Oil and Gas Operational Trial
Establishment Report to March 1, 2003

Summary of progress towards overall project objectives and deliverables:

1. Identify a representative sample of abandoned well sites in Northeastern British Columbia suitable for the study of reclamation techniques.
   Deliverable: Inventory of sample well sites showing end-land use objective potential.
   1st year progress: data collected for inventory, results included in this report

2. Evaluate site conditions including soil compaction, soil type, soil nutrients and/or contaminants, moisture regime, Biogeoclimatic zone, slope, etc. to determine suitable end-land use objectives and prescribe test treatments that will lead to enhanced knowledge of well site rehabilitation.
   Deliverable: Ten reclamation test site summaries and twenty reclamation prescriptions signed by a Registered Professional Forester.
   1st year progress: Six test site summaries and site assessments have been submitted. Twenty site assessments were submitted, but the final reclamation prescriptions and sing-off by a Registered Professional Forester will be submitted after trial site monitoring period to ensure the optimum treatments are prescribed for each site.

3. Develop and refine a reclamation prescription template and interim pre-site assessment template to improve efficiency and effectiveness of future reclamation efforts.
   Deliverable: Reclamation prescription template.
   1st year progress: Refined reclamation prescription template, based on steering committees' comments is included as attachment to report.

4. Complete the required reclamation treatments on test sites. The test sites will follow the design of an operational trial to maximize information obtained. The availability of other funding will dictate rehabilitation work on remaining sites with RP's.
   Deliverable: Reclamation and treatment details.
   1st year progress: Four sites were treated, which is fewer than the 6 sites we had intended to complete in the first year. Progress was slightly slower because of timing and weather conditions. Treatments on the remaining 6 sites will be completed in 2004.

5. Monitor treatment success and soil conditions through follow-up site visits.
   Deliverable: Monitoring of treatments and annual reports detailing the findings
   1st year progress: Monitoring of treatments will commence next spring/summer.

Inventory & Treatment Site Selection

Introduction:

There are more than 20,000 wellsites in British Columbia's well index. Approximately 4000 of these sites (ca. 20 percent) have received a Certificate of Restoration (COR). Older well sites are more likely to have a COR (Figure 1), but the majority of wells drilled prior to 1970 are still awaiting COR status, mostly because of many of these wells are still active. For this project, we focussed on well sites within the Dawson Creek (93P) and Fort St John (94A) mapsheets (Figure.2), where 1873 well sites had received

COR, out of a total of 9279 well sites (20.2 %). To identify candidate COR wellsites for site assessments and reclamation treatments, a screening process was used that evaluated biogeoclimatic zone, land status, years since oil and gas drilling, and expected forest productivity.

Figure 1. Distribution of COR'd wellsites by rig release age class for all wells in BC

