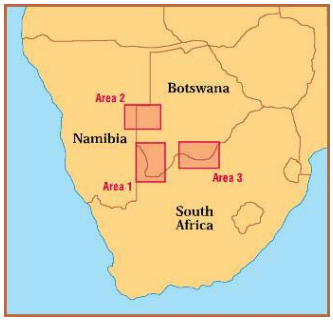
Soil Fertility & Sustain-ability *in the dry-subhumid southeast*

Key points

- Drought and poor soils impact on crop production in this marginal area
- Crop production in unsustainable without nutrient additions
- An integrated fertility system combining organic and inorganic elements is best
- System success depends on farmer's abilities to fertilise and good consistent extension advise



Research areas:

1 Arid southwest:
- a) Mier, South Africa
- b) SW Kgalagadi, Botswana

2. Semiarid northwest:
- a) Ghanzi Dist, Botswana
- b) Omaheke, Namibia

3. Dry sub-humid southeast:
- a) NW Province South Africa
- b) Barolongs, Botswana

No. 6

PANRUSA Briefing Notes

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Indigenous farming in NW Province South Africa and the Barolong District of SE Botswana is based on mixed arable (maize, sorghum, groundnuts) and livestock systems. The landscape of gentle slopes draining to the Molopo River and wind-deposited sandy soils has both low natural fertility and a tendency to become acidic, and is susceptible to run-off and wind erosion. The region is drought-prone, with droughts and low rainfall in the 1990s having an impact on water availability and agricultural sustainability. Land degradation issues were investigated using the methods in BN 1C, including both participant and scientific assessments. These were conducted on 15 farms at the field-scale, mirroring the principal unit of agricultural decision making in the region.

Land use, change and drought

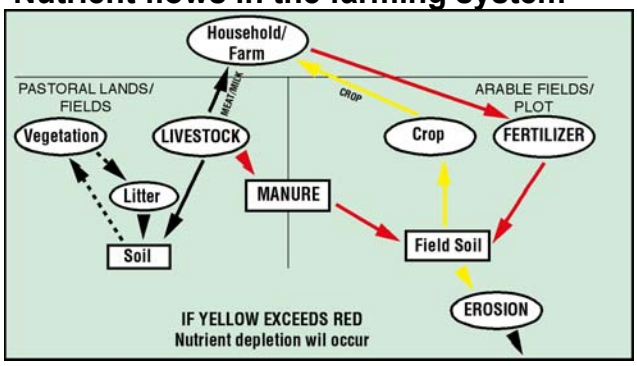
Both areas have experienced significant changes in the last two decades. The Barolongs were regarded as the 'granary of Botswana' up to the 1980s since when maize production has declined, many fields have not been ploughed, and farmers have faced competition from imports from South Africa. NW Province has seen land tenure changes before and after the end of apartheid that have resulted in changing patterns of settlement and land use. In both areas the majority of land users are semi-subsistence farmers that sell surplus crops in good years. In the Barolongs a farmer has 10 ha of allocated land and up to 30 ha if successful. In both areas farmers have been influenced by loan-schemes that have encouraged them to purchase seeds, inorganic fertiliser & machinery to increase production, but droughts and other factors have meant that they have often incurred debts that are difficult to repay. Some farmers operate at a larger scale, having bought up or leased land from smaller producers who have found the land insufficient for successful production, while in the Barolongs extension officers are encouraging co-operative actions & sustainable practices. In both areas many farmers attempt several activities (livestock, maize, horticulture, a small shop) and have remittances from other family members or drought relief work, to offset the risks or impacts of drought. However some extension officers consider the lack of specialisation as inhibiting farmers from being successful and skilled in a particular task.

Land degradation

Erosion Many farmers spoke of light and dark soils: the former sandy sediments having a susceptibility to wind erosion, and the latter more clayey soils retaining water better during wet periods but drying out quickly and therefore problematic in droughts. Many farmers in both South Africa and Botswana reported wind erosion to be a problem, particularly in the largest fields and especially at the beginning of the planting season when fields are bare and seedlings (notably maize) are susceptible to scouring and abrasion. Gully erosion was observed on dark soils but the extent was very limited except at Logageng where slopes leading to a neighbouring valley are steeper. Overall, the volume of sediment removed by wind and water is low, and its impact on soil quality restricted by low natural soil fertility levels.

Fertility Nutrient balance studies allow overall field fertility trends to be estimated. Low natural levels of potassium (K) nitrate (N) and phosphorous (P) mean that continuous cropping without additional nutrient inputs will lower soil fertility below already meagre natural levels. In 1998/9 negative nutrient balances were not calculated, but this was a drought year with poor or zero crop production and therefore little loss of nutrients. In years with normal production levels nutrient depletion would occur. Maize particularly depletes N and groundnuts deplete P & K. Poorer farmers noted declining maize yields over a number of years, and they cannot afford fertiliser inputs. Some add livestock manure but this is insufficient in quantity and quality to restore all nutrients. Some farmers/villages kraal livestock at night, which makes collecting and using manure more efficient. Other farmers add compound inorganic fertiliser prior to sowing crops. Excessive inputs, especially in years when crops subsequently fail due to drought, adds to soil acidity, which is a 'hidden' form of degradation prevalent in the area.

Nutrient flows in the farming system



Factors reducing/restoring soil fertility & causing/limiting land degradation

- **Drought** is the major risk faced by farmers. It reduces crop production, & leads to the use of money on fertiliser & seeds that ultimately fail.
- **Low soil fertility** means crop production is unsustainable without fertiliser additions.
- **Maize & groundnuts** have to be **rotated** in fields otherwise they rapidly deplete soil N and P respectively, further degrading the soil.
- **Manure** is a good soil addition but limited availability means it is insufficient to restore soil fertility.
- **Kraaling** makes manure easier to collect and more plentiful, but is decreasing in occurrence, often because of labour shortages as family members move to towns for waged labour.
- **Grazing livestock on crop residues** in the field after harvest returns nutrients rapidly to the soil. Recent droughts have reduced livestock numbers and manure availability.
- **Compound inorganic fertilisers** are costly but vital for fertility maintenance. Over-use makes soils even more acidic.
- **Liming** to reduce acidity is more effective than fertiliser additions in raising yields in acidified soils.
- **Household waste** (ash, manure, crop waste) is collected by a few small scale farmers and provides value fertiliser for key crops. More widespread adaptation by subsistence farmers would be beneficial.
- **Integrated fertility strategies** involving organic & inorganic strategies will be more cost efficient and less environmentally damaging and more sustainable.
- **Village-to-village differences** reflect the unevenness and sometimes conflicting nature of extension activities. Good extension advice is encouraging farmers in some areas to experiment with fertility and cropping strategies.

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