

A Study of Concurrent Reclamation Practices at the Point Aconi Surface Mine (NTS 11K/08)

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Introduction

The Nova Scotia Department of Natural Resources (DNR) has undertaken a review to optimize community benefits resulting from reclamation activity at surface coal mines in Cape Breton County. The Surface Coal Mine Reclamation Enhancement Initiative was announced in April 2006 by the Minister of Natural Resources in response to community concerns related to the proposed development of surface coal mines. The committee overseeing the initiative has conducted research to increase potential community benefits from reclaiming lands following surface coal mining.

The committee was given a broad mandate, which included the following tasks:

- develop a qualified oversight committee representing academia, government, industry and the public;
- review former mine site surface conditions and develop protocols to evaluate existing conditions;
- conduct a literature review of leading practices;
- conduct ecological studies;
- develop test vegetation plots and monitor them; and
- make recommendations for existing sites and for future reclamation standards.

The committee initially met in October 2006 in Sydney with 21 persons participating. The committee was made up of representatives from:

- Cape Breton University, Acadia University, Dalhousie University and Nova Scotia Agriculture College;
- provincial departments of Natural Resources, Environment and Agriculture;
- industry, including mine operators,

- engineering/environmental consultants, Nova Scotia Federation of Agriculture; and
- local residents (volunteers).

A vegetation enhancement sub-committee was formed and several meetings were held to develop work plans. The committee reconvened in December 2008 to review the results of committee work conducted since 2006. A comprehensive set of observations, conclusions and recommendations were issued by the committee following the December 2008 meeting.

Results of Vegetation Surveys

The results of vegetation surveys at several former surface coal mines in Nova Scotia have shown that for the majority of former mine sites reclamation practices were effective in controlling erosion and developing a self-sustaining vegetative cover, mostly consisting of grasses. On some sites, however, the effect of planting grasses has delayed the succession to more typical Acadian forest ecology. The committee concluded that given sufficient time, typical Acadian forest ecology will become dominant at all sites. This conclusion was based on field observations at sites mined over 30 years ago, which have become fully re-integrated into the surrounding land surface. Detailed vegetation surveys were conducted at a number of former mine sites, as shown in Table 1.

The committee noted that a number of recently reclaimed mine sites lacked an abundance of organic matter and it was recommended that use of on-site organic matter be studied for future mine reclamation. The survey results have been tabulated and categorized using standard biological survey

Table 1. Sites of detailed vegetation surveys, Cape Breton County.

Site	Time Since Reclamation	Current Conditions
Little Pond	3 to 8 years	wetlands, grasslands, shrubs
Toronto Road	8 to 15 years	wetlands, grasslands, shrubs
Gardener Mine	15 to 20 years	wetlands, grasslands, shrubs
Point Aconi (Novaco Mine)	30 years	wetlands, grasslands, shrubs, forest
Alder Point (Devco Mine)	30 years	shrubs, forest

reporting protocols, including estimates of ground cover.

Results of Literature Research

The committee found that other jurisdictions in North America have also recently gone through a similar evaluation of surface coal mine reclamation methods and the resulting vegetation and ecology. The Appalachian Regional Reforestation Initiative (ARRI) is a coalition of groups, including citizens, the coal industry and government, dedicated to restoring forests on coal-mined lands in the eastern United States. The initiative was established in early 2004 and includes the states of Kentucky, Maryland, Ohio, Pennsylvania, Tennessee, Virginia and West Virginia, the Office of Surface Mining Reclamation and Enforcement, their partners in industry, environmental organizations, academia, local, state and federal government agencies, and private landowners.

The results of studies in other jurisdictions, especially those in the Appalachian coalfields, indicate that the common objective of developing a stable, non-eroding grassland cover often delays the subsequent succession of trees and other common plant species. While a grassland reclamation may be appropriate for some lands destined for agricultural use, if the ultimate goal is to re-integrate previously forested lands back to a similar pre-mining condition, alternative approaches need to be utilized. The ARRI observations (Burger *et al.*, 2009), discussions and recommendations regarding the effectiveness of past reclamation practices are generally consistent with those of the Nova Scotia committee.

The committee in Nova Scotia also came to the same general recommendation as the Appalachian researchers regarding the preferred post-reclamation land-use objectives for mined lands. In the absence of a designated alternate land use, reclamation practices should encourage the re-establishment of pre-disturbance ecology to provide the maximum opportunity for future land uses, such as wildlife habitat, human recreation and potential commercial harvesting of forest products.

Recent guidance documents have been prepared by the Appalachian Regional Reforestation Initiative to assist mine operators with the so-called “Forestry Reclamation Approach” (Burger *et al.*, 2009). Reclamation protocols required for a forestry reclamation approach are generally less costly to implement when compared to traditional grassland reclamation techniques and, therefore, implementation provides potential immediate economic benefits to mine operators during mining.

Vegetation Test Plots (2007 and 2008)

In 2007 and 2008, the committee established a number of vegetation test plots at Little Pond and Toronto Road (Table 1) to apply soil amendments and monitor the results. The majority of the treatments used traditional amendments such as chemical fertilizers, limestone and grass seeds. Other treatments included the use of a ‘green manure’ process by planting buckwheat covers. Early in the committee discussion, the use of forest-floor grubbing materials as a potentially valuable, and often under-used, growth amendment was proposed and a test plot was created by importing and spreading forest-floor materials

excavated from a local land-clearing operation.

