

The Osoyoos Desert Society: Experimental Studies on Ecological Restoration of the Shrub-Steppe Habitat

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ABSTRACT

The antelope-brush ecosystem of the South Okanagan, with its many rare or potentially rare, endangered, and vulnerable species, is one of the most endangered ecosystems in Canada. Over half of this shrub-steppe habitat has been totally destroyed, with more disappearing every year. Only 9% of the remaining antelope-brush ecosystem is in a relatively undisturbed state. Alien species, especially weed invasion, livestock grazing, and other disturbance, now impact the remnants of this desert community. Little has been set aside in protected areas, and those areas now protected are too small, too few, and too scattered for effective biodiversity conservation. If current initiatives are successful, an ecosystem renewal plan for the South Okanagan will soon be established with biodiversity conservation core areas, corridors, and buffer zones, in a sound and community-acceptable landscape network. This conservation plan, focused especially in the antelope-brush community will require future emphasis on ecological restoration, habitat renewal, and management. The methodologies for these in the antelope-brush habitat have not been established. The Osoyoos Desert Society, whose objective is the saving of this desert community, has initiated a scientific and experimental study of the techniques for ecological restoration in this shrub-steppe habitat. The plans, design, and progress in the establishment of the 300 experimental plots are described, and future objectives for a desert ecosystem interpretive program and centre on the study site near Osoyoos are discussed. This interpretive program will emphasize the significance, values, and threats to the South Okanagan, and will be a vital part of the community outreach and public awareness strategy for the ecosystem.

Key words: ecological restoration, experimental studies, Okanagan, Osoyoos Desert Society, shrub-steppe habitat.

The Osoyoos Desert Society is dedicated to saving the remnants of Canada's pocket desert—the hot, dry, and fragile ecosystem confined to the southern Okanagan Valley. The society has recently acquired land near Osoyoos, on which it has started scientific experiments on ecosystem restoration, and will soon launch a public education and nature interpretation program. In this paper I summarize the ecosystem context for these studies, and then outline the restoration research and the objectives for the planned interpretive centre.

ECOSYSTEM CONTEXT

The antelope-brush ecosystem in the South Okanagan is 1 of the 4 most endangered ecosystems in Canada (Scudder 1980, Durance 1992, Schluter et al. 1995). It is restricted to the lower dry areas of the valley and is part of the vital landscape corridor between the dry grasslands and shrub-

steppe habitats of the Columbia Basin, and similar habitats in the Thompson and Nicola valleys to the north and west (Scudder 1997).

Over the past century, more than 60% of this antelope-brush ecosystem has been destroyed, and converted to vineyards, orchards, croplands, or urban residential and industrial areas (Schluter et al. 1995). Much of the remainder has been disturbed and invaded by alien plants such as diffuse knapweed (*Centaurea diffusa*) and cheatgrass (*Bromus tectorum*; Cannings et al. 1999, Scott 1999). Less than 9% of the ecosystem now remains relatively undisturbed (Redpath 1990), in isolated patches on hillsides.

Less than 5,000 ha of the antelope-brush ecosystem was left in 1995 (Schluter et al. 1995), most of this in private ownership or on Indian Reserves. About 60% was in 1 area, namely the Osoyoos Indian Reserve. Over the next 5 years, Vincor International Inc. plans to convert approximately 810 ha (2,000 acres) of this shrub-steppe habitat into grape production, thus developing 1 of the largest vineyards in Canada (Hemmera Resource Consultants 1997). The first

phase started in 1998 and aimed to plant approximately 203 ha (500 acres), and there are plans for an equivalent area to be converted in 1999 (Hemmera Resource Consultants 1997). Additional areas involving more than 100 ha of antelope-brush in East Osoyoos and other areas of the east bench were also converted to vineyards by other wine producers in 1997. The ecosystem is thus disappearing at an ever-increasing rate.

