Geophysical Research Abstracts
Vol. 16, EGU2014-14974, 2014
EGU General Assembly 2014

The Great Karoo region of South Africa: A carbon source or sink?

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Work undertaken in the seasonally arid upland areas of the Great Karoo region of South Africa has established a link between land degradation and overgrazing that began approximately 200 years ago when European farmers first settled the area. In response to changing land use, coupled with shifting rainfall patterns, parts of the landscape are now characterised by badlands on footslopes of valley-sides and complex gully systems on valley floors. Limited precipitation and agricultural intensification, particularly from around the 1920s onwards, resulted in a growing demand for water, and led to the construction of many small reservoirs, most of which are now in-filled with sediment. Whilst the deposited material has provided a means of linking catchment-scale responses to land use changes over the last ca. 100 years, the influence of land degradation on erosion and deposition of soil-associated carbon (C) has received only limited attention. Despite a reversion to extensive agriculture and reduced livestock densities in certain areas, limited vegetation regrowth suggests that soil rehabilitation will be a long-term process. This communication presents preliminary results from an investigation to determine whether land degradation in the Karoo has resulted in a shift from a net sink of C to a net source of C. Sediment deposits from a silted-up reservoir in a small dry valley system was analysed for varying physicochemical parameters. Total Carbon (TC) content was recorded and the sharp decrease in total C content with decreasing depth suggests that land degradation during and after post-European settlement probably led to accelerated erosion of the relatively fertile surface soils, and this presumably resulted in the rapid in-filling of reservoirs with carbon-rich surface material. Overall, the results indicate a sharp decline in soil organic matter (SOM) of eroded material, presumably as a consequence of land degradation. This suggests that in landscapes such as the overgrazed drylands of the Karoo, the C sink effect caused by soil erosion is now much smaller than at the onset of overgrazing leading to accelerated erosion. Such a loss of C sinks on degraded rangeland soils raises the question whether past soil erosion may have had a greater attenuating effect on GHG emissions than modeled scenarios of present emissions suggest.