Markets Research Project for Four Lessor-Known Bolivian Hardwood Species

February, 1998

This project was undertaken through a contract with ***Chemonics International Inc*** on behalf of the U S AID ***BOLFOR*** Project headquartered out of Santa Cruz, Bolivia

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Table of Contents

Figures

Markets Research Project for Four Lessor-Known Bolivian Hardwood Species

February, 1998

Introduction

In 1997, Mater Engineering was retained by the US AID BOLFOR project in Bolivia through a contract with Chemonics International to evaluate *technical profiles* and *market opportunities* for four lessor-known hardwood species from the forests in and around the Santa Cruz area The four lessor-known species are

* ***Yesquero Blanco*** *(Carinana estrellensis)*
* ***Ochoo*** *(Hura crepitans)*
* ***Cambara*** *(Erisma uncinatum)*
* ***Murure/Amarella*** *(Clarisia racemosa)*

Evaluation of these lessor-known species is particularly important given the new Forestry Law recently passed in the country, the results of which place higher importance on identifying markets for all wood species from Bolivia's forests

The scope of work undertaken for the project included the following tasks

1) Conduct a targeted *species technical analysis* determining the technical profiles for each of the targeted species Technical profiles include both the mechanical characteristics and working properties of each species, coupled with any dry schedule information which might be available,

2) Provide a *general product trends analysis* on major wood products which could be developed and marketed from the targeted species Within this general analysis, concentrate on major North American and European markets where product is likely to be marketed,

3) Provide an overview of the *markets for sustainable and certified forest products* in the US and Europe,

4) Provide an overview of *product distribution systems* which are important to moving wood products manufactured from the targeted species,

5) Identify the "*best bet*" product areas which should be first targeted for the selected species Include a listing of potential clients for each product area analyzed along with product pricing guidelines,

6) Provide a description of *manufacturing needs* based on the products markets research, and

7) Provide a *specific strategy* to market the targeted species, along with a *recommended long-term strategy* plan for the Bolivian forest products industry

This final report covers the findings, conclusions, and recommendations for each of the tasks detailed above

Methodology

In order to undertake this project, Mater Engineering personnel spent time in Bolivia evaluating the species characteristics and wood products industry in and around the Santa Cruz area Specific attention was paid to manufacturing capabilities and capacities, along with direct experience in working with the targeted species being evaluated for this project

For the markets evaluation, in-depth markets research was conducted, including primary research required to evaluate market demand for "*characterwood*" in product development

For the technical profiles of the wood species conducted for this project, Mater Engineering contracted with Dr Gracie Santos of Wood Information Network based out of California, USA to provide the baseline wood profile information Further analysis of the wood properties and comparative correlations to US and tropical species was completed by Mater Engineering personnel

New technologies recommended for Bolivia which are discussed in this report were researched and evaluated by Mater Engineering personnel through direct interview process with the technology producers

General Markets Analysis

Five (5) separate areas were evaluated by Mater Engineering in conducting a general markets analysis for this project

- Product Trends Overview,
- Recent Economic Events and Impacts,
- Sustainable Forestry and Certification Issues in the US and Europe,
- Market demand for Products Made from "*Characterwood*", and
- Product Distribution Systems Overview

a Product Trends Overview

The ***August, 1997 Progress Report*** for this project prepared by Mater Engineering provided detailed product trend overviews and product buyer contacts for BOLFOR in the following product categories

Wood Doors
Wood Windows
Wood Window Coverings
Wood Furniture
* *General Trends*
* *Casual Outdoor Furniture*
* *Commercial and Home Office Furniture*
Wood Flooring
Wood Cabinetry
Specialty Products (Wood Coffins)

Because the US is intended to be a major market for Bolivian species, special market trends information for the US was provided Summarized product trends for each product category covered in that ***Progress Report*** are as follows

Wood Doors

* 39% of the total U S door shipments are used in remodeling and repair projects vs new home construction By the year 2000, remodeling and repair will account for over 40% of the total

* Wood door manufacturers have had to contend with increased competition from metal door producers This trend is most evident in entrance door and garage door product lines Wood products are at a disadvantage with regard to energy efficiency, security features, and ease of maintenance This suggests that market concentration for Bolivian species look more to interior and specialty door designs for market entry

* The interior and exterior doors have accounted for about 61% of total wood door shipments since the 1970s Specialty doors has captured the remaining 39% The interior and exterior door sector is lead by increased demand for panel-type door designs

* In the specialty door sector, growing patio door demand has caused total patio door shipments to reach almost 20% of total door shipments in the US Sliding patio doors represents 55% of total wood patio door shipments, with swinging door designs representing the remaining 45%

* The number of U S plants specializing in the manufacture and sale of wood doors has risen since the mid-1980s Despite rising competitive pressures, wood door manufacturers have been able to improve their bottom line performance

* Product types with the strongest price increases include hardwood faced, flush type, hollow core doors, hardboard faced, flush type, solid core doors, and bi-fold doors

* Brazil is listed as one of the current top importers of flush doors, french doors, and specialty doors and frames to the U S

Wood Windows

* Within the US , growing residential replacement markets, new products, and increasing government regulations have led to expanded sales opportunities Wood window manufacturers have been able to hold their own share of the residential window business despite sharp gains made by vinyl windows

* Producers have been especially keen on gaining a piece of the growing d0-it-yourself market, and increasing sales through home centers and warehouse retailers

* The number of plants specializing in wood window production is on the rise

* Imports have increased in importance since the late 1980s

* Specialty product line shave increased in importance Other complete wood window units, such as single hung and horizontal sliding, are estimated to account for almost 20% of the total wood window industry

* Knock-down products are the growing segment of the wood window sash market

* Prices have been strongest for window frames and knock-down sash sold separately, and for horizontal sliding window units Prices are weakest for awnings and casement window units

Wood Window Coverings

* Segments of the window covering industry point to wood as a preferred material of choice by U S consumers, with added growth potential

* The largest sector of the US window covering industry is venetian blinds, accounting for 49% of total domestic shipments Venetian blinds are projected to hold that lead through 1998

* U S producers have increased their emphasis on wood slat blind products Industry experts predict a continuation of the demand for wood blinds as a growing preferred material of choice for window coverings by American consumers The wood blind industry is predominately served by basswood

* Similar to furniture, the wood venetian blind industry is responding to consumer preferences for more distressed, rustic look in the home

* Main US export markets are Mexico, Canada, the UK, and France

Wood Furniture

* *General Trends*

1) The furniture industry continues to be driven by the American consumer's preference toward Casual Contemporary furniture designs (***see Figure 1, attached***) With the exception of Formal Dining furniture in the medium-to-high-priced range, casual contemporary furniture designs show commanding presence in bedroom furniture, formal dining furniture (low-end price) casual dining furniture, and occasional tables in all price ranges This design preference affords unusual opportunities to wood product producers to employ both non-traditional wood species and lower-grade utilization in product development

2) The casual contemporary preference in the traditional furniture lines is even more pronounced in specialty lines Especially notable is the use of "characterwood" in product development Characterwood is, to the traditional wood product producer, wood with ***defect*** To the retailer and consumer, it is *highly-figured*, "*natural*", *distressed*, *antiqued*, *time-and-weather worn* in other words - ***desirable***! (See the "***Catalog Analysis***" and "***Producer Analysis***" tabs of this document for complete details of this unusual marketing opportunity)

3) Furniture finishing is also quite reflective of the popularity of the distressed, characterwood look In the survey of high-end catalogs in the U S and over seventy wood product producers, actually *hand-distressing* the wood during the furniture production process to make sure that weathered, antiqued look was evident in the furniture piece produced was noted in significant percentages (See the "***Catalog Analysis***" and "***Producer Analysis***" tabs of this document for complete details of this unusual marketing opportunity)

More traditional furniture finishes appear to be moving away from a light wood look for natural wood, but are also far removed from a preference toward dark woods As noted in ***Figure 2***, below, medium wood tones appear to capture first place in consumer preference in both the "best selling" category for 1996 as well as the "fastest-growing" category

Figure 1

U.S Furniture Retailers Survery (n = 159) (1997)

	Bedroom		*Formal Dining*		*Casual Dining*		*Occasional Tables*	
	Price Range (Retail)	*Fastest-Growing Styles*	*Price Range (Retail)*	*Fastest-Growing Styles*	*Price Range (Retail)*	*Fastest-Growing Styles*	*Price Range (Retail)*	*Fastest-Growing Styles*
Low	$999 & below	Eary American (26%) Casual Contemporary (33%)	$1,499 & below	Early American (25%) Casual Contemporary (25%)	*$699 & below	Casual Contemporary (39%) Early American (43%)	$199 & below	Casual Contemporary (80%)
Medium	*$1,000 - $2,999	Shaker (49%) Early American (-19%)	*$1,500 - $3,999	18th Cent (24%) European Tradional (22%)	*$500- $1,499	Casual Contemporary (47%) Early American (27%)	*$200 - $599	Casual Contemporary (30%) English Country (25%)
High	$3,000 & up	18th Cent (25%) Casual Contemporary (27%)	$4,000 & up	18th Cent (65%)	$1,500 & up	Early American (20%) Casual Contemporary (18%)	$600 & up	Casual Contemporary (30%) European Traditional (25%)

** Best Selling Price Points*
Source Furniture Today, May 1997

Figure 2

Finishing Survey Results for All Furniture Types (1996)

	Medium as #1	*Light as #1*	*Medium or Light as #1 or #2*
Best Selling ('96)			
Low $	100%	0%	100%
Medium $	100%	25%	100%
High $	75%	0%	100%
Fastest Growing			
Low	75%	25%	100%
Medium	100%	0%	100%
High	75%	25%	100%

Source Furniture Today May 1997

4) Oak and cherry are the top species used in furniture offerings in the U S covering bedroom furniture, formal dining furniture, casual dining furniture, and occasional tables Pine and mahogany also make strong appearances As noted in ***Figure 3***, the market opportunities for targeted Bolivian species uses as resource substitutions appears quite good based on both matching woodworking properties as well as compatible wood machining characteristics (See "***Wood Profiles***" tab of this document for detailed discussion)

* *Casual Outdoor Furniture*

a Outdoor living product purchases in the US are at an all-time high for outdoor furniture, outdoor lighting, trellis and arbors, fencing, and barbeque grill center accessories

b Factors contributing to the growth of wood outdoor products are the changing consumer tastes for different styles, and new products made of wood that consists of more sophisticated styles

c The estimated retail sales of wood casual outdoor furniture in the US climbed from $99 million US in 1991 to $115 million US in 1995

d Environmental concerns over the use of non-sustainable hardwoods by US consumers has impacted the sales growth trends for wood outdoor casual furniture, underscoring the importance of certified wood use in this market

e Industry experts anticipate that the casual outdoor furniture will continue to make steady gains in sales over the nest few years, outpacing the growth rate of the traditional household furniture sector

* *Commercial and Home Office Furniture*

a In 1996, the value of office furniture shipments in the US jumped by more than 6% to $10 4 billion US Sales are expected to continue to grow to reach $11 billion US in 1998

b Corporate office furniture needs reflect the use of flexible work hours, job sharing, teaming, telecommuting, and open floor plans This has increased the use of just-in-time office suites and the need for technology-friendly office furniture Corporate office furniture purchases emphasize flexibility, adjustability, ergonomics, and innovations that improve worker productivity

c Manufacturers of desks and desk extensions, tables, units, and file cabinets have benefited most from these trends These product sectors have experienced the strongest gains both on a dollar and volume basis

Figure 3

Wood Use Survey Results for All Furniture Types (1996)

	Low $	***Medium $***	***High $***
First Choice	***Oak (75%)***	***Oak (75%)***	***Cherry (50%)***
• *Bolivian match based on woodworking properties*	*Cambara* *Ochoo*	*Cambara* *Ochoo*	*Cambara*
• *Bolivian match based on wood mechanical properties*	*Cambara* *Yesquero*	*Cambara* *Yesquero*	*Cambara*
Second Choice	***Oak (25%)*** ***Cherry (25%)*** ***Pine (25%)***	***Cherry (50%)***	***Cherry (50%)*** ***Mahogany (50%)***
• *Bolivian match based on woodworking properties*	*Cambara* *Ochoo*	*Cambara*	*Cambara*
• *Bolivian match based on wood mechanical properties*	*Cambara* *Ochoo* *Amarella* *Yesquero*	*Cambara*	*Cambara* *Amarella*

Source Furniture Today May 1997

d One of the most striking changes in workplace has been the emergence of the work-at-home (WAH) market Households with at least one individual working after hours, operating a home-based business, or telecommuting accounted for 33% of US households in 1995 This figure is expected to rise to 36% by the year 2001

e Save for seating products, the sales of wood products in the US has outpaced the sales of non-wood products during the 1990s This trend is expected to continue through 2001

f Desks and desk extensions have been one of the strongest growing industry product sectors Wood desks have accounted for almost 56% of the total shipments since the mid-1980s

g During 1996, wholesale unit price gains for office furniture were strongest for wood work/conference tables

h The number of US office furniture manufacturing companies and plants has been increasing over the past two decades During 1996, there were about 600 companies operating 622 wood office furniture plants This compares to 316 companies and 331 plants in 1977

Wood Flooring

* Hardwood flooring usage is on the increase, and provides opportunities for manufacturers using all species of hardwoods, including species with natural stains and "character" defect

* Hardwood flooring is estimated to account for 95% of total wood flooring shipments in the US, and around 96% in volume sales

* Residential remodeling and repair is the largest market for hardwood flooring, accounting for 48% of total shipments, and is the key end-use market for the industry

* New characteristics of wood now preferred in certain flooring markets include variable grain patterns, variable grain density, worm and nail holes, and knots of various sizes and shapes

* The top importers of wood flooring into the US currently are Canada, Malaysia, Brazil, and Indonesia

* The laminated flooring industry is a growing competitive industry segment to the wood flooring industry which deserves watching

Wood Cabinetry

* In the US as well as Canada, custom cabinets lead the total number of cabinetry jobs

* Following furniture markets, another trend in high-end custom cabinets is the use of distressed finishes Finishes such as glazing, spattering, and antiquating are becoming more popular than pickled or whitewashed finishes Experts expect consumer preferences to move toward more natural woods, distressed woods, and heavily pigmented doors

* Top consumer needs for storage and *organizational* products demonstrating excellent market growth in the US include products for the closet, childrens, bedroom, and garage/utility rooms

* Top consumer needs for *bath and vanity* storage and organizational products demonstrating excellent market growth in the US include vanity organizers, shower caddies, corner shelves, and shelving and cabinets

* Top consumer needs for *bedrooms* storage and organizational products demonstrating excellent market growth in the US include underbed storage, bookcases, wall mount shelving, and shelving for multi-purpose uses

* Top consumer needs for *closet area* storage and organizational products demonstrating excellent market growth in the US include closet organizers, shoe organizers, bins, creates, totes, containers, stacking and drawers/shelves

* Top consumer needs for *family and rec* room storage and organizational products demonstrating excellent market growth in the US include media storage, photo storage, multi-purpose storage, wall mount shelving, and bookcases

* Top consumer needs for *garage and utility* storage and organizational products demonstrating excellent market growth in the US include tool organizers, small parts organizers, shelving/cabinets, bins, totes, containers, and specialty wall racks

* Top consumer needs for *home office* storage and organizational products demonstrating excellent market growth in the US include bookcases, cabinets, shelving, file organizers, media storage, baskets, crates, bins, desk organizers

* Top consumer needs for *kitchen storage* and organizational products demonstrating excellent market growth in the US include cabinet organizers, specialty racks, bins, baskets, and trays

* Top consumer needs for *laundry storage* and organizational products demonstrating excellent market growth in the US include shelving organizers, garment racks, cabinets, towers, and sorters

Specialty Products (Wood Coffins)

* The US funeral industry receipts will grow at about 6% per year through the year 2002 By the 2002, the industry's receipts should total $17 37 billion US

* 1 9 million caskets are sold annually at an average price of $2,146 US The value of the casket industry segment is estimated at $4 billion US

* Within the US, there are approximately 300 companies which manufacture, assemble, or distribute caskets The three largest manufacturers in the US are Batesville, The York Group, and Aurora

* There is a growing need for wood urns as cremation is a growing consumer preference in the US

* Of the more than 12 billion board feet of hardwood lumber purchased annually in the US in 1997, and for the first time, the purchase of hardwood lumber for miscellaneous product manufacturing exceeded lumber purchases for millwork, cabinets, and flooring Miscellaneous products include value-added products such as tool and broom handles, caskets, dowels, toys, sporting goods, picture frames, decorative boxes, wood tableware, and musical instruments (Note these miscellaneous products are more likely to purchase characterwood and prefer certified over non-certified wood)

* Specialty products such as pet cremation urns and burial units are also in high demand in the US

b Recent Economic Events and Impacts

Recent economic events and activities need to be closely scrutinized in order to formulate and monitor an effective marketing strategy for market entry and acceptance of Bolivian lessor-known species There are at least three recent events which deserve discussion

- The downturn of the Asian economy,
- Economic restructuring plans of other countries, and,
- Isolated events against the purchase of all tropical hardwoods

1) The downturn of the Asian economy

The downturn of the Asian economy has and is expected to continue to have a significant impact on wood product movement throughout the world Wood product normally destined for the Asian markets are now being diverted to other geographic regions throughout the world or remain in supplier inventories Simply put, this can make market entry of lessor-known species, at a time when potential inventory build-ups of traditional species, much more difficult and may further underscore the need to differentiate the product offering through certification

2) *Economic restructuring plans of other countries*

As of February, 1998, the government of Indonesia has substantially relaxed their export levies on sawnwood A maximum levy of 10% of the FOB value of the order for all species will be in effect which will make it financially viable for Indonesian millers to resume sawnwood exports Such actions may have far reaching impacts to other wood and wood product exporters throughout the world

3) *Isolated events against the purchase of all tropical hardwoods*

The City Council of the State of New York in the US is currently considering a recently-introduced Bill which will "prohibit the purchase of any tropical hardwood or hardwood products" The City Council is expected to vote on the Bill within the immediate future Such legislative requests, regardless of whether they pass or not, receive a large amount of unusual national visibility and impact actions and events in other states across the US Again, it becomes apparent how important product differentiation through certification may become in Bolivia's forest products future

c *Sustainable Forestry and Certification Issues in the US and Europe*

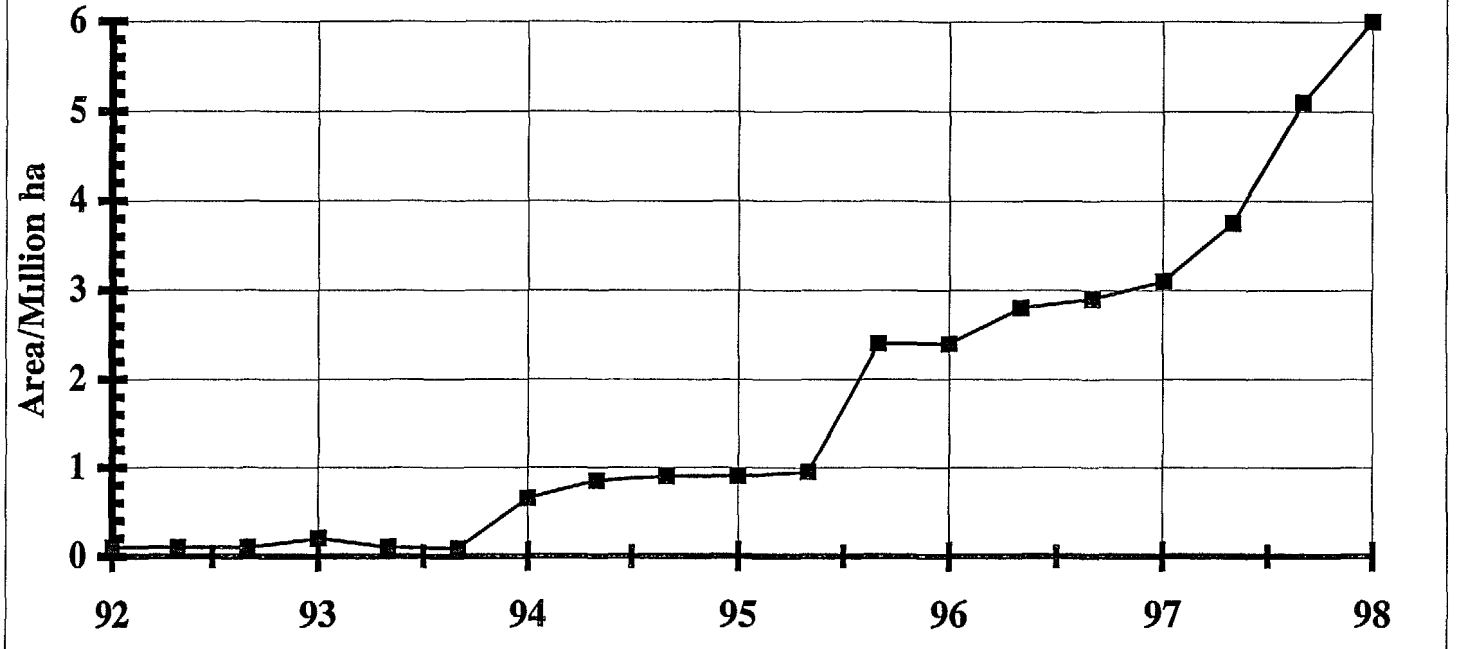
The concept of obtaining certification on forest lands demonstrating compliance with sustainable forest management practices was reviewed and detailed by Mater Engineering in the August, 1997 ***Progress Report*** to BOLFOR for this project The ***Progress Report*** data is summarized below, along with discussion on several events of significance have occurred since submittal of that Progress Report to BOLFOR

Globally

- Independent, third-party certification (under the Forest Stewardship Council [FSC] umbrella) now appears to be a significant reality in the forest products sector worldwide, with more than 10 million acres of managed natural forests and plantations having been certified worldwide, and more than 635 million board-feet of certified wood being traded annually

- The dramatic increase in the volume of acres introduced into FSC-certification worldwide especially since 1996, as noted in ***Figure 4***, is considered *significant* within the international wood products industry While much debate continues around the issue of which certification program will emerge on top, industry analysts worldwide all agree that *sustainable forest practices and certification* are here to stay

Figure 4 FSC Performance To Date



Source: FSC - U S , 1998

- Especially from a pulpwood producer and pulp and paper manufacturer perspective, the announcement in September, 1997, of FSC's decision to allow for *percentage-based product claims* is having a significant impact on increased credibility of FSC-certification worldwide As of September, 1997 certified content of a pulp and paper product must document 70% volume as FSC-certified in order to use an on-product label For off-product labeling (brochures, leaflets, market mechanisms, truth in product advertising applies Variations are also allowed for pulp and paper producers employing recycled material coupled with certified product

Within the U S

- Regional technical standards employed by FSC-certifiers used for assessment of sustainable forest management practices in the U S are well underway in a significant portion of geographic regions across the U S , as is noted in ***Figure 5***, attached, and the ***FSC Regional Working Groups Map,*** also attached

- During 1997, an industry evaluation of a sampling (n=31) of those who sell certified wood products in the US revealed the following

  1) 43% of the manufacturers have been in operation more than 15 years

  2) 86% *diversified* their existing product offerings to include certified product

  3) Products sold as certified

     - rough lumber (40%)
     - flooring (27%)
     - furniture (27%)
     - S2S lumber (23%)
     - S4S lumber (10%)
     - veneer (10%)
     - plywood (7%)

  4) 71% have certified sales outside of immediate area

     - 25% within region
     - 38% across U S
     - 16% international

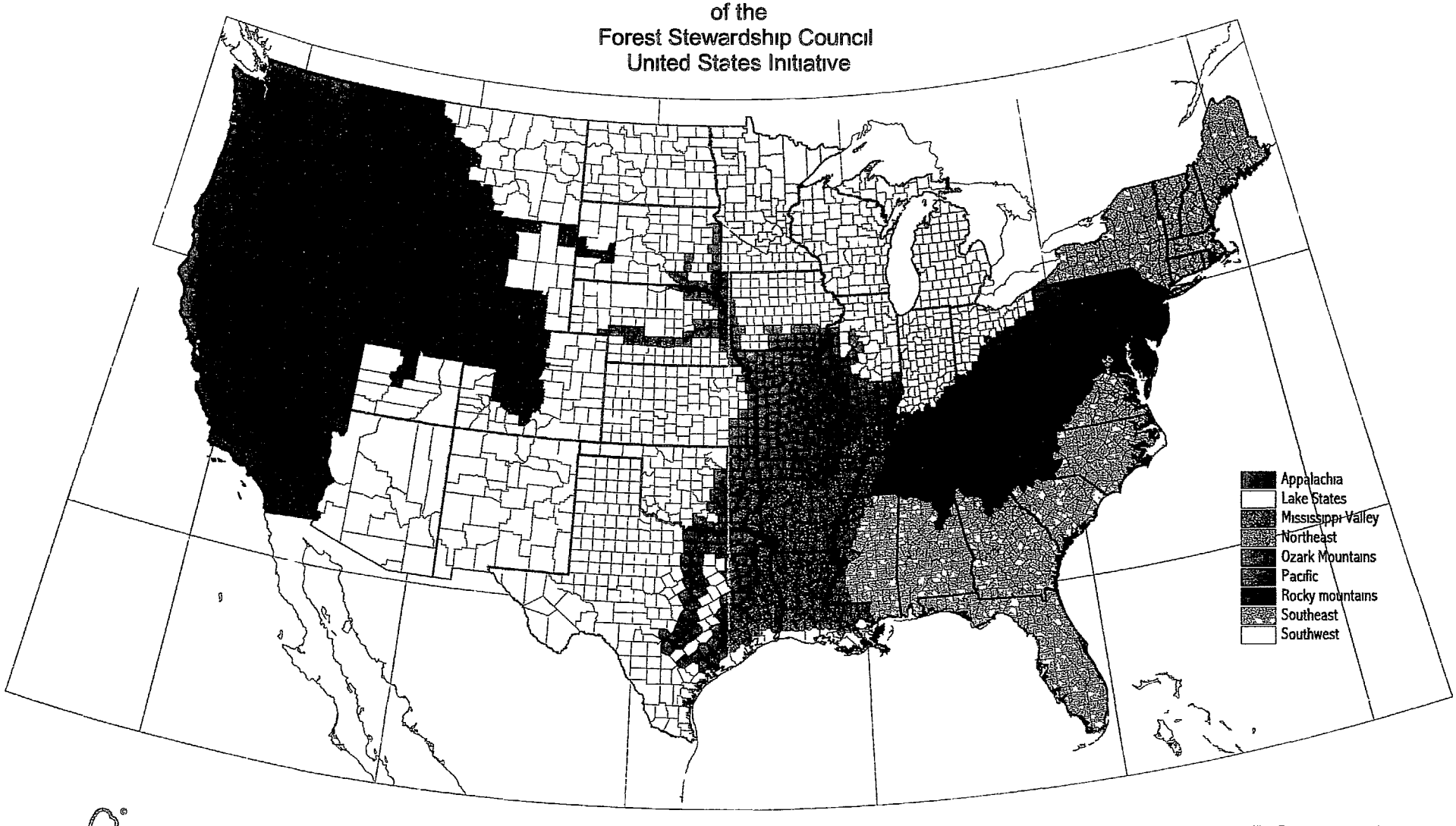
  5) 64% of manufacturers reported *volume* increases in sales last year, 23% reported constant sales, 13% reported decreases in sales

  6) 97% expect increase in sales this year, 87% expect increase in the percentage of certified products in their sales portfolio

Figure 5 Update an FSC Activities

Region	*Working Group Formation*	*1st Draft of Standards*	*Approval of Standards*
Pacific	Sept 96	Mar 97	Oct 97
Appalachia	May 97	Jun 97	Oct 97
Southwest	May 97	Aug 97	Dec 97
Northeast	May 97	Sept 97	Dec 97
Southeast	Aug 97	Oct 97	Dec 97
MAV/Ozarks	Jul 97	Sept 97	Mar 98
Great Lakes	Aug 97	Feb 98	Oct 98
Rockies	Oct 97	Apr 98	Oct 98
Hawaii	Dec 97	Jul 98	Dec 98
Alaska	Dec 97	Jul 98	Dec 98
Maritimes	Feb 96	Mar 97	Oct 97
British Columbia	Apr 97	Oct 97	Dec 97
Ontario	Aug 97	Oct 97	Dec 97
Boreal region	Dec 97	July 98	Dec 98

Regional Working Groups of the Forest Stewardship Council United States Initiative



FSC

Albers Equal Area Conic Projection

Data provided by ESRI ArcUSA
and members of the FSC US Initiative
Map produced by Shepard McAninch
and Jennifer Hromyak

- Major academic institutions throughout the U S (eg Michigan State University, Penn State University, Minnesota State University, Yale, Duke, University of Florida, University of California at Berkeley, Oregon State University) currently have curriculum developments underway to integrate SFM teaching techniques into existing forestry and natural resource degree offerings In December of 1997, Oregon State University sponsored the first ever inter-university forum on certification and sustainable forest management practices Over 15 major academic institutions throughout the U S participated in the conference staged to discuss the changes needed in forestry and forest products curriculum development to dovetail SFM approaches The inter-university form was sponsored by the USDA Cooperative State Research, Education, and Extension Service, the National Association of professional Forestry Schools and Colleges, Weyerhaeuser, and International Paper

- Certification application to public forestlands in the US was undertaken for the first time in 1997 The results of certifications on *public* as well as *private* forestlands in the US will have significant bearing on the perceived substance and credibility of FSC-certification efforts to wood product manufacturers and buyers alike In January 1997, through the funding efforts of the Heinz Endowments and the Rockefellers Brothers Fund, the states of Pennsylvania and Minnesota undertook the first state forestlands pilot projects in the U S Details surrounding the projects and their status for each state follows

  Pennsylvania

  a) Approximately 1 2 million acres included in certification assessment (1/2 of all state-owned forests),

  b) Scientific Certification Systems (FSC-certifier), authorized as an FSC-certifier, was selected to serve as the certifier for this project,

  c) The U S Forest Service served as official observers to the process,

  d) The project assessment was completed in September, 1997, recommending the state for certification

  e) The state signed a five-year certification contract with SCS in December, 1997, covering the assessed acreages

  f) Again, through the follow-on funding provided by the Heinz Endowments, Pennsylvania decides to engage in an assessment of their remaining 1 2 million acres of state forestlands This portion of the project is currently underway, with completion date scheduled for October, 1998

Minnesota

a) Approximately 614,000 acres included in certification assessment of both state and county-owned forest lands,

b) Smartwood, also an FSC-authorized certifier, was selected as the project certifier by the state and county,

c) Assessments of the state and county forest management practices were completed by Smartwood in July, 1997, recommending certification for both the State of Minnesota and Aitkin County on the targeted forestlands

Both the state and Aitkin County signed five-year certification contracts with Smartwood in November, 1997

Since then, two additional states (Michigan and New York) have been awarded funding by the Great Lakes Protection Fund (GLPF) to engage in pilot project certification assessments Details of those state projects are

Michigan

Mainstream forest products industry in the U S and Canada have certification on their "business radar screen" but are also unclear as to the similarities and differences between the two key independent, third-party certification systems they are currently evaluating - the ***FSC*** certifications program, and the ***CSA*** (Canadian Standards Association) certification program Michigan is initiating a project which will incorporate both systems in a site-specific project

The Michigan DNR will be developing a new forest planning system that will meet international standards for sustainable forest management The state has selected the ***Lake Superior State Forest (LSSF)*** (1 million acres) as the state forestlands to be subject to this pilot project which will include the development of a new forest planning system that will meet international standards for sustainable forest management The new forest planning system to be designed will follow CSA criteria and guidelines for certification process

The state has selected ***Smartwood*** to serve as the FSC component to this project Because this project encompasses the development of a new forest planning system for the LSSF, not the assessment of an existing forest management system currently employed in the LSSF, Smartwood will not be conducting a certification assessment They, instead, will undertake the following tasks

1) Provide input to the development of the new CSA forest planning system which assists the state in understanding what FSC criteria and indicators would be used to evaluate performance in an FSC-evaluation of the system being designed

2) Observe and participate in the public participation and stakeholder segments of the project to, again, assist the state in understanding what FSC criteria and indicators which would be used for an FSC-evaluation of the system being designed

3) Conduct a series of three (3) *scopings* on sites within the LSSF where the new forest planning system is to be implemented to determine likely performance of the new system in the field The three sites selected will coincide with sites selected by the state to evaluate the in-field performance of on-site indicators developed for the new forest planning system

Note *Scopings* as conducted by Smartwood are ***not*** assessments They occur prior to engaging in an official assessment to help forestland managers determine their *readiness* to engage in an FSC assessment

It is important to note that a project of this nature has not been done before The information and learning experiences anticipated to be gained from this project be will useful to far more audiences than just the State of Michigan, CSA, and FSC

It is the intent of the State of Michigan, once the new forest planning system has been designed and FSC scoping has been completed, to determine whether it will elect to gain certification of their new system from either CSA, FSC, both, or none

New York

New York houses approximately 4 million acres of state-owned forestlands, the majority (approximately 3 3 million acres) are held in two large forest *preserves* No harvesting of timber is conducted within these preserved lands The remainder 700,000 acres of state forestlands are scattered throughout all regions of the state New York has opted to include all of their non-preserved state forestlands into this pilot project Smartwood will conduct a *standard certification assessment* in accordance with FSC criteria and guidelines on the targeted acreages This means that a comprehensive assessment will be conducted such that, at the end of the assessment, assuming certifier recommendations are favorable, New York could proceed with obtaining a certification contract on the targeted state forestlands encompassed within this assessment The Smartwood regional partner which will be the primary lead on this project will be the ***National Wildlife Federation*** located in Montpelier, Vermont

The project is expected to be concluded in approximately nine (9) months

- The U S Forest Service is also carefully monitoring these pilot projects During this last year, the Forest Service served as official observers in the state forestland pilot projects undertaken in Minnesota and Pennsylvania In an August 1, 1997 memo released by USFS field team observers on the project, the following conclusions were noted

" *The assessment process observed was consistent with the descriptions provided by both the states and certifiers on the projects, as well as the intuitive logic associated with said process when applied to public lands* "

