ELSEVIER

Journal of Arid Environments 70 (2007) 767–781

Journal of Arid Environments

www.elsevier.com/locate/jaridenv

Restoring degraded landscapes in lowland Namaqualand: Lessons from the mining experience and from regional ecological dynamics

P.J. Carrick*, R. Krüger

Department of Botany, Institute for Plant Conservation, University of Cape Town, Private bag, Rondebosch 7701, South Africa

Received 28 September 2005; received in revised form 25 July 2006; accepted 16 August 2006
Available online 9 November 2006

Abstract

Three-quarters of a century ago diamond mining was added to livestock grazing and cereal cropping as a serious cause of landscape degradation in the north-western semi-arid region of South Africa, Namaqualand. Since that time the activities of diamond mine operators and prospectors have eclipsed all other land uses as a cause of degradation in this region. Discontinuous patches along virtually all of the 400 km of the Namaqualand coastline have been, or are currently, being mined or prospected. Prior to 1992 little was done to restore the landscapes and ecosystems to their pre-mining state, but since then legislation has placed a clear responsibility for restoration on mining operators. Implementation of ecological restoration was initially slow, but has recently gained momentum, in line with a growing awareness of environmental responsibilities amongst the global mining industry. In general, autogenic recovery of the perennial vegetation does not take place. The low annual rainfall and prevailing strong windy conditions present the greatest climatic challenges to the restoration of the flora. While the unique vegetation, and its features (e.g. poor representation of perennial species in the seedbank) present challenges to understanding the interventions that are critical in achieving ecological restoration. At the same time, climatic conditions such as the strong seasonality and low variability of rainfall, together with floristic features such as the high incidence of succulence, and the extraordinary drought tolerance of many seedlings, present opportunities for restoration. Perhaps the greatest challenges to restoration derive from the unsuitability of much of the mined overburden soils for plant growth. The nature and importance of climatic conditions, mined soils, topsoils, soil nutrients, landscaping, seedbanks, seeding, transplantation, and the

*Corresponding author. Tel.: +021 650 5789; fax: +021 650 4046.
E-mail addresses: carrick@botzoo.uct.ac.za (P.J. Carrick), Rkruger@botzoo.uct.ac.za (R. Krüger).

doi:10.1016/j.jaridenv.2006.08.006

interactions between these and other factors are evaluated in the context of this semi-arid environment and the prevailing mining practices.

Keywords: Soils; Wind erosion; Seedbanks; Patch dynamics; Succulent karoo; Semi-arid

1. A brief history of mining and restoration in Namaqualand

People have derived their livelihoods from the Namaqualand region for millennia. Approximately 2000 years ago, hunter-gathering started to give way to the widespread herding of sheep and goats (Webley, 2007). The impact of these activities on the ecosystems of Namaqualand is unknown, but the impacts are likely to have increased dramatically in the early 1800s when both the indigenous people of Namaqualand, and the newly arrived farmers of European descent, began clearing and ploughing patches of land in order to plant grain crops (Jowell and Folb, 2004). It is the unusual mineral wealth of Namaqualand, however, that led to the most intense human impact on its ecosystems.

High grade copper was discovered at Springbok in 1850, and the residents of Namaqualand, together with new immigrants, began mining in earnest in 1852 (Jowell and Folb, 2004). Copper deposits were later mined at a number of sites in the uplands of Namaqualand (Jowell and Folb, 2004). In 1925, as the era of copper mining was drawing to a close, diamonds were discovered in marine terraces at Oubeep, near Port Nolloth. A number of discoveries along the west coast, both north and south of Oubeep, followed in 1926 (Carstens, 2001). Since that time the landscape of the west coast of Namaqualand has been altered extensively in search of diamonds. Discontinuous patches along virtually all of the 400 km between the Olifants River in the south, and the Gariep (Orange) River in the north, have been, or are currently being mined or prospected. This represents about half of the 800 km of coastline along the west coast of South Africa (from Cape Point to the Gariep River). However, public access is restricted to most of this area. Similar degradation continues north of Namaqualand, along the west coast of Namibia as far as Luderitz, which has a slightly longer history of diamond mining (diamonds were first discovered there in 1907; Cornell, 1986). While terrestrial diamond mining (there are also marine diamond mining operations), has taken place almost exclusively within a few kilometres of the coast and the major rivers, gypsum and heavy mineral mining (primarily for titanium) have, more recently, extended the degradation of the Namaqualand lowlands further inland (de Villiers et al., 1998; Schmidt, 2002). In this paper we will focus on past and current degradation, and the potential restoration of the ecologically distinct Namaqualand lowlands, an area that stretches inland from the west coast 100 km or more to the base of the escarpment (Namaqualand uplands).

While there has been a relatively long history of degradation of Namaqualand's ecosystems, there has been a very short history of restoration of these ecosystems. Only since the Minerals Act 50 of 1991 came into effect has there been legislation that expressly requires the holders of mining and prospecting permits to restore the land surface to its natural state. Legislation has been further strengthened by the Mineral and Petroleum Resources Development Act 28 of 2002 which is more comprehensive and explicit than the previous act. Although the implementation of ecosystem restoration practices among