

1 August 2006

Extracts from final report on Conservation Farming Project submitted to the World Bank on 30 September 2004

To evaluate the role of conservation farming as part of national and regional strategies to conserve biological diversity in South Africa.

The main achievement of the Conservation Farming Project was to provide a sound basis for evaluating the role of conservation farming in strategies to conserve biological diversity. Other projects funded by the GEF and CEPF in South Africa have already established that conservation on private land is an essential component of national and regional conservation strategies. This project showed how and where conservation farming can make a contribution.

- The clearest outcome was the case for Succulent Thicket. Here game farming has a clear biodiversity benefit, which is also more financially viable than goat farming, and corresponds to the greatest carbon benefit. The win-win outcome suggests that conservation farming can play an important role in conservation strategies.
- In Nieuwoudtville, there is a definite biodiversity benefit associated with practices that retain existing vegetation remnants and where the veld is periodically rested from grazing. However, these farming practices result in a financial loss for farmers unless they are able to increase revenue from ecotourism. Conservation strategies in this region therefore need to find ways of compensating farmers for lost income or increasing farmers' access to revenue from ecotourism.
- In the southern Drakensberg, conservation farming practices occur within the context of dramatic conversions in land use from extensive rangelands to either afforestation or high intensity dairy farming. Although conservation farming provides benefits in terms of biodiversity, water provision, and carbon sequestration, there are limited benefits for farmers. Security problems, the high value of land, and the expansion of forestry have created a dynamic situation where land use and conservation planning are far more important for effective conservation strategies than the implementation of conservation farming practices.
- Finally, in the Nama Karoo, we were unable to discern any clear benefit associated with different grazing systems. However, Karoo ecosystems are known to take up to 40 years to respond to changes and part of the strategy for this area should be to monitor the status of biodiversity under different grazing systems.

III. Summary of Main Lessons Learned

- ◆ All farming systems have an impact on biodiversity, but some are better than others. However, it is important to develop objective criteria for assessments because factors such as land use history and the location of the farm (e.g. heterogeneity) can obscure the impacts of current land use.
- ◆ Farmers generally care about the environment and most view themselves as conservation farmers. This is partly due to confusion regarding what they are trying to conserve (soil, agricultural resources, or biodiversity) and it is important to make the case for biodiversity conservation more explicit.
- ◆ The social component of the study showed that land use decision making is a complex process that is influenced by a variety of needs and satisfiers. In addition to financial reasons, farmers may pursue certain practices because of support networks (extension services, social networks), quality of life decisions, or security needs. The mainstreaming of biodiversity in the agricultural sector needs to take this into consideration when developing enabling mechanisms.
- ◆ A review of past successes in conservation farming showed that enabling mechanisms (subsidies, extension services, research) were more effective at achieving a change in

behaviour than legal instruments, which were seldom applied. The challenge is to provide enabling mechanisms that focus on biodiversity.

- ◆ Farmers identified three relatively simple needs that would enable them to accommodate biodiversity in their farming practices. These needs should be addressed by the newly formed South African National Biodiversity Institute.
 - Information on WHAT biodiversity occurs on their farms
 - Information on the IMPACT of farming practices on biodiversity
 - Information on ALTERNATIVES. Most farmers articulate this as a need for further RESEARCH on sustainable land use practices
- ◆ At present farmers do not derive any benefit from the downstream value of ecosystem services (water provision, carbon sequestration). Land use decisions in places like the Drakensberg may be quite different if water provision and carbon sequestration provided financial benefits to farmers.
- ◆ The benefits to farmers from local (on farm) use of ecosystem services (pest control, soil health) is often too obscure to elicit a change in behaviour. This may be possible for services such as pollination, but is hard to demonstrate for many other services, especially services that may have different values at local and regional scales (e.g. water infiltration)
- ◆ Conservation farming practices are often linked to charismatic individuals with a good understanding of the ecology of their farms. Unless their insights and ideas are more widely adopted in the community, the conservation value of the land will decline when the land passes on to new owners.
- ◆ Farmers are inherently experimental, but often do not properly assess the outcomes of their experiments, either on farm production or the environment. Many farmers expressed interest in a research format that links scientists with farmers to test their ideas more rigorously. This should be taken up by research groups in South Africa.

