

Culturally Driven Forest Management, Utilization and Values: A Nuxalk First Nations Case Study

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The forests of British Columbia have been managed for thousands of years to provide a range of products and services. For the Nuxalk people of Bella Coola, BC, their forests were used to: build homes and canoes, act as a transportation system (grease trails), and provide material for clothing, fuel and cultural/artistic needs. These forests also provide a host of plants used for nourishment and medicine. With the arrival of Western cultures the lives of First Nations people have been dramatically altered; and from a First Nations perspective, these traditional goods and services have been eroded. Today they seek to restore and protect the forests which provide these goods and services, while at the same time recognizing the needs of a modern life which include: improved housing, energy that is environmentally friendly and the development of new products and services to sustain their economy.

Over the past year a number of people from different disciplines came together at the University of British Columbia to assist the Nuxalk Nation by conducting a series of applied research projects (titles in bold). These included **Exploring Forest Management Alternatives** and developing options for addressing some of the key economic, environmental, social and cultural challenges. The projects developed to address these challenges included a number of energy projects that focused on **Forest Biomass for Hot Water and Warm Houses, Energy from Wood Waste,** and **Sawdust Products: Briquettes and Biochar.** Other economic development projects focused on markets for non-timber forest products such as those identified in **An Essential Oils Plan** and high value artisanal products that can be developed using advanced **Manufacturing and Design Technology.** To assist with social development, the UBC team focused on the inadequacy of residential and senior's housing and plans were developed to provide **Help and Housing for Those Who Need it Most,** and culturally reflective designs were completed for a **Solid Wood House Made in Bella Coola.**

The series of short articles which follow are a brief description of these projects. We do wish to thank the Nuxalk people for agreeing to work with us, and some major financial sponsors that made it

possible: the Nuxalk Development Corporation, MITACS Research Funds and the Coast Opportunity Funds.

Exploring Forest Management Alternatives

Over the past two decades, a number of British Columbia's (BC) First Nations have received timber tenures from the provincial government to manage forest lands in their traditional territory. In 2000 the Nuxalk First Nation joined BC's pilot community forest program and in 2011 the Nation was awarded the Community Forest Agreement, K3H. The Nuxalk First Nation's community forest is located near the community of Bella Coola on British Columbia's central coast and comprises a land base area of 48,614 hectares. Most of the community forest's land base is covered by the Coastal Western Hemlock biogeoclimatic (BEC) zone with the dominant tree species being Western Hemlock, Western Red Cedar, Amabilis Fir and Mountain Hemlock.

With control over the community forest, the Nuxalk First Nation is striving to practice Aboriginal forestry that incorporates traditional ecological, as well as conventional forestry knowledge. In striving for balance between economic, social and environmental objectives, the Nuxalk assigned the management of the community forest to Nuxalk Limited Forestry Partnership (NLFP). Currently, NLFP is in its start-up phase and faces many challenges and opportunities. One of the challenges posed to NLFP was the incorporation of community planning documents, such as the Nuxalk Nation Comprehensive Community Plan, into forest management practices. To do this, a project exploring management alternatives for the community forest was conducted by Master's student Matthias Splittgerber.

In BC, timber production has been the focal point of forest management and a major source of revenue. However, carbon offset markets are evolving and providing forest managers with new opportunities for revenue while managing forests for a wide range of values. The basic principle behind carbon offset

projects is to improve forest's ability to sequester carbon. This can be achieved by planting trees on non-forested areas, greater reforestation after harvest operations than is required by the province, incorporating additional management practices that go above and beyond provincial requirements and setting aside sections of a forest from harvesting. Carbon that is stored in addition to the business-as-usual practice can then be sold as carbon credits on offset markets. The consideration of carbon storage as a forest management tool provides a way of reserving more forest area for a range of different values, while offsetting losses from decreasing timber harvesting.

In analyzing the community documents, it became apparent that cultural, economic and environmental benefits are at the forefront of the Nuxalk First Nation community's objectives. Therefore this project proposes a number of forest management alternatives that manage the community forest for harvested timber volumes and carbon stocks in a respectful and sustainable way. Together with provincial guidelines, the community and forest management values were integrated into four different forest management scenarios.

