COMMUNITY STABILITY AND REGIONAL ECONOMIC DEVELOPMENT:

The Role of Forest Policy in the North Central Interior of British Columbia.

by

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ABSTRACT

Community stability in the sense of the long run survival of forest industry centres has often been declared an objective of public forest policy. It has been widely asserted that "community stability" can and does result from the practice of sustained yield forest management. Sustained yield also generally includes a requirement for an even annual flow of timber (equal to the annual growth). The implication is that stability of employment opportunities and incomes in the forest industry over shorter periods can also be attained as a result of the planned even flow of timber from the forests. This model of forest regulation has recently been defended and justified on this basis, particularly when criticism has been focussed on its obvious economic inefficiencies. It is argued here that even-flow regulations per se can not achieve the desired and anticipated effects on employment and incomes when the forest industry of a region produces primarily for a volatile export market and is also subject to economies of scale and location. However, in British Columbia, certain public policies and procedures introduced in the pursuit of technical objectives may have had substantial indirect effects on regional development and community stability through their influence on the corporate structure, geographic location and capital intensity of the forest industry.

Qualitative and quantitative (econometric) methods are used to analyse the socio-economic consequences of these changes, focusing particularly on employment - its stability, trends and

location - within a defined region. It was found that the logging, processing, assembly-repair and service occupations are the most relatively unstable, and that the instability of total unemployment has been much greater in a single-industry town than a diversified city. Furthermore, employment instability in the primary wood-using industries was found to be correlated with changes in the price of lumber destined for export markets. The conclusions emphasise that forest policies to regulate the short-run supply of timber from the provincial forests are not the most relevant to questions of stability of employment in the forest-related industries. The British Columbia Forest Service does not have exclusive control over regional development or "community stability". This analysis suggests that not only reappraisal of Forest Service practices and procedures, but also of its objectives and capacity to fulfil them, is indeed long overdue.

While the forest industry remains dominant in the regional economy, a wood products marketing agency or a price support scheme might contribute to community stability by buffering some of the exogenously induced shocks. However, for a number of reasons, it is considered that the most realistic prospects for attaining employment stability lie in the diversification of the regional economy. Since this cannot be accomplished costlessly, it remains to be decided by the political process how much community instability the people of British Columbia can afford and what steps they are prepared to take to attain more stability.

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Common Abbreviations.

A.A.C.	Annual Allowable Cut (cubic feet/year)
B.D.U.	Bone dry unit of wood chips (2000 lbs)
B.C.F.S.	British Columbia Forest Service
Cunit	100 cubic feet of round wood
LRATC	Long run average total cost
M.A.I.	Mean annual increment (cubic feet/acre/year)
M f.b.m.	Thousand feet board measure; volume of lumber or lumber estimated to be recoverable
P.S.Y.U.	Public sustained yield unit
SRATC	Short run average total cost
T.F.L.	Tree Farm Licence, formerly Forest Management Licence
T.S.L.	Timber Sale Licence
T.S.H.L.	Timber Sale Harvesting Licence

I. INTRODUCTION

My attention was first drawn to the topic of community stability by a number of headlines and articles in local newspapers in 1974, documenting the plight of numerous small towns in the interior of British Columbia. The local sawmill, the only major employer, had closed down all or part of its operations and the repercussions on employment and incomes throughout the district were being felt. My questions were what policy measures had been or could be used to prevent such apparent boom-bust cycles? Furthermore, what conditions had led to the evolution of such susceptible one company - one industry towns?

Fortunately there is quite an amount of revealing and/or analytical literature on British Columbia's public forest policies and community stability (defined in part to include the above example). Further, during the recent public hearings of the Royal Commission on Forest Resources, statements alluding to the "industrial stability" and community stability to be derived from certain forest tenure policies, yield regulations and timber disposal procedures were made by almost every participant from the forest industry. It occured to me then that the alleged relationship between public forest policy and the much-vaunted objective of community stability - a consistent theme of public policy discussions - has not yet been rigorously defined or analysed in the British Columbia context, and that such an analysis was long overdue.

This study begins with a broad examination of the objective of community stability and the role widely attributed to policies of forest management and yield regulation especially, in fulfilling that goal. The focus is then narrowed to the particular case of British Columbia where the objective of regional economic development has been added (sometimes explicitly but more often implicitly) to the purposes of forest management. The institutions, policies and procedures which have evolved in B.C. are then examined to ascertain whether the conceptual relationships between regional economic development, community stability and forest policy are logical, feasible and reasonable.

In order to focus more clearly on the issues, a particular region of the province - the North Central Interior - has been chosen for case study. This is a part of the province readily identifiable as an economic region, in which economic development has been dramatic, changes in the stability of employment and incomes and in the distribution of the rural population can be documented and the determinants of the changes (both forestry- and non-forestry- related) can be highlighted.

After a description of the region and its evolution, quantitative evidence is presented on the corporate and geographic structure of the forest industry, which can be related to the existing population distribution and recent developments. Data from the British Columbia Forest Service (B.C.F.S.)on the number of employees and man-months worked, by ranger districts within the study region, could provide rather crude evidence on trends over the last ten years. These trends

become more apparent when the data are stratified on the basis of the present structure (concentration and size) of the sawmilling industry in each ranger district.

The proposition presented is that employment opportunities, incomes and population density and distribution are largely determined by the location, size and structure of the dominant forest industry. This in turn may be dependent on transportation links, market conditions and many exogenous factors, as well as provincial resource management and tenure disposition policies. In some ways, this investigation overlaps that currently undertaken by the Royal Commission on Forest Resources, particularly under item 5 of its Terms of Reference (issued in Vancouver, May 1975).

> "5. The implications of these tenure arrangements for the structure of the forest industry, having regard to its pattern of integration, concentration, ownership and control; and for the structure of markets for forest products produced in the Province."

Narrowing the focus of the study still further, evidence on the stability of employment is presented by analysing the instability of unemployment in ten major groups of occupations, in the city of Prince George and the town of Quesnel. Attempts are then made to statistically correlate unemployment in total and in the service sector with changes in the level of activity or unemployment in the dominant logging and (wood) processing sectors. The analysis continues, seeking to document the source of fluctuations in these major forest industries, with the expectation that exogenous changes in the export demand for lumber predominate.

After examining employment instability in two centres shown to be forestry - dependent (typical of much of the region and, to a lesser extent, of B.C.) the scope of the study broadens again to extrapolate the causes of instability to the whole province. From this, alternative strategies to attain community stability if it is still an objective, can be considered. The implications for the "development" objective and the provincial economy in general warrant intensive examination.

II. COMMUNITY STABILITY AND YIELD REGULATION

Much of the U.S. literature on public forest policy, with particular regard to community stability through yield regulation, has been reviewed by Schallau (1974). Perhaps the most concise expression of the intent and purpose of yield regulation appears in the prologue to the Sustained Yield Forest Management Act (U.S.Congress,1944)...

> Be it enacted ... that in order to promote the stability of forest industries, of employment, of communities, and of taxable forest wealth, through continuous supplies of timber;...

However the same intent can be traced back to the Pinchot Letter of 1905[1] and others.

While it is not possible to reconstruct in detail all the arguments that shaped the history of B.C.'s forest policy, one can gain numerous insights into the forest policy - stability relationship as it was thought to exist. The most authorative statements for B.C. are to be found in the Reports of the Royal Commissions on Forest Resources (Sloan,1945,1956).[2] For example, Sloan (1945, p.128) concluded,

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[1] Letter from Secretary of Agriculture Wilson to Gifford Pinchot, Feb 1, 1905, cited by, inter alia, R.M.Alston (1972).

[2] Others who presented the argument here include Mulholland (1931, 1937) Orchard (1945) and Gilmour (1949).

> "... A sustained yield policy, perpetuating our forest stands, will not only provide a continuity of wood-supply essential to maintain our forest industries, primary and secondary, with consequent regional stability of employment, but will also ensure a continued forest-cover adequate to perform the invaluable functions of watershed protection, stream-flow and run-off control, the prevention of soil erosion, and of providing recreational and scenic areas, and a home for our wild bird and animal life."

He subsequently reiterated, (Sloan, 1957, p.90)

> "...The real purpose of our forest policy ... is social and economic rather than technical; it is the use of British Columbia forests for the maintenance of maximum and stable employment and profitable production of manufactured commodities..."

The concern for permanence or stability of the forest industry is evident in the province's early history. Mullholland (1928) noted,

> "The desirability of maintaining a permanent forest industry was realized twenty years ago, when a reserve was imposed upon all remaining crown timber. ... Sawmills are constructed to be written-off after a few years' cut, with no thought of creating a permanent industry. Undoubtedly there will be many more temporary logging and mill camps before the industry is properly settled on a permanent basis in the best economic locations ... Protection may be perfect and silviculture may be perfect, and yet without regulation, we may some day find ourselves without a merchantable stick to cut."

Similar concerns had been expressed as early as 1871, in a letter from Sir John A. MacDonald to the Premier of Ontario, cited by Orchard (1953, p.45).

> "The sight of the immense masses of timber passing my windows every day (rafting down the Ottawa River) constantly suggest to my mind the absolute necessity there is for looking at the future of this great trade ... What is to become of the Ottawa region generally, after the timber is cut away, one cannot foresee."

Orchard then argued that,

> "... In Canada at least, we have come to depend on wood for such a large part of our livelihood (ranging up to 50% in British Columbia) that any serious failure of the wood supply would be nothing short of disastrous to the Canadian economy."

While the preceding statements were made by people who were well informed and influential in determining government policies, there have been few publicly issued policy statements by the B.C.F.S. The most recent was

> "The objective of the British Columbia Forest Service as the forest administration agency for the government of British Columbia is to develop and enforce policies which will ensure for all time the proper balance of timber supply, forest recreation, wildlife protection and environmental preservation on the Crown forest lands of the province."[1]

However, there appears to be no way that the administrative procedures followed in allocating licences to cut Crown timber for sawlogs or pulpwood, in requiring adherence to minimum annual cuts or in offering protection to established operators[2] can be attributed to the objective stated here. One can only conclude that the B.C.F.S. has operated with other objectives which have not been officially stated. Thus the B.C. situation is somewhat different to that described by Le Master (1976) in

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[1] Statement in Forestalk, a newsletter published by the Information Division of the B.C.F.S. 1974. (emphasis added.)

[2] These are discussed in detail in the final section of Chapter Three, along with other administrative policies of the B.C.F.S. which appear to have influenced the development and stability of regional economies.

the United States. Legislation has recently been proposed there (Senate Bill 3091, sec.11) which appears to establish in law the principle of non-declining even flow. Previous legislation required sustained yield management on National Forests as

> "The achievement and maintenance in perpetuity of a high level of annual or regular periodic output of the various renewable resources of the National Forests without impairment of the productivity of the land."

In the pursuant regulations (Reg 36 CFR 221.3), each National Forest timber management plan is required inter alia to

> "provide, so far as possible, an even flow of National Forest timber in order to facilitate stabilisation of communities and of opportunities for employment."

It therefore seems that the U.S. legislation has explicitly stated the policy and underlying purpose of National Forest management which have to date only been implicit in the actions of the B.C.F.S.

One is led to conclude from this review of the literature that those who were responsible for the declaration of sustained yield as public policy, were not persuaded by technical ideals of the normal forest, or because foresters of the day considered it "good forestry". Rather they were convinced that sustained yield was necessary to perpetuate the resource, and sufficient to guarantee "community stability". The implementation of the policy has similarly been oriented to the community stability objective, although only by implication. As Haley concluded from his review of B.C. forest policy,

> Sustained yield, which has been a cornerstone of B.C.'s forest policy since 1947, is largely predicated upon the belief that such a policy promotes regional economic growth and "community

stability". [1]

However, it has proven extremely difficult to find any rigorous definition of "stability". While Schallau (1974) seemed to accept Kaufman's definition,

> "The term community stability as used here, implies orderly change rather than a fixed condition",[2]

it is not obvious that this is what was originally intended, in the B.C. context at least. Sloan's discussions of - and almost preoccupation with - ghost towns and the necessity of "stabilising the industry" i.e. reducing mobility, seem to indicate that his interpretation was more one of long run survival. Such a concept seems to still have some impact on B.C.F.S. approaches to certain problems, particularly in yield regulation and the tacit acceptance of the "non-declining flow" concept.

Few of those writing on the use of forest policy to stabilise communities have thought about the reasons for the existence of a community (village or town) - a fundamental question for all economic geographers. Given that a town serves the needs of its population and surroundings, its nature and even its existence surely change as the needs of the community change and its hinterland expands or contracts, particularly as transportation changes. This fact appears to have been largely

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[1] In Haley et al, Unpublished Report to B.C.F.S. Productivity Committee, July 1975.

[2] H.F.Kaufman (1953) p.117.

ignored by those writers hoping to ensure the permanence of communities through yield regulation.

Sloan also recognised a problem of short run instability - the boom-bust nature of the province's forest economy and regional development. This too he attributed to lack of yield control (Sloan 1945, p.127). Kaufman (1953, p.117) also argued that the absence of regulation "has in large measure produced the boom-bust cycle for forest industries". Mulholland (1931) argued in favour of sustained yield regulation that,

> "If it is desirable to develop and keep a steady market; to provide steady employment year by year; to secure a stable annual revenue; then the forests which are to provide them must be worked on properly constructed plans..."

One may reasonably conclude that these authors have indeed been using "stability" in two senses, i.e., permanence (long run) and the absence of sudden unexpected fluctuations (short run) although this distinction was never explicitly recognised. If it had been, perhaps an analysis of the potential of yield regulation to accomplish "community stability" would have appeared much sooner. In this thesis, short-term employment stability is taken as the focal point of social and political concern with reference to short run regional economic instability in general.

None of the authors cited above (or their many supporters and defenders) seem to have asked why yield control was or is necessary. Why was logging or sawmilling activity so variable? At the time of their writings the major causes of boom-bust were (just as they still are) fluctuations in individual's

expectations and in the demand and price for lumber.[1] Waggener (1969, p.13) concluded that,

> "The social costs of a migrating lumber industry in the early days of this century were largely responsible for the emphasis placed on obtaining stability in the forest products industry. Under economic conditions of the times, private industry sought individual profits and became highly mobile, leaving many towns stranded in its wake. Because of these social costs, community and market stability became one of the primary objectives of traditional forest management."

That is, the external social costs of a migrating industry were recognised. Yet if the residents of the small logging/milling centres could have anticipated relocation as the resource became physically or economically exhausted, facilities could have been built to be depreciated by that time. The problem arose because public expectations of perpetual existence of such communities were not met. The situation was aggravated by the widespread belief (e.g. Mulholland, 1931) that natural resources are the only source of development, and once they are depleted, the community is doomed.

The simple recitation of instances in British Columbia's early development when mills did cut out and get out, leaving a stranded community and facilities, in no way proves that

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[1] The problem of a transient industry was much less severe in the 1940's than it had been in the period 1880 to 1920's. To dissuade loggers/millers from moving on over the next hill etc. two strategies are obvious:
reallocate logging activity through time by yield regulation, or limit the resource base, i.e. convince the operators that there was nowhere else to go, forcing them to recognise the user cost of their actions. The removal of the open access characteristics of forests should have led to private readjustment in the intertemporal allocation of exploitation.

regulation would have kept the mill and town there in perpetuity, nor that it would have been socially desirable to do so. In those circumstances where mills have closed down due to market or technological changes, yield control seems merely to treat the symptoms, not the causes, of the problem. Yet the argument that yield control can and does provide for community stability persists, as evidenced by statements made in Briefs presented to the Public Hearings of the Royal Commission on Forest Resources in Prince George in 1975, by prominent members of the forest industry.

> "Forest policy should be developed to protect the industrial base of the community, with the dominant portion of the industrial base in the Quesnel area identified as being the existing companies who are equipped to use the entire forest profile...
> A forest area for the Quesnel community ... should be established and managed so as to ensure the continuity and permanence of the local resource base.
> The brief warned against the simplistic approach of maximising economic rent by overcutting in good markets, a theory which many economists seem to support. It stressed that the economic base must be maintained through systematic annual cutting, if the community is to be maintained."[1]

> "Overcommitment of the timber resource could have serious implications for community stability and the region's economic wellbeing ... (and urging a more intensive forest management program) ... the stability of existing forest-based communities is at stake, quite apart from the need to create additional

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[1] The preceding quotes are taken from a report on the Proceedings, prepared by Industrial Forestry Service Ltd. of Prince George, No.1, August 13, 1975.

job oppportunities in the years ahead."[1]

The obvious implications of the argument for stability through yield control are that the demand for forest products would fluctuate less if annual yields are equal, that the loss of public revenue through not cutting more during good markets is more than compensated for by the benefits of "stability" in processing[2] or that locational factors (especially transportation economics) would not encourage a plant to close or relocate, as long as equal yields are available locally. The popularity of the contention that yield control contributes to community stability suggests that many foresters (and some planners) fail to consider regional development economics and location theory (if they mean long run survival), or market cycles and industrial organisation (if they mean short run stability). As Lewis (1974) noted, stability has been discussed in terms of annual cuts, employment and incomes. There is no obvious direct relationship between the three, they are not equivalent, and stability in any one may well induce instability in another.[3]

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[1] D.L. McInnes, President of Weyerhauser Canada, quoted in Vancouver Sun, Friday october 3, 1975, p.27.

[2] Despite the fact that equal annual cuts are not rigidly enforced but are allowed to vary within 50% annually and 10% over 5 years.

[3] For example, see Waggener (1969) pp.13-18.

Yield Planning In British Columbia.

The preceding review has established that British Columbia's forest policy is firmly committed to yield regulation of public forests with the intent of preventing depletion of the resource, promoting the permanence or survival of communities and minimising short run fluctuations in employment and incomes in timber-based industries. It therefore seems most relevant to observe how these intents have been translated into practice. One may then analyse the appropriateness of British Columbia's policies and institutions to the social objectives to which they have been addressed.

Figure 1 examines the planned, preferred and feared trends in harvests from B.C.'s forests which are implicit in the procedures followed. From an examination of the yield calculation procedures used by the B.C.F.S.[1] one could infer that their long range yield planning can be represented by Figure 1a. Annual allowable cuts (A.A.C.s) are calculated such that a constant even flow of timber will be possible for the entire old-growth conversion period, allowing (very conservatively)[2] for all sorts of eventualities (such as "land withdrawals" for parks and other uses during the remainder of the current rotation, regeneration delay, roads and fire losses). The area-volume allotment check must indicate that the

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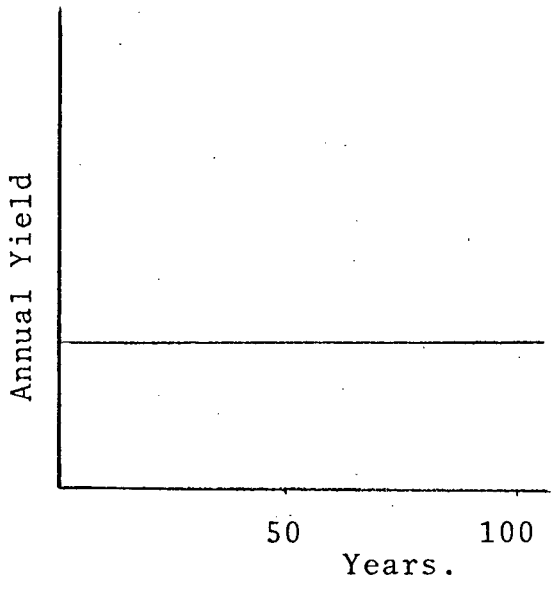
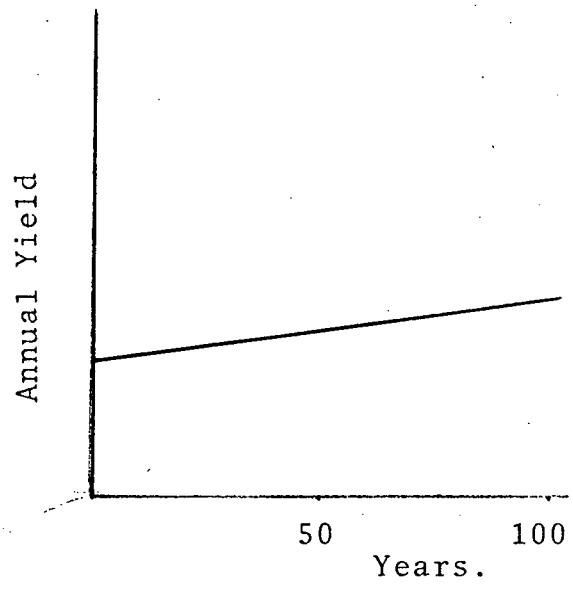
[1] Royal Commission on Forest Resources Background Paper, (1975).

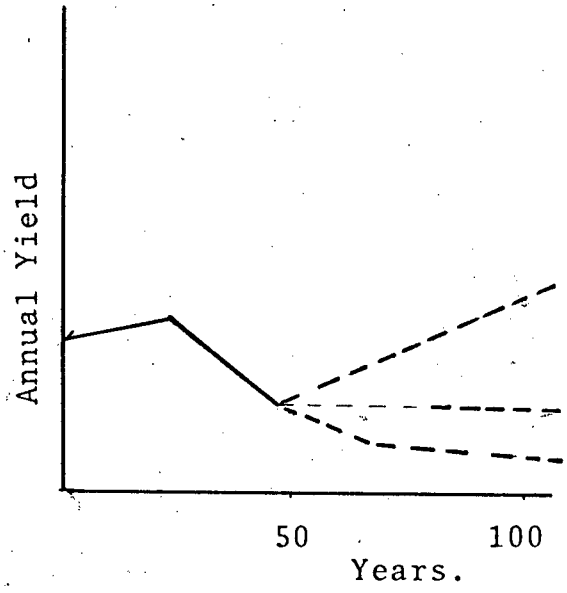
[2] As noted by Smith (1975).



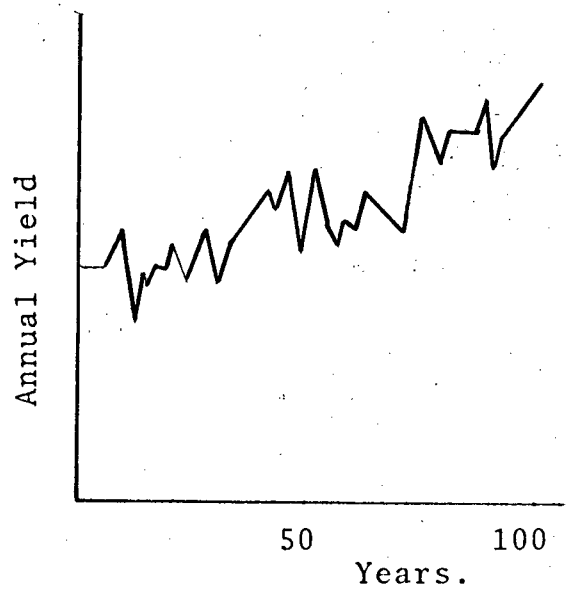
1a. Planned



1b. Preferred.



1c. Feared.



1d. Actual.

Figure 1. Alternative Harvest Strategies for a Forest Management Unit in B.C.

indicated A.A.C. could be harvested every year to the age of culmination of mean annual increment (M.A.I.) plus/minus 1%. Thus it can be concluded that the B.C.F.S. plans for a stable (static?) yield, and implicitly assumes fixed factor proportions for logs and labor to give constant production levels for 80 to 100 years.[1] Thus the objective of community stability is "satisfied", because the same amount of labour will always be required to process the annual cut. That is, prospects for increased labour productivity are ignored.

While the B.C.F.S. may be deliberately erring on the side of conservatism in calculating and planning the even flow of timber from public forests, one can infer that the B.C.F.S. administration considers that a growth trend, or expanding yields as in Fig. 1b, would be socially preferable. Such growth could come through expansion of the extensive or intensive margin as more remote or inaccessible stands are brought into the "management fold" and the productivity of forest land is varied through intensified silvicultural management. Since such a growth trend could provide the stimulus for regional development, if one again naively assumes fixed factor proportions and output coefficients, the Forest Service's assumed responsibility for regional development would appear satisfied. That is, employment would have to expand to process

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[1] However, somewhat paradoxically, the B.C.F.S. recognises the inevitability of change in that there are provisions to revise A.A.C. calculations every ten years. That is, with each decade a new perpetual plan is produced, in which constant rates of cut are assumed.

the increased annual cuts. This assumption that the Forest Service has a major role in regional development and its apparent insensitivity to the complexity of the economic processes involved, is evidenced by the statement:

> "Development of railroad transportation into northern areas of the Province is improving the feasibility of establishing new industries in that area, thus creating a demand on the forest resource. Reviews are in progress to establish further sustained yield units as demand develops."[1]

The desirability of bringing forest management and harvesting to remote northern and, in many cases, submarginal forests is implicit in this statement, as it has been in many B.C.F.S. activities and procedures. That is, it has been assumed the expansion of the extensive margin of operations can be, and should be hastened, for silvicultural reasons and to expand total provincial production in terms of volume, if not in terms of net value.

The informal but strongly held requirement for non-declining yields indicates again the supposed relationship between wood harvest and (an immobile) labour force over a long period. A decline in future yield of any particular management unit is presumed to be in conflict with the vaguely defined objective of stability about a growth trend. Perhaps forest managers have been unable to reconcile the gradually declining importance of some towns or areas, with overall provincial or regional development objectives. Thus any yield "falldown" at

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[1] B.C.F.S. Annual Report (1972), p.48.

any future date (as in Fig.1c) is held to be undesirable, though expected in many cases, and is provided for by the ten-yearly revisions of A.A.C.s. Two questions for discussion elsewhere, are whether it is likely to occur [1] and whether it will really matter to the industry, labour force and/or regional economy, if indeed a falldown does occur in some forest management units.[2]

Concern for regional stability, balance or non-declining timber flows is highlighted by the enforcement of A.A.C.s on the basis of (relatively small) P.S.Y.U.s. Although the total cut from P.S.Y.U.s in the province is considerably less than the conservatively estimated A.A.C. (10,728,109 cunits of a possible 21,238,630 cunits in 1974), logging activity in some regions has been severely constrained, while being encouraged in other areas.

Robinson (1972, p.5) noted that,

> "As in other mining regions, individual mines close and new ones open but the coastal area as a whole remains a producer."

This is in complete contrast to the case of forestry, where

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[1] The U.S.F.S. Forest Regulation Study (1973) inter alia suggested non-declining timber cuts following an initial drop in allowable cuts. Zivnuska (1975, p.4) noted that an immediate reduction in cut to avoid a feared future reduction, would only be rational in an economy characterised by a large negative rate of social time preference. The future reduction is not avoided, merely brought back to the present where its costs are maximised.

[2] See Schallau, Maki and Beuter (1969). Yet if log supply declines, output/log rises and labour required/output falls, all by uncertain amounts, is there a reliable basis for forecasting future regional trends in employment or location? The crucial issue is whether any labour displaced from sawmilling will have local alternative employment opportunities.

every management unit is required by legislation to be perpetual, in order to keep the region, as a whole, producing.

The actual trend in yield from interior P.S.Y.U.s is stylistically illustrated by Fig.1d. At any particular level of A.A.C., variations of plus or minus 50% are allowed in any one year, though actual cut is required to be within 10% over five years.[1] Thus any major overcut must be followed by successive years of "undercutting". With advances in utilisation standards, silvicultural practices or a new inventory, the allowable cut is increased resulting in a series of erratic plateaus.[2] Reed and Associates (1975) presented data (reproduced here as Figure 2a) on the volumes of timber harvested in B.C., on the Coast and in the Interior, which strikingly demonstrate the increasing trend of timber harvests and periodic fluctuations about the trend.[3] Yet the irrelevance of thirty years of Sustained Yield forest management and even-flow yield planning has apparently been ignored, as long as the harvest has been expanding. Despite evidence such as this, the B.C.F.S. continues to plan for even flow and, in many cases, imposes strict constraints on that

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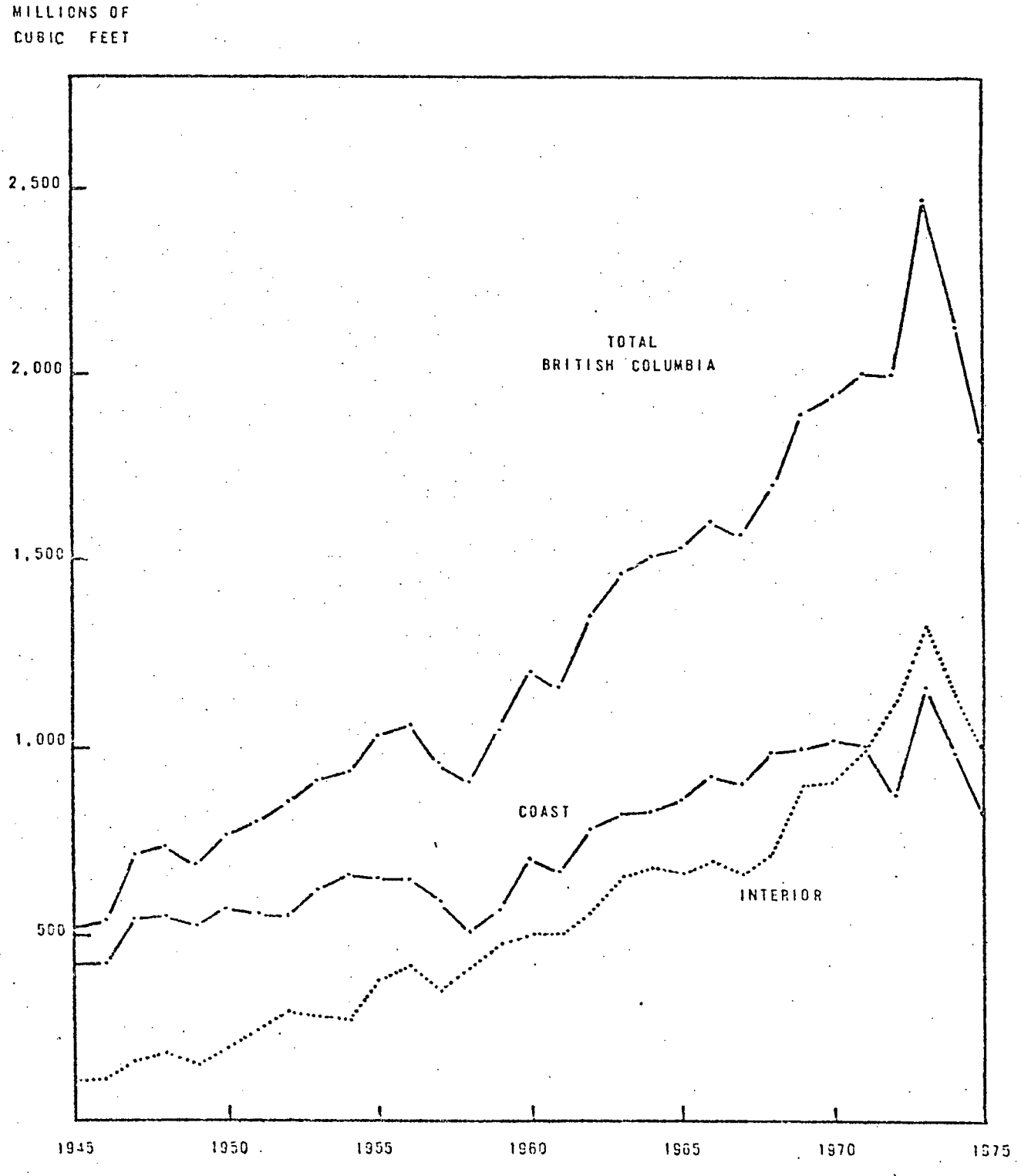
[1] Royal Commision Background Paper (1975), op cit.

[2] The nature of the very large increases in allowable cuts attributable to close-U (up to seven-fold in eight years in some interior P.S.Y.U.s) is discussed in Chapter 3. The volume and method of disposition of this new-found timber appear to have had profound ramifications on the interior forest industry's structure.

[3] This observation is supported by Figure 2b which shows increasing but widely fluctuating production of lumber in the Northern Interior.

Figure 2a. TIMBER HARVEST



Source: F.L.C. Reed and Assoc. (1975).

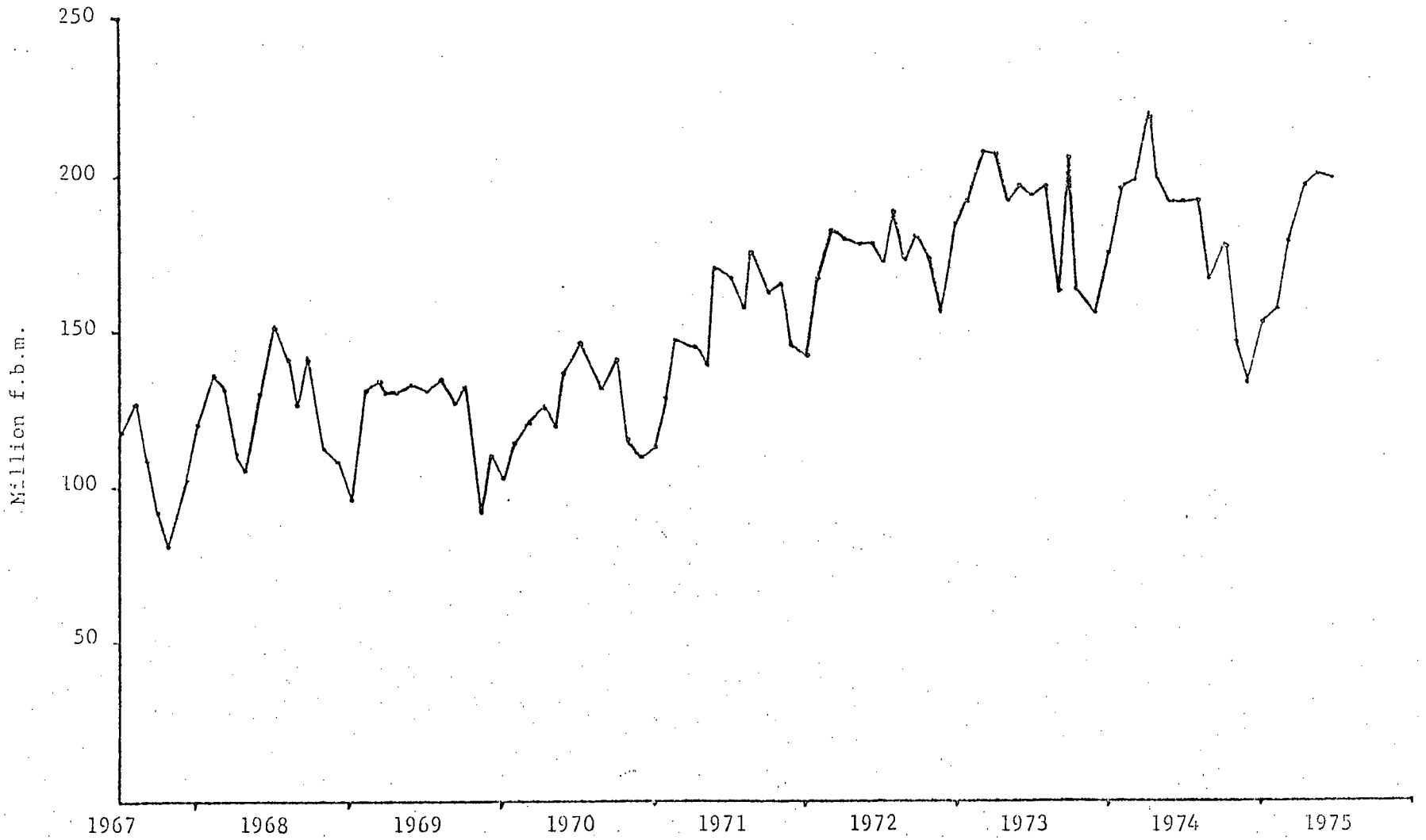


Figure 2b. Monthly Production of Lumber and Ties from Northern Interior Mills: 1967-1975.

Source: Compiled from "Production, shipments and stocks on hand in British Columbia." Statistics Canada Series 35-003.

basis.

The fact that sustained yield as implemented in B.C. allows limited flexibility does not rationalise the objective of even-flow per se. As Waggener (1969, p.13) noted,

> "If sustained yield was rigidly practiced, the entire market adjustment would fall on price. Price fluctuations would be more severe than under more flexible harvesting. Economic uncertainty would be increased, and the financial incentives to invest in forestry would be reduced."

The relationship of this type of "yield planning" to community stability is far from obvious, in these circumstances.

From this brief review, it appears that British Columbia's forest yield planning bears little relation to actual harvests. That is, its usefulness in meeting the socio-economic objective of community stability is very limited. In British Columbia the concept of the Public Sustained Yield Unit (P.S.Y.U.) has evolved as the basic unit of forest yield planning, from which regional economic development and community stability are expected to follow. All the logs from the P.S.Y.U. would be processed in the (little) mill or mills of the (little) town, in approximately equal volumes every year, thereby providing stable employment opportunities for the local residents for all time. [1]

Under what circumstances would this scenario be appropriate? Firstly, there should be uniform demand for the product - there should be no business or construction cycles or

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[1] This was explicitly recognised and supported in some of the briefs to the Royal Commission on Forest Resources, e.g. that of the City of Prince Rupert, September 12, 1975.

changes in export markets. Thus either a world of no trade and local self-sufficiency [1] or participation in stable export markets would be appropriate. Secondly, there should be no technological changes in processing and no substantial changes in relative factor prices, since changes in factor proportions or output coefficients in logging and processing would, among other things, upset the requirement for a stationary labour force (or if the population of the village is to grow, then technical change should lead to greater labour intensity). Thirdly, to maintain this scenario, there should be no changes in transportation technology or costs, or in the location of transport routes. Any of these could influence the economies of localisation or urbanisation[2] to be gained through relocation of the village mill.

There are, no doubt, other conditions which could be specified, but briefly the above characterise sustained yield in its original context, as a stationary,[3] self-sufficient regional economy constrained by transportation possibilities, under which circumstances it seems quite appropriate. Yet this concept, illustrated in Figure 3, has apparently been the basis of B.C.'s

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[1] This was the case in many fourteenth and fifteenth century European communities from which the sustained yield concept originally evolved. See Haley (1966).

[2] See W.Alonso (1964) or H.W.Richardson (1969),pp 70-87.

[3] The concept of endogenously induced technological change as an innovative response to factor scarcity, appears to have completely eluded forest regulation models, despite ample evidence that it is occurring and ongoing.

