

Data and Assumptions Update and Preliminary Resource Analysis for the FN TSA

SCEK Project:	RA2007-02
Project Name:	Data and Assumptions Update and Preliminary Resource Analysis for the Fort Nelson LRMP Area (TSA)
Proponent:	Forest Ecosystem Solutions
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Introduction

This document represents the final administrative report to the SCEK Fund on the project, funded by SCEK, to conduct a data and assumptions update and preliminary resource analysis on the Fort Nelson Land and Resource Management Plan (LRMP) area. This document summarizes the project—the objectives, approach followed, the deliverables produced and the application of the project findings.

Objective

The objectives of this project included the following:

1. Document the oil and gas activity in the Fort Nelson LRMP area for input into the development of the new oil and gas regulations including the environmental protection and management regulations—eventually to become the Oil and Gas Activities Act (OGAA) and the Environmental Protection and Management Regulation. This documentation was done by updating the existing spatial data and assumptions for the Fort Nelson LRMP area along with landscape/resource emphasis data; and
2. Apply the Ecosystem Representation Analysis (ERA) concept from the forest sector to the oil and gas sector to develop a preliminary assessment of an ERA for oil and gas activity on the surface land base in the Horn River Basin.

Background

The most recent strategic surface land use analysis for the Fort Nelson LRMP area (same as timber supply area) was the Timber Supply Review (TSR) completed in 2003. While forestry centric, the TSR process attempts to identify the current (and future) level of timber harvest considering existing legislation, regulation, and policy as well as consideration of other land uses. Since then, forestry activity within the LRMP area has declined to the point where oil and gas development represents the largest surface land use activity.

The previous TSR utilized where available spatial data to represent oil and gas activity within the Fort Nelson LRMP area, and where limited, made assumptions to approximate existing activity. The following key data and assumptions were applied in the Fort Nelson TSR:

Data and Assumptions Update and Preliminary Resource Analysis for the FN TSA

1. Other than geophysical (aspatial assumption), no future oil and gas development considered,
2. No regrowth/regeneration of geophysical lines – all program types included,
3. Facilities, sites and wellpads were excluded (in error),
4. Spatial geophysical data gap from 1996-2000 used historical development to approximate aspatial area estimate,

Since the completion of the TSR (2003) data standards and availability of oil and gas spatial data has improved significantly especially for development activity \geq 2006. In addition, the Oil and Gas Commission have initiated internal standardized GIS scripting processes to report on oil and gas surface area (footprint) for any given jurisdiction in BC. An output of this procedure is a spatial oil and gas surface area dataset, which could be used to support future strategic land use analyses.

At the time, the Ministry of Forests (MOF)—now the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO)—noted that the impact and extent of oil and gas activities on the forested land base is not well quantified. Although the best available data at the time was used: there were deficiencies in the location of seismic lines, lease sites, burrow pits and sumps, pipelines, and camp locations. Also, there is limited information available regarding the width of the seismic lines and the size of site activity, as well as documentation of the regeneration potential for these areas to form a commercial stand in the future is incomplete. With the upcoming implementation of the Oil and Gas Activities Act (OGAA) and associated regulations, specifically the Environmental Protection and Management Regulations (EPMR), there will be the need for the BC Oil and Gas Commission (OGC) as well as the oil and gas industry to be able to assess and understand the strategic and tactical surface land use implications.

Project Team

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Data Sources

Table 1 shows the data sources used in the updated analysis dataset and the ecosystem representation analysis for the Horn River basin.

Table 1: Data Sources

Category	Data Source	Data Currency
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Data and Assumptions Update and Preliminary Resource Analysis for the FN TSA

Category	Data Source	Data Currency
ANALYSIS DATASET		
Water Bodies and Wetlands	MSRM (VRI)	2002/03
Parks, Protected Areas and Ecological Reserves	MWLAP	2007
Woodlots	MoF	2007
Indian Reserves	MoF	2007
Other Ownership	MoF	2002
Agricultural Land Reserve	LRC	2007
Streams	TRIM II	1996
Transmission Lines	TRIM II	1996
Railway Lines	TRIM II	1996
Existing Roads	Various Sources:	
	TRIM I and TRIM II	1996
	Canfor Road Data	2003

