A common language for describing inland aquatic ecosystems in South Africa

A common language for the description of wetlands and other inland aquatic systems in South Africa, which can be used for a number of different applications, has been published in the form of a User Manual. This lays down guidelines for using a nationally applicable classification system that has been developed for wetlands and other inland aquatic ecosystems. Petro Kotzé spoke to Dean Ollis of the Freshwater Consulting Group, one of the many people involved in the development of the classification system, to find out more about the system in general and the User Manual.

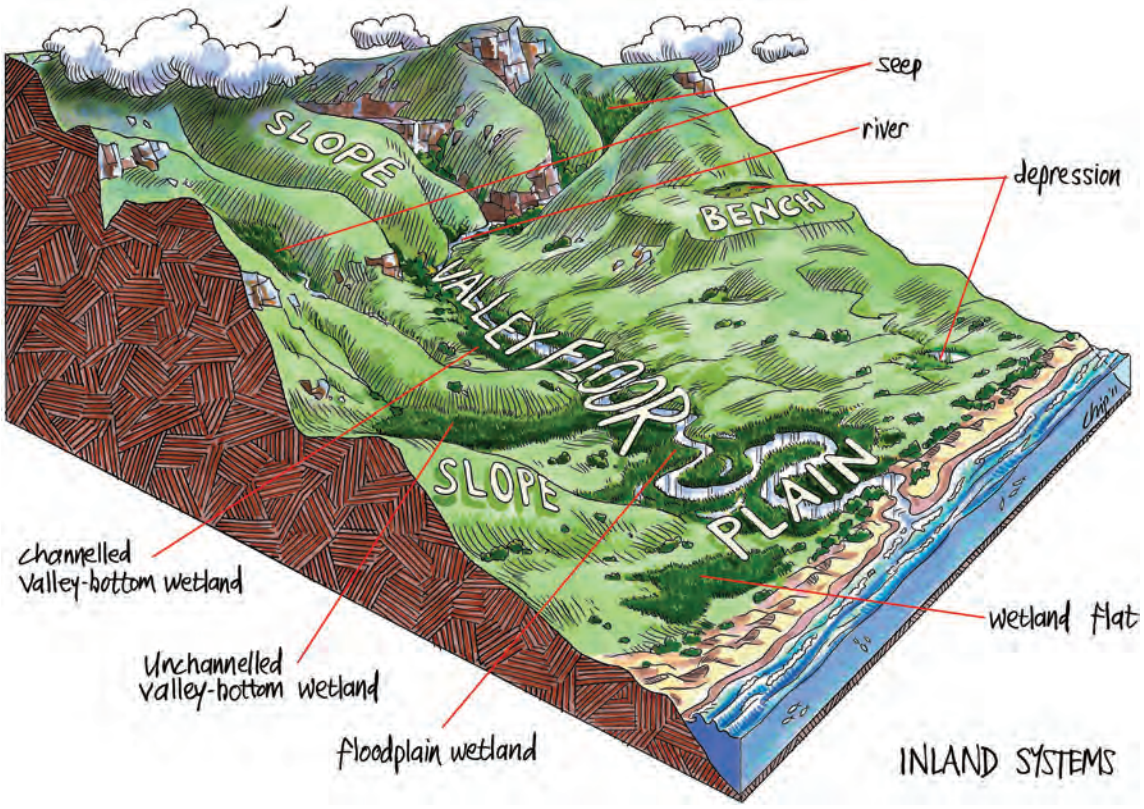
Fresh off the printing press (published this April), the challenge is now to spread the word far and wide so as to facilitate acceptance of the system across a wide spectrum of potential users. Yet, says Ollis, the classification system should be seen as "a living work in progress that will be continuously improved."

The project started in 2005 when the Water Research Commission (WRC) and the South African National Biodiversity Institute (SANBI) commissioned the development of a prototype National Wetland Classification System for the South African National Wetland Inventory. It culminated in the development of a preliminary classification system. In late 2007, a follow-up project was initiated by SANBI to further develop and refine the classification system, and an updated version was presented at the end of 2009. Towards the end of 2010, the compilation of the User Manual was commissioned. Compiled by the Freshwater Consulting Group, many people and organisations assisted with the development of the classification system.

WHICH ECOSYSTEMS DOES THE CLASSIFICATION SYSTEM COVER?

