Christopher Scott

I WOOD®

THE GROOVED LUMBER

I WOOD® : The Grooved Lumber
by Christopher Scott

1st edition

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www.treecycling.com
www.iwoodkits.com

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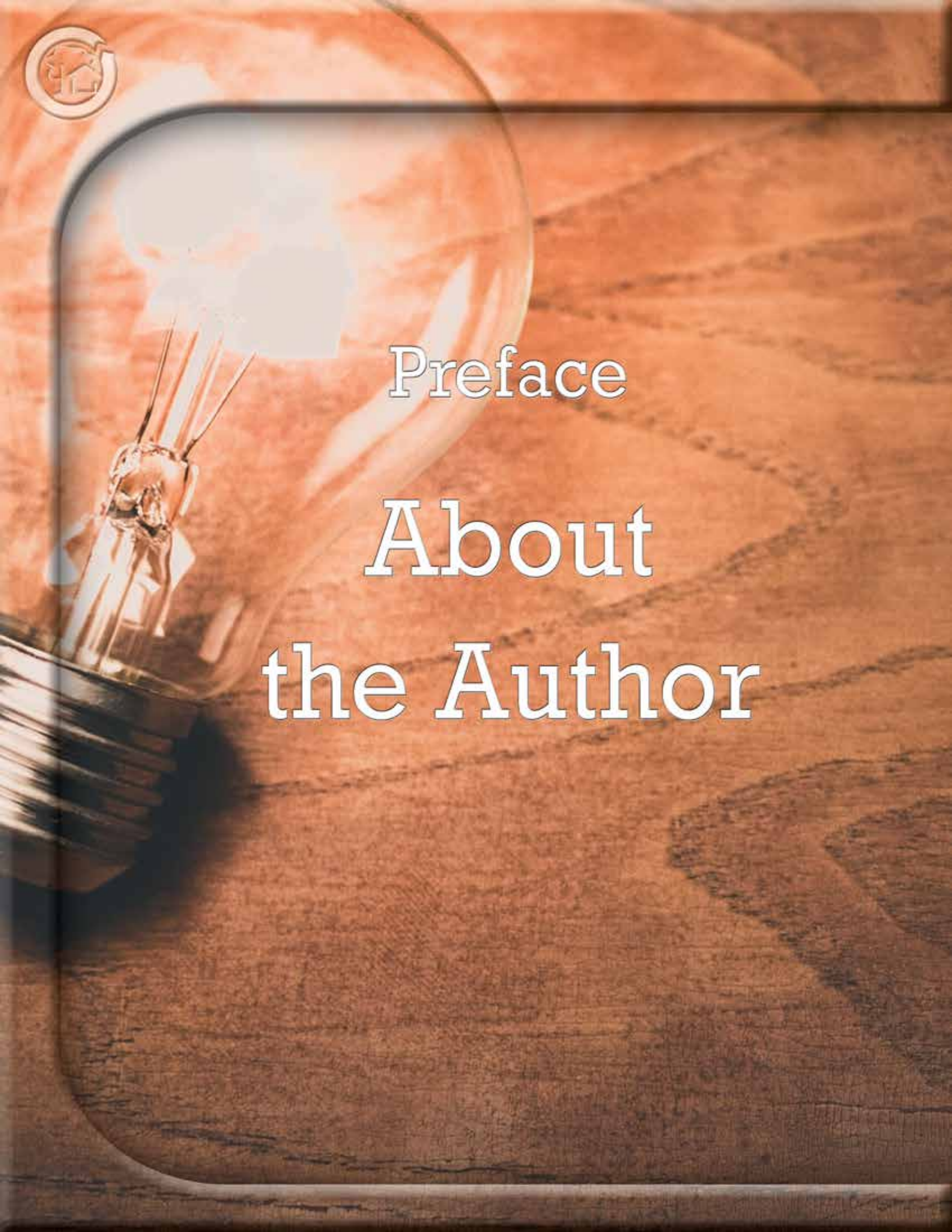

Preface

About the Author

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He believes he can make his dream a reality... one tree and one house at a time.

Inventor Chris Scott has spent the last half of his life following his passion and working tirelessly toward his dream—finding ways to help slow climate change while also housing everyone who needs a roof over their head.

"More than fifty percent of the wood cut in the world is not fully used. If it were used properly, we could significantly reduce our carbon footprint—at almost no cost—and we could house millions of people with wood that would otherwise have been tossed away," Chris says. "If the majority of people had their own home and felt secure and safe within themselves, if they felt they had a future and had jobs, and had food, and had leisure time, then the world could focus more on education, health and the future and do something more to slow climate change."

It all began while Chris was on a business trip in Europe. A spontaneous visit to a small IKEA® store in Switzerland in the 1970s ultimately led him to open four of the first IKEA stores in North America. Inspired by his love for wood and the IKEA do-it-yourself building concept, Chris went on to develop his own building system, which he believes can achieve his vision. He continues to tweak and improve the components of his system and champion its benefits to our planet and those who need housing.

Chris credits IKEA with sparking the

inspiration that prompted him to come up with the I WOOD® building system, because it is based on the same concept of DIY assembly and flat box shipping.

Then, in 1980, while examining a WWI biplane known as a Sopwith Piper Cub, in the Ontario Science Centre Museum in Toronto, he noticed that the main wing strut, which held the wing up and connected it to the main body of the plane, had a groove cut out of it, and that the entire aircraft was made out of wood, even the propeller.

"Why the hell are they taking strength away from the strut by cutting out those grooves?" he wondered. "It's supposed to be the strongest and most critical part of the aircraft."

By studying the plane, he realized that the strength-to-weight ratio had to be greater by using this grooved beam than if it had been made out of solid wood. These planes were still flying eighty years after they were first designed, so they really were strong, incorporating the same I-beam shapes used in railway lines, high-rise apartments and steel bridges.

"Why don't we cut wood that way? It's got to be more than strong enough."

Chris started thinking in broad strokes. He realized that if grooves were cut into conventional wood studs, the weight and therefore the shipping cost of those studs would be reduced by a third. The carved-out portion—the "waste"—could then go back into pulp to make paper, thereby reducing the mill's raw material cost.

Chris called his system of cutting grooves into conventional 2×4 wood studs, I WOOD® (trademarked in 1988). From the side—or its profile—his specially cut wood beam had the shape of a capital I, or an I-beam.

About the Author

Although grooves are cut out of either side of a traditional I-beam to make I WOOD, the remaining wooden beam is still structurally strong, is lighter to handle and ship, and makes more efficient—and green—use of the entire log, because more pieces can be cut out of a single tree.

