The Certification Information System: A Chain-of-Custody Framework for Environmentally Certified Wood Products

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Introduction

An argument against wood product environmental certification is the difficulty in maintaining an audit trail of certified material through the distribution chain. At first glance, it does seem to be a daunting task to track certified wood products from a harvested log, through multiple layers of primary and secondary processing as well as through one or more levels of distribution to the fabricated consumer product. The purpose of this paper is to give an overview of wood product environmental certification and to describe the Certification Information System (CIS), a technology based solution for maintaining certified product 'chain of custody' integrity through all levels of distribution.

Environmental product certification

Environmental product certification arose out of consumer demands for more 'environmentally friendly' products as well as consumer confusion and distrust of environmental claims being made by product manufacturers. For instance, research has shown that consumers are confused by 'green' symbols used by manufacturers (e.g. the recycling symbol), whether symbols refer to the actual product or its packaging, and the terms used by manufacturers in environmental labeling (e.g. biodegradable, ozone friendly, preconsumer and postconsumer). It has been suggested that this confusion can be attributed to several factors (15). First, the terms used in environmental advertising are used by different companies to promote different environmental meanings. Also, the knowledge required to understand the environmental information in product promotion and advertising is often complicated and can be subject to change. Finally, comparisons between products are frequently limited to one environmental benefit and not the complete life cycle of the product which can create confusion for consumers. In fact, Kangun et. al. (15) found that 58% of the environmental advertisements examined in their study contained at least one misleading or deceptive claim.

In addition to confusion, consumers are often suspicious of manufacturer advertising and product claims, environmental or otherwise (10). This skepticism has arisen out of conflicting information provided by manufacturers and from several cases of environmental or green fraud[1].

Thus, environmental certification programs exist to allow credible, third party organizations to pass judgment on the environmental performance of products and packages, rather than leave assertions to product manufacturers themselves (10). These programs have been developed to overcome the problems of consumer confusion and mistrust by providing consumers with important environmental information which is documented and verified by an independent certifying organization. Environmental certification began in West Germany in 1977 with the Blue Angel program which now certifies over 3000 products in 57 countries. In general, third party certification provides information to consumers on six distinct environmental areas: raw materials consumption; energy consumption; emissions into air; emissions into water; solid-waste generation; and indirect resource consumption or impact (e.g. destruction of wildlife habitat, species preservation) (10). In essence, certification exists as a method of

[1]For example, the well publicized case of Hefty "Degradable" Trash Bags which were mis-marketed by the Mobil Chemical Company as environmentally safe.

reducing consumer anxiety or cognitive dissonance regarding the environmental impact of the products they purchase and consume.

Wood products environmental certification

Wood products environmental certification has been identified by an American Forest & Paper Association (AFPA) task force as one of the top issues facing the industry (2). As is the case with other environmental certification programs, wood products certification is emerging to provide uniform and scientific guidelines for assessing the relative sustainability of various timber producing operations and to provide an independently verified basis for potential market place claims (13). Wood products certification grew out of environmental concerns for forests in general and concern for the fate of tropical rainforests in particular. Also, the efforts of many non-governmental (NGO) conservation organizations to assess timber harvesting and its associated impacts led to the concept of organizations that would specialize in third party certification of sustainable forest management. Although wood certification began as a mechanism to provide credible information on tropical forest sustainability, and to provide an alternative to consumer boycotts of tropical timber (18), these programs are now being developed with the objective of certifying the sustainability of all the world's forests, both tropical and temperate.