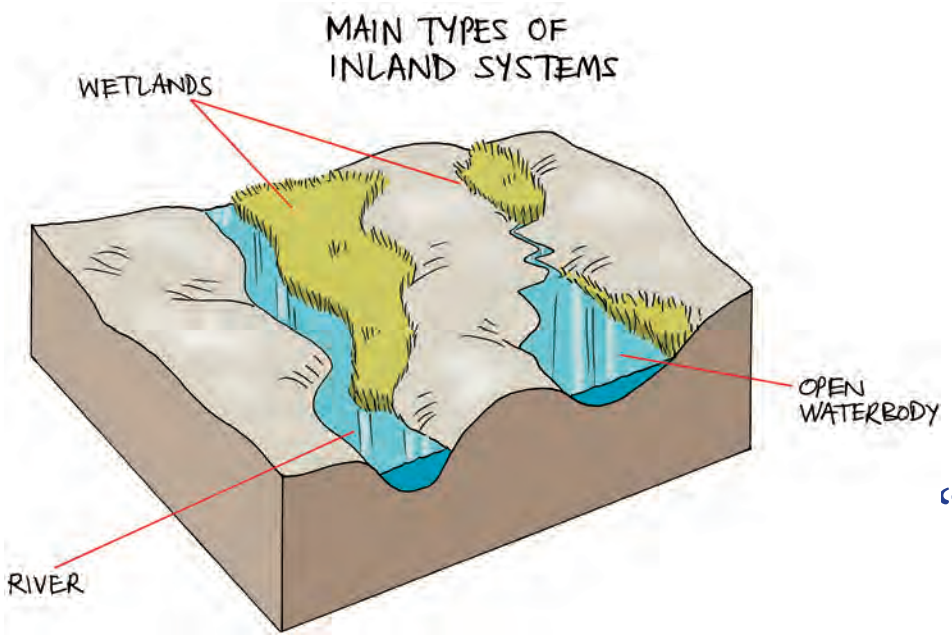
First called the 'National Wetland Classification System' the name was changed to its current form due to confusion around the definition of the term 'wetland', specifically due the different definitions according to the Ramsar Convention of 1971 and South Africa's National Water Act of 1998.

Originally, the classification system was developed around the Ramsar definition, which defines wetlands as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres." This thus encompasses rivers, lakes and other



An illustration of the seven primary hydrogeomorphic units and their typical landscape settings.

Bruce Paxton



***Above**: The three main types of inland systems – rivers, wetlands and open waterbodies.*

*Typical unchannelled valley-bottom wetlands. **T**he Maloti-Drakensberg area (**below left**) and the Kamiesberg Uplands of the Northern Cape (**below right**).*

open waterbodies, estuaries, shallow marine systems as well as wetlands as more commonly defined.

The National Water Act defines wetlands as "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 adapted to life in saturated soil." This definition includes only a subset of the ecosystems encapsulated in the Ramsar definition.

In the final version of the classification system, as presented in the User Manual, a 'wetland' has been defined according to the above-mentioned definition in the National Water Act. The scope of the classification system, however, covers all aquatic ecosystems characterised by the permanent or periodic presence of water other than marine waters deeper than approximately six metres (i.e. all ecosystems encompassed by the Ramsar definition of 'wetland').

Ollis says that the title has thus been changed to refer to both wetlands *and other aquatic ecosystems* to avoid confusion as to what is covered in the classification system, which includes rivers, wetlands and open waterbodies.

HOW DOES THE CLASSIFICATION SYSTEM WORK?

"We attempted to keep the classification system as simple as possible, without losing scientific rigour," says Ollis, "in order for it to be understood and utilised by a wide range of potential user-groups."

The classification system follows the hydrogeomorphic (HGM) approach to classification, which uses hydrological and geomorphological characteristics to distinguish primary units. In essence, the approach attempts to group aquatic ecosystems in a way that explains how they function. This is in contrast to the more traditional approach by which the primary units of aquatic ecosystems are distinguished on the basis of structural features (such as size, depth,


Donovan Kotze


Dean Ollis

vegetation cover and presence of surface water) – in other words, how they look.

"A shift towards the HGM approach is consistent with local and international trends, largely because geomorphology and hydrology are recognised as the fundamental features that determine the existence of wetlands and other aquatic ecosystems and how they function," says Ollis.

The classification system has six levels, with more detailed information required at each successive level.

At Level 1, a distinction is made between inland, marine and estuarine systems using the level of connectivity to the open ocean as a discriminator of the biophysical character of each. Work on the classification of marine and estuarine systems will be continued at a later stage.

