

The Oil and Gas Industry in Alberta: Seismic Exploration

Conventional practices:

- Seismic (or geophysical) exploration is used to identify and map oil and gas deposits prior to drilling. The technique is based on analyzing how sound waves are reflected from subsurface structures.
- First, a long linear corridor, 6-8 m in width, is cleared using a bulldozer.
- Then truck-mounted drilling equipment is used to drill a series of holes at defined locations along the corridor for the placement of dynamite charges (the usual source of seismic sound waves).
- The dynamite charges are sequentially exploded and the reflected sound waves are recorded at the surface using portable recording equipment.
- In the final step a computer is used to amalgamate the sequential recordings into a seamless cross-sectional representation of the subsurface.
- A complete seismic survey of an area typically involves a series of seismic lines running parallel to each other, usually at a distance of 400 m or more between lines.

Low-impact seismic:

- Low-impact seismic is refers to a new approach that is now being implemented in an attempt to reduce losses of merchantable forest.
- Seismic lines are an average of 5 meters wide.
- Valuable stands of merchantable forest are avoided through the use of meandering lines.
- Disturbance of the soil and ground cover are minimized through the use of vehicles with low ground pressure.

Rate of activity:

- From 1979 to 1995 an average of 57,750 km/year of seismic lines were approved in the Green Zone of Alberta.
- The total length of seismic lines approved in the Green Zone as of 1995 was approximately 1.4 *million* km.
- From the 1950s to the mid 1970s, seismic operations resulted in the clearing of approximately 234,700 ha of forest, compared with 255,692 ha cleared by the forest industry. The relative proportion of clearing continues to be the same today.
- Because only a fraction of the wood from seismic operations is salvaged (being of the wrong species or age class, or impractical to haul out), the impact of seismic is largely additive to that of the forest industry.
- Seismic operators are not required to reforest the lines they cut, and studies have shown that 88% of lines older than 20 years have still not regenerated (because of soil and root disturbance, grass competition, and use as access routes)

Ecological impacts:

- Because regeneration is inadequate, seismic activities result in a progressive loss of mature forest and alteration of forest structure. Given the high rates of seismic activity in the Green Zone, the cumulative loss of habitat is substantial.
- Direct losses are magnified by the avoidance of habitat in the vicinity of seismic lines by some species, such as caribou.
- Habitat effectiveness is further reduced by the extensive fragmentation of forest stands that results from seismic activity.
- Seismic lines provide access routes into the forest for all-terrain vehicles, snowmobiles, and off-road trucks. This leads to increased hunting and poaching and can have significant adverse effects on soil and vegetation.
- Damage to aquatic systems. Deleterious impacts include increased stream sedimentation, bank erosion, barriers to fish passage, destruction of aquatic habitats, and alteration of drainage patterns.
- Alteration in predator-prey interactions (e.g., wolves are able to move faster along seismic lines than in the forest).
- Damage to soil (e.g., compaction and erosion).
- Disturbance of wildlife from dynamite blasting and machinery noise.
- Introduction of aggressive weed species into the forest.

Best practices:

- A dramatic reduction in the impact of seismic exploration can be achieved through the use of recently-developed *enviro-drills*. These are shot-hole drills mounted on specially-designed all-terrain vehicles that require only 2.5 m corridors for access.
- A meandering course should be standard for all lines, not just for avoiding valuable forest stands.
- Lines should all have intermittent blockages to prevent their use as access corridors.
- Ground cover should be preserved and lines should be reforested within a specified (short) period of time.
- Thresholds for the maximum cumulative area in seismic lines need to be set on the basis of best-available scientific knowledge. It is quite likely that such thresholds have already been exceeded in many areas of the province, implying that active revegetation of older lines will be necessary before new lines can be cut in these areas. In sensitive areas (e.g., habitat of threatened species) thresholds will likely need to be set so low that only helicopter-based seismic will be feasible.