There's a catch - changing the way that the lumber and building industries approach ecology and climate change (they would literally have to cut the tree differently to gain that more efficient use of the wood) has been an uphill battle. But Chris is committed to seeing it through. Some might say obsessively so.

Chris has spent more than $2.5 million dollars—of his own money, grants and funding from large corporations—to conduct engineering tests and test market the I WOOD concept. He's obtained international patents, started a non-

profit organization, and built dozens of prototype homes and structures with I WOOD in the United States, Canada and Mexico—homes for the poor, homes for the homeless, and even a home for himself. All to prove to the world that I WOOD works.

"That's one of the things I still believe, that it's got the potential," he says. "Whether it's stubbornness or whatever, I don't know, but I believe that it could make a difference."

"Wood is the most wonderful building product that you could possibly have," Chris says. "It benefits the atmosphere while it's being produced, while it's growing. It increases the water table, it reduces runoff and erosion, and it creates oxygen from carbon. One tree basically puts back $1,000 of value into the world every year, so for every tree you don't cut down, you're saving the world $1,000 a year."

Chris believes that using the I WOOD building system can make better use of the trees we have, and in turn, save the planet. He conceived the terms "Treecycling" and "Precycling," because he could find no words in the English language that incorporate the idea of planning to recycle a material before it is even manufactured.

Recycling refers to the re-use of a product after its primary use is over. But the I WOOD concept actually incorporates other repurposing uses for the "waste" pieces and particles that are removed during the cutting of grooves into beams used to build structures, i.e. using them to make pulp, paper, particle boards, or ethanol.

The waste also can be made into pellets and used for cooking and heating in third world countries, rather than using gas or electricity or coal. Such repurposing should be used instead of recycling wherever possible.

About the Author

In 2006 Chris established Treecycling, Inc. as a 501(c)(3) not-for-profit company, with the hope of getting other people to use his uniquely-shaped components to help people build their own homes, as a kind of communal idea.

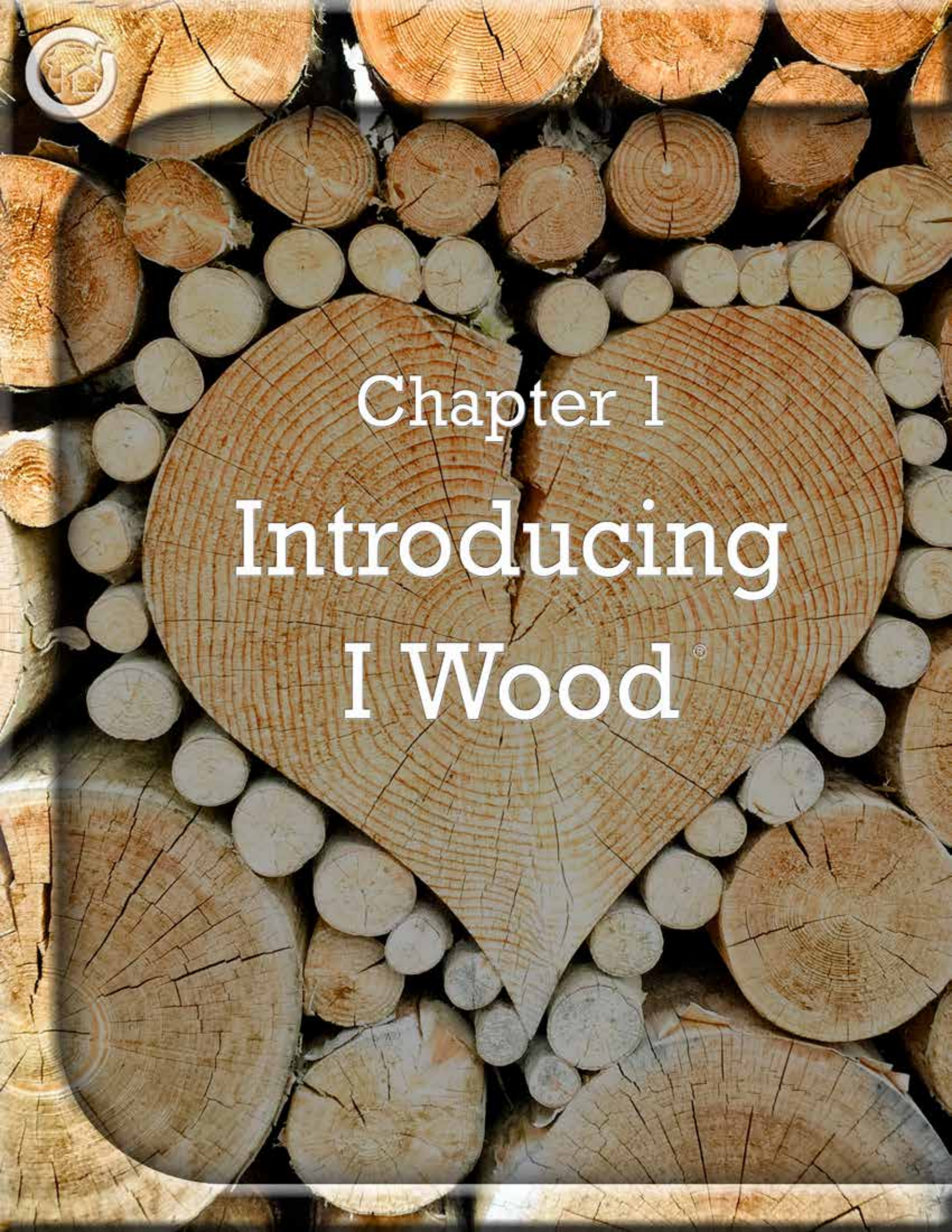
Chris is liked by pretty much everyone he meets because he's a good-hearted soul who sees the best in people, and wants the best for them.

Working with his church and groups such as Habitat for Humanity, Youth With a Mission, and Corazon, he has donated thousands of his own dollars and traveled to the poorest neighborhoods in Tijuana and Ensenada, Mexico, to build structures that provide homeless families with roofs over their heads.

He wants everyone to have a home, whether it is completely made out of I WOOD, or expanded with I WOOD, room by room, and bit-by-bit... whatever people can afford. If you can't afford to buy a parcel of land, then he wants you to be able to put a home wherever you can get permission.

Clearly, Chris knows how to make things fit together. He knows wood and pulp, he loves trees and working with his hands. He is in his element when he is in his workshop, where he literally lives and breathes I WOOD.

"The idea is a little like sliced bread," he says. "No one thought of pre-slicing bread for years. And when someone did. It took years to win acceptance. Now no one can imagine doing without it."



