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# How El Niño-related conditions could affect farm water

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The El Niño–Southern Oscillation, or ENSO, is a naturally occurring cycle in the tropical Pacific Ocean that influences weather patterns across the world. El Ni*ño and La Niña* are the warm and cool phases of this cycle, respectively, with ENSO fluctuating irregularly between El Niño, neutral, and La Niña conditions, roughly every two to seven years. ENSO is one of the major drivers of seasonal climate variability globally, but it does not act alone. Its interactions with other ocean–atmosphere systems and regional processes mean its influence varies across regions and from one event to another.

In South Africa, the influence of ENSO is most evident during the summer months from December to February, particularly across the summer rainfall regions. El Niño events are generally associated with drier and warmer conditions than the long-term average, whereas La Niña events are typically associated with wetter and cooler conditions. These are statistical tendencies rather than certainties, and individual events do not always follow this expected pattern. South Africa has experienced wetter-than-average conditions during some El Niño events, drier-than-average conditions during some La Niña events, and near-average rainfall during either phase.

For water resources, the influence of ENSO extends beyond variation in rainfall alone. Reduced rainfall can contribute to lower runoff and inflows to rivers and dams, while warmer conditions can increase evaporative demand, water losses and water temperatures. In contrast, increased rainfall can lead to the mass mobilisation of sediments and pollutants, localised flooding and crop damage. The combination of land use and cover, rainfall amount and intensity, and catchment dynamics influences how pollutants are transported and mixed within watercourses.

Current observations indicate a very strong El Niño event, with seasonal forecasts suggesting further strengthening, which is expected to influence South Africa's 2026/2027 summer rainfall season. Much discussion has arisen over this event and potential upcoming implications, with a focus on rainfall, dam levels and irrigation supply. However, water quantity is only half the challenge. Farmers and communities must also consider how water quality may be affected if river flows decline, groundwater levels drop, farm dams shrink, and hot, dry conditions persist.

## A strong ocean signal, but not a precise farm forecast

At the time of writing in early October 2026, very strong El Niño conditions are firmly established across the equatorial Pacific Ocean and continue to strengthen. Current forecasts indicate a high likelihood that El Niño conditions will persist through the remainder of 2026 and into 2027, potentially until around June 2027, with further strengthening possible during the austral spring and summer months.

The strength of an El Niño event does not,

however, directly determine the severity of its impacts in South Africa. Each event develops within a different combination of oceanic and atmospheric conditions that can strengthen or weaken its regional influence. A strong El Niño signal therefore does not necessarily translate into strong impacts at a particular location. For example, El Niño can increase the risk of drought, hot spells and heatwaves across South Africa's summer rainfall regions, but the severity and spatial extent of these impacts cannot be determined from the strength of El Niño alone.

The latest seasonal outlook indicates an increased likelihood of below-normal rainfall over most of South Africa's summer rainfall region during OND, NDJ and DJF. For OND, much of the region has at least a 40% chance of receiving below-normal rainfall. This dry signal strengthens into NDJ and DJF, when larger parts of the region have more than a 60% chance of below-normal rainfall. The temperature outlook shows an even stronger signal, with above-normal minimum and maximum temperatures forecast across most of South Africa throughout OND, NDJ and DJF. Together, these signals point towards an increased risk of drier- and warmer-than-normal conditions during the 2026/2027 summer season. The latest seasonal forecasts and updates on the developing El Niño can be accessed through seasonal forecasts provided by the South African Weather Service and the University of Pretoria's Seasonal Forecast Worx.