Data and Assumptions Update and Preliminary Resource Analysis for the FN TSA

Category	Data Source	Data Currency
	Canfor and BCTS Forest Development Plans	2002 - 2007 Plan
	OGC	2007
	Non-Spatial Roads	2003
Pipelines	Various Sources:	
	TRIM II	1996
	OGC	2007
Geophysical Programs	OGC	2007
Wells	OGC	2007
Oil and Gas Facilities	OGC	2007
Oil and Gas Ancillary Features	OGC	2007
Environmentally Sensitive Areas	MSRM	2002
Terrain Stability	Various Sources:	
	Kokanee Forest Consulting	2000

Data and Assumptions Update and Preliminary Resource Analysis for the FN TSA

Category	Data Source	Data Currency
	Klohn-Crippen	2000
	JM Ryder & Associates	2000
Existing and Recommended Visual Quality Objectives	MSRM	2007
Wildlife Range Burn Areas	MoF (Fort Nelson Forest District)	1999
Moose Winter Habitat	OGC (Area Operating Protocol)	2008
Boreal Caribou Winter Habitat	OGC (Area Operating Protocol)	2008
Trumpeter Swan Nesting Locations	OGC (Area Operating Protocol)	2008
First Nations Areas of Importance	OGC (Area Operating Protocol)	2008
Resource Management Zones	MSRM	2008
Biodiversity Emphasis Option Areas	MSRM	2003
Domestic Water Licence Intakes	MSRM (Water Licensing Office)	2003
ERA		
Ecogroups	Fort Nelson ERA	2005

Data and Assumptions Update and Preliminary Resource Analysis for the FN TSA

Category	Data Source	Data Currency
Netdown	Fort Nelson ERA	2005
Seismic Lines	Fort Nelson TSR3	2003
Remaining Gas	Conventional Gas Play Atlas	2006
Undiscovered Gas	Conventional Gas Play Atlas	2006
Infrastructure:	OGC	2007
Ancillary		
Facilities		
Wells		
Roads	OGC	2003
		2007
Pipelines	Fort Nelson TSR3	2003
	OGC	2007
Horn River Boundary	OGC	2008

Data and Assumptions Update and Preliminary Resource Analysis for the FN TSA

Data Processing

All data was collated and geoprocessed in an ArcInfo format (using union functionality) to form a vector, resultant dataset combining all the source data. This provides an integrated dataset, which can be analyzed spatially for a multitude of values and purposes. Specifically for the ERA, in order to analyze the distribution of ecogroups within areas of oil and gas activity, the resultant required the ecogroups, land use netdown, seismic density, remaining and undiscovered gas estimates and infrastructure layers.

There are many technical, processing and data management challenges with ERA projects some of which are related to the uncertainty of the application and whether ERA would actually be adopted as a management tool for the oil and gas industry. However, strictly from a data perspective, assuming all the data sources are easily available and accessible, there are several key data processing issues that should be noted.

For ERAs, data used to determine the non-managed land base should only be included spatially. This can be a data management and processing challenge when applying ERAs to large strategic land bases like the Fort Nelson LRMP area, especially when incorporating linear features (ie. riparian reserve areas) which can create millions of polygons and significantly increase data sizes. Long narrow, small polygons (slivers) often result which require technical post-processing to remove this data noise, while maintaining the underlying linework of key spatial features.

Another data challenge with ERAs is that site level, ecosystem mapping is not complete provincially and can be completed with different accuracies and types so a given project may require data gaps to be addressed or various mapping of different qualities applied. Beyond that site level ecosystem mapping can occur as 3 deciles per polygon, whereby the proportion of each site series in the polygon is specified in one-tenth increments. There are 2 options to deal with this: use only the first decile, or to do an aspatial analysis using all 3 deciles. Using only the first decile is faster, and also easier for mapping. However, it will mean that the more common ecogroups are over reported, and rare ecogroups that occur only in the second and third decile may be missed completely. For this assessment all 3 deciles were included ensuring that area totals are accurate to the decile level, which is a more precise approach than using only the leading site series.

ERA Analysis

The ERA concept was originally developed for forest industry certification, essentially using the abundance of ecosystem sites and their presence within unmanaged areas of the land base where they are assumed to remain in an undisturbed state as a way to account for those species/habitats that are not directly monitored or managed for.

An ERA project for the Fort Nelson Land and Resources Management Plan area was completed for Canfor in March of 2005. The methodology and results from this project are described in the report Ecosystem Representation in the Fort Nelson Timber Supply Area, Forest Ecosystem

Data and Assumptions Update and Preliminary Resource Analysis for the FN TSA

Solutions Ltd 2005. The basis of the ERA is to group site series into clusters based on similarities in vegetation species composition and prominence and are referred to as ecosystem groups (ecogroups). Ecogroups are named after their leading site series those with the greatest productive area.