The timber scenario focusses on the sustainable and most productive flow of timber from the community forest and does not take an increase in carbon sequestration into account. The ecosystem-based management (EBM) scenario draws from the intent of sustaining healthy ecosystems and improving human well-being. In contrast to the timber scenario, the EBM scenario reserves larger areas for wildlife habitat, riparian areas and old-growth representation while sustaining moderate carbon stocks and meeting the provincially determined timber flow. The conservation scenario involves a more comprehensive forest reserve and protection level in the community forest. Although the conservation scenario still provides timber, the scenario's focus lies on increasing carbon stocks in the community forest. The "no primary forest harvesting" (NPFH) scenario limits harvesting of timber to areas in the community forest that have been previously logged and conserves untouched forest areas. Of all four

forest management alternatives, this scenario provides the highest amount of carbon stocks in the community forest but does not meet the provincially determined timber flow.

The objectives and interests of the Nuxalk First Nation regarding their community forest are diverse and must be adaptive over time. Given the output of these forest planning models in conjunction with the current management goals of the Nuxalk, the four forest management alternatives will enable the Nuxalk to make informed decisions on how to move forward in managing their community forest. Depending on market prices for timber and carbon credits, the Nuxalk can select a scenario that best suits their wants and needs. In combining harvest volumes and carbon stocks with the protection of wildlife habitat areas and other environmental values, the EBM scenario provides an ideal opportunity to conserve forest values while providing jobs and revenue to the community. In conclusion, the four scenarios provide a spectrum of forest management alternatives to meet the Nuxalk First Nations targeted triple bottom line of economic, social and environmental values.

Matthias Splittgerber is a graduate student in the Transatlantic Forestry Master's program researching forest management and planning in Canada and Germany.

Forest Biomass for Hot Water and Warm Houses

Like most remote communities in Canada, Bella Coola is not connected to the natural gas grid and must rely upon a variety of other fuels and energy sources for cooking, space and hot water heating. These alternative options include electric heat (e.g., baseboard for space heating; electric hot water heaters; electric stoves), heating oil (furnace), propane, and cord wood. These heat sources can be high cost and inconvenient for residents and business owners. Based upon the positive experience of communities in Canada and Europe, a project examining the potential for a district energy system in Bella Coola was conducted by Jamie Stephen of the Queen's Institute for Energy and Environmental Policy (QIEEP) at

Queen's University in Kingston, Ontario. District heating systems, or district energy systems (DES), consist of one or more centralized heat generation energy centres and a network of pipes to deliver hot water or steam to two or more separate buildings. Instead of each building having its own furnace, boiler, stove, or electric heaters, a heat exchange system connects the home heating system with the hot water/steam pipes of the district heating system. In Canada, the first DES was introduced in London, Ontario in 1879 and currently, there are approximately 130 systems operating across the country. Many are either found in large urban centres, university campuses or hospital complexes, but there are also examples of DES' providing heat for smaller communities such as the Cree village of Oujé-Bougoumou, QC; Drake Landing, AB; and Revelstoke, BC. DES energy centres can be fueled by all the same fuels that can be used at the individual residence level, including natural gas, heating oil, propane, and biomass. However, the larger scale enables the use of lower grade biomass types, such as wood chips and hog fuel (residues containing bark), that are typically unacceptable for residential consumption. DES energy centres can also co-generate electricity with heat. The potential for this facility design was examined in the project led by Amadeus Pribowo (see Energy from Wood Waste in this publication).

The biomass heating assessment for Bella Coola and its Four Mile subdivision examined the potential for a DES and contrasted this with a decentralized heating option comprised of wood pellet boilers in each individual residence and commercial building. After surveying the community in June of 2013, a geographic information system (GIS) was used to map four potential DES routes. Survey data were used to estimate heat load, consisting of space heating and hot water demand, for both the DES and decentralized wood pellet boiler options. Capital costs, feedstock costs, and other operating and maintenance costs were calculated for the four DES routes and wood pellet boiler deployment options. This was compared to the 'business-as-usual' energy mix of electricity, heating oil, propane, and firewood currently used in Bella Coola.

The project team determined that the current average cost of on-reserve heat in Bella Coola is approximately \$100 per megawatt hour (MWh), with low cost cord wood, which currently meets approximately one-third of the heat demand, offsetting the high cost of heating oil (\$163/MWh), propane (\$141/MWh), and electric heat (subsidized at \$130/MWh). The DES scenarios ranged in cost of heat from \$128-154/MWh and the decentralized biomass boiler options ranged from \$96-127/MWh. Due to the high capital cost, it was recommended that a DES be considered only if electricity is being co-generated by the biomass energy centre. This would provide additional revenues that could reduce the delivered cost of heat. On the other hand, the decentralized wood pellet boiler options were quite competitive with business-as-usual and installation could target displacement of heating oil, propane, and electricity.