Chapter 1

Introducing I Wood®

INTRODUCTION TO TREECYCLING INC AND I WOOD

Treecycling, Inc. is a California nonprofit 501(c)(3) company, charged with the responsibility of promoting the I WOOD building concept worldwide.

I WOOD is an alternative to conventional lumber in that one or more of the sides has a groove cut in it rather than being planed to a smooth surface.

Treecycling is an example of how specific industries can evaluate their products and marketing procedures, putting the environment and sustainability at the forefront of their mission statements.

Treecycling, as the name states, presents a totally new way to look at the wood industry from logging procedures all the way to fast food stir-sticks.

Wood is traditionally treated, like water, as an unlimited resource. The extraction logging process and the milling process probably cause as much environmental change as building large dams.
Traditional logging procedures, such as clear cutting and slash and burn techniques, affect aquifers, erosion, animal life and local weather patterns, to mention just a few.

Treecycling is addressing the concept that trees are an essential part of our ecological world balance, a factor that has not changed for many millions of years. Each tree is an ecosystem in its own right and can be considered a minute example of the world we live in. Every part of every tree should be treated with respect and the wood that is harvested should be maintained in a solid form as a carbon sink at least as long as if it had lived out its natural life.

The I WOOD concept advocates examining our lumber products industry as

diligently as possible, to establish where there are significant benefits to this new approach and how we as a small part of our industrialized world, can make improvements.

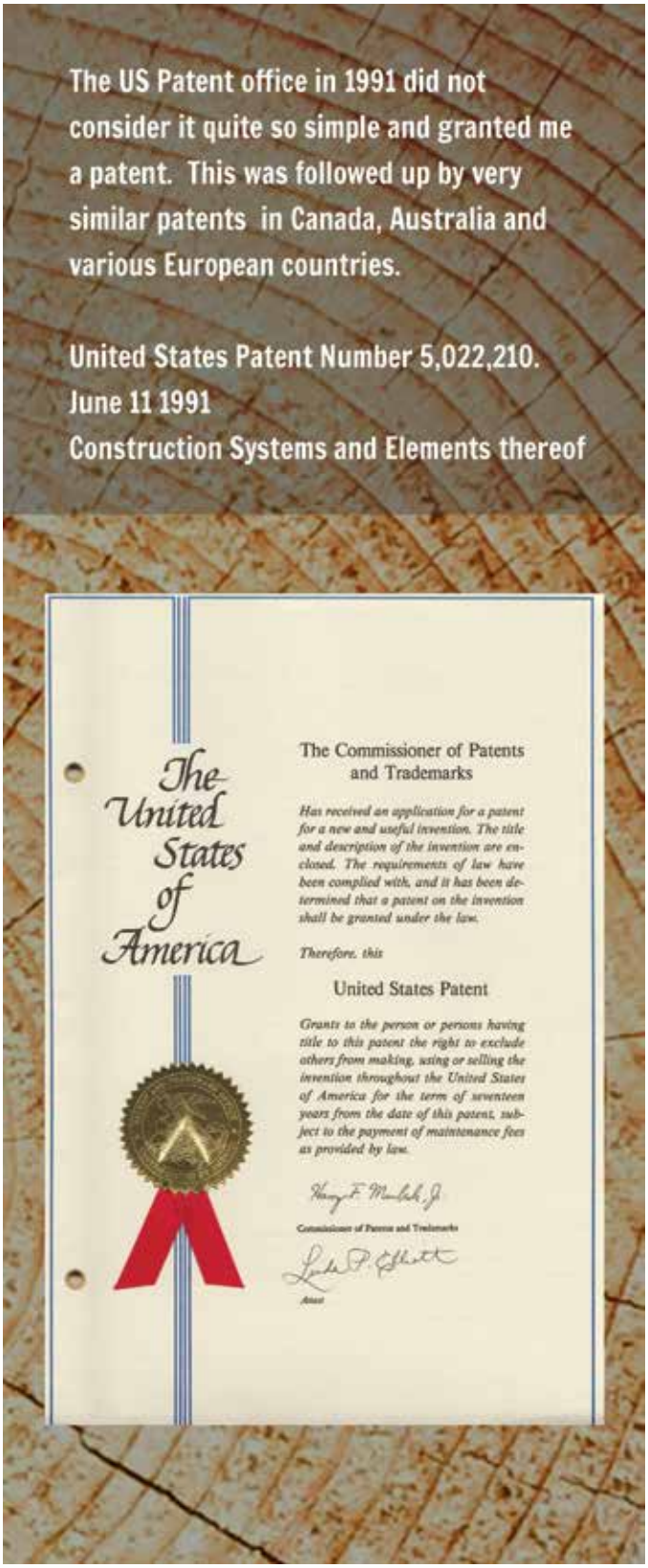
Our initial findings suggest that within ten years of fully embracing the concept, we can:

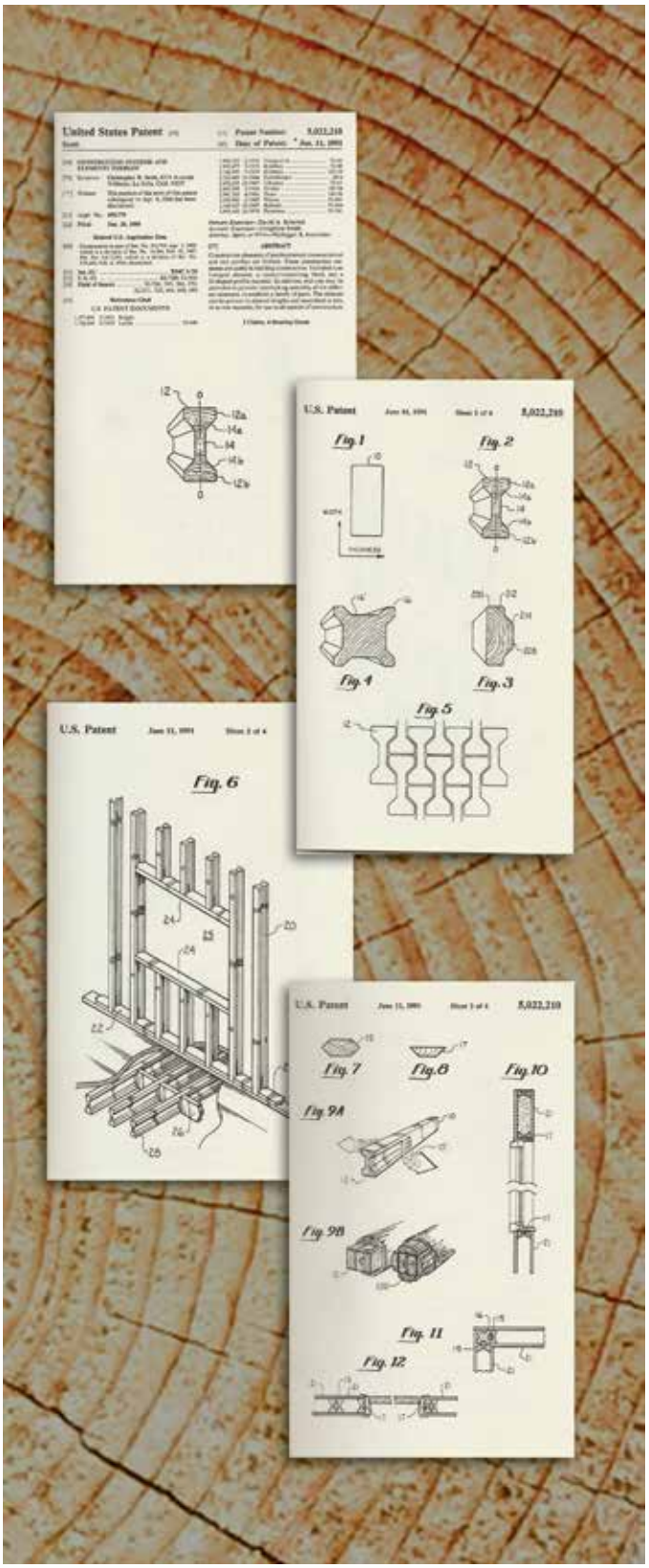
- Enjoy savings of many billions of dollars within just ten years, in the United States alone;
- Dramatically reduce our carbon footsteps while actually saving money;
- Create thousands of small businesses around the world,
- Provide a roof for every family in the world who wants one, by 2100.

