

# Scaling Overview

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## 1.1 The Role of Scaling and its Importance

Scaling plays an essential role in meeting the needs of both government and industry. This chapter provides an overview discussion on:

- the role and importance of scaling,
- the evolution of B.C.'s scaling practices, and
- of the legal and administrative framework for scaling.

The following chapters in this manual describe B.C.'s scaling practices in detail.

Scaling plays a very important role for government, the forest industry and other users of scale data. For government, scale data is used to invoice the forest industry for stumpage (in 2006 almost \$1.2 billion in stumpage was billed) and to administer the cut. For the forest industry, scale data is the basis for many transactions, including buying and selling forest products, and contractor payment. In fact, many parties are dependent on an accurate and meaningful scale. The scaler is the most significant player in providing this assurance.

As discussed in the following sections, scaling practices in British Columbia have adapted and evolved to meet the needs of the consuming wood industry, government and other parties with an interest in the scale.

### 1.1.1 Cruise Based Tenures

These tenures are not scale based and are not meant to be scaled. Instead an estimate of volume is done under the cruise regime and licensees are billed on that basis. Scalers, when receiving timber, should take care that they are familiar with the billing method of the tenure.

Refer to the [\*Cruising Manual\*](#) for more information.

## 1.2 The Evolution of BCs Scaling Practices

Scaling in British Columbia is rich in history. An understanding of this history provides an insight into today's scaling practices and their roles and relationships in forest administration.

### 1.2.1 British Columbia's Official Scales

The earliest scaling in British Columbia consisted of the licensee or lessee keeping a written account of the number of trees felled on a tract of land. Each month, the operator submitted a sworn statement of trees felled and accepted responsibility to pay dues based on this count. The term "stumpage" arose from this crude procedure. While the approach enabled a fast and accurate check on the statement of trees felled and dues payable by simply counting stumps, it failed in providing meaningful information for buyers and sellers about value, volumes and quality. The need for a more accurate and versatile scale was soon identified.

In 1895, the British Columbia Board Foot Log Scale was established as the official scale. It was used to determine scale in foot board measure (BCFBM). The Scribner, Decimal C and Doyle Log rules were used along side the B.C. Log Rule until 1915 at which time they were no longer accepted for government measurement purposes. The B.C. Log Rule was derived mathematically and was tempered with certain arbitrary assumptions.

$V_{\text{FBM}} = .0476(D-1.5)^2 L$		
where:	$V_{\text{FBM}}$ =	volume in foot board measure (board feet),
	D =	small end diameter in inches, and
	L =	length in feet.

**Figure 1.1 The B.C. Log Rule.**

The resulting formula yielded the number of board feet of lumber (rough, green) that could be cut from logs of a given length and small end diameter. The formula was later modified to better account for longer logs.

While the B.C. Log Scale provided satisfactory results of the timber profile harvested when the rule was first introduced, later forest exploration in the 1930s saw the harvest of smaller timber and the production of longer logs. Scale results quickly came under criticism from buyers and sellers, and scalers were accused of manipulating scale results to the benefit of their employer. This problem is inherent of scale rules just as much today as it was then. Consistent and accurate results can only be expected when the timber profile and processing practices are within the often narrow confines of that assumed in the log rule. By the 1940s, over 50% of the provincial cut was converted into products other than lumber, and as such, users of scale data often had little interest in a scale premised on lumber recovery.

In 1946, an amendment to the *Forest Act* introduced the British Columbia Cubic Scale. The amendment followed the 1945 Sloan Royal Commission Report, which set out a blueprint for the introduction of sustained yield forestry practices to the province. The cubic scale was introduced as a means of developing information that would be more useful for the Forest Service in reconciling forest depletion with its inventory.

