Land cover change and savanna heterogeneity in Kruger National Park, South Africa.

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Vegetation composition, distribution and dynamics underlie the ecosystem patterns we observe (Packer *et al.* 1999). Traditional techniques of field survey meant that ecological investigations were mostly confined to the local scale, requiring the ecologist to extrapolate the results to understand the regional dimensions of the process in question. This essentially meant that the knowledge-base developed for ecological patterns and processes was limited, in both its spatial and temporal extent and the data derived remained 'patchy' for conservation and management purposes.

Structure and pattern are two of the most common physical characteristics that one sees investigated in studies linking vegetation with ecological processes. The ability to detect changes in pattern and make readings at more than one level of resolution is being increasingly recognised as fundamental for ecosystem science. This has assumed more importance given the realisation that management activities at one scale often have unexpected or undesirable effects at other scales. Achieving this goal requires identification of the physical and biological processes of interest, estimation of the variables and parameters that affect those processes at different scales and development of rules to translate information across scales (Gardner 1998). Through its objective view and synoptic, repeatable coverage, satellite remote sensing has made it possible to map large areas with varying spatial and temporal resolutions relatively easily. However remotely sensed data are generally collected at a single spatial resolution, in contrast to the many scales at which nature operates, making it necessary to have a multi-scalar analytical approach when such data are used for ecological applications.

The savanna constitutes the largest biome in southern Africa occupying 46% of its area and over one-third of the area of South Africa (GRID 2004). It is the primary habitat type in two large national parks: Kruger and Kalahari Gemsbok. With an area of 1,898,458 ha Kruger occupies almost 2.5 percent of the total land surface area in South Africa. Heterogeneity at multiple spatial and temporal scales is a key attribute of savanna ecosystems, as is the relative dominance of woody and herbaceous species. Variation in the proportion of these is driven by the changes in the disturbance regime (fire, herbivory, floods) as well as climate. Disturbance is considered to be a major factor influencing landscape pattern and vegetation composition (Forman and Godron 1986), especially so in savanna, which has fire as one of the major drivers of ecosystem change. We hypothesise that the frequent and extensive fires in the Kruger savanna landscape lead to a shortening of the temporal scale of patchiness, leading to homogenisation of the native vegetation. In terms of scaling, as spatial and temporal resolutions become coarser, the patchiness fuses into homogeneity.

In this study we examine the change in the spatial pattern of vegetation in Kruger National Park over a 30-year time period (1972 – 2002) through the analysis of time-series images from Landsat sensors – Multi-Spectral Scanner (MSS), Thematic Mapper (TM), and Enhanced Thematic Mapper Plus (ETM+). We propose to investigate the relationship between land cover change and savanna heterogeneity at multiple spatial and temporal scales. Different vegetation types manifest particular spectral reflectance and emittance properties, which result in distinctive spectral response patterns (Packer *et al.* 1999). The differential absorption of solar energy by green vegetation at the red and near-infrared region of the solar spectrum – the basis for vegetation indices – has long been one of the techniques used for vegetation mapping (Justice *et al.* 1985; Townshend and Justice 1986). Among the indices proposed Normalised Difference Vegetation Index (NDVI) has seen the most use, especially in global-scale change-detection studies. Given the structural openness that is typical of savanna (compared with the closed-canopy structure of tropical forests), we propose to use Soil Adjusted Vegetation Index (SAVI), which effectively normalises soil substrate variations (Huete 1988) so as to not influence the vegetation measure.

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