Typically, a data netdown procedure is used to determine the non-managed land base, the theoretical area that is expected to remain in an unmanaged state for the purposes of the ERA. For the forest industry, this is well understood through the TSR process where the surface land constraints and exclusions are commonly mapped and analysed as the excluded and non-harvestable land base. Currently there is no similar type of classification or mapping available for the oil and gas industry. It is expected that as the Environmental Protection and Management Regulation (EPMR) under the Oil and Gas Activities Act is implemented, clarity around where surface oil and gas activity likely will and will not occur should be available. With minimal parks and protected areas (<0.1%) in the Horn River Basin, there is a limited area, which is currently legislated for no future oil and gas surface development at this time.

Therefore, a full ERA considering oil and gas development in the Horn River Basin was not completed but some of the key ERA concepts were applied and the distribution of ecogroups within areas of existing and potential future oil and gas activity was tested. Prior to the completion of the EPMR, a preliminary assessment of ERA considering oil and gas development could be considered as a component of “fostering a healthy environment” and possibly represent an aspect of biological diversity in OGAA. If adopted, the ERA concept could also provide a way to work with the forest industry on cumulative issues in the northeast management units where ERAs are in place. However, this work does not represent a complete assessment of ecosystem representation and would require support from the BC Oil and Gas Commission.

For this project, the two outputs (ecogroups and forestry netdown) were clipped to the Horn River study area. Since there is no available data identifying where oil and gas activity will/not occur, an estimate of current and potential activity was based on 3 different datasets: seismic line density, remaining and undiscovered gas reserves, and existing infrastructure.

Seismic Density:

Seismic density is a means of estimating oil and gas activity on the land base. Where seismic cutlines are close together, there is more proportionate disturbance than areas where there are very few seismic lines. Seismic density was calculated in metres per hectare over the entire Fort Nelson TSA, and the output was grouped into classes in 30m/ha increments. Finally, the seismic density dataset was clipped to the Horn River study area.

Infrastructure:

The infrastructure source data was provided by OGC as point, line and polygon features. The polygon data was not modified, however in order to calculate the area, the point and line data needed to be buffered to make polygons from it. The buffers were 24.6m for ancillary points (gives a 0.2 ha circle), for facilities the buffer was 39.5m (0.5 ha circle),

Data and Assumptions Update and Preliminary Resource Analysis for the FN TSA

and for wells 71.8m (1.6 ha circle). Road lines were buffered 10m (20m total width) and pipelines 7.5m (15m total width). Once all buffering was done, all these datasets were combined to make the overall infrastructure layer.

Gas Reserves:

The data from the Conventional Gas Play Atlas provides data for northeastern BC based on petroleum-natural gas grid blocks. For each block, there are a series of values indicating discovered reserves, undiscovered reserves, gas produced etc. For this project, only remaining marketable gas and undiscovered marketable gas values were used. The data is in millions of cubic meters, and was classified based on the maps in the Conventional Gas Play Atlas publication.

Results

Once all the input datasets were combined, maps and summary graphs were generated and are summarized in the Excel file: era_graphs.xls. This spreadsheet contains a summary table and graph for ecogroups by netdown, by seismic density, by remaining gas class, by undiscovered gas class, and by infrastructure category. The accompanying map (**hr_era_map2.pdf**) illustrates the results spatially.

The Horn River basin study area is entirely within the BWBSmw2 BEC variant, which represents 9% of the provincial distribution of this climate type whereas the Fort Nelson LRMP area represents 74%. Therefore, the Fort Nelson LRMP area would have a high responsibility for ecosystem representation for the BWBSmw2 types.

Based on the existing ecogroup classification there are 9 productive ecogroups within the Horn River basin study area representing dry, zonal, poor, moist/rich, and wet ecosystems (Table 2).