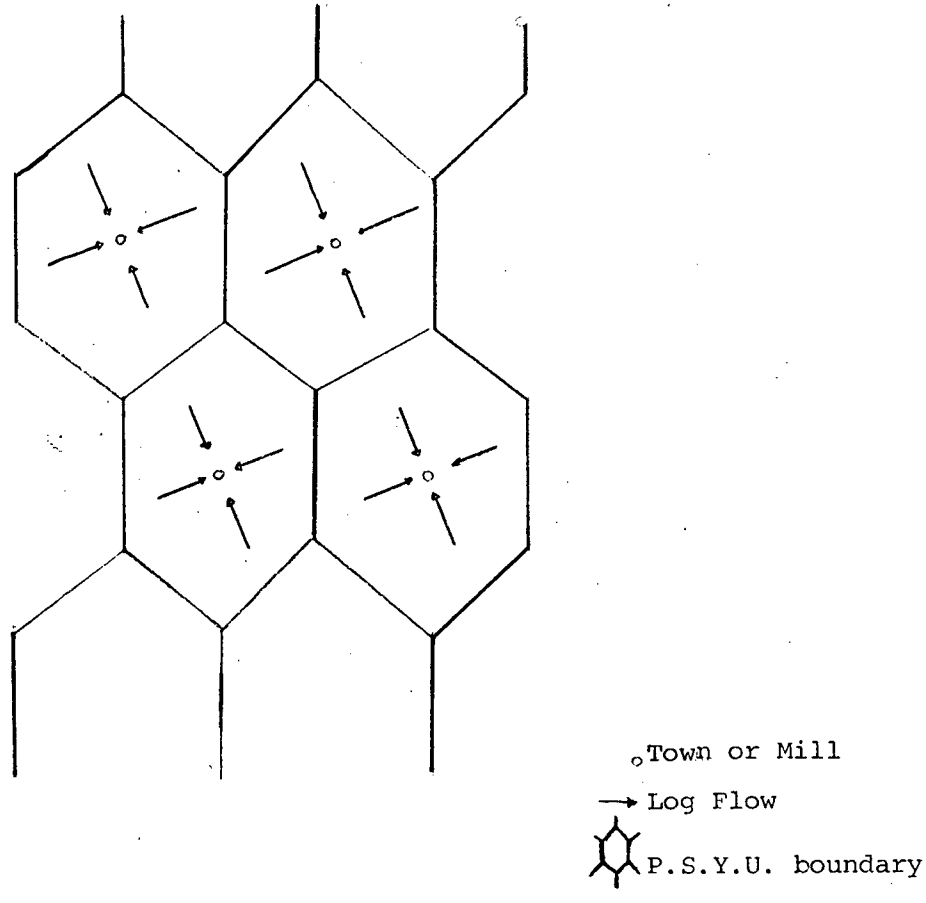


Figure 3. The Original P.S.Y.U. Concept.

yield regulations, although almost all economic characteristics, especially transportation and relative factor prices, are quite different in the two cases. It must also be noted that all these criteria for the circumstances under which sustained yield is appropriate, rely explicitly or implicitly on the assumption that timber industries will remain a dominant, if not the only, basic sector in the regional economy. This again need not necessarily apply in all regions of British Columbia.

The belief that natural resources (particularly forests in the case of British Columbia) are the source of all development and social wealth is extremely pervasive in the sustained yield literature. "Without its natural resources, a community will surely fade away and development will cease." The possibility of moving society's assets from the form of timber into alternative forms, was rarely considered.

> "... sawmills convert trees into pay-cheques which are spent in British Columbia. Every living tree is unspent money. This natural wealth is shared by everyone when the tree is converted into saleable products. However, we should not touch the capital, but use the interest, which is annual growth."
>
> "Apparently, once a nation has finally destroyed its forests, it never has the hardihood of character to struggle through 100 years of rehabilitation. Erosion and other attendant evils of deforestation weaken the economy, and the possibilities, instead of improving, get progressively more hopeless."
>
> "... to balance income against expenditure, growth against harvest, is the only way to keep out of the poor-house, unless we have another sure source of income to which we can turn after we have dissipated our existing capital."

In these statements and many others, Orchard (1945, 1949)

continually refers to the dissipation of the forest wealth, never to reallocation to more productive or more necessary assets such as schools and roads.

Neither did he consider whether the forest inventory must be perpetually maintained at its pre-settlement levels. Thus, it is also noteworthy here, that the British Columbia Forest Service has long endeavoured to bring all land capable of supporting a forest crop under active (although extensive) forest management. Unlike many other jurisdictions, B.C. does not seem to recognise the concept of "vacant crown land", being that which does not economically warrant management for a particular purpose. When Orchard (1945, 1949) expounded the four basic principles of forest management, they included

> "1. All productive lands must be kept continuously under growing crop. ...
> 3. The crop must be so handled and harvested so as to get the maximum recovery."

It has been widely held that only in this way can the maximum wood yield/year be obtained from the province's forests. Yet both objectives lack any economic dimensions or criteria. Thus, "all the lands of the province that will find their highest use under forest crop shall be classified as 'Forest Lands'" (Orchard, 1945, p.25), although the value in that use may be less than the returns obtainable from alternative management efforts. That is, it is possible that the B.C.F.S. has dissipated part of its funds and perhaps more importantly, much of its energies, in administering, inventorying and attempting to market the timber from marginal forests, when it could have concentrated its efforts on highly

productive sites close to markets.

The questions of "How many acres of commercial forest land should British Columbia have?" and "How intensively can we afford to manage each acre, given our limited financial and manpower resources?" have scarcely been asked,[1] least of all analysed. While the stocking density and species composition of the original forests have been recognised as non-optimal, the initial acreage of forest is presumed to indicate the optimal inventory of standing timber.

In this chapter it has been shown that British Columbia's forests are managed for socio-economic and conservationist objectives, i.e., industrial and community stability and survival and prevention of depletion respectively. Yet the policies and procedures used were more appropriate in vastly different eras and countries, and can contribute little to the "community stability" objective so often proclaimed in British Columbia. It is possible that the imposition of these policies has severely constrained and confused discussion of where, how much and when to harvest British Columbia's forests, with consequences on the local labour force and population which have been undetermined to date.

---

[1] The answer to the second question lies in investing in each forest unit to the point that the values of the marginal product from each are equal.

III. THE NORTH CENTRAL INTERIOR OF BRITISH COLUMBIA.

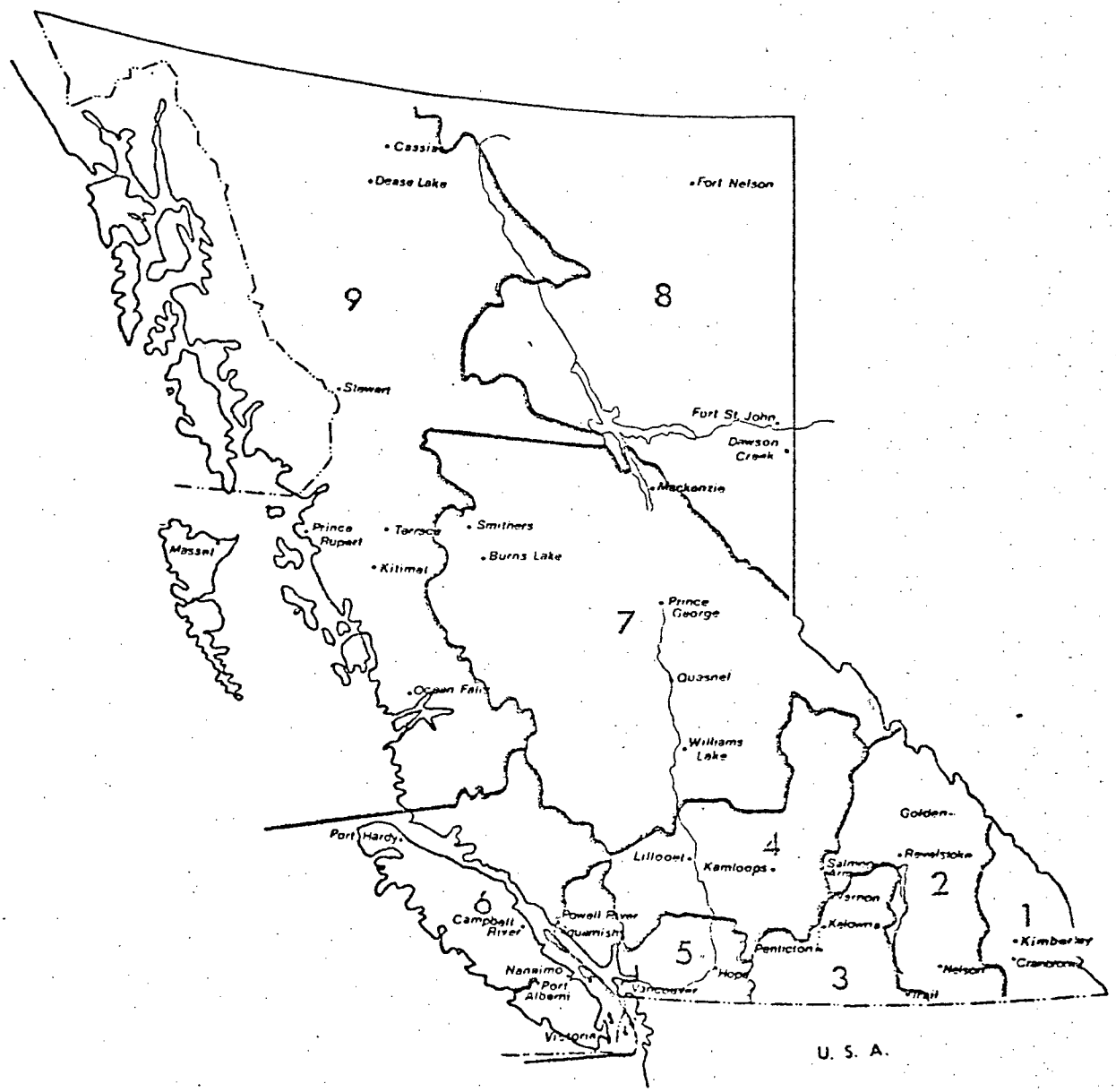
For the purpose of illustrating the general relationships between government policies towards the use of forest resources and regional economic development and stability, an area of the province was chosen for detailed case study. The North Central Interior - Region 7 in Map 1 - was selected, as it appeared most suitable for the discussion of the following issues:

> rapid population growth and regional economic development based on the industrial use of forest resources;
>
> the dependence of a regional economy on one major industrial group (logging and wood processing);
>
> the instability of employment and incomes in the short run which could result from such dependence, if the demand for local production fluctuates in response to exogenous factors; and
>
> changing patterns of population distribution as the forest industry relocates in response to locational factors and administrative direction.

The Study Area

Region 7 as defined in Map 1 is in fact the sum of three Census Divisions which correspond to the three Regional Districts of Bulkley - Nechako, Fraser - Fort George and Cariboo. These Regional Districts, with their offices in Burns Lake, Prince George and Williams Lake respectively, were defined by the Provincial government in 1965 to incorporate existing school and hospital districts, which "presumably have a common

Map 1. British Columbia Economic Regions.



Source:

DEPARTMENT OF INDUSTRIAL DEVELOPMENT, TRADE, AND COMMERCE

identity, similar socio-economic patterns and communications networks".[1] Economic Development Region 7 lies within three Resource Management Regions, viz. Skeena, Ominica - Peace and Cariboo, which approximate the Forest Districts of Prince Rupert, Prince George and Cariboo used prior to January, 1975. However, these administrative regional boundaries of the Forest Service and the Environment and Land Use Committee, which cover the entire province north of 53° North latitude, are inadequate for examining the regional economic implications of forest policy. A smaller region, such as Economic Region 7, of relative economic homogeneity and independence, is required. The towns and villages of this region, with the possible exception of the South Cariboo and Williams Lake, are predominantly reliant on the forest industries, and dependent on Prince George - the only large city in the region - for higher order goods and services. This region was found to be consistent with the "city - region theory", in which an economic region is defined by the interrelationships between the major city, its satellites and their hinterlands, in terms of infrastructure and the flow of goods and services.[2] Whether these "economic regions" are correctly defined is a most interesting problem in economic geography. Yet whether real or arbitrary, they are *ipso facto* the regions for which data exist, the source of our knowledge and problems, and the regions to which major policy decisions

---

[1] Parker (1968) p.18.

[2] Haley *et al* (1975) p.10.

will be applied.[1]

The central location of Prince George at the junction of the British Columbia and Canadian National Railways and of the Yellowhead and Cariboo Highways, has contributed substantially to its development as the service and distribution centre of the region, with a hierarchial structure of towns and villages focused towards it. Recent population statistics for the centres in the region are presented in Table 1 and the hierarchy of functions performed by each is reflected in Tables 2 and 3. In addition, the following estimates by the Prince George Chamber of Commerce (March 31, 1975) illustrate the size of Prince George's forest industries relative to its population.

Population of Prince George City	65,000
Population of Metro Prince George	71,700
Population of Trading Area	160,000
Employees in the logging industry	2,600
Employees in sawmills	5,000
Employees in the pulp and paper industry	2,400

While it is undoubtedly a major resource processing centre, its role as a distribution and service centre does seem at least as significant.

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[1] The fact that the Environment and Land Use Committee, charged with "social and economic development consistent with the protection and preservation of a desirable environment" (Stokes, 1971, p.7), excluded until 1975 the B.C. Department of Economic Development, has not greatly facilitated regional analysis and policy implementation.

Table 1. Population Statistics for Northern British Columbia.

Census Division	1951	1961	1971	Annual Growth Rate(%) 1951-71
1. Bulkley-Nechako	12,075	17,437	27,145	4.13
2. Cariboo	13,086	27,103	39,357	5.66
3. Fraser-Fort George	14,801	31,726	64,364	7.63
4. Peace River-Laird	14,625	31,352	43,996	5.66
5. Kitimat-Stikine	9,669	23,031	37,326	6.99
6. Stikine	804	1,224	1,470	3.06
7. Skeena A	13,295	17,592	22,299	2.62

Source: Statistics Canada - 1971 Census.

Table 2. Employment by Major Occupational Groups in Quesnel and Prince George, 1971.

	QUESNEL			METRO PRINCE GEORGE		
	Male	Female	Total	Male	Female	Total
1. Management, Teaching, Medical and Technical	200	155	355	1325	1015	2340
2. Clerical	60	240	300	600	1775	2375
3. Sales	155	100	255	1250	440	1690
4. Service	160	130	290	835	945	1780
5. Farming	0	0	0	25	30	55
6. Primary*	155	0	155	305	20	325
7. Processing, Machining	300	5	305	785	15	800
8. Assembly, Repair	160	0	160	1005	15	1020
9. Construction	220	0	220	1310	10	1320
10. Transportation, Unclassified, Not Stated	410	80	490	2175	555	2670
TOTAL			2530			14375

* Occupational Group 6 is dominated by Logging and Forestry.

Source: Statistics Canada - Economics Population Labour Force File 1971.

Table 3. Percentage Employment by Principal Sectors in Major Centres, 1971.

Centre	Primary	Manuf.	Service
Houston	18.1	30.2	44.1
Kitimat	2.3	52.9	38.6
MacKenzie	10.3	34.8	41.1
Terrace	13.1	13.3	63.9
Quesnel	7.6	24.2	61.0
Smithers	8.2	6.0	76.0
Williams Lake	5.1	14.3	80.0
Burns Lake	6.2	8.2	79.4
Fort St. James	20.7	20.7	42.2
McBride	9.5	7.1	73.8
100 Mile House	7.4	16.5	63.5
Valemont	14.5	23.6	61.8
Vanderhoof	8.2	12.2	71.6
Prince George	4.9	17.3	69.8

Source: Statistics Canada - Economics, Population, Labour Force File 1971

A Brief Economic History Of The B.C. Interior Forest Industry.

From an examination of the history of the Interior forest industry, the appropriateness of the P.S.Y.U. model discussed in Chapter II above can be further considered. The North Central Interior provides an excellent illustration and the policies and events in the years prior to the 1950s seem very relevant to the issue.[1]

Prior to 1908, the North Central forest industry consisted of quite a number of very small mills scattered along what is now the CNR rail line, producing mainly ties. (There was also a good deal of speculative holding of forest land.) Through to 1939, mill location was determined primarily by raw material supply and access. Because of the poor quality of roads and the fact that the expense of the prevailing transport technology was not warranted for the extraction of low-value logs (and because of the general absence of cheap water transport) the areal spread of the industry was restricted. Of necessity, logging and milling were very closely associated, with an average log haul less than two miles. Mills were small, although some analysts, including Mullins (1967) argued that they were overcapitalised considering the small and volatile export markets. The low lumber prices of the 1928-40 period generally led to contraction or stagnation of different components of the industry.

---

[1] This historical analysis draws heavily from Mullins (1967). Among the many other authors are Eckardt (1967), Haley (1971), Hardwick (1963), Lewis (1974), Nagle (1970), Orchard (1959, 1964), Robinson (1971) and Siemens (1972).

The period 1940-57 was characterised by areal dispersion due to the unexpected but sustained increase in demand from the U.S.A. and Britain for wartime facilities followed by the post-war building and housing boom.[1] Over six hundred new portable mills, with 3-8 employees each, appeared in the North Central Interior, mainly along the new (1952) PGE railway[2] and the Hart highway. For example, in 1948 there were 33 mills within thirty miles of Quesnel; in 1954 - 180 mills (and now there are five, all in Quesnel). While logging and sawmilling remained spatially and frequently corporately linked, their rough product was transported to centrally located (but usually separately owned) planer mills, processing the output of up to thirty independent mills. For example, on Prince George's "Planer Row" in 1954, seventeen planer mills dressed 75% of the region's output and shipped it out by rail. While there was wide dispersion of these smaller mills out into the resource base,

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[1] The U.K. market is no longer of major importance to the Interior industry although some lumber is exported via Vancouver. However Mullins (1967) documented the importance of the U.K.'s wartime lumber demand in the early expansion of the interior sawmilling industry.

[2] The Pacific Great Eastern Railway, now the British Columbia Railway was constructed as far north as Quesnel in the 1920s, but with this extension to intersect the CNR at Prince George, its effect on the forest industry was enhanced.

and small towns appeared,[1] "growth nodes" were already becoming apparent, in these regional processing centres. At this stage, there probably was a mill, of sorts, and a settlement of some kind, even if only a logging/milling camp, in each P.S.Y.U. or provincial forest. A 20 year old map of the province illustrates the wide areal dispersion of small communities in this region, most of them focused on sawmills. The spread of the industry in the fifties and early sixties (and its subsequent contraction) is documented in Maps 2a - 2d (the first three being reproductions from Mullins, 1967).

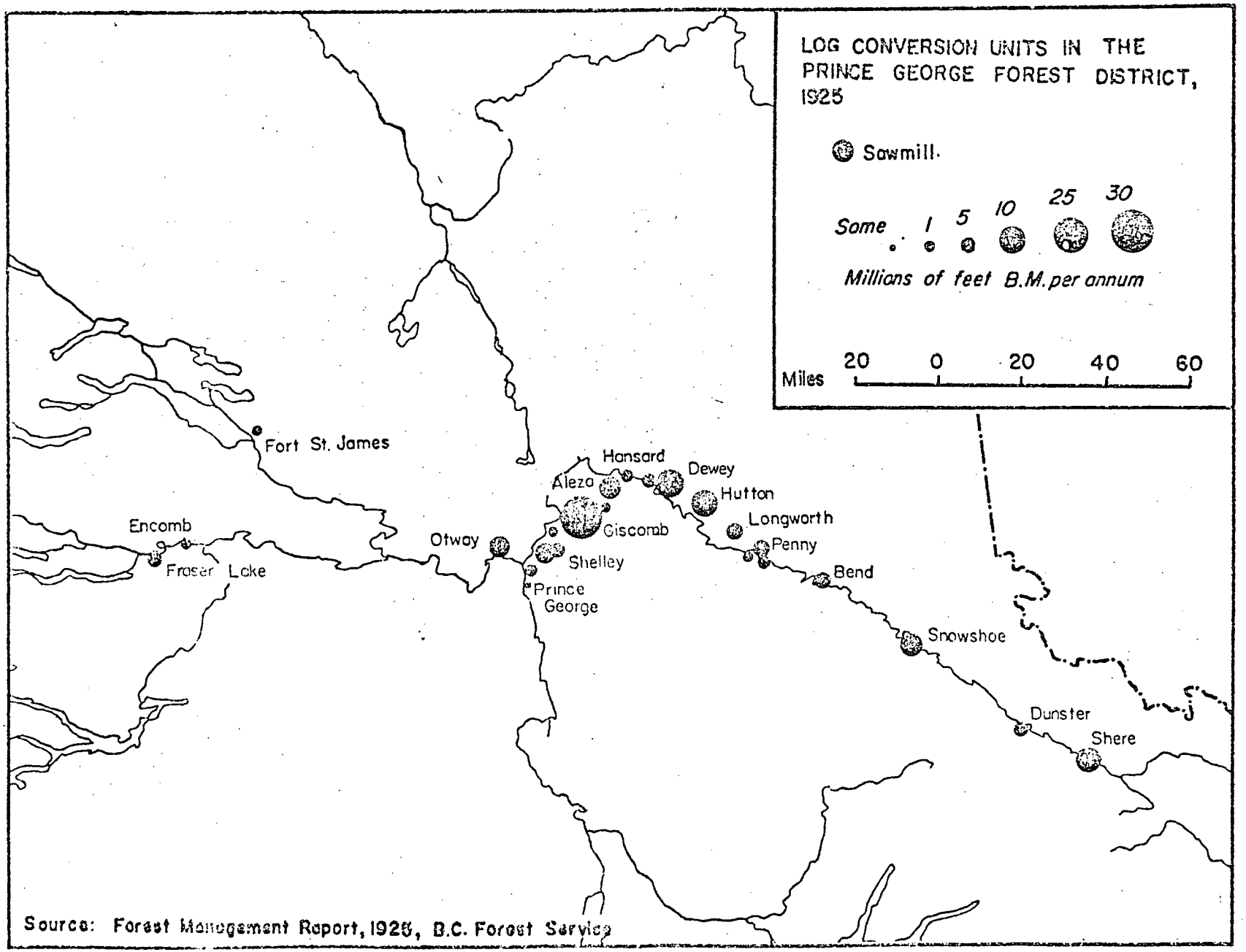
The determinants of these changes are analysed below. They include changes in the costs of transportation, increasing quality of the products sold in export markets, technological change which produced significant economies of scale and changing labour force requirements.

1. Transportation was revolutionised, especially with the improved general quality of the roads. Also, with the invention of the diesel logging truck, logs were no longer much more expensive to haul than lumber (and the volumes and values recoverable were increasing simultaneously). As a result, the (portable) mills no longer had to locate at the source of logs (as would be predicted by location theory on the basis of value/weight or bulk ratios).

It has been estimated by Mullins (1968, p.102) that in the

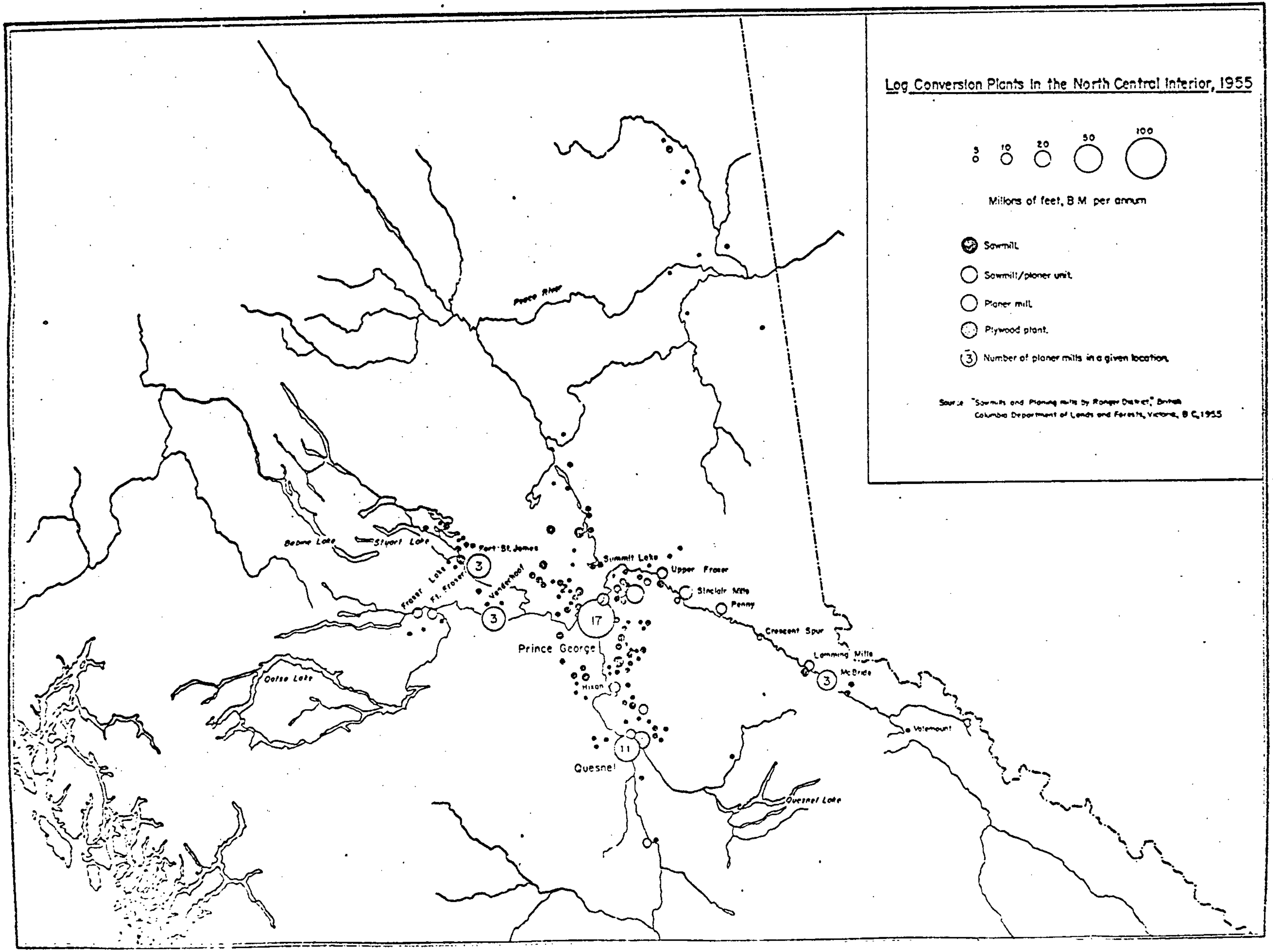
---

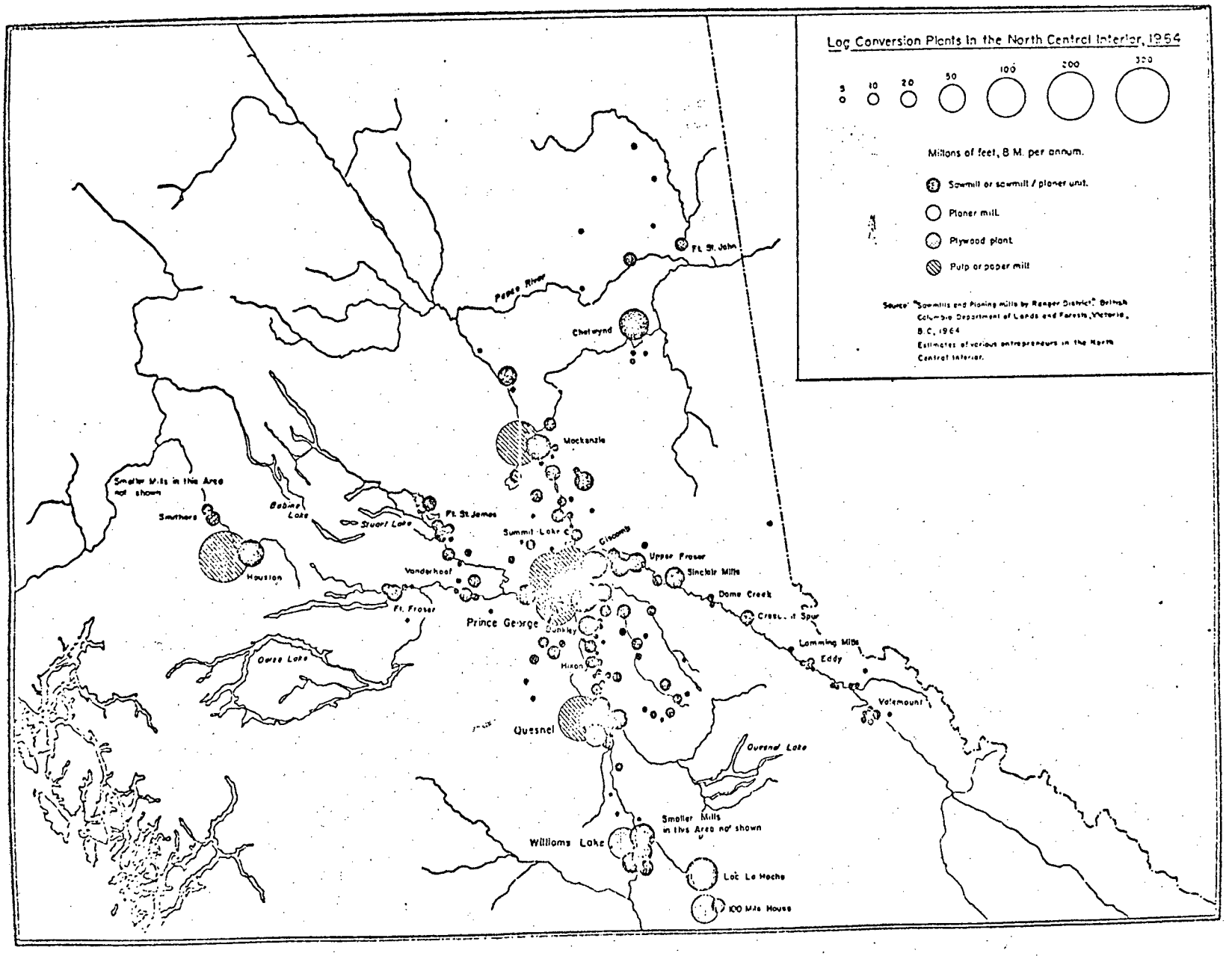
[1] Some of these small towns were little more than logging camps. However Webber (1960) documented the creation of the village of Bear Lake, on the Hart highway within the Crooked River P.S.Y.U. This was to establish a stable and attractive site for the labour force of eight new mills in the immediate vicinity. Although many of these mills have since closed, the village of Bear Lake still persists.


LOG CONVERSION UNITS IN THE PRINCE GEORGE FOREST DISTRICT, 1925
Sawmill.
Some
1
5
10
25
30
Millions of feet B.M. per annum
Miles
20
0
20
40
60
Fort St. James
Hansard
Dewey
Aleza
Hutton
Longworth
Giscomb
Encomb
Otway
Penny
Shelley
Fraser Lake
Bend
Prince George
Snowshoe
Dunster
Shere
Source: Forest Management Report, 1925, B.C. Forest Service

Map 2a.

Map 2b.

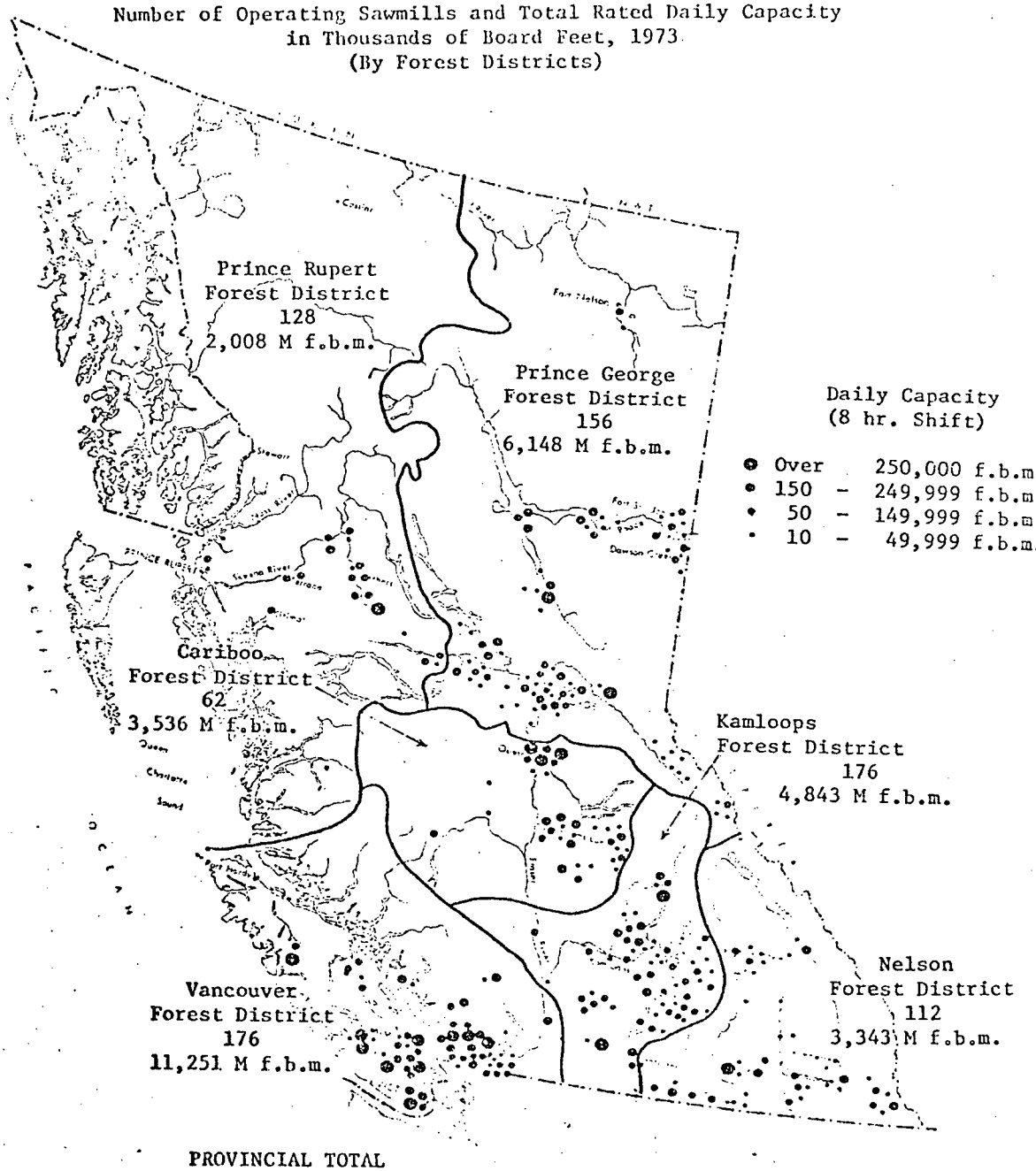

Log Conversion Plants in the North Central Interior, 1955
5
10
20
50
100
Millions of feet, B.M. per annum
Sawmill.
Sawmill/planer unit.
Planer mill.
Plywood plant.
3 Number of planer mills in a given location.
Source: "Sawmills and Planing mills by Ranger District," British Columbia Department of Lands and Forests, Victoria, B.C., 1955
Peace River
Babine Lake
Stuart Lake
Fort St. James
Fraser Lake
Ft. Fraser
Vanderhoof
Summit Lake
Upper Fraser
Sinclair Mills
Penny
Crescent Spur
Lamming Mills
McBride
Valemount
Prince George
17
3
3
3
Hixon
11
Quesnel
Ootsa Lake
Quesnel Lake


Log Conversion Plants in the North Central Interior, 1954
5
10
20
50
100
200
300
Millions of feet, B.M. per annum.
Sawmill or sawmill / planer unit.
Planer mill.
Plywood plant.
Pulp or paper mill
Source: "Sawmills and Planing Mills by Ranger District" British Columbia Department of Lands and Forests, Victoria, B.C., 1964
Estimates of various entrepreneurs in the North Central Interior.
Ft. St. John
Peace River
Chetwynd
Mackenzie
Smaller Mills in this Area not shown
Smithers
Babine Lake
Stuart Lake
Ft. St. James
Houston
Vanderhoof
Summit Lake
Giscome
Upper Fraser
Sinclair Mills
Dome Creek
Ft. Fraser
Prince George
Dunkley
Hixon
Lamming Mills
Eddy
Owen Lake
Quesnel
Quesnel Lake
Williams Lake
Smaller Mills in this Area not shown
Loc La Hache
100 Mile House

Map 2c.

Map 2d. SAWMILLS IN BRITISH COLUMBIA.

Number of Operating Sawmills and Total Rated Daily Capacity
in Thousands of Board Feet, 1973
(By Forest Districts)



PROVINCIAL TOTAL

Number of Operating Sawmills 810

Rated Eight-Hour Daily Capacity 31,129 M f.b.m.

Source: British Columbia Forest Service, Victoria.

early sixties, it cost $7/M f.b.m. more to move logs than for lumber, over a forty mile haul. [1] Information on the current price differential between log- and lumber- transportation rates was provided by the Appraisals Division of the B.C.F.S. In the Prince George area, the cost allowance for lumber transport over a fifty mile round trip, empty one way and including loading and unloading, is approximately $4.00/M f.b.m. A comparable haul of logs is estimated to cost approx. $15.00/M f.b.m. Thus, while the differential seems to have widened since 1964 (in apparent contradiction to the accepted theory) it could be assumed that economies of agglomeration more than compensate. (Otherwise there would be a trend of sawmills relocating into the forests rather than in processing centres.) Of course, it must be noted that most of the log hauling costs are absorbed by the Forest Service through the appraisal system. Thus even small economies could be sufficient to offset any haulage cost differential.

As Farley (1972, p.95) concluded,

> "Logging continued to be spatially associated with sawmilling but the introduction of newer means of transport permitted a greater separation, so that logging camps were established at some distance from milling sites ... This growing spatial dissociation contributed to the development of large-capacity fixed mills that could draw upon a large resource hinterland for their continuing operation ... Milling has tended to become

---

[1] While other parts of North America were using logging railways to transport logs prior to the development of cheap road transport, this did not occur in the North Central Interior. The volumes and value of (small sized) logs tributary to a railway were too small to warrant the high capital expenditure - particularly when better logs were available elsewhere, as on Vancouver Island.

centralized but logging has expanded areally."

2. Export markets generally required higher grade lumber, necessitating the installation of expensive planing, drying and finishing machinery. It became apparent that substantial economies existed because of indivisibilities of these installations, as well as in marketing the products for export. The fact that the countries importing British Columbia's lumber found themselves without the capacity to finish rough lumber (at a price less than the B.C. product) was an important stimulus to the B.C. forest economy. While importing countries frequently want to import goods in their least processed state in order to protect domestic employment, their sudden surge in demand for finished lumber meant that they were not only prepared to accept it, but required it and would pay well for it.

3. After finding that economies of scale (indivisibilities) existed and could be exploited by consolidation of a number of mills, the question was frequently where to locate the new mill. Location theory predicts that there may be substantial economies to be made by "localisation" and "urbanisation". Localisation economies are internal to the industry, arising for example, from being able to trade in raw materials or from the production of complementary products. Urbanisation economies are external to the industry, e.g., through access to a stable supply of suitably skilled labour. Sawmill managers have stated that the greatest cost saving in locating in a city comes through lower labour turnover rates, while direct costs of transporting and housing employees in bunk houses have also been significantly

reduced.

Location theory also predicts that real savings in transport costs may be made through locating the processing plant at any point of transhipment between different media. A cursory glance reveals that most, if not all, of the major sawmills in the B.C. Interior are located at such a transhipment point, usually between road transport of logs and rail export of lumber.[1]

4. The requirements of the industrial labour force have also had major impacts on the relocation and agglomeration of the forest industry. It is generally accepted that:

a. a "more skilled" labour force is required for a sophisticated modern operation, although the measurement of relative skills is most difficult. This really applies only to the employees who construct and maintain the plant rather than to the routine operators;

b. with general "progress" and changes in social mores and expectations, relatively fewer people seem to want to live "the rugged life style", far from all the facilities for a "good life";

c. the labour force has become more unionized (although still

---

[1] The decision regarding the location of the sawmills and the town of Mackenzie illustrates this point. Most logs arrive by water and lumber leaves by rail for market. The same mill at Prince George, for example, would require transhipment of logs to land, 100 miles of road or rail haul, processing, and then export by rail. Presumably, the savings from transporting lumber rather than logs, and through reduced transport costs, substantially compensate for the costs of constructing an instant town.

much less so than on the coast of B.C.); and

d. the money cost of labour apparently rose relative to other factor costs and product prices. (See Figure 4).