One particularly attractive option is the use of biomass boilers to eliminate or reduce the use of electricity for hot water heating in the community. Since BC Hydro has a cost of electricity generation from diesel fuel estimated to be in excess of \$0.40/kWh (and hence >\$400/MWh for heat) but only charges residents \$0.13/kWh, the utility should have an incentive to encourage a reduction in the consumption of electricity used for hot water heating. The selection of wood pellet boiler or cord wood boiler to enable this reduction is likely to be made on a case-by-case basis and dependent upon the individual circumstances of the building and residents/users in question. Pellets are typically more convenient than firewood, since they can be stored in bulk, are automatically fed into the boiler, and only need reloading once every few months. In contrast, firewood needs manual reloading several times per day. However, firewood is locally available while pellets need to be delivered to the community by truck or barge at present. Alternatively, the Nuxalk Nation could seek to establish a small wood pellet production facility in Bella Coola. Overall, biomass has the potential to reduce heat costs for the people of the Nuxalk Nation living in Bella Coola, reduce the cost of electricity subsidization for

BC Hydro, reduce emissions in the Bella Coola Valley, and increase energy independence of the community.

Jamie Stephen, PhD is a Postdoctoral Fellow researching biomass energy opportunities for remote communities.

Energy from Wood Waste

Bella Coola, with a population of more than 1,900 people, consists primarily of the Nuxalk First Nations community and a Norwegian-descent community. It is one of the largest communities in Canada not connected to the main North American electrical grid, though they do have access to electricity through a local microgrid. This lack of grid connection results in community reliance upon a mixture of diesel and seasonal run-of-river (Clayton Falls) power generation to supply electricity to the neighboring towns of Bella Coola and Hagensborg. The reliance on expensive diesel fuel is a barrier to growth, results in a net cash outflow, creates few local jobs, and emits significant greenhouse gas. At the same time, the community is also looking for options to manage sawmill and forest harvest residues. These forestry residues can potentially be used to provide heat and power which would reduce or displace fossil fuel consumption in the community. In addition to providing economic benefits to the community, a successful utilization of local biomass resources to meet local energy demands may provide a model for implementing bioenergy solutions in other remote communities across Canada. Therefore, UBC, together with the Nuxalk Development Corporation (NDC), has investigated the potential and the required technology deployment to utilize local biomass resources in the Bella Coola Valley for energy generation. This investigation was led by PhD student Amadeus Pribowo of the Forest Product Biotechnology/Bioenergy Lab at the University of British Columbia (UBC). In the Bella Coola Valley, electricity is supplied by the Ah-Sin-Heek (ASK) diesel power station and Clayton Falls (CFA) hydroelectric station with capacities of 7.2 MW and 2.1 MW, respectively. During the winter time, due to low winter

season stream flows and the resulting lack of electricity generation from the CFA power station, the community relies almost entirely on diesel generation. Furthermore, the electricity demand is higher during the winter time with peak loads ranging from 2,600-3,500 kW between October and April compared to peak loads from 2,200-2,500 kW between May and September. On average, the diesel power station produces around 40% of the annual electricity generation, and consumes 200,000 litres of diesel every year.

There are currently two forestry tenures in the Bella Coola Valley held by the Bella Coola Resource Society (BCRS) and the Nuxalk Forestry Limited Partnership (NFLP). These are managed by Bella Coola Community Forest Ltd. (BCCFL) and NDC, respectively. The current annual allowable cut (AAC) of the forest tenure managed by BCCFL is 30,000 m³ and that managed by NDC is 20,000 m³. All these forest operations result in a significant amount of forest residues in the Valley, which could potentially be used as an energy source to produce electricity and heat. However, the majority of the residues are not readily available due to the mountainous topography and a lack of infrastructure to transport them. In addition to forest operations NDC also owns and manages a sawmill, which currently processes 17-18 m³ of logs/day with a planned expansion to 40 m³/day. In this study, the currently available biomass potential from forestry in Bella Coola that could be accessed for bioenergy purposes was estimated at 6,000 bone-dry tons (bdt)/year, consisting of about 1,000 bdt/year of sawmill residues from the NDC sawmill operations and 5,000 bdt/year of harvest residues from the forest operations of the BCCFL. These biomass residues can potentially be utilized to generate around 24 MWh of energy annually.

