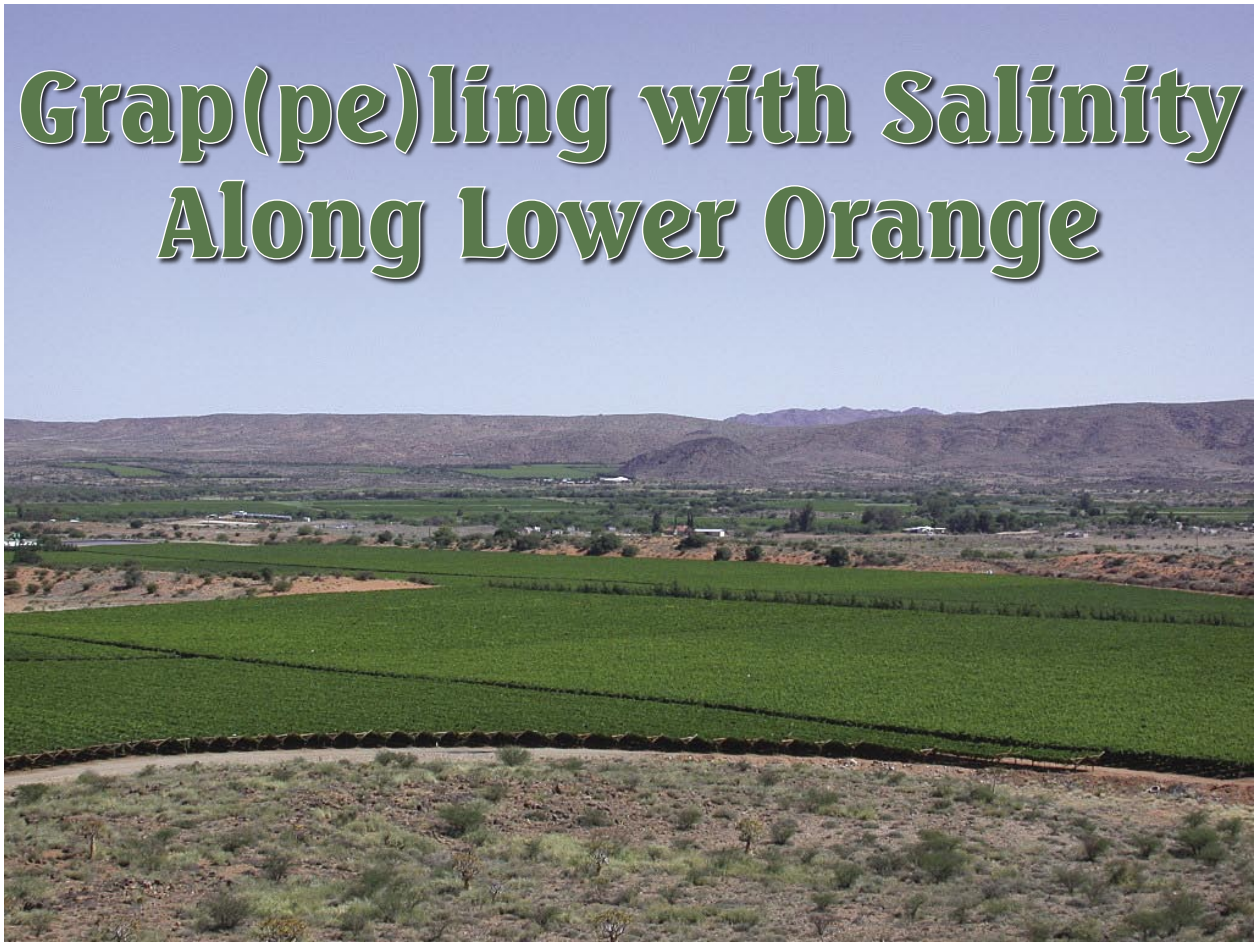
Grap(pe)ling with Salinity Along Lower Orange



Courtesy of ARC

In the Lower Orange River region increasing salinity of irrigation water is potentially threatening the livelihood of grape farmers in the area. The Water Research Commission (WRC) funded a study aimed at unearthing the root of the problem with the eye on possible solutions. Lani van Vuuren reports.