Overall, as can be seen in Figure 1, the results of all vegetation amendments showed a visually discernable response by increasing the overall density and health of the plants contained in the test plots compared to control test plots with no amendments. Test plots were subjected to an initial baseline vegetation survey and there are currently plans for these areas to be resurveyed to quantify the perceived benefits. A test plot containing forest-floor grubbing materials showed that diverse Acadian forest plant ecology could be established in a short period of time by transplanting the forest materials. Research identified from other jurisdictions has resulted in similar results and conclusions (Burger *et al.*, 2009).

In December 2008, the DNR committee recommended that further research be conducted, if possible, with the cooperation of an active mine operator to allow for larger scale testing of forest-floor transplanting trials. The committee was informed that Pioneer Coal Limited had begun using forest transplanting techniques at the Point Aconi surface coal mine and the committee

approached Pioneer Coal regarding participating in a collaborative study on the concurrent mine reclamation practices at Point Aconi.

2009 Reclamation Program at Point Aconi

Pioneer Coal Limited has operated several surface coal mines in Nova Scotia during the past three decades. The most recent mine, the Point Aconi Reclamation Mining Project, began in 2006. Near-surface coal resources at Point Aconi are being recovered following the 2001 closure of the underground Prince Mine. A representative from Pioneer Coal Limited participated in the Surface Coal Mine Reclamation Enhancement Initiative and some of the ideas and methods developed through the initiative are now being applied at the Pioneer Coal project at Point Aconi, Cape Breton County.

In 2009, Pioneer Coal allowed access to the mine site to document the reclamation practices employed and to conduct vegetation surveys of pre-



Figure 1. Location of vegetation test plots at Little Pond, Cape Breton County.

existing conditions and post-reclamation conditions. The results gained from this research will be shared with the committee.

Reclamation Approaches Applied at Point Aconi

The mine operator has used three main approaches to utilize existing on-site vegetation during final reclamation at the mine site. Forest-floor grubbing and transplanting, shrub-clump transplanting and shrub-clump plantation methods were all applied during 2009 and are discussed below.

Preparations for removing and transplanting the existing vegetation consisted of clearing existing trees from the forest by using a tree shredder/chipper. All larger trees were felled and chipped in place to conserve the organic matter available for reclamation (Fig. 2).

Forest-Floor Grubbing

Following tree clearing, the forest floor (organic layer) was grubbed off with an excavator and loaded into dump trucks. Loaded dump trucks travelled to areas previously prepared for reclamation and discharged their loads. The materials were then spread with another excavator and a ground-cover depth of over 30 cm was generally achieved. The excavator operator attempted to place stumps in an upright position while covering the previously graded surfaces to encourage new tree growth. The work was conducted in winter months when plants were dormant (Fig. 3). This approach was similar to the test plot conducted at Little Pond in 2007 and 2008 but at a much larger scale.

Shrub-Clump Transplanting

The second method used at the site was to remove large ‘shrub-clumps’ and transport them to a



Figure 2. Coal mining and land reclamation operations at the Point Aconi surface coal mine, operated by Pioneer Coal Limited.



Figure 3. Location of forest-floor grubbing and shrub-clump transplants at the Point Aconi surface coal mine.

reclamation area immediately following excavation. This process was accomplished using a loader equipped with a large pan-shaped bucket approximately 3 m by 4.25 m, as can be seen in Figure 4. Shrub clumps were transported using the loader and placed on the surface in a relatively intact condition without disturbing roots and surface soil structure. The clumps were placed tightly together to essentially cover all the ground, as can be seen in Figure 5. This work was conducted during the spring and summer of 2009.

Shrub-Clump Plantation

The third method used at the site was a variation of the shrub-clump transplanting technique. The primary change was that the shrub-clumps were not placed tightly together, instead the clumps were placed in a plantation pattern with areas remaining bare between the clumps. The plantation approach allows larger reclamation areas to be treated with 'islands' of native vegetation, with the expectation that the vegetation will spread from the transplanted vegetation clumps, as can be seen in Figure 6. This work was conducted during the summer and fall of 2009.

Initial Observations of Point Aconi Reclamation Practices

The transplanted forest-floor grubbing material and shrub clumps appear to be growing well after a few months of observation. The plants emerging from the transplanted materials are consistent with the native ecology found on the mine site, as can be seen in Figures 7 and 8.

Future Monitoring and Reporting Plans

Future field observations and vegetation surveys at the Point Aconi surface mine may provide some insights as to which reclamation methods are most effective in encouraging the establishment of typical Acadian forest ecology in the shortest time possible. The committee currently is developing future work plans to build on the research and accomplishments to date.



Figure 4. Loader transplanting a 'shrub clump' on a pan-shaped bucket.



Figure 5. Transplanted shrub clumps for use in site reclamation.



Figure 6. Location of shrub-clump plantation transplants.



Figure 7. Cape Breton University biology students collecting information in a vegetation survey plot on transplanted forest-floor grubbing transplant materials.



Figure 8. Plants growing in forest-floor grubbing transplant materials.

Reference

Burger, J., Davis, V., Franklin, J., Zipper, C., Skousen, J., Barton, C. and Angel, P. 2009: Tree-

compatible ground covers for reforestation and erosion control; The Appalachian Regional Reforestation Initiative, Forestry Advisory No. 6, 6 p.