In contrast to the British Columbia Log Scale, that attempted to estimate the amount of lumber that could be produced from a log, the cubic scale made no allowance for wood wasted in slabs and kerfs, and only attempted to estimate the volume of the log suitable for the manufacture of lumber. The Cubic Scale was not expressed in foot board measure (FBM), but rather cubic feet (or 'cunits', representing 100 cubic feet).

Initially, the cubic scale was known as the B.C. Lumber Cubic Scale because the scale made allowances for log defects such as twist, crook, knots, shake, and split. It also allowed for collars of sound wood around holes and rot recognizing that defects must be 'squared out' in the manufacture of lumber.

During the mid-1960s, with the introduction of Close Utilization Standards, the references to lumber manufacture were dropped from scaling and the scale only represented the net firmwood content of each log. The only permissible deductions for scaling purposes were rot, missing and charred wood, and catface. This scale became known as the B.C. Firmwood Cubic Scale.

When first introduced in 1946, the use of the cubic scale was optional and licensees could use either an FBM or cubic scale. In 1952, all new sales made provision for cubic scale, and in 1972, both FBM and lumber cubic scales were no longer authorized for use. Metrication in 1979 saw the B.C. Metric Cubic Scale proclaimed as the only official scale for British Columbia, and it remains so today.

From the inception of cubic scaling, the Smalian formula (Figure 1.2), which calculates logs on the basis of a parabolic frustum, was adopted as the cubic scale rule. This scale requires measurement of the two inside bark diameters and the length.

$$V = \frac{A_1 + A_2}{2} \times L$$

where: V is the volume of the log in m<sup>3</sup>.

A<sub>1</sub> is the area of the small end of the log in m<sup>2</sup>.

A<sub>2</sub> is the area of the large end of the log in m<sup>2</sup>.

L is the length of the log in m.

**Figure 1.2 The Smalian Formula.**

The elimination of the FBM log scale was met with much resistance from the forest industry, and was an eddy of controversy from within government as well as within

industry. Although cubic scaling represented a stronger and more consistent basis for forest depletion and revenue collection for government, the industry was very reluctant to base commercial transactions on a scale that had a different relationship to product output. Dual scales in cubic and FBM became commonplace and are common to this day, as are the use of conversion factors to better relate scale data to a given product.

The Scribner Decimal C Scale is still the basis for most forest commerce in the western United States and Alaska, as well as in the Asian markets. Similarly, there is still a demand for scalers with experience using the B.C. Log Scale (FBM), even though it was removed from official use years ago.

The use of dual scales clearly reflects the observation that one scale often does not satisfy all needs.

### Significant Events in BC Scaling and Grading History

1884	Scribner's Lumber and Logbook, Doyle Rule (F. B. M.) used as basis for scaling.
1894	Provision for Appointment of Official Scalers under the Official Scalers Act.
1895	BC Board-foot Log Scale (FBM) established as the official scale.
1902	Log grades first established made official by Timber Measurement Act, 1902.
1912	Provision for Re-scales to be made, also the issuance of licences (proclaimed under the first BC <i>Forest Act</i> , which also established the BC Forest Service).
1915	Doyle rule no longer accepted, new log grades for cedar, fir, spruce, pine and cottonwood are introduced on the Coast.
1920	Scaling fund established, official scalers were given the opportunity to apply for civil service status.
1944	Cubic measure first authorized for use - BC Cubic Scale (Lumber Cubic).
1948	Hemlock log grades introduced on the Coast.
1952	New timber sales and TFL permits to be scaled by BC cubic scale - Dual scale performed (i.e., Cubic Scale and BCFBM).
1963	Weight scaling introduced in BC Interior.
1965	Firmwood cubic scale introduced (FBM and cubic).
1972	BC Log Scale (FBM) and lumber cubic discontinued.
1979	Metric Scale replaced Imperial firmwood cubic (BC Metric Cubic Scale proclaimed the official scale for BC).
1979	Alleged scaling incident at Shoal Island.
1980-81	Portable data recorders for scaling developed by the Ministry and Epic Data Ltd.
1981	Coastal letter grades adopted (change from numeric to letter grades).
1985	Revenue scaling was privatized.
1988	Log grading was introduced to the Interior (Sawlog, Lumber Reject, Firmwood Reject grades).
1988	Provision made for industry to transmit scale data electronically.
1989	Auditor General Review cites shortcomings in scaling and scale controls.
2003	New Harvest Billing System introduced. Electronic system for all sites scaling over 500 m <sup>3</sup> annually.
2006	New Interior grades introduced. Grades 3 & 5 are eliminated.

