Fibre Plantations in British Columbia
(Land Base Investment Program)

9 year old red alder plantation

Commercial thinning hemlock

Wood-based Fibre Plantation Project

Mission:

Develop new wood product opportunities, such as bioenergy and other wood-based fibre based products, from a limited land base

Where:

Areas of high productive capacity in close proximity to potential processing facilities.

- Within a short haul distance to facility (within 100 km)
- Access structures in-place and maintained or easily re- activated
- BEC site series suitable for selected species
- Rich, Moist sites series that do not experience significant drought periods during growing season.
- No environmental or cultural heritage concerns
- Minimal snow damage potential
- Minimal ungulate browse potential
- Minimal insect and disease potential
- Areas where herbicides are an option
- Reforestation obligation (BCTS/FSMF) and non-obligation (FFT/FSMF) land
- Reasonable or justifiable costs
- Consideration needs to be given to impacts on the wood supply within the respective forest management unit of converting landbase from sawlog focus to fibre focus

What:

A range of species capable of producing high volumes in a short time frame (target of 15 – 30 years).

- Broadleaf
    - **Hybrid poplar**
    - **Cottonwood**
    - **Aspen**
    - **Birch**
    - **Red alder**
    - **willow**
- Conifer
    - **Lodgepole pine**

    - **Western larch**
    - **Douglas-fir**
    - **Western hemlock**

How:

Utilize a variety of stand management strategies/techniques to produce a range of wood-based fibre products

- Strategies
    - Short rotation plantations
    - Establish high density plantations
    - Management of naturally occurring high density stands
    - Non-commercial brush conversion
- Techniques
    - Fertilization
    - Commercial thinning
    - Juvenile spacing

Utilize the full suite of silviculture treatments to maximize growth and site occupancy for each stand management strategy.

- Site preparation (mechanical and chemical)
- Planting
- Superior genotypes
- Vegetation management
- Fertilization.

Considerations prior to establishment/treatment:

- Costs to establish/treat
- Stand maintenance costs after establishment/treatment
- Legislative requirements

Reforestation and stand management strategies and techniques for the production of wood-based fibre

Typically, the reforestation and stand management regimes employed on a site are defined by the greatest value product. However, planning for establishing and managing the growing stock should consider all potential products that could be produced from the site throughout the rotation of the stand. Reforestation and stand management strategies can also be combined in numerous site specific silviculture regimes that optimize the productivity, value, and product output from a particular area.

Different silviculture treatments impact stands in a variety of ways. Very generalized impacts on harvest volume, piece size, sawlog volume, investment return, biological risk, and employment opportunities are outlined in Table 1. The size and direction of the arrows refer to the relative magnitude and nature of the response.

Table 1[1]: **Average impact of stand level management regimes aimed at maximizing wood-based fibre production as compared to current regimes[2]**

Silviculture Regime	Total Biomass	Piece size	Sawlog volume	Investment return	Biological risk	Employment opportunity
Intensively managed short rotation plantations [3]	▲ (small)	▼ (moderate)	▼ (large)	▲ (small) / ▼ (small)	▲ (moderate)	▲ (small)
Intensively managed long rotation plantations[4]	▲ (moderate)	▲ (small)	▲ (small)	▼ (moderate)	▼ (small)	▲ (moderate)
Rehabilitation[5]	▲ (large)	▲ (large)	▲ (large)	▲ (small)	▲ (small)	▲ (large)

KEY **Relative change: Symbol (increase/decrease):** **Large** ▲ ▼ **Moderate** ▲ ▼ **Small** ▲ ▼

[1] Modified from Mitchell, K., Goudie, J., Bealle Statland, C., de Montigny, L. 2001. Research Branch Ministry of Forests' Input to FRBC Review memo File: 22212-01

[2] Site preparation, planting with select seed, and vegetation management with rotation lengths 60 + years

[3] Broadleaf management - Site preparation, planting with select seed, vegetation management, fertilization with rotation lengths of 15 to 35 years

[4] Site preparation, planting with select seed, vegetation management, interim product capture, and fertilization with rotation lengths of 60 + years.

[5] Management of naturally occurring dense stands not producing to site capabilities or conversion of non-commercial brush areas to current regimes. Includes the estimated 1.5 million hectares of non-commercial brush and 119,000 ha of conifer stands older than 20 years that have more than 10,000 sph.

The following is a more detailed discussion of some of the possible reforestation and stand management techniques that could be employed to either target a wood-based fibre end-product or to provide wood-based fibre product opportunities at different points through the development of stands over time.

