TOWARDS A SOIL PROTECTION STRATEGY FOR SOUTH AFRICA

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Soil degradation – physical, chemical and biological – is a world-wide problem and of particular concern to developing countries. In South Africa this has been recognised for many years and a number of programmes initiated to address it. Historic and current approaches, as well as the emphasis of the Department of Agriculture (DoA) on developing a Soil Protection Strategy (SPS), are discussed.

The overarching aim is to stop further degradation of soil and to ensure that soil can provide all its functions for human activities and ecological sustainability. The development would be based on best available knowledge and information, without delaying action due to incomplete information or knowledge. Consultation and communication of all information in a transparent manner is considered key.

The DoA tasked the ARC-ISCW with the SPS project and a number of task teams were initiated to establish current knowledge on soil degradation under the traditional sub-divisions of Soil Science. The coordinators of these task teams adopted a combination of their own experience, available literature including overview articles on the occasion of both the 25th and 50th anniversaries of the Soil Science Society of South Africa, and consultation with peers, researchers and analytical laboratories across the country. The degree to which these different avenues were employed differed between coordinators.

Through this process a number of comprehensive status papers have been generated, which will be made available in due course. These have been used for identification of issues of importance for focused attention, with the accompanying information relating to extent, severity, approaches and key stakeholders.

These issues will be discussed.

Keywords: Soil degradation, Soil Protection Strategy

CLIMATE CHANGE: IMPLICATIONS FOR CROP AND HORTICULTURAL SCIENCES IN SOUTHERN AFRICA

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Southern Africa is a region characterised by mostly semi-arid and seasonally dry sub-tropical climates with high intra-seasonal, inter-annual and inter-decadal variability of rainfall. This region has been identified globally as particularly vulnerable to human-induced climate change linked to the continuing increases in atmospheric greenhouse gases. Evidence of significant recent changes include rising temperatures, especially in the Western Cape and Kwazulu-Natal, decreasing chill units, and more intense rainfall. Over the next 25-35 years temperatures are predicted to increase by another 1-4 °C, with stronger warming towards the interior of the sub-continent. Changes in rainfall amount and distribution are likely to range from decreases in winter rainfall in the Western Cape, to increases in mid- to late-summer rainfall along the eastern summer rainfall region. Climate variability is predicted to increase, with more frequent, longer and more intense droughts and floods and other extreme events such as heat waves. These changes would lead to shifts in agro-climates and soil and water resources. Agricultural production would experience a primary impact with resulting socio-economic implications. Yield, yield variability and crop quality would be affected as a result of drought stress and increased crop water demand, increasing incidence of heat stress (e.g. disrupted reproductive processes and sunburn), changing pressures from pests, diseases and weeds, reduced soil fertility, and reduced chilling units for some crops. However, the fertilising effect of higher CO_2 concentration would ameliorate these effects to some extent. In southern Africa, the most vulnerable crops will be those dependent on rainfall, especially in the more arid western regions, and those which require significant chill units (e.g. apples) where these are already marginal. The most vulnerable farming communities will likely be subsistence and small-scale farmers with limited capacity, resources and skills. Many autonomous adaptation options in agriculture are extensions or intensifications of existing risk management or production enhancement activities. Agriculture has always had high levels of autonomous adaptation, but deliberate planned measures will become necessary (i) where crops are already at the threshold of their climate tolerance, (ii) where multiple stresses exist (e.g. soil degradation), (iii) where producers' capacity for autonomous adaptation is exceeded. Adaptation options would include breeding and selection for heat- and drought-resistance, changed crop choices, stepped up monitoring and control of pests and diseases, amelioration of the microclimate (e.g. shading), water conservation methods (e.g. more efficient drip irrigation), effective climate monitoring and early warning systems, and altered marketing strategies. In order to reduce negative impacts and capitalise on opportunities, agriculture requires good planning, increased awareness by all role players, good supportive research in key areas, support from industry bodies and support from government.