Appendix A.

List of reports and publications arising from the Conservation Farming Project. (30 March 2004)

Scientific papers

1. Bragg, C., Donaldson, J.S. & Ryan, P. In press. Cape porcupines as ecosystem engineers: density and disturbance in a semi-arid environment with high geophyte diversity. *Journal of Arid Environments*
2. Donaldson, J.S. 2002. Biodiversity and Conservation Farming in the Agricultural Sector. In: Pierce, S.M., Cowling, R.M., Sandwith, T., MacKinnon, K. (eds) *Mainstreaming Biodiversity in Development, Case studies from South Africa*. The World Bank Environment Department.
3. Donaldson, J.S. 2003. Conservation and sustainable use of pollinators in agricultural landscapes, a South African perspective. In: Kevan, P. (ed.). *The conservation and sustainable use of pollinators in agriculture*.
4. Donaldson, J.S., Mills, A., O'Farrell, P., Todd, S., Skowno, A., Nanni, I. 2003. Conservation Farming With Biodiversity in South Africa: A Preliminary Evaluation of Ecosystem Goods and Services in the Bokkeveld Plateau. In: Lemons, J., R. Victor, D. Schaffer (eds) *Conserving Biodiversity in Arid Regions*. Kluwer Academic Publishers, Boston
5. Donaldson, J.S., Nanni, I., Kemper, J. & Zachariades, C. 2003. Effects of habitat fragmentation on pollinator diversity and plant reproductive success in renosterveld shrublands of South Africa? *Conservation Biology*
6. Mills, A, O'Connor, T., Skowno, A., Bösenberg, D.J., Sigwela, A, Lechmere-Oertel, R., Fey, M & Donaldson, J.S. Ecosystem carbon storage under different land uses in three semi-arid shrublands and a mesic grassland in South Africa. *Agriculture Ecosystems and Environment*
7. Mills, A.J., & Fey, M.V. (accepted). Declining soil quality in South Africa: effects of land use on soil organic matter and surface crusting. *South African Journal of Science*.
8. Mills, A.J., & Fey, M.V. 2003. Factors affecting soil crusting in five contrasting biomes of South Africa. *Soil Use and Management*.
9. Mills, A.J., & Fey, M.V. 2003. Soil carbon and nitrogen in five contrasting biomes of South Africa. *S. Afr. J. Plant Soil* 2004, 21(2) p 81 – 90.

10. Mills, A.J., & Fey, M.V. 2003. Declining soil quality in South Africa: effects of land use on soil organic matter and surface crusting. *South African Journal of Science* 99, 2003. pp429 – 436.
11. Mills, A.J., & Fey, M.V. 2003. Frequent fires intensify soil crusting: physicochemical feedback in the pedoderm of long-term burn experiments in South Africa. *Geoderma*
12. Mills, A.J., & Fey, M.V. 2004. A simple laboratory infiltration method for measuring the tendency of soils to crust. *Soil Use and Management* 20, 8 –12.
13. Mills, A.J., & Fey, M.V. 2004. Transformation of thicket to savanna reduces soil quality in the Eastern Cape, South Africa. *Plant and Soil* 0: 1 – 11, 2004.
14. Mills, A.J., Cowling, R.M., Fey, M.V., Kerley, G.I.H., Donaldson, J.S., Lechmere-Oertel, R.G., Sigwela, A.M. and Skowno, A.L. A semi-arid thicket that rivals mesic forest as a carbon sink. *Austral Ecology*
15. Mills, A.J., Fey, M.V. & Johnson, C.E. 2003. Ionic strength as a measure of sulphate salinity stress: effects of sodium sulphate, sodium chloride and manganese sulphate on kikuyu (*Pennisetum clandestinum*) growth and ion uptake. *South African Journal of Plant and Soil*.
16. O'Connor T.G., Mills, A.J Influence of land use on nutrient stocks in the montane grassland of the southern Drakensberg, South Africa. *Journal of Applied Ecology*.
17. O'Connor, T.G. Influence of land tenure on populations of the medicinal plants *Alepidea amatymbica*, *Eucomis autumnalis*, and *Gunnera perpensa*. *South African Journal of Botany*.
18. O'Connor, T.G. Influence of land use on phytomass accumulation in Highland Sourveld grassland in the southern Drakensberg, South Africa: implications for carbon sequestration. *Journal of Applied Ecology*.
19. O'Connor, T.G., Uys, R.G., & Mills, A.J. 2003. Ecological effects of firebreaks in the montane grasslands of the southern Drakensberg, South Africa. *African Journal of Range and Forage Science*.
20. O'Connor: Influence of land use on plant community composition, structure and diversity in Highland Sourveld grassland in the southern Drakensberg, South Africa. *Journal of Applied Ecology*.