**Figure 1.3 Scaling in B.C. – Principal Events.**

This is an itemized list of some of the historically significant scaling event in BC. For more information on scaling history read: *Without Fear or Favour – Culling and Scaling Timber in Canada 1762-1992*, by T.G. Honer.

### 1.2.2 History of Log Grading in BC

Grading timber dates back to 1902 on the BC coast. Timber is graded to provide information about potential end use and log quality. It also makes scale data more meaningful for administering the provincial cut for various business transactions.

Grading is regulated by schedules of timber grades specific to the coast and the interior under the *Scaling Regulation*.

Official scale rules (same as log rules) set the standard for estimating the net yield from logs. Since timber was first measured in BC in the mid-1800's five official scales have regulated timber measurement.

Official Scale		Yield Estimate: Units of
Prior to 1894	Foley and Doyle Log Rules	Board feet of lumber
1895	British Columbia Board Foot Scale (FBM)	Board feet of lumber
1844	British Columbia Cubic Scale (lumber cubic)	Cubic feet suitable to cut lumber
1985	British Columbia Firmwood Cubic Scale	Cubic feet of firmwood
1979	British Columbia Metric Scale	Cubic metres of firmwood

The significance of these official scales to grading lies in the fact that some of the practices and conventions followed in applying today's grading rules are very similar to those used in applying some of the official scales developed over 100 years ago.

Grading played a much lesser role in the interior until 1988, at which time a formal schedule of grades was introduced to better differentiate timber quality and to accommodate revisions to the utilization and timber pricing policies.

Significant growth in the interior forest sector did not get under way until the mid 1960s. The first interior grading system was introduced in 1988 to enable reduced stumpage rates to be applied to lower quality logs. The interior schedule was subsequently amended in 1990 to meet the needs of a new utilization policy. The most recent major revisions were made in 2006 with a change to the Schedule of Interior Timber Grades. This change, developed jointly with ministry and industry, redefined the two sawlog grades with respect to size, quality and quantity, and with the elimination of the 'dead and dry' grades, merged the two lumber reject grades into one.

While the early very basic schedule of timber grades evolved and expanded greatly in response to changing demands and needs to make scale data more relevant for its many users, the principles of grading have changed very little over the years.

Logs scaled using B.C. Metric Cubic Scale will be represented in cubic metres for volume and will use the applicable Schedule of Timber Grades for either the Coast or the Interior.

### **1.2.3 The Roles and Responsibility for Scaling**

The appointment and licensing of scalers has remained a responsibility of government since 1894 with the proclamation of the Official Scalers' Act. While the Pacific Northwest States moved towards the concept of a third party scale under log scaling bureaus jointly funded by buyers and sellers, the provincial government policy until 1985 saw provincial employees conducting almost all scaling for revenue purposes. Non-government licenced scalers were authorized for scaling only where government scalers were not available, or where timber values were considered low.

Government scalers were not commonplace in the interior until the early 1960s because the less significant interior harvest was largely processed through many small bush mills. Rapid expansion of the interior forest industry occurred during the 1960s with the introduction of pulp mills and the consolidation of the industry.

British Columbia's policy on scaling is rooted in the province owning over 90% of the forest land base. During the 1960s and 1970s, this arrangement saw some 450 to 500 government scalers trained and supervised by the province. While various funding arrangements were in place, the industry traditionally absorbed the costs of scaling.