The idea is naïve and ludicrously simple: rather than supplying wood with squared edges and smooth sides, we can groove the sides of lumber and boards and cut it into immediately usable components.

The US Patent office in 1991 did not consider it quite so simple and granted me a patent. This was followed up by very similar patents in Canada, Australia and various European countries.

United States Patent Number 5,022,210.
June 11 1991
Construction Systems and Elements thereof





Weyerhaeuser, one of the largest forest products company in the world, fully endorsed my claims.

Weyerhaeuser Company

AFFIDAVIT

The Weyerhaeuser Company, a large integrated forest products company, annually invests over $0 million dollars in product development research. My title is Director of Product Development, and is organizationally located within the Research and Development unit of Weyerhaeuser's Forest Products Company.

I have 20 years of experience in wood products research and hold a Ph.D degree in wood products engineering from Syracuse University.

One of the products my group is currently evaluating is the "Profile Lumber" product and its potential applications in building structures.

Our preliminary evaluation is positive and we are continuing to further evaluate the product, its manufacture, marketing and associated economics. It offers benefits in forest conservation, effective manufacturing processes, as well as meeting consumer needs.

It is our understanding that Mr. Christopher R. Scott has obtained a Canadian patent covering several inventive products related to "Profile Lumber" and some of its applications. Mr. Scott has informed us of his progress before the United States Patent and Trademark Office and we are of the opinion that the "Profile Lumber" product is unique. I am not aware of any prior art teaching a "dog-bone" shape, and believe that the advantages it offers in manufacturing and assembly are novel.

We fully endorse the claims presented in the "Profile Lumber" patent application which you are currently reviewing.

Gilbert L. Comstock

Date May 14, 1986

Subscribed and sworn to before me this 14th day of May, 1986.

Notary Public

My Commission Expires 2-14-90

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The term Profiled Lumber, as referred to above, is called by the registered name, I WOOD, because one of the first grooved "profiles" was similar to a metal I-beam. We now have a large family of different shapes to choose from an alphabet of more than 20 different letters rather than just one: C Wood and D Wood, just to name two. We also simplify referring to the I WOOD family as 2I4 or 2D4 rather than the traditional 2X4 term.

The concept of grooving wood for the reason of increasing strength is not original. Swedish long boats had keels with grooves very similar to the I WOOD shapes.

The wings of wooden planes had grooves in the main wing struts

Many of the early rails in the US west were built on steel-capped wooden rails. These were replaced with the steel rail we know today, shaped like I WOOD for material and transportation expense reasons.

All of the I WOOD grooves can be produced on the same machines as conventional lumber, changing only the shape of the blades. Most I WOOD lumber requires two blades, a male and a female shape - while conventional lumber needs one. This is very significant as it means the forest and building industries could change to using I WOOD grooved lumber very quickly while improving their bottom line at the same time.

Political encouragement, with some form of tax incentive, encouraging companies to make the simple changes, would also benefit voters with lower building costs. The material taken out by the grooving process could result in up to 30% fewer trees needing to be cut down for a given market for wood, both solid and as fiber for such products as fiberboard, paper and wood pellets.

The benefits of not cutting down 30% of a region's trees include:

- Significantly less time spent disrupting the forest when logging;
- One tree left standing is the equivalent of planting perhaps 10,000 seedlings and waiting for a percentage of them to reach maturity in 20 to 25 years;
- Mature trees reduce carbon in the air, reduce erosion, replenish water tables, protect habitat, and a host of other benefits.

Grooving the lumber and boards:

- Reduces shipping volumes and storage space;
- Results in lighter and stronger end products;
- Reduces size and cost of fastenings;
- Results in more aesthetic designs;
- Pre-cutting component parts reduces waste and pressure on landfill;
- Provides 5% reduction in home energy costs through better insulation.

WHY NOT CAPITALIZE ON EXISTING HOME WORKSHOPS?

This could be a grass roots revolution, as there are millions of under-used workshops in the United States - many of them owned by skilled woodworkers, at home, with time on their hands.

Just about every home in the world has a few tools available to complete jobs around the house. The extent of these available tools range from a few thrown together in a drawer to a dedicated workshop with thousands of dollars worth of tools... too many of which are seldom used.

The I WOOD/Treecycling concept is promoting a movement which takes advantage of this resource, to fill the demand for well-crafted, useful and attractive items predominantly made from wood which can be used in homes locally and around the world.

The world is currently going through a renaissance and has now reached a stage where computer operated machines have transformed the job market. The workforce, apart from the service industry, has changed completely.

The virus challenge starting in early 2020, has accelerated these changes unbelievably. The resource of home workshops around the world is immense. They have the potential to supply needed products, from shelving through furniture, to small buildings, manufactured from local materials and local tastes, to the local market. Individuals working from their own homes can do this. When the virus threat becomes controllable, the jobs created in the home workshops can continue to be very beneficial around the world; working from home reduces the need for travel to work, rush-hour roadblocks, city parking blocks and many other currently accepted “ways of life”.