" *At this preliminary stage in USFS observations, nothing associated with the processes observed or described appears to be counter to stated objectives, or contrary to the sustainable resource management goals of public forest resource management agencies* "

- As a result of the recent certification designation obtained on 550,000 acres of state and county owned forestlands in Minnesota, the states' Division of Forestry (DOF) is in the process of proposing a $700,000 funding package to its Legislature for a ***Phase 2 Forest Certification Project*** Phase 2 funding request is to help cover the costs of the following

  a Third-party assessment of an additional 1 1 million acres of state and county managed forestlands throughout the entire state (615,000 acres of state lands and 500,000 acres of county lands)

  b Certification of up to five private forestry consultants to be designated as FSC-certified resource managers to work directly with non-industrial private forestland owners in gaining affordable access to certification of their NIPF forestlands (In going through a certified resource manager, the resource manager is FSC-certified to manage forestlands in a certified manner This dramatically reduces the cost of certification assessment to the landowner as resource manager certification costs are shared among the resource manager's multiple clients)

  c The creation of a fulltime staff position within the Division of Forestry to facilitate the certification process between areas and agencies and to cover administrative requirements of the certification contract

  d Fees to cover certification maintenance including annual certifier auditing costs

  e Funds to cover improved technology costs including the options to accelerate land classification systems and incorporate improved GIS and computerized tracking and reporting systems as required under the conditions of their existing certification contract

  If the DOF is successful in its effort, it will be the first state in the nation to request legislative appropriation for certified forestry operations on public lands The DOF feels it has a reasonable chance at securing legislative approval for the funds if outside funds can be obtained to cover the cost for county forestland assessment which state dollars cannot be used for (estimated to be between $50,000 - $80,000)

  The State of Minnesota Division of Forestry is also proposing consideration of a project to help finance COC assessments for targeted wood product manufacturers in the State According to recent discussions with Minnesota DOF officials, impetus for the project resulted from recent buyer demand for certified wood products to be generated from the now-certified state and county forests,

but lack of *certified* manufacturers on line to produce the certified products in demand has prevented the sales The project proposes that the State finance 50% of the total cost of COC assessments for up to 12 small/intermediate-sized mills in the state in order to

* facilitate the certified wood product flow from the state, and,

* establish a baseline of activity which will serve as a catalyst for certification investment by other wood product producers in the state

The COC assessments are projected to cost between $1,000 and $1,500 per mill The State is currently evaluating other financing options to match their proposed 50% grant contribution to the project

- Little published information currently exists which specifically addresses certification costs to the wood product *manufacturer* relative to chain-of-custody (COC) costs These costs can vary dramatically depending on the type of products being produced, consistency and volume availability of a certified wood flow on a monthly basis, species and grade requirements for product development, etc Currently, a fast-tracked research project is underway to specifically address these cost questions Proposed to be financed by an unusual private foundation - forest industry partnership, a joint research effort will be conducted by Oregon State University and Michigan State University to address these manufacturing cost questions The project is projected to begin January, 1998 with a completion date of June, 1998 With approximately 10 actual forest products operations throughout the U S to be used as case studies, Oregon State University will take the lead for softwood producers while Michigan State University will take the lead for hardwood producers

- Decisions by notable public and private organizations throughout the US to employ FSC-certified wood products in their purchase decisions have created increased visibility and acceptance of certification within the wood products industry Examples include

  a) ***US Environmental Protection Agency*** New $280 million office complex in Durham, North Carolina Specifications call for use of FSC-certified wood in building materials FCS-certified wood use in furniture construction currently under construction

  b) ***City of Los Angeles*** Have just adopted a preference for the purchase and use of FSC-certified wood in all wood product procurements, including a 10% premium payment to secure the certified products

  c) ***U S Postal Service*** Construction of a new post office building in Michigan requires contractors to evaluate the use of FSC-certified wood

d) ***Duke University*** Currently evaluating shifting its purchases of dorm furniture to sources using FSC-certified wood *Furniture will also be made of lower grade wood and lower value species*

e) ***Dartmouth College*** Currently evaluating adopting a preference clause for the purchase and use of FSC-certified wood in all wood product procurements

f) ***The GAP*** New headquarters building in San Francisco being built with FSC-certified lumber and flooring

g) ***Turner Construction*** The nation's largest commercial construction company is currently evaluating options to include certified wood in their construction projects throughout the U S

h) ***The Nature Company*** Just installed product display units in all of its stores across the U S made from FSC-certified wood

i) ***US Department of Defense*** Recently required prequalification of contractors for a multi-billion dollar renovation and expansion project to indicate whether the wood products they sell come from "*independent, third-party certifiers such as Smartwood or Scientific Certification Systems*"

- Case study results in sustainable forest management practices and state forestland certification pilot projects are having an impact on lending activity from some traditional financial institutions and banking communities in the US Logging contractors to FSC-certified Seven Islands (1 2 million acre forestland owners in Maine) were able to secure conventional bank financing for new low-impact logging equipment required to harvest on Seven Islands forestlands According to front page coverage of this story in the November 26, 1997 issue of the Wall Street Journal

  " *Stands of spruce and fir [on Seven Islands lands] grew so tightly packed after a hurricane hit 60 years ago that they can't be thinned with ordinary gear So Seven Islands encouraged Nicols Bros Logging to spend $800,000 on state-of-the-art equipment The machine's 25-foot arm reaches into the forest, snips off a selected tree at ground level, strips off its branches, and cuts it into desired length logs and stacks it, all in one motion Seven Island, thus gets the revenue from the logs it couldn't reach* ***without clearcutting****, and the remaining trees can grow into more valuable timber*

  For both Nicols Bros and its bankers, green certification was a factor in deciding to purchase and to finance the equipment "It told me there will be wood to cut here for a long time to come," states Billy Nicols "

In Europe

- ***B&Q***, one of the country's largest DIY chains, has a countdown to the year 2000 that reflects the following

    * ***January, 1998*** All wood product suppliers to have action plan to achieve FSC-certification,

    * By June, ***1999*** 50% of total wood product volume sold in the stores must be FSC-certified,

    * By ***December, 1999*** All uncertified wood products will be replaced by FSC-certified products

- ***B&Q*** refuses to carry wood products supplied by Canadian-based MacMillan Bloedel because the company does not supply products with a certification seal-of-approval

- ***B&Q*** gives its Finnish timber suppliers until March, 1998, to set up a cast-iron timetable for FSC-certification implementation If suppliers fail to deliver assurances of FSC-certification intent and timeline for completion, their products will be "dumped" from B&Q stores

- British retailing giant ***Sainsbury Homebase*** announced that beginning March, 1998, all of its sawn timber and softwood mouldings would "*start to bear FSC logo*" Supply sources in Canada and Indonesia are under particular scrutiny for this effort The retailing giant states they are willing to, or example, switch from Canadian hemlock to beech for its stairparts in order to comply with this new mandate The progress toward certified softwood resulted from consistent pressure from suppliers like AssiDomain, Sweden's largest private forestland owner

- Sweden has become the first country in the world to have a national forestry standard endorsed by the FSC With this endorsement, large private forestland owners like Stora and AssiDomain plan to have the largest percentage of their private forestlands certified shortly

Price Differentials Paid and Market Share Increases Realized for Certified Wood Products

The MacArthur case studies referenced above are the first efforts to begin to document both product price and market share differentials which are being experienced by those forest resource suppliers and forest products producers who invest in certified wood products Case study examples include

- Collins Pine Company, with both certified hardwood holdings in Pennsylvania and certified softwood holdings in California, found that sales to retailers and manufacturers increased by about 25% directly as a result of certification

- Menominee Tribal Enterprises, owners of 235,000 acres of forestland in Wisconsin receives a 10% free-and-clear premium for certified hardwood veneer logs Volume of sales, however, is small as the tribe's commitment to sustainable logging practices prevents it from delivering more than a quarter of the 4 million board feet buyers seek from it each year

- Minnesota's Colonial Craft, which owns no forest lands, became the first molding and millwork company to become FSC-certified in 1994 The publicity the company has received for its commitment to certified wood brought it to the attention of a major barbeque grill manufacturer looking for certified wood handles parts on its barbeque grills in order to sell into the European markets The firm approached Colonial Craft agreeing to a 15% premium for the certified wood product made by Colonial Craft Further, the barbeque grill company negotiated a second deal with Colonial Craft for a non-certified product line which has reportedly increased the gross annual sales of Colonial Craft by more than 10%

- Seven Islands Land Co , located in Maine, owners of over 1 million acres of forestland, became FSC-certified in 1994 Rather than continuing to sell their logs to non-certified primary and secondary producers, the company outsourced the production of their certified wood into certified hardwood flooring which it now sells throughout North America and Europe The company states it recouped its certification costs in 18 months through premiums paid on its certified wood

d Market demand for Products Made from "Characterwood"

Although viewed as wood "*defect*" by those traditionally schooled in the wood products industry, the natural character of wood is now being incorporated into value-added products to service worldwide consumer demand for this type of look At no time has the visible use of "*characterwood*" in product development been more evident - especially in furniture manufacturing It is a factor which has not gone unnoticed by the academic community Based on recent (1996) research conducted by wood scientists at Virginia Tech and University of Kentucky, the use for characterwood in product development can be broken into traditional and non-traditional character mark categories

Traditional character marks

- sound knots (1" diameter or less)
- small holes (pin holes, wormholes)
- small pitch/gum pockets
- mineral streak
- mineral or sap stain
- grain and color variations

Non-Traditional character marks

- unsound knots
- large knots (> 1" diameter)
- bark pockets
- wane
- split
- large wormholes
- insect tunneling
- short/shallow checks

Although the study concentrated on mill yield of characterwood rather than determining actual market demand for characterwood, the researchers determined that characterwood acceptance in furniture should lead to a *shift in the relative prices of different lumber grades* This would make it economically feasible for sawmills to cut additional boards from the center cants

With approximately 30% of all U S hardwood lumber going into furniture, dimension, and cabinet production and typical sawmill recovery rates of 50%-60%, the researchers determined that each 1% increase in rough mill yield that occurs industry wide will reduce hardwood timber demand by approximately 2% On a per-mill basis, the increase in yield is dramatic The researchers undertook on-site testing of different cutting patterns in sawmills which would accommodate characterwood marks in dimension production Results of the testing illustrated that allowing for character marks in furniture dimension parts increases yield significantly

1) Allowing for character marks up to 2-inches in diameter on both faces of dimension parts increases the yield 13 8% for 2A Common lumber and 6 1% for 1 Common lumber

2) If 2-inch character marks are only allowed on one face with the other face entirely clear, the yield increase is 6 5% for all 2A Common lumber and 3 2% for 1 Common lumber

3) If character marks are limited to 1-inch diameter and allowed on both faces, the yield increase for 2A Common is 7 8% and 3 3% for 1 Common

4) If 1-inch character marks are only allowed on one face with the other face entirely clear, the yield increases are 3 9% and 1 9%, respectively

The importance of understanding and catering marketing strategy to characterwood markets is important to Bolivian producers grappling with, for example, the unique gray-blue stain found in Ochoo

Since no published market research evaluating the use of characterwood in product development currently exists, for this Forest Bank project Mater Engineering evaluated the U S high-end catalog market and general U S wood product producer market for characterwood use products manufactured and sold to U S consumers Results of these evaluations are detailed below

High-End Catalog Market for Characterwood Products

For this project, twenty leading catalogs offering higher-priced furniture pieces were evaluated The catalogs were selected based on their widespread market distribution and their wide variety of product types and styles offered to U S consumers (see the "***Catalog Analysis***" tab in this document for a full listing) Examples of catalogs surveyed included *Gump's, Bloomingdale's, Pottery Barn, Crate and Barrel, Sugar Hill, Horchow Home*, and *Sundance*

The purpose of the product analysis was to determine the following

1) How many catalogs offer furniture pieces with characterwood as a ***stated*** benefit in the product text Product text in catalogs is an excellent indicator of consumer preferences in product selections Furniture pieces offered to consumers with text that describes the attractive use of knotty wood or wormwood are extremely important indicators of consumer preferences to wood product producers

2) What types of traditional and non-traditional wood characteristics were observed in furniture product offering photos in the catalogs Furniture pieces offering the attractive use of wormwood may also have other characteristics noteworthy to the wood product producer

3) How many catalogs offered furniture products with ***stated*** finishes imitating characterwood In order for product manufacturers to offer furniture pieces with consistent characterwood markings throughout the piece, distressing of the wood is often accomplished during in-line production As with the actual use of characterwood, it is important to not how many catalogs refer to the unique finishes which may be employed in product development - again as a key indicator of consumer preference

4) How many catalogs offered furniture pieces illustrating contemporary painted furniture This is important when considering the introduction of lessor-known species use, as well as characterwood use, in product offerings

Figure 6, attached, illustrates that a significant volume of the catalogs analyzed for this project actually *stated* the use of characterwood in their product offering text Over 65% of the surveyed catalogs employed phrases such as *"knotty wood", "rough-sawn wood", "seasoned or rustic wood", "burly wood", "figured wood", "wormwood", "checked wood", "distressed wood", and weather-aged wood"*, to describe the unique attributes of the furniture piece being offered to the consumer For example, ***Blue River Trading Company*** catalog offers an "*antique pine and wormwood desk that is more than a piece of furniture, it's a collectible of the find that becomes an heirloom*" (See color photo examples and specific catalog response breakouts included in the "***Catalog Analysis***" tab of this document)

Figure 7, attached, illustrates that a significant volume of the catalogs analyzed for this project included product photos of furniture which was observed to have both traditional and non-traditional characterwood marks 100% of the catalogs surveyed offered furniture products with traditional character marks such as *sound knots, small holes, small pitch/gum pockets, mineral stain, and color and grain variations* Over 55% of the surveyed catalogs offered products with non-traditional character marks such as *large knots, insect tunneling, short/shallow checks, splits, and even the use of*

Figure 6 *Catalog Furniture Offerings with Stated Characterwood (20 Top U S Catalogs Survey)*

Wood Characteristics	*% With Stated Characteristic in Product Text*
Wormwood	35%
Knotty	15%
Seasoned/Rustic	15%
"Natural" Wood	15%
Burly	15%
Reclaimed/ Recycled	15%
Weather-Aged	10%
Barn Wood/ Fence Wood	10%
Rough-Sawn	10%
Figured	5%
Checked	5%

Figure 7 *Observed Traditional & Non-Traditional Characterwood in Furniture Offerings (20 Top U S Catalogs Surveyed)*

Characteristics	*% With Characteristic Observed in Product Photo*
Traditional	
• *Small/Sound Knots*	85%
• *Small Holes*	90%
• *Grain/Color Variations*	100%
• *Pitch/Gum Pockets*	40%
• *Mineral/Sap Stain*	35%
Non-Traditional	
• *Unsound Knots*	25%
• *Large Knots*	50%
• *Short/Shallow Checks*	40%
• *Large Wormholes*	30%
• *Insect Tunneling*	30%
• *Spalty Wood*	25%
• *Splits*	10%
• *Wane*	0%
• *Bark Pockets*	0%

spalty wood As an example, Pottery Barn offers a $1,000 US Sierra Armoire which, although not stated in the product text, clearly exhibits the following characterwood markings

- mineral stain
- large knots (>1" diameter)
- small holes
- small/sound knots
- splits
- short/shallow checks

Bloomingdale's By Mail offers a "rustic" 5-drawer chest which appears to employ spalty wood in the drawer panels (See color photo examples and specific catalog response breakouts included in the "***Catalog Analysis***" tab of this document)

Figure 8, attached, illustrates that a significant volume of the catalogs analyzed for this project actually ***stated*** the use of finishes in their product offering text which imitates characterwood Over 85% of the surveyed catalogs employed phrases such as *"antiqued/aged", "distressed", "weathered", "crackled", "time-worn", and "wormwood"*, in their product text to describe the finishes on unique furniture pieces being offered to the consumer For example, ***Sugar Hill*** catalog offers a Thomas bed design with a *"time-worn coffee-washed, antiqued finish to recall the flavor of an old Victorian porch* (See color photo examples and specific catalog response breakouts included in the "***Catalog Analysis***" tab of this document) Demand for these type of products was also evidenced in manufacturer inquiries received by Mater Engineering during the course of this project As an example (see attached cover letter), DL Gremmels & Associates contacted Mater Engineering in April, 1997 to inquire into the location of manufacturers who would be able to produce Thomas Beds and Night Stands with white lacquer and antique-honey lacquer finishes *Per month* quantities from just this one inquiry were as follows

- Bed with white lacquer 88 units
- Bed with antique-honey lacquer 40 units
- Night Stand with white lacquer 44 units

The price per unit being offered by Gremmels for the bed unit is $245 US The catalog price to the consumer is $900 US per unit

Figure 9, below, illustrates that a significant volume of the catalogs analyzed for this project offered furniture pieces with contemporary paint finishes adaptable to lessor-known species use and characterwood use Over 90% of the surveyed catalogs offered these type of product offerings with majority of the pieces made from hardwoods 30% of the product offerings were made from mahogany or other tropical hardwoods - although the consumer would never know it by looking at the piece Examples

Figure 8 *Catalog Furniture Offerings with Stated Finishes Imitating Characterwood (20 Top U S Catalogs Survey)*

Finish Characteristic	*% With Stated Characteristic in Product Text*
Antiqued/Aged	70%
Distressed	55%
Color-Washed	35%
Weathered	25%
Crackled	15%
Time-Worn	15%
Seasoned/Rustic	10%
Wormwood	5%

Figure 9 *Catalog Furniture Offerings Illustrating Contemporary - Painted Wood (20 Top U S Catalogs Surveyed)*

80% of surveyed catalogs offered furniture pieces with a contemporary paint finishing Of those.	
60%	• Painted ***hardwood*** furniture pieces
50%	• Painted ***softwood*** furniture pieces
30%	• ***Painted mahogany*** or other tropical hardwood furniture pieces

DL GREMMELS & ASSOCIATES

9 APRIL 1997

CATHERINE MATER
MATER ENGINEERING
101 SW WESTERN BLVD
CORVALLIS, OR 97333

DEAR CATHERINE

I WAS INTRODUCED TO YOU IN 1995 DURING A SEMINAR AT YOUR OFFICE FOR EMCO WOOD PRODUCTS WE DESIGN FURNITURE FOR SPECIALTY MAIL ORDER CATALOGS AND INTERNET SPECIALTY RETAILERS I AM ENCLOSING DRAWINGS OF PRODUCTS THAT ARE CURRENTLY BEING PRODUCED IN A BORDER TOWN OF MEXICO FOR ONE OF OUR CLIENTS

IT IS OUR DESIRE TO FIND FACTORIES THAT ARE INTERESTED IN PRODUCING FOR MAIL ORDER AND INTER NET RETAILERS DO YOU HAVE ANY CLIENTS THAT MAY BE INTEREST IN MANUFACTURING FOR THESE TYPE OF CLIENTS?

THE ATTACHED PRODUCTS ARE BASICS IN A MAJOR NATIONAL CATALOG THE PRODUCTS WILL RUN FOR AT LEAST ONE YEAR. THE MONTHLY REQUIREMENT AND UNIT COSTS ARE LISTED BELOW

DESCRIPTION	PER UNIT $	QUANTITY
THOMAS BED WHITE LACQUER(POPLAR)	245 00*	88**
THOMAS BED ANTIQUE HONEY LACQUER (PINE)	245 00*	40**
THOMAS HEAD BOARD WHITE LACQUER(POPLAR)	127 00*	23**
THOMAS HEAD BOARD ANTIQUE HONEY LACQUER(PINE)	127 00*	7**
THOMAS NIGHT STAND WHITE LACQUER(POPLAR)	110 00	44
THOMAS NIGHT STAND ANTIQUE HONEY LACQUER(PINE)	110 00	
RILEY HEAD BOARD ANTIQUE HONEY LACQUER(PINE)	126 00*	135**
KEY LARGO CHEST CUSTOM LACQUER FINISH(PINE)	158 00	118

* COST ON QUEEN SIZE
**TOTAL MONTHLY UNITS OF ALL SIZES - TWIN FULL, QUEEN KING & CA KING
NOTE THOMAS NIGHT STAND MONTHLY QUANTITIES ARE NOT LISTED AS THE CUSTOMER IS HOLDING A LARGE INVENTORY OF THESE ITEMS MONTHLY REQUIREMENTS WILL BE AVAILABLE IN 30 DAYS

PO BOX 20711 * SEATTLE WA 98102 1711 * TEL. 206 323-5822 * FAX 206 323 3629

THOMAS NIGHTSTAND
THOMAS BED
Property of
D.L. Gremmels & Assoc®
DL GREMMELS & ASSOC
Seattle Washington ®
THOMAS BED & NS ©1997
Sheet 4-4
Drawn By YB
Designer DLG
Approved By
Scale
Date 02-10-97
Drawing No 1124

- *Sugar Hill* offers its consumers a "hand-painted southern folk-art chest" that to be "distressed" to produce "the look of a prized antique" The piece sells for $950 US

- *Bloomingdale's By Mail* offers a cocktail table made from "*sturdy plantation mahogany*" that is then painted in antique white resulting in a "*colonial times*" fashion piece Crate and Barrel offers a cache made from "*solid mahogany*" which then has a "*hand-applied blue antique finish*" to it

(See color photo examples and specific catalog response breakouts included in the "***Catalog Analysis***" tab of this document)

Overall Producer Analysis of Characterwood Use in Product Development

In addition to the catalog product offering analysis conducted for this project, Mater Engineering also surveyed over 70 wood product producers throughout the U S to determine their use of characterwood and finishes in product offerings The manufacturers represented approximately 14 different types of wood products including

- Furniture
- Flooring
- Cabinetry
- Doors
- Building Materials
- Clocks
- Musical instruments
- Marquetry
- Stair systems
- Moulding and Millwork

Figure 10, attached, delineates the results of that survey, illustrating the following

1) 44% of all product type producers *stated* the use of characterwood in their product brochure text,

2) 29% of all product type producers *stated* the use of contemporary paint finishes imitating characterwood in their product brochure text,

3) 46% already use tropical species in their product manufacture

A complete breakout of information by product producer, including species used, type of characterwood stated, and type of product finish stated in product brochures is included under the "***Producer Analysis***" tab of this document

Figure 10 U S Product Manufacturers Survey Matrix
July, 1997

Product Produced	*# of Producers Surveyed*	*Characterwood Stated in Product Text (% of Product Total)*	*Contemporary Paint Finish Stated in Product Text (% of Product Total)*	*Already Use Tropical Species in Product Manufacture (% of Product Total)*
• *Cabinetry*	2	2 (100%)	1 (50%)	0
• *Building Materials*	1	1 (100%)	1 (100%)	0
• *Clocks*	5	3 (60%)	1 (20%)	4 (80%)
• *Wooden Containers*	1	0	0	0
• *Musical Instruments*	6	2 (33%)	0	6 (100%)
• *Doors*	2	2 (100%)	1 (50%)	1 (50%)
• *Flooring*	5	5 (100%)	0	0
• *Gazebos*	3	0	0	0
• *Architectural Millwork*	9	1 (11%)	1 (11%)	5 (56%)
• *Furniture*	24	13 (54%)	13 (54%)	8 (33%)
• *Stairs*	5	0	1 (20%)	3 (60%)
• *Marquetry*	2	2 (100%)	0	2 (100%)
• *Outdoor Furniture*	5	0	1 (20%)	4 (80%)
• *Upholstered Furniture Frames*	1	0	0	0
Totals	71	31 (44%)	20 (29%)	33 (46%)

Industry Association Characterwood Campaign Efforts

The American Hardwood Export Council (AHEC) is dedicated to promoting United States hardwood exports worldwide In 1996, AHEC launched an advertising campaign in Europe referred to as the "Bin" program The image depicted in the ads reveal a trashcan (called "bin" in the U K), and the copy reads "Are you wasting the wood?" The aim is to reveal the fact that a great deal of lower-grade and character-marked wood is wasted because of the stringent specifications for clear lumber, and the utilization of a narrow range of wood species dictated for product development

The ad campaign targets manufacturers, designers, architects, and specifiers to plan wood use to meet existing resource The greater aim of the campaign is to increase the utilization of lower grade and character-marked hardwoods, with an emphasis on utilizing a wider variety of species

According to AHEC officials, the ad campaign elicited inquiries from the target audiences, created considerable interest among consumers, and attracted a positive response from environmental groups in Europe In order to make sustainability work, the market needs to adapt to a changing forest mix AHEC noted that there were new trends exhibited at the annual Furniture convention in High Point, which revealed designs utilizing character-marked "distressed" furniture

Another new ad campaign has been launched by AHEC in Europe The image is a 1950's-style American refrigerator in eight different species and the accompanying slogan "We can lay on a great spread " The refrigerator is used as a metaphor for the wide choice of wood species, from light and dark colors to wood grains and smooth textures The ad campaign also promotes a significant environmental message According to Michael Buckley, the European director of AHEC, "We're stressing the sustainable forestry practices used in the U S and encouraging the market to use the various species available, rather than concentrate on just a few We're also using timber with a lot of character marks to emphasize that this is part of its beauty "

Specific Industry Examples of Price Differentials Paid for Character Wood

As noted above, little information is published regarding characterwood use in product development However, industry examples are beginning to emerge which illustrate the significant product pricing opportunities for characterwood - especially employed in furniture and flooring markets For example

- In 1997, Kane Hardwoods (subsidiary of Collins Pine) located in Kane, Pennsylvania used falldown due to wood "defect" from hardwood lumber production provided for Lexington furniture to turn wood waste into a high-end wood product The hardwood falldown traditionally went into pallet stock and sold at $150/mbf as pallet grade Kane Hardwoods figured out they could redirect that characterwood downfall into the custom flooring market Sold as a custom grade, the lumber achieved a $480/mbf price from flooring producers Sold as custom flooring, the flooring producer was able to sell the product to home builders at $3,300/mbf retail value

- Collins Pine also had similar experiences with their west coast softwoods Prompted by the need to move *certified* pine shelving made from lower-grade (#3) lumber, they quickly realized that consumers in the DIY markets were requesting "appearance grade" pine products ("appearance grade" refers to the desirable "character" of knots, grain variation, mineral stain, etc found in the wood) Sold as appearance grade pine, Collins Pine realized a price differential of one lumber grade difference (between #3 grade sales prices to #2 grade sales prices)

- In Utah, during 1997, wood product producers concerned about the amount of substantially lower-grade spruce, aspen, and subalpine fir embarked on a markets analysis to determine if market demand existed for Characterwood products made from these lower grades Focusing on the furniture and flooring markets just in the U S , the manufacturers were able to convert 46 cents per board foot prices for lower grade lumber into $2 50 per board foot custom grade flooring product

- In Vernon, British Columbia, Canada, a first of its kind log sort and sales yard was established as a pilot project in 1996 to evaluate other log sales options for the Ministry of Forestry The government placed a twenty-five cents ($ 25) per cubic meter sales price on low-grade logs in order to entice logging operations to extract the material rather than leaving it to rot on the forest floor Known as their "*two-bit*" log sales, the character logs (usually with high sweep - twists, turns, and "pistol grip" configurations) were, instead, sorted as custom sorts in the log sort/sales yard and sold to log home manufacturers for $80 per cubic meter

e *Product Distribution Systems Overview.*

Outside of the traditional product distribution channels employed by the wood product industry worldwide, other product distribution channels and players which the Bolivian forest products industry should be tracking on include

- ***Certified wood products buyers groups***

  The growth of wood product buyers groups dedicated to informing buyers of certified wood and wood products available for sale has not gone unnoticed by the forest products industry

  Throughout the world

  Following the footsteps of the certified wood products buyers group formed by retailers, product manufacturers, brokers, and wholesalers in the U K , approximately 15 other countries throughout the world have formed similar buyers groups dedicated to the same purpose Countries which have certified buyers groups formed and operating are Canada, Japan, Germany, Spain, Holland, Finland, Switzerland, Greece, Denmark, Australia, France, and Austria

Within the US

In December of 1997, the ***North American Certified Forest Products Council (CFPC)*** was announced to the public With already over 200 wood product buyer members committed to purchasing certified wood for product development and sales, the Council has been successful in gaining both higher visibility and delivered performance to the certified wood products arena

- ***Targeted brokers who move certified wood products***

Although still few in numbers throughout the world, there is a growing number of traditional wood product brokers who have recognized the importance certified wood products are and will continue to have in the global marketplace These brokers are making decisions to offer certified wood products as part of their total product portfolio to worldwide buyers As a result of the efforts of BOLFOR, The John D and Catherine T MacArthur Foundation, CADEX, CFV, and The Tropical Forest Management Trust, Bolivian wood product manufacturers were introduced to brokers with this focus in November, 1997, in Santa Cruz The ***Bolivian Encuentro*** was billed as a success in bringing Bolivian forest product producers together to meet with US and European brokers and buyers interested in moving Bolivian lessor-known species and certified wood The direct buyer-seller interest and actual orders generated as a result of this one effort should underscore the importance of the direction *and* follow-on similar events

- ***Product buyers for the high-end catalog markets***

Bolivian value-added and finished product manufacturers should recognize the importance that the mail-order catalog market plays in product distribution to consumers Within the U S , for example

1) Nearly 6 out 10 rural Americans (59%) purchased by catalog in 1996, compared with 57% of urban Americans

2) On average, U S catalog shoppers spent $530 each on catalog purchases in 1996

3) The growth of sales in catalog shopping has been significant since 1992

   - 1992 $36 billion in sales
   - 1996 $58 billion in sales
   - 2001 $113 billion in sales (estimated)

4) 43 million Americans receive 5 or more catalogs each month

5) Home furnishings, garden accessories, collectibles, and crafts and hobby accessories comprised a healthy share of the total catalog market equaling over 10% ($6 billion) of the $58 billion sold in 1996

As noted in earlier sections of this final report, mail order catalogs do cover a variety of wood products which are adaptable to lessor-known Bolivian species The mail-order catalog markets are also great product distribution channels for products made from custom grades or "characterwood"

Finally, it should be noted that the mail-order catalog market is not only evidenced within the US, but has also a strong presence in other countries throughout the world

- ***Brokers targeting both traditional and characterwood grades***

This takes some survey work and investigation, but it is worth identifying those brokers who have done their homework in tracking market demand for wood products made of characterwood and have targeted appropriate buyers for this purpose Many of these same brokers will also be recognizing the importance of lessor-known species in product applications and can provide valuable buyer-seller assistance in this arena as well

Targeted Species Analysis

For this project, Mater Engineering undertook a complete technical profiles analysis on the four targeted Bolivian species Detailed technical evaluations and product market options based on the technical evaluations are included under the "***Wood Profiles***" tab of this document

This report section will provide discussion on the following

a Technical profiles of the four targeted species,

b Anticipated harvest volumes and grades for the four targeted species based on the new Bolivian Forest Management regime, and

c Product selections per targeted species based on a and b above

a Technical Profile of the Four Targeted Species

Section "***A***" of the "***Wood Profiles***" tab covers the technical, markets, and pricing evaluation for ***Yesquero Blanco*** (*Carinana estrellensis*), Section "***B***" for ***Ochoo*** (*Hura crepitans*), Section "***C***" for ***Cambara*** (*Erisma uncinatum*), and Section "***D***" for ***Murure/Amarella*** (*Clarisia racemosa*) Each of these evaluations includes the following

1) Mechanical properties of the targeted species compared to similar US species,

2) Price comparisons of similar US species,

3) *Mechanical properties of similar tropical species with market acceptance in the US and European markets*

4) *Price comparisons of similar tropical species,*

5) *Recommended product applications of targeted species based on similarity to traditional US woods, and*

6) *Estimated outlook for targeted species if sold as a substitute for traditional US species*

Section "*E*" of the ***Wood Profiles*** tab of this document provides a comparative evaluation of the report's four targeted species with other Bolivian species currently evidencing product market acceptance in both the US and European markets

Based on the results of the wood profiles analysis conducted for this project, ***Figure 11***, attached, provides a graphic illustration of the working properties of the four targeted species compared with both traditional US species and accepted tropical species This type of simplified graphic illustration can be an especially effective tool in the marketing of these Bolivian lessor-known species in both the US and Europe

Based on the results of the general markets evaluation conducted for this project coupled with the findings from the wood profiles analysis, ***Figure 12***, attached, delineates the best product market opportunities for the four targeted Bolivian species *excluding consideration of wood volume availability*

b Anticipated harvest volumes and grades for the four targeted species based on the new Bolivian Forest Management regime

Because of the provisions of the new Forestry Law recently implemented in Bolivia, forest management plans for each intended harvesting site must be submitted and approved by the Bolivian government New criteria increasing the diameter size before harvesting of traditional species coupled with new requirements for the harvesting of lessor-known species have increased the challenges for wood extraction operations and wood processing concerns in the country With no forest management approvals received by the Bolivian government as of December, 1997, ***Figure 13***, attached, represents BOLFOR's best estimate of potential available annual volumes of the species targeted for this project

Figure 11 *A Comparison of Working Properties of U S and Tropical Hardwoods*

★★★★Excellent ★★★Very Good ★★Good ★Fair

Species	Gluing Properties	Machining Properties	Resistance to Splitting	Nail & Screw Holding Ability
Amarella (Clarisia racemosa)	★	★★★	★★	★★★★
Black Walnut	★★	★★★	★	★★★
Hard Maple	★	★★★	★	★★★★
Cambara (Erisma uncinatum)	★★★	★★★★	★★	★★★★
Cherry	★★	★★★★	★★★	★★★
White Oak	★★	★★★★	★★★	★★★★
Soft Maple	★★	★★	★★	★★★★
Yesquera (Carumana estrellensis)	★★★	★★	★★★	★★★★
Ash	★★	★★★	★★★	★★★★
Birch	★	★★★	★	★★★★
Ochoo (Hura crepitans)	★★★	★★★	★★★	★★★
Alder	★★★	★★	★★★	★★★
Red Oak	★★	★★★★	★★★	★★★★
Basswood	★★★	★★	★★★	★★
Robe (Amburana cuerensis)	★★	★★★★	★★	★★★★
Curupau (Anadenanthera macrocarpa)	★	★★★	★	★★★★
Ilchiturique (Aspidosperma cylindrocarpon)	★	★★★★	★★	★★★★
Cuchi (Astronium urundeuva)	★	★★★★	★	★★★★
Verdolago (Terminalia amazonia)	★★	★★★★	★★	★★★★

