STUDIES OF RUMINANT DIGESTION, ECOLOGY, AND EVOLUTION

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ABSTRACT

This thesis examines ruminant digestion, ecology, and evolution, particularly where they can improve livestock production systems. We performed an experiment that estimated ruminal in situ degradation parameter values of grass and legume forages. In one analysis, we showed the relative feed value system did not explain variation in these parameter estimates, underscoring a biological limitation of this system. In a subsequent analysis, we found that ruminal digestibility estimated from mean parameter estimates had large 95% confidence limits (81% of digestibility means), suggesting digestibility values so estimated have little meaning.

We performed another experiment that monitored concentrations of labeled forage particles within the reticulorumen. We inferred that once a particle escapes from the dorsal sac for the final time, it must escape from ventral regions soon after entry.

We also developed a mechanistic model of ruminant gastrointestinal tract function (based on chemical reactor theory) that predicted feed intake of wild and domestic ruminants precisely (generally $R^2 > 0.9$, root mean square prediction error < 1.4 $kg \cdot d^{-1}$). We then used this mechanistic model, along with allometric equations and the fossil record, to demonstrate the pattern of large BW within the Ruminantia is a response to nutritional resource limitations.

Our final study recapitulates key points in the ecology and evolution of wild ruminants, then discusses how these points and others presented in the thesis offer insight into improving livestock production systems.