These small workshops will be able to compete with large corporations thanks to very low overhead costs, using locally grown materials, and selling locally to local preferences. In time, they may grow their own trees.

E-commerce has also opened up opportunities for marketing home workshop products. www.iwoodkits.com is just one of the options in this area.

The I WOOD/Treecycling concept is encouraging individuals who have these frequently under-used workshops to develop and design products that can be easily put together with hand tools, and then finished artistically by people living in apartments and condominiums, where power tools are not encouraged. These city-dwellers often are extremely creative, and could enjoy the challenge of beautifully finishing component kits that they can use in their homes, adapted to their needs and their decorating tastes.

IF THIS IS SUCH A GOOD IDEA, WHY HASN'T IT CAUGHT ON?

Up until the last 2 years, I've been concentrating on the small building market, specifically low-cost, easy-to-build-homes for the homeless and financially challenged. Local ordinances, building codes and NIMBY-ism made this a very difficult project.

Having come to the realization that governments and large organizations have problems implementing new ideas, I decided to go from a trickle-down to a trickle-up approach. If I could show people that building furniture and household objects from easy-to-assemble, precut component parts was financially and creatively beneficial, they could realize that they might do the same thing building larger wooden structures, such as sheds, workshops, greenhouses and small houses.

My focus has been to establish--from existing prototype designs--a line of household items and day-to-day unfinished furniture kits for individuals, many of whom live in condominiums and high-rise apartments.

The kits we are envisioning are very simple to put together, require very few tools and not too much imagination. They fit into a niche somewhere between The Home Depot® and IKEA®. The I WOOD grooved lumber provides LEGO®-like advantages, as it tends to nest together. Finishing options are left to the buyers of the kits.

The Treecycling*I* WOOD designs are directed towards these individuals. The intent is to make precut component parts of various items that can be finished in a small studio apartment over a few days or weeks without upsetting the neighbors. While making their own furniture and household items might have been practical for many of their parents, this is no longer an option for many, since noisy tools and sawdust do not fit into downtown urban living,

I was lucky enough to know Ingvar Kamprad, the founder of IKEA®, shown here riding my son's motorbike. He managed to totally change peoples' attitude toward the furniture industry. Suddenly, there was no longer a need for brick-and-board bookcases and orange-crate coffee tables. Could Treecycling*I* WOOD do the same for the forest indutry by selling carbon sink and sustainability rather than landfill, deforestation and profits? My development of I WOOD has been strongly influenced from working with Ingvar's ideas and business model.

COULD THIS SET AN EXAMPLE FOR OTHER INDUSTRIES?

We are living in a new world. Emphasis on sustainability and global warming has become mainstream at last. COVID 19 has shown us that working from home is both possible and has many advantages over a daily commute.

Woodworkers around the world could be part of this extraordinary change by showing that there are alternatives to mega conglomerates monopolizing the way we use our forest.

Small and local is beautiful. Social distancing can have many benefits.

LONG TERM VISION

By the year 2100, everyone in the world has, for their lifetime, "ownership" in some form of a roof over their head, lives close to being off the grid, and produces some of their own food. Perhaps we can add working two days-a-week in a forested world that can maintain the ecological balance we enjoyed 12,000 years ago.

We can all have our dreams. It is a troubling thought that a virus could be part of the events that make this dream come true. I hope that I WOOD*I* Treecycling suggests a viable approach and honest analysis, for the lumber and other industries to embrace to make sure this is a friendly transition.

Chapter 2

The Benefits of I Wood®

A BETTER BUILDING PRODUCT THAT CAN SAVE BILLIONS OF DOLLARS EVERY YEAR.

One expert referred to I WOOD, the grooved wood created by Treecycling, Inc., as "the first major improvement in the framing of houses since the 1830s." The current conventional building method, using standard, smooth-surface lumber, known as dimensional lumber, such as 2x4's and 4x4's, hasn't seen any significant improvement in the last century.

By manufacturing the groove in the lumber, we produce more efficient shapes. The new I WOOD lumber standard is promising a leap towards better buildings, easier construction, and new options in the design of furniture.

As will be explained later, it is the simple groove that the I WOOD system incorporates into all of our family of products, which makes this such a revolutionary concept. I WOOD lumber, like Lego® blocks, wants to lock together, with more than just friction and fasteners providing the required strength. The numerous environmental advantages will be covered later in this book (Chapters 3 and 4), so here, let's see how the technical benefits of I WOOD building materials can make a difference in re-inventing an improved usefulness of wood.

One of the core elements of I WOOD's evolutionary process is the accuracy possible with modern tool development and the use of templates and jigs in the making of the interlocking components. It enables an upgraded building method, using interlocking surfaces that take

advantage of the natural strength of wood, rather than relying on the friction imparted by nailing flat surfaces together.

ANOTHER IMPRESSIVE ASPECT IS I WOOD'S SIMPLICITY.

By providing I WOOD grooved wood as the components of a ready-made kit, an I WOOD furniture or a structure frame can be assembled very quickly by relatively unskilled individuals. The assembly calls for inexpensive and safe-to-use hand tools, so that anybody who can read the simple instructions can assemble an I WOOD product. Like IKEA flat-box products, assembly becomes even easier with experience.

Thus, savings on labor costs are added to significant savings on material costs. The lighter, more compact building materials offer a multitude of opportunities to lower the total cost of a construction project. The components themselves require fewer trees being cut, reducing their price tag. Pre-cut kits can be shipped in more compact packaging so I WOOD lumber reduces shipping costs, takes 30% less floor space and stacks more safely because of its interlocking nature. Because of lower weight and volume, there is a 30% savings in transportation right through the distribution chain.

Manufacturing I WOOD components is also straightforward. Only two router blades are necessary to produce the smaller, more common shapes, enabling small-scale woodworkers to afford to make a business out of their hobby. They then help their communities

with the economic benefits of locally made housing, furniture products and employment.

The decentralized, locally sourced manufacturing process promotes a "zero-waste" production chain - when making I WOOD components, licensed woodworkers keep the waste material to transform into useful by-products. For example, they can turn sawdust into wood pellets for cooking and heating.

The I WOOD building process also promotes a "zero-waste" mentality, as there is little waste left on the job site, except for some recyclable packaging. The job site requires very few power tools, so even the use of electricity is kept to a minimum.

The design of I WOOD lumber results in the wood itself producing strength at all important connecting joints of a building. Tests show that I WOOD joints are stronger than the conventional nailed system, whereas in a conventional frame structure, the fasteners take the full load. This is an important benefit when offering I WOOD shelters in disaster areas (see Chapter 6), because it allows the quick assembly of structures that reduce the devastation of earthquakes and hurricanes. As shown later, using C-WOOD (2C4) lumber in a continuous truss arch produces exceptional strength and is remarkably simple to construct.

