Remotely sensed vegetation phenology for describing and predicting the biomes of South Africa

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Abstract

Questions: What are the patterns of remotely sensed vegetation phenology, including their inter-annual variability, across South Africa? What are the phenological attributes that contribute most to distinguishing the different biomes? How well can the distribution of the recently redefined biomes be predicted based on remotely sensed, phenology and productivity metrics?

Location: South Africa.

Method: Ten-day, 1 km, NDVI AVHRR were analysed for the period 1985 to 2000. Phenological metrics such as start, end and length of the growing season and estimates of productivity, based on small and large integral (SI, LI) of NDVI curve, were extracted and long-term means calculated. A random forest regression tree was run using the metrics as the input variables and the biomes as the dependent variable. A map of the predicted biomes was reproduced and the differentiating importance of each metric assessed.

Results: The phenology metrics (e.g. start of growing season) showed a clear relationship with the seasonality of rainfall, i.e. winter and summer growing seasons. The distribution of the productivity metrics, LI and SI were significantly correlated with mean annual precipitation. The regression tree initially split the biomes based on vegetation production and then by the seasonality of growth. A regression tree was used to produce a predicted biome map with a high level of accuracy (73%).

Main conclusion: Regression tree analysis based on remotely sensed metrics performed as good as, or better than, previous climate-based predictors of biome distribution. The results confirm that the remotely sensed metrics capture sufficient functional diversity to classify and map biome level vegetation patterns and function.

Keywords:

- AVHRR;
- Biomes;
- NDVI;
- Net primary production;
- Phenology;
- Regression tree;
- Vegetation mapping