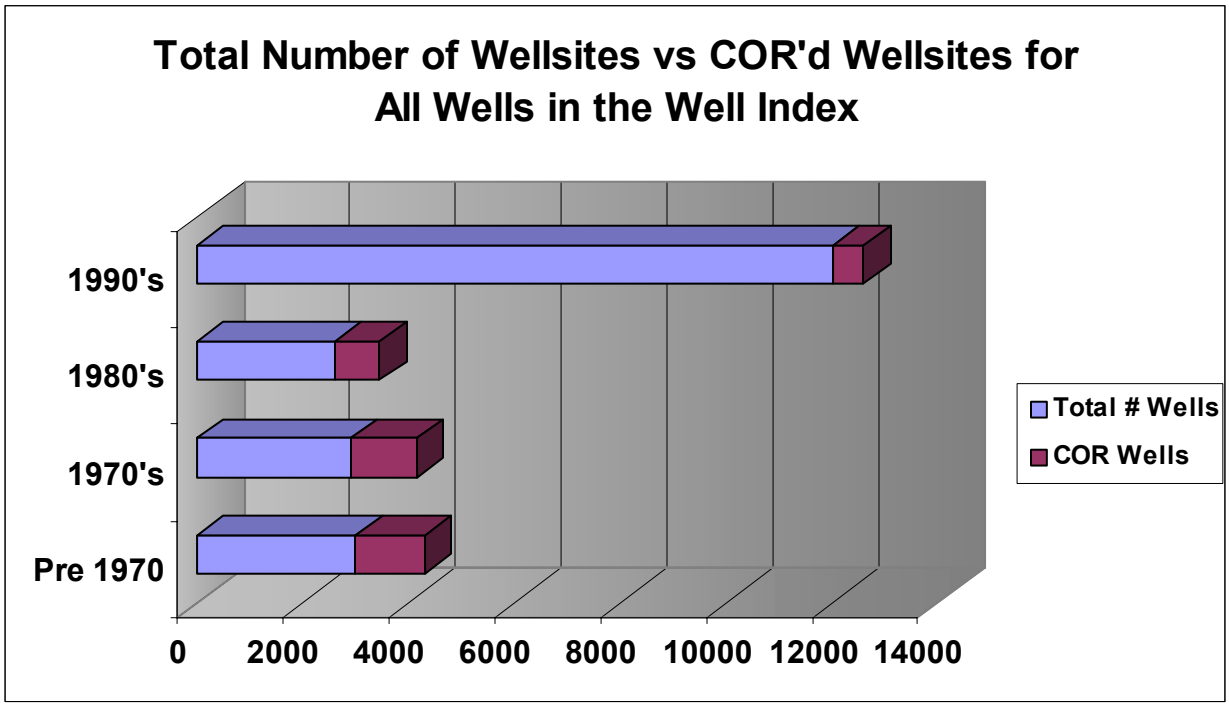
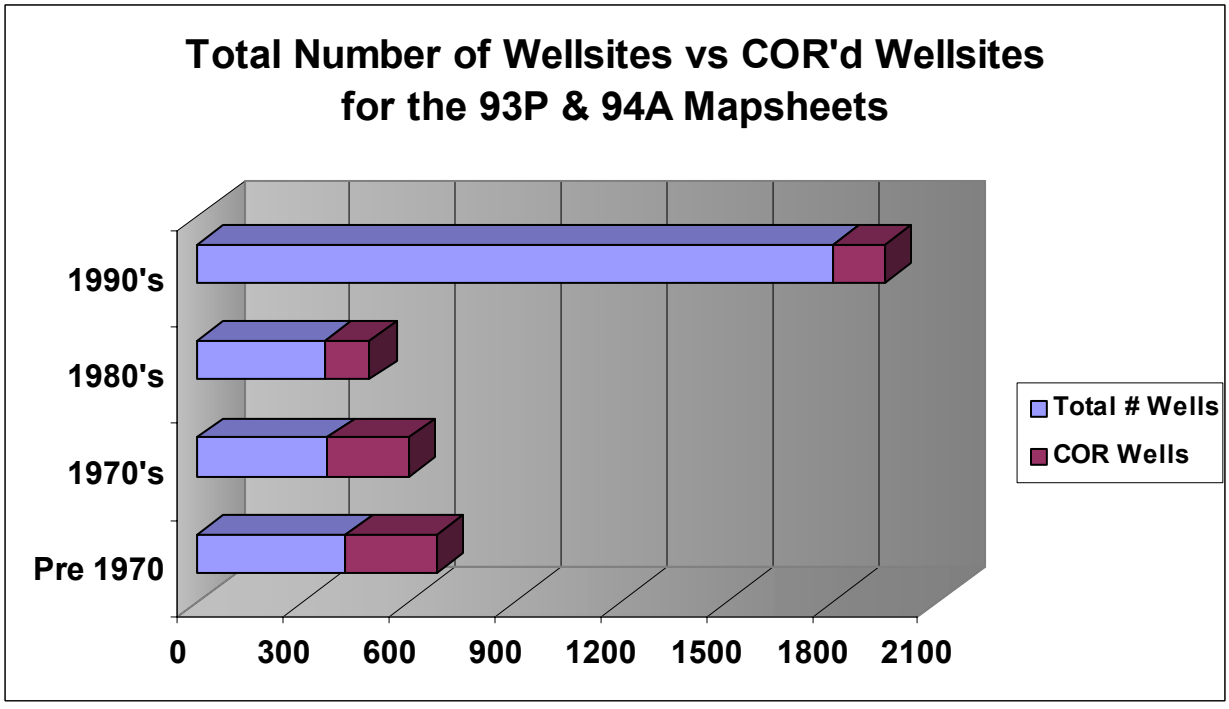