Mullins (1967) considered the last to be a major cause of the changes in industrial structure, having noted that the price of spruce lumber had risen by 10% and wage rates by 80% in the period 1953-1965. However, since her analysis does not discuss the relative proportions of labour costs to value of production, or account for changes in the productivity of labour as the industry became more capital-intensive, her assumption of one way causality is weakly based. That is, higher wage rates did not necessarily force concentration and technical change. The labour component of total production costs could still be the same as in 1964 or even less if other costs have risen faster. It must also be noted that if B.C. wages caused the industry to become more capital-intensive, then innovation should have begun in B.C. In fact, increasing capital-intensity and technological change is world-wide and increases in wage rates could be the result, rather than the cause of increased labour productivity.[1] The scarcity of labour for more remote sawmills, discussed above, may also have been instrumental in bidding up wage rates in sawmilling and logging.

The net result of these influences has been the agglomeration of sawmills into processing centres along railway

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[1] This has also been observed recently in Scandinavia where Randers (1976) argued that increased scale had led to higher labour productivity and ability to pay competitive wages.

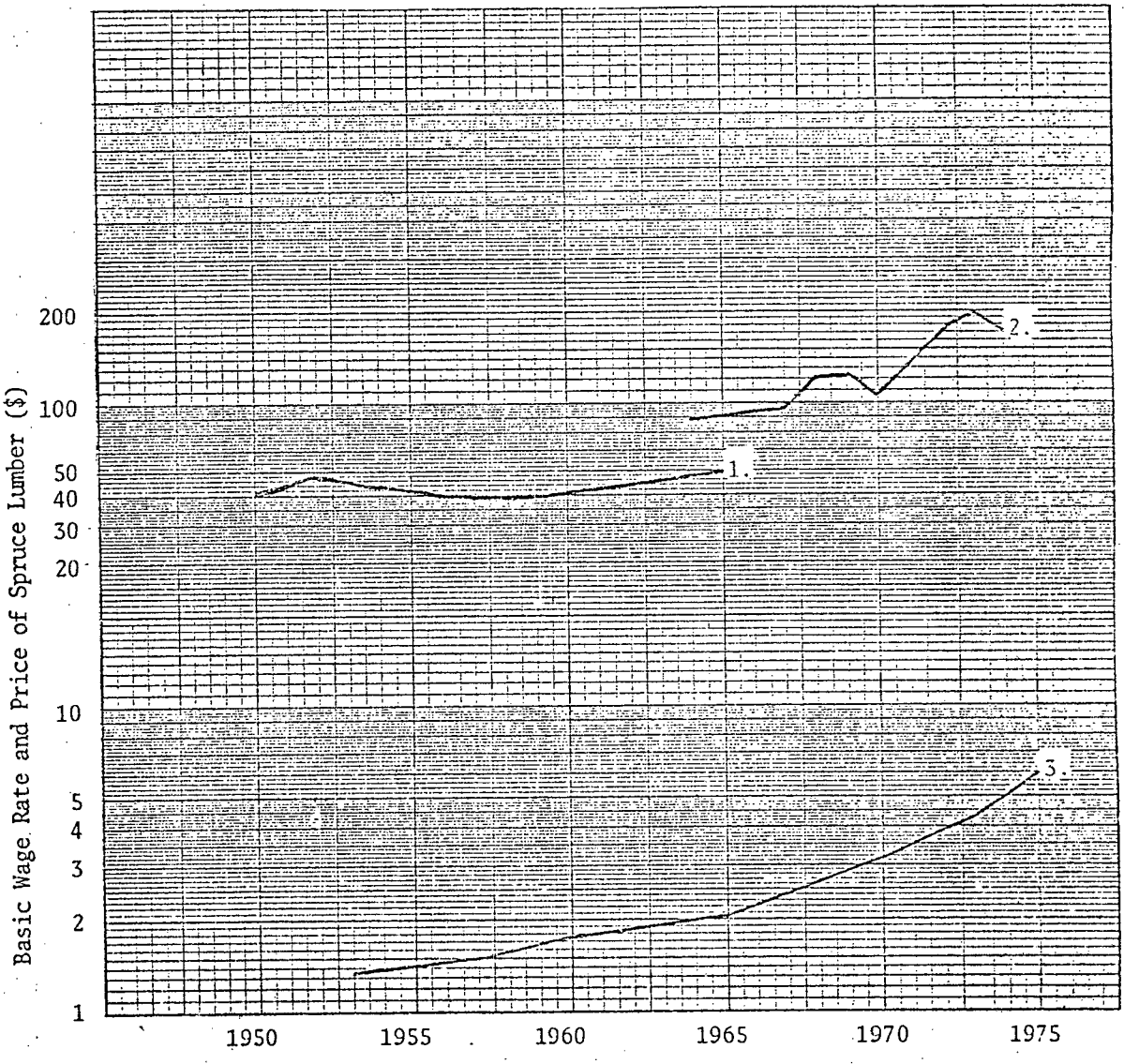

Figure 4. Lumber Price - Wage Rate Comparison.

Note: Logarithmic Scale used.

Sources: 1. Average Value of Spruce Lumber: Dominion Bureau of Statistics, cited by Mullins (1967).

2. Price of Kiln-dried Interior Spruce 2x4, (delivered to N.Y.): Madison Annual (1975).

3. Basic Hourly Wage Rate: I.W.A. - N.I.L.S. Master Agreements, 1953-66 cited by Mullins (1967).

lines, drawing log supplies from logging operations in a number of P.S.Y.U.s.[1] This is illustrated by Figure 5, in contrast to the original concept of a P.S.Y.U. (Figure 3 on page 24).

The Impacts Of B.C.F.S. Policies In Shaping The Regional Economy.

Thus far, the role of B.C.F.S. or government policies in the industry's transition from many small scattered portable sawmills to a few large integrated complexes has not been mentioned. Many analysts[2] have included these policies as causal factors in the observed developments but from the preceding discussion, one might infer that this conclusion can be questioned. Government policies seem to have been either an encouragement to the agglomeration process, or permissive in the sense of irresistable forces for inevitable change being merely accommodated through policy or procedural changes, or both,

---

[1] Teeguarden (1974) has discussed the successive enlargements or agglomeration of U.S.F.S working circles in California. This seems to be a direct and rational response to the regional nature of timber supply, as industry relocates and concentrates. Changes in B.C.'s administrative boundaries have occurred since they were established in the 1950s. These were generally in recognition of the changing industrial structure and transportation capability. The topic is again under investigation by the B.C.F.S.

[2] Mullins (1967), Nagle (1971), Haley (1971), and Lewis (1974), for example.

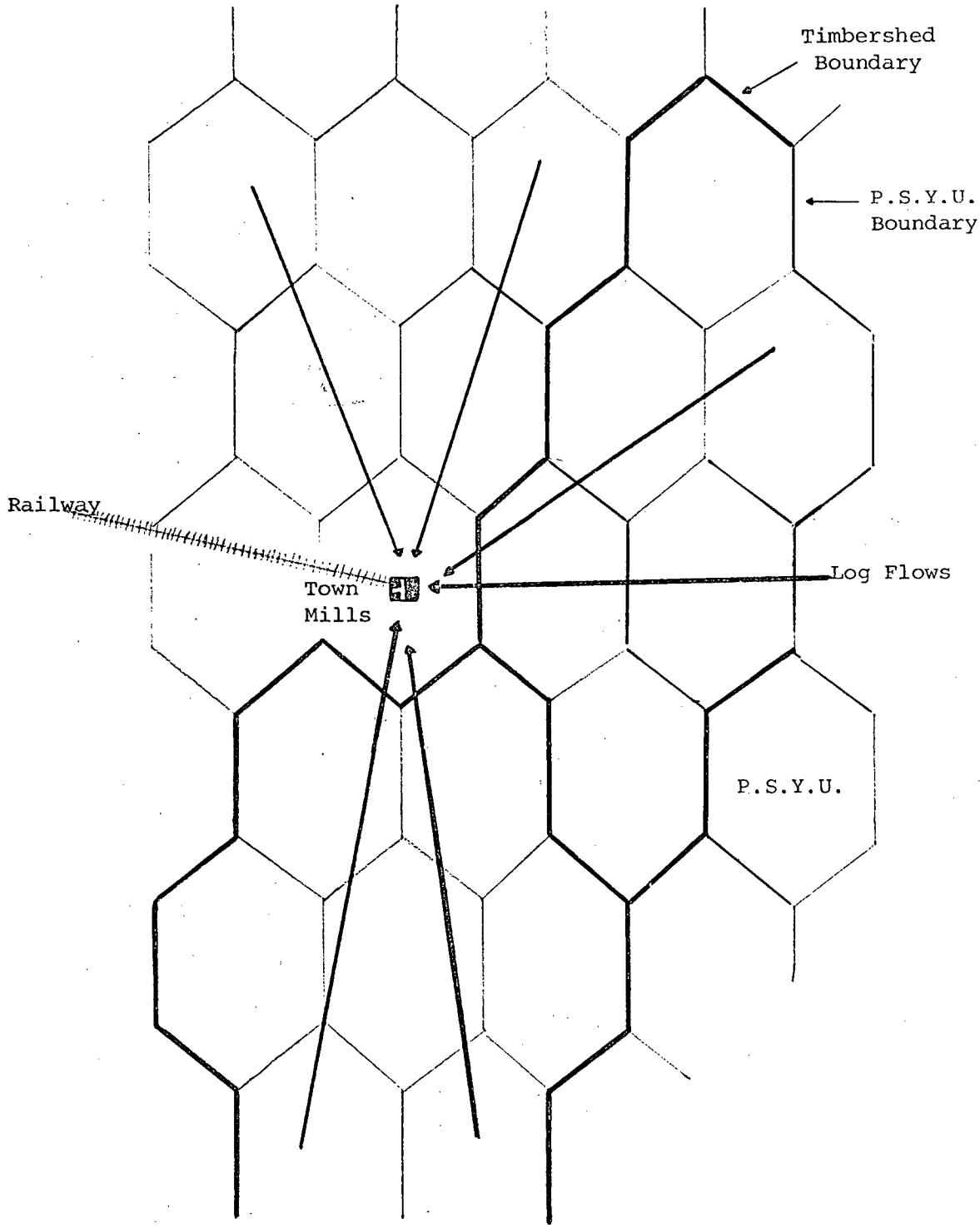

Figure 5. Regional Agglomeration of Sawmilling and Timber Supplies.

i.e. policies may have accelerated inevitable changes.[1]

It is therefore the intent of this chapter to document those changes in forest policy and administration which have directly affected the size, location and structure of the forest industry, thereby also affecting the type, location, stability and amount of employment available to the region's workforce. These forest administration practices may have been complementary to the stated objective of community stability or may have been contradictory in their impacts.

The factors which are being considered here include:

the recognition of established operators, and guarantees of wood supply (quota) to them;

the policy of allowing these informal "quotas" to be traded and accumulated as capital assets;

the imposition of non-refundable bidding fees for non-quota holders, to further discourage new competition;

the imposition of close utilisation standards;

the creation of a new form of tenure (Timber Sale Harvesting Licences) in 1968 to encourage conversion to close - utilisation standards and facilitate private planning of logging activity through lengthening the tenure period;

the stumpage appraisal system used, especially in the interaction between minimum stumpage and the absorption of haulage costs;

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[1] The fact that agglomeration in the forest industry is not unique to B.C. - rather it is almost universal - suggests that B.C. forest policy can hardly be a direct causal factor.

the direct allocation of T.S.H.L.s in new areas and of licences for "Third Band" timber, to new and established companies, (which substantially altered corporate and geographic concentration of the industry), on the criteria of "need" and "performance"; and

the imposition of an overlay tenure, the Pulpwood Harvesting Agreements, in 1963, to encourage a pulp economy (which would in turn utilise more of the previously "wasted" wood residues).

All of these have been widely described and analysed in detail in the past, but the population distribution and employment impacts have received little emphasis in those discussions. Seven further comments on some of the above seem warranted, to expand and strengthen the understanding of the role played by the B.C.F.S. in the evolution of the regional economy.

1. Sloan (1956) and Orchard (1953) argued that the smaller independent operators should be afforded "protection" against being forced out of business by the large integrated companies which obtained Tree Farm Licences or Pulpwood Harvesting Agreements. Under P.H.A. 1, the Canfor / Takla / Prince George Pulp and Paper group were prohibited from competing with established operators in the area covered by their P.H.A. Only after approximately 8 years did they begin to concentrate their sawmilling efforts around Fort St. James (and at Chetwynd outside the P.H.A.). A different response was displayed by Northwood, which promptly bought out and amalgamated the six Tree Farm Licences in their P.H.A. and proceded to purchase and

combine sawmills with the intent of establishing a Prince George complex. The pertinent point is that the P.H.A. contracts were not uniform - the rights, responsibilities and conditions vary between contracts,[1] presumably as the concept evolved. The "protection of established operators" clause of the first agreement gave way to one wherein the established mills were, in effect, given an asset (their quotas). The sale of these quotas was generally approved,[2] facilitating agglomeration and integrated processing. Neither the necessity for protection nor the best form for any such protection to take were seriously analysed at the time of the introduction of quota, although there was a sustained and heated debate.[3] It seems that any repercussions on the forest industry's structure or the socio-economic consequences did not weigh heavily in the decision to rapidly establish a pulp industry which would utilise low-grade timber.

2. The introduction of compulsory close utilisation standards in the late 1960s may have had major effects on the aggregate size and composition of the sawmilling industry, as well as stimulating the development of the pulp and paper

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[1] Pearse et al, (1974b), p.99.

[2] Nagle (1970) reported that quota had been sold in British Columbia at $10 to $40 per cunit during the 1960s. Thus the quota system provided an attractive exit from the industry to many of the operators who were inclined to discontinue their operations.

[3] See Eckhardt (1967).

industry. It can be argued that the compulsory close-U policy (and the price incentives given as palliatives) hastened inevitable technological advance in sawmilling.[1] However, enormous increases in usable forest inventories also resulted immediately, and their disposition through "close utilization increases" and Third Band Sales, is illustrated by Figures 6a to 6e. The lower solid line (CU Quota allowed) shows the increase of approximately one-third with the change from intermediate to close utilisation standards in each P.S.Y.U. By comparing this line with the lower dashed line (CU Quota cut), one may observe whether the existence of quota rights has been associated with even-flow harvesting in each unit (although it is enforced on a basis of each cutting permit for each firm operating in each P.S.Y.U.). Alternatively, it may be taken as illustrating the effectiveness with which the A.A.C. constraints have been imposed.

The upper solid line (Total A.A.C.) is the sum of allocated quotas, third band rights, miscellaneous permits and Forest Service reserves; and illustrates the rapid expansion of the (calculated) resource base with close utilisation. The increases in the Interior were large in comparison to the Coast, because of the very large volumes and areas of small (7" to 10" d.b.h.) lodgepole pine in particular, which suddenly became

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[1] This is obviously consistent with the traditional conservationist position that raw materials should not be wasted. However, since much of this technology was labour-saving, the social objective of job creation-job security was apparently secondary to the technical-conservation objective.

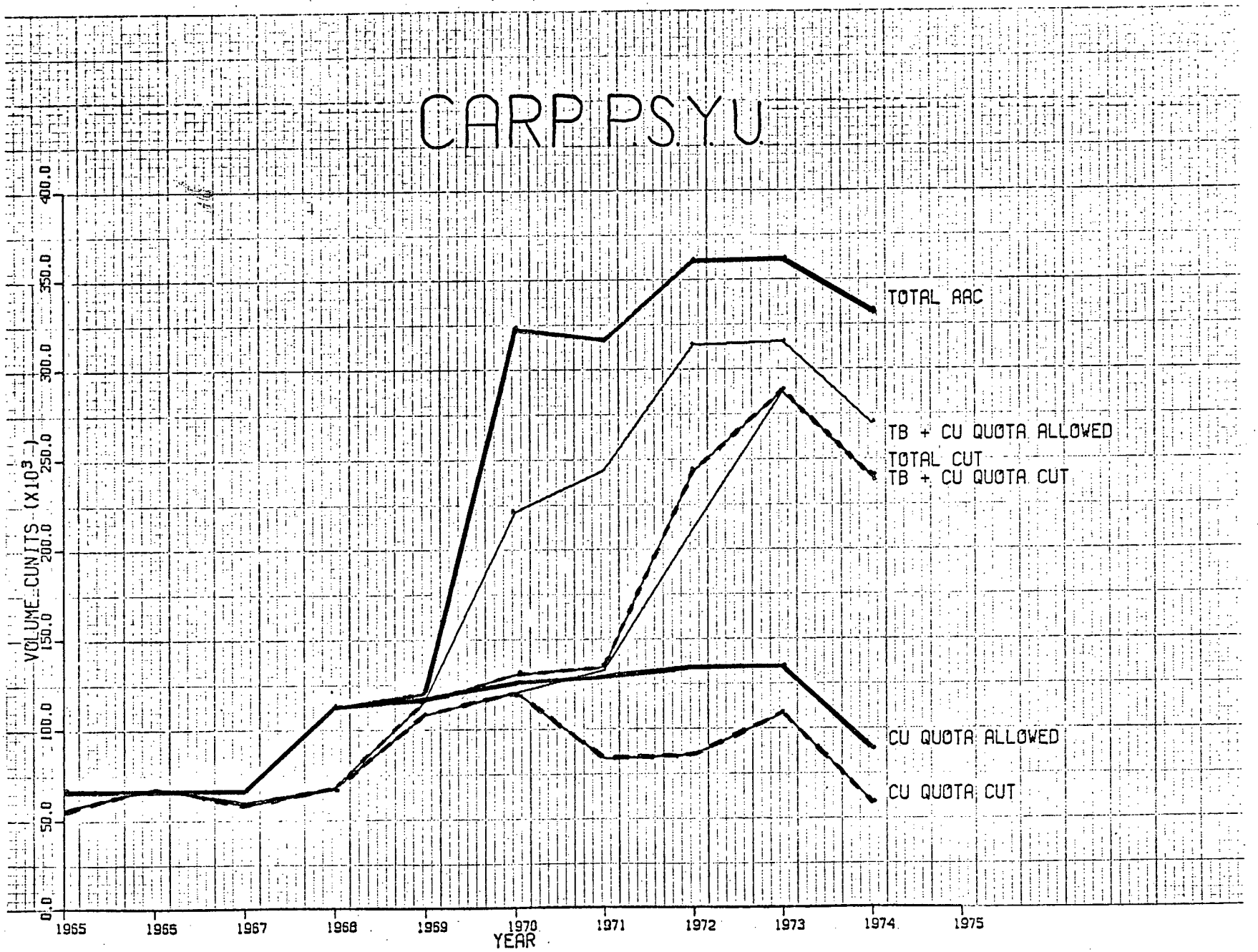
Figures 6a to 6e. Expansion of Allowable and Actual Cuts for 5 P.S.Y.U.s in the North Central Interior of British Columbia.

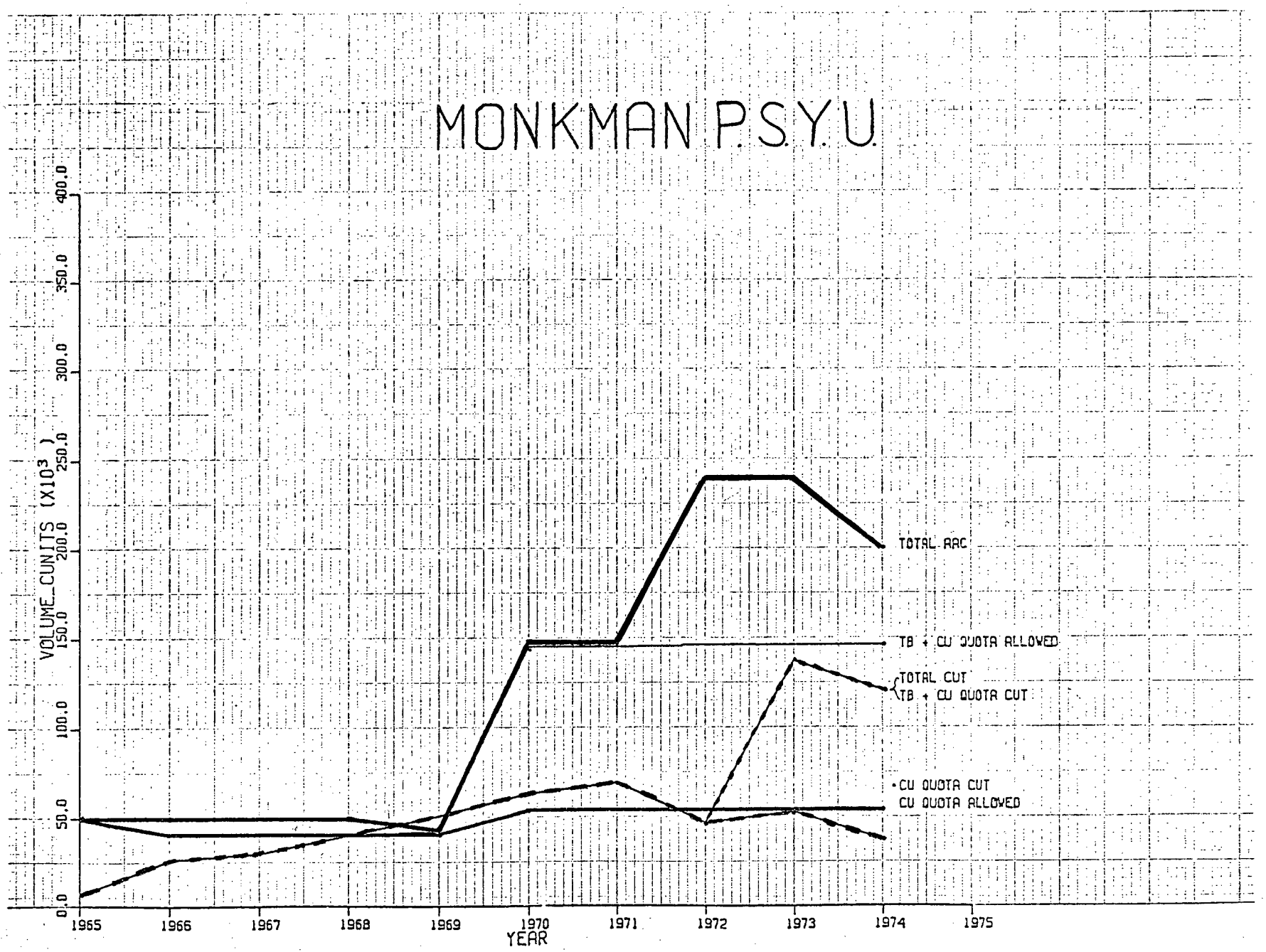
Note 1. Allowable Cuts: The original quotas introduced in the early 1960s were increased by one-third if logging changed from "intermediate" to "close" utilization standards (generally between 1967 and 1969).

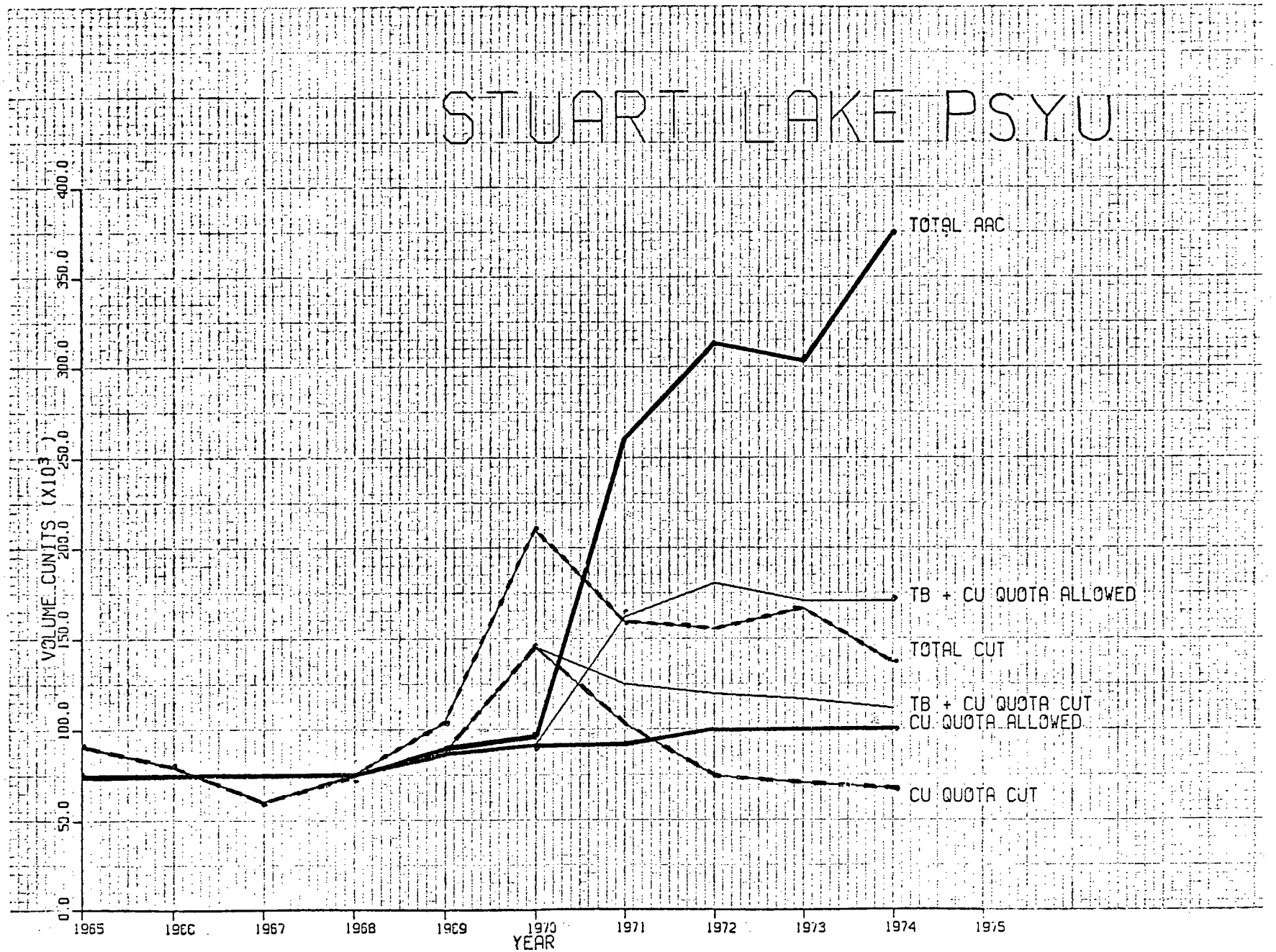
Third Band (T.B.) allocations of additional wood supplies were made (in 1970 - 71) on the basis of "performance" and/or need, to new or established operators.

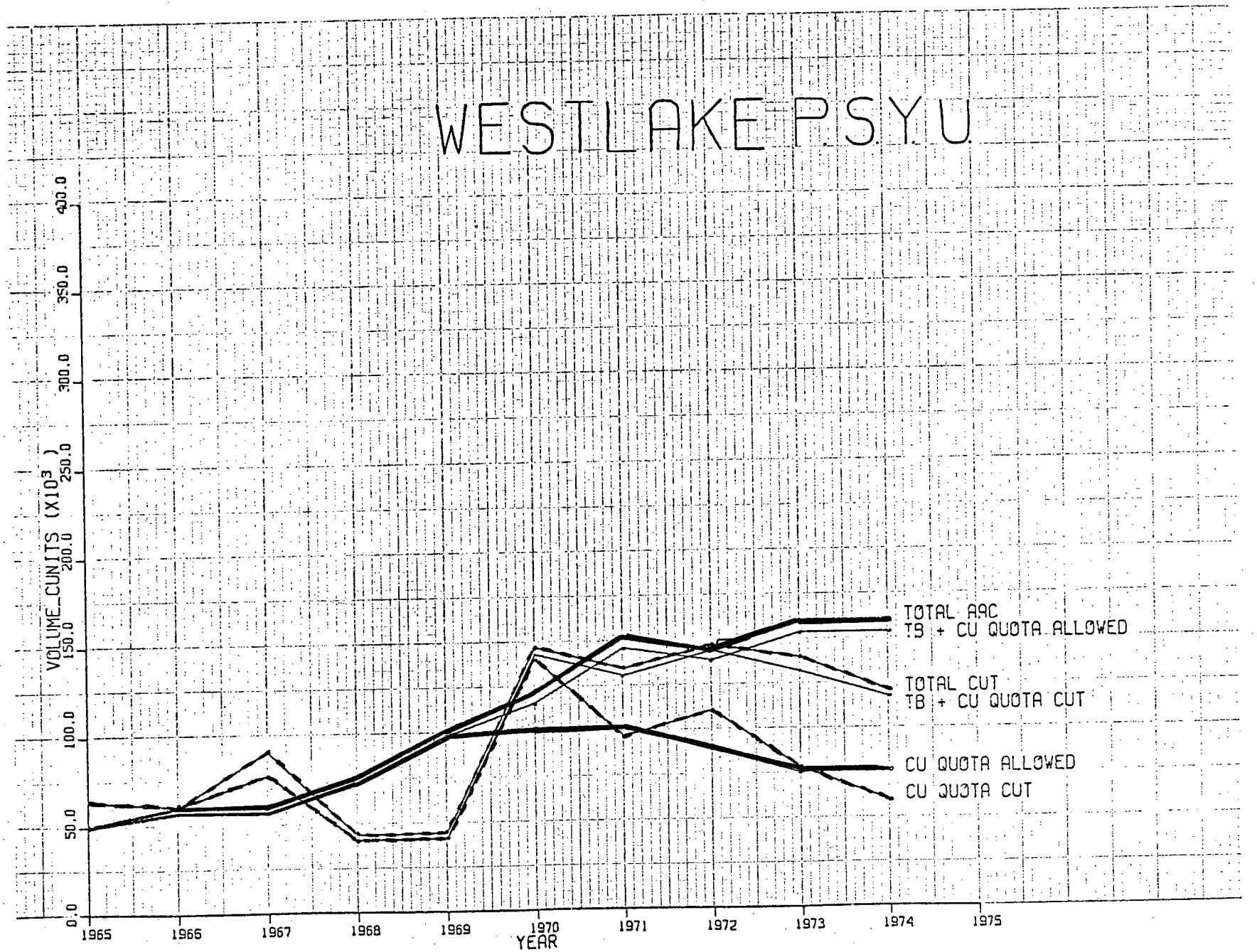
The difference between the total net Annual Allowable Cut and T.B. + C.U. Quota is mainly Forest Service Reserve.

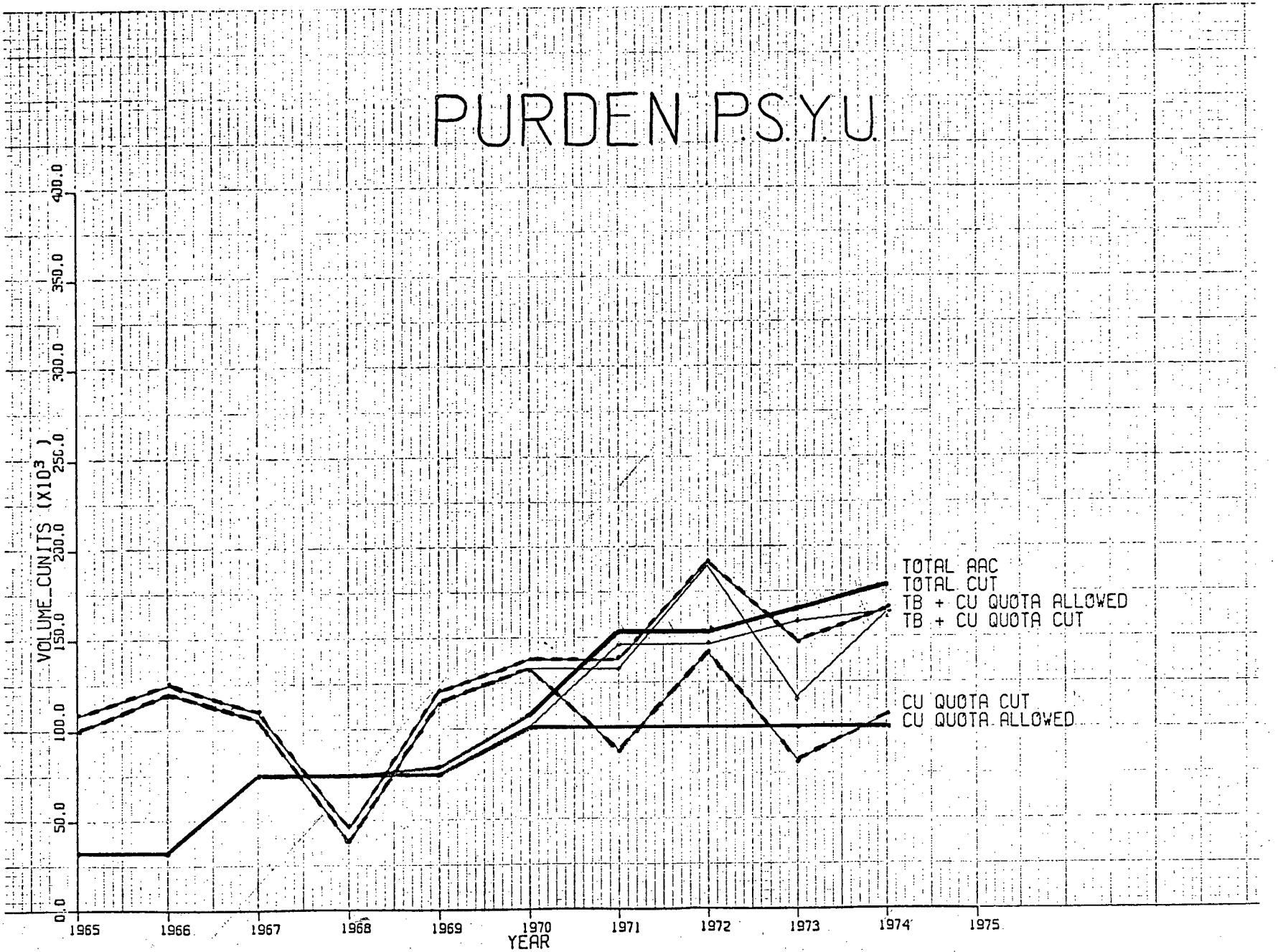
Note 2. Actual Cuts: The difference between Total Cut and T.B.+C.U.Quota represents logging by miscellaneous permit/licence holders.


CARP PSYU
VOLUME CUNITS (X10³)
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
YEAR
TOTAL AAC
TB + CU QUOTA ALLOWED
TOTAL CUT
TB + CU QUOTA CUT
CU QUOTA ALLOWED
CU QUOTA CUT


MONKMAN P.S.Y.U.
VOLUME_CUNITS (X10³)
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
YEAR
TOTAL ARC
TB + CU QUOTA ALLOWED
TOTAL CUT
TB + CU QUOTA CUT
CU QUOTA CUT
CU QUOTA ALLOWED


STUART LAKE PSYU
TOTAL AAC
TB + CU QUOTA ALLOWED
TOTAL CUT
TB + CU QUOTA CUT
CU QUOTA ALLOWED
CU QUOTA CUT
VOLUME CUNITS (X10³)
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
YEAR


WESTLAKE PSYU
VOLUME CUNITS (X10³)
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
YEAR
TOTAL AAC
TB + CU QUOTA ALLOWED
TOTAL CUT
TB + CU QUOTA CUT
CU QUOTA ALLOWED
CU QUOTA CUT


PURDEN P.S.Y.U.
VOLUME_CUNITS (X10³)
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
YEAR
TOTAL AAC
TOTAL CUT
TB + CU QUOTA ALLOWED
TB + CU QUOTA CUT
CU QUOTA CUT
CU QUOTA ALLOWED

"commercial".[1] The questions of what to include in a forest inventory and the techniques used by the B.C.F.S. to calculate A.A.C.s are important, but somewhat beyond the scope of this study. Nevertheless, it is essential to emphasise that the stock of natural resources is not static, while technology advances and relative prices change. While this may be obvious to a resource economist, it has been consistently ignored by B.C.F.S. planners. However, it must be noted that most of the A.A.C. expansions are derived from the same dated inventory. For example, it was known in 1962 that when the Westlake P.S.Y.U. reached full close-U standards, the A.A.C. would rise from 50,000 to 160,000 cunits/year. Thus these graphs may illustrate the gradual expansion of the industry as the cut constraints were relaxed each time the technical objective of close-U was met.

Along with this expansion of allocations, the B.C.F.S. is holding at present, a very large part of the net A.A.C. as "Forest Service reserves" in some of these P.S.Y.U.s, as illustrated in Figures 6a to 6e and Table 4a. This may just be another margin of conservatism on the part of the B.C.F.S., against future reductions in allocated cuts. There have been significant withdrawals from the commercial forest area in some P.S.Y.U.s with the advent of Environmental Protection Forests, which were discussed by Levy (1976). He concluded that while

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[1] The extension of transport routes to provide logging access to new forest areas also seems to have played a major role, but not in the sense implied in the B.C.F.S. quote on page 15 above.

Table 4a. 1974 AACs and Forest Service Reserves for Ten Northern Interior P.S.Y.U.s.

PSYU	Total C-U AAC (cunits/year)	Reserve (c/yr)	B.C.F.S. Plans
Purden	178,120	14,773	No more allocations until "Environmental Protection Forests" issue is resolved.
Stuart Lake	374,660	154,660	Potential for new sales.
Big Valley	81,430	3,400	No more to be allocated.
Willow River	116,700	4,450	No more to be allocated.
Monkman	200,000	53,707	Undecided.
Parsnip	215,000	9,700	No more to be allocated.
Westlake	160,000	6,016	No more to be allocated.
Robson	122,000	32,840	Waiting new inventory.
Carp	331,500	61,360	Possible emergency pulpwood sales. (Reserve includes deciduous forests.)
Takla	624,480	284,580	Undecided. (Depends on B.C. Rail and Indian land claims.)

Source: B.C.F.S. personnel, Prince George District Office, Personal interview, July 1975.

generally the less productive sites are withdrawn, there are significant volumes of mature and immature timber involved. Although gross A.A.C.s are thereby reduced, it has not been determined whether or not previous allowances in arriving at a net A.A.C. generally exceeded this requirement.

Alternatively, these reserves might represent submarginal timber which it is believed will become commercial within the next rotation period (in which case the entire net A.A.C. should be allocated and the presently commercial stands harvested).[1] Yet again, they may be "real" contingency reserves held pending a request for increased allocations, by a new or existing mill.

This conservative bias in allocation of the calculated and approved net Annual Allowable Cut suggests that the non-declining flow concept (and its economic irrationality) is implicit in B.C.F.S. policies. To the extent that sawmill capacity in the Interior responds to "timber availability" (suggested by these data), this policy of withholding reserves may have effectively constrained the size and areal distribution of the logging and sawmilling industries. This is not only true of the P.S.Y.U.s of the North Central Interior, but also on a much wider scale, as indicated in Table 4b below.

It can be concluded therefore, that while the close

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[1] Because of the "reserves" (whether they are submarginal or not) the net AAC, conservative as it is, is not allocated and therefore rarely cut. As a result, the reserves will accumulate over time, and grow physically as well. Thus the old-growth will not be fully removed by the end of the calculated conversion period - the potential cut from the forest will not be taken.