The currently under-utilized biomass residues from the forest sector are promising feedstocks for heat and electricity generation to reduce diesel consumption. Biomass fuels are used most efficiently in a combined heat and power (CHP) system to generate heat and electricity. The electricity produced is expected to reduce diesel consumption especially during the 8 months when the CFA does not fully

meet the electricity demand. Possible uses for the co-generated heat include space heating in a district energy system (DES), wood drying in a kiln facility, farming in a greenhouse, or other applications such as in a hemlock oil distillery, a wood pellet plant, or a briquetting plant. Among various biomass CHP technologies, gasification and organic rankine cycle (ORC) are two technologies that have enjoyed the largest numbers of commercial deployments. Between these 2 technologies, an ORC system is identified as the preferred technology for Bella Coola due to its simple operations and ability to take heterogeneous feedstocks. The study has identified that implementing a biomass ORC system with a capacity of 300 kW electricity (kWe) and 1400 kW thermal (kWth) is economically feasible when the co-generated heat is also used efficiently, such as in a district energy system to displace the use of heating oil. It is estimated that around 4,400 tonnes (wet) of biomass is required to fuel a CHP facility at this size. Therefore, the amount of available biomass in the Bella Coola Valley is more than enough to meet the required biomass input. Implementing this CHP biomass facility is expected to reduce diesel consumption by 90% annually.

Amadeus Pribowo is a PhD candidate researching enzyme processes in biomass refineries.

Sawdust Products: Briquettes and Biochar

The Nuxalk First Nation of Bella Coola is currently in the process of acquiring new community forest agreements (CFA) to expand its forest operations, to create new economic opportunities close to home, and to take a greater role in the stewardship of local forests. These expansion plans provide an exciting opportunity for the Nuxalk but also pose additional challenges to the remote community in terms of how to manage the increased flow of wood. The Nuxalk Development Corporation (NDC), the entity that manages the CFA, would like to mill more of the logs locally. This will enable them to retain more value from the forest and to increase community participation in managing and utilizing their forest resources.

To accomplish this, the capacity of the mill will need to expand and new markets will need to be developed.

The North American forest products industry in general is characterized as having little to no waste. Although only approximately 52% of all the logs brought into sawmills are processed into lumber, sawmill residues serve as inputs into secondary industries. Of the raw material that cannot be processed into lumber, 36% is transferred to other facilities, such as fibreboard manufacturers, and the remaining 12% is recovered for energy production (Bowyer et. al. 2012) . However, in the absence of a well-integrated market due to isolation, and the inability to reach economies of scale, the NDC needs to explore different sawmill residue utilization strategies. With the advent of new technologies and the rise in energy prices, a portfolio of new biomass waste valorization strategies are now possible.

PhD student Kahlil Baker is undertaking a research project that looks at the economic viability of manufacturing different products from sawmill residues which require minimal capital expenditures. The focus will be on producing wood and charcoal briquettes as well as biochar. The investigation into the relative attractiveness of these products contrasts the other more capital-intensive waste utilization options such as a combined heat and power plant.

One of these strategies is the use of wood briquettes. Wood briquettes are made from dry, untreated wood shavings or sawdust that is compressed using high pressure but without any binder. Pressing releases one of the natural components of wood, lignin, which has the property of becoming liquid at high pressure (or temperature) and, as it subsequently cools, it binds the wood together in its new form. The result is a solid piece of wood of uniform shape commonly in the form of blocks or cylinders. Although attractive firewood markets in urban areas across Canada exist, the energy density of firewood is low making transportation costs prohibitive. Wood briquettes have about double the energy density of conventional firewood. Furthermore, because briquettes can be moulded into blocks there is less

empty space when transporting. This means that the briquettes could be transported for 30 to 50% of the cost of conventional firewood. The uniform briquettes can also be neatly packed making them clean and easy to handle. This makes them more appealing for domestic heating purposes, especially in urban settings or for the elderly. Wood briquettes have been a mainstay in Northern Europe for a while and have wide application in all kinds of stoves, boilers, fireplaces and furnaces. Although wood briquettes have many advantages, they also present various challenges. One of these challenges is developing the market locally and educating consumers on their numerous advantages when compared to conventional firewood. The average Canadian fireplace owner has likely heard of wood briquettes but would consider them to be a specialty item rather than something bought in bulk as a primary heating source.