Figure 12 ***Product Market Opportunities for Targeted Bolivian Species***
July, 1997

Product	*Increased Opportunities*	*Decreased Opportunities*	*Best Bolivian Species Match*
Doors	✓ (Interior, panel-type, French, and patio)		Cambara Amarella (Murure) Yesquero Ochoo
Door Frames		✓ (Move to metal frame)	
Windows & Window Component Parts	✓ (Remodel and repair sector) (Manufactured housing sector)		Ochoo Yesquero
Window Coverings	✓ (Venetian blinds)		Ochoo
Furniture	✓ (Character wood, casual, contemporary & Shaker)		Cambara Ochoo Amarella (Murure) Yesquero
Cabinetry/Shelving	✓		Cambara Amarella (Murure) Yesquero
Flooring	✓		Yesquero Amarella (Murure) Cambara
Coffins/Urns	✓		Ochoo Yesquero Amarella (Murure) Cambara
Moulding	✓ (Architectural, cabinetry)		Ochoo Yesquero

Figure 13 Anticipated Volumes of Targeted Bolivian Species

	Targeted Bolivian Species								
	Cambara			*Ochoo*			*Yesquero Blanco*		
Industrial Areas	*Volume lumber m3*	*No 1 quality me*	*No 2 quality me*	*Volume lumber m3*	*No 1 quality me*	*No. 2 quality me*	*Volume lumber m3*	*No 1 quality me*	*No. 2 quality me*
Taruma	6,837	3,213	3,624	0	0	0	0	0	0
La Chonta	0	0	0	3,069	2,148	921	818	327	491
Lago Rey	3,727	1,751	1,976	0	0	0	0	0	0
Vasber	0	0	0	8,824	6,177	2,647	9,419	4,709	4,710
Lago Verde	0	0	0	2,597	1,818	779	662	463	199
TOTAL m3	10,564	4,964	5,600	14,490	10,143	4,347	10,889	5,499	5,400
TOTAL board feet	4,479,136	2,104,736 47%	2,374,400 53%	6,143,760	4,300,632 70%	1,843,128 30%	4,621,176	2,331,576 50%	2,289,600 50%

Although larger volumes of these targeted species are predicted to be available in the near future, the rather small supply of initially anticipated volumes can prove a limiting factor in moving the species in major commodity markets, and further suggests well-placed emphasis on higher-end product markets where smaller volumes are required, but maximum values can be targeted

c *Product selections per targeted species based on known working properties and anticipated volume availability*

As noted above, smart marketing strategy will be a necessary tool in moving the targeted lessor-known species into international product markets Based on the technical evaluations of the wood species, the anticipated volumes of wood to be made available through government-approved forest management plans, and the results of general markets analysis conducted for this project, the following key *constraints*, *opportunities* and *solutions* are noted

- *Key constraints*

a) At the onset, smaller volumes available per year (although likely to change overtime as more landowners and concession holders get forest management plans approved by the government),

b) Lessor-known, non-traditional species Many product producers throughout the US and Europe are looking at alternatives and species substitutions for the more endangered traditional hardwoods such as teak and mahogany As a result, other tropical hardwood species such as ***roble*** (*amburana caerensis*), ***curupau*** (*anadenanthera macrocarpa*), ***jichuturique*** (*aspidosperma cylindrocarpon*), ***cuchi*** (*astronium urundeuva*), and ***verdolago*** (*buchenavia spp*) are currently gaining market entry These other species may actually serve as competition to market entry for the targeted lesson-known species Further, based on direct interview results, many buyers from North America and Europe harbor incorrect information regarding the actual technical characteristics of these lessor-known species Again, astute marketing strategy will need to be in place to overcome these constraints

c) Technical performance questions for some of the targeted species remain unanswered (especially drying schedules, consistency of quality, etc) Information voids especially regarding appropriate drying schedules for these woods can be a significant barrier to gaining product market entry

d) "Guess"-timates given relative to anticipated lumber grades for the targeted species do not provide reassurances to potential product buyers that adequate supply in lumber grades required will be available and accessible Based on the BOLFOR information provided for this project (see ***Figure 13*** preceding this section), it is estimated that at least 50% of the anticipated volumes for *Cambara*, *Ochoo*, and *Yesquero Blanco* will be of Grade 1 lumber quality (although the accuracy of those estimates should be closely monitored as actual volume comes on line) Unfortunately, no lumber grade data exists for *Murure*, making this a *high-risk* species for product consideration

- *Key Opportunities*

a) The look of the targeted species is excellent for product application As noted in the "*Wood Profiles*" tab of this report, the targeted species do have visual characteristics which make them highly adaptable to value-added product manufacturing and marketing From a visual perspective

* *Yesquero blanco* could serve as a substitute for Northern red oak, beech, birch, or ash The species also has an elegant gray/pink tone which may make it highly preferred as a custom (characterwood) grade material

* *Ochoo* could make an excellent substitute for many popular light-colored hardwoods and softwoods such as aspen, soft maple, cottonwood, basswood, yellow poplar, and western red alder The species also has a blue-grey stain (character) which can be easily marketed as a desirable custom grade characterwood

* *Cambara*, a beautiful wood species resembling Black Cherry and bigleaf maple has small striated pores like oak which will allow this species to become an elegant wood addition to contemporary furniture and flooring markets

* In appearance, *Murure*'s rich golden brown color, fine grain, and smooth surface are remarkably similar to Teak, although harder Its hardness and grain give it excellent machining qualities, and allow for a mirror-like polish It may best be renamed "*Bolivian Teak*" for market acceptance

b) With the working qualities which are known for these targeted species, good comparative values to other tropical and North American traditional species have been done to address the misconceptions that may exist about these lessor-known species

c) Once a working and acknowledged government forest management approval system is fully functional within Bolivia, the system could prove to be a valuable marketing asset to producers

- *Key solutions*

Based on the above constraints and opportunities, the following product foci are recommended

* Target smaller volume - high-end specialty markets and buyers due to smaller volumes being initially offered for sale For all four species, position the wood for value-added wood product production versus commodity production

* Panel products and veneers may be an option for some of the targeted species, but usually require significantly larger volumes to interest market

* Key product markets for the targeted species should be

  a) *Flooring* (characterwood grades in demand both in certified and non-certified markets Allows for multiple lumber grade designations, smaller piece use with less concern over unknown drying schedules, etc)

  b) *Furniture (Indoor)* - (Target styles such as casual, contemporary, and solid wood product producers At the onset while volumes are small, avoid furniture manufacturers that require veneer production along with dimension production from species There are furniture producers that differentiate themselves by offering only solid wood product),

  c) *Lawn and garden products* (including outdoor furniture, other garden products such as garden sheds, trellis and arbor designs matched with new fencing products for the DIY markets)

  d) *Specialty interior and patio door designs* (paying attention to higher-end unique custom designs and specialty sizes which can be both *reactive* to broker demand for product, but also *proactive* in innovative new designs to capture market demand)

  e) *Wood venetian blinds* (with supply problems surrounding access to basswood volumes in North America, *Ochoo* may be particularly well-suited as an attractive substitute species for this specialty market)

  f) *Miscellaneous products* (including products which now utilize the largest volume of hardwood lumber purchased annually in the US Includes products such as caskets, picture frames, dowels, toys, sporting goods, and musical instruments)

Manufacturing Needs and Considerations

As a component of this project Mater Engineering personnel visited wood processing operations in and around the Santa Cruz area in 1997 to

* Observe general production practices, capabilities, and capacities,

* Observe the production of some of these lessor-known species to determine wood workability, constraints, and the quality of the products that are currently from these lessor-known species,

* Evaluate production technology, capacity, and possible opportunities for improved product design and manufacturing targeted for the lessor-known species,

* Evaluate industrial flow and safety practices employed in product manufacturing which could have a direct impact on capturing product marketing opportunities and constraints, and

* Ascertain the willingness of producers to consider new marketing opportunities which may be able to be generated from the manufacturing of *certified* and "*characterwood*" products

The site visits primarily concentrated on secondary processing plants in the Santa Cruz area with little opportunity to observe any primary production However, when possible rough cut, green lumber was examined at each of the plants to determine the quality of the starting product for the value-add operations Based on these in-field evaluations, coupled with a review of existing technical reports provided for review by BOLFOR, the following added observations and follow-on recommendations are provided for consideration

Observations:

Opportunities

1) ***Good, hard-working laborforce***

The on-sites visits to wood products operations by Mater Engineering personnel proved most helpful in observing the commitment and work habits of the laborforce Without exception, the workforce within these production operations consistently appeared hard-working and dedicated to carrying out the production tasks directed to them by supervisory personnel This type of a workforce is an added benefit when looking at implementing operational changes in production such as increasing industrial flow efficiencies and implementing improved safety practices within production (see ***Recommendations*** discussion below for further details)

2) ***Willingness of production managers to learn new techniques which will help them increase their market penetration***

Similar to observations noted for the workforce, mill supervision and those involved in production management appeared open to new techniques for increasing internal product flow efficiencies The managers appeared also keenly interested in learning product differentiation techniques and new product designs which would help them increase market penetration of their products It was also clear from discussions with these production managers that the advent of the new Forestry Law in Bolivia was being taken quite seriously, with many indicating major concerns over not being able to quickly adapt to new regulations set in place

3) ***CADEX appears to bring a strong, professional, viable association focus to the wood products industry which will grow in value and function***

The level of strong affiliation and servicing that CADEX brings to the forest products industry in Bolivia was clearly evident This last year, the association played a critical role in helping to bring European and American wood product brokers and buyers into Bolivia to meet with product producers As such, CADEX should continue to play a leading role in identifying and helping to implement product marketing and export solutions to an industry undergoing change both in volume and species use in offered products (see ***Recommendations*** discussion below for further details)

Constraints

1) ***Observed quality of rough cut lumber could be improved to meet market demand Observed examples included***

- Significant amount of thickness variation within and between boards
- Side-to-side variations in thickness,
- Significant amount of saw marks and cutting defects observed,
- Handling damage observed in the stacks,
- Stain and sun damage observed

2) ***Existing drying procedures and systems could restrict or hinder offshore buyer interest in contracting with Bolivian operations due to***

- Dry kiln designs in general are inadequate for efficient, consistent quality lumber production,
- Loading and unloading procedures are inefficient and slow,
- Quality control procedures are inadequate

3) ***Many of the processing operations observed had inadequate facilities to protect the quality of the rough cut wood to the finished products***

- Much of the lumber was exposed to the sun and weather,
- Green lumber was stored un-stickered and exposed to the weather,
- Dried lumber was stored partially exposed to weather or in the sun,
- Mill yards are unpaved and muddy resulting in dirt on green, dry, and finished lumber

4) *Inefficient industrial flow patterns may restrict or hinder offshore buyer interest in contracting with Bolivian operations due to*

- Significant amount of unnecessary handling of material and components which leads to increased production time and costs,

- Inefficient utilization of labor It was often observed that 4 or 5 people were performing a job 1 or 2 people could adequately perform Workers appeared willing and capable, but appeared to lack direction

- Often observed the wrong type of tool being used to perform an operation such as using a chain saw to rough cut components out of a board for furniture or door manufacturing

5) *Inefficient material utilization*

- Little thought given to inventory organization around end utilization this one factor not only dramatically impacts wood use and recovery capabilities within and operation, but will also be a critical evaluation factor for gaining chain-of-custody certification should operations elect to work with certified wood

- Wood cut decisions were often based on individual piece needs at the time, not on best utilization of board

- Very high wood waste factor noted throughout the in-field evaluation

6) *Training of workers and supervisors needs improvement*

- Inefficient use of manpower and material
- Lack of safety awareness
- Very little preventative maintenance observed

7) *Inadequate saw and knife sharpening and grinding*

It was both observed by Mater Engineering personnel and stated by several of the operators interviewed that keeping saws sharp and knives properly ground was a constant problem Inadequate saw and knife sharpening and grinding results in poor quality and/or extra steps to achieve finishes acceptable to markets

Recommendations

Rough, Green Production

Discussions with operators indicated that much of the problem in rough, green production stemmed from an industry that was switching from relatively soft and valuable Mahogany which could be cut quickly and easily on the band sawmills in the country to much harder species These harder species are much more difficult to cut and significantly reduce the production rates for the existing sawmills As a result of this change the following is recommended

1) *Examine different sawing techniques for the harder species*

   Even though, generally, circular saws are not used in the area consideration should be given to using large circular saws for initial breakdown of these harder species The advantages of circular saws include

   - Ease of maintenance in remote areas,
   - Faster cutting than band saws,
   - Greater dimensional accuracy which will allow closer sawing targets for the boards off-setting any lose from the greater kerf,
   - More flexibility in quarter sawing for vertical grain recovery

2) *As an alternative to circular saws, larger, heavy duty bandmills could be used* However, these require greater maintenance and result in larger kerfs than most of the bandmills currently being used

3) *Consideration should be given to providing less final green cutting in the field* Flitches and cants could be cut efficiently in the field at the sawmills These could then be brought to locations closed to the end users of the material and remanufactured on higher technology rip and re-saws The advantages of this process include

   - Greater quality control
   - Less time from the cut to drying
   - Higher tech machinery would result in less waste
   - Greater maintenance is available near the larger cities
   - Greater control over custom cutting and grading of lumber
   - Better opportunity for short and custom grade recovery

4) ***Conversely, where the remote sawmills have access to needed maintenance and skilled crews, consideration should be given to providing pre-drying facilities for the lumber*** Lumber would be dried in kilns to approximately 20% to 30% Finish drying would take place at the remanufacturing location This would have several advantages

- Reduction in stain from wet lumber storage and transportation
- Less weight to ship from remote locations
- If the kilns were wood fired, they would provide a use for sawdust and slabs at the mill sites
- Less drying time and therefor capacity would be required at the remanufacturing site
- Pre-drying only requires less quality control than finish drying

Remanufacturing and Value-Added

Facilities for remanufacturing and value-add production ranged from minimal to sophisticated However, with very few exceptions, the greatest need for improvement was with *manpower* and *material utilization* The majority of the problems are not unusual in the industry worldwide and can be addressed through training of management, supervisors, and workers, and application of some new technologies specifically focused on the problem areas Mater Engineering recommends the following for consideration

- Establishment of a CADEX ***Technical Training Center***,
- Establishment of a ***Materials Production and Finishing Center***,
- Consideration of new technologies purchases

1) ***Consider establishing a Technical Training Center housed/administered by CADEX***

Key areas of concentration would be operational safety and industrial flow training

- *Operational safety*

During the in-field evaluations conducted by Mater Engineering, numerous operations were observed to place workers at risk of life and limb Safety programs are not necessarily intrusive to the operations and can actually be designed to *improve production* through paying attention to difficult and dangerous operations

This reduced worker safety can directly impact Bolivia's ability to enter offshore product market arenas During the November, 1997 visitation of European and American wood product buyers to the Santa Cruz area, wholesalers and buyers more than once noted *both verbally and in follow-up written documentation* their concern over worker safety in the milling operations they visited

A general safety consciousness must be raised in the industry

- *Industrial flow production training*

  As noted above, aside from improvements in baseline machinery which should be considered by Bolivian wood product producers, concentrating on improvements in industrial flow efficiencies may be the first priority for consideration which is likely to result in immediate improvements CADEX may be the best industry organization to initiate this effort in training *in-country specialists* in industrial flow efficiencies who can continue on-going training to producers and designated mill personnel The added training from a credible source such as CADEX is also likely to have immediate positive market visibility from buyers who are evaluating whether manufacturers are capable of meeting product volume requirements in a timely fashion (an area that has been highly criticized by offshore buyers in the past)

2) ***Consider establishing a Materials Production and Finishing Center catering to the needs of both producers and buyers***

Separate from the typical functions of a technical materials testing lab, a Materials Production and Finishing Center would specifically address the needs of potential product buyers, while conducting "hands-on" production processing tests for in-country producers Specific needs to be addressed by such a Center would include

- *For Potential Offshore Product Buyers*

  a) The ability to see first hand the *machinability* of Bolivian wood species in a smaller-scale "hands-on" setting without having to locate producers who may be doing production runs of the types of variations a buyer may want to see in order to ascertain interest in species substitution in products For example, a producer may wish to see how Murure looks and feels as a turned dowel as well as evaluate the wood's potential for architectural millwork Finding a producer in the Santa Cruz area that 1) works with Murure and 2) produces multiple product lines to service a buyers needs may prove challenging A Materials Production and Finishing Center could address this concern

  b) Product finishing relative to the ability of wood species to take paint and stain is a significant consideration for buyers looking at transitioning from traditional species use to substitute species use For the same reasons as identified in a) above, having a Center which allows for finishing tests on multiple Bolivian species, along with displays of finished product may facilitate more expeditious dialogue between producers and buyers

The development of such a Center not only serves a practical technical purpose, but again sends a clear message to product buyers that Bolivian producers are serious about global market entry for their lessor-known species

- *For In-Country Product Manufacturers*

  Bolivian producers are also needing more hands-on information relative to the working characteristics of these lessor-known species With the passage of the New Forestry Law, the need to gain better insight into the product development potential for these LKS is immediate Such a Center could also serve as an important service to in-country producers

3) ***Consider establishing a centralized saw filing and grinding center***

In many countries, private companies provide saw filing and knife grinding for multiple remanufacturing operations This allows for enough business to afford the modern equipment and training required to do an adequate job for the industry In other areas, multiple companies or organizations work together to set up a centralized saw filing and knife grinding facility Either way it is important that the individuals performing the service be adequately trained in both the operation of the machinery and the theories behind wood working They need to have enough understanding of the different types of wood they are processing to assist manufactures in developing their products and obtaining the optimum use of the machine tools they have This is especially true with the denser woods manufacturers in Bolivia will be working with in more volume in the future as a result of the New Forestry Law

4) ***Consider purchasing new technologies which are particularly focused on value-added production and wood waste utilization, and can be cost-effective for smaller-scale application***

With the level of wood waste evidenced in production facilities throughout the Santa Cruz area, combined with the acceptance of composite, fingerjointed, and edge/end-glued products in the global marketplace, Mater Engineering recommends consideration of the following new technologies

- *Wood Fiber Waste Conversion* (***Sorbilite***)
- *Wood Scrap Recovery Systems* (***Yield Pro***)
- *Wood Trim Ends Drying* (***Trim Block Dry Rack***)
- ***Soybean-Based Adhesives***

A discussion of each technology (product) recommended follows

a ***Wood Fiber Waste Conversion (Sorbilite)***

Although being addressed by technological advances for large scale wood product producers, identifying cost-effective, efficient technologies that focus on fiber wood waste conversion for small-scale product manufacturers lacks focused visibility for many regions throughout the world

Conversion of wood fiber (sawdust, chips, trim ends and shorts, etc) into composite products has been a valued and growing technology in the wood products industry during the last decade Composite board production, in particular, has experienced substantial growth especially with the improvements and growing markets for medium density fiberboard (MDF) and oriented strand board (OSB) What has been consistently lacking in this area has been appropriately sized and priced composite product technology that adapts to smaller-scale production, while allowing for increased value-added processing *Sorbilite* technology has been introduced in Europe and marketed in other regions throughout the world (almost 70% of the existing customer base is in South America and Asia)

The Sorbilite composite molding system was designed to provide cost effective, efficient compression molding technology which is particularly adaptive to smaller-scale use, and provide the ability to produce a high-quality composite product using lower volume wood fiber waste

As such, the Sorbilite system offers substantial benefits to the environment by

- Utilizing wood fibers which might normally be chipped or landfilled, and converts that fiber into a high value-added product,
- Creating additional fulltime, family-wage jobs for rural communities,
- Converting wood waste from existing processed material into valuable product rather than requiring more resource to be harvested from the forest, and
- Adapting to smaller-scale production by allowing for as small as 1 pound of fiber to be processed into value-added product at any given time

The system utilizes substantially less energy in production than other composite board production technology and can manufacture compressed molded products that apply to a variety of value-added product sectors, many of which are currently being produced in the Santa Cruz area from the targeted lessor-known species

- casket production
- upholstered furniture parts
- full-sized raised panel doors
- decorative molding

- building parts
- floor tiles
- cabinet doors
- chair parts
- fireplace mantles
- toys
- frames and wall plaques

Specific performance benefits generated by the Sorbilite system are many

1) The Sorbilite compression molding process allows for a combination of fibrous material in product development Along with wood fiber, as an example, other materials such as carpet fibers, paper, and peanut shells can all be added to a special bonding agent to create products that are as strong and dense as wood, but cost less to produce

2) The Sorbilite Membrane Press generates intense, even pressure up to 725 psi The vertical pressing power is five times greater than any competitive machine currently on the market with low operating cost with a 3 5 hp motor The press weighs only a fraction of most competing machines, so no special building preparations or excavation is required

3) Estimated calculations for composite product manufactured by the Sorbilite process illustrate keen profit advantages Using cabinet door production as an illustration, ***Figure 14***, attached, illustrates a gross profit per door produced of $2 85 US, with a daily gross profit of $7,900 US

   Additional cost comparisons provide further illustration of the economic benefit using the Sorbilite process To manufacture a wood back for a secretary chair, plywood costs about 90 US cents per chair The Sorbilite process can mold the chair back for about 30 cents US

   With an estimated upfront purchase price of approximately $350,000 US, payback on investment appears to be between 12 to 30 months, depending on the volume and products being produced, and location to markets This is a substantial difference when comparing the millions of dollars required to be expended in order to purchase traditional composite panel production equipment

4) Mechanical characteristics of the Sorbilite product, when compared to other traditional panel products such as particleboard, receive high marks across the board Compared to particleboard, Sorbilite molded product is almost 3 times as hard and out-performs particleboard in holding screws by approximately 45%

Figure 14 Sorbilite Profit Calculation (1995 Values)

Production Capabilities *For 12"x15" (1 25 sq ft.) cabinet doors (two sides); and assuming a total raw materials cost of $1 87 per sq ft.*	
Press time	2 minutes
Doors per press cycle	15
Doors per hour	400
Doors per 7 hour day	2,800
Labor	4 men at $10 00 per hour 10¢ per door
Overhead, energy, etc Total cost with the Sorbilite Membrane Press	25¢ per door
Estimated sale price per sq ft	$4 50
Gross profit per door	**$2 85**
Gross profit per day	**$7,900**

5) The Sorbilite process uses chemical bonding of the fiber combined within compression pressure (up to 2,000 tons), rather than cooking the entire product to create the compressed molding products Conventional press technology usually heats or cooks the entire panel during processing to activate the bonding agent mixed with the fibers As a result, the Sorbilite process saves energy during product processing

6) The Sorbilite process emits very little steam or noxious gas during processing Additionally, the small compact systems can be located where fibrous waste is created, a real advantage in helping to serve many rural and isolated parts of the world

7) The process allows for use of wet wood fiber (up to 50% moisture content), unlike traditional compression technology that requires 8% or less moisture content

Sorbilite
5721 Bayside Road
Virginia Beach, Virginia 23455
Tel (757) 464-3564
Fax (757) 464-6959

b ***Wood Scrap Recovery Systems (Yield Pro)***

From *garbage* to *gold* recovery and use of wood residue and scraps resulting from traditional wood processing is nothing new to the industry, but technologies which effectively and affordably combine scrap recovery process options matched with the ability to process smaller pieces is new and deserves focus in this technical note One such technology is being manufactured by Auburn Machinery located in Auburn, Maine, USA, which may hold dramatic opportunities for the very large volume of trim ends and shorts evidenced in wood processing operations throughout the Santa Cruz area Through the design and manufacture of a series of ***Yield Pro*** machines, machinery processing choices include

- ***Yield Pro - 2*** 2-head machine to handle materials with a flat bottom face and one good straight edge Used for ripsaw edgings, short cut-off blocks, mis-machined components, etc

- ***Yield Pro - 3*** 3-head machine to handle materials with a flat bottom face Used for mill slabs along with edgings, cut-off blocks, mis-machined components, etc

- ***Yield Pro - 4*** 4-head machine to handle materials with a flat bottom face and one good straight edge Used for ripsaw edgings, short cut-off blocks, mis-machined components, etc

Even with strong emphasis on raw resource maximization and value-added focus in today's forest products industry, many operations visited in the Santa Cruz area still treat wood trim ends, lumber shorts, lumber jackets, edgings, mis-machined material, and low grade or defect cuts as scrap material to be chipped, burned, landfilled, etc As a rule of thumb, a good way of evaluating good waste recovery in an operation is to spot-check the outfeed system feeding the wood waste pile or hog to see how much "valuable" scrap is ending up as waste material Very little, if any, technology is employed in the Santa Cruz area which improves scrap recovery within operations Limiting factors in existing technology tend to be a lack of *single-pass* processing of lumber slabs and short wood pieces, and a lack of ability to process shorter-length wood waste material

The Auburn system has been uniquely designed to address some of these technical constraints by

1) Converting both softwood and hardwood material to valuable resource which can be utilized in value-added wood product production,

2) Targeting a more cost-effective single-pass process especially adapted to difficult process material such as lumber slabs odd-shaped pieces, and trim ends and shorts,

3) Accomplishing the above with adaptable technology that can

   - accommodate hand-infeed as well as automatic infeed,
   - accommodate both wet and dry wood processing , and
   - accommodate multiple feed rate options for wood infeed handling

4) Combining scrap recovery processing with new innovative small wood piece drying to address major technology needed in the industry worldwide, and

5) Creating an environmentally-responsible technology which creates a higher return on value from every tree cut

The ***Yield Pro*** line accomplishes its objectives by providing a technical option for both large and small-scale producers to convert

   * Random short cut-off blocks to uniform fingerjoint blanks,
   * Ripsaw edgings to moulding blanks and glue blocks,
   * Edger strips to kiln sticks and grade stakes,
   * Mis-machined parts to usable materials,
   * Live-edge squares into smaller-edged units, and
   * High defect material to pallet stock and crating parts

The process technology also allows more value-added product made with existing harvested resource and more value-added jobs to be created in the region where wood resource extraction occurs

Specific examples of processing performance include

- Machining a 1 1/2" reject square due to severe wane down to a useable 1" dimension piece in only one pass
- Converting a debarked softwood slab destined for the chipper ($35 00/mbf US chip value), to a machined 1" by 4" joint blank valued at approximately $750/mbf US
- Converting single and double live-edged boards into valuable component parts
- Converting an assortment of "waste" trim ends and wood shorts into valuable blocks used in fingerjointed lumber

The ***Yield-Pro*** sestina handles multiple wood scrap sizes with thickness capacity at 1/2" to 2", width capacity at 3/4" to 6", and shortest piece for through-feed at 6" The process handles both wet wood and dry wood scraps, and has variable operating speed performances of 20 lf/min for manual feed and 100 lf/min for speed feed

Effective marketing of the technology is contingent upon development of new technology to allow for effective, affordable drying of wet lumber trim ends and shorts Auburn has now teamed up with the developers of that technology for full product service offering (see below for discussion of *Trim Block Drying Rack* system)

Primary wood product producers in the US considering purchase of the technology were contacted during this project to ascertain their projections on calculated waste recovery in their operations using the Auburn scrap recovery system Manufacturers estimated a total percentage added recovery of 8% volume, with 2% of that recovered volume coming from slab recovery alone A maximum two-year return on investment was projected, with initial capital investment costs ranging from $60,000 to $100,000 for complete system purchase

The technology is well adapted to both use in primary production mills as well as secondary wood processing operations

Auburn Machinery, Inc
P O Box 3065
Auburn, Maine 04212
Tel (207) 784-4244

c *Wood Trim Ends Drying (Trim Block Dry Rack)*

Designed and manufactured by State of Oregon-based company called Carter and Sprague, specialists in the design and development of thermal products for the forest products industry, the Trim Block Drying Rack system provides a solution to the long-standing problem of how to dry wood trim ends and shorts for conversion into value-added products

The new Trim Block Drying Rack system facilitates bottom-line driven yet environmentally-appropriate change in production behavior and practice Combined with effective scrap recovery processing equipment (see section above), and existing and new fingerjointing technology, industry no longer needs to treat green (wet not dried) trim ends and shorts as wood waste

Specific technical objectives for this new technology included the ability to

1) Convert wood waste into resource for value-added wood product,

2) Create more full-time family wage jobs in area closest to where timber is extracted,

3) Make more product using equal or less volume of resource,

4) Have a drying technology that was adaptive for use in both hardwoods and softwoods mills,

5) Reduce energy consumption during the wood drying time, but provide uniform drying capability throughout the wood load,

6) Reduce defect resulting during the dry time, and

7) Have a system that was easy to physically handle in storing, loading, and unloading conditions

Completed test results conducted on the Trim Block Dry Rack system support manufacturer claims

1) The system was successfully tested on selected US softwood commodity lumber trim ends, resulting in reduced moisture contents down to 19% to 7% mc,

2) Current testing is being finalized for selected hardwoods,

3) Reduced labor costs over a non-rack method for drying of trim ends and shorts were demonstrated,

4) Elimination of kiln sticks and sticker stain on wood resulting in less defect in dried material was documented,

5) Quality of drying was improved due to increased "air-to-board" contact and reduced moisture removal from ends (due to end-to-end layout),

6) Less energy was used to dry boards due to more "air-to-board" contact and hollow aluminum support structure increasing uniform heat transfer through full load, and

7) The system was easy to store, load, and unload

In order to gage the importance of the trim block dry rack, it is necessary to estimate what the *lost opportunity* is in both hardwoods and softwood manufacturing without employing the new technology For standard ***hardwood*** mills, the calculated total recovered net value per year when employing the Trim Block Dry Rack system is over $500,000, as shown in ***Figure* 15**, below

Figure 15 ***<u>Hardwood</u> Net Recovered Value for Wood Waste Conversion to F/J Stock***

1) Assume 10 mmbf/annual production

2) Rough green trim ends = 5% of total production or 500 mmbf/yr

3) 100% of that rough green trim end volume can be converted into fingerjoint stock

4) Calculation assumptions

• Sales value of F/J stock	=	$1,250/mbf
• Labor to load	=	$65/mbf
• Drying cost	=	$40/mbf
• Softwood chip value	=	$50/mbf

5) Calculated recovered net value using the Trim Block

• Sales value of F/J	=	$625,200
• Less chip value	=	($25,000)
• Less cost to recover and dry	=	($52,500)
Total Recovered Net Value	=	**$547,500**

Wood producers who had recently purchased the Trim Block Dry Rack system were interviewed regarding their estimated recovery rates, return on investments, increased job generation, and added wood product volume based on recovered waste One softwood manufacturer processing approximately 60 million board feet of lumber annually provided the following data

- Projected annual increase in wood volume production is estimated at 3 6 million board feet as a result of the Trim Block Dry Rack installation,
- The operation would go from a one-shift production to a two-shift operation with a 20% increase in total manpower,
- With their ability to effectively dry trim block, the operation would not only convert their own waste into valued product but be able to purchase green and partially-dried trim ends and shorts from surrounding wood processing operations in the area for processing
- The investment made in the purchase of the Trim Block Dry Racks would be easily recouped during year 1

Carter and Sprague
P O Box 6206
Beaverton, Oregon 97007
Tel (503) 848-8478
Fax (503) 848-9508

d Soybean-Based Adhesive Technology

The ability to join pieces of wood together in a fingerjoint fashion has been developing in the wood products industry during the last decade The benefits of employing fingerjointing in operations have been touched on in both the scrap recovery and trim block dry rack sections of this technical note Aside from the environmental benefits to engaging in waste recovery practices in wood products operations, the specific financial benefits for producing fingerjointed blocks or lumber are quite convincing for both hardwood and softwood operations, as noted in ***Figure 16***, attached

Market demand for fingerjointed products is evidenced in many products - most particularly paint grade clears for mouldings, facing, etc , door and window parts, to include paint grade clears and core stock materials, vertical use only studs, and (in development) full structural rated products, i e truss cords, floor joist, and other horizontal or tension loading uses

Figure 16 Fingerjoint Technology Conversion Table

For Hardwoods: *Item*	*$/unit (mbf)*	*% Value Increase/unit from next lowest value*
Boiler Fuel	$12/ton or $24/ton	baseline
Paper Chips	$25/ton or $50/mbf	+108%
Mulch	$54/ton or $108/mbf (limited species)	+116%
Pallet Stock	$200/mbf	+85%
Block for fingerjoint	$500/mbf	+150%
Fingerjointed hardwood moulding blanks	$1,350/mbf (poplar)	+170%

Fingerjointed material is clearly capturing commanding market share in targeted products - especially moulding and millwork products Some producers report up to 30% premiums paid for fingerjointed product (Reported dollar values for premiums paid range from a few dollars/mbf up to $50/mbf)

From a product buyer perspective, purchasing fingerjointed material over solid wood product provides several benefits Most noted is the ability of fingerjointed material to maintain dimensional integrity when stored Because of long continuous grain structures, solid lumber tends to cup and warp when "yarded" over time Export customers in Japan have experienced as much as 32% yard loss due to cupping and warping Fingerjointed material has significantly higher performance in this area, with average yard loss of only 3%-4%

Although fingerjointing is not an emerging technology, several adhesive applications that allow for fingerjointing of wood are new Of particular interest and importance to Bolivian species may be a new soybean-based adhesive just recently introduced in the US

Developed through a joint effort sponsored by the United Soybean Board, a new soy-based adhesive targeted for the wood fingerjoint industry was announced in 1996

Documented benefits for employing this adhesive product include

- The process was introduced to the market in September, 1996 through a joint effort between Weyerhaeuser and the United Soybean Board,
- Successful testing has been completed on multiple North America softwood species,
- Successful testing has been completed on species exceeding 150% mc,
- Requires no high-technology equipment or electricity Glue can be applied by hand with brush, end pressure can be applied by simple lever action or even with a sledge hammer (benefit to under-developed countries)
- Purported cost savings over other wet fingerjointing technologies is fairly significant

Constraints associated with the use of this adhesive application process include the fact that it can't be used with standard fingerjointing technology but must have new technology adapted for "honeymoon" application

Omni Tech International
2715 Ashman Street
Midland, Michigan, USA
Tel (517) 631-3377 (x304)
Fax (517) 631-7360

Specific and Long-Term Marketing Strategies
The 11-11 Bolivian Plan

Based on the markets research findings determined for this project, Mater Engineering recommends a two-prong marketing strategy plan for Bolivia Dubbed the ***11-11 Bolivian Plan***, the two-prongs each contain eleven (11) key actions for implementation