Very little of the antelope-brush steppe is preserved within officially designated protected areas (Scudder 1993, Schluter et al. 1995). Two small ecological reserves north of Osoyoos (the Field's Lease at 4 ha, and the Haynes Lease at 101 ha) protect token tracts (Scudder 1993). The latter was almost entirely burned in 1993 (Schluter et al. 1995). Although there are some additional areas of antelope-brush protected to some degree in provincial Wildlife Habitat Reserves, the Vaseux Bighorn National Wildlife Area, and areas owned by The Nature Trust of British Columbia around Vaseux Lake, these in total are too small, too few, and too scattered for effective biodiversity conservation (Scudder 1993).

This shrub-steppe ecosystem is vital for survival of many rare species in British Columbia (Scudder 1980, 1992, 1993, 1997; Durance 1992; Cannings and Cannings 1995; Schluter et al. 1995; Cannings et al. 1999). The ecosystem provides critical habitat for 30% of the Red-listed and 46% of the Blue-listed vertebrates in the province, with several of these listed as nationally Threatened or Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC; Cannings et al. 1999). There are many rare vascular plants whose range in British Columbia is restricted to this area in the South Okanagan (Cannings et al. 1999). More than 24 invertebrates are known from only this small area of the world, with an additional 80 species occurring here and nowhere else in Canada (Scudder 1992, 1994, 1996; Cannings and Cannings 1995).

To save these species, their habitats must be conserved. However, with so little of the ecosystem now represented in protected areas, with so much pressure now to develop this "raw" or "useless" land, and with the anticipated future doubling of the human population in the valley by the year 2021 (Cannings et al. 1999), it is obvious that some major conservation initiatives are needed immediately.

The antelope-brush ecosystem lies within the area being considered by the Okanagan/Shuswap Land and Resource Management Plan. This planning process is currently in a draft phase, and it is to be hoped that the remnants of this endangered shrub-steppe will receive priority for conservation in some way. An ecosystem recovery plan is being developed (Cannings et al. 1999), and this will be a major component of the upcoming "Integrated Landscape Planning and Assessment" program for the South Okanagan (Olson + Olson Planning and Design Consultants 1998).

The essential plan for an integrated landscape conservation network, with core areas, buffer zones, and connectivity corridors, has been outlined (B. C. Ministry of Environment, Lands and Parks 1999). It is obvious that ecological restoration and habitat renewal will be a priority for such landscape planning. Until now, the required ecological research on habitat restoration in the antelope-brush community has not been undertaken. This research is now underway.

EXPERIMENTAL STUDIES ON ECOLOGICAL RESTORATION

The Osoyoos Desert Society, through its ad-hoc Scientific Committee, has received funding from the Habitat Conservation Trust Fund for research on "Ecological Restoration and Habitat Renewal of the South Okanagan Shrub-steppe." With additional financial support from Environment Canada, and Human Resources Development Canada, detailed comparative experiments are now underway at the Osoyoos Desert Society site near Osoyoos.

This 26.8-ha site, acquired by the Regional District of the Okanagan-Similkameen, through the cooperation of Crown Lands, the British Columbia Ministry of Forests, the Town of Osoyoos, the Osoyoos Indian Band, and rancher J. Pendergraft, is now leased to the Osoyoos Desert Society. It contains 2 provincially Red-listed shrub-steppe communities, namely the antelope-brush (*Purshia tridentata*) and the Great Basin sage (*Artemisia tridentata*) associations. When first assessed in 1996, the site was heavily grazed, and was considered to be in fair condition, but the trend was for continued deterioration because of a high percentage of non-indigenous weedy species, a low percentage of perennial native grasses and forbs, and a very low vascular plant recruitment rate (Atwood 1996). This assessment was made possible through the cooperation of J. Pendergraft, who also allowed the invertebrate diversity on the site to be determined while still subject to livestock grazing. This invertebrate study emphasized the ground-dwelling species, and was sampled by pit-fall trapping in 1996–97, with Forest Renewal British Columbia support.