Currently there are eight independent, non-profit organizations which maintain wood products certification programs in the United States (see Table 1), and several similar programs outside of the U.S. (e.g. United Kingdom, Germany and Australia). For example the Rainforest Alliance's "Smartwood" program certifies all sources of timber including natural forests, plantations, large commercial concessions, and small community forestry projects (8). Under the program, sources of timber are evaluated on a case-by-case basis using criteria based on the following broad criteria: (1) maintenance of environmental functions, including watershed stability and erosion control; (2) sustained yield production; and (3) a positive impact on the well being of local communities. Another program, the Scientific Certification Systems' (SCS) Forest Conservation Program involves in-depth evaluation of specific timber harvesting operations on three program elements: (1) sustained yield of timber; (2) forest ecosystem and wildlife maintenance; and (3) financial and socio-economic considerations. As explained by Debbie Hammel, SCS Director of Forestry Programs (13), fundamental to this process is the evaluation of management practices against objective and regionally appropriate principles of sustainable forestry. The program calls for ongoing, periodic monitoring to assure continued adherence to management plans and practices, and to assure adequate tracking of the chain-of-custody of products from certified operations (i.e. from the forest to the retailer and to the final consumer). SCS and the Rainforest Alliance have successfully certified five and six forestry operations throughout the world, respectively (see Table 2).

The Forest Stewardship Council (FSC) is an international, non-profit, non-governmental organization which was established for the purpose of evaluating accreditation and monitoring of organizations such as the Rainforest Alliance and SCS, that have developed certification programs (4,11). The FSC does not itself certify forest products; it provides a mechanism for recognizing forest stewardship through their Principles of Good Forest Management, guidelines intended for use in all forest types (26). According to its mission

statement, the Forest Stewardship Council, through its activities and Principles of Good Forest Management, promotes environmentally appropriate, socially beneficial, and economically viable management of the world's forests (4).

Table 1. Certification Organizations in the United States.

Ecoforestry Institute 607 S.E. 15th Avenue Portland, OR 97214	Institute for Sustainable Forestry P.O. Box 1580 Redway, CA 95660
The Forest Partnership 431 Pine Street Burlington, VT 05401	Rainforest Alliance 65 Bleeker Street New York, NY 10012
The Forest Trust P.O. Box 519 Santa Fe, NM 87504	Rogue Institute for Ecology and Economy P.O Box 3213 Ashland, OR 97520
Global Resource Consultants 9501 Lomond Drive Manassas, VA 22110	Scientific Certification Systems 1611 Telegraph Ave., Suite 1111 Oakland, CA 94612

Source: Winterhalter

Table 2. Current Certified Forestry Operations by Scientific Certification Systems and the Rainforest Alliance.

Scientific Certification Systems - Forest Conservation Program

Forestry Operations	Date of Certification	Types of Wood (may not be complete)	
Plan Piloto Forestal Quintana Roo, Mexico	1/26/91	Honduran Mahogany Spanish Cedar Ramon Many Lesser Known Species	
Menominee Tribal Enterprises Keshena, WI	2/14/92	Hemlock White Pine Yellow Birch Beech Hard Maple Soft Maple Basswood American Elm Red Oak Red Pine Aspen Jack Pine	Cherry White Birch Balm Butternut Hickory Oak Tamarack Rock Elm Fir Spruce B&W Ash Cedar
Collins Pine Portland, OR	3/26/93	Sugar Pine Incense Cedar Doug Fir	White Fir Red Fir Ponderosa Pine
Portico S.A. Costa Rica	2/16/93	Doors made from Carapa (Royal Mahogany) and Gavilan	
Pingree Family Ownership; **Seven Islands Land Management Company Bangor, ME**	11/8/93	Black Spruce Red Spruce Paper Birch Sugar Maple Brown Ash Aspen American Beech	White Spruce Yellow Birch Balsam Fir Red Maple White Ash

Northern Red Oak
Eastern White Pine
Eastern Hemlock
Northern White Cedar

Table 2. Continued.

The Rainforest Alliance - Smart Wood Program

Forestry Operations	**Types of Wood**
State Forestry Corporation **Java, Indonesia**	Teak Mahogany Rosewood Pine
Cooperatives approved by Broadleaf Forest Development Project **Honduras**	Many Lesser Known Species
Plan Forestal Estatal **Quintana Roo, Mexico**	Many Lesser Known Species
AMACOL Ltda. **Portel, Para, Brazil**	Many Lesser Known Species
Masurina, Papua New Guinea	Pencil Cedar Water Gum Also, Many Lesser Known Species
Tropical American Tree Farms **Campo Real and Santo Domingo** **Costa Rica**	Plantation in early stages of growing. Principal species planted for harvest: Purpleheart Teak Also, Many Lesser Known Species

Sources: (6; 1).