- ***Prong 1*** An 11-point specific marketing strategy to address market entry opportunities and constraints for the four targeted species evaluated in this report, and
- ***Prong 2*** An 11-point long-term overall marketing strategy plan to address the overall issues for the Bolivian forestry and forest products industries

Proposed details of each prong are discussed below

Specific Strategies for Targeted Species

To effectively introduce the four targeted species into products sold in North American and European markets, Mater Engineering suggests implementation of the following eleven-point strategy plan The 11-point action plan identified below recognizes both the constraints and opportunities discussed in earlier sections of this report, coupled with the direct interview input of potential American and European buyers obtained by Mater Engineering personnel for this report

1 ***Target your audience, then tell your story***

For Bolivian wood product producers, the new Forestry Law may prove a uniquely positive marketing tool for successfully marketing wood products made from the targeted lessor-known species There is a growing number of well-heeled financial investment groups and wood products buying organizations in the US and Europe who are beginning to make investment and buying decisions focused on sustainable forestry and sustainable forest products manufacturing They need to be exposed to *The Bolivian story* You can accomplish this by initiating a series of ***article coverage*** in traditional wood products trade journals in the U S and Europe detailing the story of the new Forestry Law in Bolivia and the focus on application of the four lessor-known species in product development The story is an interesting and important one, and the readership for well-targeted trade journals reaches exactly those wood product *producers* who should be targeted for sales potential Rather than relying on brokers to initiate dialogue with producers on lessor-known species, this type of published information directly targeted to producers is may more likely to result in faster response times for achieving interest and negotiated contracts Trade journals recommended by Mater Engineering for this effort based on wood product manufacturer/broker readership in the U S and the U K are as follows

- *Furniture Design and Manufacturing*
  Publisher Cahners Publishing Co
  P O Box 7500
  Highlands Ranch, Colorado, USA
  80216-2329

- *Wood Technology*
  Publisher Miller-Freeman Inc
  600 Harrison Street
  San Francisco, California, USA
  94107

- *Wood Digest*
  Publisher Cygnus Publishing Co
  Johnson Hill Press Division
  1233 Janesville Avenue
  Fort Atkinson, Wisconsin, USA
  53538

- *Timber Processing*
- Publisher Hatton-Brown Publishers Inc
  225 Hanrick Street
  Montgomery, Alabama, USA
  36104

- *Custom Woodworking Business*
  Publisher Vance Publishing Corp
  400 Knightsbridge Parkway
  Lincolnshire, Illinois, USA
  60069

- *CabinetMaker*
  Publisher Cahners Publishing Co
  Division of Reed Publishing
  455 N Cityfront Plaza Drive
  Chicago, Illinois, USA
  60611-5503

- *Wood and Wood products*
  Publisher Vance Publishing Corp
  400 Knightsbridge Parkway
  Lincolnshire, Illinois, USA
  60069

- *Timber Trade Journal (TTJ)*
  Publisher Miller-Freeman Corp
  Royal Sovereign House
  40 Beresford Street
  London SE 186BQ

These publications are perfect venues for correcting misinformation surrounding Bolivian lesser-known species and provide fast information access to producers interested in the technical profiles and working characteristics of these species

For reasons similar to those referenced above for the forest products industry, targeting publications and trade journals for the *investment and banking* community in the US and throughout Europe is also worth strong consideration As a result of this project, for example, Mater Engineering has learned of interest from major international and investment companies who have indicated a direct interest in evaluating Bolivian forest products projects for investment purposes In part, the interest has been generated as a result of anticipated changing forest management practices in the country which better reflect sustainable forest management harvest regimes *Investment and banking* trade journals in North America and Europe recommended for this effort which accept freelance articles include

- *Export Today*
  Publisher Trade Communications, Inc
  733 15th St , N W
  Suite 1100
  Washington, D C 20005
  Tel (202) 737-1060
  Fax (202) 783-5966

- *Business Front*
  Publisher The Publisher's Group
  P O Box 510366
  Salt Lake City, Utah 84151-0366
  Fax (801) 322-1098

- ***Business Week***
  Publisher The McGraw Hill Companies
  1221 Avenue of the Americas
  New York, New York 10020

- ***Profit, Investor Portfolio***
  Publisher Profit Publications, Inc
  69-730 Highway 111
  Suite 102
  Rancho Mirage, California
  Tel (619) 202-1555
  Fax (619) 202-1544

- ***Smart Money Wall Street Journal Magazine of Personal Business***
  Publisher Christopher L Lambiase
  1755 Broadway, 4th Floor
  New York, New York 10019
  Tel (212) 492-1300
  Fax (212) 245-7276

2 ***Initiate mechanical testing of targeted wood species to American Society for Testing and Materials Standard (ASTM) D 2555-70***

Of the four targeted species evaluated for this project, only *Cambara* had complete ASTM testing conducted which can be directly used in communicating likely *consistent working characteristics* of the wood species to potential American and European product buyers *Ochoo*, *Yesquero Blanco,* and *Murure* all had some elements of ASTM testing, but not of a comprehensive overview to qualify for meeting ASTM standard methods for establishing clear wood values The lack of application of a uniform, widely-recognized testing standard, such as ASTM, for documenting the technical characteristics of these lessor-known species will continue to be a constraint to market access, and will continue to weaken the power of the Bolivian story to be told (see "1" above)

3 ***Develop good "sound-bites" for technical information***

Even missing the uniform testing methods, Bolivian product producers and trade associations need to recognize the importance of reducing the working characteristics information of the targeted lessor-known species down to "*three-second sound-bites, with memory* " This phrase accurately depicts how American consumers *absorb* and *remember* product information that influences their

buying decisions The product advertisement must *capture the attention* of the consumer in three seconds or less, and must be presented in such a format (usually graphic) that allows the consumer to *remember* the information after the ad is out of their view It is an advertising formula equally effective in marketing to wood product buyers While potential product buyers may have a difficult time translating and remembering numerical information on the modulus of elasticity (MOE) or modulus of rupture (MOR) of *Cambara*, they are more inclined to remember that the species has the same excellent (four-star) machining properties as American Cherry, White Oak, and Soft Maple, as depicted in the *Working Properties Graph* (***Figure 11***) presented earlier in this report These simple, graphic tools of *information transfer* can be very effective in opening up lines of communication and purchase interest from investors and product buyers, and can be used to quickly dispel misinformation surrounding Bolivian hardwoods (i e *"too dense to dry"*, *"too difficult to cut"*) They are also effective pieces of information which can be easily copied and shared between brokers, buyers, and sellers

4 Create specialty species names

Similar to the effort of creating a simple, graphic illustration or "memory" of what Bolivian species are like, the strategy of linking Bolivian species to American or European species can be a smart move *Bolivian basswood* or *Bolivian beech* (gray-stain grade) to represent *Ochoo*, or *Bolivian cherry* to represent *Cambara* are examples of the important visual marketing *"links"* which help to establish the species in market structures This strategy also works well when issues of species quality are noted in the marketplace American hardwood resource suppliers may document effectively that there is more hardwood growing in the US today than ever before What the statement misses is the discussion of the volume of *quality* (higher grade) resource available for use in product development Bolivian suppliers can take advantage of this species grade offering difference when marketing *Bolivian basswood* for American basswood in short supply, or *Bolivian Cherry* to replace the diminishing supply of high quality Northern Cherry The subtle differences in this market positioning also speaks to the need for establishing a North American marketing specialist for Bolivia to track and monitor these market differences and modify strategy to meet consumer and industry demand (see *"**Long-Term Strategy***" section, below for discussion)

5 Create custom or specialty grades

As noted earlier in this report, focus and concentration on the value of creating custom or specialty grades which take advantage of market demand for wood products manufactured from "characterwood" deserve immediate attention by Bolivian producers The notable gray-blue stain grade evidenced in Ochoo is but one example of the potential to sell the character stain as an attractive custom grade for furniture producers It also speaks to the need to produce finished product (product ready for consumer use) Custom grade development may work best through Bolivian producers creating a ***finished*** vs *component* or *commodity* product for sale Rationale for focus on this ***finished*** product strategy rests with the understanding that while custom grades hold market potential, the pass-back on profit for desirable *"characterwood"* based on custom

grade offering versus lower grade can be lost to the supplier of the commodity or component producer in lieu of the broker capturing the full price premium Producing a finished product can provide closer access to negotiated contracts with finished wood product producers and end-use product buyers such as those found in the mail-order catalog business This can reduce the risk of lost profit opportunity for targeted wood products that prefer custom grades in wood

6 ***Evaluate in-field anti-staining applications targeted to certain species***

Because there will always be good markets for clear grades of wood, technically evaluating cost-effective in-field options to prevent the onset of wood defect in certain species may also be a prudent move for the Bolivian forest products sector From a visual perspective, clear grades of *Ochoo*, for example, can move into well-established basswood, alder, and aspen product markets in the US, Asia, and Europe This does suggest that tracking on effective, low-cost anti-stain methods to prevent staining after harvest can also produce good product market opportunities The key is to recognize the full market value in both "characterwood" and "clear" options, and to maximize the cost/benefit relationship in each

7 ***Rely on a <u>product</u> model versus <u>lumber</u> model to sell the species***

Gaining access to product markets with alternative species requires keen attention to the full range of product development options which can be applied to the alternative species Buyers looking to evaluate *species substitutions* for product development will want to view the workability of the alternative wood species beyond a commodity (lumber) format To observe *Cambara* conversion to lumber or flooring material is one thing To see the adaptability of *Cambara* to furniture turnings, veneer, and architectural moulding - in addition to lumber and flooring product - is quite another thing For this reason, a ***Materials Production and Finishing Center*** has been recommended to be established in Santa Cruz (see "***Remanufacturing and Value-Added***" recommendations covered in this report)

8 ***Pay attention to the value ($) of good "business basics"***

For the potential wood product buyer, gaining assurances relative to the *consistency, quality*, and *delivery timeliness* of the wood and product supply is important in reducing what are already considered as *high-risk factors* for doing business in Bolivia Recent surveys of American lumber buyers confirm that assurances and risk-reduction measures in these business basics can, indeed, produce profitable results to the product supplier Consider the additional amount per mbf American buyers indicated they were willing to pay to obtain consistent good business services and product characteristics, as noted in ***Figure 17***, attached

Recent surveys of targeted American wood product buyers regarding their interest in purchasing Bolivian wood and wood products confirms the opportunity for improvement in these basic business services and product quality offerings from Bolivian suppliers

Figure 17 The Value ($) of Good "Business Basics" to US Product Buyers

Service Characteristic	*Worth an Additional*
• Above average reputation of supplier versus below average	$11 50/mbf
• Above average ability to deliver when promised versus below average	$10 00/mbf
• Lumber available within two weeks versus four weeks	$14 00/mbf
• Above average willingness to handle problems professionally versus below average	$ 4 00/mbf

Product Quality Characteristic	*Worth an Additional*
• 99% versus 95% on-grade	$ 6 00/mbf
• No wane versus maximum allowed	$15 00/mbf
• 19% MC versus 22% MC	$ 2 25/mbf
• Straight lumber versus maximum warp allowed,	$ 6 00/mbf
• No forklift damage versus minor forklift damage	$ 7 00/mbf

9 Target certified markets in the US and Europe

(See the "***Sustainable Forestry and Certification Issues in the US and Europe***" section of this report for justification and detailing of this recommendation)

10 Target specialty products within major markets

(See the "***Product Trends Overview***" and "***Product Selections per Targeted Species Based on Known Working Properties and Anticipated Volume Availability***" sections of this report for justification and detailing of this recommendation)

11 Establish direct communications with targeted buyers

While traditional wood product brokers serve a very valuable function in moving product between supplier and buyer, they can also be the last link in the product chain to be informed of critical changes or opportunities in market structure This may be especially true in moving sustainable and/or certified wood products into American and European markets For Bolivian producers, this may require targeted direct lines of communications with end producers who may be interested in establishing purchase contracts Direct lines of communication with furniture and flooring manufacturers, for example, detailing *the Bolivian story*, may result in quicker negotiated contracts

Long-Term Strategy Plan

In addition to a specific markets strategy for the four lessor-known species targeted in this report, Mater Engineering proposes a second 11-point action plan to implement an overall long-term marketing strategy for the Bolivian forest products industry

1 Establish an assigned marketing specialist within the U S and/or Europe dedicated to selling Bolivian resources

Although this is a serious investment issue for the Bolivian forest products industry, it may also prove a wise investment in getting Bolivian producers and products on the "*radar screen*" of American and European buyers Three of the top
benefits of financing this type of a marketing position for the industry include

- *Ability to stay on top of leading-edge product designs which have market demand*

Currently, Bolivian wood product producers are quite isolated from accessing updated product trends information for other major market areas throughout the world While conducting the in-field investigation for this project, Mater Engineering personnel observed two end results of this markets information isolation

* Value-added products currently being manufactured in the country are often based on "commodity" (traditional) designs, limiting their ability to enter markets with next-generation designs, and

* Creative, innovative wood product designs currently being manufactured in Bolivia (especially furniture designs) and sold in furniture retail stores throughout the Santa Cruz area lack the larger market visibility for international sales opportunities

From a commodity design standpoint, producers ***react*** to buyer requests for producing a product with a certain design This ***reactive*** commodity design business approach lacks the elements necessary to create *a critical marketing edge* through innovative product design, and can lock producers into serious product price "squeezes" since they are producing a product design that other competitors also produce While maintaining a ***reactive*** product development scheme, Bolivian producers should also develop a ***proactive*** product design arm that allows them to present new product designs for purchase consideration by buyers This proactive approach, coupled with maintaining a reactive design approach, can initiate new product buyer interest and lead to contracts for both traditional and innovative product design lines

Having a dedicated marketing specialist for Bolivian producers located in either North America of Europe would provide wood product manufacturers with

* Continual critical access to updated product trend information in the major markets for Bolivian products,

* Direct contact with potential wood product buyers looking for both traditional and innovative product design offerings, and

* A direct line of information transfer to wood product buyers regarding the use of lesser-known species in product applications,

- *Ability to track species substitution considerations and present solutions*

Establishing a marketing specialist position in the US and/or Europe would also allow close scrutinization of current species substitutions in product development which can provide "*avenue for entry*" for Bolivian species With the quality of wood volume changes dramatically within the US, especially for hardwood product producers, species substitutions are occurring more often in product development

- *Ability to connect with new product distribution channels*

  Establishing a Bolivian marketing specialist position in the US and/or Europe would also provide more direct access to different product distribution systems which normally would not be visible to Bolivian wood product manufacturers The lucrative mail-order catalog market which, as noted earlier in this report, sells "characterwood" products to consumers throughout the US is but one example of new product distribution systems which could be accessed by a Bolivian marketing specialist (see ***Figure 18 - Buyers Contacts for 20 Top Mail Order Catalogs in the US***, attached)

2 ***Identify lead private investment companies looking to invest in sustainable forestry projects***

As mentioned earlier in this report, there is an emerging group of well-established major investment firms and organizations which are now actively seeking investment opportunities in sustainable forest management projects throughout the world During this project, for example, Mater Engineering personnel had several conversations with Fortune 500 companies, such as ***Leucadia International***, which have indicated a direct interest in Bolivia's sustainable forestry operations and product development Fostering productive lines of communications with these types of leading investment organizations can produce substantial development opportunities for Bolivian forest land owners (concession-holders) and wood product producers

3 ***Encourage more encuentros meetings to get buyers and sellers meeting face-to-face***

As noted earlier in this report, the first ***Bolivian Encuentro*** conducted through the efforts of BOLFOR, The John D, and Catherine T MacArthur Foundation, CADEX, CFV, and The Tropical Forest Management Trust proved quite successful in bringing wood product buyers from Europe and the US into Bolivia to meet directly with wood product producers Equally important to this ***Encuentro*** effort was the ability to target buyers and brokers dedicated to wood products manufactured from sustainably-managed and certified Bolivian forests

These kinds of in-field buyer-seller sessions are extraordinarily helpful in facilitating negotiated contracts They provide immediate, hands-on information exchange for interested buyers and provide very valuable product development and design information to Bolivian wood product producers

These sessions also pose immediate visibility to producer key constraints such as inefficient industrial flow processes and inadequate drying technologies These constraints do impact buyer decisions in purchasing wood products from Bolivian producers However, the immediate impact of buyer concerns registered in these areas which may prevent deal-making can also place increased emphasis and priority on the need to correct these problem areas in order to increase international business opportunities

Figure 18 ***Buyers Contacts for 20 Top Mail Order Catalogs in the U S Which Sell Wood Products***

Company	*Address*	*Phone*	*Contact Name (Buyer)*
Sundance	1909 South 4250 West Salt Lake City, UT 84104	801-973-2711	Laura Thorpe
Sugar Hill	1037 Front Avenue Columbus, GA 31902	706-565-2100	Connie Smith
Plow & Hearth	PO Box 500 Madison, VA 22727	540-948-2272	Steve Wagner
Last Best Place	1112 7th Avenue Monroe, WI 53566	513-936-3170	Dianne Combs
Personal Touch	1 Komer Center Elmira, NY 14902	607-733-5541	Maureen Monroe
Crate & Barrel	PO Box 9059 Wheeling, IL 60090	847-480-2024	Pat Eckerstrom
Coldwater Creek	1123 Lake Street Sandpoint, ID 83864	208-263-2266	Tina Manchester
Gardeners Eden	PO Box 7307 San Francisco, CA 94120	415-421-7900	Melissa
Eddie Bauer	Fifth & Union, PO Box 3700 Seattle, WA 98124	425-882-6470	Harvey Cantor
Orvis	Historic Route 7A, PO Box 798 Manchester, VT 05254	802-362-3622	Francis Woodwork
Pottery Barn	PO Box 7044 San Francisco, CA 94120	415-421-7900	Liz Melzner
Anticipations	9 Ross Simons Drive Cranston, RI 02920	800-521-7677	Tiffany Hiporite
Home (Bloomingdale's)	475 Knotter Drive Cheshire, CT 06410	212-705-2000	Dan Engle
Kitchen & Home	PO Box 46 Hanover, PA 17333	201-863-7300	Laurie Rudeshauser
Charles Keath, Ltd	1265 Oakbrook Drive Norcross, GA 30093	800-388-6565 770-449-3100	Terry
Gump's	250 Post Street San Francisco, CA 94108	800-284-8677	David Peck
Hold Everything *(subsidiary of Williams-Sonoma)*	PO Box 7807 San Francisco, CA 94120	800-421-2264	Craig Latters
Nature Company	PO Box 188 Florence, KY 41022	800-227-1114	Beverly
Signals	WGBH Educational Foundation PO Box 64428 St Paul, MN 55164	800-669-9696	Furnishings Buyer
Plummer-McCutcheon	98180 Le Saint Drive Fairfield, OH 45014	800-321-1484	Ray Moore

4 Encourage more value-added in niche markets employing characterwood

Already focused on in this report, the ability to recognize the importance and value of characterwood in product development deserves on-going attention The important characterwood match to value-added product development versus commodity product offering must also be observed and followed Finally, identifying and tapping into the appropriate product distribution channels for products made from characterwood will also need follow-through and monitoring

5 Track on documented volumes to be available for harvest based on new Forestry Law and submittal/approval of management plans

Consistency of wood species, volume, and quality are the fundamental footprints to successful marketing strategies With the passage and implementation of the new Forestry Law, tracking and documenting the actual projected volumes by wood species and grades will be crucial to being able to demonstrate options for *consistency of supply* to product buyers Accurate monitoring of these volume-species-grade questions will also alert product producers to the ability to enlarge product development opportunities Larger consistent volumes of Cambara, for example, may suggest veneer production opportunities not economically feasible for smaller volume production

6 Target short piece lumber offerings to specific wood product producers

The amount of wood waste generated in product manufacturing through trim ends and shorts is very significant in Bolivian operations For this project, Mater Engineering has already identified new processing technologies which should be evaluated for converting this wood waste into wood product options The firm has also researched hardwood markets for miscellaneous product manufacturing in the US and determined that the largest percentage of total hardwood volume purchase in the US now goes into products using short pieces such as picture frames, toys, tool handles, decorator boxes, etc

As a long-term marketing action item, immediate analysis and determination of the actual anticipated volumes of trim ends and shorts needs to be conducted within the Santa Cruz area in order to ascertain realistic product development options, and processing technology and flow plan requirements

Recent prior research work conducted by Mater Engineering for tropical hardwoods markets underscores the fact that U S wood product producers are interested in purchasing shorter pieces of lumber for product manufacturing Some are even interested in true lumber "shorts" of 12" lengths

7 *Consider a compliment production outsourcing program with selected U S producers*

One strategy to get wood product buyers to acknowledge the value of lessor-known species use in product development is to initiate an outsource production pilot project in the targeted market areas For Bolivia, this suggests, for example, development of a pilot project which allows for outsourcing a certain volume of product manufacturing to a selected US or European manufacturer The Bolivian producer retains ownership of the resource and *outsources* (contracts out) the production of the wood into value-added product to a selected producer willing to contract production The benefit to this type of pilot project is three-fold

- First - a wood product producer in the country you wish to market product to has the opportunity to work with the wood to verify wood machining and drying characteristics Telling your story based on your own production runs is one thing But having an American producer talk about the ease of machining and drying of these lessor-known species brings substantial added credibility to the statements made and can be real sell points to interested buyers,

- Second - the outsource setting allows easy access for respected trade journals to document the product manufacturing process and technical merits of the wood species In essence, you allow easy venue for trade journal reporters to cover *the Bolivian story* (see the "***Specific Strategies for Targeted Species***" section of this report), and

- Third - the outsource setting also allows convenient access for potential product buyers to view the workability of the wood and evaluate the look and feel of a finished product made from these lessor-known species

8 ***Develop a wood samples packet for potential product buyers which focuses on providing key visibility to the virtues of the lessor-known species***

Most product buyers will wish to receive a wood samples packet to determine even their initial level of interest in purchasing product manufactured from the targeted species These sample packets must

- be well-designed
- convey the look, touch, and feel of the wood desiring to be being sold,
- illustrate the ability of the wood to take paint and stains well,
- convert the technical information into those "*three-second sound-bites, with memory*", and
- present *the Bolivian story* in a credible format

9 Focus on the issue of getting the lumber drying process done correctly

Lack of attention to this area will continue to be one of the single largest fatal flaws to moving volume of lessor known Bolivian hardwoods in to American and European product markets *It will also continue to be the largest limiting factor in attracting investments for value-added wood production in Bolivia* Even if forest management inventories are completed and approved by the Bolivian government providing risk reductions in log supply issues, inadequate wood drying technologies and practices can directly and dramatically impact availability of lumber volume and quality, and will continue to ultimately impact potential buyer purchase decisions

10 Take advantage of the upcoming trade fairs such as EXPOCRUZ

For trade fairs such as EXPOCRUZ, consider side-by-side visual comparisons of turnings made from Bolivian lessor-known species to traditional U S species (i e *alder-ochoo-basswood*) Establish an exhibit which asks the EXPO attendees whether they can *tell the difference* between the look and feel of the species Set up a similar *can you tell the difference'* exhibit for multiple stained and finished products The key is to exploit, rather than avoid, the process of species comparisons by forcing attendees to take a closer look at new solutions in product development

11 Consider conducting your own consumer preference survey using targeted Bolivian species rather than solely relying on brokers to input your marketing information

The difference in market opportunities based on consumer preferences may be quite different than what traditional brokers and buyers actually think A 1997 consumer survey regarding lessor-known US west coast hardwoods conducted by Oregon State University provides an excellent case in point Conducting direct in-field interviews with *consumers* and *product buyers* in home center stores in Oregon, researchers found that consumers and buyers differed significantly relative to their preference in species and look of wood used in products sold in the home center stores Evaluating market opportunities for lessor-known Oregon white oak and west cost bigleaf maple, buyers stated that consumers would indicate a preference for the traditional eastern red oak and eastern maple Consumers, however, showed a significantly smaller preference for red oak than what buyers expected, and ranked bigleaf maple significantly higher than eastern maple in material preference in a variety of wood products Of the 60 consumers interviewed in the home center stores and in contrast to the wood product brokers/buyers interviewed for the study, almost 70% of those consumers *liked* the wavy grain variation in Oregon white oak Similarly, almost 70% of consumers *preferred* the knots noted in bigleaf maple, with more than 70% of those consumers willing to purchase product with knots *unevenly dispersed* through the grain

The survey also concluded that consumers did respond differently to species preferred when the product was stained While light-colored staining held the same consumer preference conclusions as stated above, the same species finished with a dark stain did result in a consumer-preference drop for the lessor-known species due to a "muddy" appearance

YESQUERO
(Carinuana estrellensis)

Yesquero is a medium weight tropical hardwood with physical properties similar to the domestic species of Blue Ash, Red Oak, Black Walnut, Beech, and Birch, and the tropical species of Mahogany, Apamate, and Avodire Its appearance is very similar to ash and birch, with a fine-grained, smooth texture, but Yesquero is more grayish tan in color, with occasional pinkish streaks Its heartwood and sapwood are similar and both are utilized Yesquero is weather-resistant when not in contact with soil, and resistant to dry-wood termites Visually, Yesquero substitutes very well for products made with Ash, Birch, Beech and Red Oak, especially where its interesting middle color tones are desireable However, demand is much higher for lighter toned wood, so Yesquero's elegant gray/pinkish tones would need marketing emphasis for their ability to span interior color harmonies and contrasts

Product Applications

In Bolivia, Yesquero is used to make the following products (*exported)

general construction	shipbuilding	furniture
*furniture parts	*flooring, parquet	*plywood veneer
railroad ties	matches, pencils	tool handles
*doors, door frames	*mouldings	*lumber

U S woods that are similar to Yesquero are utilized in the following forest products

athletic equipment	musical instruments	tool handles
furniture, upholstered	furniture, all wood	flooring
millwork, mouldings	paneling	fancy veneer
turnings	doors	coffins
cabinetry		

Outlook for Yesquero if Substituted for Ash, Birch, Beech, Walnut, or Red Oak

According to U S hardwood industry experts, red oak is currently much more popular than ash (its most obvious substitute), "Ash remains the slowest of the Northern species Red Oak demand is the strongest (especially) in the #2 Common", but Red Oak production is fairly high and demand does not exceed supply "If the trend moves from the Hard Maple look (very

light, no grain) to more grain and darker colors, Ash will again be sought after " Both Beech and Yellow Birch have experienced an increase in demand for furniture and flooring production, including demand from export buyers, but both species are in limited supply or length assortments Prices are expected to move higher, especially for kiln-dried wood

Walnut is a dark wood that finishes well and it has some different product uses--it is especially popular in high-priced furniture and flooring Walnut also commands fairly high prices Because Yesquero also has grayish brown tones that are similar to Walnut (though lighter), it may be a satisfactory substitute for some of these products Currently, both the price and the demand for Walnut appears to be steady, with no anticipated increases in the near future

Based on market research and manufacturer/products distribution survey analysis conducted for this project, clear market opportunities appear to exist for this species (See "Product Trends" tab of this document)

The following pages in this section on Yesquero cover

- Mechanical properties compared to similar U S species
- Price comparison of similar U S species
- Mechanical properties of similar tropical species
- Price comparison of similar tropical species

YESQUERO *(Carnıana estrellensıs)*		
Mechanical Properties (green / dry)	***Domestic trees with similar properties***	***(green / dry)***
Specific gravity. ***46***	Sassafras Baldcypress (Interior south)Douglas fir Red pine Western hemlock Silver maple	46 46 46 46 45 47
Modulus of elasticity· ***1 18 / 1 522 (million psi)***	Rock elm Paper birch Black oak Overcup oak Sweetgum	1 19 / 1 59 1 17 / 1 59 1 18 / 1 64 1 15 / 1 42 1 20 / 1 64
Modulus of rupture. ***10,200 / 13,800 (psi)***	Blue ash Pecan Honeylocust	9,600 / 13,800 9,800 / 13,700 10,200 / 14,700
Compression parallel to grain ***4,620 / 7,100 (psi)***	Blue ash Honeylocust Black walnut	4,180 / 6,980 4,920 / 7,500 4,360 / 7,580
Compression perpendicular to grain· (not ASTM standard) ***1,394 / 1,948 (psi)***	Hickory species are similar, though there is no match for the 'green' figure because it is high compared to domestic species	
Side hardness ***/ 1,020 (air dry) (lb)***	Southern magnolia Black maple Southern red oak Black walnut	/ 1,020 / 1,180 / 1,060 / 1,010
Shrinkage. ***(not ASTM testing standard)*** ***tangential - 7 4%*** ***radial - 4 4%*** ***volumetric - 11 5%***		

YESQUERO *(Carinıana estrellensis)*		
Mechanical Properties (green / dry)	***Domestic trees with similar properties***	***(green / dry)***
Maximum shearing strength ***/ 2,030 (dry only) (psi)***	Blue ash American beech Cherrybark oak Water (red) oak White oaks	/ 2,030 / 2,010 / 2,000 / 2,020 / ≈2,000
Gluing properties ***good to very good***	"Very good" glues well with a variety of glues under a range of gluing conditions, "good" glues satisfactorily with good quality glue under controlled conditions	
Machining properties ***good to very good***	Similar trees have good to very good machining properties in turning, shaping, smoothness of cut, and boring	
Splitting resistance in nailing and screwing ***fair to good***	Similar trees have fair to good percentages of pieces free from splits when nailed or screwed - preboring is recommended	
Nail & screw holding ability ***very good to excellent***	Similar trees have very good to excellent nail and screw holding ability, including high withdrawal loads and allowable loads for nails, bolts, screws	
Kiln Drying Schedule ***USA T3-D2 (4/4,5/4,6/4)*** ***USA. T3-D1 (8/4)*** ***British Schedule D (4/4,5/4,6/4)***		

YESQUERO *(Carinıana estrellensıs)*		
U S hardwoods wuth sımılar mechanıcal propertıes	***Products***	***US $ per 1000 board-feet July 1997***
Ash	Northern ash, 4/4 K-D	$
	Sel/Btr	1,060
	#1 Common	753
	#2 Common	500
	Northern ash, 4/4 green	$
	FAS	740
	#1 Common	525
	#2 Common	300
	Southern ash, 4/4 K-D	$
	FAS/1F	1,190
	#1 Common	745
	#2 Common	455
	Southern ash, 4/4 green	$
	FAS	970
	#1 Common	575
	#2 Common	310
	Appalachıan ash, 4/4 K-D	$
	FAS/1F	1,115
	#1 Common	768
	#2 Common	490
	Appalachıan ash, 4/4 green	$
	FAS	820
	#1 Common	545
	#2 Common	300
Yellow Birch	N yellow bırch, 4/4 K-D	$
	Sel/Btr	1,353
	#1 Common	838
	#2 Common	540
	N yellow bırch, 4/4 green	$
	FAS	1,045
	#1 Common	610
	#2 Common	370

YESQUERO *(Carinıana estrellensıs)*		
U S hardwoods with sımılar mechanıcal properties	***Products***	***US $ per 1000 board feet July 1997***
Red Oak	Northern red oak, 4/4 K-D	$
	Sel/Btr	1,573
	#1 Common	1,185
	#2 Common	838
	Northern red oak, 4/4 green	$
	FAS	1,300
	#1 Common	910
	#2 Common	585
	Southern red oak, 4/4 K-D	$
	FAS/1F	1,298
	#1 Common	880
	#2 Common	650
	Southern red oak, 4/4 green	$
	FAS	1,010
	#1 Common	655
	#2 Common	480
	Appalachıan red oak,4/4 K-D	$ (area 1)
	FAS/1F	1,438
	#1 Common	1,028
	#2 Common	763
	Appalachıan red oak,4/4 K-D	$ (area 2)
	FAS/1F	1,478
	#1 Common	1,068
	#2 Common	798
	Appalachıan red oak, 4/4 grn	$ (area 1)
	FAS	1,090
	#1 Common	765
	#2 Common	485
	Appalachıan red oak, 4/4 grn	$ (area 2)
	FAS	1,110
	#1 Common	770
	#2 Common	485
Red Oak strıp flooring	Appalachıan red oak flooring	$
	Sel/Btr	1,625
	#1 Common	1,253
	#2 Common	790

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YESQUERO *(Carniana estrellensis)*		
U S. hardwoods with similar mechanical properties	***Products***	***US $ per 1000 board-feet July 1997***
Walnut	Appalachian walnut, 4/4 K-D FAS/1F #1 Common #2 Common Appalachian walnut, 4/4 grn FAS #1 Common #2 Common	$ 1,948 1,010 575 $ 1,385 620 200

YESQUERO *(Carinıana estrellensıs)*		
Mechanical Properties (green / dry)	***Common tropical woods with simlar properties***	***(green / dry)***
Specific gravity. ***46***	Khaya Tanguile Lauan Mahogany Parana Pine	47 46 45 46
Modulus of elasticity. ***1 18 / 1 522 (million psi)***	Khaya Spanish cedar	1 18 / 1 41 1 18 / 1 42
Modulus of rupture ***10,200 / 13,800 (psi)***	Apamate	10,600 / 13,800
Compression parallel to grain ***4,620 / 7,100 (psi)***	Apamate Bagtikan Mahogany Red Merantı	4,930 / 7,340 4,360 / 6,850 / 4,510 / 6,630 4,450 / 6,970
Compression perpendicular to grain ***967 / 1,920 (psi)***	No published data is available	
Side hardness ***1,020 (dry only) (lb)***	Avodire Apamate Teak	/ 1080 / 960 / 1030
Maximum shearing strength ***2,030 (dry only) (psi)***	Avodire Goncalo alves	/ 2,040 / 2,060

YESQUERO *(Carıniana estrellensis)*		
Mechanical Properties (green / dry)	***Common tropical woods with similar properties***	***(green / dry)***
Work to maximum load ***17 in-lbs*** ***in^3***	Courbaril Oak (Quercus costaricensis) Ramin	17 6 16 8 17 0
Gluing properties	No published data is available	
Machining properties ***very hard, smooth finish, and stable***	Works easily with occasional blunting effects on cutting tools due to silica deposits in wood cells, finishes smoothly and is stable when manufactured	
Splitting resistance in nailing and screwing·	No published data is available	
Nail & screw holding ability	No published data is available	
Kiln Drying Schedule ***USA T3-D2 to T3-D1*** ***British Schedule D***		
Shrinkage ***tangential - 7.4%*** ***radial - 4 4%*** ***volumetric - 11 5%***	Andiroba	r=4 0, t=7 8