Manuscripts under review

1. Bragg C.J. & Donaldson, J.S. Effects of porcupine foraging behaviour on the diversity and abundance of geophytes in a variegated agricultural landscape
2. Breebaart, L. & Donaldson, J.S. Feeding selection in three grazing systems in the Nama Karoo and its implications for maintaining biodiversity in rangelands.
3. Kerley, G.H., Landman, M., Schoeman, D.S. The effect of transformation on browse availability for indigenous (kudu, bushbuck, duiker) and introduced domestic herbivores (goats) in subtropical thicket, South Africa.
4. Koelle, B., Oettlé, N, Thobela, M, Arendse, A. Learning in Partnership to Conserve Biodiversity.
5. Kotze, D.C., Walters, D.J., O'Connor, T.G. Influence of land use on community organization and ecosystem functioning of wetlands in the southern Drakensberg mountains, South Africa.
6. Mills, A.J., & Milewski, M.V. 2003. A ratio controlling height of vegetation and amount of carbon sequestered in wood? To be submitted to *Bioscience*
7. Mills, A.J., Donaldson, J.S., Todd, S., Fey, M. Soil crusting and plant distribution on the Bokkeveld Plateau.
8. Mills, A.J., Donaldson, J.S., Todd, S., Fey, M. Soil crusting and plant distribution in the Nama Karoo, South Africa.
9. Mills, A.J., Kgope, B., Fey, M. & Donaldson, J.S. Can soil respiration be used as an early warning of impaired ecosystem functioning: investigations in karoo, thicket and grassland biomes of South Africa
10. O'Farrell, P. & Donaldson, J.S. Effects of landscape heterogeneity and farm management on ecosystem services in a semi arid environment.
11. O'Farrell, P., Donaldson, J.S. & MacGregor, M.N. The effect of vegetation transformation on soil health in a semi-arid environment
12. O'Farrell, P., Donaldson, J.S. Using landscape function analysis and rainfall simulation to determine resource loss under three different grazing systems in the Nama Karoo
13. O'Connor T.G., Kruger, S. Synchronous decline of small antelope populations in an 'island' reserve in the southern Drakensberg. Intended for the *South African Journal of Wildlife Research*.
14. Oettlé N.M. and Koelle, B.R.I. 2003. New directions for extension in democratic South Africa
15. Perrot, N. & Donaldson, J.S. Effects of soils, land use and moisture availability on the dispersal and establishment of *Brunsvigia bosmanae* in a variegated landscape.
16. Short, A.D., O'Connor, T.G., Hurt, C.R. Medium term changes in grass composition and diversity of Highland Sourveld grassland in the southern Drakensberg in response to fire and grazing management. Submitted to the *African Journal of Range and Forage Science*.
17. Theron L-J., Donaldson, J. Vegetation types in relation to soil and climatic variables in the central Nama-Karoo