Figure 2. Distribution of reclaimed wells by rig release age class for the 93P/94A Mapsheets



Inventory Methods:

Within the 93P and 94A mapsheets there were approximately 1873 COR'd wellsites identified in the well index (May, 2003 version). We evaluated summary statistics using an Excel spreadsheet and displayed the results in charts and graphs. Our screening for field study sites involved selection of well sites that were:

1. located in the BWBS biogeoclimatic zone (BC Ministry of Forests biogeoclimatic maps)

2. in townships / NTS blocks ("map units") with > 80 % crown land (based on colour coding provided on maps produced in 2001 by McElhanney, Ft St John) , and
3. in map units with > 65% forest cap classes 1, 2, 3, and 4 (Canada Land Inventory maps)

This selection process reduced the number of candidate well sites to 412 COR'd wells, and they were located in 98 map units. We then prepared a randomized list of the map units, and selected all sites within those map units sites for further evaluation. To ensure some geographical diversity in our study, we chose sites from 94A and 93P in proportion to their representation in the overall list ie approximately 75 percent of sites were from 94A and 25 % from 93P. We used the BC government "online cadastre" web–based geographic information system to obtain an orthophoto of each well site, which was used to make preliminary evaluations of a) access, b) extent of ingrowth, and c) characteristics of the surrounding vegetation. As the site assessments were being carried out, we further modifed the selection process to ensure a range of site ages were evaluated, and in some cases, sites with difficult access were rejected.

Through this process, 25 site assessments were carried out in the summer of 2003, and six high capability forest sites were selected for treatment.

Inventory Results:

Figure 3. reclaimed well sites in 93P and 94A

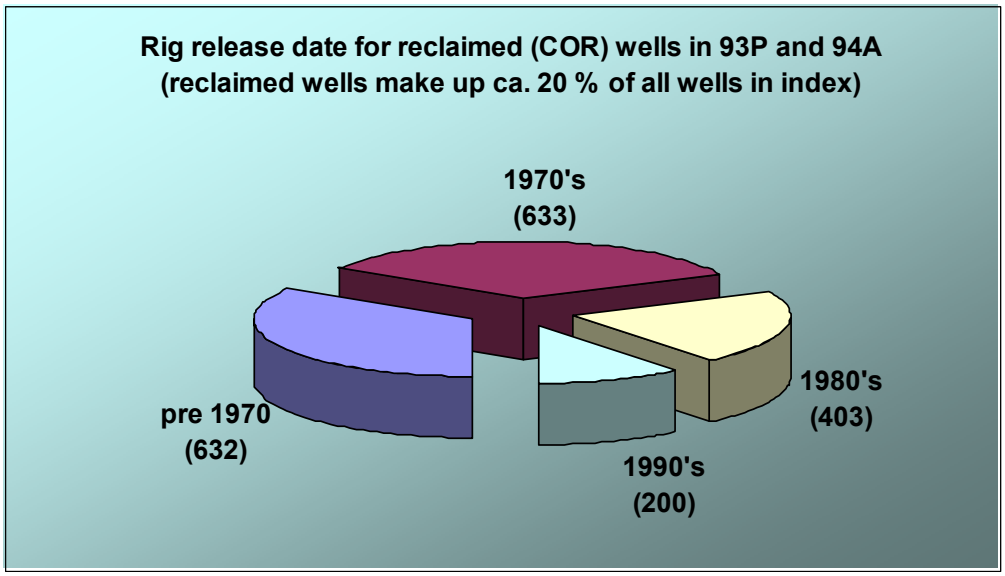
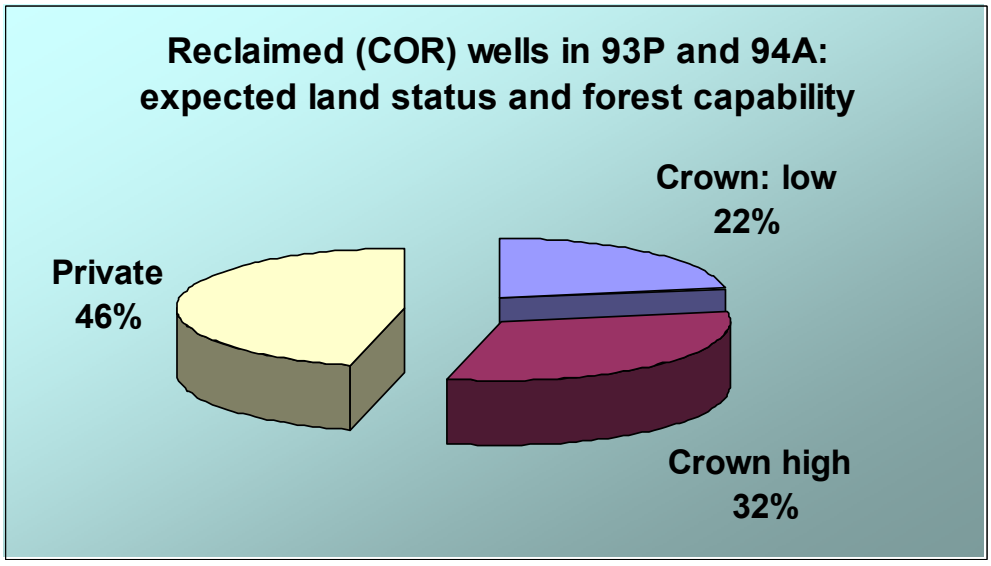


Figure 4. Expected land status and forest productivity of reclaimed wellsites



Site Assessments

Introduction:

Site Assessment Methods & Results:

Site Treatments

Introduction:

Our treatments were designed to test whether or not soil conditions on COR well sites were suitable for the production of commercial tree species. The results of our previous study had emphasized the importance of the soil moisture regime in determining regeneration success of planted pine, so we stratified our site selection based on the expected moisture regime. Stratification was accomplished initially by examining Canada Land Inventory maps of the area and estimating the average moisture regime for map units of approximately 100 square km. The actual moisture regime for candidate treatment sites was then verified by field checks, and detailed site assessments. In the first year of our study we focused our efforts on treating sites with mesic moisture regime. Sites with wetter conditions will be identified and treated in 2004.

We based our selection of soil treatments on the factors that were expected to limit productivity, based on the results of our previous research. Our treatments were designed to test operationally realistic treatments to address limitations arising from (a) reduced site organic matter levels on disturbed sites and (b) competition from seeded cover crops. In addition, we included treatments designed to test the assumption that soil physical conditions do not provide serious impediments to the growth of tree roots, and therefore will not impact forest productivity.
Reforestation treatments were designed to evaluate the performance of a variety of tree species that could be used in reforestation. Reforestation treatments will be carried out in spring 2004
The soil treatments are outlined in Table 1.

Table 1. Site treatments for operational trial of wellsite reforestation.

Treatment Code	Decompaction	Vegetation control	Organic amendment	Amendment Application method
U	none	none	none	n/a
B	none	brush mats	none	n/a
C	none	none	10 cm layer of wood chips	mulch
D	to 50 cm	none	none	n/a
DC	to 50 cm	none	10 cm layer of wood chips	mulch
DCI	to 50 cm	none	15 cm layer of wood chips	incorporate to 25 cm