YESQUERO *(Carıniana estrellensıs)*		
Tropical hardwoods wth sımılar mechanıcal properties	***Products***	***US $ per cubıc meter May 1997***
Mahogany	Brazıl	$
	Fırst grade logs	390 00
	K-D, FAS	1,030 00
	Lumber	830 00
	Veneer (0 7mm)	2 70 (per sq meter)
	Ghana	$
	FAS 100mm plus 1 8m	480 00
	FAS 150mm plus 2 4m	520 00
	Veneer, face	1 20 (per sq meter)
	Veneer, ınterıor	0 90 (per sq meter)
	Veneer, backıng	0 55 (per sq meter)
	Spliced veneer	1,149 00
	Afrıcan mahogany,UK prıces	
	Dınıng chaır	$
	(hıgh)	535 00
	(medıum)	344 00
	Dınıng table	$
	(hıgh)	1,823 44
	(medıum)	1,456 82
	(low)	1,114 33

OCHOO
(Hura creptans)

Ochoo is a light weight tropical hardwood with physical properties similar to the domestic hardwood species of Aspen, Soft Maple, Cottonwood, Basswood, Poplar, Alder, Sycamore, and a variety of softwoods--pines and firs Among tropical species, it is most similar to Cativo, Spanish Cedar, and Lauan Ochoo's light creamy color is similar to Alder, Ash, Beech, Birch, Maples, Pine, and Spruce Its clear smooth grain has little character or color differentiation, like Basswood, though Ochoo is susceptible to a blue stain similar to domestic pines which allows it to substitute for uses requiring "character wood" Ochoo machines easily and finishes well, but it may have tension wood zones that produce fuzzy and torn surfaces in planing It also weathers very well Ochoo would make an excellent substitute for a wide variety of popular light-colored woods, and it would substitute for many softwoods in applications where light weight and hardness are desireable

Product Applications

In Bolivia, Ochoo is used to make the following products (*exported)

*doors, door frames	*coffins	*windows, window frames
*mouldings	general construction	boxes, crates
veneer	furniture	plywood
joinery	telegraph poles	fiberboard, particle board

U S woods that are similar to Ochoo are utilized in the following forest products

furniture, general	flooring	athletic equipment
musical instruments	tool handles	millwork
mouldings	paneling	structural panels
fiberboard, particleboard	pulp	veneer
fixtures	toys	baskets, boxes
wood carvings		

Outlook for Ochoo if Substituted for Light-Colored U S Hardwoods (and some Softwoods)

Light-colored woods and their products are in demand domestically and abroad Essentially, clear white woods (hard and soft) are easy to sell--all are experiencing steady increases in price without significant increases in supply, especially for flooring Light colored woods are used

for a wide variety of furniture products because their light surface offers many more finishing alternatives from clear finishes to stains to paints, depending on fashion

Ochoo is unusual in that it is a softer, lighter-weight hardwood, making it doubly attractive for furniture because of reduced transportation costs Light softwoods like Eastern White Pine are experiencing strong demand in the furniture industry On the down side, the furniture industry has become highly competitive world-wide This trend has increased the demand for higher quality in traditional furniture applications, especially for furniture lines using traditional lumber grades Ochoo would need to be processed and graded to fit this demand to be competitive in this high quality furniture market On the up side, new market opportunities are clearly emerging for custom grades and character-wood in furniture and flooring applications (See "Product Trends" tab of this document)

The following pages in this section on Ochoo cover

- Mechanical properties compared to similar U S species
- Price comparison of similar U S species
- Mechanical properties of similar tropical species
- Price comparison of similar tropical species

OCHOO *(Hura crepitans)*		
Mechanical Properties ***(green / dry)***	***Domestic trees with similar properties***	***(green / dry)***
Specific gravity. ***33 to 38*** ***(green or dry not specified)***	Bigtooth aspen Quaking aspen American basswood Incense cedar Balsam fir Grand fir Sugar pine Engelmann spruce	36 / 39 35 / 38 32 / 37 35 / 37 34 / 36 35 / 37 34 / 36 33 / 35
Modulus of elasticity ***1 04 / 1.170*** ***(million psi)***	Black cottonwood Silver maple Sassafras American sycamore Black tupelo Balsam fir Sugar pine Subalpine fir Engelmann spruce	1 08 / 1 27 94 / 1 14 91 / 1 12 1 06 / 1 42 1 03 / 1 20 96 / 1 23 1 03 / 1 19 1 05 / 1 29 1 03 / 1 30
Modulus of rupture ***6,310 / 8,710*** ***(psi)***	Silver maple Sassafras Incense cedar Eastern hemlock Jack pine	5,800 / 8,900 6,000 / 9,000 6,200 / 8,000 6,400 / 8,900 6,000 / 9,900
Compression parallel to grain ***2,790 / 4,800*** ***(psi)***	Bigtooth aspen Silver maple Sassafras American sycamore Grand fir Western white pine Eastern white pine	2,500 / 5,300 2,490 / 5,220 2,730 / 4,760 2,920 / 5,380 2,940 / 5,290 2,430 / 5,040 2,440 / 4,800

OCHOO *(Hura crepitans)*		
Mechanical Properties (green / dry)	***Domestic trees with similar properties***	***(green / dry)***
Compression perpendicular to grain. ***412 / 626 (psi)***	Sweetgum Baldcypress Interior west Douglas fir old growth Redwood	370 / 620 400 / 730 420 / 760 420 / 700
Side hardness ***440 / 550 (lb)***	Red alder American chestnut Yellow poplar Alaska cedar Interior north Douglas fir Western hemlock	440 / 590 420 / 540 440 / 540 440 / 580 420 / 600 410 / 540
Maximum shearing strength ***825 / 1,081 (psi)***	Red alder Bigtooth aspen American chestnut Yellow poplar Baldcypress Noble fir Eastern hemlock	770 / 1,080 730 / 1,080 800 / 1,080 790 / 1,190 810 / 1,000 800 / 1,050 850 / 1,060
Work to maximum load ***6 to 7 in-lb in^3***	Bigtooth aspen Quaking aspen American basswood Noble fir American chestnut White fir Lodgepole pine White spruce	5 7 / 7 7 6 4 / 7 6 5 3 / 7 2 7 0 / 6 5 6 0 / 8 8 5 6 / 7 2 5 6 / 6 8 6 0 / 7 7
Gluing properties ***very good to excellent***	Trees with similar properties "very good" glues well with a variety of glues under a moderate range of conditions, "excellent" glues very easily with a wide variety of glues under a wide range of conditions	

OCHOO *(Hura crepitans)*		
Mechanical Properties ***(green / dry)***	***Domestic trees with similar properties***	***(green / dry)***
Machining properties ***fair to good***	Similar trees have fair to good machining properties turnings, borings, and smoothness	
Splitting resistance in nailing and screwing ***good to very good***	Similar trees have good to very good resistance to splitting from screws and nails	
Nail & screw holding ability ***fair to good***	Similar trees have fair to good ability to hold nails, screws, and bolts (but these are the lowest among load bearing woods for lag bolts)	
Kiln Drying Schedule ***USA T6-D2 (4/4, 5/4, 6/4)*** ***USA T3-D1 (8/4)*** ***British Schedule E*** ***(4/4, 5/4, 6/4)***		
Shrinkage ***tangential - 4 5%*** ***radial - 2 7%*** ***volumetric - 7 3%***	Similar to all cedars	r≈3% t≈5% to 6% v≈7% to 10%

OCHOO *(Hura crepitans)*		
U S hardwoods with similar mechanical properties	***Products***	***US $ per 1000 board-feet July 1997***
Aspen	Northern aspen, 4/4 K-D	$
	Sel/Btr	725 to 855
	#1 Common	465 to 595
	#2 Common	305 to 405
	Northern aspen, 4/4 green	$
	FAS	525
	#1 Common	370
	#2 Common	240
Soft Maple	Northern soft maple, 4/4 K-D	$
	Sel/Btr	1225 to 1300
	#1 Common	790 to 840
	#2 Common	475 to 525
	Appalachian soft maple, 4/4 K-D	$
	FAS/1F	1270 to 1345
	#1 Common	810 to 900
	#2 Common	445 to 505
	Northern soft maple, 4/4 green	$
	FAS	970
	#1 Common	620
	#2B Common	340
	Appalachian soft maple, 4/4 green	$
	FAS	955
	#1 Common	670
	#2A Common	390
	Southern soft maple, 4/4 green	$
	WHND	
	FAS	505
	#1 Common	465
	#2B Common	345

OCHOO *(Hura crepitans)*		
U S hardwoods with similar mechanical properties	***Products***	***US $ per 1000 board feet July 1997***
Cottonwood	Southern cottonwood, 4/4 K-D	$
	FAS/1F	670 to 770
	#1 Common	450 to 525
	#2 Common	315 to 355
	Southern cottonwood, 4/4 green	$
	FAS	610
	#1 Common	395
	#2A Common	230
Basswood	Northern basswood, 4/4 K-D	$
	Sel/Btr	1,123
	#1 Common	600
	#2 Common	335
	Northern basswood, 4/4 green	$
	FAS	760
	#1 Common	395
	#2 Common	220
	Appalachian basswood, 4/4 K-D	$
	FAS/1F	1,065
	#1 Common	565
	#2 Common	335
	Appalachian basswood, 4/4 green	$
	FAS	745
	#1 Common	330
	#2 Common	205

OCHOO *(Hura creptans)*		
U.S hardwoods with similar mechanical properties	***Products***	***US $ per 1000 board-feet July 1997***
Poplar, yellow	Southern poplar, 4/4 K-D FAS/1F #1 Common #2 Common Southern poplar, 4/4 green FAS #1 Common #2 Common Appalachian poplar, 4/4 K-D FAS/1F #1 Common #2 Common Appalachian poplar, 4/4 green FAS #1 Common #2 Common	$ 873 570 400 $ 695 420 290 $ 888 590 400 $ 685 420 290
Western Red Alder	Prices paid by importing country - March 1997 Germany Italy Taiwan Japan Republic of Korea	**US $ per cubic meter** $ 633 40 587 86 364 84 499 60 321 47

OCHOO *(Hura creptans)*		
U S hardwoods with similar mechanical properties	***Products***	***US $ per 1000 board-feet July 1997***
Sycamore	Southern sycamore, 4/4 green FAS #1 Common # 2A Common	$ 470 450 380

OCHOO
(Hura creptans)

Mechanical Properties (green / dry)	*Common tropical woods with similar properties*	*(green / dry)*
Specific gravity *33 to 38*	Jelutong Okoume Spanish cedar	36 to 38 37 38
Modulus of elasticity *1 040 / 1.170* *(million psi)*	Cativo Primavera	95 / 1 15 98 / 1 22
Modulus of rupture. *6,310 / 8,710 (psi)*	Cativo Spanish cedar	5,900 / 8,700 5,200 / 7,900
Compression parallel to grain *2,790 / 4,800 (psi)*	Cativo Spanish cedar (C ordorata)	2,590 / 4,490 2,760 / 4,450
Compression perpendicular to grain· *412 / 626 (psi)*	No published data available	
Side hardness *440 / 550* *(lb)*	Cativo Almon Lauan Mayapis Spanish cedar	450 / 610 500 / 590 480 / 590 450 / 570
Maximum shearing strength *825 / 1,081 (psi)*	Cativo Almon Lauan Mayapis Lauan	860 / 1,040 840 / 1,090 770 / 1,090
Work to maximum load *6 to 7 in-lb* *in^3*	Cativo Jelutong Obeche	5 4 / 7 2 5 6 / 6 4 6 2 / 6 9

OCHOO *(Hura crepitans)*		
Mechanical Properties (green / dry)	***Common tropical woods with similar properties***	***(green / dry)***
Gluing properties ***very good***	No published data available	
Machining properties ***machines well but tension wood produces torn surfaces in planing and fuzzy veneers***	Similar trees have irregular and interlocked grain and reaction wood (tension wood) that affects machining	
Splitting resistance in nailing and screwing	No published data available	
Nail & screw holding ability ***good***	No published data available	
Kiln Drying Schedule ***USA T6-D2 to T3-D1*** ***British Schedule E***		
Shrinkage ***tangential - 4 5%*** ***radial - 2 7%*** ***volumetric - 7 3%***	Cativo Ishpingo Nogal	r=2 3%, t=5 3% r=2 7%, t=4 4% r=2 8% t=5 5%

OCHOO *(Hura creptans)*		
Tropical hardwoods with similar mechanical properties	***Products***	***US $ per cubic meter May 1997***
Malaysian Lauan	Logs, mixed Logs, hollow heart, mixed	$ 300 00 to 315 00 $ 145 00 to 169 00
Indonesian Lauan	Lumber, 3 - 4 meters Flooring, tongue-and--grooved strip 18x70mm x 2 2 - 4 1 m	$ 344 00 to 416 00 $ 13 26 to 15 07 per sq meter

*Domestic Prices Of Hura creptans in Peru **			
Month	***Domestic Products***	***$ per cubic meter***	***$ per mbf (International Rule)***
January 1998	Logs Sawnwood	14 00 58 00	48 78 202 09
February 1998	Logs Sawnwood	28 00+ 89 00+	97 56+ 310 10+

* In Peru, *Hura creptans* is listed as "Catahua"

CAMBARA
(Erisma uncinatum)

Cambara is a lighter weight tropical hardwood with physical properties very similar to the domestic species of Black Cherry, Bigleaf Maple, Elm, and White Oak, or the tropical hardwood Red Lauan Its heartwood and sapwood are quite distinct, with the heartwood being reddish to purplish brown in color (like aged Cherry) and the sapwood being light gray, but only the darker heartwood is utilized

Cambara's surface has small striated pores like oak and it will not take a mirror-like finish like Cherry, however it will suffice in any application that uses Oak or Elm It looks like a slightly darker Cherry with a grain that is finer than Oak

Product Applications

In Bolivia, Cambara is used to make the following forest products (*exported)

boats	furniture	*doors
framework	paneling	*door frames
boxes	crates	utility plywood
railway ties	poles	*millwork

U S woods that are similar to Cambara are utilized in the following forest products

millwork	spiral staircases	boats
doors	door frames	turnings
flooring	cabinets (kitchen, etc)	coffins
veneers	mouldings	musical instruments
clocks	furniture	light construction

Outlook for Cambara if Substituted for White Oak, soft Maple, Elm, and Cherry

Cherry and Maple are in high demand, especially better grades "The current market is dominated by the well-publicized price increases for Hard Maple, Soft Maple, and Cherry supply problems (are) pushing prices up in other species like Red and White Oak " (Rising

prices for Maple and Cherry are shown in the following pages) An industry analysis expresses strong concern about supply problems, explaining that continued rising demand cannot be met by domestic producers, resulting in price volatility Because of the supply problems due to volume availability and reduced quality of material, industry experts expect that the consolidation of mills and yards by major companies will continue Elm is presently not being utilized in any significant volume to make its substitution with Cambara feasible

Cambara presents itself as an attractive alternative to Cherry, soft Maple, and Oak, and may be a potential substitute for these woods given their high prices and supply problems Because domestic shipments of oak and maple flooring are steadily increasing, this might be an opportunity for Cambara to take advantage of the situation

Based on market research and manufacturer/products distribution survey analysis conducted for this project, clear market opportunities appear to exist for this species (See "Product Trends" tab of this document

The following pages in this section on Cambara cover

- Mechanical properties compared to similar U S species
- Price comparison of similar U S species
- Mechanical properties of similar tropical species
- Price comparison of similar tropical species

CAMBARA *(Erisma uncinatum)*		
Mechanical Properties (green / dry)	***Domestic trees with similar properties***	***(green / dry)***
Specific gravity. ***46***	Silver maple Southern magnolia Bigleaf maple American elm Mountain hemlock Red pine Interior south Douglas fir	47 50 48 50 45 46 46
Modulus of elasticity ***1 308 / 1 564 (million psi)***	Black cherry Honeylocust hickory Black maple Chestnut oak Grand fir Western hemlock Red pine	1 31 / 1 49 1 29 / 1 63 1 33 / 1 62 1 37 / 1 59 1 25 / 1 57 1 31 / 1 69 1 28 / 1 63
Modulus of rupture ***8,439 / 12,687 (psi)***	Black cherry Slippery elm Black oak Chestnut oak Overcup oak Swamp chestnut oak	8,000 / 12,300 8,000 / 13,000 8,200 / 13,900 8,000 / 13,300 8,000 / 12,600 8,500 / 13,900
Compression parallel to grain ***3,911 / 7,211 (psi)***	White ash Blue ash Black cherry Rock elm coast Douglas fir Interior west Douglas fir	3,990 / 7,410 4,180 / 6,980 3,540 / 7,110 3,780 / 7,050 3,780 / 7,240 3,870 / 7,440

CAMBARA *(Erisma uncinatum)*		
Mechanical Properties ***(green / dry)***	***Domestic trees with similar properties***	***(green / dry)***
Compression perpendicular to grain ***411 / 811*** ***(psi)***	Slippery elm Hackberry Southern magnolia Interior west Douglas fir Bigleaf maple Western larch Sand pine	420 / 820 400 / 890 460 / 860 420 / 780 450 / 750 400 / 930 450 / 836
Side hardness ***622 / 869*** ***(lb)***	Black cherry American elm Slippery elm Bigleaf maple Sweetgum Eastern redcedar	660 / 950 620 / 830 660 / 860 620 / 850 600 / 850 650 / 900
Maximum shearing strength ***1,038 / 1,138*** ***(psi)***	American elm Sassafras coast Douglas fir	1,000 / 1,510 950 / 1,240 900 / 1,130
Gluing properties ***good***	Similar trees show "good" properties glues satisfactorily with good quality glue, under well-controlled conditions"	
Machining properties· ***very good to excellent***	Similar trees show very good to excellent machining qualities turning, shaping, boring, and smoothness of cut	
Splitting resistance in nailing and screwing ***fair to good***	Similar trees show fair to good resistance to splitting in nailing and screwing	

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CAMBARA *(Erisma uncinatum)*		
Mechanical Properties (green / dry)	***Domestic trees with similar properties***	***(green / dry)***
Nail & screw holding ability ***excellent***	Similar trees show excellent nail and screw holding ability	
Kiln Drying Schedule. USA T1-D2 (4/4,5/4,6/4)		
Shrinkage ***tangential - 10%*** ***radial - 4 3%*** ***volumetric - 13 4%***	White ash (%) River birch (%) Slippery elm (%) Red maple (%) Northern red oak (%) Water tupelo (%) Silver fir (%)	r=4 9,t=7 8,v=13 3 r=4 7,t=9 2,v=13 5 r=4 9,t=8 9,v=13 8 r=4 0,t=8 2,v=12 6 r=4 0 t=8 6,v=13 7 r=4 2,t=7 6,v=12 5 r=4 4,t=9 2,v=13 0

CAMBARA *(Erisma uncinatum)*		
U S hardwoods with similar mechanical properties	***Products***	***US $ per 1000 board-feet July 1997***
Bigleaf Maple (soft maple)	Northern soft maple, 4/4-KD	$
	Sel/Btr	1,263 00
	#1 Common	795 00
	#2 Common	515 00
	Northern soft maple, green	$
	FAS	965 00
	#1 Common	610 00
	#2 Common	335 00
	Appalachian soft maple, 4/4-KD	$
	FAS/1F	1,333 00
	#1 Common	840 00
	#2 Common	455 00
	Appalachian soft maple, 4/4 green	$
	FAS	975 00
	#1 Common	725 00
	#2 Common	380 00

CAMBARA *(Erisma uncinatum)*		
U S hardwoods with similar mechanical properties	***Products***	***US $ per 1000 board feet July 1997***
Black Cherry	Appalachian cherry,4/4-KD	$
	FAS/1F	2,490 00
	#1 Common	1,125 00
	#2 Common	615 00
	Appalachian cherry,4/4 green (area 1)	$
	FAS	1,895 00
	#1 Common	910 00
	#2 Common	475 00
	Appalachian cherry,4/4 green (area 2)	$
	FAS	1,945 00
	#1 Common	925 00
	#2 Common	490 00

CAMBARA
(Erisma uncinatum)

U S hardwoods with similar mechanical properties	*Products*	*US $ per 1000 board feet July 1997*
White oak, 4/4	Northern white oak, 4/4-KD	$
	Sel/Btr	1,370 00
	#1 Common	863 00
	#2 Common	580 00
	Northern white oak, 4/4-green	$
	FAS	965 00
	#1 Common	565 00
	#2 Common	335 00
	Southern white oak, 4/4 - KD	$
	FAS/1F	1,270 00
	#1 Common	803 00
	#2 Common	543 00
	Southern white oak, 4/4 green	$
	FAS	940 00
	#1 Common	570 00
	#2 Common	360 00
	Appalachian white oak, 4/4-KD	$
	FAS/1F	1,443 00
	#1 Common	873 00
	#2 Common	578 00
	Appalachian w oak,4/4-grn, (1)	$
	FAS	1,085 00
	#1 Common	610 00
	#2 Common	340 00
	Appalachian w oak, 4/4 grn,(2)	$
	FAS	1,110 00
	#1 Common	620 00
	#2 Common	340 00
White oak strip flooring 3/4" x 2 1/4"	Appalachian white oak	$
	Sel&Btr	1,430 00
	#1 Common	1,018 00
	#2 Common	790 00

CAMBARA *(Erisma uncinatum)*		
Mechanical Properties (green / dry)	***Common tropical woods with similar properties***	***(green / dry)***
Specific gravity. ***46***	Andiroba Khaya Red Lauan Yangulle Lauan	45 47 44 46
Modulus of elasticity. ***1.308 / 1.569 (million psi)***	Red Lauan Laurel Parana Pine Spanish cedar	1 38 / 1 63 1 26 / 1 49 1 35 / 1 62 1 31 / 1 44
Modulus of rupture ***8,439 / 12,687 (psi)***	Tangulle Lauan Bagtikan Laurel	8,300 / 12,900 8,800 / 12,600 8,800 / 12,100
Compression parallel to grain ***3,911 / 7,211 (psi)***	Tangulle Lauan Parana Pine Ocote Pine	3,940 / 6,580 4,000 / 7,650 3,690 / 7,680
Compression perpendicular to grain ***411 / 811 (psi)***	No published data available	
Side hardness ***622 / 869 (lb)***	Khaya Tangulle Lauan	640 / 830 620 / 770
Maximum shearing strength ***1,038 / 1,138 (psi)***	Red Lauan Tangulle Lauan White Lauan Spanish cedar	930 / 1,220 940 / 1,290 910 / 1,200 990 / 1,100
Gluing properties	No published data available	

CAMBARA *(Erisma uncinatum)*		
Mechanical Properties (green / dry)	***Common tropical woods with similar properties***	***(green / dry)***
Machining properties ***easy to saw, plane and sand, but does not finish well***	Similar trees have reaction wood (tension wood) that affects machining qualities	
Splitting resistance in nailing and screwing	No published data available	
Nail & screw holding ability	No published data available	
Kiln Drying Schedule USA T1-D2 (4/4,5/4,6/4)		
Shrinkage ***tangential - 10%*** ***radial - 4 3%*** ***volumetric - 13 4%***	Andiroba Banak Parana pine Virola	r=4 0%, t=7 8% r=4 6%, t=8 8% r=4 0%, t=7 9% r=5 3%, t=9 6%

CAMBARA *(Erisma uncinatum)*		
Tropical hardwoods with similar mechanical properties	***Products***	***US $ per cubic meter***
Malaysian Lauan	Logs, mixed Logs, hollow heart, mixed	$ 300 00 to 315 00 $ 145 00 to 169 00
Indonesian Lauan	Lumber, 3 - 4 meters Flooring, tongue-and- -grooved strip 18x70mm x 2 2-4 1 m	$ 344 00 to 416 00 $ 13 26 to 15 07 per sq meter

AMARELLA, (Oiticica, Aji, or Murure)
(Clarisia racemosa)

Amarella is a medium weight tropical hardwood with physical properties very similar to the domestic species of Black Walnut, Sugar Maple (Hard Maple), and White Oak, or the tropical hardwood species of Teak, Santa Maria, and Kerving In appearance, Amarella's rich golden brown color, fine grain, and smooth surface qualities are remarkably similar to Teak, though Amarella is harder Its hardness and grain give it excellent machining qualities and allow it to take a mirror-like polish It is a strong candidate as a substitute for Teak or Black Walnut, or for Hard Maple where its color and grain suit the application (This wood might be given the name "Bolivian Teak" to enhance its marketability in the United States and Europe, where knowledge of Teak is already high)

Product Applications

In Bolivia, Amarella is not currently being utilized or exported in any known quantities under this name It does have other common names of Oiticica and Aji, but none of its three names appear on production, sales, or export records provided to Mater Engineering for this project It appears that some Bolivian mills call this wood "Murure", which is also the name of a completely different tropical hardwood from the genus Brosimum (Alicastrum group)--the name Murure also does not appear on any sales or export records

U S woods that are similar to Amarella are utilized in the following forest products

millwork	doors	flooring
veneer	musical instruments	turnings
gunstocks	paneling	boxes
furniture, indoor	butcher blocks	doors
furniture, outdoor	utensils	cabinets
handles, fixtures		

Outlook for Amarella if Substituted for Black Walnut, Hard Maple, White Oak, or Teak

Prices and demand for Walnut and White Oak are very steady, but prices are increasing for Hard Maple Industry experts state that the demand for Hard Maple appears to have no end as price does not seem to be a limiting factor There are scattered signs that buyers are looking to

use other species Part of what drives the demand for Hard Maple is rising domestic and overseas demand for white or light-colored hardwoods The color of Amarella may preclude its taking advantage of this particular market, where the natural wood is exposed However, many of these light woods are being painted and finished in a variety of ways which clearly leave strong market opportunities available

Amarella has ideal qualities for many of the high value products made from Hard Maple, Black Walnut, or Teak The high-end furniture market is doing well, as are markets for kitchen cabinets and flooring (While Amarella has similar mechanical properties to White Oak, its appearance is quite different and it is not likely to be substituted for Oak, see the CAMBARA section for analysis of White Oak prices)

The following pages in this section on Amarella cover

- Mechanical properties compared to similar U S species
- Price comparison of similar U S species
- Mechanical properties of similar tropical species
- Price comparison of similar tropical species

AMARELLA (Oiticica, Aji, or Murure) *(Clarisia racemosa)*		
Mechanical Properties (green / dry)	***Domestic trees with similar properties***	***(green / dry)***
Specific gravity ***53***	American, Slippery elm Hackberry Red maple Black walnut	/ 53 / 53 / 54 / 55
Modulus of elasticity ***1 664 / 1 749 (million psi)***	Magnolia, cucumbertree Sugar maple Scarlet oak Live oak Black walnut	1 56 / 1 82 1 55 / 1 83 1 48 / 1 91 1 58 / 1 98 1 42 / 1 68
Modulus of rupture 13,370 / 14, 010 (psi) (note this wood has no match for the green state, almost as robust as the dry state)	Green ash Rock elm Honeylocust Sugar maple Black walnut	9,500 / 14,100 9,500 / 14,800 10,200 / 14,700 9,400 / 15,800 9,500 / 14,600
Compression parallel to grain 7,069 / 7,311 (psi) (note green state is almost as robust as dry state--no match in USA)	Green ash American beech Black cherry Sugar maple White oak Black locust Black walnut	4,200 / 7,080 3,550 / 7,300 3,540 / 7,110 4,020 / 7,830 3,560 / 7,440 6,800 / 10,180 4,300 / 7,580
Compression perpendicular to grain ***1,124 / 1,735 (psi)***	Honeylocust Black locust	1,150 / 1,840 1,160 / 1,830
Side hardness ***1,155 / 1,620 (lb)***	Pin oak Swampy white oak	1,070 / 1,510 1,160 / 1,620
Density. ***44 (lb/ft^3)***		

AMARELLA (Oiticica, Aji, or Murure) *(Clarisia racemosa)*		
Mechanical Properties ***(green / dry)***	***Domestic trees with similar properties***	***(green / dry)***
Shear parallel to grain ***1,209 / 1,408*** ***(psi)***	Silver maple Chestnut oak Black tupelo Black walnut	1,050 / 1,480 1,210 / 1,490 1,100 / 1,340 1,220 / 1,370
Gluing properties ***fair to good***	Similar trees have fair to good properties "fair"requires very close control of glue and gluing conditions, or special treatment, "good" glues satisfactorily with good glue under controlled conditions	
Machining properties ***very good to excellent***	Similar trees have very good to excellent machining properties in turnings, borings, and smoothness of cut, but hardness blunts saws and cutters	
Splitting resistance in nailing & screwing ***fair to good***	Similar trees have fair to good resistance to splitting when being nailed or screwed	
Nail & screw holding ability ***excellent***	Similar trees have excellent nail and screw holding ability	
Kiln Drying Schedule ***from Columbia· Mild*** ***from Ecuador Severe***	 British Schedules C and D British Schedule J	
Shrinkage ***tangential - 4 9%*** ***radial - 2 6%*** ***volumetric - 7 4%***	Northern white cedar Western red cedar	r=2 2,t=4 9,v=7 2 r=2 4,t=6 9,v=6 8

AMARELLA (Oiticica, Aji, or Murure) *(Clarisia racemosa)*		
Hardwoods with similar mechanical properties	***Products***	***US $ per 1000 board-feet July 1997***
Hard Maple (including Sugar Maple)	Northern hard maple, 4/4-KD	$
	Sel/Btr	1,720
	#1 Common	1,140
	#2 Common	700
	Northern hard maple,4/4-green	$
	FAS	1,455
	#1 Common	925
	#2 Common	565
	Appalachian hard maple, 4/4-KD	$
	FAS/1F	1,770
	#1 Common	1,130
	#2 Common	690
	Appalachian hard maple, 4/4-grn	$
	FAS	1,520
	#1 Common	935
	#2 Common	530
Walnut	Appalachian walnut, 4/4-KD	$
	FAS/1F	1,948
	#1 Common	1,010
	#2 Common	575
	Appalachian walnut, 4/4-green	$
	FAS	1,385
	#1 Common	620
	#2 Common	200
Teak	Indonesian log prices	**US $ per cubic meter** $1,050 to $1,250

AMARELLA (Oiticica, Aji, or Murure) *(Clarisia racemosa)*		
Mechanical Properties (green / dry)	***Common tropical woods with simular properties***	***(green / dry)***
Specific gravity ***56***	Andiroba Santa Maria Teak	0 56 / 0 54 / 0 57 /
Modulus of elasticity ***1 644 / 1 749 (million psi)***	Banak Kokrodua Tanguile (red) lauan Santa Maria	1 47 / 1 72 1 77 / 1 94 1 54 / 1 81 1 57 / 1 82
Modulus of rupture. ***13,370 / 14,010 (psi)***	Kerving Santa Maria Teak	11,900 / 14,500 10,500 / 14,800 11,000 / 13,300
Compression parallel to grain ***7,069 / 7,311 (psi)***	Apamate Avodire Kerving Teak	4,930 / 7,340 - / 7,180 6,230 / 8,000 5,470 / 7,110
Compression perpendicular to grain· ***1,124 / 1,735 (psi)***	No published data available	
Side hardness ***1,155 / 1,620 (lb)***	Jarrah Peroba de campos Sapele	1,285 / 1,915 - / 1,600 1,020 / 1,510
Shear parallel to grain· ***1,209 / 1,408 (psi)***	Apamate Kerving Palosapis Teak	1,240 / 1,450 1,160 / 1,360 1,000 / 1,410 1,290 / 1,480

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AMARELLA (Oiticica, Aji, or Murure) *(Clarisia racemosa)*		
Mechanical Properties (green / dry)	***Common tropical woods with similar properties***	***(green / dry)***
Gluing properties ***good***	No published data available	
Machining properties ***very good***	Similar tree species machine very well but have hard mineral deposits (silica or calcium carbonate) that dulls cutters	
Splitting resistance in nailing and screwing	No published data available	
Nail & screw holding ability ***good***	No published data available	
Kiln Drying Schedule ***from Columbia mild*** ***from Ecuador severe***	 British Schedules C and D British Schedules J	
Shrinkage ***tangential - 4 9%*** ***radial - 2 6%*** ***volumetric - 7 4%***	Cativo Ishpingo Nogal Teak	r=2 3, t=5 3 r=2 7, t=4 4 r=2 8, t=5 5 r=2 2, t=4 0

The following tables describe products and mechanical characteristics of other exported Bolivian hardwoods gaining acceptance in U S and European markets

Properties of Other Exported Bolivian Hardwoods

(Source 1 ITTO, Tropical Timber Atlas of Latin America)
*(*Source 2· Caracteristicas, Propiedades y Usos de Maderas del Paraguay - I N.T N)*
(Source 3. Mater Engineering Market Research

Bolivian Common Names	*Species name*	*Products*
ROBLE, *Soryoko*	*Amburana caerensis*	Furniture Cabinet work Interior and exterior joinery Exterior joinery Stairs Flooring Moulding Wainscot Decorative Veneer Cooperage Carpentry
CURUPAU, *Kurupay*	*Anadenanthera macrocarpa (Piptadenia macrocarpa)*	Interior and exterior joinery Flooring Carpentry Naval Construction Sleeper
JICHITURIQUE	*Aspidosperma cylindrocarpon*	Furniture Cabinet work Interior and exterior joinery Flooring Slicing Turnings Carvings
CUCHI, *Urunday*	*Astronium urundeuva*	Cabinet work Interior and exterior joinery Flooring Decorative veneer
VERDOLAGO	*Buchenavia spp , Terminalia amazonia*	Furniture Cabinet work Interior and exterior joinery Flooring Moulding Decorative veneer Slicing Turnings Naval construction