Seasonal forecasts cannot, however, determine exactly how much rain will fall, when it will occur, or what an individual farm or catchment will experience. Continued monitoring is therefore important as the season unfolds. The ARC's Agricultural Drought Early Warning System (ADEWS) provides information on current drought conditions and now includes information on drought observed at different timescales during previous El Niño events, helping users place the developing season within a historical context. The ARC's Weather Risk website complements this information with shorter-term weather forecasts, allowing farmers to monitor rainfall, temperature and other weather risks relevant to their location. Considering information across these different timescales - from ENSO and seasonal forecasts

**Figure 1: El Niño-influenced dry periods can modify water quality. Lower flows may concentrate pollutants and salts, while returning rainfall can rapidly mobilise accumulated contaminants in the first flush.**

to shorter-term weather forecasts and drought monitoring - provides a stronger basis for preparedness than relying on the El Niño signal alone.

**Water quality and ENSO**

The effects of ENSO-related conditions on water quality are complex, and research on the Crocodile River (East) in Mpumalanga shows this. Between 2016 and 2021, chemical oxygen demand, suspended solids and *E. coli* responded differently across El Niño, La Niña and neutral periods. Similarly, a study of Gauteng's Klip River found poorer overall water quality during the hot, dry 2015–2016 El Niño season compared to the wetter 2016–2017 season. However, the pollutants and areas of greatest concern changed between seasons. Together, these studies show that ENSO alters how existing pollution is diluted, retained and transported, while local land use, infrastructure, wastewater treatment and runoff determine the outcome (Figure 1).

During hot, dry periods, lower flows provide less dilution for sewage, industrial effluent and agricultural return flows. Evaporation may concentrate dissolved salts, while warmer water generally holds less oxygen and slower-moving water reduces mixing. Nutrient-rich water may encourage algal growth or cyanobacterial blooms, producing high oxygen during the day but sharp declines at night or when the algae decompose. Low dissolved oxygen within the water column may allow for ammonium to persist while also enabling bacteria to convert nitrate into nitrogen gas, removing it from the water. Near the bottom of a river or dam, oxygen depletion may release phosphate previously bound to iron compounds in the sediment, potentially sustaining algal or cyanobacterial blooms.

International studies reveal similarly varied responses. During the strong 2015/2016 El Niño, reduced rainfall in Malaysia's Kampar River coincided with unfavourable changes in dissolved oxygen, suspended solids, turbidity and ammonium. In Spain, a 44-year study of the Sau Reservoir linked declining inflows to an estimated 20% reduction in reservoir oxygen conditions. Agricultural studies also distinguish pollutant concentration from load. Research in Georgia (USA) found that ENSO was more clearly reflected in nitrate loads than concentrations because the quantity transported depended strongly on streamflow. A modelling-based study across the US Corn Belt found that different types of El Niño produce contrasting changes in nitrogen and phosphorus loads.

These international findings cannot be applied directly to the South African context, but they help us to identify changes worth taking note of, including flow, temperature, salts, oxygen, sediment, nutrients and microbial contamination. Because the outcome of impacts associated with El Niño events are dependent on local rainfall, land use, pollution sources and infrastructure, one parameter, or one sample, cannot tell the whole story. The ARC Water Science division has developed a water quality toolbox to help farmers, citizen scientists and water practitioners screen key indicators in the field, track changes in their water over time and identify when more detailed laboratory testing may be needed. More information on this toolbox and the results of testing are available on the Water Research Observatory citizen science website.

**What this could mean for the farming sector**

For the 2026/2027 summer season, the practical message is not that every farm will experience deteriorating water quality. Rather, water conditions may change quickly as rainfall, river flow and dam levels change. Two periods deserve particular attention. These are extended hot and dry spells, and the first substantial rainfall that produces runoff. During a severe drought associated with El Niño conditions, farmers may face a water quantity–quality paradox. Reduced rainfall and dam inflows can lower irrigation allocations and farm dam reliability, while higher temperatures increase crop water demand, soil moisture depletion, and evaporation losses. At the same time, declining river flows and greater evaporation may concentrate salts in irrigation water. This poorer-quality water can increase the leaching requirement needed to prevent salt accumulation in the root zone, precisely when less water is available. Crops may therefore experience water and salinity stress simultaneously, resulting in yield losses even where some irrigation water remains available (Figure 2).