Table 2. Ecogroup distribution for the Horn River Basin

Type	Ecogroup	Description	Productive Area (ha)	Proportion of HRB (%)	Proportion of HRB in FNL RMP (%)
Dry	2	BWBSmw2/02	13,442	2.1%	63.4%
	6	BWBSmw2/04	29,269	4.6%	16.6%
Zonal	8	BWBSmw2/01	180,683	28.4%	9.6%
	9	BWBSmw2/03	12,051	1.9%	5.0%
Poor	11	BWBSmw2/06	24,793	3.9%	6.7%
Moist/Rich	15	BWBSmw2/05	103,130	16.2%	11.1%
	16	BWBSmw2/07	11,985	1.9%	37.7%
Wet	20	BWBSmw2/08,09	221,346	34.8%	26.3%
	22	BWBSmw2/10	40,151	6.3%	40.8%
Total			636,850		

Data and Assumptions Update and Preliminary Resource Analysis for the FN TSA

Ecogroups 8, 15 and 20 have the highest productive areas in the Horn River Basin while ecogroups 2, 9, and 16 exhibit the lowest productive areas. While not a complete ERA, once climatic abundance is considered along with the Horn River Basin contribution of ecogroups to the FNLRMP area, ecogroups 2, 16 and 22 are most uncommon and exhibit a potentially high responsibility in the basin.

If an uncommon ecogroup is in an area of high activity, it can present a potential ecological risk. For the purposes of this study while we don't know what the unmanaged land base may be for the Horn River Basin we can assess the potential risk based on the level of disturbance within each of the ecosystem groups as it relates to the existing oil and gas activity (seismic and infrastructure) as well as based on remaining gas reserve estimates as an indication of where future development may occur.

Overall, seismic activity and oil and gas infrastructure occurs in all ecogroups with most of the activity being concentrated in groups 8, 15 and 20. These groups represent approximately 80% of the productive area of the Horn River Basin and are relatively common with low responsibility. Ecogroup 2 and 9 have the highest proportion of area with remaining gas estimates in place at approximately 25% (75% with no estimate) while the others are 20% or less (>80% with no estimate). While this data does not provide a direct prediction of future gas development, it does not illustrate a significant risk of development on the key ecogroups.

The results as presented are preliminary and are not complete enough to draw any concrete conclusions, but are more for information purposes to determine if the ERA concept could be useful in oil and gas development planning.

Key Deliverables

Analysis Dataset Update

- **Fort Nelson TSA TSR 3 and OGC Data Dictionary1.xls** – detailed summary of metadata for analysis dataset update.
- **<xyz>.jpg** – suite of map images showing key datasets.
- **FTNLRMP_spatial data.zip** – spatial dataset update resultant for the Fort Nelson area.
- **FTNLRMP_database.zip** – database update resultant for the Fort Nelson LRMP area.

ERA

- **hr_era_map2.pdf** – map illustrating ecosystem representation results for the Horn River Basin.
- **<xyz>.jpg/.pdf** – suite of map images showing key data inputs and results.
- **ERA_graphs_revised Horn River Bndry.xls** – summary of all the charts prepared for the ecosystem representation analysis illustrating key oil and gas development attribute information.
- **era_horn.shp** (and other associated shapefiles) – spatial data for era group results and associated shapefiles for disturbance type, boundary, resultant, png subsurface resource estimates and seismic density.

Data and Assumptions Update and Preliminary Resource Analysis for the FN TSA

Extension/Application

- Presentation of draft results to OGC GIS and RAS staff;
- Presentation of draft results to Horn River Environmental Sub-Committee Chairman; and
- Presentation to the SCEK Steering Committee (July 8, 2011).

Creation of the original update dataset has been modified several times since project has been completed to incorporate updated footprint information and improved environmental data. For this reason, the dataset created in this project is no longer current and should not be used in any current or future analysis. Users looking for more current data should contact the OGC.

The preliminary ERA findings in this project have also formed the basis for advanced analysis support in preparation of the OGC's basin management processes specifically, the completion of the Liard Basin Tactical Analysis. Future basin plans will be able to leverage the value in the processes that originated with this project.

If the ERA concept that was explored in this project is considered for future use by the oil and gas sector, and if completed, it could be used:

- by industry in development planning as a data layer for consideration of ecosystems which are locally and regionally uncommon.
- by the OGC to support future permit application approvals.

There may be an opportunity to work with the forest industry (Canfor specifically) in their northeast management units where they are currently updating their ERA plans.

Recommendations

- 1) Review by OGC internal and external biological/ecological expertise to determine whether ERA meets the expected OGAA requirements for biological diversity,
- 2) Identifying a method/approach to determining the strategic future land base for oil and gas surface development,
- 3) Consider update and revision of ERA for oil and gas based on outcomes of recommendations 1 and 2.
- 4) If adopted, consider providing supporting investment in improved site level ecosystem mapping where required.
- 5) Engage with Canfor on the potential to integrate ERA for forestry and oil and gas development as a reflection of the full management of the surface land base.