

Making wetlands ‘watertight’

By Michelle Nel

Up till recently South Africans did not have a loophole-free definition of a wetland, never mind action plans to protect them. Thanks to the Mondi Wetlands Programme all that has changed.

Agriculture, forestry, and urban development have been among the main culprits in the destruction of South Africa’s wetlands. But one could almost not blame them. For one thing, there was no clear definition of what a wetland is, or guidelines for delineating its boundary. It was rather like something out of a Monty Python movie. The Department of Water Affairs and Forestry’s (DWAFF) ‘Afforestation Permit System’ (which came about in the early 70’s and was in force until recently when it was replaced with the improved stream flow reduction regulations) said *planting in wetlands is forbidden*. They even stipulated how far away from a wetland one had to plant. Only one problem – nobody, not even DWAFF itself, could tell you accurately where the wetland began! The same applied to the Department of Agriculture’s Conservation of Agricultural Resource Act, which forbade planting crops in wetlands it couldn’t accurately define or delineate. If you cannot accurately define what a wetland is and where its boundary is, how can you ever prevent planting in one?

Luckily the Mondi Wetlands Programme (MWP) realised the absurdity of the situation. After extensive lobbying, the Programme succeeded in changing the definition of a wetland in both the New Water Act in 1998, and amendments that were made to the Conservation of Agricultural Resource Act in 2000. Of all South African Law, it is these two Acts that provide wetlands with the greatest protection. Previously vague wetland descriptions full of loopholes were changed to become one strict, unambiguous regulatory definition common to both Acts. By working together with the forestry industry, the MWP also succeeded in getting them to delineate their wetlands properly, and institute a wetland-friendly buffer distances between the wetland edge and beginning of plantations. Now we need other farmers, especially the sugar industry, to follow the forestry example.

So what if you are a responsible landowner and want to do the best for your wetlands – how do you mark where they begin and end? Why not try our simple, accurate method wetland of delineation.

Three is the key

According to the South African Water Act a wetland is “land which is transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil”.

This definition allows us to conclude that there are three indicators, which allow us to decide whether a piece of land is a wetland, or not:

- ***A high water table***
- ***Hydromorphic soils***
- ***Hydrophytic plants*** living in these soils

When delineating a wetland, these same three indicators are used.

1. High water table: As the water table depth changes in response to summer and winter climate changes, the presence of water cannot always be used as a reliable field indicator. This is most noticeable in temporarily and seasonally waterlogged areas, which is what most of South Africa’s wetlands are. Luckily the soil morphology also indicates the water regime so in delineation we concentrate on hydromorphic soils and hydrophytic plants.

2. Hydromorphic soils: The water regime has a strong effect on the colour patterns of the soil. This means that we can indirectly determine what the water regime is for a particular area by interpreting these patterns. When a wetland is drained and the water regime is changed the soils retain their

characteristic colour signatures forever. Therefore, soils are useful for indicating if a drained area used to be a wetland. This helps in mapping where wetlands used to be and assists in working out the extent of wetland loss. Because the colour patterns develop slowly they reflect 'average' conditions over a long time. They save us the time and effort of measuring the water regime continuously. These colour patterns are read by looking at the soil colour, and the presence of mottles in the top 50 cm of the soil profile.

- Soil colour – Well drained soils (dryland) that are seldom saturated have enough oxygen present to oxidise the iron, resulting in a uniform red/brown/yellow colour. Under anaerobic conditions, when the soils are waterlogged, the iron oxides are reduced and broken down so wetland soils are generally grey in colour. See a Munsells soil colour book (looks just like a regular Dulux paint chart) and the forestry wetland delineation guideline (see below) to accurately define what "grey" is.
- Organic matter – Most micro-organisms which decompose organic matter use oxygen in the process. This means that organic matter is not as readily broken down in waterlogged soils. The wettest parts of the wetland, which are most anaerobic, tend to have the highest organic matter content. This results in darker soil (and more grey) as you move into the wetter sections of the wetland.
- Mottles – When anaerobic soil dries out, iron oxides form orange, yellow or red spots called mottles. So soil, which is grey, but has many mottles, will indicate a zone with a fluctuating (rising and falling) water table. In permanently wet soils, mottles will not form in the soil, as no oxygen is present. However in some instances for permanently waterlogged soil, mottles may form in tubes around plant roots, where oxygen has diffused out of the root and into the surrounding oxygen deficient soil.

