EVALUATION OF NDVI AND EVI AS MEASURES OF FOOD AVALIABILITY FOR FRUIT-EATING MONKEYS

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NGOGO MONKEY PROJECT

ABSTRACT Estimates of food abundance are central in studies of primate behavior and are usually comprised of visual measurements from the ground, yielding crude estimates of food biomass. This method is time- and labor-intensive, especially in tropical rainforests where most primates live. Remote-sensed data is a powerful alternative for calculating vegetation indices (VIs). We tested two VIs derived from NASA's Moderate Resolution Imaging Spectroradiometer dataset as estimates of food availability and energy gain for fruit-eating monkeys in Western Uganda. We calculated NDVI and EVI for six groups of red-tailed monkeys (*Cercopithecus ascanius*) over four years. **There was no relationship between the VIs and fruit production; additionally, fruit production did not correspond directly with monkey energy balance. Instead, the interaction between NDVI and fruit production predicted energy balance.** These findings indicate that more research is needed to disentangle the relationships among plant reproduction, VIs, and consumer energetic condition.

Research question: can we use publicly accessible, remote-sensed vegetation indices (VIs) to:

1. estimate forest phenology and,
2. predict energy gain for fruit-eating monkeys?

Lab URINARY C-PEPTIDE — Biomarker of energy gain

Urine samples (N = 1417) collected noninvasively from 109 individuals in 6 groups. → Radioimmunoassay of C-peptide of insulin a biomarker of energy gain → Assayed specific gravity to standardize urine sample concentration → Individual monthly mean C-peptide value

R MONTHLY PHENOLOGY VALUES

Measurements of important foods in red-tail diet measured on existing trails within the home ranges → Crop size estimates log-binned (0, 1-9, 10-99, 100-999, etc.) → Calculated monthly FAI per monkey home range

R MONKEY GROUP HOME RANGES

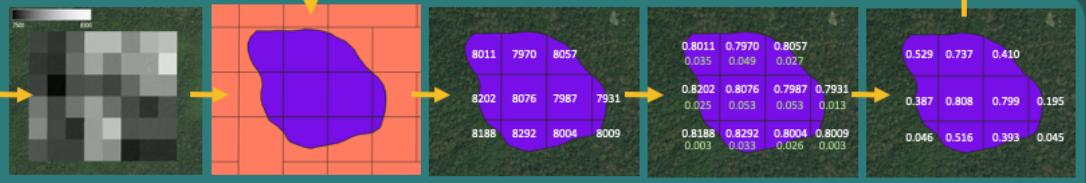
30-minute center-of-mass GPS locations

Shapefiles calculated using 95% kernel density estimate

Summarize mean monthly home range VI values

QGIS VEGETATION INDICES

MODIS/Terra 16-day L3 Global 250m SIN Grid (NASA.gov)



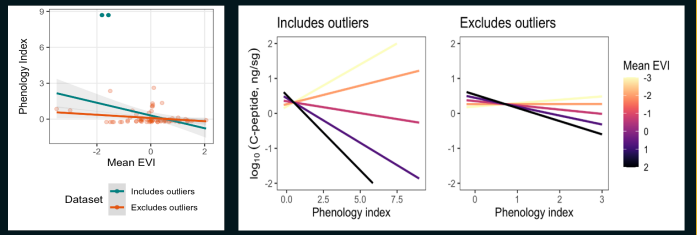
Vectorize VI raster ("Polygonize") → Clip VI layer to monkey home range shape → Scale raw MODIS VI values to correct VI range (-1 : +1) → Calculate area of each VI tile within home range → Create weighted VI values (Weighted mean = $\Sigma x^*w/\Sigma w$)

Findings:

1. Groups varied slightly in their home range VIs, while their energy varied widely

2. No correlation between NDVI or EVI and phenology (relationship only driven by two outliers)

3. Phenology is a minor driver of energy gain, and EVI is a modifier of this relationship



Though they are widely used to assess habitat characteristics, we found that VIs are not ideal replacements for "on-the-ground" habitat productivity measures for fruit-eating primates, perhaps because VIs are a measure of greenness, which does not always correspond to fruit production. More research is needed to disentangle the relationships among plant reproduction, VIs, and consumer energetic condition.

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