Table 4b. Provincial Reserves of Annual Allowable Cuts.

Forest District	Reserves as % of Net A.A.C.
Vancouver	17%
Prince Rupert	61%
Prince George	52%
Cariboo	35%
Nelson	24%
Kamloops	38%

Source: Derived from unpublished B.C.F.S. Data.

utilisation standards dramatically increased the estimated size of the commercial resource, the administrative arrangements for allocation of the increases may have had greater social significance. The holding of reserves limited aggregate expansion of the logging and sawmilling sectors, the requirement for chippers and barkers excluded some of the smaller mills with less capital backing from sharing in the expansion and the increase in wood residues to provide raw materials for pulp mills encouraged that industry.

3. The sale of quota rights in B.C. has an interesting parallel in the State of Queensland, Australia. There too, established sawmill operators held quota rights to logs from State Forests, but the rights were not transferable by sale until 1969. A fragmented technologically obsolete sawmill industry eventually persuaded the Department of Forestry to allow (limited) amalgamation of mills and their appurtenant quotas in the interests of economic viability and physical efficiency.[1] As happened in the B.C. Interior, many bush mills and associated villages are disappearing, as regional processing centres evolve. An interesting difference between sawlog quotas in B.C. and in Qld., is that in Qld., increases in log entitlements are not allocated (without charge) on the basis of "need" or "performance". Rather they are sold at competitive auctions.

Since quotas have been a capital asset, their sale by the

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[1] Straker (1970)

Crown would retain for the public a share of their value. It has also been suggested that the Third Band timber allocations in B.C. were inequitable in the sense that some mills bought quota while others (who had not) were "given" an opportunity to purchase Crown timber. However, these Third Band sales are on a less secure basis, since the T.S.L.s are for shorter periods and the holder is not protected from competitive bidding. Nevertheless, it could be argued that the B.C.F.S. should have sold all or none of the (valuable) rights to medium term security of wood supply. Of course the factors inhibiting the use of competitive auctions for selling timber in B.C., would similarly inhibit the use of competition in allocating harvesting rights.

However, in evidence to the Royal Commission on Forest Resources, the Deputy Minister of Forests, John Stokes, acknowledged that

> "... It has been the government which has eliminated competition through various past rulings ... He confessed himself to be worried by the present situation, lest it lead to stagnation and industrial inefficiency ... The service still follows the old form and advertises public auctions at which only one bid will be received. Stokes said forest service concern about the elimination of competition and the effect that this might have on efficiency led to performance incentives being introduced. These took the form of discretionary awards of so-called third band cutting rights, on the basis of efficient performance."[1]

Some bitterness and distrust between the industry and the B.C.F.S. resulted from the discretionary nature of awarding

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[1] As reported in The Province, October 30, 1975, p.20.

these valuable cutting rights on such vague criteria. It is not at all obvious that the third band incentives have "kept the industry efficient", nor that any worthwhile compensation has been received by the Crown, for the competitive "bonus bids" foregone.[1]

4. Crown stumpage charges are indirectly derived from the 3-month moving average of prices for lumber and other wood products in the nearest appropriate markets. Therefore, stumpage fluctuates in the short run with market demand.[2] It can be argued that the Crown thus shares much of the risk in the forest industry with the operators-licencees although the two parties do not share the rent in a constant proportion.[3] A rapid change in lumber prices would create "windfall gains" or economic rents (or losses) but these do not all accrue to the Licencee. In this sense, through absorbing some market risk, the appraisal system reinforces any other measures encouraging "steady production".

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[1] Any losses in revenues from timber sales may have been partially offset by logging and provincial income tax revenues. The magnitude of these is dependent upon the extent to which lower stumpages have contributed to increased profitability, the tax rates, and the federal/provincial arrangements for sharing of income tax revenues.

[2] For details such as the changes in product prices tolerated before stumpages are recalculated, the lags between lumber and log price changes and the mechanics of the appraisal calculation, see Pearse et al (1974a).

[3] As the lumber selling price rises above that at which the minimum stumpage is imposed, the stumpage payable to the Crown increases at a faster rate than does the allowed profit to the operator, unless a maximum stumpage is also set. This is a characteristic feature of the (modified) Rothery method which is used in B.C. For the original method, see Rothery (1945).

Some economists have criticised this aspect of the appraisal system, on the following grounds:-

a. Market price mechanisms are distorted. The producer will tend to continue working as usual, although the market is depressed, until the point of minimum stumpage is reached. At lower lumber prices, the incentive to continue operating is quickly reduced, as profits approach zero.

b. Subsequent producers or merchants can stockpile the inventory of low priced wood for later capital gains, and

c. Timber can be stored much cheaper on the stump than after processing (although this is debatable).

In the context of this study, if one presumes the desirability of continuous production from logging and milling operations (because of the stated goal of continuous stable employment) the disadvantages above may be virtues. This would be particularly so if the capital gains referred to in b., accrue to the producer himself, a cooperative or a government agency (which might represent the producers). The question is at which stage of processing should the inventories be held, given that final demand is fluctuating. Should "the slack in demand" be taken up by holding inventories of dried lumber, logs or standing timber? If the fluctuations are absorbed by accumulation of inventories of lumber, logging and milling employment could be effectively buffered from the exogenous demand shocks.

This system of stumpage appraisal can be contrasted with one initially proposed by Orchard (1945, p.54-5), wherein

> "The price bid for the timber by the successful tenderer will be translated in the timber sale contract into terms of a percentage of the Department's published average sale values of lumber or other product."

Under this scheme, stumpage is always positive, being a direct

fraction of lumber selling prices, thereby placing the burden of lumber price instability onto profits. The opposite is the case under the modified Rothery method, although negative stumpages are prevented by legislated minimums. The adoption of Orchard's 1945 suggestion would have made profits in the lumber industry even more volatile than they have been, in the event of lumber price changes. His method also ignores changes in operating costs during the term of the timber sale contract, unless there was some provision for revising the percentage taken as stumpage with changing conditions over short periods.

It is therefore concluded that the modified Rothery method of stumpage appraisal theoretically should contribute more to stability of employment than would a fixed timber price or a stumpage levied as a fixed percentage of lumber selling prices. Since stumpage falls after a decline in selling prices, a sawmill should be able to continue to operate longer in a receding market. Conversely, if stumpage did not increase during boom markets, production and employment might well exceed the equilibrium or trend levels.

5. Another major effect of the stumpage appraisal system has been the absorption of the log purchaser's haulage costs, if there are no other closer, suitable mills.[1] This has facilitated sawmill relocation to centres of urbanisation/agglomeration and made the economies of scale there appear even greater, since the B.C.F.S. absorbs the extra hauling costs through stumpage

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[1] and if stumpage is not already at its legislated minimum.

appraisal, if all suitable mills between the forest and the city have closed down. This has been officially recognized in at least one instance. Because average conversion costs are estimated by B.C.F.S. appraisal officers to be $5/cunit lower within a defined area around the city of Prince George, logs from 40-50 miles away appraise better to Prince George than to a closer mill! That is, the B.C.F.S. considers that it is economically more attractive to haul logs past a mill which could physically use them but which does not experience the economies of urbanisation found in Prince George.

Thus we can conclude from this survey that increased industrial concentration can lead to:

greater returns to the province as owner of the forest, and presumably to sawmills also;

more business for the log-hauling industry;

a greater likelihood of amenities being provided for labour;

improved prospects for community stability, particularly if industry and employment are diversified in that centre, rather than being closely tied to one industry; and

the possibility of some of the smaller towns becoming "ghost towns" or satellite dormitories for the population of the industrial centres.

6. As the lumber market weakens, appraised stumpage is adjusted downwards to a minimum level. Theoretically this adjustment should enable a logging/milling operator of average efficiency to maintain his "allowed" profit margin, but only while the appraised stumpage is not less than the minimum. At

this point, the operator should be considering closing down if the appraisal mechanism is accurate (although operations will generally continue at a loss for some time if fixed (depreciation and overhead) costs can be met). The choice is then to either pay minimum stumpage and continue logging, or to stop logging and perhaps still have to pay, because of the minimum A.A.C. regulations, although these are generally waived in severe depressions.[1] Why then are there minimum A.A.C.s and why would they ever be enforced?

a. Because the government insists that mills should operate year round. This is predicated on the belief that substantial "downstream benefits" are to be derived after logging and milling, and that whole towns are dependent upon their sawmills, for their economic wellbeing (though not necessarily for survival). It is difficult to imagine how the B.C.F.S. can convince members of the forest industry that they should operate at a loss because of an externality while the B.C.F.S. is not prepared (for a number of reasons)[2] to sell timber at less than

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[1] Either way, the public owners of the forest derive much less direct revenue than they would if the forest was logged , say a year earlier or later, in a healthy lumber market. However, the costs of paying welfare when the industry is depressed may partially offset the direct increases in stumpage revenues if cuts were allowed to fluctuate freely.

[2] These include the argument that the Crown's timber should not be sold at a very low price or given away, the fact that timber thus sold could have been kept and sold later for a much higher price in a better market, and the economist's argument that any factor charged at less than its real value will be over used, distorting the relative intensities of labour, capital and resources used in production.

minimum or at negative stumpage, to achieve the same ends.

b. Because of the technical objective of converting to a normal forest in one rotation. This argument is trivial. It will hardly matter, in 100 years, whether the forest has
1,000 acres of 100 year old + 1,000 acres of 99 year old
or 2,000 acres of 100 year old + none of 99 year old
or even none aged 95-100 years + 6,000 acres aged 101 years. This is especially irrelevant if the rotation age meanwhile changes to 50 years. As Lewis (1974) noted, any cost in 100 years of cutting the "wrong age" stand now is almost zero at any realistic (positive) discount rate.

7. It was the deliberate policy of the provincal government from the late sixties to 1972 to encourage vertical and horizontal corporate integration.[1] This was motivated or justified by a desire to prevent physical waste of wood raw materials. That is, there was a strongly held belief that high utilisation standards could only be achieved by large integrated complexes.[2] This may well be correct. It is also extremely likely that an integrated (perhaps multinational) corporation has exploited economies of scale (thus raising residual stumpage payable to the province, perhaps) and requires a much more stable workforce, because of its high fixed costs, start-up

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[1] See Williston (1971a, p.4 ; 1971b, pp.8-11) and Stokes (1971).

[2] This conviction was expressed by Sloan (1945) and others who testified before him. In his second report (1956, p.191) Sloan in effect concluded that it would be preferable to have one technically efficient "survivor" mill than competition between 4 or 5 mills which could lead to the failure of each of them.

costs, etc.

The net results of pursuing the technical objective of close utilisation logging and maximum recovery in conversion (because wood is all important and must never be wasted!) have apparently indirectly advanced the social/political objectives, of regional development with employment stability, although the amount of labour required per unit production will have declined.[1]

Sloan (1945, p.128) argued that large vertically integrated companies would offer the greatest stability and prosperity to communities as well as technical advancement and larger payments to the Crown. While the bases for his conclusions seem simply intuitive, some of his forecasts have proven correct. However, it seems that he overlooked the vulnerability of single industry communities to labour disputes, transportation problems and market fluctuations. Moreover, the undesirable aspects of vertical integration and oligopoly presented by economists in regard to competitive theory, viz. loss of rents to the owner of the resource selling to an oligopolist, were overlooked in favour of the anticipated "social benefits". However, because the provincial government is both the resource owner and the taxing agency, some fraction of any losses in resource rents can

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[1] Close utilisation standards and Woodchip sales to pulp mills almost certainly altered the economics of log transportation. Since more of a log would be recovered as a saleable product, a miller could afford to haul it farther to the utilisation point. This suggests that conservationist ideals led to the close-U policy, creating significant transportation and urbanisation economies, which facilitated (the almost inevitable) agglomeration.

be recovered through logging and income taxes, depending upon the extent to which those rents appear in taxable incomes. It would be most discriminatory, however, if the situation evolved where the B.C. forest industry was receiving one of its primary inputs at reduced prices and paid the same tax rates as all other industries across Canada.

The objections of economists to vertical integration rely primarily on equity considerations, i.e. in the sharing of the rents between the Crown and the processors. There have been few suggestions of allocative inefficiency resulting from integration. Rather it is probable that the physical and economic efficiency of the industry is improved after vertical integration. Given that there is not perfect competition for supplies of wood, labour or capital, one cannot predict on theoretical grounds that the presence of oligopoly or monopoly at the logging and sawmilling levels will contribute to allocative inefficiency.

Perhaps the essential ingredient for industrialisation and agglomeration, especially in pulp mills and the large integrated complexes, is security of wood supply as argued for example, by Wayman (1973) and most of the industry participants at the recent Royal Commission hearings. The Northern Interior Lumber Sector's brief said,

> "The overiding reason for having security of raw material is that it contributes heavily to stability of employment and community stability."

In response, Dr. Pearse commented,

> "We have observed over the last two or three decades very rapid changes in the northern interior lumber industry, not only in its

> structure but also in its geographical distribution and I am wondering how much effect tenure policy has had on that rapid evolution. Would it be desirable to try to stabilize all these communities that used to have mills, but now don't, and curtail the growth of others that have grown rapidly, such as Prince George, with the enormous substitution of capital for labor that we have seen? ... I guess I'm really asking you whether you want a stable industry or a dynamic industry and the growth that goes with it."[1]

If security of wood supply has been significant, the change in forest policy may have been an essential prerequisite to the agglomeration and developments of the past 20 years, given the special landlord role of the B.C.F.S. While many analysts and briefs concluded that "raw material supply must be assured in order to justify large scale mills" and that this would "help to stabilize the industry", a precise definition of "assured" has never been offered. Whether it means perpetually, for the mortgage life of the mill or for a few years, and whether it means at any price, or for the price the miller would like to offer, are crucial to any meaningful analysis of the policy's success.

This argument of guaranteed raw material supply is one which an economist can only understand by acknowledging the absence of a real or free market for raw (wood) materials. After the apparently unsuccessful use of competitive markets for timber allocation, because of spite bidding, blackmail, etc., followed by a system of government allocation based on principles which were not widely known or understood, one can

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[1] The Vancouver Sun, Tuesday Sept. 16, 1975. p23.

recognise some basis for the demand by industry and its bankers for long term guaranteed wood supplies. This "need" is naturally heightened by high ratios of fixed to variable costs, as accompany sophisticated conversion plants.

Mullins accepted the argument that rapid increases in labour costs in a period of stable prices led to a search for economies of scale and automation. From this she concluded that,

> "if no future guarantees of continued operation had been made, it is unlikely that the industry could have met the market and labour demands".[1]

That is, security of supply was seen as <u>essential</u> for investment in planers and chippers and for long term planning. While there is, no doubt, some truth in this argument, such a neat causal relationship between quotas and industrialisation is not obvious.

This argument does not counter the evidence that the industry is now much more footloose, that is, less tied to its local resource base, than in the past. Chips for pulp mills (especially under the present regulated pricing scheme which absorbs up to $10/BDU in transport costs) can be and are moved hundreds of miles. There are very few examples of a conversion plant (or a whole town) dependent on one neighboring P.S.Y.U., for its wood supplies, in this age of agglomeration. Thus any requirements that each or every P.S.Y.U. must individually

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[1] Mullins (1967) p.115. She supported this argument with a labour cost - lumber price comparison, discussed with reference to Figure 4 above.

provide an even annual flow of logs, to sustain local employment and incomes, seem to be quite anachronistic. In addition, any fears that the B.C.F.S. would suddenly refuse to make wood available, or that all contracts with sawmills for the purchase of wood chips would be abrograted, are difficult to understand now. The sawmilling industry seems to have underestimated the extent to which the timber seller (the Crown) relies on the purchasers.

From the preceding analyses, it becomes apparent that even-flow (and perhaps even modulated expanding yield) regulation of the rate of harvest can have no necessary direct effects on short term local employment stability or long run community survival. The British Columbia situation is very similar in this regard to that in the Pacific Northwest, where Schallau, Maki and Beuter (1968) addressed a very similar question. "Do permanent forests, producing a sustained even flow of timber, assure economic stability of timber dependent communities?" Their conclusions (p.104) included:-

> "What the economic impact study of alternative levels of log production illustrates most clearly is the difficulty of rationalizing a sustained yield forest management policy in terms of local community stability. Not only modern timber technology but also the structural features of a regional economy inhibit use of a community stability criterion."

However, the repercussions and responses of the companies in the forest industry to certain public policies in B.C. have been substantial. If the B.C.F.S. has been following a consistent theme in its policies and administrative practices, this theme is primarily related to technical and conservationist objectives

in resource management. It bears little resemblance to the other stated objectives of community stability (of employment) and survival. What may seem to be ad hoc tinkering with industrial organisation and location may fortuitously have helped achieve those goals which cannot be achieved through the declared approach of sustained yield.

IV. THE EVIDENCE

The argument which has been developed thus far is that the B.C.F.S. instituted a conservative policy of sustained yield forest management in order to achieve stability and permanence of communities and to promote regional development of the resource base to its full sustainable capacity. While the objective has been politically approved and is therefore assumed to be socially desirable in a broad sense, the regulatory technique has been found to be inappropriate for the attainment of the goals.

However, many concurrent developments over the past thirty years have borne significantly on the prospects of attaining these goals. Some have been exogenously supplied (e.g., processing technology), some have resulted indirectly from the administration of the sustained yield policy, and some have come from general development, particulary with regard to transportation and infrastructure. These have affected the size, location, scale and labour intensity of the wood processing industries, and thereby affected the stability of local employment, potential for permanence of communities and the rural-urban distribution of population. This chapter documents the changes which have occurred and analyses the consequences, with regard to concentration of ownership of timber rights (oligopoly), areal concentration or urban agglomeration and the nature and stability of employment opportunities in parts of the North Central Interior.

Concentration

Evidence on the concentration of timber holdings in British Columbia has been presented by Stanbury and McLeod (1972). Their data show, *inter alia*, that in the Prince George "timber market";[1]

two companies held the only two remaining T.F.L.s,[2]

the four largest firms held 40% of the allowable cut from T.S.L.s and T.S.H.L.s,

the eight largest firms held 62.7% of the allocated A.A.C., and

the ten largest firms held 69.8% of the A.A.C. from T.S.L.s and T.S.H.L.s in 1972.

In investigating corporate concentration, the geographic unit used was a "timbershed" defined by Haley *et al* (1975) as an area from which logs are moved to a recognisable major processing centre. The boundaries of a timbershed are the result of the interplay of economic, locational and especially, institutional factors (tenure patterns, B.C.F.S. District boundaries etc.).[3] The region of study - the seven timbersheds

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[1] These "timber markets" were defined by adding and subtracting P.S.Y.U.s from the 5 Forest Districts, on the basis of geographic location of conversion plants, topography and transportation costs, and species mix, age and stand quality.

[2] One of these is an amalgamation of 6 earlier T.F.L.s, (actually Forest Management Licences 5b,7,12,13,15 and 16).

[3] The data basis for the delineation of the timbersheds was a set of P.S.Y.U. records of allocations and 1974 harvests, and the Sawmill Registers for the Prince Rupert, Prince George and Cariboo Forest Districts, supplied by the B.C.F.S.

shown in Map 3 - represents the timber supply area for Economic Region 7 centred upon Prince George, and is the aggregate of thirty P.S.Y.U.s.[1] While it is different from Stanbury and McLeod's Prince George timber market, the resulting estimates of corporate concentration, presented as Tables 5a & 5b, are similar.[2]

In commenting on the results of his earlier study on the lumber industry in the Douglas-fir region of the U.S., Mead (1975, p.34:3) stated that there

> "are hundreds of small companies in lumber and plywood production that are one-product companies. While entry into the lumber and plywood industries is easy when product prices are attractive and exit is easy when markets are weak, the long-term history of these two industries shows that very small firms and very large, fully integrated firms coexist. Small firms are clearly effective competitors with large firms in both lumber and plywood production."

The key factor here, for the industry's level of output and employment, is the easy exit and entry. The large companies have relatively stable production with the small enterprises coming and going with market demand. In British Columbia industrial concentration and the removal of the smaller firms, resulting from barriers to obtaining quota and the requirement for

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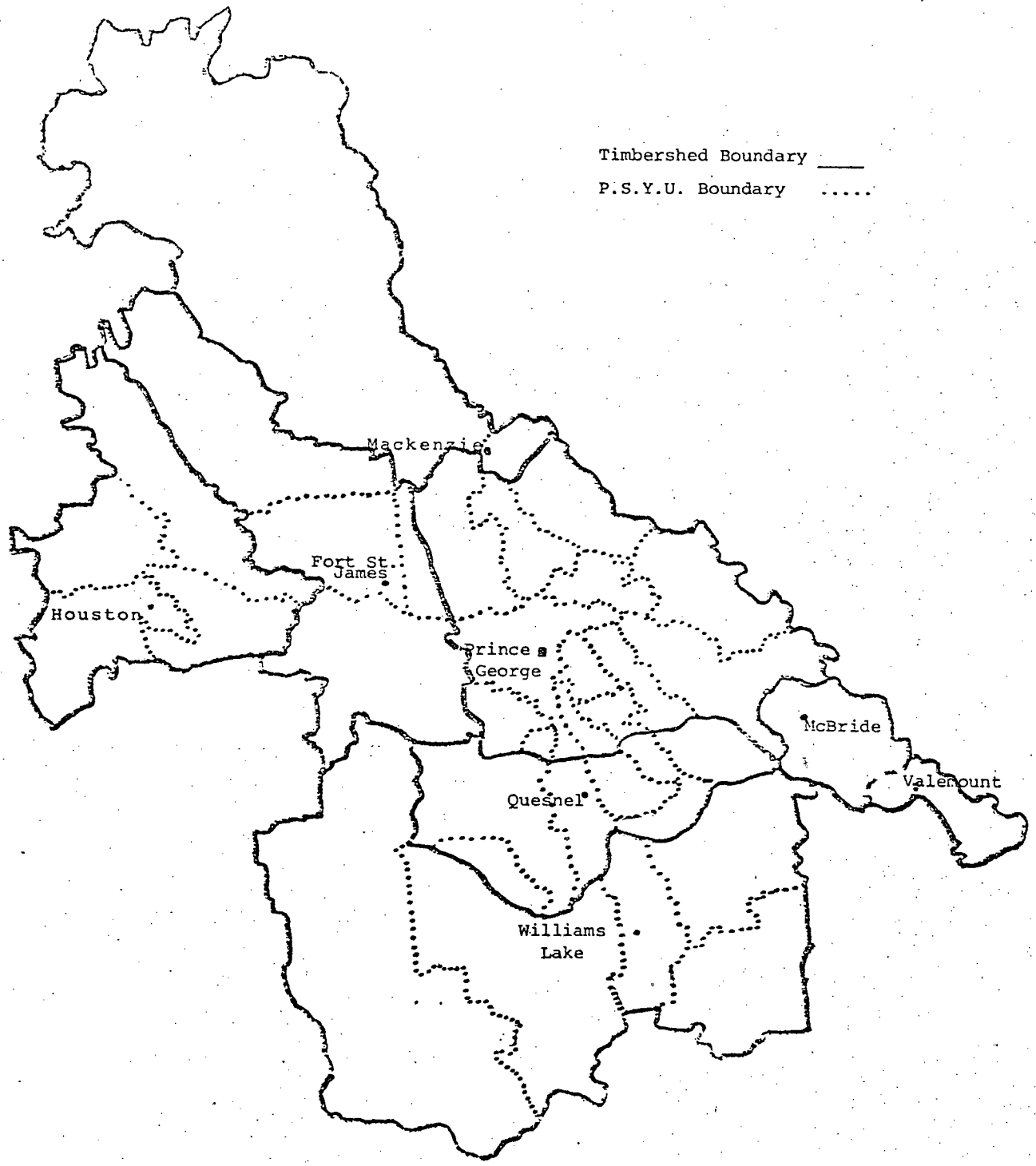
[1] The total area (forest and non-forest land) covered by the seven timbersheds is 50,854,585 acres, compared to the provincial total of 126,101,700 acres. (Derived from B.C.F.S. Annual Report, 1974.)

[2] Note that Table 5 concerns actual 1974 harvest, whereas Stanbury and McLeod used A.A.C. entitlements.



Map 3. Timbersheds of the North Central Interior of B.C.

Table 5a. Corporate Concentration in Timbersheds of North Central B.C.

Timbershed	Percentage of 1974 Harvest by Largest:		
	1 Firm	2 Firms	4 Firms
1. Houston	64%	76%	85%
2. Quesnel	40%	68%	94%
3. Williams Lake	20%	40%	70%
4. Fort St. James	34%	54%	73%
5. Mackenzie	60%	100%	---
6. Prince George	23%	42%	65%
7. McBride/Valemount	36%	70%	89%

Table 5b. Corporate Concentration in North Central B.C.

Company	% of 1974 Harvest
Northwood	13.3% + T.F.L. 30
B.C.F.P.	5.5%
Weldwood	8.7% + T.F.L. 5
West Fraser	8.5%
Takla	7.9%
The Pas	5.5%

That is, the six largest companies in this region cut approximately 50% of the total 1974 cut from Public Sustained Yield Units.

Source: Derived from B.C.F.S. Annual Reports and unpublished District Annual Reports (1974).

deposits prior to a timber sale, may well have removed this element of flexibility in the industry. Thus the burden of changes in market demand may well have been shifted onto the large companies with higher fixed costs and greater skill requirements for labour, and the unstable employment opportunities in "gypo" operations have disappeared.

The quota system, limiting competition for timber sales and favouring established operators, may have had important consequences for Crown revenues, despite the fact that policies were introduced for political-social reasons. Although data for B.C. are unavailable, Mead (1966) found that small firms obtained 74.5% of their National Forest timber supply at competitive bidding, while the figure for large firms was 65.8%. At these competitive auctions, the small firms paid an average premium of 68% over appraised prices, while for the large firms it was 43%. Combining these two aspects, the small firms paid an average premium of 51% and the large firms 28% over appraised prices. To determine the net effect on U.S. Forest Service revenues, these premiums would have to be weighted according to the value of all sales going to the smaller firms, relative to the value of sales to large firms. Mead did not present any evidence as to the accuracy of the appraisal process in each category, but assumes that in each case the appraisal is the best estimate of the real value of the stand. However, this suggests that the higher utilisation standards and labour stability accompanying corporate integration in British Columbia may not have been costless to the public purse.

Moreover, if one considers the construction of a new

sawmill in an area currently supplying the industry, this action could foreseeably lead to higher prices for logs and labour, which would benefit the owners of these resources. This suggests that the B.C.F.S. policy of restricting entry in an attempt to guarantee the success (and therefore, it is assumed, the permanence) of the existing industry has been at the expense of direct government revenues. The counter argument from the B.C.F.S. (or Sloan) is that if there are too many mills, a number of these will fail. There will be ghost towns and very little industrial activity (i.e., no market for B.C.F.S. logs in the future). Thus it has been assumed that the loss of current revenues (no bonus bids) is more than compensated for by the knowledge (or faith) that the industry will be perpetuated. Yet the restriction of entry has not been proven to be necessary to ensure a future market for logs or sufficient (with sustained yield) to assure the permanence of communities. A trade-off of current incomes for expected future benefits has been made, with little analysis of probabilities of the problem arising, or of the relative magnitudes of the benefits.

> "Rules of thumb have been developed from empirical studies (of industrial structure) over the last two decades. These rules hold that monopoly profits begin when the big-four firms account for more than 50% of the output in a given industry or the big-eight firms account for more than 70% of industry output."[1]

In the application of these criteria, the arbitrary definition of geographic boundaries is obviously critical.

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[1] Mead (1975, p.34:4)

Factors in log transport economics (including, for example, value/weight ratios for logs) make each spot timber market smaller than an economic region, for example, although larger than a P.S.Y.U., such as the timbershed defined here. At this "timbershed" level - within the areas in which each firm has agglomerated - monopoly power in the acquisition of timber seems obvious, and oligopoly appears to exist at the regional level. Although Mead (1966, p.96) found that the weighted average log haul for timber sold from the Douglas-fir region's National Forests was 42.8 miles, it is feasible that in the Northern Interior of B.C., mill agglomeration has been more widespread and road costs and volumes per acre are low. Consequently log hauls are longer.

This areal concentration of the sawmilling industry is of perhaps greater interest in discussing regional development, community stability and the role of B.C.F.S. timber allocation policies. Many interesting points which can only be explained with reference to the administrative procedures of the B.C.F.S., emerge from the data presented in Table 6.

Firstly, within each of the timbersheds (or timber supply areas), there is one major processing centre towards which most of the surrounding Crown timber is transported. In some of the timbersheds, there are smaller centres nearby which also account for much of, but not all of, the remaining timber supply. There are yet smaller centres in three of the timbersheds to which a very small fraction of the annual cut is allocated or transported.

Table 6. Geographic Concentration of Sawmilling in North Central B.C.

Timbershed	Municipality	1974 Cut[1]	1974 Allocation[2]
1.	Houston	63.8%	46.1%
	Burns Lake	5.8%	29.0%
	Smithers	12.1%	24.4%
	Total	338,100 cunits	687,700 cunits
2.	Quesnel	100.0%	97.5%
	Total	659,800 cunits	784,900 cunits
3.	Williams Lake	79.7%	72.2%
	Canim Lake	20.3%	23.0%
	Total	841,100 cunits	1,033,490 cunits
4.	Fort St. James	45.9%	47.0%
	Vanderhoof	19.4%	14.7%
	Fraser Lake	12.8%	9.4%
	Total	738,200 cunits	1,113,600 cunits
5.	Mackenzie	100.0%	100.0%
	Total	523,600 cunits	1,333,300 cunits
6.	Prince George	52.0%	50.7%
	Hixon	8.5%	10.0%
	Upper Fraser	11.0%	11.9%
	Summit Lake	15.7%	16.2%
	Total	1,431,300 cunits	1,544,200 cunits

[1] Percentages of the 1974 harvest of that timbershed which went to mills located in or near these towns.
[2] Percentages of the total AAC of the PSYUs of that timbershed which is allocated to mills in or near these towns.

Source: Derived from unpublished B.C.F.S. District Annual Reports(1974)

Secondly, the recent dramatic development of Houston[1] as a processing centre can be traced to the amalgamation of seven sawmills by a company which sought and obtained a Pulpwood Harvesting Agreement.[2] The choice of Houston as the site of the agglomerate mill is an example of the interplay of location theory and the private preferences of owners/managers. By locating at Houston, most of the log hauls from the sale areas were downhill, in contrast to Burns Lake and Smithers which also lie within the timber supply area and on the C.N. rail line. In addition, the proprietor's family were long time residents of Houston.

The difference between the 1974 cut and allocation directed towards mills in Burns Lake and Smithers largely represents recent government policy in actively directing new sawmill expansion to these centres; timber allocations had been made in 1974 but the new sawmills were not yet operating (or operating at capacity).[3]

This type of government direction has been further used in the allocation of cutting rights for a newly-created P.S.Y.U. (Kluskus). Bids were invited from companies prepared to construct a new mill in a particular town (in timbershed 4). As

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[1] See Table 1.

[2] Documented in Industrial Progress of the North, (pp.21-22), 1969.

[3] Deliberate direction of new mills in this area was discussed and the impacts on the communities analysed by Gilgan (1974).

it happened, there was one company whose mill there had recently been destroyed by fire and which was planning to construct another to replace it. It was subsequently awarded the cutting rights offered in the new P.S.Y.U. The B.C.F.S. has been active in planning and directing the location of industry (and consequently of the labour force) through its timber disposal policies.

The complete geographic concentration of sawmills in Mackenzie (timbershed 5) is obvious given that the town was primarily created for the purpose of processing the logs from the large Finlay P.S.Y.U. Again the importance of institutional constraints must be emphasised. While there are better logs closer to Mackenzie to the south, these had been previously allocated elsewhere. While this study has not covered the Peace-Liard region, northeast of the Rockies, the same type of agglomeration is obvious there. A particular case is Canfor's Chetwynd complex formed by combining 11 mills and their quota rights, from numerous surrounding towns.[1]

The overall concentration in sawmilling in the Northern Interior is further illustrated by Figure 7. Combined with the increasing harvests and production shown in Figures 2a and 2b, it is obvious that the average size of sawmills has increased greatly. This has been analysed by Dobie (1971).

The census information presented in Table 3 yielded

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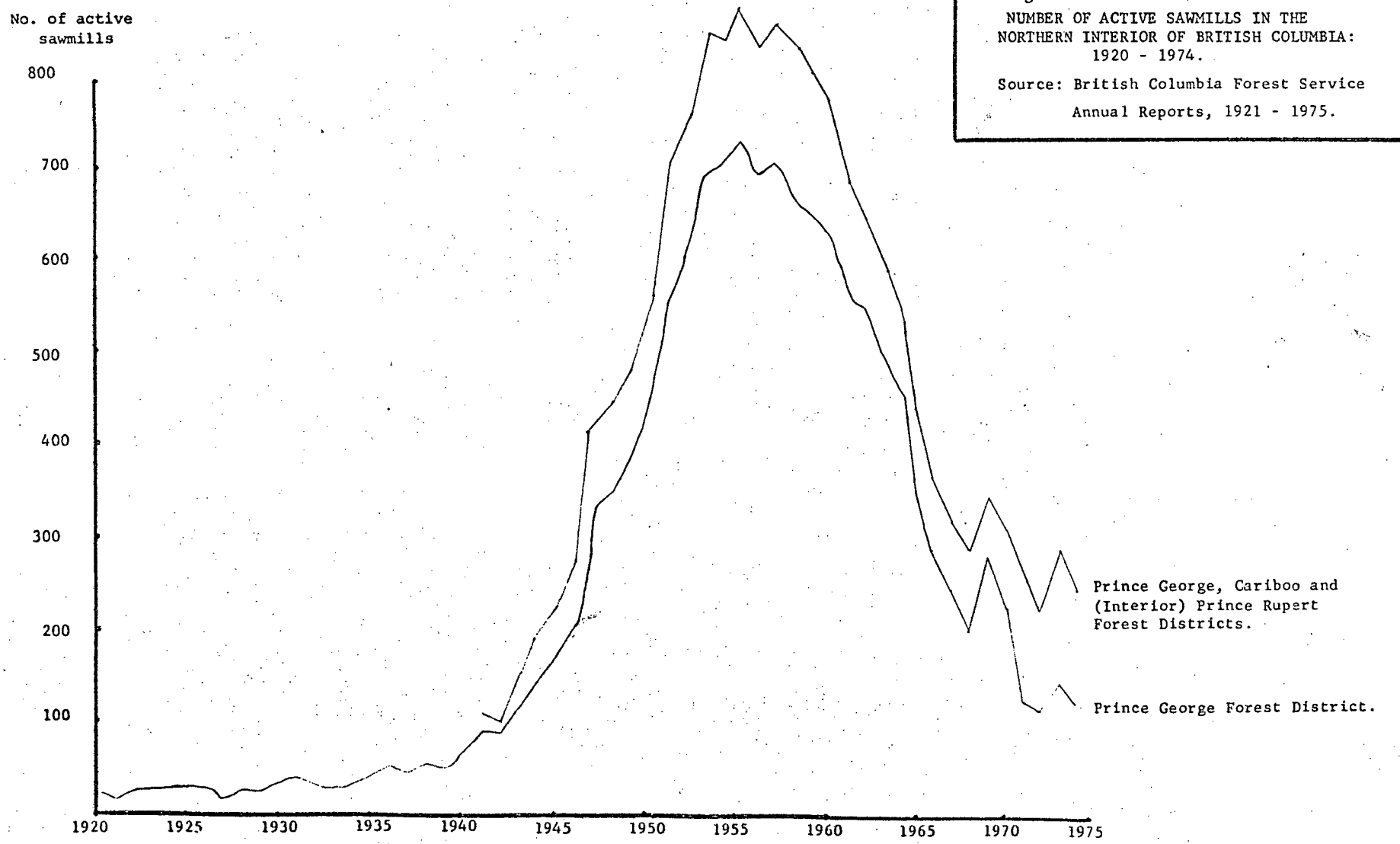
[1] The inclusion of this area in Stanbury and McLeod's Prince George timber market, explains their result of the overall predominance of this company in British Columbia's northern interior.

Figure 7.
NUMBER OF ACTIVE SAWMILLS IN THE NORTHERN INTERIOR OF BRITISH COLUMBIA: 1920 - 1974.

Source: British Columbia Forest Service Annual Reports, 1921 - 1975.



considerable insight into the functional integration or hierarchial structure between the towns of the North Central Interior, as it existed in 1971. While more recent data are not yet available, there are solid grounds to suspect that substantial changes in the functions performed by some of the developing towns have occurred since, as a result of governments' "development policies" (which are usually manifested through explicit or implicit direction of components of the forest industry).

However, Robinson (1972, p.5) observed that

> "The forest industry of the interior is now establishing geographical patterns of concentration, and corporate integration of processing, similar to that which developed on the coast prior to 1940."

This implies that post-1950 changes in forest policy and administration practices did not, in isolation, cause concentration, but rather it was probably due to developments in transportation and economies of scale. There are therefore two arguments that need to be reconciled. On one hand, the conscious direction of components of the Interior forest industry by the B.C.F.S. over the past ten to fifteen years has clearly been oriented towards determining the size and location of the industry. On the other hand, the end results observed by Robinson are similar to those which evolved earlier on the coast without B.C.F.S. direction and are also similar to the experience in such diverse jurisdictions as Sweden (Randers, 1976) and Australia (Straker, 1970). It may therefore be concluded that the forest policies discussed above were not uniquely causal but might well have facilitated the changes, as

the area was "developed".

Employment Stability

Although "stability" or "community stability" has been very widely discussed in general, a precise definition is imperative in order to measure it, theorise about it, or suggest policies to deal with it. As noted in Chapter 2, "stability" has been used in the sense of "security, reliability, steadiness and equilibrium" as well as "permanence, entrenchment or immutability". In this thesis, employment stability is taken as the focal point of social and political concern with respect to regional economic instability in general. (This is consistent also with the interpretations of many previous authors on community stability and forest policy.) Thus the definition of stability as "orderly change" and the absence of unexpected, sudden changes seems appropriate. Thus both continual but slow growth or decline is acceptable, but frequent trend reversals are not. It can be expected that employment instability will approximate instability in production and in incomes, at both industry and regional levels, if inventory adjustments within the logging-milling phases are relatively small. This relies on the assumption that the labour component of production does not vary greatly in the short run.[1]

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[1] Andrews (1969) discussed the strengths and weaknesses of such measures as employment, payroll, value added and physical production, in the context of economic base analysis.

It has proven impossible to get comprehensive and completely reliable data to investigate the present state of employment stability in the North Central Interior. Two types of data from two different sources have been used in this study, firstly, to analyse crude trends in employment and employment security over a broad area and secondly, to analyse the nature and stability of unemployment in the city of Prince George and the town of Quesnel.

1. Employment Stability And Industrial Structure. Data on employment and man-months worked, in logging and sawmilling in each ranger district of northern B.C.'s three Forest Districts were supplied by the B.C.F.S. [1] From these data one can only observe trends in the average number of months worked/ year/man in each district, and then attempt to correlate these with the changes in industrial organization (number, scale, location and ownership) within that ranger district. It has frequently been asserted that the creation of a sophisticated conversion complex has been accompanied (in this area) by a change from winter to year round logging[2] i.e. short term stabilisation of labour

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[1] Some was circulated through Canada Manpower as a memorandum to forest industry counsellors, dated 2 May 1975. The collection method and reliability of these data are undetermined but they probably merely represent the local ranger's best guess. The data appear in each Forest District's (unpublished) Annual Report and are used in Reports by the B.C. Dept. of Economic Development.