Strategies

Short rotation plantations

Short rotation plantations are those plantations managed so that the time to re-harvest is reduced from those typically used for a particular species. The choice to employ shorter rotations should consider the potential forest level impacts on the supply of fibre for all potential products from the management unit.

All current commercial species in British Columbia have the potential to be managed on shorter rotations. In order to maximize growth potential and minimize investment to achieve maximum growth only the high productive sites (SI > 30m) are considered suitable for short rotation plantations. Almost all of the high productivity sites occur on the coast of BC. A small amount of area within the interior has similar growth rates and is associated with the valley bottoms of some of the larger drainages (i.e Skeena, Kooteney, Thompson, Upper Fraser, etc). .

The rate of growth (wood-based fibre volume production) of each species is dependent on the amount of effort and funds one is willing to invest to achieve a greater productivity. Some broadleaf species, such as hybrid poplars, red alder, aspen, birch and willows have naturally high growth rates at early ages, as do some conifer species such as Douglas-fir, Western Larch, and lodgepole pine.

Hybrid poplars

In all portions of the province, the best growing sites (nutrient rich, moist, well-aerated soils) for hybrid poplar are also the best growing sites for agriculture, thus a large portion of the readily accessible areas are already under private land and producing higher value food crops.

Outside of the agricultural areas, the sites where Hybrid Poplar can achieve its growth potential are high quality crown land. These sites are typically associated with river valley bottoms that have high fisheries and wildlife habitat value and are also the best sites in British Columbia to grow high value sawlogs. To achieve the potential Hybrid Poplar growth rates on these areas requires considerable investments of funds for site preparation, vegetation control, and fertilization.

Due to favourable climate and good clone reliability, the greatest potential for Hybrid Poplar resides on the coast. Feasibility of realizing this potential is limited by cost of access to remote valleys and the environmental constraints (e.g. riparian and wildlife) associated with the suitable growing sites. While able to produce sizable trees on rotations of 10 to 12 years on the coast under intense silvicultural regimes the high growth rates for hybrid poplar on these productive coastal areas requires considerable investment in treatments such as site preparation, vegetation control, and fertilization. Operationally, Kruger Products Ltd. (TFL 43) is growing hybrid poplars under 2 regimes: intensive (south coast 25 yr rotations) and extensive (lower central coast 30 yr rotations).

Based on clone reliability, interior areas currently suitable for hybrid poplar are only located in the Southern Interior Forest Region (south of Clinton). Due to climate, suitable clones, and favourable ecosystems achieving the maximum growth potential of hybrid poplars is restricted to the Kooteney River area. No suitable reliable clones have been identified for areas outside of this portion of the southern interior. In the Northern Interior no suitable reliable hybrid poplar clones have been developed for northern British Columbia climates.

Other issues associated with hybrid poplar may impact the risk associated with mass deployment of this species. The disease Septoria canker is causing some problems with clone production on the coast and there is concern that this disease will expand into plantations and start destroying those investments. Septoria canker is not yet identified as a problem in the interior. As well, some certification bodies (i.e. Forest Stewardship Council) may not certify forest management that incorporates hybrid species and single species (monoculture) management.

Other potential species for short rotation management

Douglas-fir plantations on the southern coast can achieve rotations of 35 to 40 years with moderate investments (planting and, but not necessarily, juvenile spacing). As an example, TFL's 39 and 44 both have target rotations for Douglas-fir of about 35 years on high productivity sites as part of their approved Management Plans. These stands are able to achieve sawlog products with associated residual biomass to produce sufficient returns on investment in this short period. Some forest management units are harvesting at these younger ages to maintain harvest flows.

Similarly, the coastal hardwood strategy promotes the establishment and management of red alder on suitable sites targeting rotation lengths of 25 to 35 years. The end product objective of this management is high value sawlog but associated residual biomass may be available for other uses.

In most interior ecosystems, lodgepole pine is able to produce high volumes in a relatively short time frame in ecosystems where it is an ecologically suitable species. Depending on the establishment densities and management strategies throughout the rotation this species can produce a variety of wood-fibre based end products.

Aspen has very similar growth rates as lodgepole pine but has the added benefit of typically reproducing at high densities through natural regeneration. This species when grown on suitable ecosystems can produce volumes of wood-fibre at rates comparable to lodgepole pine.

Paper birch is another interior species that has high early growth rates. This species, if intensively managed (planted, multiple spacing's) can produce high quality sawlogs in as little as 35 to 40 years. As with other species the residual biomass could be used for other wood-fibre based products. Without intensive management interventions this species could produce lower valued wood-fibre based products similar to that of aspen and lodgepole pine over a rotation age of 60 to 70 years.