The aims of the restoration research are: 1) to restore the community structure, function, and species composition of the antelope-brush ecosystem, and 2) to develop effective and economical restoration techniques for degraded natural areas of this ecosystem. The adjacent Field's Lease Ecological Reserve will serve as a benchmark reference.

In the research, experiments are being conducted in paired 100-m² experimental and control plots, with each treatment replicated 5 times. Some 30 experiments are planned. Thus, >300 plots were established in 1998, and characterized with respect to plant diversity, and vegetation and soil condition. Control plots and other areas not used for the experimental plots will be studied to assess the response

to removal of livestock grazing.

Planned experiments can be classified as either (a) passive methods for ecological restoration, or (b) active methods for ecological restoration. Passive methods to be investigated include: 1) effectiveness of mechanical (cutting, pulling, or burning) and chemical control of Dalmation toadflax (*Linaria genistifolia* var. *dalmatica*) and diffuse knapweed; 2) effectiveness of using various herbicide application rates and timing for control of annual brome or cheatgrass; and 3) effectiveness of solarization for weed control. The latter, which is achieved by covering experimental plots with clear plastic (kindly proved by K & P Silviculture, Oliver, B.C.), is expected to encourage germination, growth, and, subsequently, death from overheating. The mechanical control experiments (excluding burning) with Dalmation toadflax and diffuse knapweed, as well as the solarization experiments, were started in 1998.

Experiments using active methods of restoration will be complex, and will attempt to (a) determine the most effective plant materials and methods of planting, and (b) determine the most beneficial soil manipulations and modifications for plant establishment. Most of these experiments will not start until the year 2000, because they depend on the use of native seed that is being collected from surrounding areas during the first 2 years of the research. However, some hay-seeding experiments were started in 1998, and additional experiments involving manipulations of the native microbiotic crust and the soil mycorrhizal fungi are planned for 1999.

Weed control in areas surrounding the experimental plots has started, alien shrubs and trees (mostly Siberian elm [*Ulmus pumila*]) have been removed, and pruning has been done to open shrub and riparian canopies. Considerable effort is being made to reduce all other impacts on the site, a major concern in such a small area under intensive investigation for a long period of time. In 1998, >3,000 kg of weeds was removed, along with many alien metal and glass objects.

Ecological restoration is a long-term project, with few starting results to be expected in the near term. The alien weed-seed bank in the soil is likely to persist for >15 years, and this is the time frame for realistic assessment of this research.

The experimental studies, under the direction of L. Atwood of Genoa Environmental Consulting, will continue over the initial 5-year experimental plan, provided outside funding is continued. At the same time, I will continue monitoring the response of the ground-dwelling invertebrate community to the various changes and manipulations. This research is currently funded by grants from the Natural Sciences and Engineering Research Council of Canada.

PUBLIC EDUCATION AND INTERPRETIVE PROGRAM

The Osoyoos Desert Society is planning for a desert ecosystem interpretive program and centre on the study site. A 3-km walkway around the site has been established, and a wooden boardwalk will be constructed in 1999. Once this is completed, by early summer, a public interpretation program will be launched.

Initially, this will concentrate on educating local citizens and visitors about the ecosystems of the South Okanagan, especially the antelope-brush ecosystem and its essential components, characteristics, and threats. The ongoing habitat restoration research will be explained and related to the long-term plans for ecosystem renewal and a comprehensive landscape conservation network. The basic concepts of conservation biology will be explained, with reference to the rationale behind the establishment of core conservation areas, buffer zones, and corridors. Particular emphasis will be placed on the importance of stewardship and public involvement.

The Society hopes to construct the first module of the interpretive centre by the year 2000. It plans for this to be a major centre for school education programs, and a popular attraction in the area, where the public can obtain details of the values and threats to the fragile ecosystems of the South Okanagan. Particular emphasis will be put on local public involvement, because, in the long run, this is seen as the most important component for saving the many species at risk in these endangered ecosystems.

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