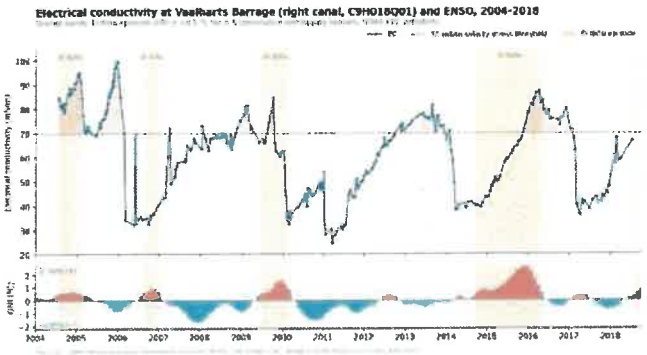


**Figure 2: Salinity (measured as electrical conductivity, EC) in the water at the Vaalharts Barrage right canal from 2004 to 2018.**

Readings above the dashed line exceed the 70 mS/m salinity stress threshold. Orange bands mark El Niño periods, and the lower panel shows the strength of El Niño (red) and La Niña (blue) over time. Salinity builds up gradually over a few years and then drops sharply, most likely when big summer flows flush the system. High salinity is not limited to El Niño or drought conditions, with elevated readings also occurring during neutral and La Niña periods. But when salinity does rise during a drought, it creates a double problem for irrigators. Saltier water means more water is needed to leach salts out of the root zone, and that extra water is needed just when it's scarcest. Data: Department of Water and Sanitation (site 90906) and NOAA Climate Prediction Centre.

Farmers who rely on watercourses and irrigation canals should not assume that low flow means cleaner water. Poorly treated wastewater and other continuous discharges may make up a larger share of the available flow during dry periods. When rain returns, it may increase water availability but also carry sediment, manure, fertiliser, pesticides, sewage and litter into rivers and dams. Elevated salinity and sodicity can affect sensitive crops and gradually damage soil structure, particularly where limited rainfall provides little flushing of the root zone.

Changes in farm dams and livestock watering points may be gradual and easy to miss. As water levels fall and less new water enters the dam, the remaining water can become warmer, while salts, nutrients and organic matter become more concentrated. These conditions can encourage algal or cyanobacterial blooms. Surface scums, unusual green or blue-green water, strong odours, animals avoiding the water or unexplained illness should trigger further investigation. Clear-looking water is not automatically safe, as salts, pathogens and some toxins are not always visible to the naked eye.

Groundwater generally responds more slowly than rivers and dams. Reduced recharge may only become apparent later through falling groundwater levels, declining borehole yields or longer pumping times. Increasing abstraction to compensate for declining surface-water supplies can worsen the problem and may draw more mineralised water towards the borehole.

**Practical steps for farmers**

Farmers cannot prevent drought (or drier conditions), but they can reduce its impacts by planning water use early, directing scarce supplies to where they deliver the greatest value, maintaining irrigation systems, conserving soil moisture and monitoring changes in both water quantity and quality. A useful approach is to establish a pre-season baseline for important water sources and repeat measurements during extended low flow and after the first major runoff-producing rainfall. Electrical conductivity provides a quick indication of changing salinity, while temperature, pH, turbidity, nutrients, and *E. coli* help identify other emerging concerns. The most effective response is not a single intervention, but a staged plan with clear thresholds for adjusting irrigation, crop area, water sources, or livestock numbers. The purpose is not to predict a farm's water quality from the El Niño label alone, but to detect changes before unsuitable water is repeatedly applied to crops, supplied to livestock or compensated for through excessive groundwater pumping. Under the drier and warmer conditions that can accompany El Niño, the concern is therefore not only whether farms will have enough water, but whether the water that remains will be safe, suitable and feasible to use. Water availability without suitable water quality is not water security.

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