An analysis of Alberta’s Conservation and Reclamation program - does the program work as intended?

AIA conference
April 2018
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Alberta Environment and Parks
A bit of history

- 1987 – Land Conservation and Reclamation Council
- 2018 – Environmental Monitoring and Science Division (Alberta Environment and Parks)
Assumptions

- Physical, chemical and biological conditions are conserved at certified sites in Alberta
- Current C and R programs assure equivalent land capability
- Long term ecological impacts of industrial activities on Alberta’s private and public lands are well known and predictable
- Ecological impacts at private and public lands are minimal and diminish over time
- Public interests are assured
Tension

- Landowners want/expect land conservation and protection
- Tenants want less rules, faster authorizations, easier closure
- What is the role of professionals to land owners and tenants?
Role of professionals*

- Ensure that all acts, regulations are followed
- Ensure that information is accurate
- Legal, ethical and moral obligation to safeguard the public and the environment

*Joint practice standard for Reclamation and Remediation v1.0, 2007 (AIA, ASPB, ACPA, APEGGA, CAPF, CAPFT)
Why is EMSD conducting this evaluation?

- Bill 18 (2016) – an Act to ensure independent environmental monitoring
  - To report to the public on the condition of the environment in Alberta on the basis of scientific evaluations and assessments

- The land conservation and reclamation program effectiveness has never been evaluated

- There is a province-wide information gap on the long term impacts and ecological performance of reclaimed and certified lands

- Scientific information is needed to enable ecological accounting, reporting, informed program adjustments and assuring public trust.
Three things I wish I had known 30 years ago

- Knowledge of legislation, regulations and guidelines
- Knowledge of physical, chemical and biological processes and their interactions at industrial sites
- Knowledge of long term ecological impacts of industrial activities on private and public lands in Alberta
C and R program analysis - Ecological Recovery Monitoring

Several options

- Proactive – policy assessment
  - Analyze the policies before or while they are enabled to predict assurance of environmental outcomes – will policies work as intended?
  - Advantages
    - make necessary adjustments before policy is implemented.
    - Low cost

- Reactive – field assessment
  - Analyze environmental conditions of certified sites years and decades after policies are in place – did policies work as intended?
  - Disadvantage
    - After-the-fact – adjustments are too late
    - Very costly
Ecological Recovery Monitoring Advisory team

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ERM program

- Ecological Recovery Monitoring Project
  - 73 certified oil and gas well pads – forest, range, cultivated
  - Certified dates – 1964 to 2011
  - Level to gently undulating topography
  - Stone-free, medium textured soils
  - Avoid fence lines, field edges, depressions, hilltops
  - Chemically benign soils

- Objectives
  - Assess and document soil and vegetation conditions at certified well pads and adjacent references
  - Evaluate data
  - Make recommendations
  - Prepare reports and publications
Project overview

- **3 year pilot**
  - 2013 - 18 grassland sites
  - 2014 – 30 forest sites
  - 2015 – 25 cultivated sites
  - ~7800 soil samples
  - >8,000 vegetation records at grass and forest sites

- **2016 to current**
  - Data analysis
  - Report and manuscript preparation
  - Policy review

- **Future of the ERM project – depends on funding**
ERM site locations

- 30 forested sites
- 25 cultivated sites
- 18 range sites
Grassland – 2013, 18 well pads
Forest – 2014, 30 well pads
Cultivated – 2015, 25 well pads
Typical ERM field sampling layout

Well pad boundary

10m x 10m
Well pad plot

Well center

10m x 10m
reference plot

100 m

N
What are the expectations for C & R at Alberta’s public and private lands?

1. Environmental protection, sustainable development, prevent impacts (EPEA 2)
2. Equivalent land capability - C&R reg 2
3. Conservation - EPEA 1 (l) and 137
4. Protect public interest
1. Sustainable development expectation?

- What C & R legacy will be left for future Albertans?
- 1000 ?? years of certification remaining?
- What about pipelines, S&G, borrow, coal mines, oil sands?
2. Equivalent land capability expectation

Three potential tools to assess:

- Land Suitability Rating System – Agriculture Agri-Food Canada - 1995
  - 25 cultivated sites
- Ecological recovery index (ABMI - 2017)
  - 30 forested sites
  - 18 grassland sites
- Ordination (in process)
  - Plant species
  - Soil property and plant species relationship
Site assessments in 2015:
• 25 southern Alberta well pads on cultivated land
• Well pad vs adjacent reference
• 225 plots & 2700 soil samples
• LSRS data inputs
  o Soil organic carbon
  o pH
  o Bulk density
  o Electrical conductivity
Land suitability rating (LSRS)* for 11 cultivated well pads (certified pre-1995) and adjacent references in Southern Alberta Dark Brown soils**.