ROBLE *(Amburana caerensis)*		
Mechanical Properties (dry): ***Data from ITTO*** ****Data from Paraguay***	***Tropical species with similar properties*** ***(Bolivian species in italics)***	***Domestic species with similar properties***
Specific gravity· ***59***	Apitong Sapele Teak Andiroba	Ash species Birch species Red oak species
Modulus of elasticity ***1 276 *1.947*** ***(million psi)***	Primavera *Kokrodua	American chestnut Black cottonwood American elm *Yellow birch *Shellbark hickory *Scarlet oak, live oak
Modulus of rupture ***11,748 *14,359*** ***(psi)***	Khaya Red lauans Mahogany Limba *Kerving *Ocote pine *Santa Maria **Clarisia racemosa*	American elm Paper birch *Green ash *American beech *Red oaks *Black walnut
Compression parallel to grain ***6,527 *8,122*** ***(psi)***	Khayas Red lauans Mahogany Teak Palosapis *Pau marfim *Caribbean pine *Sapele *Santa Maria	Ashes Maples Red and white oaks *Yellow birch *Shellbark hickory
Density ***(green / *dry)*** ***53.0 / *40 6*** ***(lb/ft^3)***	No published data available	

ROBLE
(Amburana caerensis)

Mechanical Properties (dry) *Data from ITTO* **Data from Paraguay*	*Tropical species with similar properties* *(Bolivian sp. in italics)*	*Domestic species with similar properties*
Shear parallel to grain **1740* *(psi)*	*Kapur *Khaya *Parana pine *Primavera	*Oregon ash *Black cherry *Mockernut hickory *Bigleaf maple *Northern red oak
Gluing properties· *fair to good*	Data not available	"fair" - requires close control of glue and gluing conditions "good" - glues satisfactorily with good glue under controlled conditions
Machining properties *very good to excellent*	Similar tropical species have irregular or interlocked grain	Similar species have excellent machining properties
Splitting resistance in nailng & screwing *fair to good*	Data not available	Similar species have "fair" to "good" resistance to splitting
Nail & screw holding ability *excellent*	Data not available	Similar species have "excellent" nail, spike, wood screw, and bolt holding ability
Kiln Drying Schedule	Data not available	
Shrinkage *tangential - 4 5% *6.2%* *radial - 2 4% *2 9%* *volumetric -*	Cativo Teak *Clarisia racemosa* *Ochoo* *Kokrudua	Northern white cedar *Quaking aspen *Balsam poplar (cottonwood)

CURUPAU
(Anadenanthera macrocarpa)

Mechanical Properties (dry) *Data from ITTO* **Data from Paraguay*	*Tropical species with similar properties* *(Bolivian sp. in italics)*	*Domestic species with similar properties*
Specific gravity *1 0*	Green heart	no match, very high
Modulus of elasticity **2 396* *(million psi)*	*Apitong *Capirona *Lapacho	*Pignut hickory *Cherrybark red oak
Modulus of rupture· **22,046* *(psi)*	*Capirona *Lapacho	no match, very high
Compression parallel to grain **10,442* *(psi)*	*Goncalo alves *Lapacho *Ramin	*Black locust
Density *(green / dry)* */ 62.4* *(lb/ft^3)*	Data not available	Data not available

CURUPAU
(Anadenanthera macrocarpa)

Mechanical Properties *Data from ITTO* **Data from Paraguay*	*Tropical species with similar properties*	*Domestic species with similar properties*
Maximum shearing strength **2,756* *(psi)*	no match, very high	no match, very high
*Gluing properties** *fair*	Data not available	"fair" - requires close control of glue and gluing conditions
Machining properties *excellent*	Similar tropical species have irregular grain and hard mineral deposits	Similar species have excellent machining properties, but hardness may dull cutters
Splitting resistance in nailing and screwing *fair*	Data not available	Similar species have "fair" resistance to splitting, pre-boring is recommended
Nail & screw holding ability: *excellent*	Data not available	Similar species have excellent nail, spike, wood screw, and bolt holding ability
Kiln Drying Schedule	Data not available	Data not available
Shrinkage *tangential - *5 1%* *radial - *1 3%* *volumetric -	no match	no match

JICHITURIQUE
(Aspidosperma cylindrocarpon)

Mechanical Properties *Data from ITTO* **Data from Paraguay*	*Tropical species with similar properties*	*Domestic species with similar properties*
Specific gravity *0 76*	Courbaril Oak (Quercus costaricensus) Pau marfim Peroba de campos Indian Rosewood	Hickory species
Modulus of elasticity: **1 803* *(million psi)*	***Clarisia racemosa*** *Andiroba *Palosapis *Santa Maria *Sapele	*White ash *Bitternut, Shellbark hickory *Sugar maple *Cucumbertree magnolia *Northern red oak
Modulus of rupture· **19,145* *(psi)*	*Courbaril *Karri *Pau marfim	*Hickory species
Density *(green / dry)* **52 4* *(lb/ft^3)*	Data not available	Data not available
Compression parallel to grain· **9,572* *(psi)*	*Capirona *Courbaril *Kapur *Indian rosewood	*Shagbark hickory

JICHITURIQUE
(Aspidosperma cylindrocarpon)

Mechanical Properties *Data from ITTO* **Data from Paraguay*	*Tropical species with similar properties*	*Domestic species with similar properties*
Maximum shearing strength **2,610* *(psi)*	*Courbaril	*Live oak
*Gluing properties** *fair to good*	Data not available	"fair" - requires close control of glue and gluing conditions "good" - glues satisfactorily with good glue under controlled conditions
Machining properties *excellent*	Similar tropical species have irregular grain and reaction wood	Similar species have excellent machining properties
Splitting resistance in nailing and screwing *fair to good*	Data not available	Similar species have "fair" to "good" resistance to splitting, preboring is recommended
Kiln Drying Schedule	Data not available	Data not available
Shrinkage *tangential - *5 1%* *radial - *2 6%* *volumetric -*	***Yesquero*** ***Ochoo*** *Cativo	*Similar to all cedars

CUCHI
(Astronium urundeuva)

Mechanical Properties (dry) *Data from ITTO* **Data from Paraguay*	*Tropical species with similar properties*	*Domestic species with similar properties*
Specific gravity *1 10*	Lignumvitae	no match, very high
Modulus of elasticity **2 260* *(million psi)*	*Capirona *Courbaril *Gola *Ocote pine	*Sweet birch *Hickory species *Cherrybark (red) oak
Modulus of rupture **25,817* *(psi)*	*Lapacho	no match, very high
Compression parallel to grain **14,649* *(psi)*	*Lapacho	no match, very high
Density. *70 5* *(lb/ft^3)*	Data not available	Data not available

CUCHI *(Astronium urundeuva)*		
Mechanical Properties ***Data from ITTO*** ****Data from Paraguay***	***Tropical species with similar properties***	***Domestic species with similar properties***
Maximum shearing strength ****2901*** ***(psi)***	no match	*Live oak
Gluing properties* ***fair***	Data not available	"fair" - requires close control of glue and gluing conditions, or special treatment to obtain best results
Machining properties ***excellent***	Similar tropical species have irregular or interlocked grain and hard mineral deposits	Similar species have excellent machining properties
Splitting resistance in nailing and screwing ***fair***	Data not available	Similar species have "fair" resistance to splitting, pre-boring is recommended
Kiln Drying Schedule *Data not available*	Data not available	Data not available
Shrinkage ***tangential - *7 5%*** ***radial - *3 7%*** ***volumetric -***	*Andiroba *Lauan species	*Black cherry *Bigleaf maple *Hemlock species

VERDOLAGO
(Buchenavia spp , Terminalia amazonia)

*Mechanical Properties Data from ITTO *Data from Paraguay*	*Tropical species with similar properties*	*Domestic species with similar properties*
Specific gravity *0 80*	Green heart Peroba de campos Indian rosewood	no match, high
Modulus of elasticity **1 657* *(million psi)*	**Clarisia racemosa* *Lauan species *Red meranti	*Green ash *Honeylocust *Maple species *Black, Laurel oak *Sweetgum *Black walnut
Modulus of rupture **21,611* *(psi)*	*Capirona *Lapacho	*Hickory species
Compression parallel to grain **9,282* *(psi)*	*Capirona *Indian rosewood	*Hickory species
Density *55 2* *(lb/ft^3)*	Data not available	Data not available

VERDOLAGO
(Buchenavia spp., Terminalia amazonia)

Mechanical Properties *Data from ITTO* **Data from Paraguay*	*Tropical species with similar properties*	*Domestic species with similar properties*
Maximum shearing strength **2,320* *(psi)*	*Lapacho *Sapele *Karri	*Sweet birch *Hickory species *Sugar maple
Gluing properties *fair to very good*	Data not available	"fair" - requires close control of glue and gluing conditions "very good" - glues well with a variety of glues under a range of conditions
Machining properties *excellent*	Similar tropical species have interlocked or irregular grain and hard mineral deposits	Similar species have excellent machining properties
Splitting resistance in nailing and screwing· *fair*	Data not available	Similar species have "fair" resistance to splitting, pre-boring is recommended
Nail & screw holding ability	Data not available	Similar species have excellent nail, spike, wood screw, and bolt holding ability
Kiln Drying Schedule *Data not available*	Data not available	Data not available
Shrinkage *tangential - *8 0%* *radial - *3 0%* *volumetric -*	*Balsa *Lauan species	*Bigtooth aspen *Cottonwood species

PRICES OF EXPORTED BOLIVIAN HARDWOODS - 1996
($ / board-foot)

Species & Product (ranked by descending unit sales)	*Primary Products*	*Component Parts*	*Secondary Products*
ROBLE			
Lumber	$ 0 90		
Laminates		4 11	
Mouldings		1 69	
Struts, braces		0 94	
Parquet		0 71	
Coffin/box faces		3 90	
Brackets, dividers (?)		1 05	
Doors			2 69
Windows			2 78
Chairs			5 38
Furniture			1 72
Door frames		1 47	
Window frames		1 66	
Bed parts		4 09	
Wall cladding			2 36
Urns			12 00
Tables			3 01
Armchairs			0 90
Boxes			3 22
CURUPAU			
Parquet			$ 2 38
JICHITURIQUE			
Lumber	$ 1 75		
Parquet			$ 2 32
CUCHI			
Wall cladding		$ 1 23	
Parquet			$ 2 32
VERDOLAGO			
Lumber	$ 1 06		
Laminates			$ 8 82

PRICES OF EXPORTED BOLIVIAN HARDWOODS - 1996
($ / board-foot)

Species & Product (ranked by descending unit sales)	*Primary Products*	*Component Parts*	*Secondary Products*
YESQUERO			
Lumber	$ 1 31		
Parquet			$ 0 85
Struts, braces (?)		$ 1 63	
CAMBARA			
Lumber	$ 0 78		
Doors			1 83
Mouldings			0 92
Wall cladding		3 51	
Door frames		1 05	
Windows			0 48
OCHOO			
Lumber	$ 0 53		
Doors			2 27
Coffins			2 34
Door frames			2 56
Windows		1 65	
Mouldings			1 38
Window frames		1 44	
AMARELLA, Oiticica, or Aji (Clarisia racemosa)	Data not available	Data not available	Data not available

Source Estadisticas de Exportacion y Ventas Internas de Productos Forestales a Nivel Nacional (National Statistics on Exports and Internal Sales of Standard Forest Products) Camara Nacional Forestal Santa Cruz Bolivia 1996

Exhibit A

BOLFOR
U.S Mail Order Catalogs Analysis
Stated Characterwood in Furniture Product Offerings
July, 1997

Catalog Name	*Knotty Wood*	*Rough-Sawn Wood*	*Burly Wood*	*Seasoned/ Rustic Wood*	*Figured Wood*	*Wormwood*	*Barnwood/ Fence Wood*	*Checked Wood*	*"Natural" Wood Distressed*	*Recycled Wood*	*Weathered - Aged Wood*
Sundance						√	√			√	√
Kitchen & Home									√	√	
The Bombay Company											
The Kensington Collection						√					
Blue River Trading Company						√			√		√
Home Decorators Collection											
Bloomingdale's By Mail	√					√			√		
Trifles Spaces		√						√			
The Old Wagon Factory										√	
Horchow Home			√			√					

Exhibit A *(continued)*

BOLFOR
U.S. Mail Order Catalogs Analysis
Stated Characterwood in Furniture Product Offerings
July, 1997

Catalog Name	*Knotty Wood*	*Rough-Sawn Wood*	*Burly Wood*	*Seasoned/ Rustic Wood*	*Figured Wood*	*Wormwood*	*Barnwood/ Fence Wood*	*Checked Wood*	*"Natural" Wood Distressed*	*Recycled Wood*	*Weathered - Aged Wood*
Reverie						√	√				
The Last Best Place Catalog Company											
Pottery Barn				√		√					
Smith and Hawkin											
Hold Everything	√										
Crate and Barrel											
Gump's			√		√						
Sugar Hill	√		√	√							
Somerset		√									
The Company Store				√							

Exhibit B

BOLFOR
U S Mail Order Catalogs Analysis
Stated Finishes in Furniture Product Offerings
July, 1997

Catalog Name	*Distressed*	*Weathered*	*Antiqued (Aged)*	*Crackling*	*Seasoned/ Rustic*	*Color-Washed*	*Wormwood*	*Time-Worn*
Sundance	√	√	√			√		√
Kitchen & Home	√		√			√		
The Bombay Company	√		√	√				
The Kensington Collection			√			√	√	
Blue River Trading Company	√		√					
Home Decorators Collection	√		√	√		√		
Bloomingdale's By Mail	√		√					
Trifles Spaces		√						
The Old Wagon Factory	√		√					√
Horchow Home	√	√	√					
Reverie								
The Last Best Place Catalog Company	√					√		
Pottery Barn	√	√	√			√		

MATER ENGINEERING, LTD

192

Exhibit B *(continued)*

BOLFOR
U S Mail Order Catalogs Analysis
Stated Finishes in Furniture Product Offerings
July, 1997

Catalog Name	*Distressed*	*Weathered*	*Antiqued (Aged)*	*Crackling*	*Seasoned/ Rustic*	*Color-Washed*	*Wormwood*	*Time-Worn*
Smith and Hawkin								
Hold Everything						√		
Crate and Barrel			√		√			
Gump's			√	√				
Sugar Hill	√	√	√					√
Somerset			√					
The Company Store					√			

Exhibit C

BOLFOR
U S Mail Order Catalogs Analysis
Observed Traditional Characterwood in
Furniture Product Offerings
July, 1997

Catalog Name	*Sound Small Knots*	*Small Knots*	*Small Pitch/Gum Pockets*	*Mineral/Sap Stain*	*Grain/Color Variations*
Sundance	√	√	√		√
Kitchen & Home	√	√			√
The Bombay Company		√			√
The Kensington Collection	√	√	√		√
Blue River Trading Company	√	√	√	√	√
Home Decorators Collection				√	√
Bloomingdale's By Mail	√	√	√	√	√
Trifles Spaces	√	√			√
The Old Wagon Factory	√	√		√	√
Horchow Home	√	√	√	√	√
Reverie	√	√	√	√	√
The Last Best Place	√	√			√
Pottery Barn	√	√	√	√	√
Smith and Hawkin					√
Hold Everythin	√	√			√
Crate and Barrel	√	√			√
Gump's	√	√			√
Sugar Hill	√	√	√		√
Somerset	√	√			√
The Company Store	√	√			√

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Exhibit D

BOLFOR
U S Mail Order Catalogs Analysis
Observed Untraditional Characterwood in
Furniture Product Offerings
July, 1997

Catalog Name	Unsound Knots	Large Knots	Bark Pockets	Wane	Split	Large Wormholes	Insect Tunneling	Short/Shallow Checks	Spalty Wood
Sundance	√	√			√	√	√	√	√
Kitchen & Home		√							
The Bombay Company									
The Kensington Collection		√					√	√	
Blue River Trading Company	√	√			√	√	√	√	√
Home Decorators Collection		√							
Bloomingdale's By Mail	√	√				√	√	√	√
Trifles Spaces								√	
The Old Wagon Factory									
Horchow Home		√				√		√	√
Reverie	√	√				√	√	√	
The Last Best Place Catalog Company									
Pottery Barn	√	√				√	√	√	√
Smith and Hawkin									

Exhibit D *(continued)*

BOLFOR
U S Mail Order Catalogs Analysis
Observed Untraditional Characterwood in
Furniture Product Offerings
July, 1997

Catalog Name	*Unsound Knots*	*Large Knots*	*Bark Pockets*	*Wane*	*Split*	*Large Wormholes*	*Insect Tunneling*	*Short/Shallow Checks*	*Spalty Wood*
Hold Everything									
Crate and Barrel									
Gump's									
Sugar Hill									
Somerset									
The Company Store		√							

Exhibit E

BOLFOR
U S Mail Order Catalogs Analysis
Contemporary - Painted Furniture
Product Offerings
July, 1997

Catalog Name	*Contemporary - Painted*	*Hardwood Painted*	*Softwood Painted*	*Mahogany/Exotic Painted*
Sundance	√	√	√	
Kitchen & Home	√	√	√	
The Bombay Company	√		√	
The Kensington Collection	√	√	√	
Blue River Trading Company	-	-	-	-
Home Decorators Collection	√	√		√
Bloomingdale's By Mail	√	√	√	√
Trifles Spaces	√	√		√
The Old Wagon Factory	√	√	√	√
Horchow Home	√	√		
Reverie	√		√	
The Last Best Place	√		√	
Pottery Barn	√	√	√	√
Smith and Hawkin	-	-	-	-
Hold Everything	-	-	-	-
Crate and Barrel	√	√		√
Gump's	√	√		
Sugar Hill	√	√	√	
Somerset	√			
The Company Store	-	-	-	-

MATER ENGINEERING, LTD

BOLFOR
U S Mail Order Catalog Analysis
Survey Matrix
July, 1997

Catalog Name	*Furniture Species Used*	*Stated Characterwood*	*Stated Finishes*
Sundance 1909 South 4205 Wst Salt Lake City, UT 1-800-422-2770	spruce, pine, cedar, oak, teak, poplar, mango, mahogany offcuts (pieces left over from plantation harvesting), plantation teak	• salvaged barn wood • aged wood • reclaimed wood • wormwood • fence wood • weathered wood	• lightly distressed • white washed • weathered • antiqued • hand-distressed • timeworn antique • antique patina • painted patina • porch - white distressed
Kitchen & Home P O Box 2527 La Crosse, WI 54602-2527 1-800-414-5544	oak, teak (natural), select hardwoods, pine, maple, birch	• reclaimed pine • naturally distressed pine	• antiqued • whitewashed • distressed • hand painted
The Bombay Company P.O. Box 161009 Fort Worth, TX 76161-1009 1-800-829-7789	pine, hardwoods	None Stated	• antiqued • crackle-glaze • mahogany-finished • hand-distressed

BOLFOR
U S. Mail Order Catalog Analysis
Survey Matrix
July, 1997
(continued)

Catalog Name	*Furniture Species Used*	*Stated Characterwood*	*Stated Finishes*
The Kensington Collection (Good Catalog Company) 5456 SE International Way Portland, OR 97222 1-800-225-3870	pine, maple, oak, cherry	• wormwood	• antiqued • crackled • lightly-washed • wornwood finished • hand-painted
Blue River Trading Company 1500 NW 62nd Street, Ste. 509 Ft Lauderdale, FL 33309 1-800-761-1197	pine	• wormwood • distressed • aged	• aged • distressed • antiqued
Home Decorators Collection 2025 Concourse Drive St Louis, MO 63146-4178 1-800-245-2217	cedar, cherry, hardwoods, pine, hickory, poplar, beech, maple, basswood, camphorwood	None Stated	• color-distressed • white-washed • hand-rubbed distressed • mahogany finish • antiqued • hand painted • crackled

BOLFOR
U S Mail Order Catalog Analysis
Survey Matrix
July, 1997
(continued)

Catalog Name	*Furniture Species Used*	*Stated Characterwood*	*Stated Finishes*
Bloomingdale's By Mail 475 Knotter Dr Cheshire, CT 06410-1130 1-800-271-5321	pine, hardwoods of the Peruvian jungle, ebony, poplar, rainforest cedar & mahogany, patagonian cherry, plantation mahogany	• wormwood • knotty wood • natural pine	• hand-distressed • distressed white finish • antiqued white
Trifles Spaces P O Box 620048 Dallas, TX 75262-0048 1-800-456-7019	maple, spruce, mango, alder, teak	• rough-sawn • checked wood	• weathered white painted
The Old Wagon Factory 103 Russell Street P O Box 1427 Clarksville, VA 23927 1-800-874-4646	oak, select hardwood, mahogany, poplar, western red cedar, plantation teak, pine, poplar, birch	• recycled pine	• painted • antiqued • distressed • timeworn antique patina
Horchow Home P O Box 620048 Dallas, TX 75262-0048 1-800-456-7000	walnut, myrtle, pine, select hardwoods, maple, cherry, mahogany, pecan, palissander, tanganica, poplar, redwood	• wormwood • burlwood	• distressed • antiqued • pickled • black antiquing • hand-applied textured, weathered finish

MATER ENGINEERING, LTD

BOLFOR
U S Mail Order Catalog Analysis
Survey Matrix
July, 1997
(continued)

Catalog Name	*Furniture Species Used*	*Stated Characterwood*	*Stated Finishes*
Revere P O Box 12022 Cheyenne, WY 82003-4222 1-800-775-7523	pine, tico	• barnwood • wormwood	None Stated
The Last Best Place Catalog Company 1112 7th Avenue Monroe, WI 53566-1364 1-800-252-4766	pine	None Stated	• hand-distressed • color washed
Pottery Barn P O Box 7044 San Francisco, CA 94120-7044 1-800-922-5507	pine ("new"), beechwood, Douglas Fir, ramin, lenga, mahogany, mango	• wormwood • rustic pine	• distressed • antique-treated • weathered • white washed
Smith and Hawkin 117 Sales Department Mill Valley, CA 94941 (415) 389-8300	teak	None Stated	None Stated
Hold Everything P.O Box 7807 San Francisco, CA 94120-7807 1-800-421-2264	pine, birch, oak, beech, maple, red cedar	• knotty pine	• whitewashed

BOLFOR
U S Mail Order Catalog Analysis
Survey Matrix
July, 1997
(continued)

Catalog Name	*Furniture Species Used*	*Stated Characterwood*	*Stated Finishes*
Crate and Barrel P O Box 9059 Wheeling, IL 60090-9059 1-800-323-5461	mahogany, maple, aspen, nyatoh, cypress	None Stated	• hand-applied blue antique • exclusive thistle-green stain for a seasoned look
Gump's 135 Post Street San Francisco, CA 94108 1-800-284-8677	teak, cherry, non-endangered African boubinga, poplar, teak, rosewood, mountain elm, mahogany (plantation-managed), luan, paulownia, walnut, pine, zelkova	• antique burled wood • figured wood	• hand-rubbed lacquer • old world crackling technique • gold-leaf finish • antiqued
Sugar Hill 1037 front Avenue Columbus, GA 31902-1300 1-800-344-6125	pine, poplar, Alpine fir, boxwood, selected hardwoods, plantation teak, cherry, tulipwood, mahogany, birch, beechwood	• knotty pine • burls • whorls • knots • seasoned wood	• dry-brushed • timeworn, coffee-washed finish • hand-rubbed to create aged patina • ivory-washed • distressed • hand-antiqued finish • painted in weathered hues

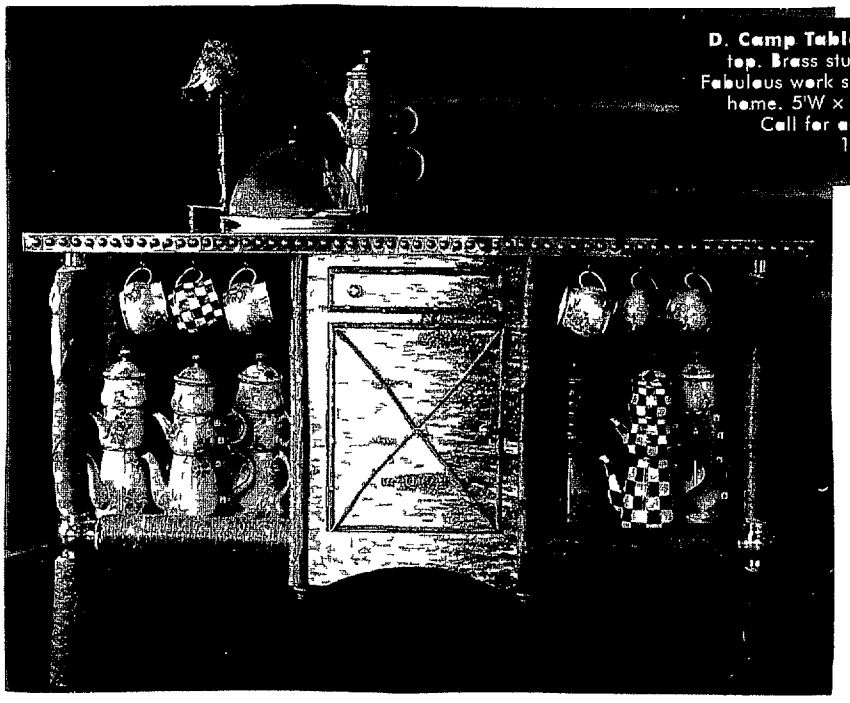
BOLFOR
U S Mail Order Catalog Analysis
Survey Matrix
July, 1997
(continued)

Catalog Name	*Furniture Species Used*	*Stated Characterwood*	*Stated Finishes*
Somerset (Good Catalog Company) 5456 SE International Way Portland, OR 97222 1-800-225-3870	oak, pine, hardwood	• rugged, rough-sawn • textured pine	• antiqued
The Company Store 500 Company Store Road La Crosse, WI 54601 1-800-285-3696	birch, selected hardwoods, hickory	• branches • twigs • bark	• mellowood pine

Many in the forest products industry consider "characterwood" to be those elements of the tree, such as the limbs, branches, and bark, with very marginal value for product manufacturing Although certainly a niche product development category, even those elements can be turned into high-value product, as noted in these product examples selling in a 1996 issue of *The Company Store Catalog* for several thousands of U S dollars

RUSTIC EMPIRE FOUR DRAWER DRESSER This one of a kind handcrafted dresser is distinguished by the knobby grain and hardy texture of real northern white birch bark The front is embellished with plaited ox twigs and pine cones and pine needles and acorn drawer pulls Cabin with concealed jewelry drawer attached to the top Please allow 4 6 weeks delivery USA Shipping note $100 00 additional shipping charge

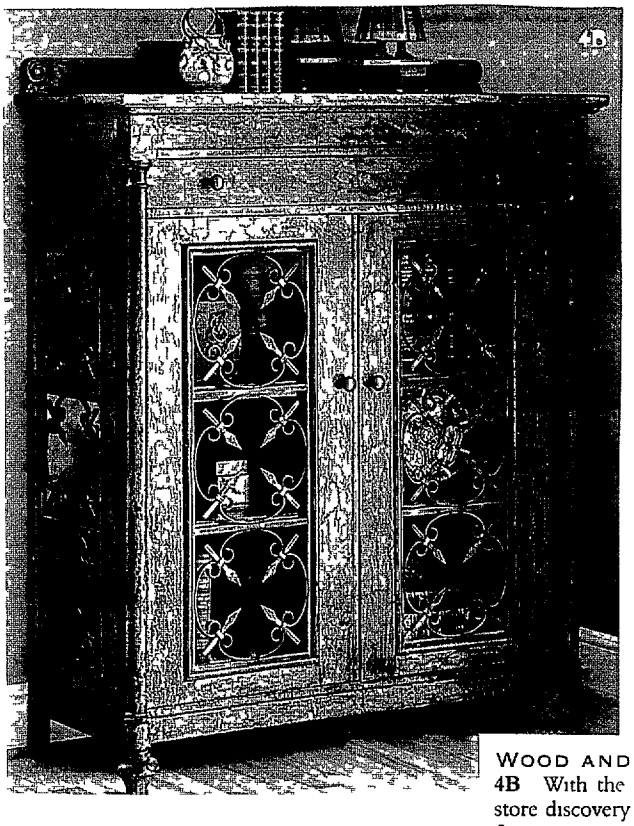
RUSTIC EMPIRE DRESSER #XA43
46 Wx21 Dx60 H $3500



D. Camp Table. Birch bark base with copper top. Brass studs. Pot hooks under counter. Fabulous work space for a midsummer's dream home. 5'W x 30"D x 36"H. #0301 **$4000** Call for additional freight charges, 1-800-525-9308.

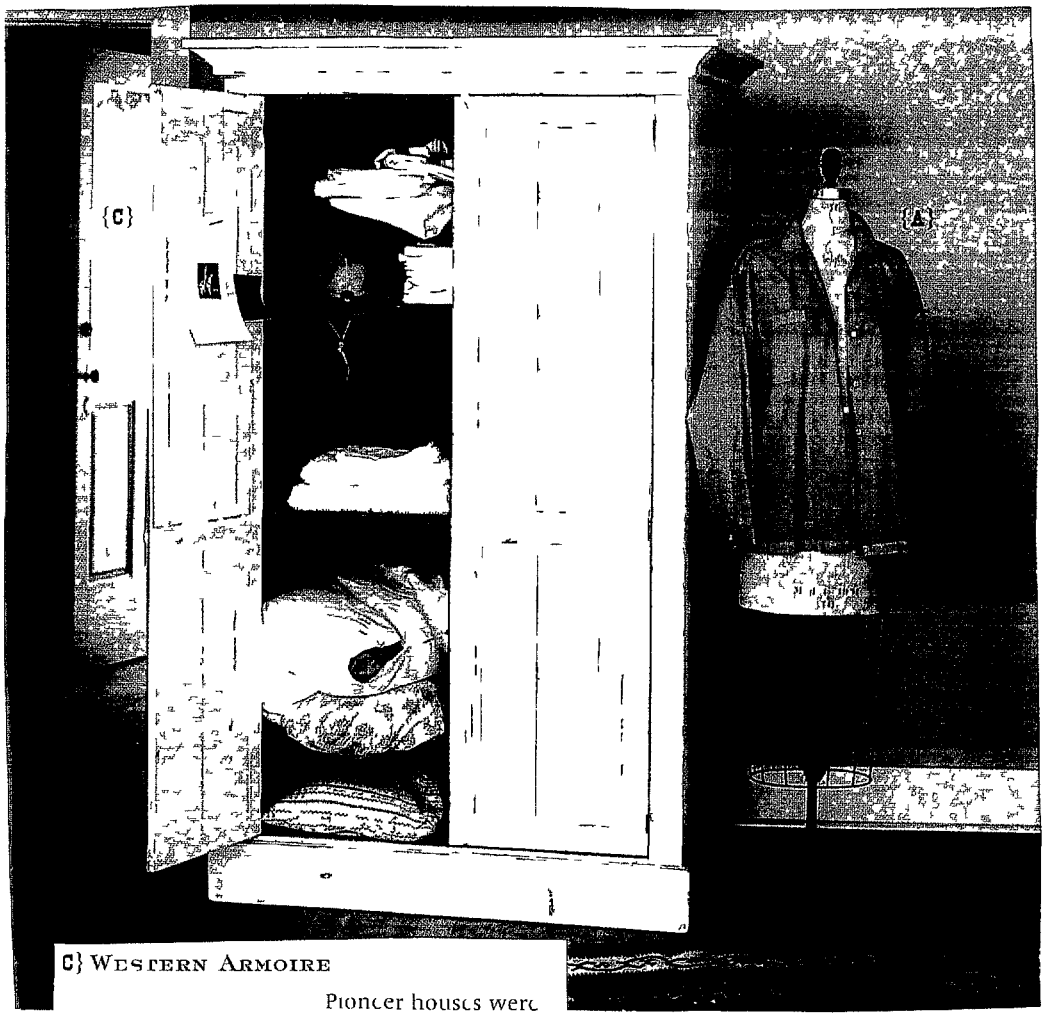
MATER ENGINEERING, LTD

More and more furniture products are being offered to North American and European consumers with "specialty" finishes being applied to give the consumer that preferred "*weathered*" look In their ***June 1996*** issues, ***The Horchow Company Catalog*** ensures their product buyers that a "hand-applied textured (crackled) weather finish has been employed on this furniture piece Not so uncommon, the buyer is not even told whether the wood is hardwood or softwood

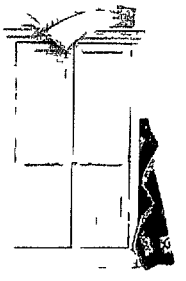


WOOD AND IRON CABINET
4B With the appeal of an antique store discovery our wooden cabinet features openwork wrought-iron panels in the doors and on the sides With a hand-applied textured weathered finish and three shelves Imported 60 W x 20 D x 48"T Allow 6-8 weeks See order form for delivery information
4B Cabinet 1 449 00 (200 00)

MATER ENGINEERING, LTD



{C} Western Armoire



Pioneer houses were built without closets so clothing and linens were kept in freestanding wardrobes similar to this one. Our reproduction serves a similar purpose in your bedroom or you might use it to store audio equipment, games, books and magazines. Inside, seven shelves (one fixed, six adjustable) can be configured to suit your needs. It's made in authentic pioneer fashion of solid sugar pine with a handpainted whitewash finish. Handcrafted in USA. 48"W x 23"D x 76"H. Please allow 8–12 weeks for delivery.

[CG428] **$1,350**

$10 SHIPPING SURCHARGE

Here ***Sundance Catalog (1997)*** tells the consumer that this armoire is made from "*solid sugar pine*" (a lower-value species in the U.S.), then "*handpainted whitewash finished*" to give that "*authentic pioneer fashion*" look. And it only costs $1,350 US!! Note the whitewash finish accentuates the added character (defect) in the pine.