Similar to wood briquettes, charcoal briquettes are compressed solid pieces of fuel (wood charcoal) that are uniform in shape and size with an energy density ~70% higher than wood. This makes them suitable for longer distance transportation. The process of turning wood into charcoal has been used since ancient times by heating it in an oxygen-limited environment. Traditionally, and to this day in many parts of the world, charcoal is made by burning wood inside a mud pit. When the fire is burning well the mud pit is sealed off for about a week to limit the amount of oxygen so that the wood turns in charcoal. They are commonly used for barbeques and are increasingly used as a low carbon a substitute for coal in industrial processes. In North America, charcoal briquettes are commonly produced at an industrial scale using very capital-intensive equipment. However, there has been increasing interest in their use in small industry settings, and numerous technology providers offer a variety of options.

Making charcoal briquettes from the NDC's sawmill residues is a value-added option that presents some exciting opportunities and unique challenges. One of the primary challenges to the NDC producing charcoal will be finding buyers that are willing to pay an attractive price relative to production costs. When sold on international commodity markets it is not uncommon for prices to be as low as \$250 per

tonne. More promising options are likely to be found in regional niche markets for consumers that value locally products with “a face and a place” that tell the unique story of the Nuxalk Nation. The barbeque charcoal briquette gourmet retail market is already segmented with several brands emphasizing premium charcoals that fetch over \$2.00 per kg (\$2,000/tonne).

A third option for producing a low cost product from sawmill residues is biochar. Biochar is essentially charcoal that isn't used as a fuel source; instead it is added to soil. Biochar has been shown to improve the structure and fertility of soils by increasing nutrient use efficiency. This is either done directly through nutrients contained in biochar or through physicochemical processes that enhance the soils ability to provide existing nutrients to plants, thereby improving agricultural yields. Biochar has a twofold higher carbon content than ordinary biomass which is highly stable, staying locked into the ground for a very long time period. This makes it an ideal form of carbon sequestration. As a result, adding biochar to agricultural soils can provide value in the form of increasing agricultural yields while being applicable as a form of carbon offset in voluntary carbon markets.

Kahlil Baker, MSc is a PhD student researching biochar's potential uses for carbon sequestration.

An Essential Oils Plan

The fast growing non-timber forest products (NTFP) sector has been a significant contributor to the British Columbia economy for decades. In 1997, the sector was valued at \$600 million a year with over 200 species harvested for sale, and employed more than 30,000 BC residents. In recent decades there has been an increasing interest in the potential of this sector for wild-harvested and other bio-products. Developing the NTFP sector can increase awareness about culturally important plants for both indigenous and non-indigenous consumers. Bella Coala has significant forest resources and a relatively

large population for a remote community. The Nuxalk, like other indigenous communities in the province, are faced with numerous socio-economic problems, including high unemployment, poverty, and poor housing. Thus, for the Nuxalk to be more self-sufficient, they require economically viable business options. This is especially significant as land conservation and climate change mitigation strategies apply pressure to reduce logging from historic levels.

The maximum potential for developing an economically viable NTFP business in the Bella Coola region lies in the production and sale of conifer essential oils, specifically Western Hemlock (*Tsuga heterophylla*), Sitka Spruce (*Picea sitchensis*), Amabilis Fir (*Abies amabilis*) and Douglas Fir (*Pseudotsuga menziesii*). Distillation of conifer essential oils has a relatively low set up cost (approx. \$60,000), and can either be sold directly (essential oil) or as value-added products (soaps, deodorants, etc.) (Coburn 2010). Thus, utilizing the conifer oils from the forest sector could provide economic benefits to the Nuxalk Nation in Bella Coola, and present an important case study for other indigenous communities in Canada looking to diversify from timber as their sole forest product. This investigation was led by Ph.D. student Devyani Singh of the Department of Forest Resources Management (FRM) at the University of British Columbia (UBC). The project generated a business plan and a report to serve as a guideline, enabling the NDC to begin conifer essential oils production in the region. Ultimately, this research project increases the financial attractiveness of the NDC sawmill by improving forest product utilization and creating meaningful employment within the Nuxalk Nation. A budgeted income statement shows the entry of the Nuxalk into the conifer essential oil industry to be a profit making venture, even under various market access scenarios. The likelihood of these scenarios depends on the scale that NDC plans to operate at, but as with any new venture there will be a learning curve.

