. Furthermore, development plans for Haskill could be used to simulate land cover change under the development scenario rather than applying development patterns from the Iron Horse development.

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[1] USGS EROS Data Center. National Aerial Photography Program. Images from July 1 and September 11, 1990 and June 18 and September 27, 2003. Sioux Falls, SD. Retrieved from <http://earthexplorer.usgs.gov/>.

[2] USDA Farm Service Agency. National Agriculture Imagery Program. Image from August 1, 2016. Salt Lake City, UT. Retrieved from <http://earthexplorer.usgs.gov/>.

[3] USGS EROS Data Center. Landsat Collection 1. Landsat 5 images from September 3, 1990 and August 13, 2003, Landsat 8 image from August 16, 2016. Sioux Falls, SD. Retrieved from <http://earthexplorer.usgs.gov/>.

[4] Kellndorfer, J., Walker, W., LaPoint, E., Bishop, J., Cormier, T., Fiske, G., Hoppus, M., Kirsch, K., and Westfall, J. 2012. NACP Aboveground Biomass and Carbon Baseline Data (NBCD 2000), U.S.A., 2000. Data set. Available on-line at http://daac.ornl.gov from ORNL DAAC, Oak Ridge, Tennessee, U.S.A. <http://dx.doi.org/10.3334/ORNLDAAC/1081>.