1 Executive Summary

Although George R.R. Martin's series *A Song of Ice and Fire* falls under the category "hard fantasy," we doubt he expected this level of rigour applied to his dragons. In our paper we address realistic concerns of raising dragons, as well as their impact on the earth. We analyze their growth and caloric requirements, their impact on local ecosystems, as well as the required human-intervention needed.

For our growth and calorie estimations, we modeled the rough size limit of a dragon using the largest known dragon, Balerion the Black Dread. We used fanciful descriptions of his teeth being as long as longswords to estimate his size and weight. We then estimated how young dragons would grow by using a model geared towards indeterminately growing species, which matched the description of dragons growing forever. We ultimately found an accurate applicable equation to model dragon growth over time.

For their calorie consumption, we took several approaches and evaluated each one in order to find a plausible caloric requirement of the dragons based on their size and activity. We used the novel unit of cows in order to better process the gargantuan number of calories that they need. We were able to obtain a equation for caloric needs based on the dragon's basal metabolic rate and the Harris-Benedict approach to account for activity levels.

In order to determine land requirements for dragons in different environments with different resource levels, we assumed that dragons could be compared to apex predators of different biomes. The model aimed to ensure environmental sustainability while also fulfilling dragon requirements. We combined data on the caloric requirements and land requirements of various carnivorous predators in different biomes to find the available calories from prey per square mile. We then used this value and the dragon's caloric requirements from the previous model to determine the total land requirements.

To account for the effects of climate on dragons, we considered both water availability and temperature. In the case of arid climates, we compared dragons to existing migratory birds, which create a net increase in water during metabolism. Using data from a Game of Thrones episode, we found the necessary water requirements of a dragon. After dividing this value by caloric intake, we compared the mass of water per kcal of dragons to that produced by birds. We then used data on bird flights to find that the metabolic rate comparison has the implication that dragons can fly for 7.5 hours without water before needing more resources. We also determined that dragons use more energy at low temperatures and conserve energy at high temperatures.

To determine how large a community would need to be to sustain these dragons, we considered both people needed for dragon management and people needed for food. Ultimately, including management of a cow farm, security, and dragon riders, we determined that 3 dragons would need to be $61x + 48$ people, where x is the amount of people per day.