MATER ENGINEERING, LTD

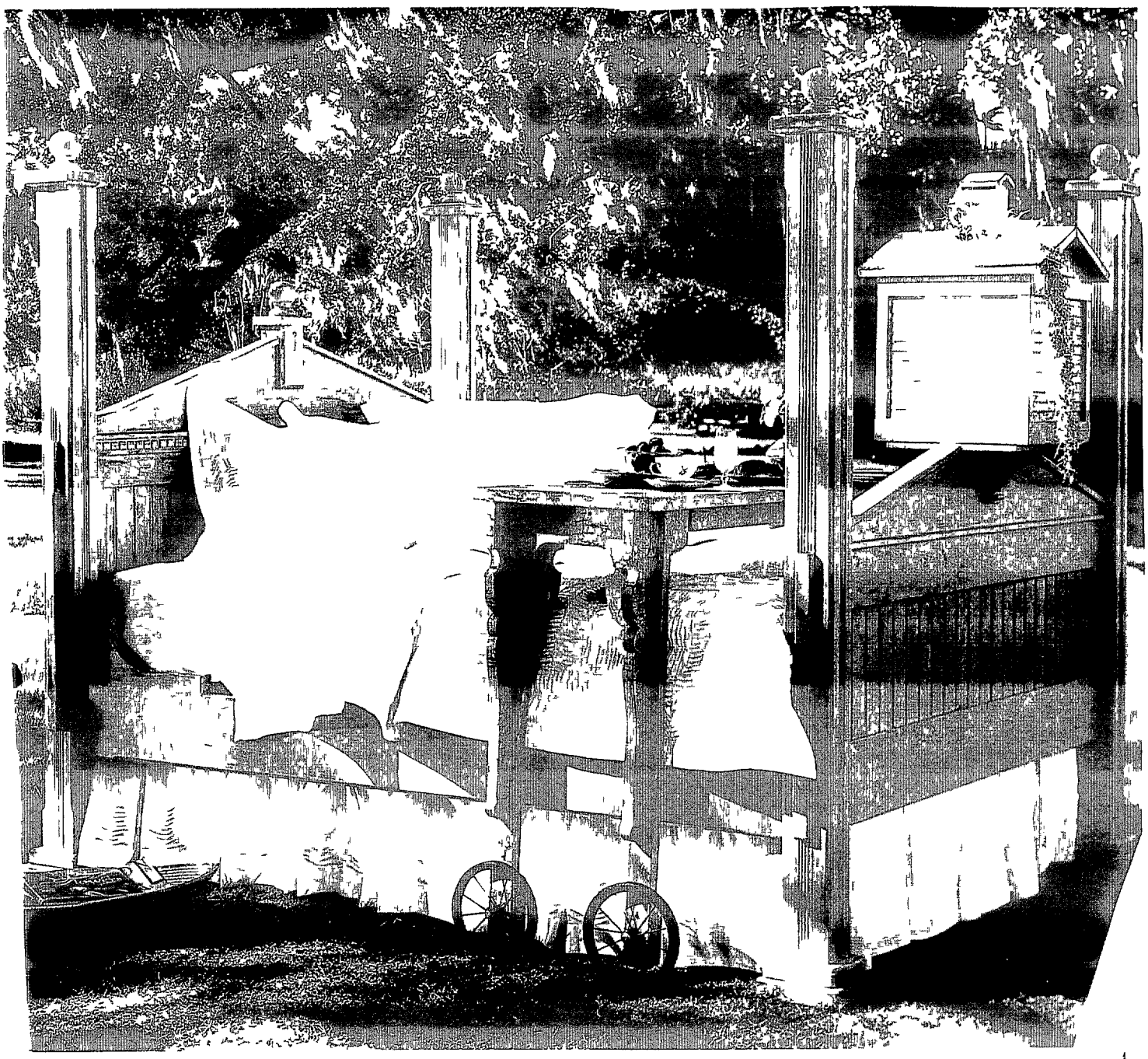
Exclusive

Hand Built Stay All Day Haven

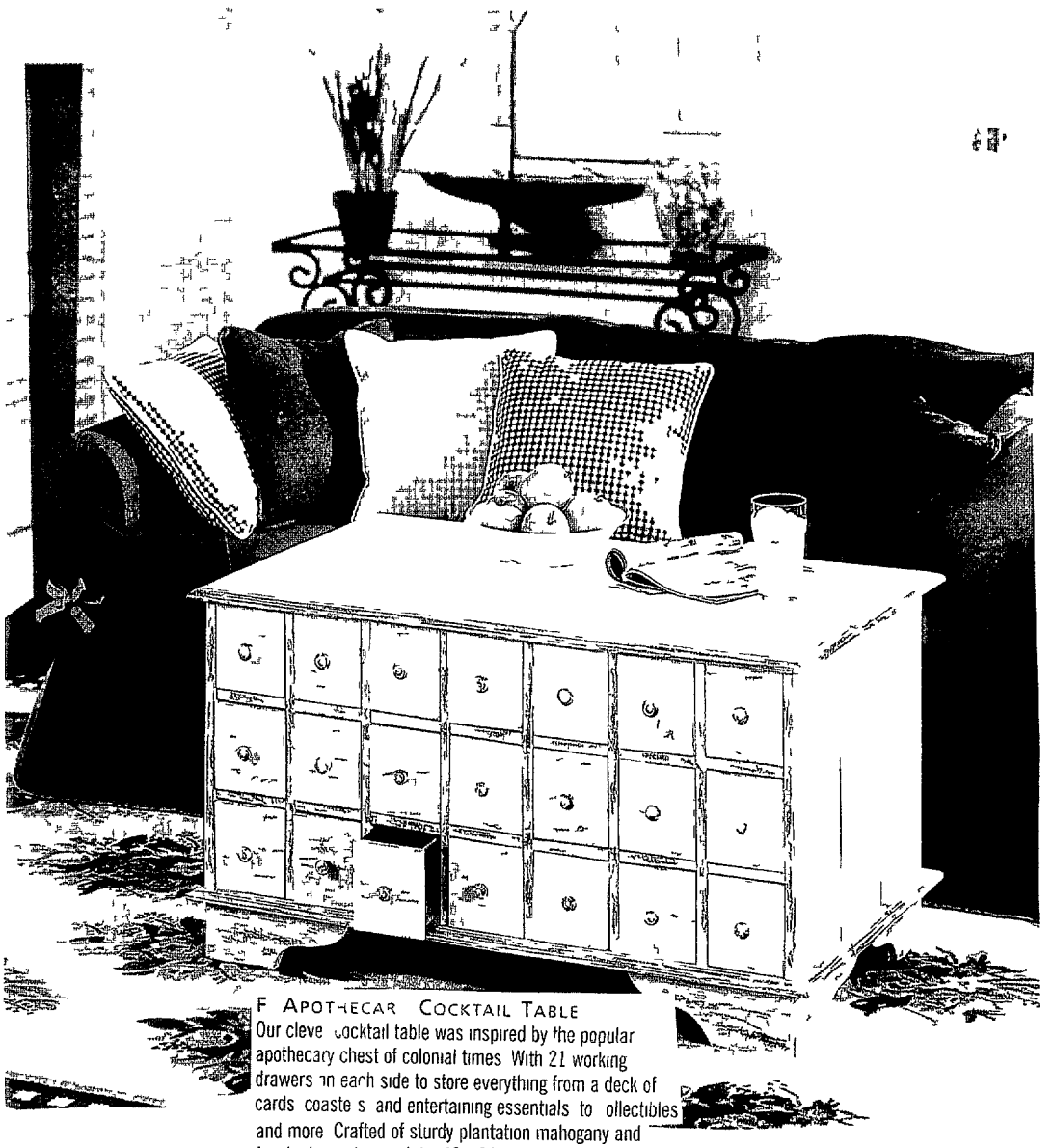
Inspired by a bed that impressed benefactors at the 1995 American Craft Museum Fundraiser our bed is a testament to the ingenuity of American folk art and architectural design Created by Lewis Krevolin a master builder of Deconstructionist furniture our stay all-day haven is designed to recall the flavor of a Victorian porch From the grounded Doric columns to the crisp paneled wainscotting this bed combines classic elements with 19th century vernacular architecture Propelled by antique baby buggy wheels the gantry table rolls up for eating reading writing or computing and can be easily removed for sleeping If desired, the footboard mounted carriage house accommodates a 9" television Hand built of solid pine with a timeworn coffee washed finish, our bed is designed and crafted exclusively for Sugar Hill Queen size only (headboard measures 69"H x 69"W) Allow 6 to 8 weeks for shipment

G89300x3 ***$5 500 00*** *(545 00)*

Sugar Hill Catalog (1996) offers its customers a special variation on a Thomas Bed design - taking into account the on-going craze U S consumers have for functional and show-piece birdhouses The "*solid pine*" bed is "*timeworn coffee-washed, antiqued finished*" to "*recall the flavor of an old Victorian porch*" The piece sells for $5,500 US

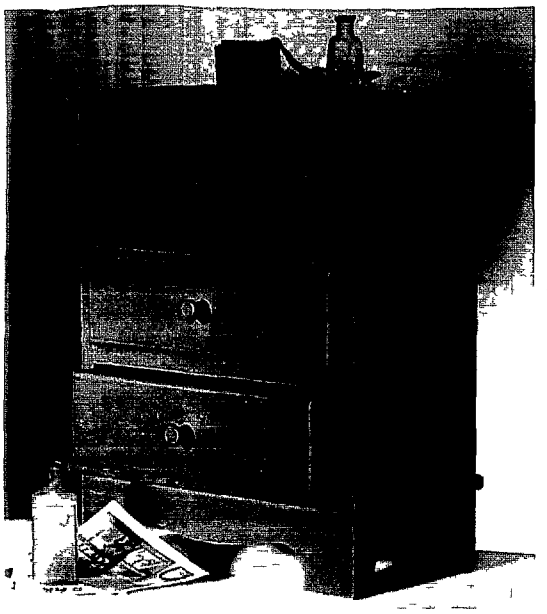


Bloomingdale's By Mail (1997) wants you to know that this clever cocktail table is made from "*sturdy plantation (environmentally-acceptable) mahogany*", and painted in antique white resulting in "colonial times" fashion piece The catalog also felt it important to let the customer know that the piece is imported

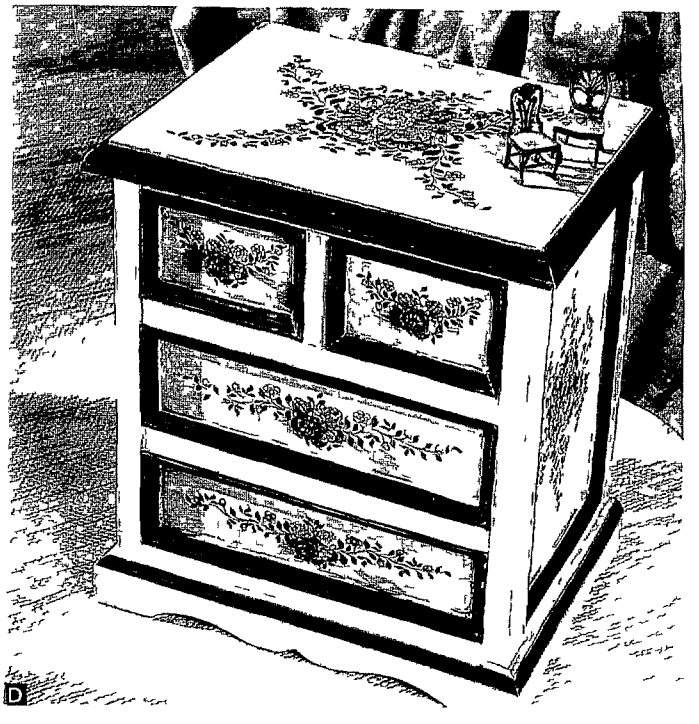


F APOTHECAR COCKTAIL TABLE
Our cleve cocktail table was inspired by the popular apothecary chest of colonial times With 21 working drawers in each side to store everything from a deck of cards coaste s and entertaining essentials to collectibles and more Crafted of sturdy plantation mahogany and finished in antique white 40 x 24 x 23H Imported
Catalog only *86603Z2* ***499 00*** *(70 00)†*
†Please allow to 1 weeks for delivery

Crate and Barrel Catalog (1996) also wants their customers to know their "cozy cache" is made from "solid mahogany", even though no one could tell since the piece has a "*hand-applied blue antique finish*" Not to be outdone, ***Bloomingdale's By Mail (1996)*** also offers its customers a chest of drawers made from "*rainforest cedar and mahogany*" (no plantation stuff here!)

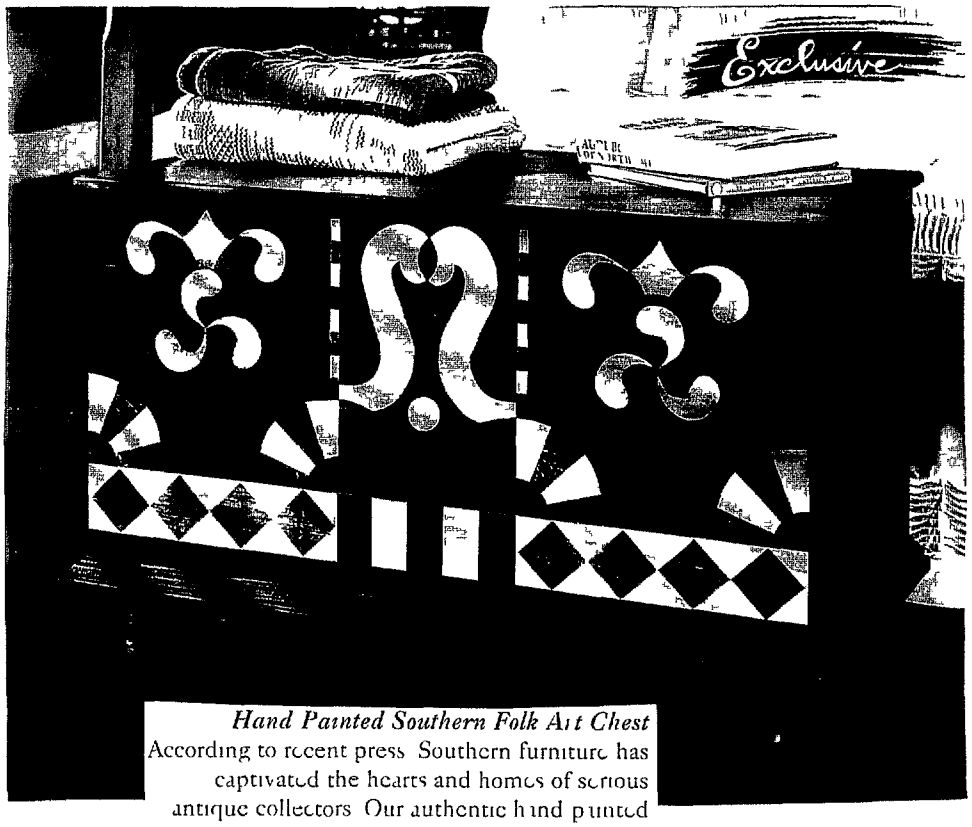


G Mini Chest Here's a cozy cache for all kinds of mementos Crafted of solid mahogany, our three drawer chest has a hand applied blue antique finish Store forget me not notes or keys to the beach house An exclusive Crate and Barrel design 15"x8½"x18"H *#7602* **$79 95**



D FOUR DRAWER CHEST
A beautiful hand rubbed blush finish gives our chest its uncommon presence further distinguished by a handpainted floral leaf design The structure is straightforward with four drawers and a sturdy base of rainforest cedar and mahogany 21L x 15W x 23½H No assembly required

This hand-painted southern folk-art chest is a rendition of the original piece that "*recently sold for $365,000*", or so ***Sugar Hill Catalog (1996)*** tells its customers The pine piece had to be "*distressed*" (apparently the wood used was not naturally distressed material) to produce "*the look of a prized antique*" $950 US



Hand Painted Southern Folk Art Chest

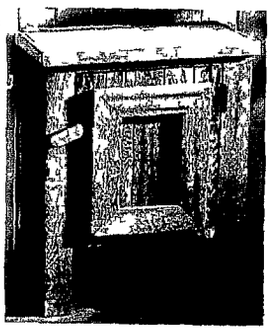
According to recent press Southern furniture has captivated the hearts and homes of serious antique collectors Our authentic hand painted chest is a close adaptation of a circa 1800 Spitler chest believed to be painted by Johannes Spitler one of the few German Swiss influenced artists of Virginia The original recently sold at Sotheby's for $365 000 To create our stunning updated version artisans in the Blue Ridge Mountains of northeast Georgia use a custom mixed palette of Prussian blue with an undercoat of clay red accented with black and white beautifully distressed for the look of a prized antique Handcrafted of solid pine with bun feet and a clay red interior the chest has a safety chain no locking mechanism Designed and produced exclusively for Sugar Hill 41½"W x 22½"D x 27"H Allow 4 to 6 weeks for shipment

G89x0244 ***$950 00*** *(72 00)*

MATER ENGINEERING, LTD

So strong is the market demand for weathered, timeworn furniture, some manufacturers have found cash opportunities from scrap material Furniture made from old barn-wood or old fence-wood has a ready market in the high-end catalog arena, as noted in this piece offered by ***Sundance (1997)***

H} Potting Bench Cabinet Adapted for Your Home



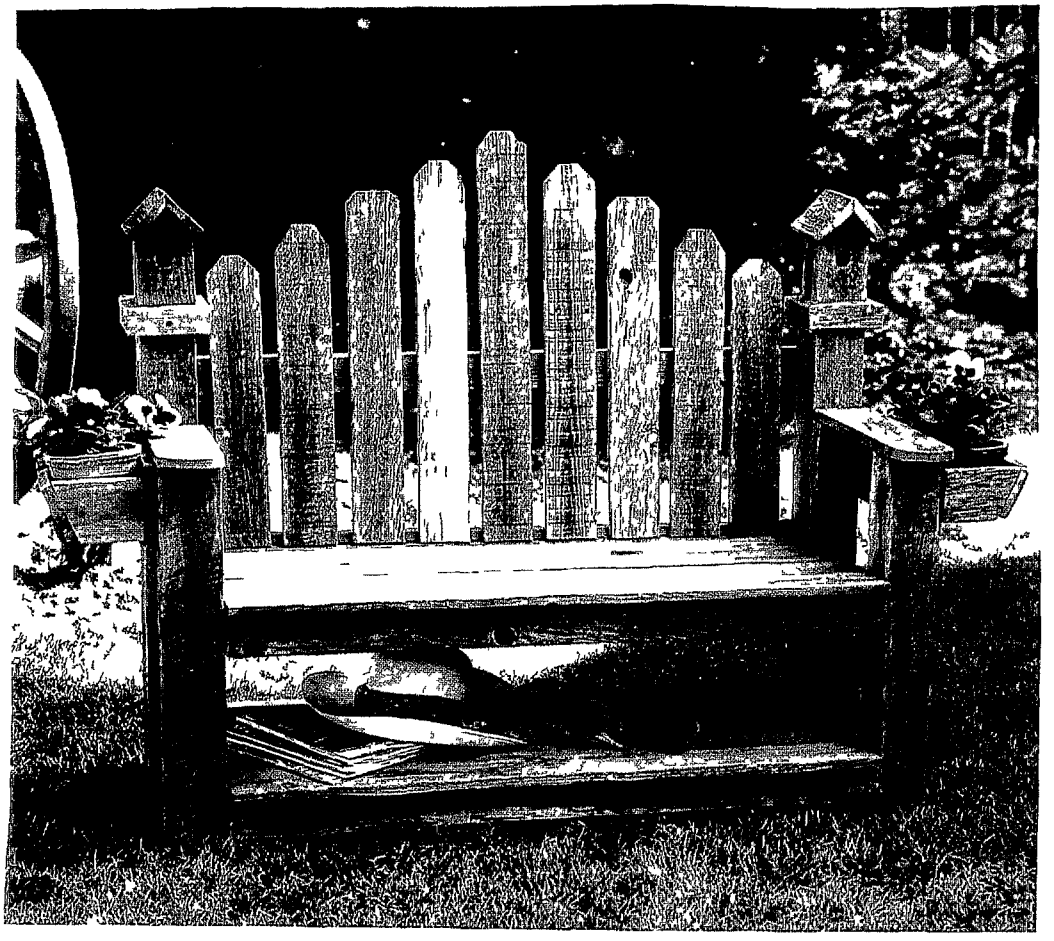
Adapted from the classic potting bench this well weathered cabinet is just the right size for so many spaces in your entry dining room family room sunroom or covered porch Handcrafted from wood reclaimed from barns and fences around Dallas Texas and hand finished to eliminate snags and roughness the rustic cabinet provides ideal storage behind its double doors for liquor barware games videos CDs and more Single door version also available

[CG142] *Double door (34 W x 16 D x 30 H)* **$185**

[CG264] *Single door (26 W x 16 D x 32 H)* **$135**

MATER ENGINEERING, LTD

For only $310 US, one can own this unique "*picket fence bench*" offered by ***Sundance (1997)*** The catalog tells the buyer the piece is "*constructed from aged spruce and cedar for weather readiness*"



Picket fence bench

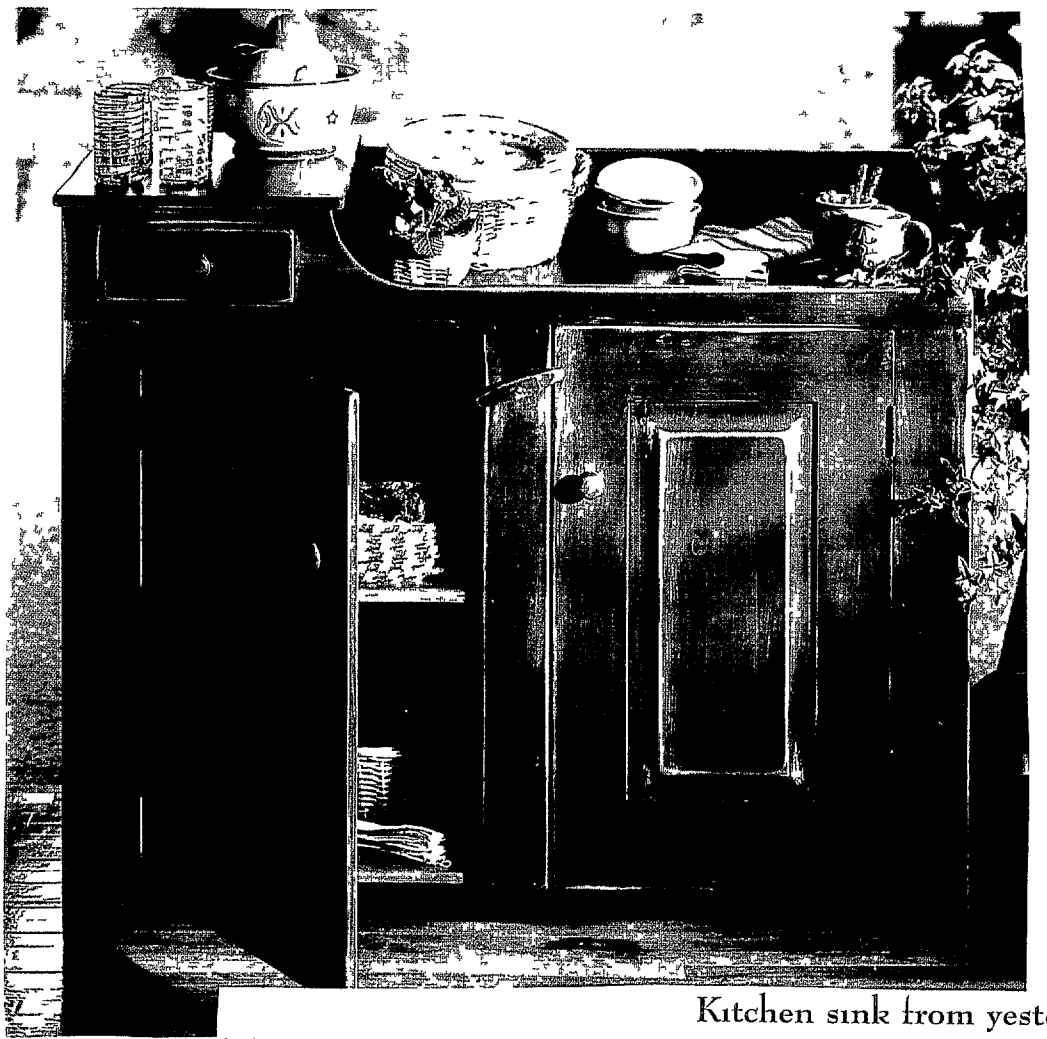
Not just for the birds, though your feathered friends will love it too, this delightful bench will quickly become a favorite garden refuge. Hand constructed with aged spruce and cedar for weather readiness, the bench big enough for two sports double birdhouses and a planter box on each side. Underneath the seat, there's a handy shelf for plants or gardening supplies. Made in USA. Some assembly required. 60 W x 20 D x 42 H. Please allow 4–6 weeks for delivery.

CT054 Birdhouse bench $310

$20 shipping surcharge

MATER ENGINEERING, LTD

There's no mistaking the origin of the distressed look on this furniture piece offered by ***Sundance (1997)*** The kitchen sink from yesteryear is "*hand-stressed painted pine to create that timeworn antique look*" $995 US



Kitchen sink from yesteryear

Before running water became common every farmhouse had a dry sink with recessed top to accommodate a water basin for washing up. Our modern replica recaptures the home spun charm of such a piece just as useful today as a buffet or bar cabinet. Authentically constructed with a splashback, turned knobs and old fashioned door latch the sink has a handy drawer for small utensils or napkins, candles and such. Two paneled doors open to reveal one shelf for spacious storage. Mountain artisans in the Ozarks handcraft each piece in solid pine, then hand stress, paint, sand and lacquer it to recreate the look of a timeworn antique. The color is a soft washed navy blue. 48 W x 20 D x 91 H. Please allow 4-6 weeks for delivery.

CG415 Farmer's dry sink $995

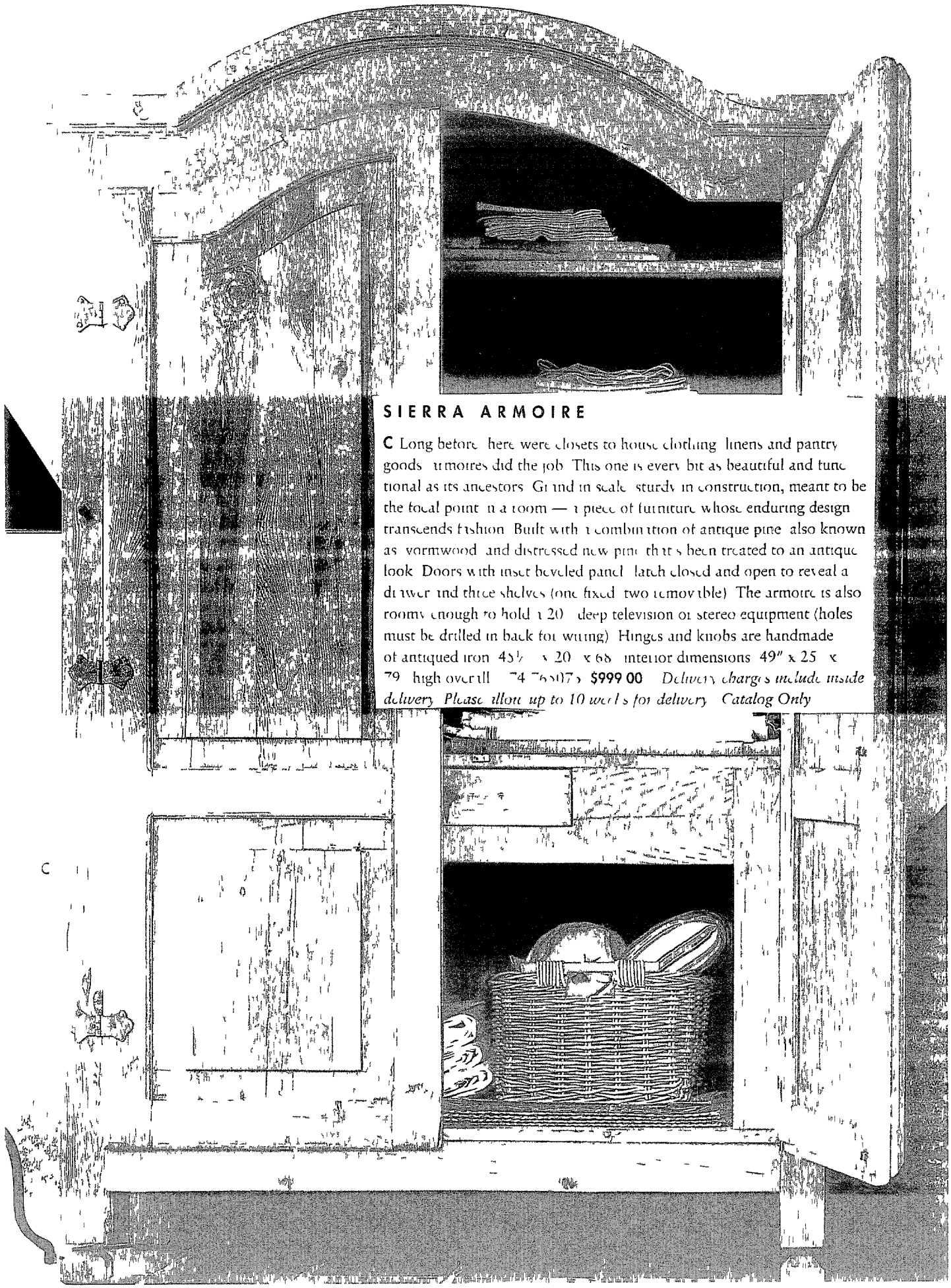
$ 0 shipping surcharge

MATER ENGINEERING, LTD

Exposing the true character of the wood used in the attached Sierra Armoire offering from ***The Pottery Barn (1997)***, this thousand-dollar piece clearly exhibits wood defects normally cut out, chipped up, burned, or thrown away by many wood product manufacturers Even with a casual eye, one notes the following defects-turned-characterwood

- Mineral stain
- large knots (bigger than 1" diameter)
- small holes
- small/sound knots
- grain and color variation
- splits
- short/shallow checks

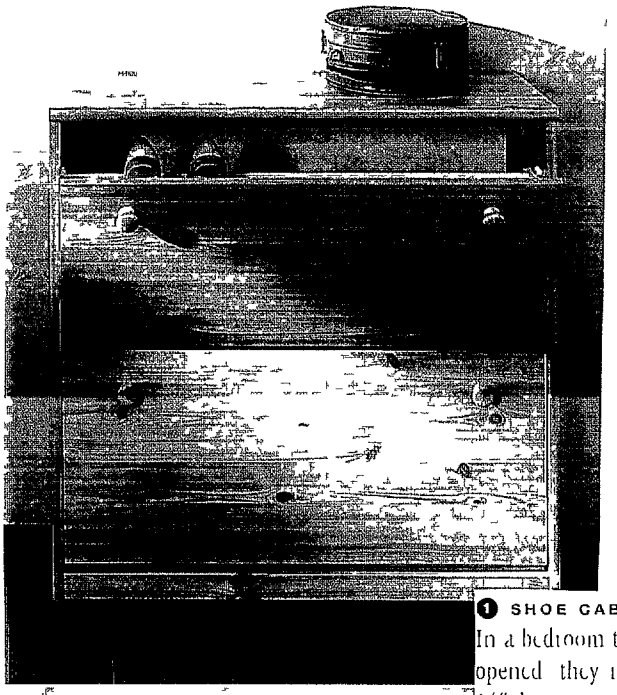
MATER ENGINEERING, LTD



SIERRA ARMOIRE

C Long before there were closets to house clothing linens and pantry goods armoires did the job This one is every bit as beautiful and functional as its ancestors Grand in scale sturdy in construction, meant to be the focal point in a room — a piece of furniture whose enduring design transcends fashion Built with a combination of antique pine also known as wormwood and distressed new pine that's been treated to an antique look Doors with inset beveled panel latch closed and open to reveal a drawer and three shelves (one fixed two removable) The armoire is also roomy enough to hold a 20 deep television or stereo equipment (holes must be drilled in back for wiring) Hinges and knobs are handmade of antiqued iron 45½ x 20 x 68 interior dimensions 49" x 25 x 79 high overall 74 76507 **$999 00** *Delivery charges include inside delivery Please allow up to 10 weeks for delivery Catalog Only*

This creatively-designed shoe cabinet offered by ***Hold Everything (1996)*** shows how small knots in wood material are quite acceptable in medium-priced furniture offerings



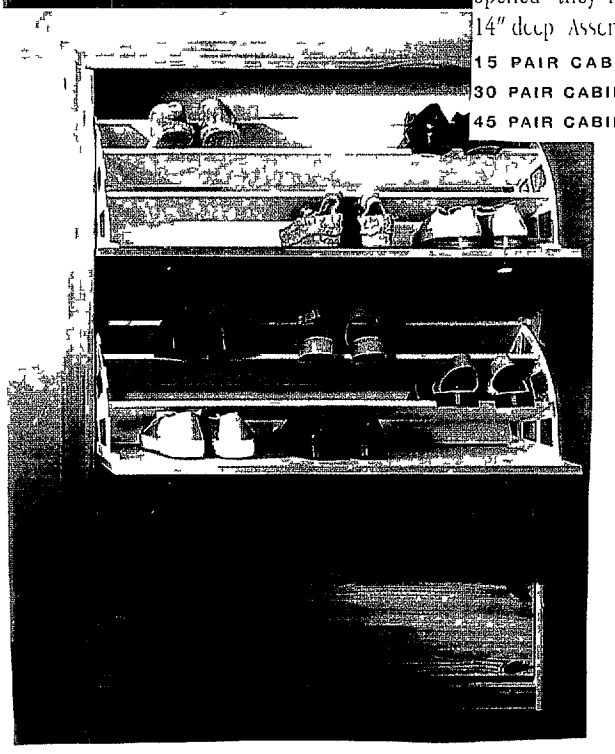
1 SHOE CABINETS

In a bedroom these cabinets appear to be chests of drawers But when opened they reveal neatly arranged rows of footwear 34" wide and 14" deep Assembly required Pine or White Laminate *catalog only*

15 PAIR CABINET not shown 18" H #78 963603 **$99 00** *($5 00)*

30 PAIR CABINET at top 33" H #78 963629 **$169 00** *($5 00)*

45 PAIR CABINET above 48" H #78 959866 **$199 00** *($10 00)*



MATER ENGINEERING, LTD

Moving to the higher-priced product offerings might suggest less allowance for defect in material Not so - as shown in this Thomas Bed and side table offering from ***The Pottery Barn (1996)*** clearly illustrating medium-distressed wood with quite large knots

MATER ENGINEERING, LTD

Antiqued-Pine Side Table

D Sized to rest beside a bed or sofa, our side table features a roomy drawer and cabinet Rustically crafted of distressed pine, it's accented by hand-forged, antiqued-iron hardware Choose Right- or Left-Hand Opening Door 19 25 x 16.75 x 27 5" h
•68-842278 $149 *($20)*