The Coastal First Nations (CFN) is an alliance of First Nations on British Columbia's North and Central Coast and Haida Gwaii. The Coastal First Nations model supports the re-emergence of a sustainable

economy while taking into account the cultural and ecological diversity of the Great Bear Rainforest. One of the key projects of the CFN Great Bear Initiative (GBI) is to develop environmentally and culturally-sustainable NTFP's, specifically conifer essential oils. We recommend that the NDC work in conjunction with the Great Bear Initiative and expand to larger markets and value added goods under their own brand name in later years. This would enable the Nuxalk to tap into existing knowledge of the GBI, obtain access to existing markets, and gain industry expertise and contacts. However, as more First Nations in the Great Bear region start to distill oils, the high rate of sales revenue enjoyed by the GBI coalition will likely diminish and move closer to retail or even wholesale pricing.

A lot of the success comes down to who at the community level wishes to take this project/business on, and what support they will get (both financial and other kinds of administration and management support). This is one of the strengths and challenges of the essential oils business. Not everyone has the knowledge of how to make and store oils, nor does everyone have access to boughs and plant materials. The NDC does have a competitive advantage given the large supply of raw material, and past experience of a current employee. However, it can be constrained in various ways and will require careful planning to work with harvesting and logging operations. The Nuxalk also have the distinct advantage of marketing and branding an aboriginal product that is linked to the Great Bear Rainforest. All things considered, the success of the above scenarios and the profits that the NDC could make depend on the effective and smooth running of operations. If these operations are not diligently managed, they have a high tendency to fail quickly. To conclude, we recommend that the Nuxalk get involved with the conifer oils distillation project. In the beginning it would be most profitable to begin the venture in collaboration with the Great Bear Initiative. As the NDC gains expertise and market contacts, they can expand into larger commercial markets and also begin producing boutique value added products.

Devyani Singh, MSc MBA is a PhD student researching social-environmental financing of cook stove initiatives.

Help and Housing for Those Who Need it Most

Most First Nations hold their elders in high esteem, and the Nuxalk Nation is of no exception. The Nation does not currently have social housing in place where loved ones can “age in place”. First Nations and Inuit Home and Community Care (FNIHCC) funds professional and non-professional Home and Community Care (HCC) services for the Nuxalk, however social housing is not funded through the FNIHCC program. Other First Nations in the province and across Canada have successfully implemented housing options for seniors in their communities. Problems associated with aging in poor living conditions can be mitigated, even if it is on a small scale. Currently, some of the Nuxalk elders must relocate to larger cities where they can be housed in greater comfort and closer to the services they require, but away from their community and families. This study examined the feasibility of social housing for elders, or “cluster-care”, for the Nuxalk Nation in Bella Coola on British Columbia’s central coast. Dallas Pootlass, of the Nuxalk Nation and a recent MBA graduate from University Canada West, led this investigation. The investigation identified precedents for social housing support of care activities. One in particular, was located on a First Nations reserve in British Columbia. The financial support for this project came from BC Housing for the construction and operation of an assisted living complex that houses up to 30 patients. An assisted living complex is very similar to a nursing home, which is not an ideal option for a remote community. Alternatively, this investigation finds that that the Nuxalk would best benefit from cluster-care, which provides a more independent lifestyle while still offering HCC services to the residents.

Cluster-care exists when three or more people “cluster” together to allow for care providers to easily go from one client to the next with very little travel time. The time savings lead to great efficiencies for the

workers and directly contribute to better health of the recipients. To qualify for cluster-care clients need to receive at least one service but no more than three by the HCC providers. Currently in Bella Coola there are 20 Nuxalk who fall under this category. Cluster-care, if implemented properly can benefit the community at large by perpetuating values of the Nuxalkmc. Those values include honoring and caring for elders in the community. This is being done, but improvements can be made if cluster-care or other housing were available to seniors in the area. Furthermore, by incorporating programs from Acwsalcta (the Nuxalk school), the cost of HCC services can be slightly offset by having students prepare food for the seniors and deliver it to their homes. In addition to the financial benefits, student participation will help the youth to remain cognizant of aging loved ones.