The flexibility of home design is a major improvement on current building practices. I WOOD can allow low-income families to build a small starter home, which can be expanded as needs and

finances dictate. I WOOD structures can be added to create extra rooms, a larger house or a guest cottage. To promote a sustainable material supply, homes can be upgraded with local materials, readily available from an urban forest resource or even "waste" from a local construction site.

I WOOD structures can incorporate double-walled exteriors which make installing plumbing, wiring and insulation exceptionally easy, thereby further reducing the overall cost of the building. Decisions regarding insulation can be adjusted to the local climate.

Structures built with I WOOD grooved lumber are more energy-efficient, with better insulation. The I WOOD walls are approximately 5% more energy-efficient than conventional walls, resulting in $100+ in annual savings, for the life of the structure.

For families who don't own land, many of the smaller I WOOD structures can be built on temporary foundations and loaded onto a flatbed trailer or truck for when it is necessary to move to a new location. The structure's lighter weight and exceptional strength make this a realistic option.

TECHNICAL ADVANTAGES

The removal of fiber when creating the I WOOD shape results in less splitting and warping as well as significant savings in the drying process. Less moisture has to be taken out of the wood. Other advantages are space saved and the ease of stacking in the drying kilns, which adds to these savings.

I WOOD's grooved shape relieves a large percentage of the stress inherent in conventionally milled 2X4s, caused by the shrinkage rates in radial and tangential directions.

Compact stacking and packaging reduces the cost, weight and volume of transportation.

EASY ASSEMBLY

Easily interlocking notches allow quick assembly by a few unskilled workers.

Only simple hand tools are required, using little electricity and leaving no waste at the job site.

I-WOOD HOME FRAMES

SIMPLE HAND TOOLS

Pre-cut kits are easy to assemble from the bottom up, with foolproof accuracy.

A tiny home frame can be built within a day, and be gradually upgraded in the future.

For the creative carpenters or hobby builders, the extraordinary versatility of I WOOD's shapes can stretch their imagination to unlimited product ideas (see Chapter 9). There are endless possibilities to improve an existing structure kit with just a bit of ingenuity and good taste.

I WOOD'S IMPACT ON THE FOREST AND BUILDING INDUSTRIES

Instead of using rectangular shaped lumber lengths (standard dimensional lumber) for framing houses and manufacturing furniture, Treecycling has designed a lumber and construction innovation that, if adapted by the lumber and construction industries, could make a significant difference on the health of our planet and our future. We have registered the name I WOOD for lumber that is grooved on one or more sides, rather than being smooth with rectangular corners.

This grooving process can be can be performed at the sawmill or further back in the process, right down to using hand tools in a small workshop. I WOOD grooved lumber has the same overall dimensions as traditional, square-cut lumber, but is up to 30% lighter and cost 30% less to transport and store.

Additionally, I WOOD grooved lumber is significantly less prone to splitting and cracking, and buildings constructed with I WOOD tend to be stronger since the grooves interlock in a similar fashion to LEGO blocks.

Treecycling has developed a variety of grooved shapes for multiple purposes - offering a virtual alphabet of profiles – the most versatile being the "C" profile. The C-WOOD offers the greatest potential to dramatically change the lumber industry by increasing both the

quality and quantity of boards that can be harvested from existing trees.

A majority of the wood used by the building industry today, and to a lesser degree by the furniture industry, is produced from trees with a smaller diameter than the giant trees harvested in the past.

Trees are round, but the wood that we traditionally use is square-cornered. For centuries, the old adage that you can't fit a square peg into a round hole, could be describing our lumber harvesting system. It hasn't been practical, nor profitable, to get traditional 2X4 lumber out of a small diameter tree (5 - 6" dia.) because the 2X4 would have to include the center core (the pith) of the tree, which results in material prone to warping and twisting, making it less desirable for a stud wall.

With C-WOOD, a small diameter tree could produce two lengths of lumber, that cut out the central pith, reducing the propensity to warp and twist, while getting closer to the round shape of the trunk. If milled directly from the log, we can harvest two lengths of solid, structural wood from a log that wasn't even appropriate for a single 2X4, for use as a stud.

Additionally, we increase the quantity of the shavings removed from the grooves when milling I WOOD, which can then be used for making products such as paper, particleboard, ethanol, insulation and more. Traditionally, we go back into the forest to harvest the materials needed for these products, which could instead be extracted as a by-product of milling I WOOD. This further increases the value

of the harvest, as well as reducing the number of trees that need to be harvested by up to 30%. What's more, the time heavy equipment has to be in the forest, with the associated damage to the ecosystem, could also be reduced.

Houses built with I WOOD lumber would be stronger and lighter, and about 5% more energy-efficient than traditional buildings because the groove leaves room for increased insulation. If your heating bill in a traditional home is $2,000 a year, with I WOOD framing it would drop by $100 (5%) every year you own the house. In the US, an estimated 1 million structures that need heating and or cooling are built or renovated every year, with a potential national savings of $100 million every year.

Year	New buildings	Annual heating and cooling savings	Compounded total savings
2020	Legislation	5% of $2000 ($100) X 1 million homes	(compounded annually)
2021	1,000,000	$100,000,000	$100,000,000
2022	1,000,000	$100,000,000	$200,000,000
2023	1,000,000	$100,000,000	$300,000,000
2024	1,000,000	$100,000,000	$400,000,000
2025	1,000,000	$100,000,000	$500,000,000
2026	1,000,000	$100,000,000	$600,000,000
2027	1,000,000	$100,000,000	$700,000,000
2028	1,000,000	$100,000,000	$800,000,000
2029	1,000,000	$100,000,000	$900,000,000
2030	1,000,000	$100,000,000	$1,000,000,000
TOTAL	10,000,000		$55,000,000,000

Total energy cost savings at the end of 10 years = $55,000,000,000 when you compound the houses built in previous years which continue to enjoy the savings annually.

No two trees are exactly the same size and very few houses have exactly the same amount of wood required to complete the framing process. For the sake of this discussion, we are assuming that an average tree has about 60 feet of usable length and averages 24-inch diameter at 5 feet up from ground level, producing approximately 600 board feet of usable lumber.

The square footage of the average building constructed in the US is equally difficult to establish, and again purely for this discussion, we will assume the average home to be around 1,500 sq. ft., traditionally requiring 5,000 board feet (8 trees) to complete.