[2] For example, in Industrial Progress of the North, June 1969, p.22.

force requirements.[1]

Figures cited by Gilgan (1974) and Williston (1971a) indicate the changes in seasonal and short run employment stability as the forest industry's structure changed. For example, in 1960, the average output per man was 128 cunits per annum while in 1973 it was 432 cunits per annum. Simultaneously, the average number of months worked rose from 4.5 to over 10 months/year in logging and sawmilling in the Bulkley-Nechako Regional District. The assertion that the changing industrial structure in the North Central Interior reduced the effects of seasonality on employment in logging and sawmilling is the essential hypothesis of this stage of the quantitative analysis.

It seemed that the B.C.F.S. data could be used to illustrate, though not verify, this alleged relationship between changes in industrial organisation and in short run employment stability. It was therefore necessary to define an index of industrial structure, which would differentiate between those geographic units (ranger districts) characterised by many small portable mills - the primary phase of development of the forest industry - and those in which there are fewer, much larger mills. The 21 ranger districts for which complete series were available were therefore stratified on the basis of the combined sawmill capacity (as estimated by B.C.F.S.) of the four largest

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[1] This is only a step forward, presumably, when the employees had no summer alternatives. A change such as this may be detrimental to employers of seasonal (summer) help.

mills in 1974. [1] This stratification proved very similar to the hierarchy of municipalities presented in Table 6 (and also quite consistent with the data in Table 3). This is hardly surprising since those towns towards which most logs move are the centres of large conversion complexes, which are being indexed here.

The estimated number of employees and man-months worked were totalled to derive a mean months worked per man for each of the 5 classes, for both logging and sawmilling. These data are also presented in Table 7, and graphically in Figures 8a to 8d. Although no positive conclusions can be drawn, the figures do suggest some trends.

a. Mean months worked per man in sawmilling rose between 1964 and 1969, except in class 1, which still has a very rudimentary sawmilling industry. Generally, the more agglomerated is the local sawmilling industry, the greater is the mean months worked per man there. That is, employment and hence production in the large scale agglomerated plants seems to be less subject to the effects of seasonal difficulties. This might be due to their technological advancement, their greater capital resources enabling the holding of large inventories or the fact that the management cannot afford to close down and leave such a capital asset for the "freeze up" or "break up" months.

b. Mean months worked per man in logging has remained static in classes 2 and 3 over the 10 year period, which (along with Figure 8a) suggests that employment characteristics in these two classes have been affected relatively little by any industrial

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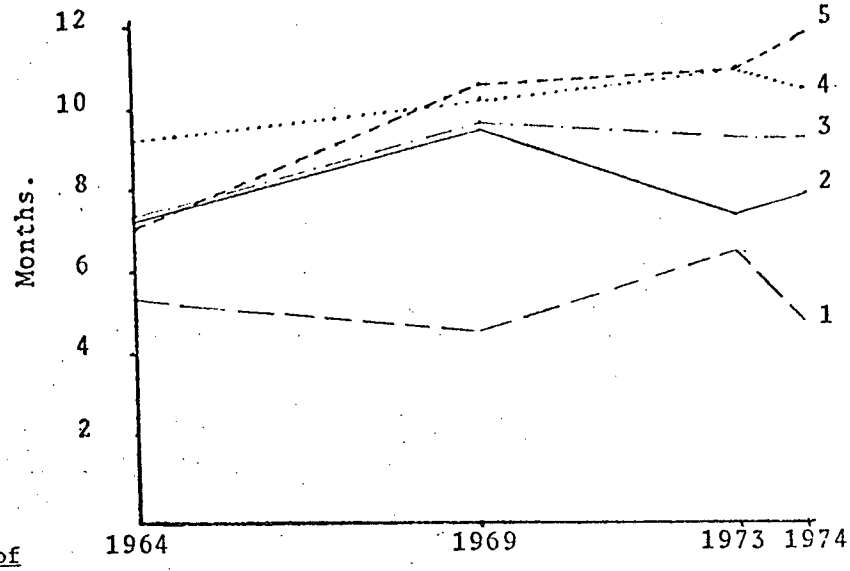
1. The class limits were chosen somewhat arbitrarily, but there are "natural" classes and it is doubtful whether redefinition would substantially alter the results.

Table 7. Mean Months Worked and Number of Employees in Logging and Sawmilling in North Central B.C.

Class	Combined Capacity of 4 Largest Mills *	Ranger Districts	Sawmilling: Mean Months Worked/Man / Average Number of Employees				Logging: Mean Months Worked/Man / Average Number of Employees			
			1964	1969	1973	1974	1964	1969	1973	1974
1.	Less than 50	Southbank and Lower Post/Atlin.	5.4	4.6	6.7	4.9	5.6	4.9	8.9	10.2
			126	70	34	39	77	167	318	233
2.	50 - 149	Burns Lake, McBride, Valemount, Dawson Creek, Fort Nelson and (part of) Prince George.	7.3	9.6	7.5	8.0	5.6	5.5	4.7	4.2
			927	1579	763	817	513	734	685	724
3.	150 - 249	Smithers, Summit Lake and Hixon.	7.4	9.8	9.5	9.5	5.5	4.7	5.7	5.6
			885	830	619	668	662	1245	917	795
4.	250 - 449	Houston, Fort St. James, Upper Fraser, Vanderhoof, Fort St. John, Fort Fraser, Chetwynd and (part of) Prince George.	9.2	10.3	11.1	10.5	6.7	5.5	7.5	5.9
			2427	1963	2896	2581	1246	2198	1973	2300
5.	More than 450	Mackenzie and (part of) Prince George.	7.2	10.8	11.0	12.0	4.8	5.2	8.7	9.9
			490	907	1619	1694	561	711	959	468

* 1974 Capacity measured in M f.b.m. of production per 8 hour shift.

Figure 8a. Mean Months Worked / Man in Sawmilling.



Class	Combined capacity of 4 largest mills, 1974.
___1___	< 50 M f.b.m.
___2___	50 - 149 M f.b.m.
_._3._.	150 - 249 M f.b.m.
.....4.....	250 - 449 M f.b.m.
___5___	> 450 M f.b.m.

Figure 8b. Mean Months Worked / Man in Logging.

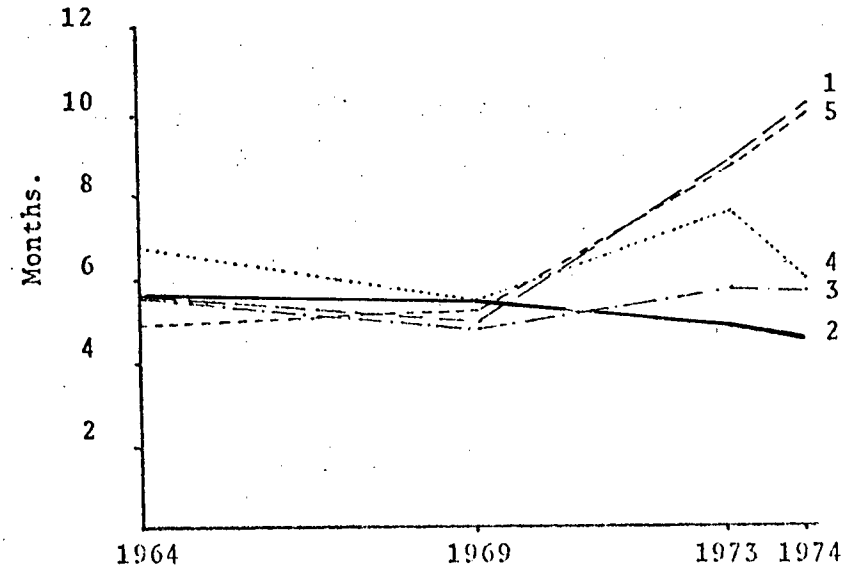
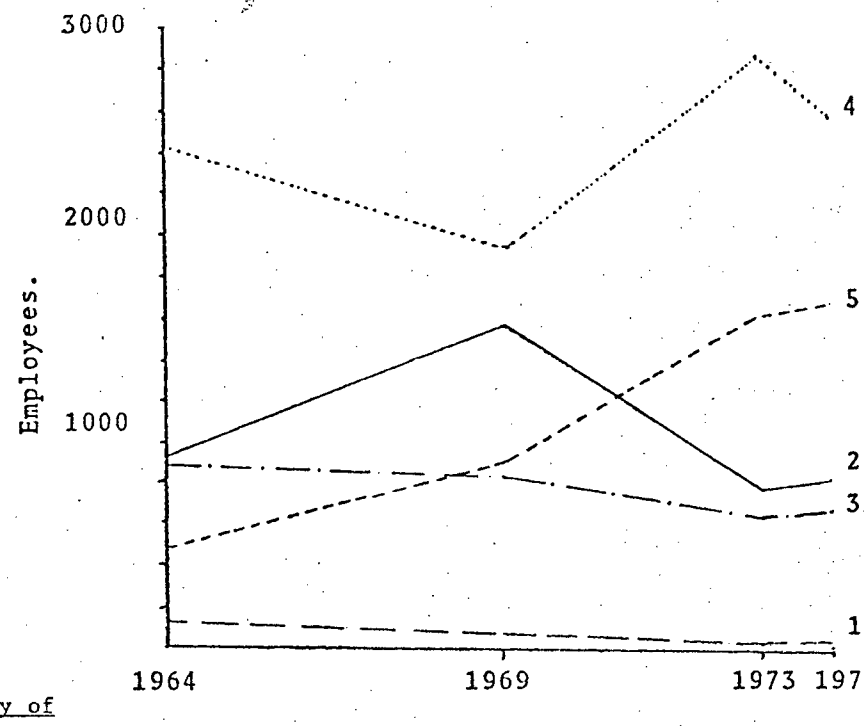


Figure 8c. Number of Employees in Sawmilling.



Class	Combined capacity of 4 largest mills, 1974.
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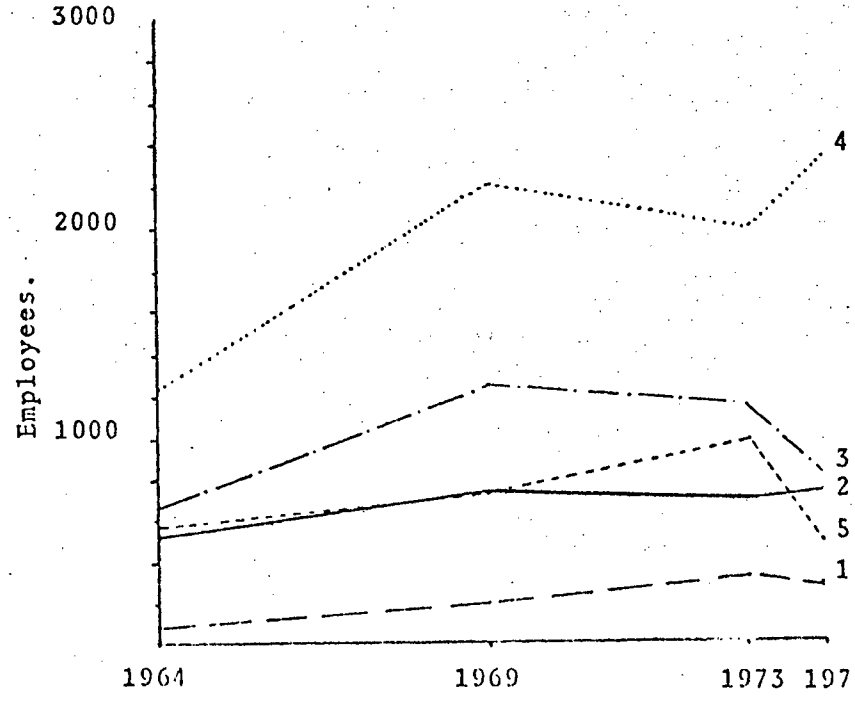
___2___	50 - 149 M f.b.m.
_._3._.	150 - 249 M f.b.m.
.....4.....	250 - 449 M f.b.m.
___5___	> 450 M f.b.m.

Figure 8d. Number of Employees in Logging.



changes which may have occurred. On the other hand, there have been major changes in the most and least developed classes. The change to year-round logging in the Southbank district (Class 1 of Table 7) may be attributable to the fact that logging there has been mainly to supply the major conversion plant at Kitimat, on the coast, rather than for the local small scale sawmilling industry.

c. The total labour force requirements in sawmilling in these ranger districts have apparently increased slightly between 1969 and 1973, but all of this was in those districts characterised by fairly concentrated, large scale mills. Any increases in the labour force seem very small in comparison to the known growth of output. That is, labour required per unit output has apparently fallen.

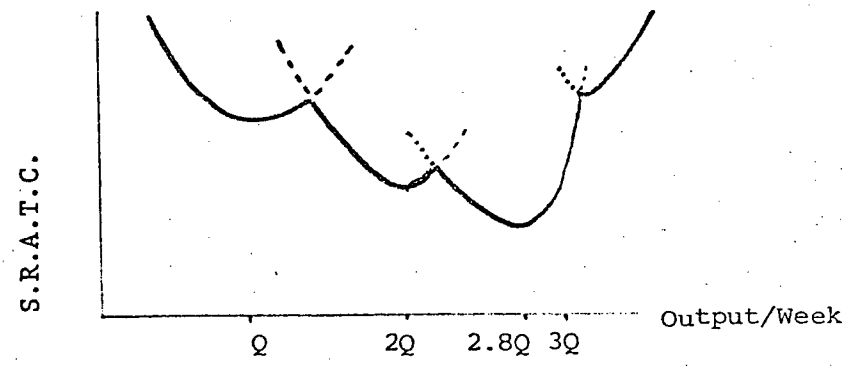
d. The number of employees in logging does not seem to have responded markedly to any industrial developments since 1964. It appears that there was a general increase (in line with increased levels of production in processing) particularly in class 4 - the centres of reasonably agglomerated sawmilling.

There is an apparent anomaly in Figures 8c and 8d. Between 1973 and 1974, the number of logging employees in the ranger districts of classes 3 and 5 declined, while the number in sawmilling rose slightly. In class 4, the opposite was true. One possible explanation is an increased flow of logs from the ranger districts of class 4, to supply the mills in Prince George and Mackenzie, where less logging but more sawmilling activity was occurring. A second possibility is an inconsistency in classification - some employees previously classed in logging

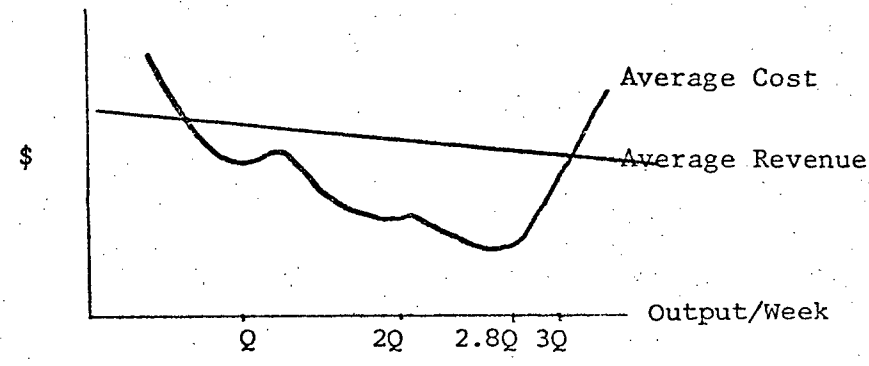
may have been counted as sawmilling employees and vice versa. As previously noted, these data are not highly regarded for their accuracy or consistency, and it may be that comparisons between two consecutive years can not be made reliably.

Even at this level of aggregation (of ranger districts each covering a number of sustained yield units), instability over the 10 year period in the number employed and in months worked per year is apparent. While this is a natural consequence of the instability in log harvest and lumber production shown in Figures 2a and 2b, this section of the thesis has presented further evidence that yield regulation of individual P.S.Y.U.s is irrelevant to questions of short- and medium-term employment stability, particularly when the nature of the forest industry has been changing. It is still not clear, however, whether the government or the B.C.F.S. in any way anticipated such changes when the administrative and policy decisions discussed above (which had such direct and indirect incidence on the industry) were made.

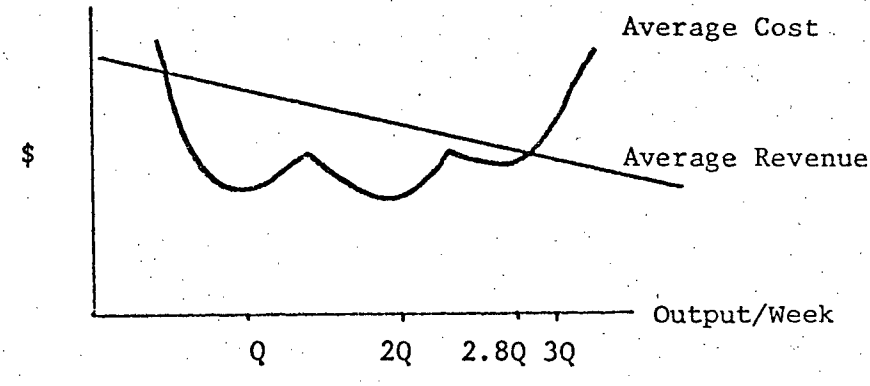
There is a second aspect to the relationship between employment stability and the structure of the forest industry, particularly the size and captial intensity of sawmills, which is associated with the managerial decision to lay-off a shift in a sawmill in the event of a market downturn. A brief theoretical discussion of this follows. A series of short run average total costs curves of a mill of given size is presented in Figure 9a. While the mill may be operated with up to three eight-hour shifts per day, the most efficient (cost minimising) level for a sophisticated capital intensive mill is generally thought to be



9a.



9b. (No Lay-offs).



9c. (Lay-offs).

Figure 9. Average Costs, Profits and the Number of Shifts for a Sawmill.

approximately 2.5 to 2.8 shifts per day. This allows for maintenance and down time, but also reduces the unit cost of the substantial overhead and depreciation charges. Thus Figure 9a shows the point of minimum short run average total costs where output per week is 2.8 times the output per week of one shift.

This leads to a SRATC such as 9b, where the number of shifts worked and throughput/shift are the decision variables. If the producer faces an almost perfectly elastic demand curve, as is frequently claimed, the dismissal of a shift in response to a falling demand for lumber results in higher average total costs, i.e., lower profit margin as well as reduced level of output. Dismissing a shift is only rational if the slope of the demand curve is greater than the average slope of the SRATC. One would expect that for a modern and sophisticated capital intensive sawmill, the reduction in average costs (because of the high percentage fixed costs) with 2 or 2.8 shifts would be significant. Thus, as the average revenue curve shifts down (weakening demand), the last point at which this capital intensive mill would operate profitably is at the point of minimum SRATC (or approximately 2.5 to 2.8 shifts per day. Unless demand is extremely inelastic, it is irrational to dismiss a shift.[1]

On the other hand, for a small bush mill whose average costs are not substantially decreased with extra shifts (or are

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[1] Assuming that the company is not subject to significant short term liquidity problems and that inventory costs are relatively small.

even increased), then even with a moderately elastic demand curve, a decline in price would induce management to cut back a shift, as in 9c. The last profitable level of operation for this mill is when one shift is working at its optimal level of output.

More generally, in making the decision to close all or part of a mill, the sum of the lumber storage (inventory) costs and the price depressing effects (if any) of an accumulation of product inventories must be weighed against the sum of the fixed (capital) costs and the costs of labour recruitment and retraining. While the net result is dependent upon the elasticity of supply of suitably skilled labour and the price elasticity of demand for sawn lumber, it can be concluded that, ceteris paribus, the capital intensity of the new integrated complexes provides for more stability of employment in the face of market shocks than was previously the case (although the number of employees/unit output is less).

However, it has been observed that many mills, apparently facing quite elastic lumber demand schedules,[1] do reduce output, lay off a shift and simultaneously incur higher average costs. These firms act as though they believe they have some monopoly power, that through withholding or reducing production they can prevent prices falling too far in a recession. It would appear that there are too many alternative lumber suppliers (especially

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[1] Mead (1975, p.34:5) commented that in all his interviews, each sawmill operator agreed that there would be no significant average price effect for standard items, of a 100% increase or a 50% decrease in the level of production of his mill.

to the U.S.A. markets) for this to be the case. A sawmill with a large fixed cost component should, like a pulpmill, operate at capacity and minimise average total costs or else close down completely. Therefore, any exogenously supplied technology which is capital intensive, or any forest administration policies which facilitate or encourage the implementation of this technology, should contribute towards more stable employment opportunities for a smaller number of production employees.

2. Study of unemployment. With access to Canada Manpower Centre records from Quesnel and Prince George, a monthly series (July 1967 - August 1975) of registered unemployed and registered vacancies for each of ten occupational groups[1] for each centre has been compiled. Canada Manpower is really the only source of unemployment statistics in any way suitable for the purposes of this analysis. Moreover, since these data are the source of the statistics used and released by governments, they seem very relevant to social and political concerns regarding employment stability.

Monthly data were considered most suitable (i.e. corresponding to the problem addressed) since that series captures seasonal and sectoral fluctuations that are reported and significant for policy. Weekly data are not available and

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[1] Defined by "Occupational Classification Manual - Canadian Dictionary of Occupations", D.B.S. ,12-537. The change in classification from 1971 necessitated adjustment of the earlier records. These figures include males and females. A specimen fron the Canada Manpower Centre records and the relevant details of the Occupational Classification Manual are included as Appendix I.

would be highly unstable, recording fluctuations not generally deemed relevant by most observers. Annual data would obscure many underlying changes. Seasonal variation is real and important in that valid reasons underly the fluctuations. In many occupations, seasonal variation in employment cannot be considered "undesirable" instability. That is, "undesirable" instability (if any) must be isolated from that which is necessary, before any policy measures can be suggested to cope with "unnecessary", "undesirable" or exogenously induced instability.

A) Instability by occupational groups.

The first question to be analysed was the degree of employment instability exhibited by each occupational group, in order to gain some insights into possible sources of instability and causal interrelationships between sectors in each centre. Figures 10a and 10b illustrate the levels and variability of the number unemployed, in total and in logging + processing, for each centre.[1]

The particular measure of employment to be used in analysing instability in these data series required some consideration. If only the number unemployed was used, changes in the number of vacancies with the fortunes of the regional economy would only appear indirectly, as some of those vacancies

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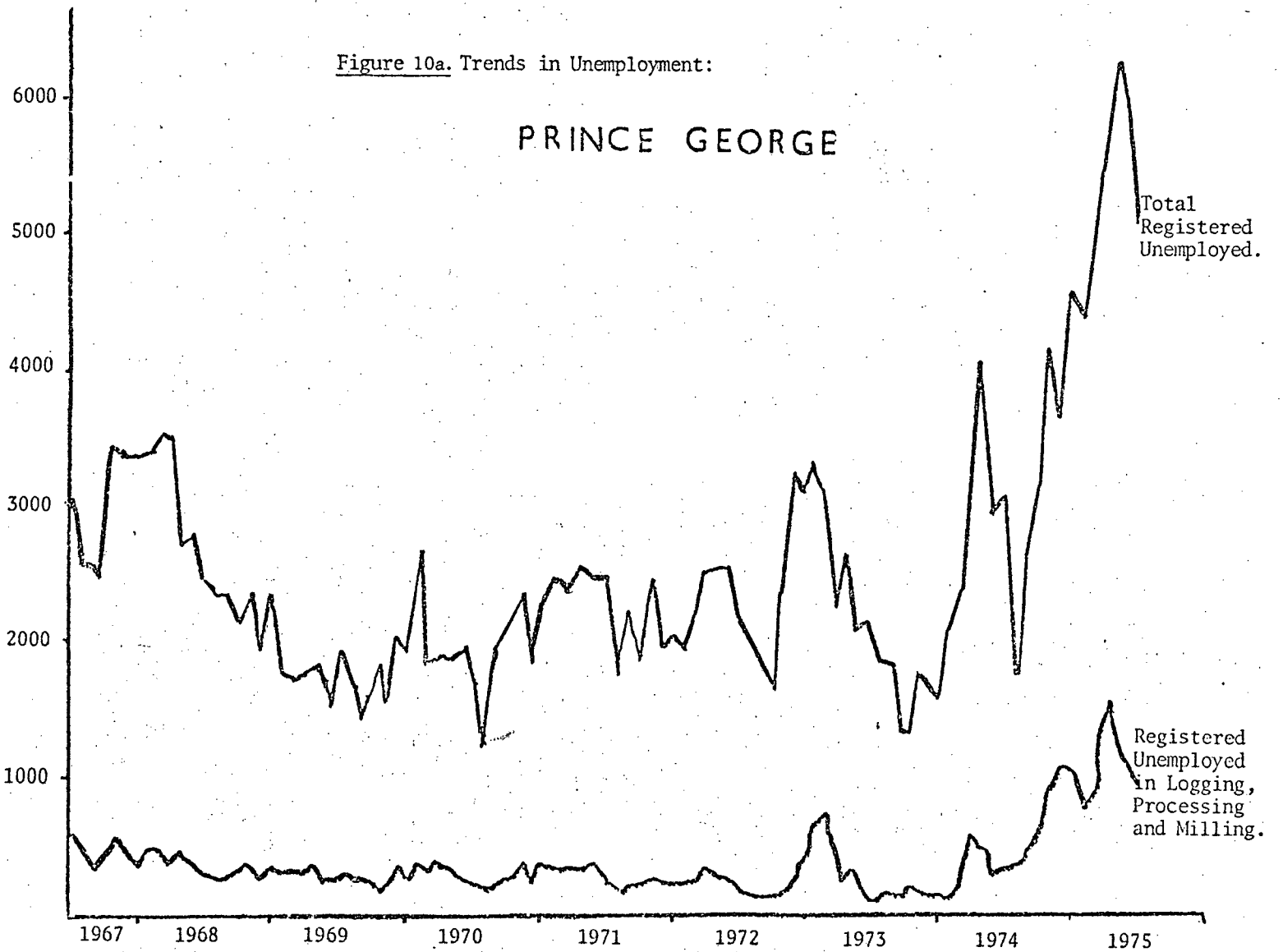
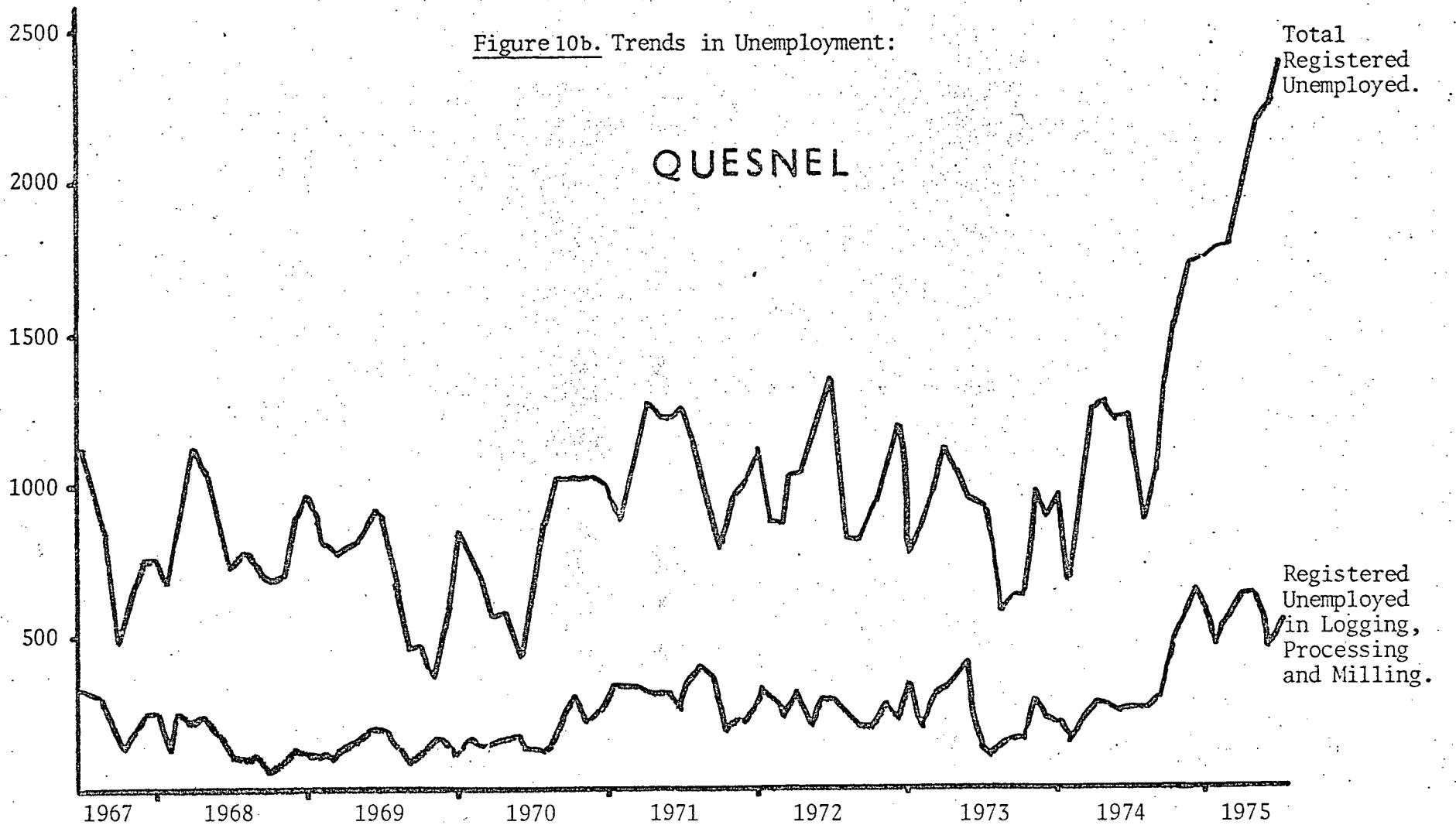
[1] The city of Prince George is not only much larger than Quesnel, but has a much more diversified economic base and much larger service and distribution sectors. Still, those areas which use Prince George's service and distribution sectors are largely dependent on the forest industry (e.g. Quesnel).

Figure 10a. Trends in Unemployment:



Source: Canada Manpower Centre Monthly Reports.

Figure 10b. Trends in Unemployment:



Source: Canada Manpower Centre Monthly Reports.

were subsequently filled. Also, in any months in which vacancies exceeded the number unemployed, important information would be lost. "Net unemployment" (unemployed - vacancies) therefore seemed a useful concept, implying the number of unemployed remaining (if any) if every vacancy was filled. That this measure becomes negative for certain occupations during periods of shortage of those skills is valuable information about fluctuations in the regional economy.

An alternative measure could be the ratio of registered unemployed per vacancy. Yet it seemed that while this could be quite useful and interesting, it is not as relevant to social and political concerns, as the absolute number of people who can not find work. In addition, a small change in the number unemployed will affect the ratio in a small sector much more than in an occupation with many employees.[1] Such an obvious source of bias, where the occupational groups with fewest employees (or more accurately, with fewest unemployed) appear most stable, should be avoided. Thus the "net unemployment" measure was used in all subsequent analysis.

The variance about the mean or trend line has frequently been used in international trade literature, [2] as an index of

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[1] Using the unemployed / vacancy ratio as a measure, these data show Agriculture and Fishing (where unemployment ranges from 3 to 12, with 2 to 4 vacancies) to be much more unstable occupations than Logging or Processing (where the number unemployed fluctuates by up to 200 and vacancies range at various times from 10 to 70).

[2] For example, U.N.C.T.A.D. (1964) and MacBean (1968).

(export) instability. However, for this study, an index like the coefficient of variation (standard deviation divided by mean or trend value of unemployment) was one alternative.[1] Another might be variance times mean. Then that occupation with the highest index would seem the least desirable, if low unemployment with stability is the goal. However, since a high variance may merely reflect scale, i.e. a large mean, it was thought that this index would weigh very heavily against those occupations with high unemployment numbers, despite the fact that the number employed has not been taken into account.

There are in fact two components of this problem of comparing stability. The first is which occupational groups are relatively unstable, i.e., the frequency and magnitude of dispersion about the trend line can be expressed as a percentage of the trend number unemployed. The coefficient of variation is such an index. These results are presented as Table 8a.

The second component is the absolute variability of each occupational group - the actual changes in the number of people unemployed - where no adjustment is made for the size of each sector. These results, which therefore reflect the importance or size of each sector and its relative dispersion, are presented as standard deviations in Table 8b. The units of standard deviation are the same as the original units, i.e. number of people.

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[1] The coefficient of variation or "relative dispersion" is a well known statistical measure of relative variability of two distributions with different means but of a similar order of magnitude.

Table 8a. Coefficient of Variation of Unemployment by Occupational Groups: 1967-75.

QUESNEL		PRINCE GEORGE	
		Service	.99
		Forestry-Logging	.90
		Assembly-Repair	.83
		Processing	.82
Assembly-Repair	.81		
		Miscellaneous	.79
Miscellaneous	.78		
		Agriculture-Fishing	.68
		Construction	.61
Agriculture-Fishing	.57		
Forestry-Logging	.54		
		Sales	.53
Administration, H.E.W.	.39		
Processing	.38		
Service	.38		
Sales	.37		
Clerical	.34		
Total	.33		
		Administration, H.E.W.	.32
Construction	.31		
		Clerical	.25
		Total	.13

Table 8b. Standard Deviation of Unemployment by Occupational Groups: 1967-75.

QUESNEL		PRINCE GEORGE	
Total	316		
		Total	299
		Miscellaneous	256
		Construction	243
		Processing	165
		Service	125
		Clerical	123
		Forestry-Logging	119
		Sales	90
Miscellaneous	86		
Processing	65		
Construction	61		
		Assembly-Repair	53
Service	48		
		Administration, H.E.W.	44
Forestry-Logging	41		
Clerical	38		
Sales	21		
Assembly-Repair	11	Agriculture-Fishing	11
Administration, H.E.W.	10		
Agriculture-Fishing	6		

From an examination of these results, one can observe, for example, that although Agriculture-Fishing is quite unstable in both centres, there are few people involved and the absolute impact of its instability is minor. The Assembly-Repair group is equally unstable in both centres, but the social impact of this is greater in Prince George (the distribution and service centre where many people are involved) than in the small town of Quesnel. Unemployment is shown to be relatively more unstable in Prince George's Service, Forestry/Logging, Assembly/Repair and Processing sectors than in Quesnel or in the other sectors in Prince George. This can not be explained in terms of the large Prince George population or labour force in these sectors, but most likely is due to exogenously induced changes in forest industry activity which have greater effect in Prince George than Quesnel.

The results also indicate that the almost single-industry town of Quesnel exhibits much greater instability of total unemployment, relatively and absolutely, than (diversified) Prince George. The relative dispersion of total unemployment in Quesnel (33%) is considerably greater than in Prince George (13%). Although Quesnel's 1975 population was only one-sixth of Prince George's, the number of registered unemployed in Quesnel is approximately half of that in Prince George, and the standard deviation about the trend in total unemployment shows that more people are directly affected by employment instability than in

Prince George.[1]

These results may be interpreted in two ways, depending on the assumptions one makes concerning labour force mobility. If the labour force was perfectly mobile between occupations and could migrate freely between regions, the problems or social costs of employment instability would be greatly reduced. Firstly, assuming that no migration occurs in response to unemployment in the region, the results indicate that the Quesnel economy is relatively unstable. If one considers fluctuations in a number of occupations out of phase, results as in Fig.11a can be anticipated. However, if the component sectors fluctuate in phase, the total variability or instability will be greatly amplified as in 11b. It would seem highly probable that Quesnel's construction, logging, processing (=sawmilling in Quesnel) and transport occupational groups would all move in response to the same factors, whether lumber prices, industrial disputes, B.C.F.S. policy or something else. Therefore, if the possibility of migration or changing occupations is ignored, there is evidence that the structure of Quesnel's economy is amplifying any instability induced in sawmilling and logging employment, while in Prince George the effect is much less noticeable.

Alternatively, if one assumes that migration and occupational changes occur, the results can be interpreted as

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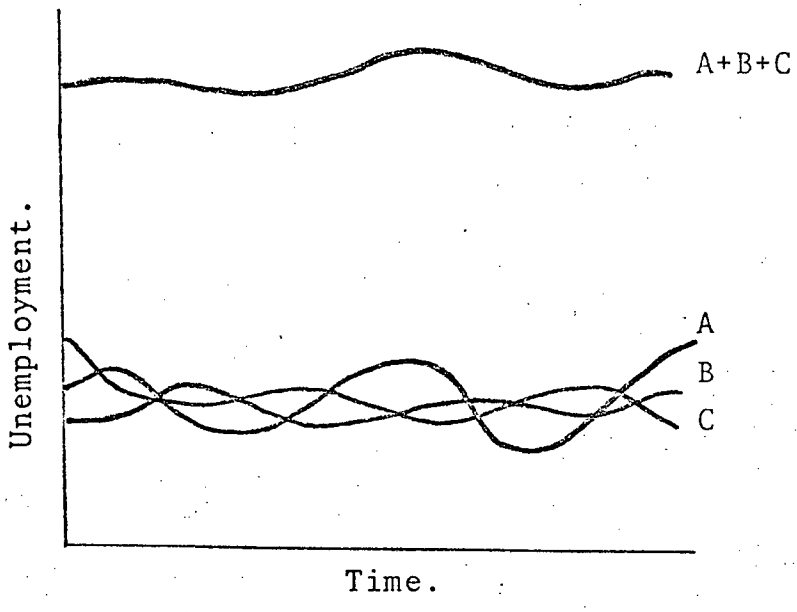
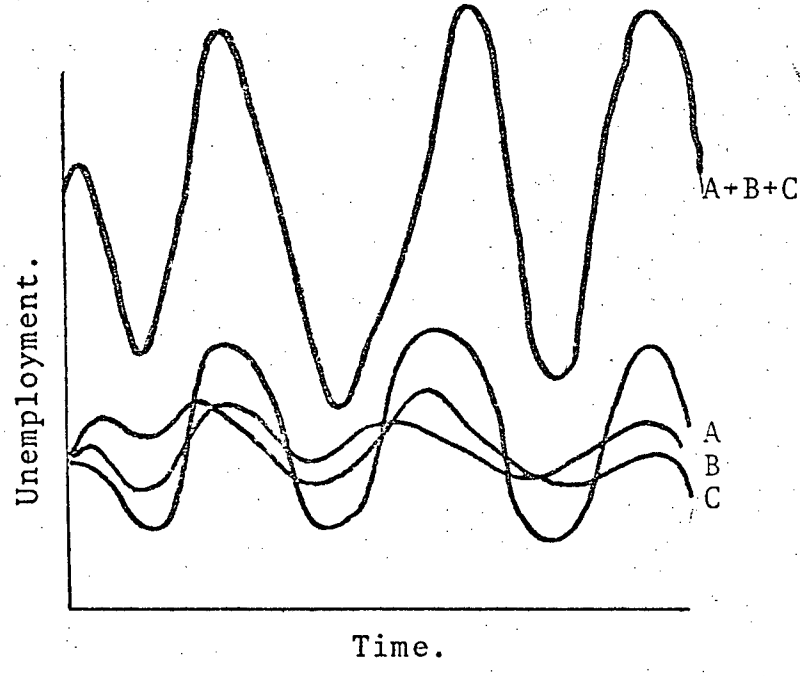
[1] This may seem quite remarkable considering the boom-town nature of Prince George's recent growth. (See Table 1.) These data suggest that the boom was not unbalanced.



11a. Diversified Economy - 3 Industries, 3 Sectors



11b. Non-diversified Economy-- 3 Industries, 1 Sector.