In addition, efforts such as the "Lake States Regional Guidelines for Assessing Natural Forest Management" are attempting to provide certification options in areas such as Michigan, Minnesota, and Wisconsin (the Lake States region) where more than 700,000 private non-

industrial forest (PNIF) owners control the forest resource. Because these private owners may not have forest management plans, this program is intended to positively affect how natural forests are managed in the region by providing direct access by the PNIF owner to the certification process (5).

Wood product certification issues

Several criticisms leveled against the use of wood products certification should be considered by any organization considering the use of this marketing tool. First, although research has shown that consumers believe that North American forests are not being managed for sustainability, and that they would trust a label that assures wood resource sustainability (27), critics question the feasibility of maintaining an audit trail and/or do not believe there exists tremendous consumer demand for wood products environmental certification. For instance, Susan Perry of the Business and Institutional Furniture Manufacturers Association explained that, "Many of the wood products in our industry are custom made of many woods often by larger-(downstream) higher-value manufacturers. Therefore, to supply country-of-growth information on every individual piece is virtually unachievable" (7). In the same article, Wendy Baer of the International Hardwood Products Association explains that because most wood products contain a variety of imported woods, and the methods by which products are processed after import would make accurate labeling virtually impossible (7). Waffle (24) asks, "...has a real market for 'certified sustainably produced' timber been demonstrated?" In addition, Waffle noted that although some small-scale natural-forest operations have been certified, there is no evidence that third-party certification programs are practical in larger-scale natural forest systems. Waffle further suggested that one of the main weaknesses of wood products certification is that each certifying organization has its own certification criteria . He concluded that certification will have little effect on deforestation in the tropics and that certification is unnecessary in temperate areas because of strict timber-cutting regulations.

Buckley (9) posed several additional questions regarding the United States' hardwood resource and certification programs. First, can an industry that sources logs from up to 4 million owners of forest land really certify that resource? How many certificates should or can be applied to one product which for example uses solid wood, veneer, and panel products in its construction? Finally, he asks how competent are the entities that monitor and certify the certification agencies?

The need for a Certification Information System (CIS)

This paper is not intended to provide answers to these questions, nor to suggest whether individual wood product companies or the wood products industry should become involved in wood products certification. However, it does provide a methodology to address chain-of-custody audit issues for companies that plan to develop wood products certification capabilities.

Specifically, this paper is a response to the argument against wood product environmental certification based on the perceived difficulty in maintaining an audit trail of certified material through the distribution chain. This paper shows how, through the use of a Certification Information System (CIS), certified logs, lumber, plywood, veneer, or component

parts may be accurately tracked through all levels of manufacturing and distribution and ultimately to the final consumer.

Current chain-of-custody procedures

As explained by SCS, the purpose of chain-of-custody procedures is to ensure that the product bearing a label of environmental certification is, in fact, produced from certified sources or materials (6). For instance the FSC's Principle #11 of the "Principles and Criteria for Forest Management," states that: 1) forest products should be clearly identifiable through marks or labels at all stages of processing and distribution; 2) forest products must be identifiable through documentation at all stages of processing and distribution; and 3) documentation must be available for independent monitoring or certifying organizations to be able to trace each product form the forest to the ultimate consumer (14). The Rainforest Alliance's Smart Wood Certification Program suggests that, "certified forest products are clearly identified through marks or labels, or separate documented storage, at all stages of processing and distribution (5)." Finally, SCS lists those basic requirements which should be drawn upon for implementing chain-of-custody procedures, including some of the following procedures: 1) all logs must bear a tag identifying the forest of origin; 2) all certified logs must be segregated in the log yard from non-certified logs; 3) until and unless automated coding mechanisms are employed, only certified logs may be run within a single production shift; 4) upon arrival at a secondary mill, all certified lumber must be segregated from non-certified lumber; 5) all certified inventory must be segregated during storage and shipment; 6) a recipient of certified product (e.g. logs, lumber, or secondary products) must maintain pertinent chain-of-custody records, including all records relating to the shipment, receipt and invoicing of the certified material; and 7) chain-of custody participants must undergo quarterly paper audits related to the manufacture and distribution of certified products (6).