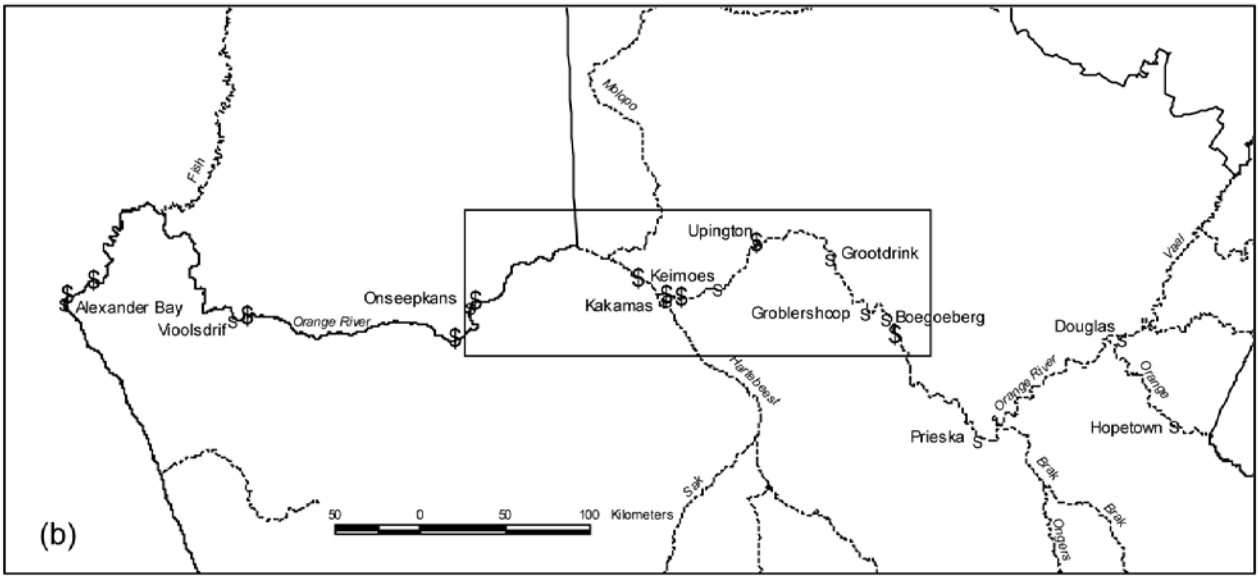
It is reported that high water tables and salinisation have been a problem in irrigated areas along the Orange River since 1948. Salt build-up beyond certain limits will certainly be costly to rectify and can irreversibly harm agriculture in the region. It is estimated that 4% of irrigated land in the Northern Cape is already severely affected by salinity or water logging.

The Lower Orange Water Management Area (WMA) is located in an arid region with limited rainfall that is characterised by high evaporation losses. The tributary inflows in the area are intermittent, and only contribute to the river flows during periods of unusually high precipitation in the Lower Orange River basin.

With the implementation of the Lesotho Highlands Water Project substantial volumes of low salinity water from the Orange River is being diverted to the Vaal River Catchment, leading to increased salt levels in the Gariep and Vanderkloof dams. At the same time, expansion of the table grape industry in the upper part of the Lower Orange River system could put additional pressure on the system by decreasing the available volume of water and increasing irrigation return flow to the river.

The WRC funded study, led by the Agricultural Research Council, focused on the river reach between Boegoeberg and Onseepkans. Irrigation is the dominant water user in this region, comprising 94% of the total water required. Nearly all irrigation developments are dependent on water from the river. More than 35 000 ha of land are being cultivated between Boegoeberg and Onseepkans, with grapes (60%) and cotton (20%) constituting the main crops.

An unyielding increase in salinity could seriously affect the economy of the area as it has been found that grapevines are more sensitive to



The location of the study area.

salinity under local conditions than found by international salinity guidelines.

WATER QUALITY

Investigations of the water quality of the Lower Orange River between Boegoeberg and Onseepkans indicated that the water is still of good quality, with limited potential for salinity and sodicity problems and almost no toxicity problems at all. Interestingly, the potential for problems increased from Onseepkans to Alexander Bay, with the highest potential at Alexander Bay where the water quality was influenced by tidal flows.