Figure 11. Total and Sectoral Unemployment.

evidence that it is more difficult to leave Quesnel or to find employment in another industry there when the forest-related industries are depressed. That is, the labour force in Prince George may be more mobile than that of Quesnel (perhaps because a house can be sold or rented more easily or because of a wider range of saleable occupational skills in Prince George). Whether or not migration occurs, the result that total unemployment in Quesnel is more unstable relatively and absolutely than in Prince George can be attributed to the differences in structure of the two towns' economies, namely that Prince George is more diversified.

For purposes of comparison, two other less satisfactory indices of employment instability were calculated and are considered below. Table 9a shows the ranking of occupational groups by variance / mean in ascending order, for the city of Prince George and the town of Quesnel, along with the mean of (registered unemployed - vacancies) for the period July 1967 - August 1975. While this index provides some interesting insights and is generally supportive of the results in Table 8a, it has two major drawbacks. It has little statistical usefulness and is therefore not generally accepted as an index, and it has no natural units (whereas the coefficient of variation is a percentage).

Table 9a. Ordering of Occupational Groups by Employment Instability Index[1] (and Mean Number Unemployed: 1967-75).

QUESNEL		PRINCE GEORGE	
Occupational Group	Mean Unemployed	Occupational Group	Mean Unemployed
Agriculture-Fishing	11	Agriculture-Fishing	15
Administration, Health, Education & Welfare	24	Administration, Health, Education & Welfare	137
Sales	55	Clerical	485
Assembly-Repair	13	Total*	2302
Clerical	111	Assembly-Repair	63
Service	127	Sales	169
Construction	195	Forestry-Logging	132
Forestry-Logging	76	Service	126
Processing	171	Processing	201
Miscellaneous (including Students and Transportation)	110	Construction	398
Total*	958	Miscellaneous (including Students and Transportation)	324

[1]The Index used here is Variance/Mean, for the 97 month time series.

Table 9b. Employment Instability - Log Variance Index.

Quesnel	Index	Prince George
	2.25	Assembly-Repair
	1.87	Processing/ Milling
Total *	1.55	
	1.53	Forestry-Logging
Miscellaneous	0.88	Construction
	0.75	Miscellaneous
Sales	0.58	
Assembly	0.47	
	0.41	Ag.-Fishing
Admin., H.E.W.	0.36	
Ag.-Fishing	0.30	
	0.25	Sales
For.-Logging	0.23	
	0.22	Service
Service	0.16	
Processing Milling	0.15	Total *
Construction	0.13	Admin., H.E.W.
Clerical	0.11	
	0.08	Clerical

Another measure of instability is a log variance index.[1] The results using this index are presented as Table 9b. The interpretation of these results is not as obvious as for the coefficient of variation, but they are similar in some respects. Forestry-Logging and Processing-Milling are relatively more unstable in Prince George than in Quesnel, while Quesnel's total unemployment is more unstable than Prince George's.

The analysis of these data is vitiated by the problem of people registering in different unemployment categories at different times. For example, an unemployed logger could register for a different type of work and might well do so if he realises that the industry in which he normally works is currently depressed. Canada Manpower can not ascertain how often this might occur, although it too presumes that no changing between classes occurs. This effect could further complicate the comparison between Prince George and Quesnel, since the scope for changing the type of employment would appear much greater in Prince George than in the almost single industry Quesnel.

B) Trends in unemployment.

Other interesting information generated by the regression of log (unemployment-vacancies) on time, concerns the trend

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[1] This is not to be confused with the somewhat different index of the same name, used in the international trade literature, which was developed by Coppock (1962). The index used here is formulated as the variance of the regression log X = c + a.Time. The use of logarithms means that proportional changes about the respective group trends are being compared by the log variance index.

growth rates of net unemployment.[1] These results are presented as Table 10. One should immediately note that the number of net unemployed in Prince George has been growing very slowly compared to the rapid growth in total population. (See Table 1) This is in marked contrast to Quesnel's rather high growth rate of the number unemployed. Coupled with its quite undramatic total population growth (see Table 1), these data suggest (not surprisingly) that Quesnel has not performed well recently. Unemployment in each occupational group has been growing considerably faster than in Prince George.

The estimates, that net unemployment for the eight year period has been declining significantly for Prince George's assembly-repair, construction and miscellaneous (including transport) groups may seem surprising at first. However, the Manpower Regional Economist in Prince George has also observed, on different criteria, that these are "persistent shortage occupations" in that area.[2] What remains most noteworthy, is the appearance of structural labour immobility in those same occupations in Quesnel. Perhaps Quesnel's unemployed skilled tradesmen are not prepared to move to Prince George where there are more vacancies. Yet, one cannot be sure whether this observation is accurate, or whether unemployed people from Prince George are moving to Quesnel in search of sawmilling, logging and related employment, thereby inflating the apparent

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[1] If $\log X = c + a.T$, then $a = d \log X/dT = 1/X \cdot dX/dT$. Thus the estimated coefficients of T in the regressions are the proportional growth rates of each occupational group's "net unemployment" over the 97 month period.

[2] See Smelser (1975).

Table 10. Trends in Number Unemployed - Vacancies 1967-75.

Occupational Group	Annual Growth Rate (Unemployed-Vacancies)	
	Prince George	Quesnel
Administration, Health, Education & Welfare	16.20%	31.83%
Clerical	9.84%	19.96%
Sales	4.42%	20.94%
Service	-0.83% *	3.63%
Agriculture-Fishing	9.05%	14.53%
Forestry-Logging	4.36%	19.00%
Processing, Machining & Milling	6.33%	12.53%
Assembly-Repair	-30.81% *	31.85%
Construction	-12.13% *	14.76%
Miscellaneous (including Students and Transportation)	-5.82% *	19.88%
Total	2.26%	18.99%

* Denotes negative trends.

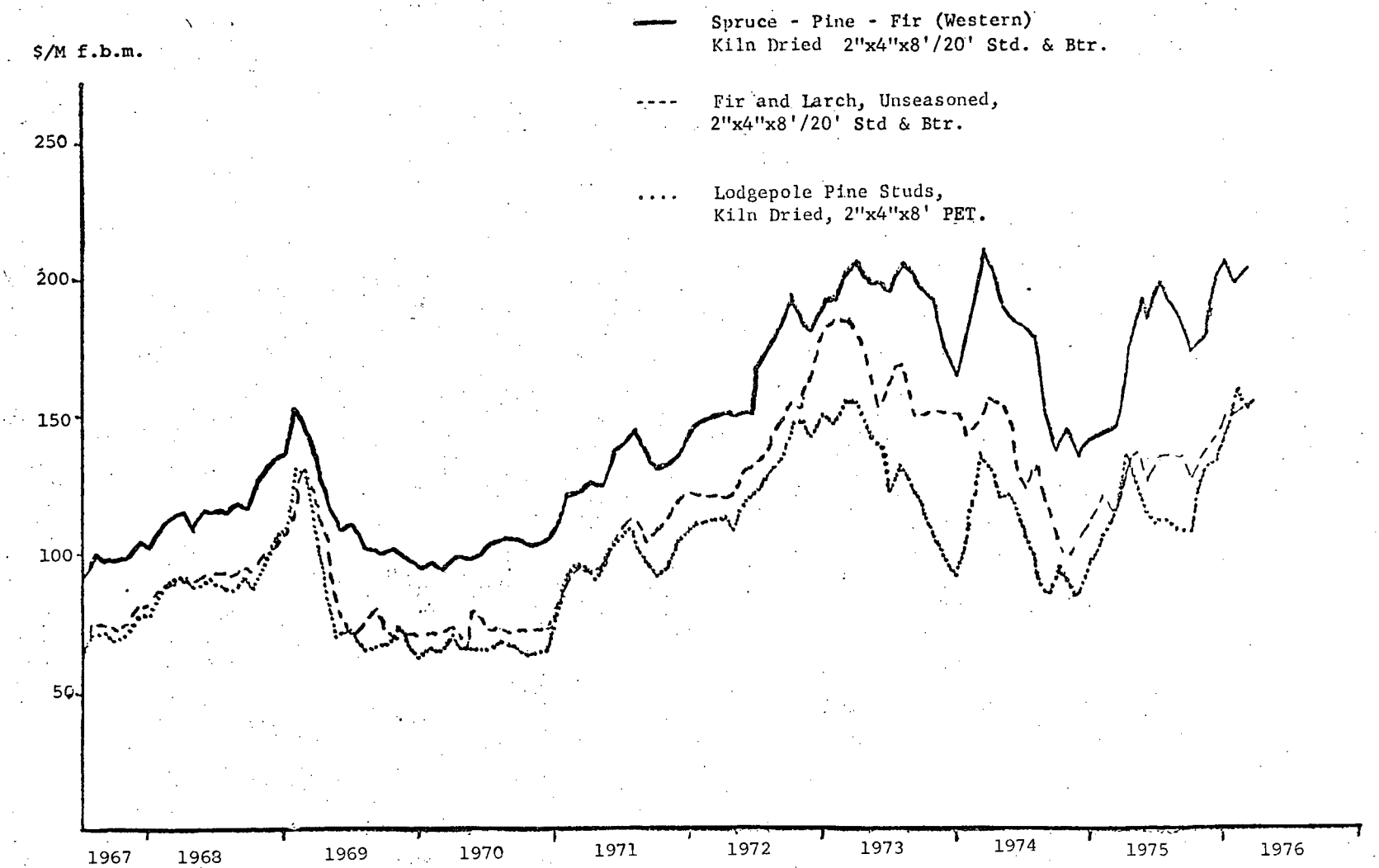
trends there. An examination of trends in unemployment such as this would be incomplete without consideration of labour force migration as previously discussed. However, it seems that the Provincial government has never recognised the difficulties of trying to create jobs for local people or maintain stable employment in remote areas, as long as it has virtually no control at all over international, interprovincial or intraprovincial migration.

C) The effects of lumber prices on employment stability.

Econometric time series analysis of these same data was used to examine the hypothesis that unemployment in sawmilling (and to a lesser extent logging) is correlated with current or previous lumber prices. Figure 12 indicates the 8-year monthly trends in prices for the species and sizes of lumber commonly produced. Numerous other relationships can be postulated from a knowledge of the area and industry, and from subjectively examining the data. For example, applicants per job vacancy or net unplaceable applicants in those industries closely associated with sawmilling (viz. maintenance, transport, construction and logging), seem to rise soon after unemployment in sawmilling rises, or about three months after a (sustained) price fall. It also seems that employment in service industries is only adversely affected after sustained downturns in sawmilling and associated activities, in these two centres.

There is no established theory to use as a basis for analysis of regional employment instability, other than the

Figure 12. Trends in Selected Lumber Prices: 1967-75.



general concepts of economic base analysis.[1] An intuition exists among analysts, e.g. Denike and Leigh (1971, p.70-71), and members of the forest industry, that export lumber prices substantially affect levels of production and employment. Thus, in this analysis, it is necessary to work backwards from the data, to a certain extent, using somewhat ad hoc rationales, to postulate more specific relationships between the demand for lumber (reflected in its price) and the level of production and employment in the forest industries.

There are of course numerous intermediate stages in the postulated relationship. Employment and unemployment levels are affected by wage rates, participation rates and population size for example, as well as the demand for labour to work in processing plants. It is then assumed here that the short run demand for labour is determined primarily by the level of processing activity[2] which in turn is largely dependent upon the profitability of the enterprise, although these relationships are certainly not simple. Finally, it has been assumed that the

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[1] where service sector (or non-basic) employment or incomes is considered to be a multiple of employment or incomes in the (basic) export commodity producing sectors.

[2] As one would intuitively expect, the number of registered unemployed in logging and processing (shown in Figures 10a and 10b) appears to be inversely correlated with production from northern mills (shown in Figure 2b). However, because of the nature of the three data series (unemployment, production and lumber prices) only the first and last could be econometrically analysed. That is the intermediate stage in the relationship between lumber prices, production and unemployment was bypassed. Figures 2a, 10a and 10b offered no evidence that these assumptions were inappropriate.

marginal profitability of logging or sawmilling enterprises will be correlated with changing lumber prices.

The last of these alleged relationships is of particular relevance to this thesis but has received only limited attention in the literature. It is therefore examined as a preliminary to the investigation of the effects of lumber prices on unemployment in the forest industry and related industries. A model of the relationship between lumber prices, the stumpage appraisal system and activity in sawmilling in the B.C. Interior is as follows.

Consider a profit-maximising, price-taking sawmilling firm, with the special condition that the supply price of logs to it is a function of the demand for or price of lumber. Yet this is not a variable relationship as would be determined by competitive bidding, but one set by a rigid calculation procedure, by the forest owner. In B.C., using the modified Rothery method,[1]

Conversion Return (CR) = Selling Price of lumber (SP)

- Operating Costs (OC)

This conversion return is to be divided between stumpage (St) payable to the Crown and profit (P) to the operator.

The allowed profit = x% of (St + OC)

where x is an allowance for profit and risk, which can range from 12% to 23%.

Thus $SP = St + OC + x\,(St + OC) = (1+x)(St + OC)$

i.e. $St = SP / (1+x) - OC$ and

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[1] See Pearse et al, (1974, Appendix II) for a detailed example.

allowed Profit = SP - OC - St = SP (1 - 1/(1+x))

Thus sawmilling profit and lumber selling prices per unit of output should be monotonically and positively related if the profit and risk allowed (x) is constant, although any changes in the conversion return are not shared between log-producer and log-processor in the same proportion. As the selling price rises above the point of minimum stumpage, stumpage increases at a faster rate than does the allowed profit.

However, the appraisal system cannot always be accurate in estimating all costs or revenues from sawmilling and logging and, as noted previously, there can be lags of some months in revising stumpage rates.

Thus, the actual profit[1] to the operator depends on his selling price and operating costs and the B.C.F.S. estimates of them which determine stumpage, as well as his level of output.

i.e. $P = SP.Q - St.q - OC(q)$

where Q is the volume of lumber produced and q is the volume of log throughput.

That is, $P = SP.Q - \left(\frac{SP}{1+x} - \text{"OC"} \right) q - OC(q)$

From this it is clear that actual profit is not a simple function of the selling price of lumber. If the profit and risk allowance or the estimated (allowed) operating costs ("OC") are revised downwards or if actual operating costs increase as selling prices for lumber increase, it is possible that actual profits might decline.

If milling activity is considered to be a function of the

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[1] Assuming a perfectly elastic export demand for B.C. lumber.

absolute size of the operator's share of the rent, rather than of lumber prices, the role of the appraisal system in setting the profitability of logging and milling becomes apparent. The appraisal system is meant to equate the profitability of all logging chances, geographically and intertemporally. To the extent that it fails to do this, overcompensates or imposes minimum or maximum stumpages, the timing and location of logging activity is distorted. Thus although lumber prices might rise 10%, for example, the actual profitability to the operator may not respond proportionately, positively or even predictably over a time series. Thus any causal relationship between changes in lumber prices and output or employment levels could be masked (to an unknown extent) by this effect of the stumpage appraisal system.

A second effect of the appraisal system which warrants attention here, stems from the fact that appraised prices for timber are derived from 3-month moving averages of product prices. Whenever lumber prices are rising, the moving average will understate the spot prices, meaning that the immediate "conversion return" is greater than estimated. That is, the operator's share of the rent exceeds what the B.C.F.S. would normally allow (if prices were static). Conversely, in any period of significant price declines, this effect could act as a deterrent to logging and/or milling activity, which may then be reflected (depending on its duration and lags) in unemployment statistics.

As the first step in quantitatively investigating the complex relationship postulated between unemployment and lumber

price fluctuations, a regression between the numbers unemployed in processing-milling and in logging, and lumber prices was tried using monthly data.[1] Deseasonalizing and detrending was considered necessary to ensure that no secular or cyclical influences were reflected in the estimated coefficients of independent variables under investigation.[2]

These results are included in Tables 11 and 12, and show significant correlation between current lumber prices and unemployment in the sawmilling industry only, and then only in Quesnel. The significant trends of increasing unemployment in each of the logging, processing and total groups in Quesnel noted above, again appear. Seasonal changes in unemployment in the logging and processing sectors were not shown to be significant, although such changes do appear for the total. It is possible to rationalize these results - production and employment in sawmilling could be expected to respond positively to a change in lumber prices, while logging may continue more steadily, year round, with any discrepancies in production being manifested in changes in log yard inventories.

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[1] The Lumber Price Index used is the weighted average of the prices in Figure 11. The weights are the harvest of that species as a percentage of the total cut in the Prince George, (Interior) Prince Rupert and Cariboo Forest Districts. Production data by species and size, for this region were not available to derive more accurate weights.

[2] Preliminary examination of the data suggested serial correlation (in the form of a first order autoregressive disturbance). To obtain consistent coefficient estimates, it was necessary to transform the data using the Cochrane-Orcutt iterative technique, prior to ordinary least squares regression.

Table 11. Regression Results - Quesnel.

	Dependent Variable	Constant	Time (months)	Summer Dummy Variable	Winter Dummy Variable	L.P.I.	L.P.I. 2 months prior	U_1 *	U_2 **	U_3 ***	R^2
1.	U (logging)	52.5	11.49			-0.231					.3132
2.	"	49.2	11.49	-5.70	12.47	-0.219					.3468
3.	"	32.7	12.52	-8.73	15.16		-0.128				.4710
4.	U (processing)	181.1	2.72	0.58	21.25	-1.244					.5725
5.	"	197.8	2.78	-4.16	19.26		-1.400				.5699
6.	U (total)	561.9	53.50			1.32					.3123
7.	"	490.5	63.60	131.52	123.89	1.38					.3714
8.	"	388.2	66.35	68.58	115.68			4.06			.7568
9.	"	304.7	0.22	43.25	-34.96				2.45		.7306
10.	"	195.1	182.99	39.11	104.66					1.65	.8013
11.	U (service sector)	182.5	37.07	-15.10	50.22		-0.279				.4788

* U_1 = U (logging) 2 months prior. ** U_2 = U (logging + milling) 2 months prior. *** U_3 = U (logging, milling, transport and maintenance) 1 month prior.

—— 95% significance ═══ 99% significance

Table 12. Regression Results - Prince George.

	Dependent Variable	Constant	Time (months)	Summer Dummy Variable	Winter Dummy Variable	L.P.I.	L.P.I. 1 month prior	L.P.I. 2 months prior	L.P.I.*	U_2 **	R^2
1.	U (logging)	151.8	1.463	-38.25	-24.75	-0.788					.3649
2.	"	202.0	2.061	-43.58	-28.63		-1.400				.3880
3.	U (processing)	205.3	2.168	-29.73	29.98	-1.062					.6384
4.	"	172.3	2.128	-34.18	30.56		-0.764				.6355
5.	"	231.2	1.958	-37.99	30.24			-1.120			.6427
6.	"	299.5	2.640	-36.93	27.20				-1.951		.6437
7.	U (total)	1528.8	-2.090	-21.65	3.16					2.407	.7393

* 3 month moving average of lumber prices.

** U_2 = U (logging + milling) 2 months prior.

____ 95% significance

____ 99% significance

However, the results for Prince George give no significant correlation between unemployment in processing and lumber prices. There are a number of possible explanations:

1. The processing group is much more diversified than in Quesnel where it is almost totally sawmilling and pulp and paper processing. Thus changes in sawmilling unemployment may occur, but not be reflected in this aggregate processing category.

2. If the sawmilling industry is structurally different in Prince George, for example, more technically efficient, or with more aggressive marketing agencies, or if the plants are subsidiaries of large national corporations instead of local independent mills, then it is possible that production (and unemployment) just does not respond as much to lumber price changes. This explanation can be discounted somewhat, given the results of the preceding analysis showing unemployment in processing in Prince George to be highly unstable, relatively and absolutely. It appears then, that unemployment in this city and occupational group corresponds to something other than (this index of) lumber prices, or responds to it in a different manner than it does in Quesnel. Perhaps this could be as a result of the industrial structure in Prince George. The effects of the stumpage appraisal system as previously discussed, can not be used to explain the absence of correlation in Prince George, when a strong correlation between unemployment in processing and the lumber price index exists in Quesnel.

Another possible explanation is that the long period covered by the data used may have vitiated this analysis. A visual comparison of Figures 2b, 10a and b and 12 suggests that

in the very short term, lumber prices and production seem to be positively correlated and inversely related with unemployment. However, over the last few years, unemployment, production and prices have all been rising. That is, the longer term trends (because of institutional and industrial changes) appear to be contradictory to the month to month relationships.

However, these simple models assume instantaneous adjustment, that is, that the dependent variable adjusts immediately[1] and costlessly to its "desired" or equilibrium level as circumstances change. It is obvious that there are lags in the adjustment process, perhaps because labour cannot be dismissed immediately, or because of unfilled order books when lumber prices decline, or a delay in recruitment if business prospects improve.[2] For these and other such reasons, regression between previous months' lumber prices and current unemployment in certain occupations seemed appropriate. The results are presented as equations 3, 5 and 11 of Table 11 and 2, 4, 5 and 6 of Table 12. Generally this recognition of lags improved the goodness of fit (R^2) of the equations slightly, but still in the processing unemployment - Prince George equations (Table 12:3, 4, 5, 6) lumber prices were not significant,[3] although the

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[1] within the same one month period.

[2] This analysis assumes that there are no critical levels, above or below which there are discontinuities in behaviour. That is, the reaction to any change is gradual and uniform.

[3] although the direction of change was negative, as expected.

coefficients of determination (R^2) for these regressions are reasonably good. It must be kept in mind that in these regressions the lumber price index has been used as a proxy for the profitability of logging or milling - the alleged primary determinant of logging and sawmilling unemployment - and this lumber price-profitability correlation may be (and seems to be) weak at times.

This quantitative analysis has been somewhat inconclusive. It has attempted to leap a number of complex intermediate processes relating unemployment to employment to production to profitability to stumpage rates and lumber selling prices. Although each of these relationships warrants much investigation, the model used contained only the observations of registered unemployed and lumber prices. It has been shown that the relationship between lumber prices and profitability of sawmills can be weak in practice due to lags and unavoidable errors in the appraisal process, although on theoretical grounds it should be precise.

In view of these circumstances, the results that unemployment in processing in Quesnel is significantly correlated with current or previous lumber prices offers a basis to support the intuition of causality. This support is not negated by the fact that the analysis of the Prince George data yielded results which were not statistically significant, which may in part be attributed to a data aggregation problem. The recognition of lags in the model confirmed that the adjustment process may take two to three months, but did not contribute further to the argument that changing lumber prices are directly

related to changes in the level of unemployment.

It is recognised that North American lumber market prices can be affected by a number of rather unpredictable factors constraining the supply of lumber from the B.C. Interior. A bad fire season may prevent mills from obtaining their desired log supply, labour disputes can limit production even in times of high lumber prices, or a shortage of rail cars to ship lumber may lead to such an inventory accumulation that production has to cease, causing temporary unemployment. However, these factors do not appear to be the most significant for the short term employment instability (or boom and bust) that has characterised the forest industry.

D) An economic base - type unemployment multiplier.

The preceding quantitative analysis did not conclusively confirm the postulated relationship between fluctuating lumber prices and unemployment in the unstable processing and logging sectors. It was nevertheless possible to continue the econometric analyses of the data supplied by Canada Manpower to seek correlations between the unemployment in forest industries - the basic (export-earning) sectors of the regional economy - and total unemployment.

The estimated relationship between the number of unemployed less vacancies in total and in the logging or processing occupations are presented in equations 8, 9 and 10 of Table 11 and 7 Of Table 12. These relationships were suggested by economic base theory and by subjective examination of the data in Figures 10a and 10b. The correlation coefficients are quite high, and t-statistics indicate that the estimated coefficients

are highly significant. Equation 10 of Table 11, for example, suggests that a crude economic base-type multiplier of 1.65 applies in the Quesnel area. This is much lower than would have been expected, on the basis of the industry's apparent significance in that centre. From equation 9 of Table 11 and equation 7 of Table 12, it seems that each unit change in unemployment in logging and milling is associated with a 1.4 to 1.45 change in non-forest industry unemployment, the following month, i.e. the multiplier is 2.41 or 2.45. These results also illustrate the obvious (although sometimes ignored) aspect of economic base analysis that the size of the estimated multiplier declines as the definition of the basic sector is expanded.

To further investigate the nature of the lagged adjustment processes between forest industry unemployment and lumber prices, and between total or service sector unemployment and the forest industry's, a simple "partial adjustment model" was introduced.

Assume $U^*_t = A + B.X_t + E1$

Where U*t is the equilibrium level of unemployment in one occupational group, in month t, if adjustment was immediate and costless,

Ut is the measured unemployment in that occupation, in month t,

Xt is the independent variable, observation for month t, and

E1 is a random error term, normally distributed with mean zero.

Because of the lags, only partial adjustment occurs, such that the difference between actual current and previous levels is some fraction (G) of the difference between the equilibrium current level and the previous level (with another random error term appended).[1]

That is, $U_t - U_{t-1} = G.(U^*_t - U_{t-1}) + E2.$

Therefore, $U_t = G.A + G.B.X_t + (1-G).U_{t-1} + (E1 + G.E2).$

Again, because of serial correlation, the data were transformed by the autocorrelation coefficient (estimated by the Cochrane-Orcutt technique) to "clean" the error terms. Thus consistent estimators could be derived, this time by non-linear least squares estimation techniques. Tables 13 and 14 present the results of so estimating this model for Quesnel (13) and Prince George (14), taking different combinations of dependent and independent variables. The estimated coefficient of the lagged dependent variable (1-G) is statistically significant in all but two of the equations. For example, Equation 1 of Table 13 indicates that logging unemployment responds negatively to a change in the lumber price index (as expected, although it is not statistically significant) and that the adjustment coefficient (G) equals 1 - 0.345 or 65.5%. This can be interpreted as meaning that only 65.5% of the response that would occur if adjustment was instantaneous and costless, takes

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[1] This is the behavioural assumption on which the standard form of the partial adjustment model is based.

Table 13. Distributed Lags Results - Quesnel. Estimated Coefficients and t-Statistics.

Dependent Variable	Constant	Time (months)	Summer Dummy Variable	Winter Dummy Variable	L.P.I.	L.P.I. 1 month prior	U_1 *	U_2 **	Lagged Dependent Variable	R^2
1. U (logging)	16.47	0.550	-12.00	-7.18	-0.103				0.345	.6985
	(1.27)	*(3.51)*	*(2.05)*	*(1.18)*	*(0.82)*				*(3.78)*	
2. U (processing)	29.93	-0.190	2.73	6.37	0.000				0.209	.6384
	(1.80)	*(0.82)*	*(0.19)*	*(0.46)*	*(--)*				*(2.83)*	
3. "	29.94	-0.190	2.73	6.37		0.000			0.209	.6384
	(1.80)	*(0.82)*	*(0.19)*	*(0.46)*		*(--)*			*(2.83)*	
4. "	7.13	0.254	2.56	16.51			0.459		0.310	.6904
	(0.53)	*(0.96)*	*(0.21)*	*(1.32)*			*(2.55)*		*(3.79)*	
5. U (total)	151.40	1.42	-31.80	-57.79				0.917	0.446	.7038
	(2.41)	*(1.35)*	*(0.60)*	*(1.10)*				*(3.23)*	*(4.88)*	

* U_1 = U (logging). ** U_2 = U (logging + milling).

95% significance

99% significance

(t-Statistics)

Table 14. Distributed Lags Results - Prince George. Estimated Coefficients and t-Statistics.

Dependent Variable	Constant	Time (months)	Summer Dummy Variable	Winter Dummy Variable	L.P.I.	L.P.I. 1 month prior	U_1*	U_2 **	Lagged Dependent Variable	R^2
1. U (logging)	76.85	0.653	-64.41	-31.51	-0.322				0.400	.4372
	(2.48)	*(1.76)*	*(4.05)*	*(1.98)*	*(1.09)*				*(4.53)*	
2. U (processing)	15.12	0.256	-32.97	31.39	-0.007				0.131	.6491
	(0.61)	*(0.82)*	*(1.82)*	*(1.72)*	*(0.27)*				*(1.69)*	
3. "	14.96	0.255	-32.99	31.38		-0.005			0.131	.6490
	(0.61)	*(0.81)*	*(1.81)*	*(1.72)*		*(0.19)*			*(1.69)*	
4. "	20.01	-1.49	-14.59	45.77			0.341		0.323	.7200
	(0.92)	*(0.50)*	*(0.83)*	*(2.68)*			*(3.25)*		*(3.99)*	
5. U (total)	669.2	0.334	-255.6	-44.44				1.055	0.428	.7209
	(4.25)	*(0.22)*	*(2.57)*	*(0.45)*				*(3.67)*	*(5.51)*	

* U_1 = U (logging). ** U_2 = U (logging + milling)

___ 95% significance

═══ 99% significance

(t-Statistics)

place within the same month. In Prince George, the result (Table 14:1) of 60% suggests that unemployment in logging responds a little more slowly there to a change in lumber prices. Equation 5 of Table 14 indicates that a change of 100 in the number unemployed in logging + milling would lead to an immediate change in total unemployment of at least 106, with only 57% (i.e. 1 - 0.428) of full adjustment taking place within the same month.

Economic base analysis is conceptually very simple although sometimes difficult in practise because of problems in defining the basic sectors. Moreover, the results may be applied where inappropriate, e.g. to a different region or to one particular sector in the economic base.[1] It is therefore essential that these results be explicitly qualified. Firstly, they apply only within the area served by each Canada Manpower office. They are not ratios of numbers employed, but reflect changes in the number of registered unemployed, over the 97 month period covered by the data. Thirdly, these results estimate marginal changes for particular occupational groups, whereas the standard economic base analysis yields only an average ratio, which is then assumed to be common to all basic sectors. For example, Equation 7 of Table 12 suggests that in Prince George there is a

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[1] An economic base study by Reed (1973) found a ratio of 2.4 between total employment within twenty miles of Prince George and employment in all basic sectors (as defined by Reed). This figure was subsequently used by the Northern Interior Lumber Sector of the Council of Forest Industries to estimate the increase in total employment throughout British Columbia resulting from increased lumber and plywood sales to Japan over the next five years. See Vancouver Sun, Sept. 16, 1975, p.23.

residual level of unemployment (1529 people) and that total unemployment also responds to a marginal change in the number unemployed in logging and processing by a multiple of 2.407, after two months. The introduction of a partial-adjustment (lag) process to the model has not particularly clarified the postulated relationship between total and forest industry unemployment, except to confirm that the two are significantly correlated and that the adjustment process is slow.

This part of the study has focused on the nature and instability of unemployment, with little reference to the absolute levels of employment in each sector. Unfortunately, the unemployment figures (from Canada Manpower) cannot be directly compared with total employment as Canada Manpower does not collect such data. The only source of that information is the 1971 Census (as shown in Table 2), which uses an entirely different geographical basis. For example, on June 30, 1971, the Canada Manpower centre at Quesnel reported 15 unemployed in Farming, while the census taken the same day indicates no-one in the Quesnel enumeration areas was listed as a farm worker. Thus only very general comparisons between the census data on employment and the Canada Manpower data on unemployment, are justifiable.

Stability Of Provincial Revenues.

Since references to the stability of the provincial tax base appear in much of the literature expounding the virtues of sustained yield forest management,[1] an investigation of the proposition that sustained yield forestry contributes to the stability of government revenues seemed warranted. Figure 2a above illustrated the variability of logging activity in the province during the past 30 years in spite of sustained yield regulations and even-flow planning. Data compiled from the Provincial Public Accounts presented in Table 15 and Figures 13a and b, illustrate the instability of provincial revenues derived from timber sales, the logging tax and other licences, leases and fees applied for forest lands.

For purposes of comparison, the crown revenues from mining activities for the same 12 years have been included, and show considerable stability (except for the introduction of the new royalty/taxation scheme of 1974/75). This is despite the fact that one would expect mining activity, like lumber production, to be closely related to business cycles and the production of capital goods. At this stage, it is only possible to speculate that the difference in volatility could be related to market structure - the size distribution of firms - and the nature of the export markets in which production is sold. Net revenues from Liquor Administration, on the other hand, seem invariant to

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[1] See, for example, U.S. Congress (1944) and Mulholland (1931).

Table 15. Sources of Provincial Revenue 1964/5 - 1975/6 ($million).

Year	Timber Sales	Logging Tax	All Lands and Forests	Mining	Liquor Administration	All Taxes	Total Revenue	% of Total from Lands & Forests
1964/65	39.830	9.213	53.706	34.120	35.455	282.263	452.993	11.8
1965/66	46.074	7.080	58.628	36.369	41.684	351.848	544.686	10.8
1966/67	41.090	6.553	53.616	42.634	44.856	406.059	727.563	7.4
1967/68	34.583	7.988	49.157	38.672	50.594	465.674	810.165	6.0
1968/69	55.033	10.425	74.621	45.637	56.055	486.769	963.794	7.8
1969/70	77.526	23.941	111.926	49.705	61.525	601.270	1169.222	9.6
1970/71	48.608	13.416	71.622	52.976	66.030	654.362	1286.545	5.6
1971/72	64.330	8.977	83.598	57.305	85.267	767.327	1462.717	5.7
1972/73	122.790	18.928	151.580	53.205	97.297	869.626	1667.218	9.1
1973/74	248.443	23.053	282.771	62.705	108.622	1093.402	2108.880	13.4
1974/75	129.545	44.643	186.788	37.784	120.300	1413.788	2625.724	7.1
1975/76*	35.000	21.000	68.000	119.700	136.000	1592.300	2900.100	2.3

Source: Public Accounts of British Columbia, Department of Finance, Victoria, British Columbia, 1964/65 to 1974/75.

* Forecast from Clarkson, Gordon Report, as published in Vancouver Sun, February 21, 1976, p.14.

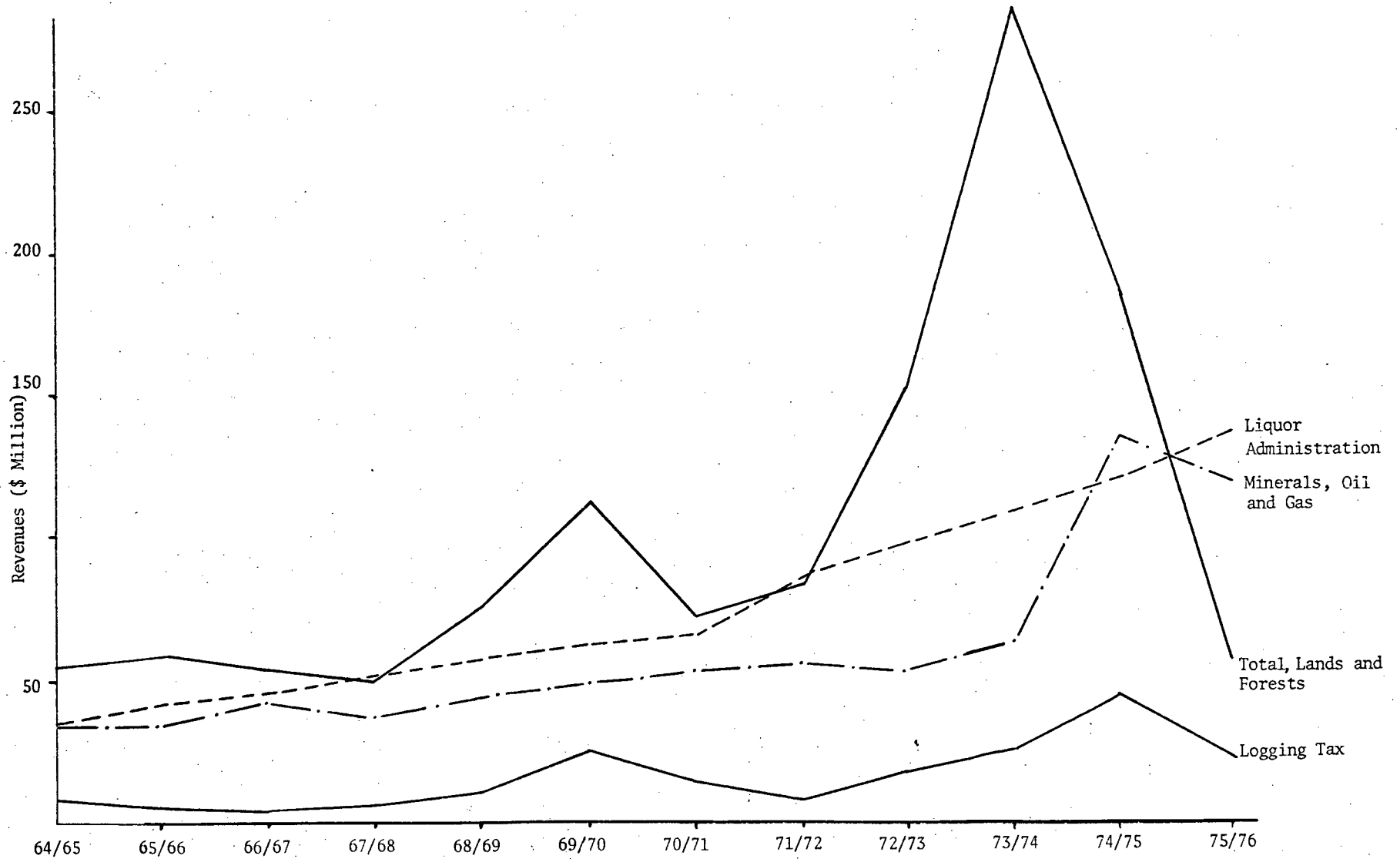

Figure 13a. British Columbia Revenues from Selected Sources: 1964/65 to 1975/76.