The Certification Information System is an attempt to operationalize and support those procedures which are being suggested by the certifying organizations and FSC. Through the use of bar code technology and electronic data linkages, in addition to any paper trail which might be generated, a system is created which ensures that proper chain-of-custody procedures are followed.

CIS elements: bar code and electronic communication technologies

Bar code technology is a competitive tool for both managing and controlling the flow of physical inventory through the product pipeline and for managing internal inventories. Vlosky and Smith (21) found that a number of North American wood products manufacturers and distribution intermediaries have or are planning to develop bar code based inventory management capabilities. In inventory applications, bar codes are found on tags attached to units of lumber, plywood, and other wood products. This is an important distinction from a different bar code symbol, the Universal Product Code (UPC), which is used on individual boards, panels or other products destined for retail point-of-sale scanning customers.

The most prevalent bar code symbols used for unit level inventory management and in the wood products industry are the UCC 128 and the UPC Shipping Container Code (formerly Interleaved 2 of 5) (3).

UCC 128 and the UPC Shipping Container Code bar codes are analogous to vehicle license plates in that they are unique and can be linked to unlimited information relating to products contained in the package or unit to which the bar code label is affixed. Information linked to wood product bar codes may include producer, manufacturing location, date of shipment, species, length, grade, moisture content, piece count, etc.

The information for every bar coded unit produced is maintained electronically and may be used to support a computer based internal inventory system, communicate inventory or shipping information to exchange partners in distribution channels, or both.

As inferred, electronically based internal inventory tracking and control systems may be developed independently from tracking product flows between exchange partners. There are two main uses of bar codes for internal inventory management. The first is in work-in-process inventories which can assist wood products producers with recovery rate calculations and the second is to establish "real time" finished and rough inventory tracking and control.

Bar codes in conjunction with electronic communication technologies, such as electronic data interchange, electronic mail or data transfer are integral components of joint inventory management between channel partners (17; 20). There are numerous examples of electronic linkages that facilitate buyer-supplier and inventory management across a myriad of industries (see for example 16; 25; 12).

The Certification Information System (CIS)

Although both bar coding for inventory management as well as communication technologies have been implemented independently in the wood products industry, only recently has their integration into a cohesive corporate business strategy been given serious consideration (21; 22).

We propose that through development of a Certification Information System (CIS), bar coding used in conjunction with communication technology could allow wood product channel members to jointly manage environmentally certified inventories and to deliver maximum supplier-to-customer logistics system efficiency. More importantly, these technologies could create a unimpeachable electronic certification audit trail through all linked layers of distribution.

The flow of certified product information, accomplished through electronic linkages may be either unilateral (from supplier to buyer) or bilateral whereby production and buying information may be exchanged. Companies at each horizontal level of distribution (e.g. all the primary producers in the first level) are not be linked to each other. Only direct vertical sales channels are linked (e.g. primary manufacturer to secondary manufacturer or primary manufacturer to retailer).

There are three required elements for CIS implementation: 1) Unit level bar coding with a certification indicator attached to the bar code information set; 2) Communication technology capabilities to transmit certified inventory information between exchange partners and; 3) Development of alliances with channel partners.