Antiqued Pine Bureau

E A straightforward bureau is distinguished by the grain and knots that characterize pine With five roomy drawers and a stable flat base, the piece has antiqued-iron drawer pulls 33 5 x 19 x 35 5" h
•68-875765 $499 *($100)*

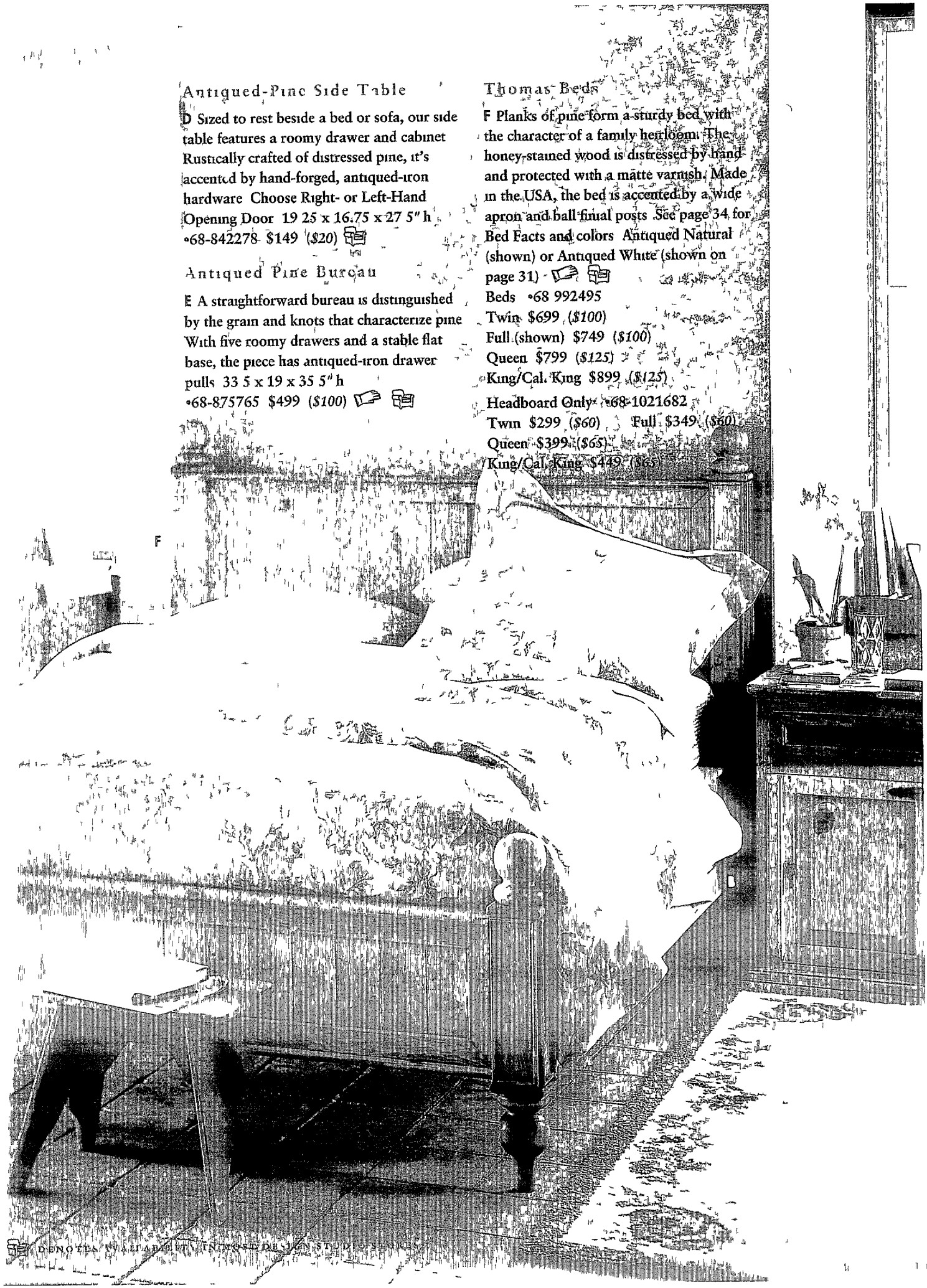
Thomas Beds

F Planks of pine form a sturdy bed with the character of a family heirloom The honey-stained wood is distressed by hand and protected with a matte varnish Made in the USA, the bed is accented by a wide apron and ball finial posts See page 34 for Bed Facts and colors Antiqued Natural (shown) or Antiqued White (shown on page 31)

Beds •68 992495
Twin $699 *($100)*
Full (shown) $749 *($100)*
Queen $799 *($125)*
King/Cal. King $899 *($125)*

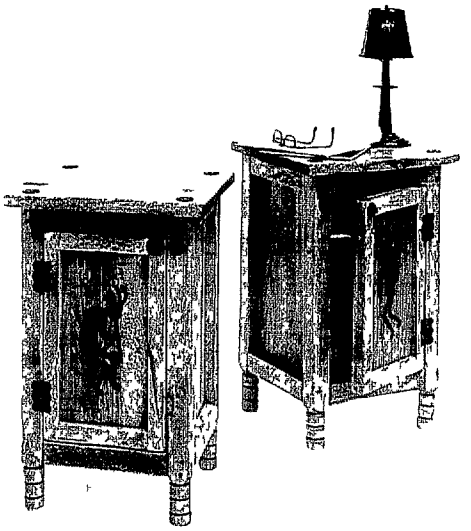
Headboard Only •68-1021682
Twin $299 *($60)* Full $349 *($60)*
Queen $399 *($65)*
King/Cal. King $449 *($65)*

F



DENOTES AVAILABILITY IN MOST DESIGN STUDIOS/STORES

Using legend from the Anasazi Indians of North America, these "*solid wood*" night stands contradict conventional wood product manufacturer mind-set that lumber with large wormholes must be considered waste material and not used in product development This piece offered by ***Sundance (1997)***



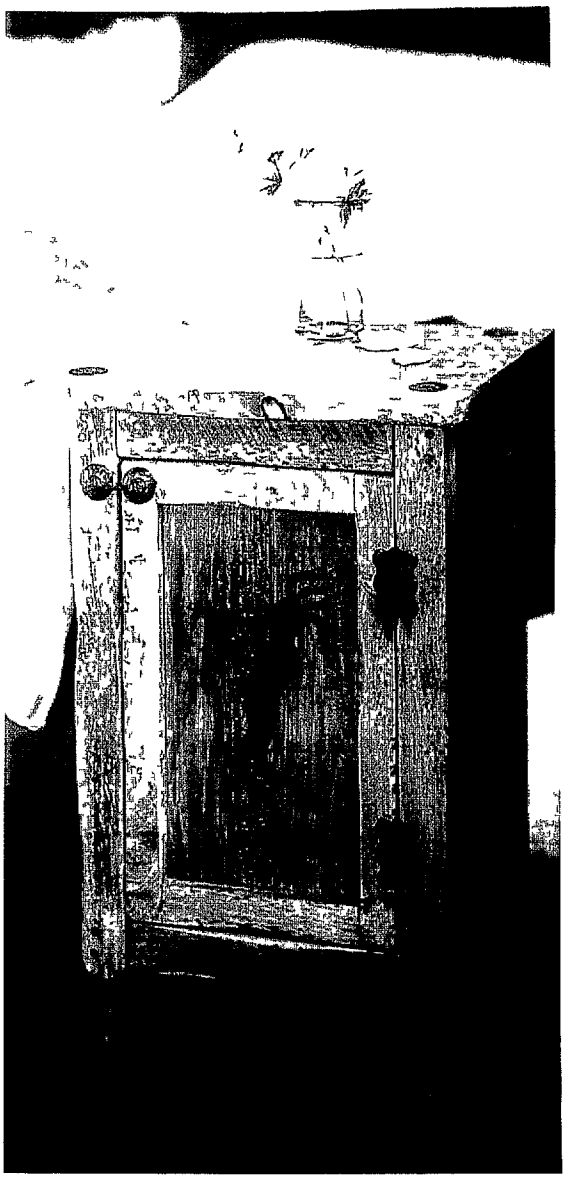
D} Sweet Dreams Night Stands

The Anasazi's favorite mischief maker Kokopelli the flute player comes to life in hand cut and rusted silhouettes on these charmingly rustic side tables Flank your bed with the complementary pair or use one next to a chair or as a telephone stand Handcrafted in solid wood with a satin finished fruitwood stain embellished with hand wrought rusted metal hardware and hook latches One shelf inside Available in left or right facing styles (please specify) or as a pair of one each A Sundance Catalog exclusive made in USA 17 W x 15 D x 28 H Please allow 4–6 weeks for delivery

[CG430] *Nightstand* **$395**

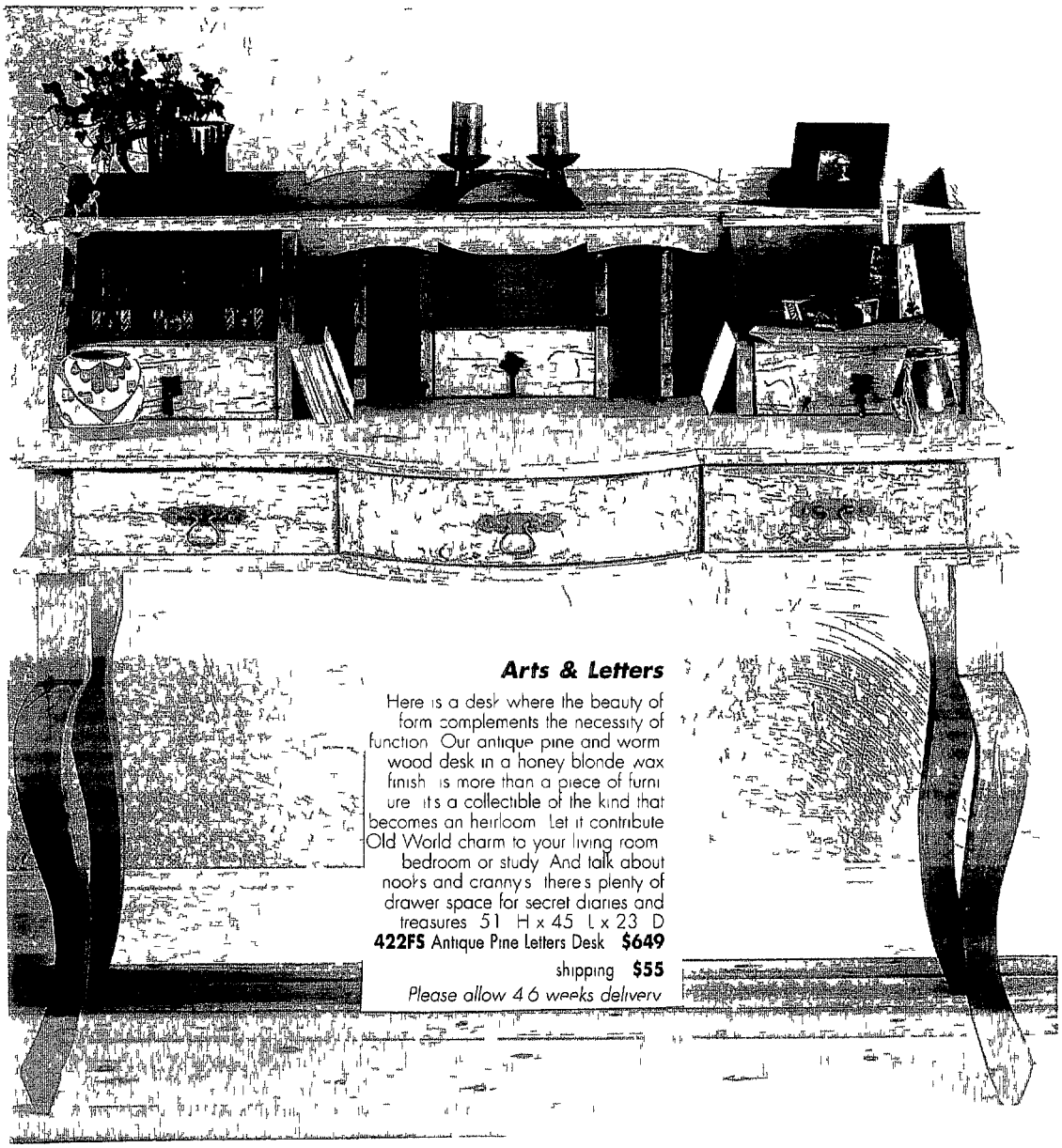
[CG431] *Pair of nightstands* **$750**

SEE SHIPPING SPECIFICS



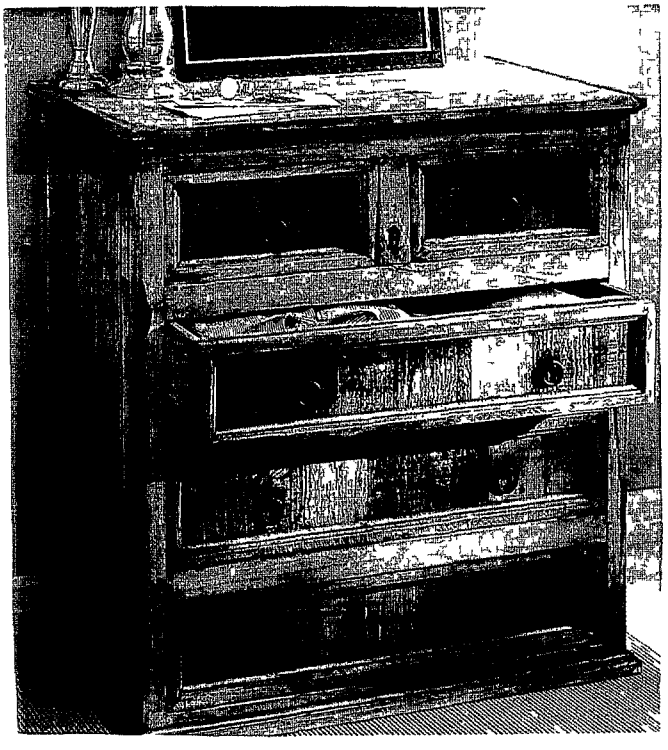
MATER ENGINEERING, LTD

Blue River Trading Company (1996) catalog has already discovered the high market value for "wormwood", as it proudly announces this desk offering to its consumers The noted insect tunneling throughout the piece is thought to be added desirable "wormwood" touches Scrap wood turned into a $650 US furniture piece!



MATER ENGINEERING, LTD

This five-drawer dresser really catches traditional wood product producers off-guard, as highly-defect spalty wood is actually used as the front panels for this $500 US furniture offering by ***Bloomingdales By Mail (1996)***



C FIVE DRAWER DRESSER
A rustic chest features the straightforward simple lines of a country classic yet works instantly in traditional to contemporary settings Crafted from solid pine with five drawers and hand wrought iron pulls hand rubbed with wax to give it a soft natural patina 33 x 19 x 35'
Catalog only Imported
83752WN ***499 00†***
†This item requires an additional delivery charge Please call our Phone Consultants for details and allow 4 to 6 weeks for delivery

MATER ENGINEERING, LTD

BOLFOR
Wood Product Producers Survey Results
July, 1997

Cabinetry

Brookhaven Cabinetry 1 Second Street Kreamer, PA 17833 PH 717-374-2711 FX 717-374-2700	***Characterwood*** Distressed Pine ***Finishes*** White Folkstone Almond	***Species*** Cherry Oak Pine Maple
Wood Mode 1 Second Street Kreamer, PA 17833 PH 717-374-2711 FX 717-374-2700	***Characterwood*** Knotty Pine Knotty Maple ***Finishes*** Heirloom Tones Cottage Colors	***Species*** Cherry Oak Maple Pine

Building Materials

Diamond K Company 130 Buckland Street S Windsor, CT 06074 PH 203-644-8486 FX Not Listed	***Characterwood*** Barn Wood Weathered Wood ***Finishes*** Brushed	***Species*** Pine

Clocks

Kuempel Chime Clockworks and Studio 21195 Minnetonka Blvd Excelsior, MN 55331-8605 PH 800-328-6445 FX 612-474-1468	***Characterwood*** None Stated ***Finishes*** Mahogany	***Species*** Black Walnut Red Oak Cherry Walnut American Red Oak
Clocks by Foster S Campos 213 Schoosett St Route 139 Timbroke, MA 02359 PH 617-826-8577 FX Not Listed	***Characterwood*** None Stated ***Finishes*** Gold-Guilded	***Species*** Mahogany
Empreror Clocks Emperor Industrial Park Fairhope, AL 36532 PH 800-642-0011 FX 334-990-7151	***Characterwood*** Burl Overlap ***Finishes*** None Stated	***Species*** Mahogany Cherry Oak Black Walnut Maple
American Clock Maker PO Box 326 Clintonville, WI 54929 PH 800-236-7300 FX 715-823-2893	***Characterwood*** Carpathian Elm Burl Imported Mahogany Burl Walnut Burl ***Finishes*** None Stated	***Species*** Red Oak Mahogany Padouk Linden Cherry Black Walnut Ash

American Heritage Clocks 1314 South Division Avenue Grand Rapids, MI 49507 PH 888-328-6445 FX 616-245-5722	***Characterwood*** Brown Oak Burl Red Maple Burl Feather Crotch Mahogany Striped Mahogany White Ash Burl ***Finishes*** None Stated	***Species*** Mahogany Cherry Yew Maple English Yew White Ash Oak Rosewood Walnut

Wooden Containers

Orleans Carpenters Box 217 Orleans, MA 02653 PH & FX 508-255-2646	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Cherry Birds Eye Maple

Musical Instruments

Musicmaker's Kits Inc PO Box 2117 Stillwater MN 55082-3117 PH 800-432-5487 FX 612-439-9130	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Cherry Spruce Padauk Redwood Butternut Mahogany Walnut Maple Baltic Birch Cedar Ebony

Conklin Guitars PO Box 1394 Springfield, MO 65801 PH 417-886-3525 FX 417-886-2534	***Character Wood*** Quilted Maple Figured Koa ***Species*** Maple, Basswood, Ash Purpleheart, Burl Walnut, Ebony Rosewood, Bacote, Alder Solid Cherry, Poplar, Koa Ziricote, Burl Walnut, Walnut Padauk, Lacewood, Zebra Mahogany, Wenge Birdseye Maple ***Finishes*** None Stated
Gurhn Guitars 400 Broadway Nashville TN 37203 PH 615-256-2033 FX 615-255-2021	***Character Wood*** Figured Wood, Limed Mahogany Quilted Maple, Curly Maple ***Species*** Maple, Englemann Spruce Sitka Spruce, Amazon Rosewood Tamo Ash, Brazilian Rosewood Korina, Indian Rosewood Curly Maple, Bolivian Rosewood Rosewood, Mahogany Spruce, Koa Mapleglo ***Finishes*** None Stated
Hughes Dulcimer Co 4419 W Collfax Avenue Denver, CO 80204 PH 303-572-3753 FX Not Listed	***Characterwood*** None Stated ***Finishes*** None Stated ***Species:*** Rosewood Spruce Walnut Birch Black Walnut

International Violin Company 1421 Clarck View Road Suite 118 Baltimore MD 21209 PH 800-542-3538 FX 410-832-2528	***Characterwood*** None Stated ***Species*** Pernambuco Spruce Ebony Maple Rosewood European Seasoned-Spruce ***Finishes*** None Stated	 Brazilwood Makore Willow Pearwood Boxwood
McSpadden Mountain Dulcimers PO Box 1230 Mountainview, AK 72560 PH 870-269-4313 FX 870-269-5283	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Walnut Spurce Birch Koa Rosewood Cherry Redwood Black Walnut Maple

Doors

Spanish Pueblo Doors PO Box 2715 Santa Fe, NM 87504-2517 PH 505-473-0464 FX 50-473-1750	***Characterwood*** Wormy Maple Light Weathered Antiqued Knotty Pine Distress ***Finishes*** Hand-Gouged Hand-Hewn Heavy Weathered-Distressed	***Species:*** Pine Fir Mahogany Alder Soft Maple Red Oak Honduran Spruce Black Walnut

Wyoming Millwork PO Box 4185 Jackson, Wyoming 83001 PH 307-733-6989 FX Not Listed	*Characterwood* Knotty Pine Color-Varied Wood Mineral / Blue Stained ***Wood with*** Dry pitch pockets Minor surface checking Insect bores Cracked / Broken Knots *Finishes* None Stated	*Species* Pine Fir

Flooring

Aged Woods 2331 East Market Street York, PA 17402 PH 800-233-9307 FX 717-840-1468	*Characterwood* Antiqued Antique Distressed *Finishes* None Stated	*Species* Oak White Pine Chestnut Yellow Pine Hemlock Poplar
Carlisle Restoration Lumber HCR 32 Box 556C Stoddard, NH 03464 PH 800-595-9663 FX 603-446-3540	*Characterwood* Recycled Heartpine Barnwood *Finishes* None Stated	*Species* Pine Oak Cherry Maple Chestnut Hickory Walnut White Pine Red/White Oak Black Cherry

The Joinery Company PO Box 518 Tarboro NC 27886-0518 PH 919-823-3306 FX 919-823-0818	***Characterwood*** Antique Wood Recycled ***Finishes*** None Stated	***Species*** Yellow Pine Douglas Fir
Vintage Lumber 1 Counsil Drive PO Box 104 Woodsboro, MD 21798 PH 800-499-7859 FX 301-845-6475	***Characterwood*** Reclaimed/Recycled Antique Distressed Wood ***Finishes*** None Stated	***Species*** Hemlock Oak Chestnut Pine Yellow Pine Poplar Beech
Wyoming Millwork PO Box 4185 Jackson, Wyoming 83001 PH 307-733-6989 FX Not Listed	***Characterwood*** Knotty Pine Color-Varied Wood Mineral / Blue Stained *Wood with* Dry pitch pockets Minor surface checking Insect bores Cracked / Broken Knots ***Finishes*** None Stated	***Species*** Pine Fir

Gazebos

Vixen Hill Manufacturing Company Main Street Elverson, PA 19520 PH 610-286-0909 FX 601-286-2099	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Western Red Cedar

Leisure Woods PO Box 177 Genoa, IL 60135 PH 815-784-2497 FX 815-784-2499	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Western Red Cedar
Dalton Pavilions Inc 20 Commerce DR Telford, PA 18969-1030 PH 215-721-1492 FX 215-721-1501	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Western Red Cedar Heart Cedar

Architectural Millwork

Anthonys Wood Products 113 Industrial Loop Hillsburo Texas 76645 PH 800-969-2181 FX 254-582-7620	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Poplar Oak Redwood
Wood Factory 111 Railroad Street Navasota, TX 77868 PH 409-825-7233 FX 409-825-1791	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Honduran- Mahogany Ash White Oak Red Cedar Redwood Poplar White Pine
Empire Woodworks PO Box 717 Blanco, TX 78606 PH 210-833-2119 FX Not Listed	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Redwood Cedar

American Custom Millwork Inc 3904 Newton Rd Albany, GA 31706 PH 912-888-3303 PH 912-888-6848	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Appalachian Poplar Walnut Oak Cherry Mahogany
Cumberland Craftwood Company PO Drawer 609 10 Stover Drive Carlisle, PA 17013-0609 PH 717-243-0063 800-367-1884 FX 717-243-6502	***Characterwood*** Exotic Wood Burl Wood ***Finishes*** Weathered Wood	***Species*** Oak Poplar Pine Oak (Red, Honey) Beech Mahogany Walnut Western Red Cedar Birch Basswood
Copper Beech Millwork 300 Industrial DR North Hampton, MA 01061 PH 800-532-9110 FX 413-582-0164	***Characterwood*** None Stated ***Species*** Oak Cedar White Ash Beech Butternut Mahogany White Pine Teak Red & White Oak ***Finishes*** None Stated	 Poplar Redwood Basswood Birch Cherry Maple Yellow Pine Black Walnut

Drıwood Mouldıng Company 623 West Lucus Street Florence, SC 29503 PH 803-669-2478 FX 803-669-4874	***Characterwood*** None Stated ***Fınıshes*** None Stated	***Specıes*** Poplar Walnut Maple Cherry Oak
Old World Mouldıng and Fınıshıng Inc 115 Allen Blvd Farmıngdale, NY 11735 PH 516-293-1789 FX Not Lısted	***Characterwood*** None Stated ***Fınıshes*** None Stated	***Specıes*** Poplar Mahogany
Haas Woodworkıng Company 64 Clementına San Francısco, CA 94105 PH 415-421-8273 FX 415-543-6928	***Characterwood*** None Stated ***Fınıshes*** None Stated	***Specıes*** "In all kınds of hard & soft woods"

Furnıture

Lexıngton Furnıture Industrıes PO Box 1008 Lexıngtıon, NC 27293 PH 800-539-4636 FX 910-249-5365	***Characterwood*** Knotty Pıne ***Fınıshes*** Antıqued Weathered Antıqued Aged Hand Stıppled Colorwashed Buckskın Antıque Whıte Hand-applıed Surface Shadıng "Old World" Fınısh	***Specıes*** Multıple Hard & Soft Woods Saddle Oak Hard Dıstressed Lıghtly Dıstressed

Moosehead Manufacturing Co PO Box 287 Monson, Maine 04464-0287 PH 207-997-3621 FX 207-997-9611	***Characterwood*** None Stated ***Finishes*** Moosehead Gold Antique Black Lacquer & Gold	***Species*** Hard Rock Maple
The Work Shops of David T Smith 3600 Shawhan Rd/ Marrow, OH 45152 PH 513-932-2472 FX 513-932-3233	***Characterwood*** Curly Maple Birdseye Maple Quilted Maple Flame Birch ***Finishes*** Crackle Custom Stains Graining Finish	***Species*** Maple Poplar Cherry Mahogany Birch
Shaver Woodworks Inc PO Box 946 Troutman NC 28166 PH & FX 704-528-3526	***Characterwood*** Interesting Grains ***Finishes*** None Stated	***Species*** Ash Oak Maple Other Hardwoods
Berea College Berea , KY 40404 PH 800 347-3892 FX 606-968-0912	***Characterwood*** Irregular Hardwood Grain Patterns ***Finishes*** None Stated	***Species*** Walnut Oak Cherry Birch Poplar Cedar Maple Ash

Shaker Workshop PO Box 8001 Ashburnham, MA 01430-8001 PH 8008409121 FX 508-827-6554	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Maple Cherry Eastern White Pine Pine
Great Meadows Joinery PO Box 392 Wayland MA 01778 PH & FX 508-358-4370	***Characterwood*** None Stated ***Finishes*** Antique Pine Spruce Blue Milk-Paint Wash Venetian Red Glaze Yellow Ochre Milk-Paint Wash Windsur Green Milk Paint	***Species*** Tulip Poplar Cherry Butternut Walnut Eastern White Pine Maple
Boston and Winthrop 35 Banks Terrace Swampscott, MA 01907 PH 617-593-8248 FX Not listed	***Characterwood*** None Stated ***Finishes*** Sponging Ragging Stippling	***Species*** Maple Pine Colorwashed Dragging Combed
Stickley Stickley Drive Manlius, NY 13104 PH 315-682-5500 FX 315-682-6306	***Characterwood*** Mission Oak Mission Cherry ***Finishes*** Dark Copper Light Copper	***Species*** White Oak Black Cherry Ebony Pearlwood Black Walnut

Fredrick Dackloe and Brothers Box 427 Portland PA 18351 PH 717-897-6172 FX 717-897-7263	***Characterwood*** Knotty Hardwood Knotty Softwood Wormwood ***Finishes*** Country Distressed Dried Apple, Severely Antiqued Black Wipe-Off	***Species*** Cherry Hickory Ash Poplar Maple Mahogany Pine
Merrit Wish PO Box 5085 Newcastle, PA 16105 PH 412-458-4811 FX 412-458-9286	***Characterwood*** Twigs & Branches ***Finishes*** None Stated	***Species*** Cherry Walnut Oak Hickory
Shaker Shop West 5 Iverness Way Ivernell, CA 94937 PH 415-669-7256 FX 415-669-7327	***Characterwood*** Knotty Pine Rough Pine ***Finishes*** Antiqued Milk Painted	***Species*** Cherry Walnut Maple Pine Cedar Ash
Leonards 600 Taunton Avenue Seekonk, MA 02771 PH 508-336-8585 FX 508-336-4884	***Characterwood*** Tiger Maple ***Finishes*** Old Paint Windsor Green Old Red Bayberry	***Species*** Maple Cherry Mahogany

Blackwelders Industries 294 Turnersburg Hwy Statesville, NC 28677 PH 800-438-0201 FX 704-872-4491	***Characterwood*** None Stated ***Finishes*** Hand-Antiqued Hand-Distressed Black-Green Beach White Cottage Green	***Species*** Chestnut Oak Cherry Pine Mahogany Ebony Tulipwood Pecan Holly
Country Bed Shop RR 1 Box 65 Richardson Rd Ashby, MA 01431 PH 508-386-7550 FX 508-386-7263	***Characterwood*** Curly Maple ***Finishes*** Old Maple Old Pine Custom Painted	***Species*** Pine Cherry Maple Mahogany Ash Oak Walnut
Heirloom Reproductions 1834 West 5th Street Montgomery, AL 36106-1516 PH 800-288-1513 FX 334-263-3313	***Characterwood*** Wormy Maple Burl Wood Swirly White Oak Mature Maple ***Finishes*** Antiqued Tiger Oak Finish Brushed Gold White Gold Bone White	***Species*** Oak Maple Mahogany Walnut Cherry Ash
Maxwell Furniture Co 715 Liberty Street Bedford, VA 24523 PH 800-686-1844 FX 540-587-9534	***Characterwood*** None Stated ***Finishes*** Hand-Finished	***Species*** Cherry Black Walnut

Northwoods Chair Shop 237 Old Tilton Rd Canterbury NH 03224 PH 603-783-4595 FX 603-783-3328	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Cherry Maple
Room and Board 4600 Olson Memorial Hwy Minneapolis MN 55422 PH 800-486-6554 FX 612-588-7971	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Ash Cherry Walnut
Thomas Moser Cabinetmaker 72 Wrights Landing Auburn, ME 04210 PH 800-708-9703 FX 207-784-6973	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Cherry
National Mt Airy PO Box 669 Bassett, VA 24055 PH Not Listed FX Not Listed	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Oak Birch Maple Walnut Pearwood
Dalcraft Furniture and Design PO Box 746 Starkville, MS 39759 PH 601-324-1314 FX No Listing	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Pine Oak Maple Walnut
Cohasset Colonials 10 Churchill Road Hingham, MA 02043 PH 800-288-2389 FX 617-740-4554	***Characterwood*** Knotty Pine ***Finishes*** None Listed	***Species*** Pine Cherry

LADD Furniture, Inc ***(Pennsylvania House)*** One Plaza Center - Box HP3 High Point, NC 27261-1500 PH Not Listed (only fax) FX 910-888-6446	***Characterwoood*** Wormwood Knotty Pine ***Finishes*** Vienna Lace Crackleboat Antique Black Antique Brushed Custom Color Painting	***Species*** Pine Cherry Oak Mahagony

Upholstered Furniture Frames

Classic Leather PO Box 2404 Hickory, NC 28603 PH 704-328-2046 FX Not Listed	***Characterwood*** Not Stated ***Finishes*** None Stated	***Species*** Mahogany Oak Ash Maple

Stairs

Dahlke Stair Company PO Box 418 Hadlyme CT 06439 PH 860-434-3589	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Walnut Mahogany Oak Philippine Mahogany
Goddard Manufacturing Company (Spiral Staircases) PO Box 502 Logan KS 67646 PH 800-536-4341 FX Not Listed	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Oak Pine

Spiral Manufacturing 17251 Jefferson Hwy Battonrouge LA 70817 PH 800-535-9956 FX 504-753-8351	*Characterwood* None Stated *Finishes* Pickled	*Species* Oak Pine Poplar
Mylen Stairs 650 Washington Street Peekskill, NY 10566 PH 800-431-2155 FX 914-739-9744	*Characterwood* None Stated *Finishes* None Stated	*Species* Oak Pine Mahogany
York Spiral Stairs RR 1 Box 945 North Vassalboro, MA 04962 PH 207-872-5558 FX 207-872-6731	*Characterwood* None Stated *Finishes* None Stated	*Species* Red Oak Cherry Mahogany Walnut Ash Teak Maple Poplar

Marquetry

The Wood Shed 1807 Elmwood Ave Buffalo, NY 14207 PH 716-876-4252 FX 716-876-4720	*Characterwood* Birdseye Mahogany Crazy Rosewood Chain-Link Maple Blistered Mahogany Cluster Burl Redwood Figured Red Gum, Purpleheart Bolivian Rosewood Highly-Figured Teak *Finishes* None Stated	*Species* Mahogany Rosewood Cherry Walnut

Artistry in Veneers 450 Oak tree Avenue South Planefield NJ 07080 PH 908-668-1430 FX Not Listed	***Characterwood*** Striped Wood Burl Wood Crotch Wood Wormy Chestnut ***Species*** (49 species including the following) Maple, White Oak, Ash, Walnut, Red Oak, Pine, Teak, Mahogany, Wenge, Zebrawood, Lacewood, Koa, Cherry, Pecan, Rosewood ***Finishes*** None Stated

Outdoor Furniture

Garden Concepts Collection PO Box 241233 Memphis TN 38124-1233 PH 901-756-1649 FX 901-755-4564	***Characterwood*** None Stated ***Finishes*** None Stated	***Species*** Cypress Ash
The Wood Classics 20 Osprey Lane Gardiner, NY 12525 PH 914-255-7871 FX 914-255-7881	***Characterwood*** None Stated ***Finishes*** Weathered	***Species*** Mahogany (Honduran not Philippine) Teak

Victor Stanely Inc PO Drawer 330 Dunkirk, MD 20754 PH 800-368-2573 FX Not Listed	*Characterwood* None Stated *Finishes* None Stated	*Species* Ipe Mahogany Redwood Teak Clean Heart Redwood Purpleheart Ash
Blake Industries PO Box 155 Abington, MA 02351-0155 PH 617-337-8772 FX 617-335-3004	*Characterwood* None Stated *Finishes* None Stated	*Species* Ipe Teak Douglas Fir
American Site Furniture PO Box 158 Concord MA 01742 PH 800-366-3080 FX 508-369-4472	*Characterwood* None Stated *Finishes* None Stated	*Species* Philippine- Mahogany & Other Select Hardwoods