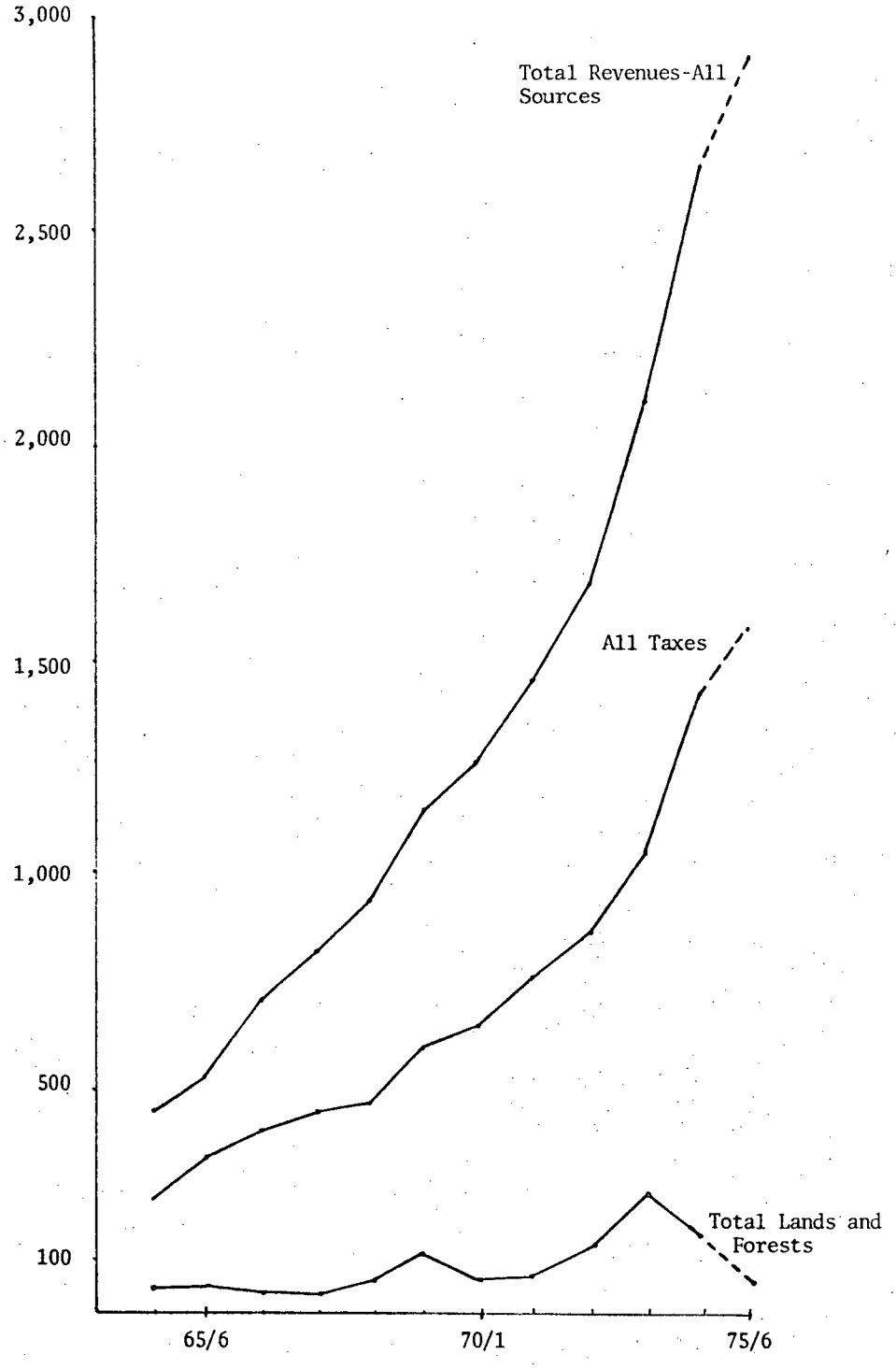

Figure 13b. British Columbia Revenues: 1964/65 to 1975/75 ($ Million).

the level of industrial activity or the state of the provincial economy, as one might expect for a consumption good. Except for the period 1972/73 to 1974/75, this income has exceeded direct provincial revenue from the sale of its forests.

While the Crown revenues from the Department of Lands and Forests have declined dramatically since 1973/74, the total revenue from all sources, and the revenues from personal, corporate, property and social services taxes (Figure 13b) have continued to climb exponentially. Thus the proportion of government revenue directly derived from the sale of the province's forest wealth has been extremely erratic, generally declining from 11.8% in 1964/65 to 2.3% in 1975/76, except for the boom year of 1973/74 when the ratio rose to 13.4%. While this is not to belittle the indirect contribution from the forest industries using the resource, to the provincial coffers, it can be taken as evidence that the sale of timber (even on a sustained yield basis) does not guarantee constant or predictable sources of financing for other government programmes.

V. STRATEGIES TO STABILISE THE REGIONAL ECONOMY.

The preceding chapter has shown that unemployment in those occupations associated with the forest industry is highly unstable, that this instability is largely due to changes in the export price of lumber, and that the instability is amplified throughout the regional economy particularly where the forest industry forms the economic base of communities. Furthermore, it has been shown that changes in industrial structure in response to technological change, locational advantages and direct (albeit uncoordinated) government intervention, have altered the stability, location and amount of employment in the forest industry. The British Columbia Forest Service and the forestry profession generally have argued that sustained yield regulation of forests is both necessary and sufficient to assure employment stability, the permanence of communities and the conservation of the resource. The first two of these claims have been shown to be unsubstantiated, while the third has been proven elsewhere (Haley, 1966 and Samuelson, 1974) to be correct but inefficient.

The Role And Limitations Of The B.C.F.S. In Regional Development And Stability.

If community stability is still an objective (i.e., if the problems that motivated past discussions are still of concern), the pertinent questions are "what are the prospects of reducing

the instability of employment?" and "what useful functions could the B.C.F.S. perform now towards this end?" The potential for a successful contribution has been apparent to many analysts. As Nagle (1971) wrote,

> "(The maximum utilisation policy)...places the public forest administration of B.C. squarely into a position towards which it has been moving for two decades - that of direct economic planning of the future of the regional forestry sector. Resource pricing, product mix and industry structure are being directly manipulated through a technically controlled allocation system for forest resources." [1]

One strongly substantiated contention is therefore, that control/influence can be exerted by the B.C.F.S. through its impacts on industry structure. An alternative proposition which is favoured as a result of this investigation, is that the determinants of community stability are largely invariant to the policies and procedures of the B.C.F.S. It seems that current concern should be directed towards understanding how and how much, these B.C.F.S. decisions can impinge on the industry, and through it on the regional economy and society, and what the other relevant forces are.

In this thesis, it has been argued that the industry's structure substantially affects the location and stability of employment opportunities, but many of the factors identified here as being of major significance to the industrial structure are largely beyond the control of the B.C.F.S. One such factor is continuing economies of scale resulting from technological

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[1] A similar conclusion was presented by Haley (1971), p.2.

change that increases the capital intensity of wood conversion operations. The shape of the LRATC is therefore discussed here with a view to determining whether any changes in it may contribute to greater corporate concentration and/or employment stability, and how the B.C. Forest Service might react to such changes.

If the LRATC is L-shaped as argued by Dobie (1971)[1] then there is no maximum efficient mill scale (or at least B.C. mills have not yet approached a point of significant managerial or other diseconomies). This has important implications for industrial organisation. With an L-shaped LRATC curve for plants in the industry, small mills should be able to compete effectively and coexist with very large mills or any others of intermediate size,[2] with respect to production costs.

However while this seems to be so, there is strong evidence that managerial and marketing economies are also important and one could conclude that in the B.C. Interior especially, a great deal more concentration yet will occur to exploit managerial and marketing economies rather than production economies. If the only constraint is raw material supply, then sawmill operators could amalgamate cutting rights (as allowed in the past) or

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[1] This is in contrast to the evidence of Mead (1966) and others that the LRATC was U-shaped and the maximum efficient size for west coast U.S. mills was 140 M f.m.b. per 8 hour shift.

[2] It must be noted that minimum or maximum efficient size for a firm or plant in the industry is <u>not</u> merely an engineering function, but rather a function of the particular context - location, market structure, supply constraints and especially the institutional framework - within which the firm operates.

sub-contract for log supplies, if cutting rights are non-transferable. That is, functional integration between firms rather than vertical integration within firms could occur. In discussing these economies in production, only plant size has been considered. Once one allows for multi-plant firms - to exploit managerial or marketing economies - then greater corporate concentration should be expected.

There is a secondary factor which may contribute to a changing industrial structure which is also beyond the influence of the B.C.F.S. It has been argued that corporate concentration is necessary to accumulate the very large capital requirements for new integrated conversion complexes (or pulp mills). The rapid inflation of construction costs has led some securities analysts to predict further concentration in the forest industries. This conclusion rests on the assertion that forest companies should be, but presently are not, generating adequate profits from current operations, to meet the capital costs of another (new) venture. The President of Canadian Forest Products (quoted by J. Lyon, in the Vancouver Sun, November 14, 1975) argued that

> "The forest industry, because of its high degree of inherent risk, must be permitted to achieve a rate of return substantially greater than that of regulated industry which has little or no direct competition and which is essentially low risk ... C.F.P. agrees ... that an absolute minimum average rate of return should be at least 11% after taxes."

Three comments seem warranted. Firstly, this argument makes the forest industry appear like a regulated utility, such as B.C. Telephone. It is true that profits are regulated in a rather broad sense, through stumpage appraisal, although there may be

some debate about the adequacy or accuracy of the appraisal data. Operation on a cost plus basis has been known to frequently lead to gross inefficiencies. Secondly, it assumes that the government, or the B.C.F.S., has substantial control over the profitability of the industry. This is correct, but the control is certainly not complete. Finally, there is a widespread presumption that the rate of return must be high enough for the maintenance of investments and to encourage and provide for expansion. However, it could be argued that the rate of return on investment in the forest industry is what it is, and that a low rate of return is a valid market signal that the industry is too big or inefficient.

There seems to be only sparse evidence to support the statement by Nagle (1971) quoted above, at the level of the individual firm. The analyses presented here support the view suggested in Chapter 3 that any industrial and employment stability which does exist is due to corporate concentration and areal agglomeration in the wood-using industries - a world wide trend - and therefore largely independent of B.C.F.S. actions. It must be noted again that the stability stemming from industrial concentration is different to that envisaged in the sustained yield literature. The short term stability of employment may be at the expense of long run survival of small towns and villages, which wane as their local sawmills are relocated.

After considering the effects of policy and technological change on economies internal to a firm engaged in the forest industry, one should turn to those effects external to the firm

and the industry. It is then possible to gain a precise realisation of the role that forest policy could play in the overall schema of regional development and stability. The most significant factors seem to be:

> labour force characteristics,
> transport routes and all other locational factors,
> the objectives and efforts of all other agencies and
> the coordination between those agencies.[1]

While many would agree with Lewis (1974, p.3),

> "Because public forests cover most of the usable land throughout the province, forest policy is a critical influence on the pattern of economic and social development... Policies affecting forest development determine in large degree the pattern of development of access, infrastructure, other extractive industries and economic development generally..."

it may be necessary to emphasise that forest policy is only one of the relevant factors. The causal link between forest policy and regional development suggested above may be called into question, given that so many other agencies are necessarily involved. Perhaps there is, or could be, a coordinated approach to regional development and/or community stability rather than a linear sequence beginning with the B.C.F.S., with subsequent

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[1] It should be noted that there are at least eleven other government agencies involved in this subject in this region, viz. (Provincial) B.C. Rail, B.C. Hydro and Power, Department of Economic Development, Dept. of Highways, Dept. of Municipal Affairs, Dept. of Recreation and Conservation; (Federal) Dept. of Regional Economic Develcpment, Dept. of Transport, Canada Manpower; and (local) Municipalities and Regional Districts.

compromises, patch ups, etc.[1]

In considering the efforts of the B.C. Forest Service, it must be acknowledged that the tasks of promoting regional development and offering employment to scattered local populations appears to have fallen to the B.C.F.S. by default. While the numerous agencies listed above have been somewhat reticent in approaching the tasks, the Forest Service approached them conscientiously but with rather outmoded concepts and technical, resource-oriented strategies. However, now that these other agencies exist and may actively offer new expertise, there is no longer any need for the B.C.F.S. to claim an exclusive role in regional development or attaining community stability.

The necessity of coordinating all the different agencies and industries which contribute to the economic base of this region (like any other) and the towns within it, has been emphasised by one of the most experienced regional planners in the B.C. Interior.

> "In the last decade we have seen in the Peace River area and Rocky Mountain trench, development of a number of small communities,

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[1] The Northern Development Concept, referred to by Gilgan (1974) involves doubling the population of two or three towns, constructing hundreds of miles of roads and rail spurs, and locating four large new sawmills. The basic reason is to thereby generate wood chips locally, to improve the poor financial performance of two pulp mills currently using roundwood. The pulp mills were originally sited in that area primarily because it was felt that the very large volume of low grade timber available locally should be used. Apparently it was assumed that a large untapped forest resource could provide the stimulus for regional development here, as it had elsewhere. Subsequent events suggest that the forest was marginal as a commercial resource, despite it physical extent. See Williston (1971b, p.14) and Gilgan (1974, p.20).

> sometimes virtually single industry based, of such small size as to be uneconomic in terms of full cultural and social development...Apart from the waste of the unplanned development in some of these communities, the early integration of the economic bases for these communities may have seen far richer and more stable communities of large size in different locations and fewer in number...Imagine how stable a small provincial city would result from the solid agricultural basis with a diversity of gas scrubbing and oil refining, railroad transportation, and supply facilities for hydro construction."[1]

It is against this type of background and in the knowledge that development with stability is more likely to stem from diversity than from forest yield regulation, that the Forest Service in particular should be re-examining its role, even its objectives, in promoting regional development or "stabilising" existing (and new?) communities. It should be superfluous to point out that B.C.F.S. is not synonymous with "Department of Regional Economic Development with Employment Stability". The fact that the forest industry is extremely important to the provincial economy or that it accounts for 65% of export earnings, in no way implies that the Forest Service currently has a mandate or the expertise to direct the location of rail lines and highways, to shift and create towns, to fold up villages or to prop up villages that inevitably will collapse.

However, it seems to be crucial to the public interest that, for as long as the forest sector dominates the Provincial economy, the Forest Service attempt to explicitly recognise the

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[1] Parker (1968) p.20.

regional social and economic implications of any actions which directly or indirectly affect timber flows or the structure, size, location and concentration of elements of the forest industry.[1] This is because of the social (political and economic) repercussions from any industry changes induced. Even 9 years ago it was stated:[2]

> "By default of other considerations, we have depended upon technical people not only to manage our forest resources, but also to set the goals of forest policy. As a result, our objectives are technical ones, and our crucial decisions are made according to technical criteria."

It may be expected that the current Royal Commission will attempt to remedy this omission by recommending a return to the social objectives towards which resource management is or should be directed.

The Prospects For Stability

The above discussions have concluded that for a number of reasons, the sawmilling industry especially is becoming more concentrated corporately and areally (with fewer larger plants located at agglomeration points) and should therefore be more

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[1] This same concern has been recently expressed and addressed by Dr. Pearse and some participants at the Royal Commission hearings. The Productivity Committee of B.C.F.S. began such an investigation last year.

[2] Pearse (1970) p.287. This paper was originally presented to the Canadian Forestry Association of B.C. in 1967.

stable in its seasonal and annual production and employment. While these conditions are generally favorable to community survival (of the growth centres and their satelites only) and short term stability, there are also consequences such as a reduction in the labour force required per unit output and a reduction in competition for labour or wood supplies.

Therefore, while the factors contributing most to increased employment stability over the last twenty years have been corporate and areal concentration, the effect of an erratically fluctuating lumber demand appears to have been greater, leaving the observed instability in the forest industry and related employment. There must be inventory problems as long as market conditions continue to fluctuate widely.[1] Whenever the inventory or cash flow problems become substantial, employment stability is adversely affected. Consequently, this section of the thesis examines the prospects and strategies for attaining greater stability of employment and encouraging permanence of communities, on the assumption that these are still part of the set of politically accepted social objectives.

While the pursuit of community stability has been widely proclaimed, to justify sustained yield and yield regulation, it is being recognised that the "problem" is the lumber market, as documented in the preceding chapter. This has been so ever since production in the European context of regional self-sufficiency

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[1] There is also the probability that the accumulation of inventories during slumps may later suppress market recovery. This seems to be happening in the B.C. market pulp industry.

was replaced in the B.C. context by production for export (of basic construction lumber particularly). Yet while foresters frequently assert that yield regulation and a surety of wood supply bring industrial and community stability, only rarely, many years ago, has a mill had to close because of lack of wood supply. It seems to have always been market conditions which have led to closures and booms in British Columbia sawmilling.[1] Simultaneously, changes in transportation routes and technology and the state of the overall economy have dictated abandoning some towns and expanding others.

There is a possibility that the general instability in forest industry production (induced by exogenous changes such as the U.S. mortage rate, building code revisions in Japan, U.S. Presidential elections or the rate of family formation in the U.S.), has been a retarding influence on the overall regional / provincial development process. This merits serious consideration. Without getting embroiled in the realm of social decision making, it is possible that development path B is socially preferable to path A, in Figure 14,[2] i.e. the classic growth rate versus stability trade-off. However, it has been suggested in some of the development literature that if major

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[1] This was the answer generally given to the current Royal Commission, when industry representatives were queried regarding the boom-bust cycles and security of wood supply.

[2] Path A may involve very rapid increases in factor costs or sectoral inflationary pressures, during the boom years and the social costs of unemployment (of labour and all other factors) during the slumps.

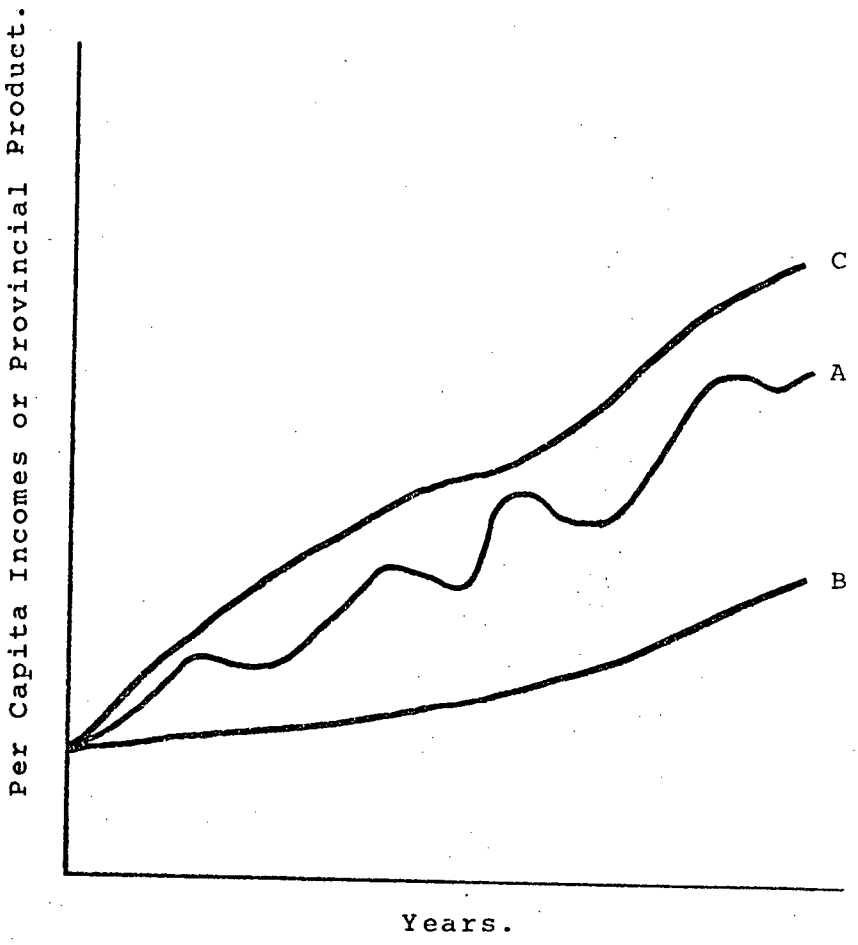

Figure 14. Alternative Growth Paths.

new investments are being discouraged because of this volatility, then an even more rapid, more stable path, C, would be attainable if only the basic instability could be "corrected" or dampened.

The Paley Commission (cited by Scott, 1972, p.90) noted a particular instance of this in the mining industry.

> "The knowledge that materials are hypersensitive to even small changes in the busines cycle makes investors extra cautious in starting a project, particularly in minerals, that may promise good profits when undertaken but, several years later when it comes into strong production, may find a market in which prices are scraping bottom. This brake on expansion, the capital expenditure wasted in shutdowns and build ups, the actual loss of inground reserves through depression, neglect of mines, all add up to lower production and higher costs than would be expected with more stable markets and prices."

More generally, it may be concluded that any efforts to remove instability may be propulsive to economic development by removal of investment uncertainty. Such efforts could avert the circular dilemma of the provincial or regional economy being tied to a single industry which is highly unstable, thereby providing disincentives to new industry with the result that it remains a single industry (undeveloped) economy. It would be very difficult to gauge how much, if at all, British Columbia's prospects are being (or have been) retarded because of the overwhelming role of the (volatile) forest industry in the provincial economy, but the possibility should not be ignored.

1. Short run stability. It has been argued in this thesis that short term employment instability in most towns[1] in the North Central Interior of British Columbia is caused by exogenous changes in the export price of lumber. If it is possible to determine the sources of instability in the regional economy by successively retracing the effects, some buffers could possibly be interposed at those stages where they could be most effective. Once the sources of instability have been determined and accepted, four general strategies in response to economic instability in the Northern Interior, can be proposed;

1. laissez faire, the predominant approach at present,

2. limited government intervention to cope with the more serious consequences of instability,

3. the establishment of an agency which would buffer or absorb the exogenously induced fluctuations in demand for B.C. forest products, and

4. diversification of the provincial economy and reorganisation of the industry and its product marketing so that the total demand for the products of the region does not fluctuate as much as at present.

The first strategy is automatically unacceptable if one has defined regional economic instability to be a problem of social and political concern. The second has been introduced on a small

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[1] This may seem a broad generalisation from an analysis of only two forest industry centres. However, while these may not be typical of all the settlements in the region in terms of function, size or industrial structure, Prince George and Quesnel provide minimum estimates of the effect. In the smaller towns with smaller locally owned and financed operations, the impacts could be greater. Prince George and Quesnel do of course account for a large component of the region's total production. See Table 6.

scale by Federal agencies such as Canada Manpower and the Department of Regional Economic Expansion, with programmes to facilitate adjustment to the fortunes of a regional economy.[1]

The third strategy might include a marketing agency, a guaranteed reserve price scheme or bank guarantees against the value of inventoried lumber. However all these are institutional changes or interventions, in what now is a freewheeling competitive market for lumber. This automatically excludes them from consideration in the minds of many people in the industry. Still, the facts are:-

A. The whole industry is based on and reliant upon one giant government intervention in supply.[2] Wood is allocated without competitive bidding, a new mill's location is subject to government direction and certain transport charges are absorbed by the Forest Service through the stumpage appraisal system and the wood chip direction policy.

B. The product market is seriously affected by a capital market imperfection, in that banks rarely lend money to cover a sawmill's operating costs, despite the security of thousands of dollars worth of dried lumber being produced. Bankers apparently do not accept that the lumber market will recover cyclically from each slump.

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[1] For example, some Canada Manpower Centres have found employment in northern Alberta for those displaced from jobs in construction and transportation in the North Central Interior of B.C. Financial assistance in relocating or otherwise adjusting to changes could be provided.

[2] Again, see Haley (1971), Lewis (1974) and Nagle (1971).

C. Even if there were perfect markets for all factors, if it is deemed that major fluctuations in local employment are undesirable, that is presumably grounds for intervention.[1]

Since one of the foundations for government intervention through yield control was (and allegedly still is) stability of incomes and employment, and since this is not achieved while lumber sales are erratic and volatile, lumber market intervention seems at least as justifiable as the existing regulation of supply.[2] That is, stability of production and employment might be obtained by an agency which would stockpile inventories during depressed market periods, for resale later. The capital gains of so doing could be returned to any producers who voluntarily participate in such a guaranteed reserve price scheme. In effect, this is a method of circumventing the short term liquidity problems of the smaller operations.

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[1] Despite the fact that marketing agencies have a very poor reputation with Canada's public, they seem to have helped producers stabilise production planning and incomes. The comparison between agriculture and forestry is noteworthy. Both have elastic product demand curves, face world commodity prices and there are concerns for rural stability, for example. Yet, as Waggener (1969) noted, agriculture opted for price stability long ago, while foresters chose quantity stability (sustained yield) as an ideal.

[2] There is no readily available information on employment instability in logging or milling for British Columbia operations unconstrained by allowable cut maxima and minima. However elementary micro-economic theory would argue that the marginal cost of labour and other factors rises during a boom period, while the marginal revenues decline, (and vice versa during poor times). This effect alone should have some effect in dampening price-induced employment fluctuations. Some comparisons might be made with the southeast U.S. See Anderson (1974).

From the trade journals, news reports and Briefs to the Royal Commission, it seems that it is the medium-to-large independent sawmillers, quite numerous in the Interior, who regard themselves as unfettered risk-taking entrepreneurs who most vociferously reject "government intervention" in attempts to achieve "stability". There seems to be a paradox here, as on one hand they demand special consideration and attention from the government because of the belief (quite accurate in many cases) that they form the economic backbone of the region. Yet on the other hand, they seem to refuse to recognise the external disamenities of allowing the forest industry to "free-wheel". They appear to accept a large forest industry multiplier effect in good times, but have difficulty in accepting that it works in the opposite direction, in hard times.

If an agency or marketing board is unacceptable to the industry and/or British Columbians generally, there may be different approaches to reducing the short run instability associated with the export demand for forest products. One partial solution at the level of the individual firms, is an experienced, widespread or aggressive marketing team. This would generally be available only to those larger scale or vertically integrated firms which have the financial support to be able to afford such a service. Thus while the Shelton Cooperative

Sustained Yield Unit[1] has been acclaimed as a success, particularly in that year to year fluctuations in employment have been very low despite market conditions, this can scarcely be attributed to forest management alone. It was recognised that

> "employment was supported by a resourceful marketing effort, by the diversity of production and by exports sold through Simpson International".[2]

It seems from a general survey of "successful" or "stable" mill operations that it is the aggressiveness of marketing coupled with managerial expertise that has stabilised employment, rather than even flow or any other yield regulation.[3]

A third method of buffering lumber market fluctuations has a more widespread application. The advent of the commodity futures market for standard grades of lumber and plywood was expected to contribute to stability of production, by providing a buffer or "hedge" for producers. However, it seems that very few members of the Interior forest industry avail themselves of

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[1] This was established at Shelton, Washington, under the Sustained Yield Forest Management Act (U.S. Congress, 1944) in 1947 "to provide continuous tree crops under multiple-use management as stability for communities served by the Unit". (People Land and Trees, 1970, p.2.)

[2] "The year of the big E" in People, Land and Trees, (1970), p.3.

[3] Haley (1971, p.4) similarly concluded that it was managerial production and marketing economies that were the basis of the "success" (on various criteria) of the Tree Farm Licence system in British Columbia .

the hedge, preferring instead to absorb the risks themselves.[1]

There is an interesting prospect that the availability of lumber futures could partially alleviate the capital market imperfection noted three pages earlier. It has been observed[2] that some U.S. bankers were prepared to advance up to 90% of the value of grain inventories which were hedged by commodity futures contracts. In comparison, the customary figure for inventories whose values were not thus protected was 60%. If this practice spread to British Columbia and the forest industry, producers engaging in commodity futures transactions would not only have a reserved future price to sell at, but would also be able to borrow more against any unsold production held in inventories during a depressed market period.

One must realise that these are some of the few responses that the forest industry in British Columbia can make to adjust to exogenous changes. However, as Lewis (1974) emphasised, there are many other determinants of the state of B.C.'s forest economy - completely exogenous to the provincial economy but perhaps even more important. Amongst these would be tariff agreements, foreign exchange rates and shipping rates. For example, legislation prohibiting the use of foreign shipping for

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[1] A few of the largest forest companies in British Columbia do trade in lumber futures but some senior executives have suggested that this is primarily for speculative purposes, rather than in search of production stability. There is some dissatisfaction amongst the mid-sized firms who feel that "outsiders" with large speculative investments can substantially affect the commodity future prices.

[2] Business Week, March 15, 1976, p.57.

forest products from B.C. ports, in order to foster a national shipping industry, could virtually eliminate British Columbia producers from eastern U.S. markets, under present conditions. Sales of lumber to the U.K. are dramatically affected by the U.S.S.R.'s lumber sales to acquire foreign exchange, perhaps because of a bad wheat harvest! World market conditions will continue to fluctuate widely and erratically in both supply and demand. British Columbia obviously cannot control international trade in lumber, since it produces approximately six percent of the world's annual output, but there is no suggestion that it needs to. A carefully managed marketing agency might buffer the exogenous shocks and so insulate the B.C. economy, i.e., establish a hedge. However, given that the forest industry has been reluctant or financially unable to take advantage of the futures market to hedge, the prospects for success of such an institution as this must be doubtful.

In summary, the third strategy is to buffer the exogenously induced changes in demand. Those firms with strong financial backing can afford some inventory buffering and can often also rely on strong sales promotion networks. However, for the many independent and/or financially constrained forest companies in British Columbia, an organisation capable of absorbing or dispersing the market risk and storage costs of holding inventories during depressed markets seems necessary. Commodity futures markets disperse the risk very widely between many individual speculators and could guarantee a certain price to the producer for his future production. In this way, it could induce greater short run stability of production and employment.

However, for a number of reasons, this has not been significantly used in British Columbia because of producers' inability or disinclination to trade in commodity futures. A provincial forest products marketing agency or minimum reserve price scheme would be similar, except that it monolithically absorbs the costs and risks of depressed markets, and might disperse any subsequent profits among participating producers. Whether such a scheme would be politically acceptable or used if introduced, are undetermined as yet.

This leads to the fourth strategy of diversifying so that the instability in demand for B.C. lumber products just does not appear to the same extent as at present. This seems both feasible and attractive since it introduces alternatives that are neither directly interventionist, or as subject to the other exogenous factors. One could argue quite strongly that the susceptibility of the provincial economy to boom-bust cycles is because it has only scarcely developed or diversified beyond the "hewers of wood and drawers of water" phase, to become producers of partially processed wood products, i.e., lumber and pulp. The dependence of the B.C. economy on primary processing of forest products has been widely analysed, e.g., Denike and Leigh (1972) and Shearer (1968).

British Columbians have, to use the cliche, put all their eggs in one basket. That is, they rely very heavily on one industry (mainly three products in only three marketing areas) for their social/political objectives of stable regional development and continuing prosperity. While the "spread effects" from the leading sector or staple product (Watkins,

1963) have generally been presumed to favour development and prosperity, the fact that the opposite can occur with equal probability and force in the event of the failure of that leading (export) sector, has been widely overlooked. Not all the consequences of the "staple theory" strategy for development are favourable; vulnerability to a decline in demand for that staple good is characteristic of single industry economies. Watkins (1963, p.149) recognised that

> "Particular export lines can create prosperity, but typically only for a short time. Over the longer pull they cease to be profitable ... This tendency can be slowed up by attempts to improve marketing and by seeking out cost-reducing innovations. ... Sustained growth, then, requires resource flexibility and innovation sufficient to permit shifts into new export lines or into production for the domestic market."

While I am not in a position to suggest which new industries warrant encouragement,[1] it can be suggested that development and stability would be promoted if the "British Columbia has always been a forest economy and therefore always should and will be" attitude was less widely accepted. Within the forest industries, further diversification of product lines and into new geographic markets should similarly lessen susceptibility to exogenously induced fluctuations. The following question can legitimately be posed. "What would an omnipotent planner do, given the task of diversifying the economy of the B.C. Interior in order to achieve "stability" of

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[1] The criteria for selecting industries to be encouraged in order to foster regional economic stability, have been analysed by Conroy (1975), for example.

employment and incomes?" It seems that no single move could accomplish that, but there are numerous small steps in that direction which could be taken or further encouraged. For example,

> 1. encourage the Council of Forest Industries to promote new products and markets (although this does not diversify the economy from forest products),
>
> 2. argue for realignment of tariff structures to facilitate the sale of manufactured goods,
>
> 3. argue for revision of freight rate schedules to enable British Columbia to supply eastern Canada with manufactures, and
>
> 4. encourage the development of gas (Peace Liard), coal (e.g. Hat Creek), mining, agriculture and tourism.
>
> 5. encourage the growth of the service sectors in the regional economy through infrastructure development.

These suggestions do not advocate undertaking inefficient projects merely in an attempt to get stability, but rather the purpose is to offer an alternative to what Watkins (1963, p.150) called an "export mentality resulting in an overconcentration of resources in the export sector and a reluctance to promote domestic development".

British Columbia's dependence on the forest industry, as analysed by Denike and Leigh (1972) and Shearer (1968), is widely accepted, almost as a tradition in B.C. It was recognised explicitly by Sloan[1]

> "When we realize that we sell about 78 per cent of our exported wood and wood products in foreign markets and must continue to do so in order to maintain a healthy economy, it does not need much imagination to appreciate how

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[1] Sloan (1956, p.13.) emphasis added.

> vulnerable we are to the impact of international and world conditions, to which we must respond, but over which we have no control."

The substantive conclusion of this thesis is that British Columbia does not necessarily have to continue as a lumber exporter over the long term, that its economy certainly has been and is vulnerable to external influences, but that there are means whereby that vulnerability could be reduced.

The goal of employment and perhaps income stability would be furthered by the promotion of domestic processing and increasing local value added. This strategy would rely on either a larger domestic market or renegotiation of international barriers and tariffs to enable the sale of finished consumer goods rather than standard commodities. Mobile home components and furniture, for example, have a more stable and less elastic demand than has construction lumber.[1] Apart from the international marketing aspects discussed above, a real advantage of such a policy could be that the influences affecting processing activity become local or national rather than autonomous exogenous factors in the foreign markets. The demand for wood is a derived demand, hence anything affecting the availability or price of those factors combined with wood in the foreign markets, affects the B.C. lumber economy. With local processing and assembly, Federal, Provincial or even Municipal

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[1] Many observers seem amazed that B.C. has a very small furniture industry. Yet to change this would require revisions to tariff structures and trans-Canada freight rates which would make it as cheap to ship manufactured products west-east as it is east-west.

fiscal policies become more significant.

2. Long run stability or permanence. There does not seem to be much relief in sight for declining towns and villages. It must be assumed that some towns will grow while others begin or continue to decline. As long as transportation continues to improve and get cheaper[1] the rate of decline will increase. If there were no more changes, there would still be a declining trend, for a while, as urbanisation economies in production were sought and exploited, especially if this continues to be associated with urbanisation amenities for the resident labour force and population. As Siemens (1972, p.9,13) observed,

> "Community halls that once served as social centres for their respective communities have generally fallen into disuse in favour of facilities of larger towns. The general store at the crossroads has atrophied and shopping centres have increased in number ... The high degree of mobility, the economic concentration and the sophistication of mass communications characterising life in the modern city have had their effects on the remotest farms and corner hamlets."

In the introductory chapters, consideration of the objective of community survival raised the following questions. What is a town? Why does it exist? What changes would make it redundant or cause it to wane? One can contemplate the historical progression from stagecoach routes to roads to

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[1] The real cost of transportation may have been significantly increased by the "Energy Crisis" of 1973-74. However, reliable current information is not yet available.

highways and the concommitant changes in population distribution. Does this mean we are headed towards a state in which only the equilibrium number of optimally sized cities (whatever that may be) are regularly distributed all over the country? There will presumably still be small towns growing and declining on the frontiers and elsewhere and perhaps static on the boundaries of spheres of growth poles. That is, the hierarchy of towns, with their different functions, might well be maintained, for a variety of reasons.

Nevertheless, from any perspective, forest management policies and yield regulations in particular, have no hope of maintaining communities in the face of all other influences, despite the strength of the conviction in some quarters that the B.C.F.S. has critical control over regional development. The almost universal nature of agglomeration and integration suggests that this process is inevitable - the B.C.F.S. can slow it or facilitate it but not prevent it (if it wants to) without very great costs (such as loss of markets, lower wages and employment, etc.).

While governments may have a natural and valid concern for the maintenance of community stability - politically, socially and economically - and should therefore give some consideration to the potential for permanence of any regional development they promote or invest in, it is surely not the only criterion for such decisions. There are examples of governments relying on one industry or even one company to develop and sustain towns and whole regions, even countries. The record of government-industry cooperation in such ventures includes a number of success

stories (i.e. rapid growth and high incomes), but some classic failures in the event of disagreements, in this bilateral monopoly - mutual interdependence situation (which the government has usually created and fostered). As Musgrave (1976) observed,

> "The consequences when one of these (one company towns) goes bust are far worse than the equivalent in a large conurbation, where the unemployed are more easily re-employed in other industries. I hope the civil servants responsible for regional investment grants, advance factories and so on will use their powers to direct large firms to large towns and small ones to small towns, if they do not already do so."

This is not necessarily the argument that "small is beautiful", but rather that the size of industrial ventures (and their technologies) should be appropriate to the environment into which they are sited. It is possible that Musgrave has exaggerated the consequences of the fall of a one company town in that any such consequences may merely be "more visible" rather than "far worse".

This discussion has a good deal in common with the development economist's dilemma in underdeveloped countries - whether to push for "growth poles", destabilising rural villages with new industries and roads, or to promote "grass roots" development, maintaining existing communities intact. The greater the economies of scale and the cheaper the transportation, the more likely one is to opt for growth poles. A two-way flow of goods and services to and from the hinterland would occur, with the only "costs" the "destruction" of small

rural towns[1] which may have undesirable sociological ramifications.

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[1] Though some would call it "cultural and economic evolution".

VI. SUMMARY AND CONCLUSIONS.

Few would dispute the dependence of the B.C. economy on the state of the forest industry in general, or the greater dependence of particular communities on the success of specific large forest companies, under the present circumstances. While this could be used as a basis to argue for more favourable treatment for the forest based industries, this thesis suggests that a policy of lessening the influence of the forest industry (with its cyclical fluctuations) would be more appropriate for the attainment of stable (steady trend) regional development. Other industries which are less subject to the exogenously induced fluctuations of building cycles, or a number of smaller industries behaving counter-cyclically would be more conducive to the attainment of employment stability. Regional economic development based on one resource-extractive industry which is rather unpredictable, should not be recommended without qualification.

A policy of sustained yield forest management as practised in British Columbia can be effective in rationing the harvest of timber over a very long period, although other authors have shown that it is economically inefficient in doing so. This thesis has shown that the extrapolation from the conservative preservation of the forest resource to indeterminate perpetuation of existing towns and industries is unjustified, because of the major effects of transportation, technological and cultural changes.

That equal annual or periodic harvests of timber are required by the idealised theory of sustained yield, has led to an expectation that British Columbia's forest policies would contribute to almost constant levels of employment in the wood processing industries in the short term. It has been shown in this thesis that no such short term stability has resulted from sustained yield regulation and that the wood processing and associated industries are among the most unstable, in terms of unemployment, in two B.C. towns. Analyses have shown the instability of unemployment and of production to be correlated with the fluctuating price of export construction lumber.

In the preceding chapter, the analysis identified four strategies which may reduce or cope with (socially undesirable) short term instability of employment in many sectors of the regional and provincial economies which is induced by exogenous fluctuations in the export demand for lumber. By virtue of the fact that it is identified as a social problem, it is obvious that a laissez-faire approach is inadequate. Policies could be introduced to facilitate private readjustment to unemployment through interregional migration or by changing occupations to those currently in greater demand. However, while these may partially solve the problems of unemployment of labour, there can be little effect on the costly unemployment of immobile capital and natural resouces.

The third strategy is to buffer the exogenously induced changes in demand. Those firms with strong financial backing can afford some inventory buffering and can often also rely on strong sales promotion networks. However, for the many

independent and/or financially constrained forest companies in British Columbia, an organisation capable of absorbing or dispersing the market risk and storage costs of holding inventories during depressed markets seems necessary. Commodity futures markets disperse the risk very widely between many individual speculators and could guarantee a certain price to the producer for his future production. In this way, it could induce greater short run stability of production and employment. However, for a number of reasons, this has not been significantly used in British Columbia because of producers' inability or disinclination to trade in commodity futures. A provincial forest products marketing agency or minimum reserve price scheme would be similar, except that it monolithically absorbs the costs and risks of depressed markets, and might disperse any subsequent profits among participating producers. Whether such a scheme would be politically acceptable or used if introduced, are undetermined as yet.

The fourth strategy analysed and recommended was one of further diversification, in many directions and at many levels, to reduce the vulnerability of the economy to any one fluctuating exogenous factor. While projects which are inefficient should not be established simply to diversify the economy, industry, investors and the government in British Columbia could be searching out alternatives which would counterbalance the forest industry fluctuations or which are consistently profitable even if they do not match the forest industry's occasional spectacular booms. A higher level of domestic processing for domestic consumption might be one

component of this strategy.

The exercise of locating the sources of instability and determining how the shocks pass through or are accommodated by the economy to the extent that Canada Manpower data reflect employment instability, might be very useful in itself. A preparedness for future changes and an awareness of how they might be modified may contribute per se to short run stability of employment.

