



## Land Abandonment in the Eastern Cape, South Africa: Implications for vegetation invasions, soil surface conditions and gully erosion

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Abandonment of cultivated lands is a widespread phenomenon in the Eastern Cape Province of South Africa, particularly in the communal lands. Most abandoned lands are associated with the replacement of indigenous perennial vegetation species by arid condition shrubs, impairment of soil biophysical properties and severe gully erosion. Despite the propensity of abandoned lands to severe erosion, they have rarely been addressed in land use modelling studies (Mulligan, 2004). In order to gain an understanding of land use and vegetation changes, and the development of gully erosion, sequential aerial photographs taken between 1938 and 1988, and infrared images for 2001 and 2005 were analysed. Soil surface strength as a surrogate for soil crusting was assessed under *P. incana* clusters and remnant grass patches using a hand-operated cone penetrometer. Relationships between the mapped phenomena and topographic variables were sought using a 20m Digital Elevation Model.

Evidence from aerial photography, infrared imagery and field observations indicated that *P. incana* invasion parallels land use change and patterns. Abandoned lands, particularly on steep south facing slopes were noted as predisposed to invasion by *P. incana*. A predominance of gullyling on abandoned lands was noted, as 80% of the total gullied area lies on abandoned lands. The development of gullies on abandoned lands within the gentle lower concave hillslope elements of the study area highlights how low the topographic threshold for gully development is on abandoned lands. A comparative assessment of soil surface conditions showed that crusting under *P. incana* interpatch bare areas is significantly greater than under grass. This implies significantly greater runoff generation under the former than the latter. The absence of appropriate management strategies and the high erodibility of the soils rendered abandoned lands vulnerable to erosion. Soil physical properties and disturbance in the form of land abandonment are envisaged to have interacted to cause a shift in water availability beyond the uptake threshold for grass species, hence the replacement by *P. incana*. The spatial correlation between gullyling and abandoned lands within concave colluvial bottom lands demonstrated that the topographic threshold for gully erosion is very low where land use, topography and soil properties interact.