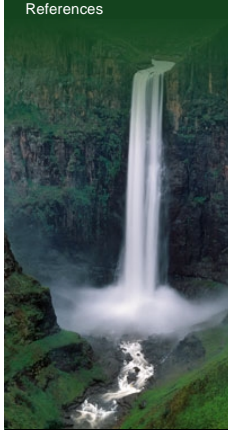


# Orange-Senqu River Awareness Kit

[THE RIVER  
BASIN](#)[PEOPLE AND  
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## The River Basin

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Ecology and Biodiversity: Biodiversity:

### Human Impacts on Biodiversity

Perhaps the earliest impact on the resources of the basin was the general elimination of most of the large mammals, first through hunting and later as a consequence of farming and fencing. Overgrazing by livestock has damaged rangelands and wetlands causing erosion and changes in species composition. Agriculture along river courses has introduced nutrients and pesticides into wetlands, increased salinity, and altered riparian species composition. Pollution and salinity have increased as a result of industry, mining and urbanisation. [Alien plants and animals](#) have also changed the ecosystems.

Aquatic invertebrates are good indicators of the status of an ecosystem and change as the ecosystem changes. In the Orange-Senqu River there is an abundance of filter-feeders, in particular the Blackfly *Simulium chutteri* and downstream of Vanderkloof dam a drop in the presence of a predaceous caddisfly. Outbreaks of blackfly are attributed to stable flow conditions, particularly high winter flow, deterioration in water quality, and encroachment of in-stream vegetation.

A number of aquatic invertebrates have also declined and possibly disappeared from the Orange River system, including mayflies, snails, a large Elmidae beetle, and a leech species which was known to be parasitic on hippopotami, the latter becoming extinct. By contrast, an invasive snail *Physa acuta* has spread dramatically.

Fish communities in the Upper and Lower Orange River are considered extensively modified, and their status is deteriorating, mainly because of deviation from the natural flow and deterioration in water quality. The poor ecological status and negative trends of the Orange River are a result of both in-stream and peripheral changes.

### The Types of Impact

The impacts of **human activities on biodiversity** can be broadly characterised as:

- Water quality
- Water quantity
- Alien Invasive Species
- Land use change

The main **human activities driving these impacts** are:

- Agriculture
- Mining
- Industry
- Infrastructure development
- Urbanisation

These two aspects of human influence are discussed below, along with the **preliminary assessment of ecological status** of the Limpopo River basin.

### Human Impacts on Biodiversity

#### Water quality

[Water quality](#) is known to play a prominent role in determining the distribution of aquatic organisms. Impacts on water quality, as described in detail in the water quality section, can eliminate aquatic and other species, influence their adaptation to the environment and their community structures. Water pollution also affects microbial and ecological processes such as metabolic rates and nutrient cycling processes.

#### Water Quantity

Reduction in streamflow for irrigation and water supply results in an overall reduction in the availability of water in the downstream ecosystems. As water is a fundamental building block of aquatic life, reduction in streamflow has a direct impact on the biodiversity resources, limiting growth in all organisms.

Furthermore, flow regulation of storage dams can have a negative effect on aquatic and riparian ecosystems. Seasonal fluctuations in water availability are often a fundamental part of the growth cycle of plants, particularly those adapted to living in the riparian zone of a river the size of the Orange-Senqu.

#### Alien invasive species

[Alien invasive species](#) often do not have natural enemies in the invaded region. They can however compete with indigenous species for space, nutrients and sunlight. Dense invasions of aquatic plants can alter the flow of rivers and streams, disrupting the aquatic ecosystem. Reduction of light penetration reaching the deep portions of the water systems, and changes in bank vegetation resulting in erosion, alter and affect the aquatic environment.

Invasion by alien species has important socio-economic consequences.

#### Box: Socio-economic Consequences of Increased Invasion of Alien Species.

- A reduced aesthetic "sense of place", affecting the tourism potential of the basin.