Keywords: adaptation, drought stress, global warming, heat stress, quality, yield

PANTA RHEI: CHANGES IN AGROMETEOROLOGICAL ADAPTATION STRATEGIES TO CLIMATE CHANGE

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"Panta rhei", everything flows, was Plato's interpretation of Herakleitos van Efeze's unique but dark thinking on eternal (ex)change. The four elements as they were distinguished at the time, earth, water, air and fire, are in constant interaction and constantly (ex)changing. Not a bad picture of what actually happens on our planet if (solar) radiation as well as some crucial activities of mankind may be seen as part of the fire element. Eternal climate change is one of the "logical" consequences. This has serious consequences for land use and crop production. Indeed, a very serious issue in all matters related to climate change these days is to increase understanding on and experience with adaptation strategies to climate changes and their related (increasing) climate variability and extreme meteorological/climatological events. Designs of agrometeorological protection measures against extreme weather and climate, and of changes in such protection measures, do need the strategic use of agroclimatic information. Understanding vulnerabilities to changes is a critical part of estimating future climate change impacts on land use and crop production. Changing vulnerabilities may have been as important as changing climatic conditions. Although mitigation of climate change itself is an essential issue, here we are talking about adaptation by designing and getting applied protection against climate impacts and mitigation of such impacts. It are most often the vulnerabilities that can be seriously reduced by designing and getting applied temporary or permanent measures of preparedness and impact reduction. It has been proven that actual disaster risk mainstreaming contains the other three coping/protection strategies: preparedness, mitigation and contingency responses. For agrometeorological applications as well as in general it has already been stated that the agricultural sector has two obligations. The first is to be better prepared to react to the (increasing) variabilities and extremes, and prepare and get applied new scenarios for possible lasting changes in land use and crop production. The character of this continuing need to adapt is determined initially by worsening limiting factors of agricultural production and the vulnerability of farming systems, to which some new windows of opportunity, to make use of more beneficial (micro)climate, may be added. The second obligation of the agricultural sector is to react to demands of reducing its contributions to possible global warming, which asks for changes in production methods. For the poorer sectors in developing countries this should be limited to win-win situation.

Keywords: Climate change, Adaptation strategies, Agrometeorology, Land use, Crop production, Herakleitos

UNIQUE PROBLEMS WITH UNIQUE SOLUTIONS TO WEED INVASIONS IN THE EASTERN CAPE

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The first serious weed invasions were recorded from the Eastern Cape Province back in the 19th century and included various cactus species, including *Opuntia ficus-indica* (prickly pear) , *Opuntia aurantiaca* (jointed cactus) and *O. monocantha*. The serious invasions of prickly pear, in particular, prompted the then Cape Government to fund the largest biological control programme ever launched in this country. Solving conflicts of interest and other unique approaches in integrated control were just two components that featured prominently in this project and that laid the foundation of biological weed control in this country. The control of jointed cactus and nassella tussock grass (*Nassella trichotoma*) were initially based on chemical control programmes that were heavily subsidized for many years by the Department of Agriculture, but innovative research done at Rhodes University and at the Uitenhage Weeds Laboratory (Plant Protection Research Institute) eventually provided better alternatives to chemical control. Two new invaders, namely *Sesbania punicea* (red sesbania) and *Solanum elaeagnifolium* (satansbos) followed and were seriously threatening agriculture in the Gamtoos River Valley and lucern cultivations along the Sundays River south of Graaff-Reinet. In the case of red sesbania, the weed was fully controlled biologically with three natural enemies introduced from Argentina. Two beetles from the U.S.A. were also released on satansbos which gave partial control, but in combination with modified cultural practices, almost full control was eventually achieved. The latest threats now come from new invasions by Australian acacias, hakea, chromolaena, pereskia and water hyacinth. Some new emerging cactus invaders are now also drawing increasing attention. It would appear as if the initiatives launched by the Working for Water programme will continue the series of successes in weed control in the Eastern Cape.

Keywords: prickly pear, jointed cactus, nasselle, sesbania, invasive alien plants, biological control