In 1985, the responsibility for all revenue scaling was transferred to the private sector. Several factors contributed to this policy change:

- it reduced the direct costs of government,
- it removed any potential union interface problems between government scalers and industry workers, and
- it reduced government interference with industrial operations and allowed industry more flexibility in staffing and operating scaling stations.

Government's role in scaling is now comprised of the following activities:

- Examining and licencing scalers,
- Authorizing and appointing scalers and setting all revenue scaling policies and procedures,
- Authorizing scale sites and setting scale site conditions,



- Designating where timber must be scaled,
- Setting scale data computation and data control procedures and standards, and
- Assessing compliance with scaling requirements and standards.

#### 1.2.4 Scaling Methods

Scaling accounts for some 98% of the provincial harvest. Less than 2% of the harvest is accounted for through a cruise-based measurement procedure. The cruise-based procedure is confined to the interior's uniform stands and has a minimal presence on the coast. In BC, two principal scaling methods are in place:

- Piece Scaling, and
- Weight Scaling.

##### 1.2.4.1 Piece Scaling

Piece scaling or stick scaling accounts for some 69% of coastal production and about 3% of interior production. This procedure involves measuring and grading each log, usually while they are spread out in a log yard or rarely now, in a log boom floating in the water.

Before the introduction of weight scaling in the early 1960s and dryland sorts in the 1970s, almost all coastal production was piece-scaled in the water in the form of booms. Today, piece scaling through dryland sorts accounts for about 69% of the coastal piece scale production and less than 3% is still scaled on the water. Dryland sorts are flat areas, usually paved, where loads are lifted out of the water or offloaded from logging trucks and spread onto the ground for scaling, grading and subsequent sorting. Accurate scaling is greatly facilitated through dryland sorts as the scaler can view almost the entire log. With boom scaling, only a small surface was available for inspection.

Interior piece scale production is predominantly in the form of small operator scaling, usually in the mill yard. The identity of each scaled load is retained for control purposes. A listing of scale details is also maintained for all logs scaled.

##### 1.2.4.2 Weight Scaling

Instead of scaling each piece, weight scaling is a sampling method where only a portion of the total production is measured or sampled. Based on the sample results estimates are made about the production.

The 1960s and 1970s saw the rapid growth of BC's interior forest industry fuelled by the construction of pulp mills and the resultant demand for sawmill residues. Over the same period, government policy provided incentives for licensees to adopt close utilization standards in the bush. This coupled with improvements in sawmilling technology resulted in truckloads arriving at the scale site with dramatically smaller average log size and increased number of pieces on the truck. Weight scaling represented an opportunity

to estimate harvested volumes with an acceptable level of accuracy and lower costs than scaling each piece.

When first introduced in the early 1960s, weight scaling was restricted to homogeneous small diameter spruce and lodgepole pine stands. Its use was expanded as confidence was gained using the method. Today, over 97% of interior production is weight scaled.

On the coast, less homogeneous forest types, more complex sorting and marketing needs, and more complex transportation and log handling methods have impaired the acceptance of weight scaling. While weight scaling offered the same cost savings, it also represented an opportunity to account for logging production before it was put into the water and transported to processing plants. During the 1960s, almost all the coastal logging production was stick scaled while it was boomed in the water. Sinkage often accounted for very significant losses before the logs were scaled. If logs were weighed before they were watered, depletion could be correctly stated and Crown revenues could be controlled. Obviously, the Forest Service encouraged weight scaling for coastal operations.

Weight scaling grew in prominence on the coast during the 1970s and early 1980s but lost in prominence during the 90s with the growth of dryland sorts. Weight scaling on the coast now accounts for more than 30% of the total harvest.

#### 1.2.4.3 Special Forest Products

Instead of raw logs, sometimes partially or fully manufactured products are scaled. These are known as special forest products.