For discussion, let us assume that an eighth could be framed with I WOOD profiled lumber:

Standing Tree Board Foot Volumes - Doyle Rule

Number of 16 foot lengths (60' Usable Log):	4
Typical Log Size DBH (diameter at breast height):	24"
Number of Board Feet produced per tree:	600
Average building size:	1,800 sq. ft.
Assumed number of trees needed for completion:	8
Number of trees required if using I WOOD profiles lumber:	4
Assuming 25% fewer trees cut for each building, Number of trees left in the forest for every I WOOD building:	1
Lumber Price. 1000 board feet (MBFM):	$500
USDA: Dollar value in environmental benefits each tree contributes every year:	$1,000

ESTIMATED SAVINGS FROM USING I WOOD TO BUILD A HOME

Year	Trees cut for 1,000,000 homes (8 trees per home)	Trees cut to I WOOD shapes (12,5% of total)	I WOOD shapes dollar difference ($500 per tree)	Compounded savings
2020	Pass legislation			
2021	8,000,000	1,000,000	$500,000,000	$500,000,000
2022	8,000,000	1,000,000	$500,000,000	$1,000,000,000
2023	8,000,000	1,000,000	$500,000,000	$1,500,000,000
2024	8,000,000	1,000,000	$500,000,000	$2,000,000,000
2025	8,000,000	1,000,000	$500,000,000	$2,500,000,000
2026	8,000,000	1,000,000	$500,000,000	$3,000,000,000
2027	8,000,000	1,000,000	$500,000,000	$3,500,000,000
2028	8,000,000	1,000,000	$500,000,000	$4,000,000,000
2029	8,000,000	1,000,000	$500,000,000	$4,500,000,000
2030	8,000,000	1,000,000	$500,000,000	$5,000,000,000
TOTAL	80,000,000			$29,000,000,000

These figures show that by directing that I WOOD profiled lumber be used in the construction industry for a minimum of 12 ½% of the framing material, we could save the country well over $100,000,000,000 in a decade, at next to no capital cost. The industry would in fact realize more profits as a result of the change! Other significant other benefits of using I WOOD pre-cut components include far shorter building times; stronger, yet lighter buildings; new potential for exciting new design features at lower cost; the ability to build smaller homes that can be expanded later (see Note).

ESTIMATED ENVIRONMENTAL COST SAVINGS WHEN BUILDING WITH I WOOD GROOVED LUMBER

Year	Trees cut for 1,000,000 homes (8 trees per home)	Trees cut to I WOOD shapes (12,5% of total)	Environmental value: ($1000 per tree / USDA)	Compounded savings
2020	Pass legislation			
2021	8,000,000	1,000,000	$1,000,000,000	$1,000,000,000
2022	8,000,000	1,000,000	$1,000,000,000	$2,000,000,000
2023	8,000,000	1,000,000	$1,000,000,000	$3,000,000,000
2024	8,000,000	1,000,000	$1,000,000,000	$4,000,000,000
2025	8,000,000	1,000,000	$1,000,000,000	$5,000,000,000
2026	8,000,000	1,000,000	$1,000,000,000	$6,000,000,000
2027	8,000,000	1,000,000	$1,000,000,000	$7,000,000,000
2028	8,000,000	1,000,000	$1,000,000,000	$8,000,000,000
2029	8,000,000	1,000,000	$1,000,000,000	$9,000,000,000
2030	8,000,000	1,000,000	$1,000,000,000	$10,000,000,000
TOTAL	80,000,000			$55,000,000,000

These and other benefits are illustrated on YouTube and our webpage at www.Treecycling.com. Note: The capability to expand later is a unique feature of the I WOOD system that could enable millions of families to qualify for mortgages for a smaller 600 square-foot starter home, which can later be reused as part of a larger home, if more space is needed. PLEASE NOTE: All of these figures are best estimates and are subject to debate. All help in making them more exact would be highly appreciated.

Chapter 3

A Greener Lumber

A Greener Lumber

By adopting I WOOD® as a new standard for construction lumber, we could observe various significant impacts on the natural environment.

First, grooving traditional lumber releases up to 30% of the fiber from the original shape, which results in not having to go back into the forest to harvest material for making a very large quantity of pulp for paper, particleboard, wood pellets and other products. Put another way, 30% fewer trees need to be cut down to satisfy the current demand for forest products.

Second, when logs are grooved into I WOOD lumber during the initial milling process, the yield from the forest is significantly increased since the I WOOD grooving process enables a larger percentage of every tree to be used for lumber. Added to this, the pre-cutting of component parts for everything from furniture to housing reduces the waste of wood very dramatically.

As climate change is the critical issue of our decade, the benefits of I WOOD to help tackle global warming are numerous, ranging from lighter, more compact shipping to better carbon sequestration.

Assembling I WOOD structures requires a minimum number of tools and the use of precut component parts results in virtually no waste, using less energy and far fewer expensive and dangerous tools.

Our approach leads towards a greener planet, leaving very little trace of the manufacturing process on the customer's construction site.

SAVING OUR FORESTS

Our preliminary research estimates that up to half of all dimension lumber could be grooved in I WOOD shapes to everyone's advantage (except the freight companies!). The resulting financial

ramifications are very significant. Some of these are covered in the previous chapter. As stated there, help would be appreciated in checking the accuracy of the figures.

The figures used in the previous chapter are intentionally more conservative than the ones used here.

From the 60,000,000 MBFM of lumber produced in North America annually, up to 30,000,000 MBFM could be used in the form of I WOOD lumber... if the industry's aversion to change could be overcome.

If we assume it takes 2 typical small diameter trees to manufacture 1 MBFM of lumber, this 30,000,000 MBFM is equivalent to 60,000,000 trees. We can see how the 30% fiber saving produced by the I WOOD system could make it unnecessary to cut down 30,000,000 trees in America annually just to satisfy the current market for wood fiber in all its forms. Savings (not costs!) to the forest industry would be in the range of significant dollars every year.

We estimate that I WOOD's grooved lumber can be used as a substitute for conventional lumber in up to 50% of the time when the material is used for structural purposes and maybe 90% of the time when aesthetic considerations are involved.

Compared to conventional lumber, I WOOD is lighter, the joints are stronger, the wood twists and warps less, and while it looks more expensive, it is considerably less expensive when manufactured in volume as precut components.

The fiber milled out of the wood during the production process is about 30% of the total material. It can be used in products ranging from paper and fiber board to ethanol and pelletized fuel.

A Greener Lumber

Conversion to I WOOD reduces the amount of time that loggers disrupt the forests with their heavy equipment by 30%, without reducing the forest product companies' profitability. In fact, sustainable forestry is becoming synonymous with sustained long-term profits.