While the regulation of timber supply from Provincial Forests to prevent depletion has only minor relevence to the stability - permanence - development objectives commonly associated with British Columbia's forest policies, the consequences of some of the administrative practices in implementing the sustained yield policy may have been significant in facilitating the adoption of world wide trends.

It is the opinion of this author that the only roles that can legitimately be claimed as the sole provenance of the British Columbia Forest Service are the production of timber and of the commonly recognised non-wood goods and services associated with the protection and preservation of the forest resource and environment. Any advance towards socio-economic objectives such as community stability and survival or regional economic development should derive from broader disciplines and experience than would normally be found in an agency whose primary concern is for the growing, protection and harvesting of the forest resource. This analysis suggests that not only reappraisal of Forest Service practices and procedures, but also of its objectives and capacity to fulfil them, is overdue.

Areas For Future Research

A suitable framework in which to analyse the regional economic impacts of alternative forest policies and administration has not been evident in British Columbia.[1] To complete such an analysis, one needs a good deal more information than has been compiled to date, especially with regard to:

economies of scale and location;

factor input requirements and the rate and direction of technological change; and

some forecasts (or guesses) on the direction of social change as it will affect labour force characteristics,

in addition to greater knowledge of the structure of the regional economy and the interrelationships between sectors.

The least difficult useful information to obtain to further the understanding of the forces shaping industrial structure (and hence employment stability and location) is technical. Perhaps the most obvious are :

the labour and capital intensity of mills of different size,

lumber recovery factors (or output / wood input ratios) stratified by mill size, and

the shape of the LRATC curve (the significance of any economies of scale that exist).

Much of this technical information is simply not available

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[1] A framework for such an analysis which appears well suited to the British Columbia context was presented by Zinn (1976).

to date. There is little comprehensive evidence on small-scale sawmills:

whether they are still more labour intensive than large mills (as was the case with the small portable mills);

whether the labour requirements of small mills are unstable; and

whether small-scale mills can be as physically efficient as large conversion complexes.

If it could be shown that small sawmills such as a community cooperative sawmill could be viable, then the entire thrust of the experience of the past thirty years could be countered. However, this would only derive from a complete reversal of technological change (to eliminate economies of scale), a dramatically different transportation system and much greater security of markets. It is, therefore, considered an unlikely prospect, although future research may make such a strategy viable.

Another extremely interesting research prospect which would contribute a great deal to existing knowledge would be possible if there were inter- or intra-regional accounts such that an input-output model of a regional economy in British Columbia could be constructed. Until the necessary data become available, policy analysts can merely improvise or extrapolate in modelling the contributions of various sectors to the regional economy and the aggregate effects of fluctuations in any sector.

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APPENDIX I.

i) Extract from Canada Manpower Report of Registered Clients and Vacancies.

ii) Extract from Occupational Classification Manual - Canadian Dictionary of Occupations. Dominion Bureau of Statistics. BDS 12-537, pp.17-25.

LIST OF MAJOR, MINOR AND UNIT GROUPS

MAJOR GROUP 11 – MANAGERIAL, ADMINISTRATIVE AND RELATED OCCUPATIONS

111 Officials and Administrators Unique to Government

1111 Members of Legislative Bodies
1113 Government Administrators
1115 Postmasters
1116 Inspectors and Regulatory Officers, Government
1119 Officials and Administrators Unique to Government, n.e.c.

113/114 Other Managers and Administrators

1130 General Managers and Other Senior Officials
1131 Management Occupations, Natural Sciences and Engineering
1132 Management Occupations, Social Sciences and Related Fields
1133 Administrators in Teaching and Related Fields
1134 Administrators in Medicine and Health
1135 Financial Management Occupations
1136 Personnel and Industrial Relations Management Occupations
1137 Sales and Advertising Management Occupations
1141 Purchasing Management Occupations
1142 Services Management Occupations
1143 Production Management Occupations
1145 Management Occupations, Construction Operations
1147 Management Occupations, Transport and Communications Operations
1149 Other Managers and Administrators, n.e.c.

117 Occupations Related to Management and Administration

1171 Accountants, Auditors and Other Financial Officers
1174 Personnel and Related Officers
1175 Purchasing Officers and Buyers, Except Wholesale and Retail Trade
1176 Inspectors and Regulatory Officers, Non-Government
1179 Occupations Related to Management and Administration, n.e.c.

MAJOR GROUP 21 – OCCUPATIONS IN NATURAL SCIENCES, ENGINEERING AND MATHEMATICS

211 Occupations in Physical Sciences

2111 Chemists
2112 Geologists
2113 Physicists
2114 Meteorologists
2117 Physical Sciences Technologists and Technicians
2119 Occupations in Physical Sciences, n.e.c.

213 Occupations in Life Sciences

2131 Agriculturists and Related Scientists
2133 Biologists and Related Scientists
2135 Life Sciences Technologists and Technicians
2139 Occupations in Life Sciences, n.e.c.

MAJOR GROUP 21 – OCCUPATIONS IN NATURAL SCIENCES, ENGINEERING AND MATHEMATICS – Concluded

214/215 Architects and Engineers

2141 Architects
2142 Chemical Engineers
2143 Civil Engineers
2144 Electrical Engineers
2145 Industrial Engineers
2147 Mechanical Engineers
2151 Metallurgical Engineers
2153 Mining Engineers
2154 Petroleum Engineers
2155 Aeronautical Engineers
2157 Nuclear Engineers
2159 Architects and Engineers, n.e.c.

216 Other Occupations in Architecture and Engineering

2160 Supervisors: Other Occupations in Architecture and Engineering
2161 Surveyors
2163 Draughtsmen
2165 Architectural and Engineering Technologists and Technicians
2169 Other Occupations in Architecture and Engineering, n.e.c.

218 Occupations in Mathematics, Statistics, Systems Analysis and Related Fields

2181 Mathematicians, Statisticians and Actuaries
2183 Systems Analysts, Computer Programmers and Related Occupations
2189 Occupations in Mathematics, Statistics, Systems Analysis and Related Fields, n.e.c.

MAJOR GROUP 23 – OCCUPATIONS IN SOCIAL SCIENCES AND RELATED FIELDS

231 Occupations in Social Sciences

2311 Economists
2313 Sociologists, Anthropologists and Related Social Scientists
2315 Psychologists
2319 Occupations in Social Sciences, n.e.c.

233 Occupations in Social Work and Related Fields

2331 Social Workers
2333 Occupations in Welfare and Community Services
2339 Occupations in Social Work and Related Fields, n.e.c.

234 Occupations in Law and Jurisprudence

2341 Judges and Magistrates
2343 Lawyers and Notaries
2349 Occupations in Law and Jurisprudence, n.e.c.

235 Occupations in Library, Museum and Archival Sciences

2350 Supervisors: Occupations in Library, Museum and Archival Sciences
2351 Librarians and Archivists

LIST OF MAJOR, MINOR AND UNIT GROUPS — Continued

MAJOR GROUP 23 — OCCUPATIONS IN SOCIAL SCIENCES AND RELATED FIELDS — Concluded

235 Occupations in Library, Museum and Archival Sciences — Concluded

2353 Technicians in Library, Museum and Archival Sciences

2359 Occupations in Library, Museum and Archival Sciences, n.e.c.

239 Other Occupations in Social Sciences and Related Fields

2391 Educational and Vocational Counsellors

2399 Other Occupations in Social Sciences and Related Fields, n.e.c.

MAJOR GROUP 25 — OCCUPATIONS IN RELIGION

251 Occupations in Religion

2511 Ministers of Religion

2513 Nuns and Brothers (W), n.o.r.

2519 Occupations in Religion, n.e.c.

MAJOR GROUP 27 — TEACHING AND RELATED OCCUPATIONS

271 University Teaching and Related Occupations

2711 University Teachers

2719 University Teaching and Related Occupations, n.e.c.

273 Elementary and Secondary School Teaching and Related Occupations

2731 Elementary and Kindergarten Teachers

2733 Secondary School Teachers

2739 Elementary and Secondary School Teaching and Related Occupations, n.e.c.

279 Other Teaching and Related Occupations

2791 Community College and Vocational School Teachers

2792 Fine Arts School Teachers

2793 Post-Secondary School Teachers, n.e.c.

2795 Teachers of Exceptional Students, n.e.c.

2797 Instructors and Training Officers, n.e.c.

2799 Other Teaching and Related Occupations, n.e.c.

MAJOR GROUP 31 — OCCUPATIONS IN MEDICINE AND HEALTH

311 Health Diagnosing and Treating Occupations

3111 Physicians and Surgeons

3113 Dentists

3115 Veterinarians

3117 Osteopaths and Chiropractors

3119 Health Diagnosing and Treating Occupations, n.e.c.

313 Nursing, Therapy and Related Assisting Occupations

3130 Supervisors: Nursing Occupations

3131 Nurses, Graduate, Except Supervisors

3133 Nurses-in-Training

3134 Nursing Assistants

3135 Nursing Aides and Orderlies

MAJOR GROUP 31 — OCCUPATIONS IN MEDICINE AND HEALTH — Concluded

313 Nursing, Therapy and Related Assisting Occupations — Concluded

3137 Physiotherapists, Occupational and Other Therapists

3139 Nursing, Therapy and Related Assisting Occupations, n.e.c.

315 Other Occupations in Medicine and Health

3151 Pharmacists

3152 Dietitians and Nutritionists

3153 Optometrists

3154 Dispensing Opticians

3155 Radiological Technologists and Technicians

3156 Medical Laboratory Technologists and Technicians

3157 Dental Hygienists, Assistants and Technicians

3159 Other Occupations in Medicine and Health, n.e.c.

MAJOR GROUP 33 — ARTISTIC, LITERARY, RECREATIONAL AND RELATED OCCUPATIONS

331 Occupations in Fine and Commercial Art, Photography and Related Fields

3311 Painters, Sculptors and Related Artists

3313 Product and Interior Designers

3314 Advertising and Illustrating Artists

3315 Photographers and Cameramen

3319 Occupations in Fine and Commercial Art, Photography and Related Fields, n.e.c.

333 Occupations in Performing and Audio-visual Arts

3330 Producers and Directors, Performing and Audio-visual Arts

3332 Musicians

3333 Dancers and Choreographers

3335 Actors

3337 Radio and Television Announcers

3339 Occupations in Performing and Audio-visual Arts n.e.c.

335 Occupations in Writing

3352 Writers and Editors

3355 Translators and Interpreters

3359 Occupations in Writing, n.e.c.

337 Occupations in Sport and Recreation

3370 Coaches, Trainers, Instructors and Managers, Sport and Recreation

3371 Referees and Related Officials

3373 Athletes

3375 Attendants, Sport and Recreation

3379 Occupations in Sport and Recreation, n.e.c.

MAJOR GROUP 41 — CLERICAL AND RELATED OCCUPATIONS

411 Stenographic and Typing Occupations

4110 Supervisors: Stenographic and Typing Occupations

4111 Secretaries and Stenographers

4113 Typists and Clerk-Typists

LIST OF MAJOR, MINOR AND UNIT GROUPS — Continued

MAJOR GROUP 41 — CLERICAL AND RELATED OCCUPATIONS — Concluded

413 Bookkeeping, Account-recording and Related Occupations

4130 Supervisors: Bookkeeping, Account-recording and Related Occupations
4131 Bookkeepers and Accounting Clerks
4133 Tellers and Cashiers
4135 Insurance, Bank and Other Finance Clerks
4137 Statistical Clerks
4139 Bookkeeping, Account-recording and Related Occupations, n.e.s.

414 Office Machine and Electronic Data-processing Equipment Operators

4140 Supervisors: Office Machine and Electronic Data-processing Equipment Operators
4141 Office Machine Operators
4143 Electronic Data-processing Equipment Operators

415 Material Recording, Scheduling and Distributing Occupations

4150 Supervisors: Material Recording, Scheduling and Distributing Occupations
4151 Production Clerks
4153 Shipping and Receiving Clerks
4155 Stock Clerks and Related Occupations
4157 Weighers
4159 Material Recording, Scheduling and Distributing Occupations, n.e.c.

416 Library, File and Correspondence Clerks and Related Occupations

4160 Supervisors: Library, File and Correspondence Clerks and Related Occupations
4161 Library and File Clerks
4169 Library, File and Correspondence Clerks and Related Occupations, n.e.c.

417 Reception, Information, Mail and Message Distribution Occupations

4170 Supervisors: Reception, Information, Mail and Message Distribution Occupations
4171 Receptionists and Information Clerks
4172 Mail Carriers
4173 Mail and Postal Clerks
4175 Telephone Operators
4177 Messengers
4179 Reception, Information, Mail and Message Distribution Occupations, n.e.c.

419 Other Clerical and Related Occupations

4190 Supervisors: Other Clerical and Related Occupations, n.e.c.
4191 Collectors
4192 Adjusters, Claim
4193 Travel Clerks, Ticket, Station and Freight Agents
4194 Hotel Clerks
4195 Personnel Clerks
4197 General Office Clerks
4199 Other Clerical and Related Occupations, n.e.c.

MAJOR GROUP 51 — SALES OCCUPATIONS

513/514 Sales Occupations, Commodities

5130 Supervisors: Sales Occupations, Commodities
5131 Technical Salesmen and Related Advisers
5133 Commercial Travellers
5135 Salesmen and Salespersons, Commodities, n.e.c.
5137 Sales Clerks, Commodities
5141 Street Vendors and Door-to-Door Salesmen
5143 Newsboys
5145 Service Station Attendants
5149 Sales Occupations: Commodities, n.e.c.

517 Sales Occupations, Services

5170 Supervisors: Sales Occupations, Services
5171 Insurance Salesmen and Agents
5172 Real Estate Salesmen
5173 Salesmen and Traders, Securities
5174 Advertising Salesmen
5177 Business Services Salesmen
5179 Sales Occupations: Services, n.e.c.

519 Other Sales Occupations

5190 Supervisors: Other Sales Occupations
5191 Buyers, Wholesale and Retail Trade
5193 Driver-Salesmen
5199 Other Sales Occupations, n.e.c.

MAJOR GROUP 61 — SERVICE OCCUPATIONS

611 Protective Service Occupations

6111 Fire-Fighting Occupations
6112 Policemen and Detectives, Government
6113 Policemen and Investigators, Private
6115 Guards and Watchmen
6116 Commissioned Officers, Armed Forces
6117 Other Ranks, Armed Forces
6119 Protective Service Occupations, n.e.c.

612 Food and Beverage Preparation and Related Service Occupations

6120 Supervisors: Food and Beverage Preparation and Related Service Occupations
6121 Chefs and Cooks
6123 Bartenders
6125 Waiters, Hostesses and Stewards, Food and Beverage
6129 Food and Beverage Preparation and Related Service Occupations, n.e.c.

613 Occupations in Lodging and Other Accommodation

6130 Supervisors: Occupations in Lodging and Other Accommodation
6131 Managers: Hotel, Motel and Other Accommodation
6133 Chambermaids and Housemen
6135 Sleeping-Car and Baggage Porters, and Bellmen
6139 Occupations in Lodging and Other Accommodation, n.e.c.

LIST OF MAJOR, MINOR AND UNIT GROUPS — Continued

MAJOR GROUP 61 — SERVICE OCCUPATIONS — Concluded

614 Personal Service Occupations

6141 Funeral Directors, Embalmers and Related Occupations
6143 Barbers, Hairdressers and Related Occupations
6144 Guides
6145 Hostesses and Stewards, Except Food and Beverage
6147 Babysitters
6149 Personal Service Occupations, n.e.c.

616 Apparel and Furnishings Service Occupations

6160 Supervisors: Apparel and Furnishings Service Occupations
6162 Laundering and Dry Cleaning Occupations
6165 Pressing Occupations
6169 Apparel and Furnishings Service Occupations, n.e.c.

619 Other Service Occupations

6190 Supervisors: Other Service Occupations
6191 Janitors, Charworkers and Cleaners
6193 Elevator Operating Occupations
6198 Occupations in Labouring and Other Elemental Work, Services
6199 Other Service Occupations, n.e.c.

MAJOR GROUP 71 — FARMING, HORTICULTURAL AND ANIMAL HUSBANDRY OCCUPATIONS

711 Farmers

7112 Farmers

713 Farm Management Occupations

7131 Farm Management Occupations

718/719 Other Farming, Horticultural and Animal Husbandry Occupations

7180 Foremen: Other Farming, Horticultural and Animal Husbandry Occupations
7182 Farm Workers
7195 Nursery and Related Workers
7197 Farm Machinery Operators and Custom Operators
7199 Other Farming, Horticultural and Animal Husbandry Occupations, n.e.c.

MAJOR GROUP 73 — FISHING, HUNTING, TRAPPING AND RELATED OCCUPATIONS

731 Fishing, Hunting, Trapping and Related Occupations

7311 Captains and Other Officers, Fishing Vessels
7313 Fishermen: Net, Trap and Line
7315 Hunting, Trapping and Related Occupations
7319 Fishing, Hunting, Trapping and Related Occupations, n.e.c.

MAJOR GROUP 75 — FORESTRY AND LOGGING OCCUPATIONS

751 Forestry and Logging Occupations

7510 Foremen: Forestry and Logging Occupations
7511 Forestry Conservation Occupations
7513 Timber Cutting and Related Occupations

MAJOR GROUP 75 — FORESTRY AND LOGGING OCCUPATIONS — Concluded

751 Forestry and Logging Occupations — Conc.

7516 Log Inspecting, Grading, Scaling and Related Occupations
7517 Log Hoisting, Sorting, Moving and Related Occupations
7518 Occupations in Labouring and Other Elemental Work, Forestry and Logging
7519 Forestry and Logging Occupations, n.e.c.

MAJOR GROUP 77 — MINING AND QUARRYING INCLUDING OIL AND GAS FIELD OCCUPATIONS

771 Mining and Quarrying Including Oil and Gas Field Occupations

7710 Foremen: Mining and Quarrying Including Oil and Gas Field Occupations
7711 Rotary Well-drilling and Related Occupations
7713 Other Rock and Soil Drilling Occupations
7715 Blasting Occupations
7717 Mining and Quarrying: Cutting, Handling and Loading Occupations
7718 Occupations in Labouring and Other Elemental Work, Mining and Quarrying Including Oil and Gas Fields
7719 Mining and Quarrying Including Oil and Gas Field Occupations, n.e.c.

MAJOR GROUP 81/82 — PROCESSING OCCUPATIONS

811 Mineral Ore Treating Occupations

8110 Foremen: Mineral Ore Treating Occupations
8111 Crushing and Grinding Occupations, Mineral Ores
8113 Mixing, Separating, Filtering and Related Occupations, Mineral Ores
8115 Melting and Roasting Occupations, Mineral Ores
8116 Inspecting, Testing, Grading and Sampling Occupations, Mineral Ore Treating
8118 Occupations in Labouring and Other Elemental Work, Mineral Ore Treating
8119 Mineral Ore Treating Occupations, n.e.c.

813/814 Metal Processing and Related Occupations

8130 Foremen: Metal Processing and Related Occupations
8131 Metal Smelting, Converting and Refining Furnacemen
8133 Metal Heat Treating Occupations
8135 Metal Rolling Occupations
8137 Moulding, Coremaking and Metal Casting Occupations
8141 Metal Extruding and Drawing Occupations
8143 Plating, Metal Spraying and Related Occupations
8146 Inspecting, Testing, Grading and Sampling Occupations, Metal Processing
8148 Occupations in Labouring and Other Elemental Work, Metal Processing
8149 Metal Processing and Related Occupations, n.e.c.

LIST OF MAJOR, MINOR AND UNIT GROUPS — Continued

MAJOR GROUP 81/82 — PROCESSING OCCUPATIONS — Continued

815 Clay, Glass and Stone Processing, Forming and Related Occupations

8150 Foremen: Clay, Glass and Stone Processing, Forming and Related Occupations

8151 Furnacemen and Kilnmen: Clay, Glass and Stone

8153 Separating, Grinding, Crushing and Mixing Occupations: Clay, Glass and Stone

8155 Forming Occupations: Clay, Glass and Stone

8156 Inspecting, Testing, Grading and Sampling Occupations: Clay, Glass and Stone Processing and Forming

8158 Occupations in Labouring and Other Elemental Work: Clay, Glass and Stone Processing and Forming

8159 Clay, Glass and Stone Processing, Forming and Related Occupations, n.e.c.

816/817 Chemicals, Petroleum, Rubber, Plastic and Related Materials Processing Occupations

8160 Foremen: Chemicals, Petroleum, Rubber, Plastic and Related Materials Processing Occupations

8161 Mixing and Blending Occupations, Chemicals and Related Materials

8163 Filtering, Straining and Seperating Occupations, Chemicals and Related Materials

8165 Distilling, Subliming and Carbonizing Occupations, Chemicals and Related Materials

8167 Roasting, Cooking and Drying Occupations, Chemicals and Related Materials

8171 Crushing and Grinding Occupations, Chemicals and Related Materials

8173 Coating and Calendering Occupations, Chemicals and Related Materials

8176 Inspecting, Testing, Grading and Sampling Occupations: Chemicals, Petroleum, Rubber, Plastic and Related Materials Processing

8178 Occupations in Labouring and Other Elemental Work: Chemicals, Petroleum, Rubber, Plastic and Related Materials Processing

8179 Chemicals, Petroleum, Rubber, Plastic and Related Materials Processing Occupations, n.e.c.

821/822 Food, Beverage and Related Processing Occupations

8210 Foremen: Food, Beverage and Related Processing Occupations

8211 Flour and Grain Milling Occupations

8213 Baking, Confectionery Making and Related Occupations

8215 Slaughtering and Meat Cutting, Canning, Curing and Packing Occupations

8217 Fish Canning, Curing and Packing Occupations

8221 Fruit and Vegetable Canning, Preserving and Packing Occupations

8223 Milk Processing Occupations

8225 Sugar Processing and Related Occupations

8226 Inspecting, Testing, Grading and Sampling Occupations: Food, Beverage and Related Processing

8227 Beverage Processing Occupations

8228 Occupations in Labouring and Other Elemental Work: Food, Beverage and Related Processing

8229 Food, Beverage and Related Processing Occupations, n.e.c.

MAJOR GROUP 81/82 — PROCESSING OCCUPATIONS — Concluded

823 Wood Processing Occupations, Except Pulp and Papermaking

8230 Foremen: Wood Processing Occupations, Except Pulp and Papermaking

8231 Sawmill Sawyers and Related Occupations

8233 Plywood Making and Related Occupations

8235 Wood Treating Occupations

8236 Inspecting, Testing, Grading and Sampling Occupations: Wood Processing, Except Pulp and Papermaking

8238 Occupations in Labouring and Other Elemental Work: Wood Processing, Except Pulp and Papermaking

8239 Wood Processing Occupations, Except Pulp and Papermaking, n.e.c.

825 Pulp and Papermaking and Related Occupations

8250 Foreman: Pulp and Papermaking and Related Occupations

8251 Cellulose Pulp Preparing Occupations

8253 Papermaking and Finishing Occupations

8256 Inspecting, Testing, Grading and Sampling Occupations, Pulp and Papermaking

8258 Occupations in Labouring and Other Elemental Work, Pulp and Papermaking

8259 Pulp and Papermaking and Related Occupations, n.e.c.

826/827 Textile Processing Occupations

8260 Foremen: Textile Processing Occupations

8261 Textile Fibre Preparing Occupations

8263 Textile Spinning and Twisting Occupations

8265 Textile Winding and Reeling Occupations

8267 Textile Weaving Occupations

8271 Knitting Occupations

8273 Textile Bleaching and Dyeing Occupations

8275 Textile Finishing and Calendering Occupations

8276 Inspecting, Testing, Grading and Sampling Occupations, Textile Processing

8278 Occupations in Labouring and Other Elemental Work, Textile Processing

8279 Textile Processing Occupations, n.e.c.

829 Other Processing Occupations

8290 Foremen: Other Processing Occupations

8293 Tobacco Processing Occupations

8295 Hide and Pelt Processing Occupations

8296 Inspecting, Testing, Grading and Sampling Occupations, Processing, n.e.c.

8298 Occupations in Labouring and Other Elemental Work, Other Processing

8299 Other Processing Occupations, n.e.c.

MAJOR GROUP 83 — MACHINING AND RELATED OCCUPATIONS

831 Metal Machining Occupations

8310 Foremen: Metal Machining Occupations

8311 Tool and Die Making Occupations

LIST OF MAJOR, MINOR AND UNIT GROUPS – Continued

MAJOR GROUP 83 – MACHINING AND RELATED OCCUPATIONS – Concluded

831 Metal Machining Occupations – Concluded

8313 Machinist and Machine Tool Setting-Up Occupations

8315 Machine Tool Operating Occupations

8316 Inspecting, Testing, Grading and Sampling Occupations, Metal Machining

8319 Metal Machining Occupations, n.e.c.

833 Metal Shaping and Forming Occupations, Except Machining

8330 Foremen: Metal Shaping and Forming Occupations, Except Machining

8331 Forging Occupations

8333 Sheet Metal Workers

8334 Metalworking-machine Operators, n.e.c.

8335 Welding and Flame Cutting Occupations

8336 Inspecting, Testing, Grading and Sampling Occupations: Metal Shaping and Forming, Except Machining

8337 Boilermakers, Platers and Structural Metal Workers

8339 Metal Shaping and Forming Occupations, Except Machining, n.e.c.

835 Wood Machining Occupations

8350 Foremen: Wood Machining Occupations

8351 Wood Patternmaking Occupations

8353 Wood Sawing and Related Occupations, Except Sawmill

8355 Planing, Turning, Shaping and Related Wood Machining Occupations

8356 Inspecting, Testing, Grading and Sampling Occupations, Wood Machining

8357 Wood Sanding Occupations

8359 Wood Machining Occupations, n.e.c.

837 Clay, Glass and Stone and Related Materials Machining Occupations

8370 Foremen: Clay, Glass and Stone and Related Materials Machining Occupations

8371 Cutting and Shaping Occupations: Clay, Glass and Stone

8373 Abrading and Polishing Occupations: Clay, Glass and Stone, n.e.c.

8376 Inspecting, Testing, Grading and Sampling Occupations: Clay, Glass and Stone Machining

8379 Clay, Glass and Stone and Related Materials Machining Occupations, n.e.c.

839 Other Machining and Related Occupations

8390 Foremen: Other Machining and Related Occupations, n.e.c.

8391 Engravers, Etchers and Related Occupations

8393 Filing, Grinding, Buffing, Cleaning and Polishing Occupations, n.e.c.

8395 Patternmakers and Mouldmakers, n.e.c.

8396 Inspecting, Testing, Grading and Sampling Occupations, Machining, n.e.c.

8399 Other Machining and Related Occupations, n.e.c.

MAJOR GROUP 85 – PRODUCT FABRICATING, ASSEMBLING AND REPAIRING OCCUPATIONS

851/852 Fabricating and Assembling Occupations, Metal Products, N.E.C.

8510 Foremen: Fabricating and Assembling Occupations, Metal Products, n.e.c.

8511 Engine and Related Equipment Fabricating and Assembling Occupations, n.e.c.

8513 Motor Vehicle Fabricating and Assembling Occupations, n.e.c.

8515 Aircraft Fabricating and Assembling Occupations, n.e.c.

8523 Industrial, Farm, Construction and Other Mechanized Equipment and Machinery Fabricating and Assembling Occupations, n.e.c.

8525 Business and Commercial Machines Fabricating and Assembling Occupations, n.e.c.

8526 Inspecting, Testing, Grading and Sampling Occupations, Fabricating and Assembling Metal Products, n.e.c.

8527 Precision Instruments and Related Equipment Fabricating and Assembling Occupations, n.e.c.

8528 Occupations in Labouring and Other Elemental Work, Fabricating and Assembling Metal Products, n.e.c.

8529 Other Fabricating and Assembling Occupations, Metal Products, n.e.c.

853 Fabricating, Assembling, Installing and Repairing Occupations: Electrical, Electronic and Related Equipment

8530 Foremen: Fabricating, Assembling, Installing and Repairing Occupations, Electrical, Electronic and Related Equipment

8531 Electrical Equipment Fabricating and Assembling Occupations

8533 Electrical and Related Equipment Installing and Repairing Occupations, n.e.c.

8534 Electronic Equipment Fabricating and Assembling Occupations

8535 Electronic and Related Equipment Installing and Repairing Occupations, n.e.c.

8536 Inspecting, Testing, Grading and Sampling Occupations: Fabricating, Assembling, Installing and Repairing Electrical, Electronic and Related Equipment

8537 Radio and Television Service Repairmen

8538 Occupations in Labouring and Other Elemental Work: Fabricating, Assembling, Installing and Repairing Electrical, Electronic and Related Equipment

8539 Fabricating, Assembling, Installing and Repairing Occupations: Electrical, Electronic and Related Equipment, n.e.c.

854 Fabricating, Assembling and Repairing Occupations, Wood Products

8540 Foremen: Fabricating, Assembling and Repairing Occupations, Wood Products

8541 Cabinet and Wood Furniture Makers

8546 Inspecting, Testing, Grading and Sampling Occupations: Fabricating, Assembling and Repairing, Wood Products

LIST OF MAJOR, MINOR AND UNIT GROUPS – Continued

MAJOR GROUP 85 – PRODUCT FABRICATING, ASSEMBLING AND REPAIRING OCCUPATIONS – Continued

854 Fabricating, Assembling and Repairing Occupations, Wood Products – Concluded

8548 Occupations in Labouring and Other Elemental Work: Fabricating, Assembling and Repairing, Wood Products

8549 Fabricating, Assembling and Repairing Occupations, Wood Products, n.e.c.

855/856 Fabricating, Assembling and Repairing Occupations: Textiles, Fur and Leather Products

8550 Foremen: Fabricating, Assembling and Repairing Occupations, Textile, Fur and Leather Products

8551 Pattemmaking, Marking and Cutting Occupations: Textile, Fur and Leather Products

8553 Tailors and Dressmakers

8555 Furriers

8557 Milliners, Hat and Cap Makers

8561 Shoemaking and Repairing Occupations

8562 Upholsterers

8563 Sewing Machine Operators, Textile and Similar Materials

8566 Inspecting, Testing, Grading and Sampling Occupations: Fabricating, Assembling and Repairing, Textile, Fur and Leather Products

8568 Occupations in Labouring and Other Elemental Work: Fabricating, Assembling and Repairing, Textile, Fur and Leather Products

8569 Fabricating, Assembling and Repairing Occupations: Textile, Fur and Leather Products, n.e.c.

857 Fabricating, Assembling and Repairing Occupations: Rubber, Plastic and Related Products

8570 Foremen: Fabricating, Assembling and Repairing Occupations, Rubber, Plastic and Related Products

8571 Bonding and Cementing Occupations, Rubber, Plastic and Related Products

8573 Moulding Occupations, Rubber, Plastic and Related Products

8575 Cutting and Finishing Occupations, Rubber, Plastic and Related Products

8576 Inspecting, Testing, Grading and Sampling Occupations: Fabricating, Assembling and Repairing, Rubber, Plastic and Related Products

8578 Occupations in Labouring and Other Elemental Work: Fabricating, Assembling and Repairing, Rubber, Plastic and Related Products

8579 Fabricating, Assembling and Repairing Occupations: Rubber, Plastic and Related Products, n.e.c.

858 Mechanics and Repairmen Except Electrical

8580 Foremen: Mechanics and Repairmen Except Electrical

8581 Motor Vehicle Mechanics and Repairmen

8582 Aircraft Mechanics and Repairmen

8583 Rail Transport Equipment Mechanics and Repairmen

MAJOR GROUP 85 – PRODUCT FABRICATING, ASSEMBLING AND REPAIRING OCCUPATIONS – Concluded

858 Mechanics and Repairmen Except Electrical – Concluded

8584 Industrial, Farm and Construction Machinery Mechanics and Repairmen

8585 Business and Commercial Machine Mechanics and Repairmen

8586 Inspecting, Testing, Grading and Sampling Occupations, Equipment Repair Except Electrical

8587 Watch and Clock Repairmen

8588 Precision Instrument Mechanics and Repairmen

8589 Mechanics and Repairmen Except Electrical, n.e.c.

859 Other Product Fabricating, Assembling and Repairing Occupations

8590 Foremen: Product Fabricating, Assembling and Repairing Occupations, n.e.c.

8591 Jewellery and Silverware Fabricating, Assembling and Repairing Occupations

8592 Marine Craft Fabricating, Assembling and Repairing Occupations

8593 Paper Product Fabricating and Assembling Occupations

8595 Painting and Decorating Occupations, Except Construction

8596 Inspecting, Testing, Grading and Sampling Occupations: Product Fabricating, Assembling and Repairing, n.e.c.

8598 Occupations in Labouring and Other Elemental Work: Product Fabricating, Assembling and Repairing, n.e.c.

8599 Other Product Fabricating, Assembling and Repairing Occupations, n.e.c.

MAJOR GROUP 87 – CONSTRUCTION TRADES OCCUPATIONS

871 Excavating, Grading, Paving and Related Occupations

8710 Foremen: Excavating, Grading, Paving and Related Occupations

8711 Excavating, Grading and Related Occupations

8713 Paving, Surfacing and Related Occupations

8715 Railway Sectionmen and Trackmen

8718 Occupations in Labouring and Other Elemental Work: Excavating, Grading, and Paving

8719 Excavating, Grading, Paving and Related Occupations, n.e.c.

873 Electrical Power, Lighting and Wire Communications Equipment Erecting, Installing and Repairing Occupations

8730 Foremen: Electrical Power, Lighting and Wire Communications Equipment Erecting, Installing and Repairing Occupations

8731 Electrical Power Linemen and Related Occupations

8733 Construction Electricians and Repairmen

8735 Wire Communications and Related Equipment Installing and Repairing Occupations

LIST OF MAJOR, MINOR AND UNIT GROUPS — Continued

MAJOR GROUP 87 — CONSTRUCTION TRADES OCCUPATIONS — Concluded

873 Electrical Power, Lighting and Wire Communications Equipment Erecting, Installing and Repairing Occupations — Concluded

8736 Inspecting, Testing, Grading and Sampling Occupations: Electrical Power, Lighting and Wire Communications Equipment Erecting, Installing and Repairing

8738 Occupations in Labouring and Other Elemental Work: Electrical Power, Lighting and Wire Communications Equipment Erecting, Installing and Repairing

8739 Electrical Power, Lighting and Wire Communications Equipment Erecting, Installing and Repairing Occupations, n.e.c.

878/879 Other Construction Trades Occupations

8780 Foremen: Other Construction Trades Occupations

8781 Carpenters and Related Occupations

8782 Brick and Stone Masons and Tile Setters

8783 Concrete Finishing and Related Occupations

8784 Plasterers and Related Occupations

8785 Painters, Paperhangers and Related Occupations

8786 Insulating Occupations, Construction

8787 Roofing, Waterproofing and Related Occupations

8791 Pipefitting, Plumbing and Related Occupations

8793 Structural Metal Erectors

8795 Glaziers

8796 Inspecting, Testing, Grading and Sampling Occupations, Construction, Except Electrical

8798 Occupations in Labouring and Other Elemental Work, Other Construction Trades

8799 Other Construction Trades Occupations, n.e.c.

MAJOR GROUP 91 — TRANSPORT EQUIPMENT OPERATING OCCUPATIONS

911 Air Transport Operating Occupations

9110 Foremen: Air Transport Operating Occupations

9111 Air Pilots, Navigators and Flight Engineers

9113 Air Transport Operating Support Occupations

9119 Air Transport Operating Occupations, n.e.c.

913 Railway Transport Operating Occupations

9130 Foremen: Railway Transport Operating Occupations

9131 Locomotive Engineers and Firemen

9133 Conductors and Brakemen, Railway

9135 Railway Transport Operating Support Occupations

9139 Railway Transport Operating Occupations, n.e.c.

915 Water Transport Operating Occupations

9151 Deck Officers

9153 Engineering Officers, Ship

9155 Deck Crew, Ship

9157 Engine and Boiler-Room Crew, Ship

9159 Water Transport Operating Occupations, n.e.c.

MAJOR GROUP 91 — TRANSPORT EQUIPMENT OPERATING OCCUPATIONS — Concluded

917 Motor Transport Operating Occupations

9170 Foremen: Motor Transport Operating Occupations

9171 Bus Drivers

9173 Taxi Drivers and Chauffeurs

9175 Truck Drivers

9179 Motor Transport Operating Occupations, n.e.c.

919 Other Transport and Related Equipment Operating Occupations

9190 Foremen: Other Transport and Related Equipment Operating Occupations

9191 Subway and Street Railway Operating Occupations

9193 Motormen and Dinkeymen, Except Rail Transport

9199 Other Transport and Related Equipment Operating Occupations, n.e.c.

MAJOR GROUP 93 — MATERIALS HANDLING AND RELATED OCCUPATIONS, N.E.C.

931 Materials Handling and Related Occupations, n.e.c.

9310 Foremen: Materials Handling and Related Occupations, n.e.c.

9311 Hoisting Occupations, n.e.c.

9313 Longshoremen, Stevedores and Freight Handlers

9315 Materials Handling Equipment Operators, n.e.c.

9317 Packaging Occupations, n.e.c.

9318 Occupations in Labouring and Other Elemental Work, Materials Handling

9319 Materials Handling and Related Occupations, n.e.c.

MAJOR GROUP 95 — OTHER CRAFTS AND EQUIPMENT OPERATING OCCUPATIONS

951 Printing and Related Occupations

9510 Foremen: Printing and Related Occupations

9511 Typesetters and Compositors

9512 Printing Press Occupations

9513 Stereotypers and Electrotypers

9514 Printing Engravers, Except Photoengravers

9515 Photoengravers and Related Occupations

9517 Bookbinders and Related Occupations

9518 Occupations in Labouring and Other Elemental Work, Printing and Related, n.e.c.

9519 Printing and Related Occupations, n.e.c.

953 Stationary Engine and Utilities Equipment Operating and Related Occupations

9530 Foremen: Stationary Engine and Utilities Equipment Operating and Related Occupations

9531 Power Station Operators

9539 Stationary Engine and Utilities Equipment Operating and Related Occupations, n.e.c.

LIST OF MAJOR, MINOR AND UNIT GROUPS – Concluded

MAJOR GROUP 95 – OTHER CRAFTS AND EQUIPMENT OPERATING OCCUPATIONS – Continued

955 Electronic and Related Communications Equipment Operating Occupations, N.E.C.

9550 Foremen: Electronic and Related Communications Equipment Operating Occupations, n.e.c.

9551 Radio and Television Broadcasting Equipment Operators

9553 Telegraph Operators

9555 Sound Recording and Reproduction Equipment Operators

9557 Motion Picture Projectionists

9559 Electronic and Related Communications Equipment Operating Occupations, n.e.c.

959 Other Crafts and Equipment Operating Occupations, N.E.C.

9590 Foremen: Other Crafts and Equipment Operating Occupations, n.e.c.

9591 Photographic Processing Occupations

9599 Other Crafts and Equipment Operating Occupations, n.e.c.

MAJOR GROUP 99 – OCCUPATIONS NOT ELSEWHERE CLASSIFIED

991 Occupations Not Elsewhere Classified

9910 Supervisors and Foremen, n.e.c.

9916 Inspecting, Testing, Grading and Sampling Occupations, n.e.c.

9918 Occupations in Labouring and Other Elemental Work, n.e.c.

9919 Other Occupations, n.e.c.

MAJOR GROUP 00 – OCCUPATIONS NOT STATED

000 Occupations Not Stated

0000 Occupation Not Stated.