18. Theron, L-J. & Donaldson, J.S. The conservation benefits of structured grazing systems in the Nama Karoo.
19. Todd, S & Donaldson, J.S. Plant communities of the van Rhynsdorp shale Renosterveld vegetation in relation to substrate on the Bokkeveld Plateau
20. Todd, S. Plant species richness and cover in relation to livestock watering points
21. Todd, S. The piosphere as a fingerprint of land use pattern. The impact of livestock watering points on plant cover and species richness on four ranches in the central lower Karoo, South Africa.
22. Todd, S Plant species diversity and growth form richness in relation to substrate and landform. Landscape-diversity relations in the Central Lower Karoo, a semi arid region in South Africa.
23. Todd, S. & Donaldson, J.S. Current and potential future levels of vegetation transformation around Nieuwoudville on the Bokkeveld Plateau, a hotspot of plant diversity and endemism.
24. Todd, S. & Donaldson, J.S. Species richness, endemism and growth form composition of Renosterveld vegetation in relation to substrate on the Bokkeveld Plateau
25. Wildy, E.J. Effect of different land use practices on invertebrate diversity in Underberg, KwaZulu-Natal, South Africa.

Technical Reports

1. Beukes, P. 2002. Soil Biotic Activities in Nama Karoo Soils under Different Grazing Systems.
2. Ellis F. Report on a soil investigation of selected trial areas in the Nieuwoudville region of the Northern Cape Province
3. Kerley, G, Lechmere-Oertel, R, Sigwela, A. Conservation Farming Project. Final report for the Albany Centre.
4. Kerley, G, Final project report: The effect of transformation on forage availability for indigenous (kudu, bushbuck, duiker) and introduced herbivores (goats) in subtropical Thicket.
5. Koelle, B., Oettle, N., Thobela, M. & Arendse, A. 2003. Learning in partnership to conserve biodiversity: findings of the social research team of the Conservation Farming Project.
6. Kotze, D.C. Land-use impacts on wetlands in the southern Drakensberg. July 2002
7. Krug, R. Model for the restoration of indigenous plant communities and plant biodiversity on old lands in the Nieuwoudville district.
8. Mouton, P.le. & Alblas, A. Reptile diversity in the Nieuwoudville area. Report for the Conservation Farming Project. October 2002.
9. O'Connor, T. Final report for the Conservation Farming Project, Southern Drakensberg. June 2003
10. O'Connor, T. Distribution and abundance of two alien invasive plant species in the southern drakensberg. May 2003
11. O'Connor, T. Clovelly: State of soils and vegetation. 11 March 2003.
12. O'Farrell, P. Ecosystem services and benefits to farmers. Conservation Farming Project final report .
13. Robertson, H.G., van Noort, S. Effects of agricultural practices on ants and other Hymenoptera in four farming areas of South Africa.
14. Robertson, H.G Hymenoptera and plant species lists for the four study farms at Beaufort West.
15. Skowno, A. Classifying and mapping renosterveld vegetation and transformation around the town of Nieuwoudville in the Northern Cape Province, South Africa.
16. Skowno, A. Cover and biomass in an arid South African shrubland: a landscape perspective.
17. Skowno, A. Indirect biomass estimation in subtropical thicket vegetation in the Eastern Cape Province of South Africa.
18. Todd, S. Final Report to the Conservation Farming Project, Beaufort West Study Site.
19. Todd, S. Final Report to the Conservation Farming Project, Nieuwoudville Study Site.
20. Turpie, J.K. An ecological-economic appraisal of conservation on commercial farm land in four areas of South Africa

Theses

1. Bragg C.J. 2003. Cape porcupine density, burrow distribution and space use in relation to land use in a geophyte-diverse semi-arid environment. MSc Thesis, UCT.