*Agriculture and Agri-Food Canada, Ottawa. 1995

**I.R. Whitson and A. Janz. Using the LSRS to assess return to equivalent capability on certified well pads. In press.
Land suitability rating (LSRS)* for 14 cultivated well pads (certified 1995 standards) and adjacent references in Southern Alberta Dark Brown soils**

* Agriculture and Agri-Food Canada, Ottawa. 1995
**I.R. Whitson and A. Janz. Using the LSRS to assess return to equivalent capability on certified well pads. In press.
Land Suitability Rating index – 25 cultivated sites

Shift from class 4 to class 5
Southern Alberta cultivated well pads – site vs reference soil suitability index scaled to 100% reference
UAV crop stress image – July 29, 2015
RC – 1997. LSRS capability reduction from class 4 to class 5.

Wellsite boundary
Sump area
Tool #2. Ecological Recovery Index*

- ERI – used as a surrogate for Equivalent Land Capability at grassland and forested well pads
- Developed by the ABMI for EMSD
- Soil, vegetation and environmental variables
- % similarity - well vs reference
- Short term index (expected recovery in 40 years or so)
- Long term index (expected recovery in > 40 years)

Vegetation recovery index at 17 grassland sites

Indicators:
• Vegetation layer similarity
• Non-native cover
• Vegetation cover similarity

Post 95 well pads

Reference

Soil recovery index at 18 grassland sites

Indicators:
- Bulk density
- EC
- Total N

Vegetation recovery index at 15 boreal sites

Vegetation Indicators:
- Cover layers
- Live basal
- Canopy cover
- Non-native cover
- Cover similarity
- Shrub cover similarity
- Snag basal area
- Coarse woody debris
- Small woody debris

Soil recovery index at 14 boreal sites

Soil indicators:
- Bulk density
- pH
- Elect. Cond.
- Total N
- Total OC
- LFH thickness

Reference

Ecological Recovery Index Summary (recovery scores < 50%)

- **Forest (29 well pads)**
  - Vegetation – 76% of well pads
  - Soil – 90% of well pads

- **Grassland (18 well pads)**
  - Vegetation – 77% of well pads
  - Soil – 67% of well pads
Tool #3. Ordination (in process)

- Could be used as a surrogate for equivalent land capability assessment at grassland and forests.
- 100s of vegetation, soil and environmental parameters
- Evaluate strength of relationships (or dissimilarities) of soil, site and plant species
Non-metric multidimensional scaling
Vegetation Matrix
Well vs Ref sig. Grouping variable
(Multi-response Permutation Procedure $p<0.001$)
3. Conservation expectation - physical, chemical and biological characteristics (an operator must conserve specified land – EPEA 137)

- Bulk density
- pH
- Meso fauna
Bulk density (15-30cm) at 25 cultivated well pads and references in southern Alberta
The diagram compares the bulk density and pH values between reference and wellsites under different land uses: Grass, Forest, and Cultivate. For bulk density (Mg m$^{-3}$), the wellsites show higher values compared to the reference sites across all land uses. Similarly, the pH values also indicate a higher range in the wellsites compared to the reference sites, with the exception of the Forest land use where the pH values are lower in the wellsites. The graphs provide a visual representation of the data, highlighting the differences and trends between the reference and wellsites.
Meso fauna density (individuals/m-2 @ 0-10cm) – 25 cultivated sites*

*Preliminary assessment of soil meso fauna as indicators of ecological recovery at 25 reclaimed and certified well pads on cultivated land in Southern Alberta. Jeff Battigelli and Arnold Janz.
Example 1 – landscape borrow

2017 Google Earth image

Landscape borrow

Soil profile – depth (cm) and bulk density (Mg/m³)
Example 2

- Well drilled in 1993 and abandoned
- Well pad manured and deep tilled
- Site assessed by a professional
- Site certified in 1997
- ERM data collected in 2015
- Well pad is class 5 vs reference class 4
Example 2 – southern Alberta certified well pad

UAV imagery – 2015
Drilled – 1993 (D & A)
Certified – 1997
Treatment – manure, deep till
LSRS reference index – 30.3 – CL 4
LSRS well pad index – 21.0 - CL 5
Limiting factors – dB, pH
Example 3 – northern Alberta certified well pad

History
- Drilled – 1969
- Certified – 2012
- Landowner appeal to the EAB
- P Ag professional convinced the EAB to recommend that the Minister reject the landowner appeal
2017 photos - Aggregate size not equivalent
2017 photo - Profile restriction not equivalent
Conclusions

- Long term impacts of C and R program are not monitored by GOA, regulator or industry
- Industrial impacts are persistent at certified well pads
- Information on the effectiveness of C and R program is not available for public reporting
- Equivalent land capability is not assured by the C and R program at all reclaimed/certified public and private well pads in Alberta
- C and R policy and program modifications have not improved environmental outcomes at all sites.
- Public interest is not served as intended
- Certified site liabilities will begin to transition from industry to public
- Recommend transitioning the provincial C and R program from a professional judgement-based system to evidence-based.
- Recommend transitioning the provincial C and R program from reclamation and closure to a conservation and equivalent land capability priority
- Recommend that public trust become a C and R program priority
Change nothing and nothing changes.
Acknowledgements

- Alberta Environment and Parks
- Alberta Biodiversity and Monitoring Institute
- University of Alberta
- Alberta Innovates and Technologies
- Inno Tech Alberta
- Ventus Geo spatial