3. Hydrophytic plants: Hydrophytic plants are plants that have specially adapted to surviving in waterlogged soils. They generally have a rooting depth of 50 cm, and therefore need to be in contact with the water table at this depth, or less. It is for this reason that you only sample the soil for signs of hydromorphy up to 50cm.

If a wetland has been drained, the soil colour pattern will show that it was a wetland. However, dryland plants will replace the hydrophytic plants. This often happens in wetlands that have been severely impacted upon by donga erosion or drains or when crops are planted.

Do all three indicators need to be present for delineation?

As the water table is often difficult to identify, especially for temporary and seasonal wetlands, it is not essential for this characteristic to be visibly confirmed. The soils will indirectly do this. **Therefore hydromorphic soils must always be present.** The hydrophytic plants should preferably be present, as it will allow the delineation to be more accurate.

An important point to remember is that in some wetlands, especially those where the iron content of the soil is low, **mottles may be scarce** throughout the three wetness zones. Nevertheless, the general trend is likely to be encountered of an increase and then a decrease in mottle abundance as one moves from outside the wetland, and through the temporary and seasonal zones into the permanent.

In wetlands, which are covered in very sandy soil or coarse sediment, the organic material and iron oxides are often leached out. This gives the soils a white bleached look. In this case you will not be able to use colour or the presence of mottles to delineate the wetland. **Instead use other indicators such as the presence of hydrophytic plants or hydrology.**

The different wetness zones in a wetland

Some parts of the wetland are saturated to different degrees than others. The permanently saturated zone is waterlogged for 12 months of the year. The seasonally saturated zone is waterlogged for 5 - 11 months of the year, and the temporarily saturated zone, for 1 - 4 months. Under high rainfall conditions, all three zones are likely to be represented in a wetland. While under drier conditions, the permanent zone may well be absent. Both the soil hydromorphy and the hydrophytic vegetation will change from one zone to another.

Delineation in the field

A wetland boundary is identified by finding the point of transition between the dryland soils and the wetland (hydromorphic) soils. This is done by sampling the soil along a transect through a wetland using a soil auger. The transition zone where hydromorphic soils begin to appear within the top 50cm of the soil profile is regarded as the **wetland boundary**. This can be confirmed by the change in plant communities from mesophytes (plants adapted to living in well drained soils) to hydrophytes (plants adapted to living in waterlogged soils) as the soils get wetter.

Begin by sampling the soil at the beginning of the transect, in an area that you know is definitely out of the wetland. Take a sample to a depth of 50cm, and note the characteristics of the soil. Look for any signs of hydromorphy such as grey soil colour and mottles. Move forward at intervals of 10 m towards the wetland, until you have discovered signs of hydromorphy. When you find it, note the degree of hydromorphy, and the vegetation that is growing there. The dominant vegetation should be hydrophytic species, unless the wetland has been drained or cleared for the growing of crops. Now retrace your steps moving out of the wetland, and at 1m intervals sample the soil until the presence of hydromorphy disappears out of the top 50cm of the soil profile. When this happens, you have reached the edge of the wetland. Walk around the wetland, following this boundary, confirming its presence by sampling the soil every 20m. When finished, map the boundary.

Note: for more detailed notes on wetland delineation and soil hydromorphy – see the wetland and riparian delineation guidelines which have now become policy within the Department of Water Affairs. The guidelines are the product of widespread collaboration between environmental managers, hydrologists, pedologists and wetland ecologists, drawn from non-government organisations, the private sector, universities and national and provincial government. Funding and support from Mondi Forests, Water Research Commission, Forestry South Africa and the catalytic actions of the Mondi Wetlands Programme made the development of the manual possible. The manual is available from Naomi Fourie at the Department of Water Affairs and Forestry, who can be emailed on qiy@dwaf.gov.za or from the Departments' website.