2. Kamineth, A. Forage availability for boergoats (*Capra aegagrus*) and bushbuck (*Tragelaphus scriptus*) in transformed and untransformed Thicket. – Hons. Project, UPE
3. Lechmere –Oertel, R.G. 2003. The effects of goat browsing on ecosystem patterns and processes in succulent thicket, South Africa. – PhD thesis, UPE.
4. Mills, A.J. 2003. Reciprocal relationships between vegetation structure and soil properties in selected biomes of South Africa. PhD thesis, University of Stellenbosch. December 2003.
5. Ngesi, H.N. 2003. The effect of sustained intense herbivory on the mortality and canopy characteristics of *Pappea capensis*. – Hons. Project UPE
6. O'Farrell, P. (In preparation) Ecosystem services and benefits to farmers in a semi-arid region of South Africa. PhD thesis, UCT.
7. Perrot, N. 2002. Effects of landuse on dispersal and establishment of *Brunsvigia bosmanae* (Amaryllidaceae). Diplome d'Ingenieur Horticole, Montpellier.
8. Ralph, M.S. 2003. Transformation and its effect on Thicket browse availability for kudu (*Tragelaphus strepsiceros*) and duiker (*Sulvicapra grimmia*). – Hons. Thesis, UPE
9. Sigwela, A.M. (submitted) Animal-seed interactions in the Thicket Biome: consequences of faunal replacement and land use on seed dynamics. – PhD thesis, UPE.
10. Van der Spuy, A. 2000. An assessment of the impact of land use on insect diversity on a Namaqualand farm and its conservation implications. MSc Thesis, UCT)

Popular publications

1. Bragg C. Porcupines: Are they a gnawing nuisance or valuable varmints. *Farmers Weekly*
2. Bragg, C. The prickly pig. Pest or plant promoter. *Africa Geographic* May 2004 pp 44 - 49.

Books

1. Essler K., Milton S., Dean R. (in preparation) *Karoo veld Ecology*. (with contributions from the Conservation Farming Project)
2. Donaldson, J.S., Turpie, J. & Oettle, N. (In preparation) *Conservation Farming: The Costs and Benefits of Conserving Biodiversity in Agricultural Landscapes in South Africa*

Conference proceedings.

1. Ankur, P. Social review of pastoral ecosystem services in Western India. Conservation Farming Session. Proceedings of the 6th International Rangelands Conference, Durban, South Africa.
2. Cole, A.C. Using an Influence Matrix as a participatory modelling tool for assessing ecosystem services in farming communities. Conservation Farming Session. Proceedings of the 6th International Rangelands Conference, Durban, South Africa.
3. Cork, S. The nature and value of ecosystem services in Australia. Conservation Farming Session. Proceedings of the 6th International Rangelands Conference, Durban, South Africa.
4. Coughenour, M. & Boone, R. Integrated modeling and assessment systems for balancing food security and wildlife in East Africa. Conservation Farming Session. Proceedings of the 6th International Rangelands Conference, Durban, South Africa.
5. Donaldson, J.S. Evaluating the overall benefit of rangelands for people and the environment. Conservation Farming Session. Proceedings of the 6th International Rangelands Conference, Durban, South Africa.
6. Mills, A., O'Connor, T., Skowno, A., Donaldson, J.S., Bösenberg, J.D., Lechmere Oertel, R. & Sigwela, A. 2003. Putting carbon into the land use equation: evaluating carbon sequestration and its implications for land use decisions in rangelands. Proceedings of the International Rangelands Conference, Durban South Africa
7. O'Farrell, P. & Collard, S. A comparison of ecosystem services in South African and Australian landscapes. Conservation Farming Session. Proceedings of the 6th International Rangelands Conference, Durban, South Africa.
8. Sigwela, A.M., Lechmere-Oertel, R.G., Kerley, G.I.H. & Cowling, R.M. Quantifying the costs of unsustainable domestic herbivory for biodiversity and ecosystem functioning in succulent thicket, Eastern Cape, South Africa. Conservation Farming Session. Proceedings of the 6th International Rangelands Conference, Durban, South Africa.
9. Turpie, J. Integrating environmental, social, and ecological data. Lessons from the conservation farming project in South Africa. Conservation Farming Session. Proceedings of the 6th International Rangelands Conference, Durban, South Africa.
10. Donaldson, J.S. A. Mills, P. O'Farrell, S. Todd, A. Skowno, J.D. Bösenberg, and I. Nänni. Promoting conservation farming in areas with globally significant biodiversity in South Africa: an evaluation of biodiversity benefits and ecosystem goods and services in a semi-arid agricultural landscape on the Bokkeveld Plateau. The Third World Network on Scientific Organizations, GEF Project on Conservation of Biodiversity and Sustainable Use of Resources in Arid Zones – invited paper, April 2002 in Muscat, Sultanate of Oman.