The rationale for selecting the treatments was based on their expected ability to (a) alleviate growth-limiting conditions, (b) provide operationally realistic treatments, and (c) provide low-cost options for reclamation and reforestation. Since the sites had received COR, and had already been treated to reduce compaction for establishment of the cover crop, our lowest cost option is to simply plant trees on well sites that receive no further treatment (U=untreated). To alleviate the potential competition from the cover crops, which was well established on all of the wellsites, we will use brush mats attached to the ground when the sites are planted (B). To provide organic matter inputs, and to simulate the presence of forest

floor as a rooting medium, and its ability to modify soil temperature and moisture conditions, we applied a 10 cm layer of wood chips (C=chips). This is not too different from the depth of forest floor in adjacent untreated areas. To evaluate whether or not soil physical conditions are suitable for productive forest growth after standard reclamation techniques have been applied, we tilled the soil to a depth of 50 cm. As a further test of soil conditions, we added wood chips to the tilled soil, either as a mulch (DC) or incorporated (DCI). The wood chip treatments we applied were costly because the material had to be transported to the site in a large van. However, in operational situations, there are often large accumulations of waste logs and logging debris remaining after clearing and site development. The wood chips we used should effectively simulate conditions that could be obtained operationally by having a mobile chipper process waste logs and debris, and spread the material across the site during the reclamation stage.

Site Treatment Methods:

The treatments were applied in October and November of 2003. Decompaction was carried out using a Komatsu 30 ton excavator with a site preparation rake and/or a bucket. Wood ships were obtained from the CanFor sawmill in Taylor BC, and were derived from conferous logs. The wood chips had been stored at the site for some time, and were slightly discoloured. Wood chips were stockpiled adjacent to the plots by unloading the amount required from the "shuffle deck" van. Wood chips were spread across the site by the excavator after decompaction, while minimizing the need for the machine to travel over decompacted areas. In some cases, the machine was able to reach across the site and did not have to travel over treated areas. In other cases, minor amounts of machine traffic were needed, and the effects were eliminated by further treatment as the machine worked sequentially across the plot. As the excavator carried out the tillage, we were able to confirm our initial assessment of soil moisture conditions for the plots. On one site, moist soil conditions required us to relocate one plot after an initial attempt to treat it failed because of wet soil conditions. In this case, stockpiled chips were left some distance from the final plot location, and will be transported and spread over the plot in spring 2005. Road approaches were modified to allow the chip trucks to access the plots, and needed to be restored at the end of the treatments, increasing the costs above our initial estimates. The bare soil on the approaches will be copvered with grass and legume seed in the spring of 2004. Some studies indicate that addition of wood chips to soil reduces the availability of nitrogen, and can reduce the growth of planted crops. In one previous study using pine trees planted on resotred landings in south BC, pine trees were not affected by wood chips added without added N. We intend to monitor the need for supplemental N additions through soil testing and evaluating tree health, and will add N if necessary.
Plot maps and site assessments for the 4 treated well sites are included in Appendix 1 of this report.

Insert 3 or four photos highlighting 10 decompaction, 2, wood chip hauling 3, incorporation, 4, spreading the mulch, 5 finished appearance for decompacted and mulched pots.

Future Plans

We will evaluate the budget available for treating 2 additional mesic sites in the spring of 2004. Our intent is to treat two additional sites south of Dawson Creek, but this will likely require some cost effective options such as finding a machine in the area to avoid transport costs. We are also unsure if we will have the resources to haul wood chips to the plots south of Dawson Creek, nbut will attempt to install at least the plots without chips. All sites on mesic moisture regimes will be planted in spring 2004 with an alternating mixture of pine and spruce, at an approximate spacing of 1.8 m by 1.8 m. On the 20 x 20 m plots, this allows for 12 rows of 12 trees (144 total, 72 of each species – with 2 buffer rows, allowing for 32 "inner plot" measurement trees of each species). On two of the plots at each well site (U, and DCI), we have allowed additional space for the testing of hardwood species (aspen and birch), if we are able to obtain planting stock. These will be planted in rows with a close spacing, and would provide establishment information only.

Appendix: Plot layouts and brief site descriptions for treatment sites

Korey: please include the plot maps, also, except for Blueberry, I don't have the site assessments, but will boil them down into a site description table if you send them to me.