Willow has not been managed, up to this point, as a commercial species in British Columbia. Willow bioenergy plantations in Europe are typically grown as an agricultural crop because the areas where it is cultivated can quickly be changed to, and from, this crop. Rotations are, typically, 3 to 4 years and production does not start to decline in the cultivar beds until about age 20.

High density fibre plantation establishment

Fibre potential plantations are established and managed in a manner that allows the stand to have the potential to produce wood products at various stages of development and still allow for the production of higher value sawlogs at the end of the rotation. If the potential fibre products are not utilized at any stage of stand development it does not foreclose on the utilization of future fibre products and higher value sawlogs.

To a limited extent, in some species, such as lodgepole pine, increasing the initial establishment density (e.g. from 1800 to 2500 sph) can increase the total volume production on a given site. This strategy, with lodgepole pine, may also decrease the potential for mortality-induced volume reductions from certain rusts and may increase the future value of the resultant sawlogs by reducing growth ring widths and branch diameters. However, for all species the increased total volume of higher densities comes at a cost of smaller future piece size for each harvested log. Smaller piece size typically results in higher harvesting and handling costs and a greater proportion of the stand becoming available for wood-based fibre residuals. As well, smaller piece size can result in longer rotations to reach a minimum economically harvestable size or merchantable volume threshold.

Higher density allows for the potential to extract and utilize wood-based fibre or higher value products throughout the rotation of the stand. These factors will be expanded upon below under the headings of “commercial thinning” and “juvenile spacing”. The removal of wood-based fibre at various stages of stand development may provide a funding source to carry out silviculture treatments that improve future stand quality and value even though the value of the products removed may themselves not completely cover the cost of treatment.

High density natural stand management

Extensive naturally established high density stands that could also provide a substantial amount of wood-based fibre currently exist in parts of British Columbia. Many forested ecosystems throughout the province are capable of producing significant amounts of natural regeneration after a disturbance. Some coniferous stands growing at high densities experience some reduction in growth rate, thus, are not producing at their full capacity. Utilization of these stands could have the dual benefit of providing wood-based fibre and rehabilitating the site in a manner to establish a growing regime that will ensure the site is growing at full capacity.

Non-commercial brush conversion

Non-commercial brush is the term used to describe productive land that is covered by shrub or deciduous species that are currently not considered as commercially valuable. Conversion of this land to productive commercial species not only increases the amount of forest land in British Columbia producing to its capabilities but the conversion process itself could provide a variety of wood-based fibre opportunities.

Stand Management Techniques

Fertilization

Fertilization is the addition of nutrients, typically nitrogen, to improve tree growth in a given stand. The addition of nutrients at any time in the rotation can increase the growth rate, thus volume, of the stand, resulting in increased wood-based fibre availability in the short-term. Fertilization is often used to shorten a stands rotation age by increasing the growth rates of the crop trees so that they reach a merchantable size earlier.

Commercial thinning

Commercial thinning is the action of reducing stand density by removing stems that have commercial value for a range of products while improving the forest health, distribution, and value of the remaining stems. The value of the extracted wood-biomass in these situations may or may not be enough to cover the cost of their removal.

Extensive amounts of mature dense 2nd growth or high density mature natural origin stands exist throughout the province. These stands provide the opportunity to access the lower quality sub-dominant stems to provide a source of fibre for the production of a variety of products. Harvesting this material later in the rotation potentially captures and utilizes stems that may have been lost to mortality while maintaining the higher value stems on the sites growing at a rate sufficient enough to meet the desired future product objective. Commercial thinning also reduces the cost of the future harvest by creating more uniform stand conditions providing a better return on investment for the harvest of those future stands. In order not to lose potential volume production from the stand as a whole, the residual basal area and distribution of the remaining stems must remain high enough to ensure site productivity is optimized.

Juvenile spacing

Juvenile spacing is the reduction of the number of stems in a young stand prior to the removed stems being large enough to be potentially marketed as a sawlog product. The cutting of this wood-based fibre from these sites could be made available to emerging wood-based fibre industries.

Reducing the number of stems growing on a site allows for the sites resources (i.e water and nutrients) to be spread between fewer individuals. More site resources available to each remaining stem allows each individual tree to optimize their growth potential on that site, creating larger piece sizes and more uniform stand conditions. Juvenile spacing also allows for the modification of the species content of the stand by removing stems that may not be healthy, as economically valuable, or as ecologically suited to growth on that site as the targeted crop species. Decisions to undertake juvenile spacing must take into consideration possible local forest health factors in order to avoid unintended consequences that result in lower than acceptable stocking.