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| **Name** | Luveshni Odayar (Rhodes University, South Africa) | |
| **TITLE** | An investigation of the use of remote sensing techniques for assessing carbon stocks in intact, degraded and restored subtropical thickets in the Eastern Cape, South Africa | |
| **MOTIVATION** | According to Lal (2004) the depletion of soil organic carbon (SOC) stocks have contributed 78 ± 12 billion tonnes of carbon to the atmosphere, while some cultivated soils have been depleted of one-half to two-thirds of their original SOC stocks. Land degradation, potentially exacerbated by both climate change and poor land management practices and policies, have intensified the loss of SOC. A substantial portion of the depleted SOC stocks can therefore be restored by adopting and implementing restorative land use practices, which according to Lal (2004) can substantially reduce the rate of atmospheric carbon accumulation while also positively impacting on water quality, agro-industries, food security and environmental health on the whole.  The subtropical thicket biome serves as one of the five major global carbon sinks. Intact thicket in the Eastern Cape province of South Africa stores more than 20 kg/m2 of carbon, an extraordinarily high amount for a semi-arid region (Mills and Cowling, 2006). Livestock farming, a significant component of the Eastern Cape economy, is supported by subtropical thicket. Over the last century, unsustainable agricultural practices (particularly concerning livestock farming and the overgrazing of goats) have resulted in the transformation of subtropical thicket in the Eastern Cape into an open savanna (Lechmere-Oertel *et al*., 2005; Mills and Cowling, 2006), resulting in a carbon loss of 40 kg/m/yr (Nocita *et al*., 2011).  In addition to storing carbon stocks, subtropical thicket in the Eastern Cape is responsible for the provision of numerous ecosystem services. These include an increase in the wildlife carrying-capacity and biodiversity of ecosystems, improved water retention and infiltration, reduction of soil erosion, earning carbon credits on the international market and a source of livelihood and employment for rural communities (through both livestock farming and the labour involved in subtropical thicket restoration) (Mills and Cowling, 2006). It is therefore hugely important to understand the state the thicket is in.  The quantification of carbon sequestration levels in various ecosystems presents a global challenge. A recent study by Jeyanny *et al*. (2011) describes the immense potential of remote sensing (RS) geographical information systems (GIS) in quantifying and managing carbon sequestration at a regional scale in various ecosystems. RS and GIS provide an efficient and cost-effective approach to estimating the above and below-ground biomass, delineating spatial variability, predicting potential stocks of carbon and providing a basis for the management of carbon sequestration at both a local and regional level (Jeyanny *et al*., 2011). | |
| **AIM** | To investigate the use of remote sensing techniques in calibrating carbon stocks in intact, degraded and restored subtropical thicket sites in the Eastern Cape Province, South Africa. | |
| **STUDY AREA** | Subtropical thickets in the Eastern Cape Province, South Africa.  Figure 1 represents the distribution and extent of the thicket biome in South Africa, which is predominantly in the Eastern Cape Province.    Figure 1: Map showing the location and extent of the subtropical thicket biome in South Africa(Generated in ArcMap10).  Unsustainable farming practices in the region, particularly regarding goat pastoralism, have resulted in the degradation of the subtropical thicket. Lloyd et al. (2002) stated that 80% of the succulent thicket in South Africa had been transformed due to the overstocking of goats.  Intact thickets have a total ecosystem carbon storage of about 200 to 250 t/ha. This vegetation type is dominated by a stem succulent called spekboom (*Portulacaria afra*) that is able to fix carbon at a rate of 4 tC/ha/yr in semi-arid regions.  Spekboom, according to Mills and Cowling (2006) can be generated from cuttings and can in this way be used to restore the vegetation of degraded thicket sites. Numerous restoration projects have been established at various subtropical thicket sites in the Eastern Cape; these include the Addo, Baviaanskloof and Great Fish River Reserves, as well as numerous farms in the area. | |
| **Objectives** | | **Methods** |
| Map the distribution and extent of the thicket areas of the Eastern Cape Province. | | Maps will be generated in a GIS using imagery and existing data. Existing data from the SERVIR database will be used where applicable. |
| Use RS techniques to develop a signature to classify thicket into various intactness classes (intact, moderately degraded and severely degraded and restored). | | Remote sensing techniques (such as imaging spectroscopy) and ground truthing will be performed. |
| Assess the state of different categories of thicket on the ground. | | Field surveys will be conducted. |
| Devise a potential remote sensing-based management and monitoring approach to conservation of the subtropical thicket biome. | | Based on the results from the above steps, potential management guidelines will be formulated. |
| Investigate the possible use of thicket intactness as an indicator of selected ecosystem service provision. | | Based on the results from the above steps, spatial variability will be delineated, enabling a link to be drawn between the degree of thicket intactness and the provision of certain ecosystem services. |
| Possibly contribute useful data to the Rhodes Restoration Research Group. | | The data obtained in the above steps will be made available to the Rhodes Restoration Research Group, which has conducted no remote sensing-based research in the subtropical thicket sites. |
| **RESEARCH PRODUCTS** | 1. GIS data in the form of an updated vegetation layer for the thicket biome and a potential ecosystem carbon stocks layer. 2. Maps of the location and extent of the thicket biome, the state (intactness) of the thicket vegetation and potential ecosystem carbon stocks. 3. Potential management guidelines. 4. An assessment of the current state of the thicket biome. | |
| **ADDITIONAL INFORMATION** | | |
| Details of Research/Educational Activity:  My project will be carried out within a six month time period as part of my Honours degree. Concurrently, I will also be enrolled for full time study in the following four Geography courses, to be carried out through the course of an academic year: (i) Fundamentals of Geography; (ii) Advanced Geographical Information Systems; (iii) African Futures and (iv) Environmental Change.  Outreach Element for Non-selected Applicants:  The completed research will be presented at the annual Geography Students Conference, held at a different South African university each year. | | |
| **KEY REFERENCES** | | |
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