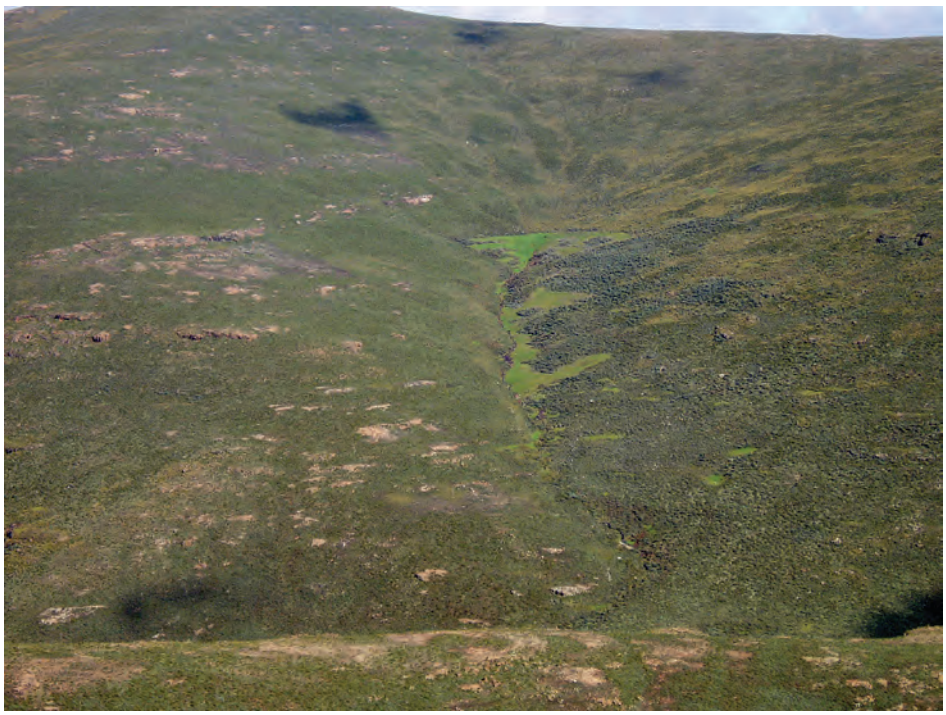
At Level 2, for inland systems, the regional setting is categorised. This reflects a combination of biophysical attributes within landscapes that operate at a broad, bio-regional scale, rather than specific attributes such as soils or vegetation. "First, in 2009, we used eco-regions as specified by the Department of Water Affairs, but these were found to be too restrictive." In the latest version of the classification system, provision is also made for the use of the National Freshwater Ecosystem Priority Areas (NFEPA) WetVeg groups or of any spatial framework that is of most relevance to a particular application.

Ollis says that the classification system thus incorporates some flexibility into how it can be used. "Level 2 is very broad and flexible mainly because research about what the best spatial framework is for a particular application or for specific broad aquatic ecosystem types must still be done. This is an important area for future research."

At Level 3 the landscape setting is categorised. A distinction is made between four landscape units on the basis of the broad-scale topographic position: slope, plain, valley floor or bench. "The assumption is that aquatic ecosystems function slightly differently in different landscape settings," says Ollis, "but again, this has not really been tested and is a good angle for future research."

The core of the classification is Level 4, says Ollis. Here, the HGM Units are defined primarily according to: **landform**, which defines the shape and localised setting of a wetland; **hydrological characteristics**, which describe the nature of water movement into, through and out of the wetland; and **hydrodynamics**, which describe the direction and strength of flow through the wetland. Together these

*A seep with channelled outflow (**below**) and a seep without channelled outflow (**bottom**), both situated in the Lesotho Highlands.*



Dean Ollis

Ross Holland

factors affect the geomorphological processes acting within the wetland such as erosion and deposition, as well as biogeochemical processes.

Although Level 5 of the classification system (the hydrological regime) is not applied in a strictly hierarchical manner, it is applied as the final step in distinguishing one functional unit from another. The criteria used to consistently distinguish between the hydrological regime categories are referred to as secondary discriminators.

"The hydrological regime tells you how long the water stays there for, and by this stage of the classification system we can really get a good idea of how an inland aquatic ecosystem is functioning. Criteria here include the inundation period and saturation levels of wetlands and, for rivers, whether they are perennial or non- perennial."

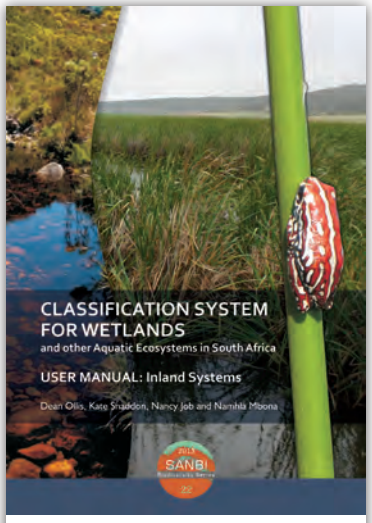
At Level 6, six 'descriptors' are included for the characterisation of inland aquatic ecosystems, on the basis of consistent criteria relating to biophysical features. They are geology (lithology); natural vs. artificial; vegetation cover; substratum type; salinity; and pH.