Of specific concern was the pH that remained above 8 for all the monitoring sites. It exceeded the upper limit for irrigation water use at Vioolsdrift from time to time. Water with pH in excess of 8,4 may cause foliar damage or decrease the visual quality of marketable products if it is wetted during irrigation, affect the availability of several micro- and macronutrients and increase problems with encrustation of pipes and clogging of drip irrigation systems.

Concerns regarding salt retention in the Boegoeberg to Onseepkans river reach appear to be valid, but should be seen in context, according to the researchers. The longitudinal annual average river salinity profiles and salt balance for the river reach between the two areas for high- and low-flow years, respectively, indicated that the river oscillates between a salinisation profile and equilibrium, or even a mobilisation profile. The salinity tends to be low if the flow is high and *vice versa*.

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It is hypothesised that salt retention occurs in the Boegoeberg to Onseepkans reach during periods following high flow in the river. The salt retention in the river reach occurs due to waterlogged conditions in low-lying soils, which make effective leaching of salt periodically unfeasible. The presence of high water tables promotes salinisation of these soils under conditions of high evaporative demand that are typical for the Lower Orange River region.

During years of low water flow, salts can be effluxed from the river reach as low water tables allow salts to be effectively leached from the salinised soils. Drainage irrigation originating from over-irrigation of foothill soils may aggravate the situation during high-flow years or prolong the period of water logging and the potential for salinisation. It also has the potential to mobilise salts which can have devastating effects on crops cultivated on low-lying alluvial soils, and to cause deterioration of the surface water quality through groundwater seepage.

Return flow from irrigated fields and leaking canals between Boegoeberg and Onseepkans is estimated to constitute between 15% and 20% of the irrigation requirement per year. It was, however, impossible to determine any effect of this return flow on the river water quality due to the lack of a reliable database. Nevertheless, indications are that return flows from irrigation cannot be the main source for the salinity in the Lower Orange River reach between Boegoeberg and Onseepkans.

SALT CONTRIBUTION FROM SOILS

Laboratory research on the salt leaching potential of the soils from

the foothills indicated that these soils are not particularly saline in their virgin state, although some local spots of exceptionally high salinity and sodicity were found. The sources of salts in these soils are both soluble salts as well as accelerated weathering of primary minerals such as feldspar and biotite. It is estimated that the earlier stages of vineyard development could release several times more salt than that which could be applied through irrigation water alone.

Contrary to belief, it was found that when virgin lands were converted to irrigated vineyards, a slight increase in salinity occurred. There was also evidence of local saline patches within vineyards. To counter the development of such salinity, sophisticated drainage should be a prerequisite for any new irrigation development on the foothills, while review of regular gypsum and fertilizer applications are strongly advocated.

Digital aerial photography was employed to map potentially salinised plots, i.e. plots which exhibited impaired vegetation growth. An estimated 14% of the randomly selected plots were found to be saline. Most of the salinised plots were either stony, sandy or water logged. In addition, most of these plots were found at the lowest elevation points in the floodplain, such as where old drainage channels had been filled and subsequently cultivated.

Specific management actions for national government, local authorities, local extension services and producers are recommended to curtail water quality deterioration and development of soil salinisation in the Lower Orange River region. Management options revolve around various aspects of improved water delivery, irrigation efficiency and reuse and disposal of drainage water.

The most important management actions proposed for the region include restricted gypsum application, improvement of irrigation efficiency (including irrigation scheduling), application of adequate leaching, revision of irrigation practices in severely salinised areas, lining of water delivery and storage structures, maintenance of drainage systems

Courtesy of ARC

An example of leaf burn due to salinity. Local vineyards are reported to be more sensitive to salinity than international standards dictate.

already installed, installation of drainage basin lands ('*hollande*') and well-judged installation of cut-off drains between the irrigated foothill soils and the basin lands to intercept drainage water.

According to the researchers, the absence of a drainage management strategy for the area as well as a lack of appropriate policy to enforce installation of drainage or to retire irrigated land where severe salinisation is apparent, undoubtedly hamper effective management of surface water and soil salinisation.

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Courtesy of ARC

An example of serious soil salinisation.

Courtesy of ARC

Soil salt leaching potential studies being undertaken in a vineyard.