In addition to the first two previously discussed elements , bar code based data collection and electronic information transmission, which establish efficient business processes, CIS implementation requires the element of partnering which involves improved communication, coordination and trust. Joint planning, including sharing of certified production schedules by the

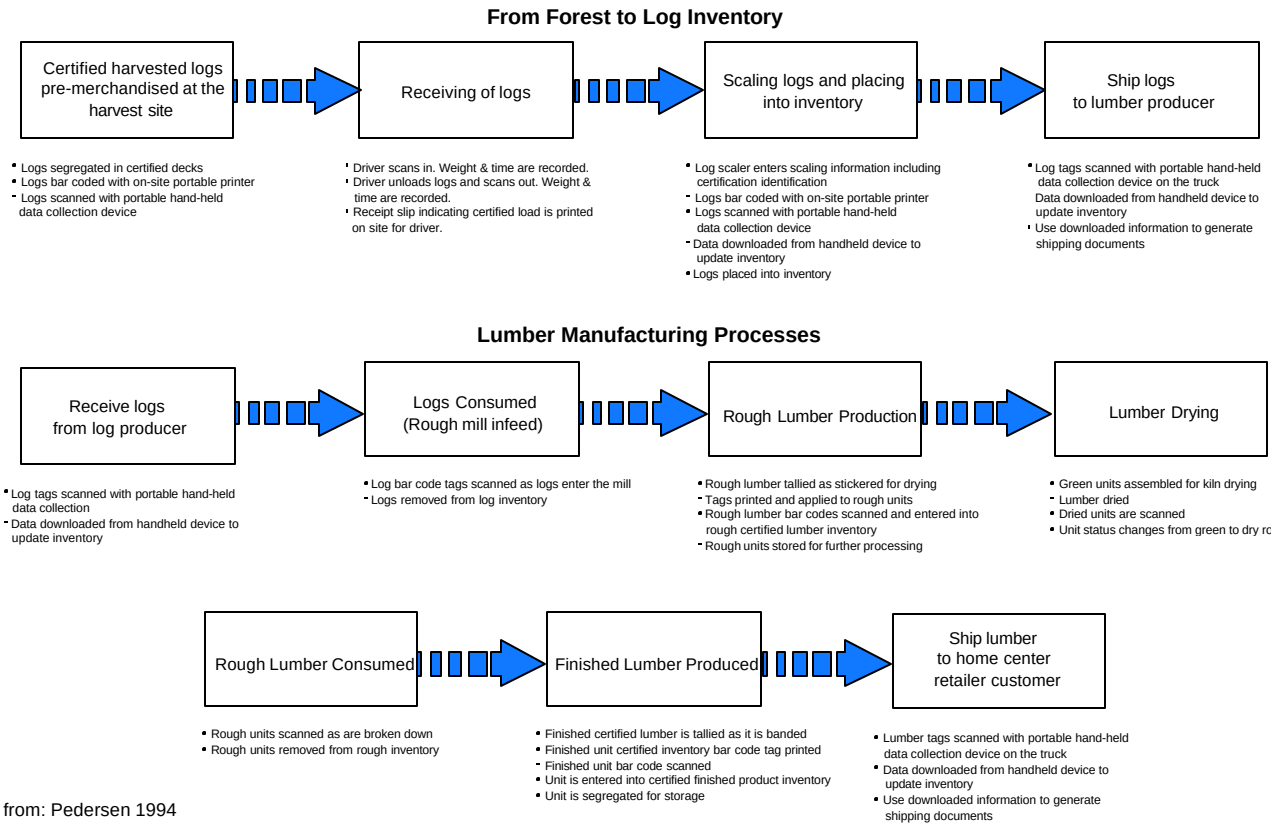
supplier, certified product buying forecasts from the buyer, and shipping information are key system inventory management elements of the joint planning process. The end result of the CIS should be maximization of efficiency in conveying certified products and information about these products through the distribution system.

A CIS Scenario

A CIS can range from a simple linkage of one supplier with one buyer, to complex networks involving many companies at multiple layers of distribution. Following is a hypothetical scenario that illustrates a CIS involving multiple layers of distribution.