"This would generally require some kind of site visit and fieldwork," says Ollis, "and it provides a really detailed level of information about the physical characteristics of an aquatic ecosystem."

WHAT IS NEXT?

The classification system has already been used to some extent, says Ollis, for example in the National Freshwater Ecosystem Priority Areas project and the wetland component of the National Biodiversity Assessment 2011. The core of the classification system (HGM types) is also very similar, and partly based on the wetland classification system used in the Wetland Management series of publications that includes WET-Health and WET-EcoServices. "Because much of the terminology we used is already known, the classification system should be picked up quite easily."

As for development of the system itself, Ollis says that it has been designed to incorporate future knowledge. A 'massive' amount of research is still needed on how wetlands and other inland aquatic ecosystems function, if this really is dependent on the landscape setting or whether it is captured by the HGM types and so forth, says Ollis. As such, the classification system is seen as a good framework for future research topics. ❑



The User Manual for the application of the Classification System to inland aquatic ecosystems is available from SANBI and can be found at the Kirstenbosch and Pretoria Botanical Gardens bookshops, as publication #22 in SANBI's Biodiversity Series at R90 a copy. Email: bookshop@sanbi.org.za or Tel: (012) 843-5001.

South Africa's wetlands are havens for scores of fauna and flora.

How the classification system is applied: Classification of the Oudebos seepage wetland

The Oudebos seep is a relatively pristine wetland in the Kogelberg Nature Reserve near the seaside town of Kleinmond. As it is not located along the coast and does not have a direct connection to the open ocean, it can easily be classified as an Inland System at Level 1 with a high degree of confidence.

- **Level 2:** The selected spatial framework at Level 2 was DWA Level 1 Ecoregions. This was ascertained by using GIS to overlay the locations of the wetland (as points) on the GIS shapefiles for DWA Level 1 Ecoregions obtained from DWA's Resource Quality Services website (www.dwaf.gov.za/iwqs/gis_data/ecoregions/getecoregions.asp). The Oudebos seep is located in the Southern Folded Mountains Ecoregion.
- **Level 3:** The landscape setting of this wetland is clearly a 'slope' with a gradient much steeper than 0.01. This has been determined with a high degree of confidence from the contour lines on the relevant 1:50 000 scale topographical maps and visual observations made during site visits.
- **Level 4:** The Oudebos seep is a wetland located on a relatively steep slope that is characterised by diffuse, unidirectional, downslope (dominantly subsurface) water movement, at least periodically (as confirmed by a number of site visits to these wetlands in different seasons). It is, as such, an archetypical Mountain Fynbos hillslope seep and is thus classified as a seep at Level 4A with a very high degree of confidence. At Level 4B, the seep was classified as being 'without channelled outflow' in terms of its outflow drainage characteristics, due to the confirmed absence of an outlet channel.
- **Level 5:** The hydroperiod for Oudebos seep was classified as mostly 'seasonally inundated' with small portions of the wetland considered to be 'intermittently inundated'. In terms of saturation period within 500 mm of the ground surface level, the hydroperiod of Oudebos seep was further classified as mostly 'seasonally saturated' with small portions that are 'permanently saturated' or 'intermittently saturated'. The confidence level of the classification of the saturation and inundation period is high due to the availability of subsurface water level and soil moisture data, and observations of the wetness characteristics of the wetland that were made during a number of site visits at different times of the year.
- **Level 6:** The optional descriptors included are 'natural vs. artificial', salinity, pH, substratum type, vegetation cover type and geology/lithology. The Oudebos seep is classified as entirely natural, because it is clearly a naturally-occurring wetland that exists independently of any human influence. In terms of geology the Oudebos seep is classified as consisting entirely of the Peninsula Formation (Table Mountain Group). In addition, the seep is classified as entirely vegetated. In terms of substratum type, for the Oudebos seep, the substratum type was only categorised at the surface, due to lack of detailed observations of the soil profile at different depths. The upper substratum was classified as consisting mostly of sandy soil with small proportions of pebbles/gravel and boulders also present at the surface. This was based on field-observations and the use of a soil auger. The salinity was classified as entirely fresh and the degree of confidence high because the categorisation was based on the collection of conductivity measurements. The pH of the Oudebos seep was classified as entirely acid based on soil and water pH measurements collected from the wetland.