Due to the expense, it is suggested that elders downsize their current Canada Mortgage and Housing Corporation (CMHC) two-story style houses to smaller 500 square foot units. The single story houses with full amenities would be safer and easier living for those with mobility issues. The actual design has yet to be determined. However, Nicholas Macleod, an architecture student at the University of British Columbia, has designed a larger house for a Nuxalk client that could be adapted for the needs discussed here (see A Solid Wood House made in Bella Coola in this publication). Macleod designed three schematics of possible lot utilization for cluster-care housing. Of the three, the “Eden Approach” offers significant advantages in terms of unit density, comfort, and amenities.

When determining potential locations for the “elders’ village”, several factors were considered. “Aging in place,” or limiting the distance the elders need to move, was a priority. Considering the location of vacant lots was also an important factor. Identifying community buildings, where they are located, and their prominence also played a role. As most elders currently reside in the main town site and the hospital is also located there, that was selected as the most appropriate area.

In order to reduce costs associated with transportation of construction materials it is vital to use the resources that are readily available to the Nuxalk. Wherever possible, local timbers produced with the Nuxalk sawmill should be used to construct the social housing for elders. Using local builders with outside help from organizations such as Builders without Borders or Habitat for Humanity will generate local jobs and provide training for the Nuxalk. Including local youth in both the construction and operation of the cluster-care system would create costs savings and providing an educational benefit, resulting in the best possible outcome for the village.

Cluster-care was found to be more cost effective than an assisted living complex. The investigation considered and discusses two cost series: the construction costs, and the ongoing operating costs. These were found to vary from a half a million dollars to several million dollars and from thousands to tens of thousands of dollars respectively. The range reflects decisions that yet need to be made by the Nuxalk people. In addition to the CMHC funding, this investigation also identified the Canada Economic Action Plan (CEAP) and Aboriginal and Northern Affairs Canada (AANDC) as sources of funding for the construction and operations of cluster-care for the Nuxalk.

Dallas Pootlass, MBA of the Nuxalk First Nation, is pursuing a career in health care administration.

A Solid Wood House made in Bella Coola

The establishment of the Nuxalk Development Corporation (NDC) in Bella Coola, British Columbia has led to several new opportunities for the Nuxalk First Nation. In particular the purchase of a lumber mill by the NDC has created an opportunity for the community to transform the timber resources of the Nuxalk Community Forest into locally produced homes. Nick Macleod, of the School of Architecture and

Landscape Architecture (SALA) at the University of British Columbia (UBC), led the design work of such a home..

The aim of this project was to develop a prototype house--one which the community could produce the materials for and construct themselves. The house was designed for a specific client, and as such, had to meet their specific needs while responding to cultural tradition, identity, and tectonics. Additionally, modern conveniences and high quality construction practices were also considered during the design phase.

The client has recognized that this house is a prototype whose design challenges the existing housing model in the community. Unlike the Canadian Mortgage and Housing Corporation's model, the design proposed here is reliant on the capacity of the community. The design limits the materials and trades imported into the community for the construction. The construction techniques and materials selected are dependent on timbers harvestable from the community forest. This feature will act to stimulate the local economy throughout the production of value added forest products.

The proposed house is a solid wood home. Choosing to design the main structure with solid wood construction, rather than lightwood framing or heavy timber construction decreases the number of trades involved in the construction process. A stacked sawn log shell of Western Hemlock provides the structural and thermal performance of the building.

The solid wood exterior wall is designed to be erected first, allowing for shrinkage and settling to occur within the structural shell. The enclosure is finished with an exterior Western Red Cedar rain-screen to protect the structure while creating a culturally identifiable facade. The interior spaces use light wood framing to reduce the volume of wood required to finish the house. Lightwood framing can easily be constructed in the interior of the building after the structural shell is complete. This creates the interstitial space for electrical and plumbing throughout the house.

Opportunities for ornamentation present themselves throughout the house. Centered on the exterior facade is a thick wooden slab that extends above the height of the roof. The 3” slab surface was designed for a local artisan carver to ornament with cultural stories and icons. Additional surfaces for ornamental carving have also been introduced throughout the interior of the house.

The interior is organized with private space to the rear of the building and the public to the front, as was typical of the traditional longhouses. The program required by the client was a small sub-urban two bedroom home. The living areas in the house include a small master bedroom, one and a half bathrooms, a large open kitchen-living-dining space and a “flex” room that can operate as a bedroom or an extension of the living space. There is also a pantry, a laundry room, an oversize mechanical room for a pellet boiler, a designated pellet hopper room, and a large working carport with space for potential food processing.