To illustrate the flow of information that might exist in a CIS scenario such as this, Figure 1 depicts how certified product inventory information can be gathered electronically at various manufacturing and logistics operations in the processing of raw logs into finished lumber through customer delivery.

Figure 1. Certified Information System Data Collection Sites



Adapted from: Pedersen 1994

Often certification initiatives impact forest resource based companies. To gain certification from third-party agencies, trees are expected to be grown and harvested according to specific parameters (6). In this example, a private softwood timber owner has decided to direct market environmentally certified harvested trees to lumber producers which, in turn, sell certified products to home center retailer customers. In this scenario, each certified log would receive a bar coded tag indicating certification status. Additional information attached to the bar code "license plate" may include species, scaled volume, harvest site, etc. This tag could be printed in the woods using a portable printer, or at the destination mill after scaling. Although the bar code tag is printed on-demand, and electronically scanned into inventory, the colored 'green' certification symbol could be pre-printed on the tag material.

Because the lumber producers in this scenario also purchase logs from non-certified sources, a separate inventory would need to be maintained for the certified logs. Similarly, in order to retain the integrity of certification status through production, certified logs must be processed separately from non-certified logs.

Rough, dried and finished goods lumber inventory for all certified products destined for home center retail customers that desire such products would also be separately maintained. A new bar code tag would be applied at each step and scanned into the appropriate inventory (i.e. green, rough, dry, finished). In addition to auditing certified product flows, an accurate record of recovery rates could also be generated.

Home center customers can potentially electronically access supplier certified product inventory information as well as suppliers being able to monitor customer inventories and sales of the certified products they purchase. As certified lumber is shipped, the bar codes on the units are scanned, thereby decrementing the suppliers finished goods inventory. When the shipment of certified lumber arrives at the home center customer site, each unit is again scanned, incrementing the customer's inventory. The final step in the process is when a piece of certified lumber is sold to a consumer and scanned at point of purchase. At this point, the home center customer's inventory for the scanned product is decremented.

In complicated logistics scenarios involving one or more distribution intermediaries, the process of monitoring certified product status and communicating available inventories to targeted customers would continue through all channels of distribution. The outcome is that the certified product attribute is tracked from the forest to the ultimate consumer.

Issues and Concerns

Any effort to monitor or audit a business process or procedure may be subverted through fraud, cheating the system or mismanagement. The CIS is no exception. Some of the areas that require special attention are: 1) inadvertent or purposeful mislabeling of uncertified material with certification identifiers; 2) failure to segregate certified inventory from uncertified inventory and; 3) maintenance of accurate records. One way to mitigate fraud is to have the certification agency issue labels or tags to participating companies that would contain the certification seal. Of course, if a company is determined to cheat, label counterfeiting may occur.

Another issue is adherence of the certification bar code labels to wood products. Vlosky and Smith (23) point out that there are some unique challenges to labeling wood products. For example, complications arise when attaching a bar code label to the end of a piece of green and/or rough lumber or to a piece of lumber that will be preservatively treated. Moreover, ensuring that labels will remain attached in harsh climatic conditions (from sub-freezing winters to sweltering summer temperatures in boxcars) from mill to point-of-sale represents additional difficulties. Affixing labels to wood products is quite different as compared to affixing a label to glass or other clean smooth surfaces. As a result, new label adhesives have been developed specifically for the wood products industry.

A third issue is the cost to implement a Certification Information System. Costs include hardware, software, communication charges and other operating expenses. Research by the authors is underway to determine costs for companies at different locations in the distribution chain to develop a CIS.

Summary

If the trend toward environmental certification of wood products is sustainable, many questions and issues remain regarding costs, benefits and ramifications of producing or conveying certified products will need to be addressed. One hurdle is the sheer logistics effort to track certified products through distribution channels. We believe that consumer driven pressure on suppliers to produce environmentally certifiable products will continue, which will, in turn, require joint supplier-buyer pipeline certified inventory management and communication. By employing a technology based solution such as the Certification Information System (CIS), the chain of custody for certified wood products can be achieved.

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