

## **PASTURE NUTRIENT COMPOSITION AIDS IN UNDERSTANDING OF SECONDARY COPPER DEFICIENCY IN HOOFSTOCK AT SAN DIEGO ZOO SAFARI PARK**

*Michele Gaffney, MS\*, Edith Galindo, MS, Jennifer L. D'Amato-Anderson, MS, and Andrea Fidgett, MSc, PhD*

*Wildlife Nutrition, San Diego Zoo Wildlife Alliance, San Diego, CA 92112, USA.*

### **Abstract**

Copper (Cu) is an essential trace mineral for animals that is necessary for a variety of functions including metabolism, connective tissue formation, hair pigmentation, immune function, and disease resistance. There are two forms of copper deficiency: primary and secondary. Primary copper deficiency occurs when animals are fed diets deficient in copper. Secondary copper deficiency occurs when dietary copper absorption is antagonized by high dietary intake of molybdenum (Mo) and/or sulfur (S). Excess amounts of Mo, S, and sulfates in feed, forage, or water adversely affect copper absorption or metabolism. Dietary S and sulfate are reduced to sulfides in the reticulorumen (Hale & Garrigus, 1953) and then react either with dietary copper to form insoluble copper monosulfide (CuS), or with copper and molybdenum to form insoluble thiomolybdates which can interfere with the absorption and storage of copper. Secondary copper deficiency has been identified in ruminant hoofstock maintained in the San Diego Zoo Safari Park (SDZSP) open-field habitats. Many of the species at the SDZSP are observed extensively grazing pasture in the large (approx. 25 to 65 acre) habitats.

In order to better approach the copper deficiency issue in these species and identify proactive ways to treat and manage the herds, pasture sampling and data collection was instituted quarterly to gather baseline data of seasonal and locational nutritional differences. In 2018-2020, quarterly samples were collected from all open-field habitats at the SDZSP with >75% pasture coverage by visual assessment. The samples were analyzed for minerals most notably iron, Cu, zinc, S, and Mo. Using the app ArcGIS Collector, pasture was sampled from the same areas to compare the analysis of nutrients over time. Five sub-samples of pasture were collected from various zones in a field habitat. The sub-samples were composited into a representative sample of each zone. All zones in the open-field habitats were sampled once every season. The ArcGIS Collector is being used to develop maps of sampling locations and create informational graphics of the nutritional data. The data collected will contribute to recommendations for improving pellet formulation (e.g., custom pellet lower in sulfur), implementing soil and pasture management to promote better mineral levels, and understanding water quality and the role of sulfates to aid with treatment of the water source. These actions, in conjunction with the project “Wild hoofstock feed space requirements in zoological mixed species habitats,” will help to establish recommendations for feeding strategies (e.g., adding feeders in the open-field habitats), which will benefit the health and well-being of hoofstock at the SDZSP.

### **Literature Cited**

Hale WH and Garrigus US (1953) Synthesis of cystine in wool from elemental sulfur and sulfate sulfur. *J Anim Sci* 12(3): 492–496.