## Interactive

### Basin Map

Explore the sub-basins of the Orange-Senqu River

[enter](#)

### Video Tour

Tour video scenes along the Orange-Senqu River related to the River Basin

[enter](#)

### Geography Maps

Investigate land cover and terrestrial ecoregions in the basin

[enter](#)

### Water Cycle

Examine how the hydrologic cycle moves water through and around the earth

[enter](#)

### Food Web

Explore the interactions of living organisms in aquatic environments

[enter](#)

- A decrease in available water as a result of high water use by alien plants.
- Increased flood peaks as a result of degraded wetland and riparian systems.
- Increased cost of water as water quality and availability is harmed.
- Costs associated with eradication of invasive species.
- A decrease in production potential of land.

Source: UNDP-GEF 2008

## Human Activities Driving Biodiversity Loss

### Agriculture

Agriculture has a series of known impacts on biodiversity:

- Water quality from agricultural effluents (livestock and arable agriculture) can modify the nutrient cycle of aquatic and terrestrial ecosystems.
- Change of land cover, modifying hydrological and runoff regimes.
- Introduction of alien species into ecosystems that can out-compete indigenous species.
- Pesticides and insecticides can damage adjacent plant communities and the chemical composition of these substances can be toxic to biota.

### Mining

Mining has a series of known impacts on biodiversity:

- Water quality can be negatively impacted by heavy metals and acid mine drainage, causing significant damage to ecosystems; poisoning fish and mammals through bio-accumulation.
- Water quantity can be reduced caused by draw-down of groundwater or streamflow reduction for operational mining and use in processing facilities.
- Land change from mining activities causes profound disturbance to the landscape. Excavations for extraction, waste rock and tailings ponds all modify the shape and hydrology of the landscape.

### Industry

Industry has a series of known impacts on biodiversity:

- Water quality can be negatively impacted by industrial effluents, causing damage to ecosystems; poisoning fish and mammals through bio-accumulation.
- Some industrial activities use significant volumes of water, which can reduce streamflow.
- Land change from industrial activities causes disturbance to the landscape.

### Infrastructure development

Infrastructure developments have a series of known impacts on biodiversity:

- Reduction or modification of streamflow from storage dams limits or changes the availability of water for ecosystems.
- Water quality can be negatively impacted, particularly in terms of temperature
- Furthermore, water quality can be negatively impacted by transportation networks - spills and surface accumulation of fuels and automotive pollution (Ashton *et al.* 2001).

### Urbanisation

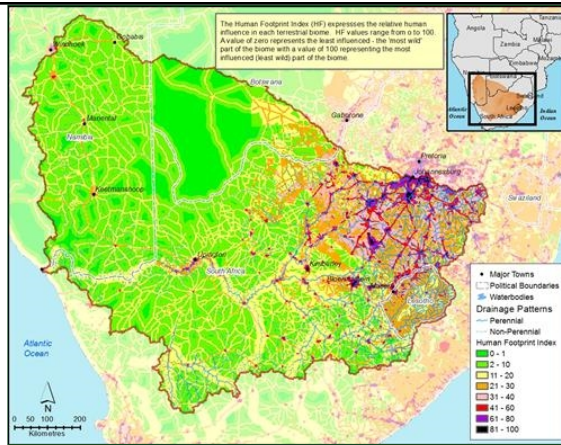
Urbanisation has a series of known impacts on biodiversity:

- Land cover change for urban developments, obviously means removal of elements of the landscape.
- Modification of hydrological regime can mean more or less water available for biodiversity due to the introduction of impervious surfaces
- Water quality degradation from sanitation and polluted run-off can impact biodiversity.

### Mapping the Human Footprint Index

One measure of the impact of human activities on the landscape is reflected in the Human Footprint Index, undertaken by SEDAC at Columbia University in the United States (Last of the Wild Data Version 2, 2005b), shown in the map below. This analysis shows the direct impact of human activities on the natural environment, clearly illustrating the wide scale transformation in parts of the Orange-Senqu River basin through urbanisation and agriculture.

The Human Footprint Index expresses the relative human influence in a region as a percentage. Its values range from zero to 100, with a value of zero representing the least influence, and a value of 100 representing the strongest influence.



**Human Footprint Index for the Limpopo River basin.**  
 Source: Last of the Wild Data Version 2, 2005b  
 ( click to enlarge )

**[Next: Laws and Policies to Protect Biodiversity in the Basin](#)** ►