The result of the design process is modest, modern, culturally identifiable, solid wood home. It reflects the rich history of the Nuxalk people and their historical building practice, while addressing the client’s current needs and desire for contemporary living. The proposed building challenges the existing material culture of the contemporary built environment by reducing the imported materials and skills required for the construction of a house. The project relies on the participation of the community. And once completed it will instil pride and confidence, teach job-skills, and stimulate the local economy by adding value to the local forest resources.

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Manufacturing and Design Technology

One of the primary economic development opportunities for the Nuxalk Nation in and around Bella Coola is the forest products industry. However, like most manufacturing industries, the forest products industry benefits from economies-of-scale; as facilities get larger, per unit capital, equipment, and operating costs go down. This can make it difficult for smaller communities, such as Bella Coola, with a limited volume of available wood or desire for large industrial operations to compete with large-scale manufacturing centres. Small- and medium-sized enterprises (SMEs) based in remote communities are therefore at a competitive disadvantage for the manufacture and export of low-value commodity forest products, such as spruce-pine-fir (SPF) or hemlock lumber, compared to large facilities found in Canada, the United States, or China.

One area that SMEs have traditionally been able to compete with larger firms is the manufacture of high-value, non-commodity wood products such as furniture, millwork, and artisanal products. However, when manufacturing is based upon hand crafting, the availability of highly-skilled labour can be an impediment to growth. Manufacturing by hand is limited by the skill and time of the craftsman. While great artists can command high prices for their artwork, competitiveness can be economically challenging for decorative and utilitarian products such as wood trim/mouldings and stair work. In addition, design and manufacturing must occur at the same site when produced by hand. In contrast, technologies based upon computer-aided design (CAD) and computer numerically controlled (CNC) manufacturing allow the separation of design and manufacturing. CAD software is used for the design of solid objects, while CNC manufacturing produces those objects based upon software-determined tool paths. In wood products manufacturing, those tool paths, generated by computer-aided manufacturing (CAM) software, typically direct a router. The router carves the shape of the object designed on the computer. The combination of these technologies permits the reproduction of a design many times, thus enabling moderate economies-of-scale based upon a single design.

The Nuxalk Forestry Limited Partnership (NFLP) is currently operating a sawmill which produces lumber and decking in the Bella Coola valley. In order to increase the market value of the products exported from Bella Coola, the NFLP is investigating the purchase of a kiln for drying wood. However, significantly more value could be added to the wood if it was dried and then used to produce final products, such as moulding, trim, doors, design features, toys, and plaques in Bella Coola. This could not only create many more jobs and bring economic benefits to the Nuxalk community, but could also be used to showcase Nuxalk artist talents. With this idea in mind, a project supported and overseen by the Nuxalk Development Corporation was initiated to investigate the potential to produce high-value solid wood products in Bella Coola using CNC manufacturing. Jamie Stephen of the Queen's Institute for Energy and Environmental Policy (QIEEP) at Queen's University in Kingston, Ontario was chosen as the primary investigator and he began work in September of 2013. The project is assessing potential markets for CNC products produced in Bella Coola and business models that will benefit both Nuxalk artists/designers and the Nuxalk Nation as a whole. The project is also investigating the large number of CAD software, CAM software, and CNC machine options available in the marketplace. Recommendations on software and equipment selection will be provided in a final project report, which will be completed at the end of December. The NDC will be able to use the report to make an informed decision on whether CNC manufacturing is a good economic development opportunity for the Nuxalk Nation.

CNC manufacturing would only be considered for Bella Coola if it complements the current work of Nuxalk artists. The goal would be to increase both economic opportunities and appreciation of traditional Nuxalk art while avoiding any potential competition between CNC-manufactured products and hand-carved products. Hand-carved work is art, while CNC-produced products are decorative and/or utilitarian in nature. Input from Nuxalk artists will be an important component of this project and the project team will be visiting Bella Coola in December to meet with artists in the community.

Income from CNC products could be used to promote traditional carving and design skills in the Nuxalk community and provide support for training of Nuxalk youth in digital design and forest product manufacturing technologies.

Jamie Stephen, PhD undertook two research projects with the Nuxalk.

References

Bowyer, J., Bratkovich, S., & Fernholz, K. (2012). Utilization Of Harvested Wood by the North American Forest Products Industry. Minneapolis: Dovetail Partners.

Coburn, E. (2010). Market analysis for conifer oil production. (Organizational Consulting Project).

Vancouver, BC: Elemental Consulting