Special forest products comprise about 3% of forest production in BC and include Christmas trees, posts, stakes, shakes and shingles, bolts and blocks, and other products as described in the Special Forests Products chapter of this manual. To be classified as a special forest product, the product must conform to the product description, be contemplated in the cutting authority (for Crown timber), and be manufactured on the area of harvest.

For scaling, the scaler does a piece count or uses a variety of approaches to estimate the volume. All special forest products except Christmas trees are recorded in cubic metres for cut administration and reporting purposes.

See the *Special Forest Products* and *Document Submission* chapters of this manual for details on scaling, documentation and submission requirements for Special Forest Products.

## 1.3 The Legal and Administrative Framework for Scaling

### 1.3.1 General

The legal and administrative framework for scaling in British Columbia is set by Part 6 of the *Forest Act* and the *Scaling Regulation*. This legislation contains the authority for scaling and sets out the requirements of scaling. It is applicable to all timber cut from both publicly and privately owned land within provincial jurisdiction. This legislation does not apply to timber cut on lands falling under federal jurisdiction. Such timber includes timber cut on native or military reserves.

### 1.3.2 The *Forest Act* – Part 6 – Timber Scaling

Section 93 – Interpretation

The term “to Scale” under the *Forest Act* means:

- To determine the volume or quantity of timber and,
- to classify the quality of that timber.

Timber under the *Scaling Regulation* is defined as trees, whether standing fallen, living, dead, limbed, bucked or peeled and includes Special Forest Products.

For more information on scaling legislation and regulations please follow the links below:

[Scaling Regulation](#)

[Forest Act – Part 6](#)

[MOFR Policy Manual](#)

This manual and BC Forest Service Scaling Policy fall within the same legislative framework and further define how scaling will be practiced and administered.

All roundwood scaling procedures must conform to the minimum criteria for scaling roundwood in metric units and minimum specifications for scaling instruments established in the Canadian Standards Association (CSA) Standard CAN3-0302.1-M86, Scaling Roundwood, and the *Weights and Measures Act*.

### 1.3.3 The *Forest Act* – Part 6 – Timber Marking

The authority for timber marks, scaled timber brands and marine log brands and the responsibility for their use is set under Part 5 of the *Forest Act*. The *Timber Marking and Transportation Regulation* prescribes how marks and brands are to be applied to timber. The Regulation also requires all unscaled timber to be transported only to scale sites

designated by a forest officer and prescribes documentation requirements which must accompany all timber in transport.

While timber marking does not generally fall under their responsibilities, scalers are required to record timber marks as a part of recording scale results. As such, scalers must have a working knowledge of timber marks, scaled timber brands, and marine log brands as well as the requirements for timber marking and branding.

**To Summarize:**

Timber carrying a *timber mark* tells you:

- the timber mark identifies the cutting authority under which the timber is harvested. This information can then be used to identify the area of origin, the identity of the mark holder, the exportability of the timber, and whether fees must be paid.

Timber carrying a *marine log brand* tells you:

- the timber has been scaled, and
- the holder of the brand (who owns the timber).

A *marine log brand* does not tell you where the timber was scaled and its use is optional.

Timber carrying a *timber brand* tells you:

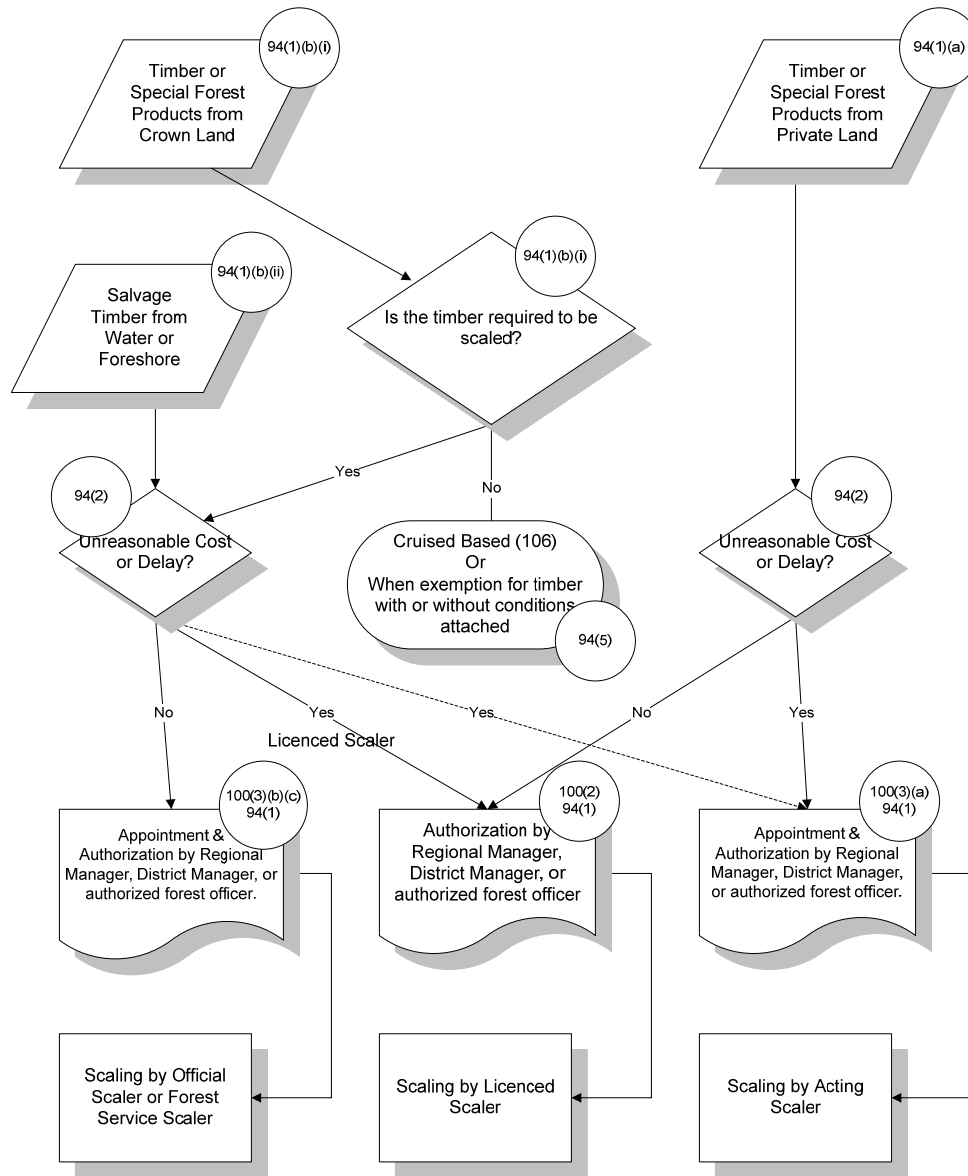
- the timber has been scaled, and
- where it was scaled.

It does not designate ownership. Its use is mandatory, as per the [Timber Marking and Transportation Regulation](#) and the [Forest Act – Part 5 – Timber Marking](#).

For a more detailed explanation of Timber Marks and their forms refer to the *Timber Marking and Branding* chapter of this manual.

## 1.4 Who Can Scale?

This schematic further defines who may be authorized to scale under various circumstances under *Forest Act* subsection 94(1) and 94(2).



The intent underlying subsection 94(1) and 94(2) is to ensure that Crown timber is scaled by the most competent and qualified scaler available.

## **1.5 Scaling Requirements in British Columbia**

If you are going to apply for a timber sale licence, cutting permit or some other licence to harvest Crown timber or harvest timber on private land, it is important that you understand some of the basic scaling requirements in advance.

The following link will take you to the MOFR Revenue Homepage to an information paper which explains:

[Scaling Requirements in British Columbia](#)