One MBFM of lumber is roughly equivalent to the lumber from one plantation grown tree, thirty to forty feet high, and eighteen inches diameter at the base. Therefore, about 10 MBFM (or 10 trees) are used to build a good sized North American home.

If I WOOD grooved lumber is used instead of conventional lumber, you would have, for the sake of discussion, twenty-five percent less wood fiber in your home.

This would be the same as leaving 3 trees standing in the forest for every home built in the future.

The I WOOD/Treecycling sustainability story is based on the fact that lumber is much stronger than it needs to be for many of the uses it is put to. The strength-to-weight ratio actually increases when a groove is cut in the sides. In many cases we can get more lumber out of small diameter logs than the traditional system can achieve.

Taking out the material provides basically a cost-free material for use as a source of biomass for other needed products, without having the environmental and financial expenses of sending heavy equipment back into the forest. The process of extracting the fiber is inexpensive, simple, and can be performed by machinery readily available in most areas in the world.

The I WOOD® Alphabet

As conventional lumber is referred to as 2X4, 2X6, 4X6 and so on... I WOOD shapes use a similar nomination. For example, a C-shaped beam that is 4" wide - 2C4 - or a U-shaped beam that is 6" wide - 2U6 - have an easy codename for quick reference in the assembly manual, and to ensure uniformity from all manufacturers. Length is added after the name, such as: 2C4-96 (inches).

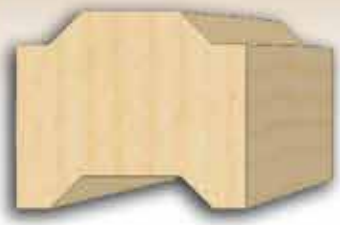
2C4
C-WOOD

2D4
D-WOOD

2H4 H-WOOD

2I4
I-WOOD

2L4
L-WOOD



2M4 M-WOOD

2O4 O-WOOD

2Q4
Q-WOOD

2U4 U-WOOD

2V4 V-WOOD

A Greener Lumber

Conventional lumber uses the shorthand of 2X4, 2X6 etc. We use the letters of the alphabet, which relate to the profiles of the grooved lumber as shown in the next page.

Lumber from small diameter trees used in conventional 2X4 form, tends to warp and twist, so it is not a prime material for construction.

I WOOD grooved lumber avoids using the pith part of the log, which is removed in the grooving process, making lumber derived from small diameter trees more suitable for construction.

Many of our kits come in compact flat units which can be readily transported to areas of need, whether these are disaster areas or traditionally low-income areas. By pre-cutting our components we also use shorter lengths of wood, which results in far better forest utilization.

WHY SUBSTITUTE CONVENTIONAL LUMBER WITH GROOVED I WOOD?

- buildings are lighter
- structures are stronger
- produce 30% more wood chips for paper, particleboard and wood pellets
- protect the environment by cutting 30% fewer trees
- reduce labor and transportation costs
- reduce total building costs
- use trees already cut for lumber - cut no extra wood
- make biomass fiber from this existing source
- encourage seedling propagation for the future
- keep biomass available at low costs
- reduce carbon footprints
- cut home heating costs by 5%
- reduce water runoff
- replenish aquifers

SMALLER CARBON FOOTPRINT

As I WOOD grooved wood proves out its advantages for housing and the environment , it could help reverse some of the climate change trends caused by Global Warming. These advantages would save money instead of costing billions of dollars, and could balance out the carbon dioxides emitted by industry within thirty years.

Looking at the bigger picture, we estimate the equivalent of 300,000,000 trees (of the same size as described above) are cut annually in the US, for dimensional lumber used in housing. If 50% (150,000,000) of these trees were instead milled into I WOOD grooved lumber and building components, the fiber not inventoried in house walls would be equivalent to 50,000,000 trees being left uncut. This, using the same ratios developed for your house, would be enough to counteract the harmful effect of 200,000 cars every year. In about thirty years, the compound effect of these fiber savings would counter balance the pollution of ALL the cars in North America.

SMALL WORKSHOPS, LOCAL JOBS, LOCAL MATERIALS

Since the beginning of the new millennium, great efforts have been geared toward energy conservation and the promotion of renewable energy sources. I WOOD supports this approach on many fronts, offering new possibilities with regard to efficient energy requirements.

The manufacturing of I WOOD components can be done in a small wood workshop,

requiring only some specialized equipment, consuming a minimal amount of electric power, compared to large-scale lumber factories. If made locally, the same wood workers can put up an I WOOD structure in a brief time, using only a few hand tools, dramatically reducing electric consumption on the job site.

I WOOD workshops are situated locally, so that very little fuel is needed to ship I WOOD kits to their destination. Because of its compact stacking and lower weight, fuel and shipping costs are reduced. I WOOD kits can be transported in smaller trucks, for shorter distances, accumulating a substantial amount of fuel savings.

BIOMASS IS A FREE BY-PRODUCT

When understanding the importance of environmentally-sound sources of energy, biomass plays an important part. The main waste material coming from workshops manufacturing I WOOD is sawdust and wood pieces - all of which can be processed into wood pellets that can be used for cooking and heating, lowering the bottom line of a nation's electricity bill. From the eco-forestry perspective, I WOOD's use of smaller-diameter trees would supply more wood to be chipped and transformed into pellets.

Imagine if we had started grooving wood years ago! Think of the positive impact that an absurdly simple idea could make to our environment; tens of millions of homes using fewer trees and being more energy efficient!

Energy-intensive building materials such as steel, aluminum and concrete release significant amounts of carbon dioxide and various other air pollutants during their manufacture. Wood products require very little energy to produce, reduce air pollution, and are a renewable resource.

It is agreed that wood is a desirable construction material because it is a renewable resource as well as many other factors, from strength to aesthetics, and as a friendly product to work with.

Another massive benefit of making I WOOD components for building I WOOD structures, is the zero-waste approach that is being incorporated into every stage of production. Forestry workers now have an alternative, a good reason to value smaller-diameter trees as useful and to amass logging residue to be transformed into pellets and/or energy.

The I WOOD manufacturing process happens to leave very little waste behind - only sawdust - to be transformed in wood pellets for energy, as mentioned earlier. As the figures below show, its manufacture produces far less carbon dioxide than other materials. Added to this, carbon dioxide is permanently stored in the wood, and not released during the production process.

ENERGY REQUIREMENTS

(extraction, processing and transportation), in BTU oil equivalent, to produce one ton of various Building Materials

(Source: National Resource Council)

ALUMINUM = 200

STEEL = 50

BRICK = 9

CONCRETE BLOCK = 9

SOFTWOOD LUMBER = 3

PROFILED LUMBER = 1* (Est.)

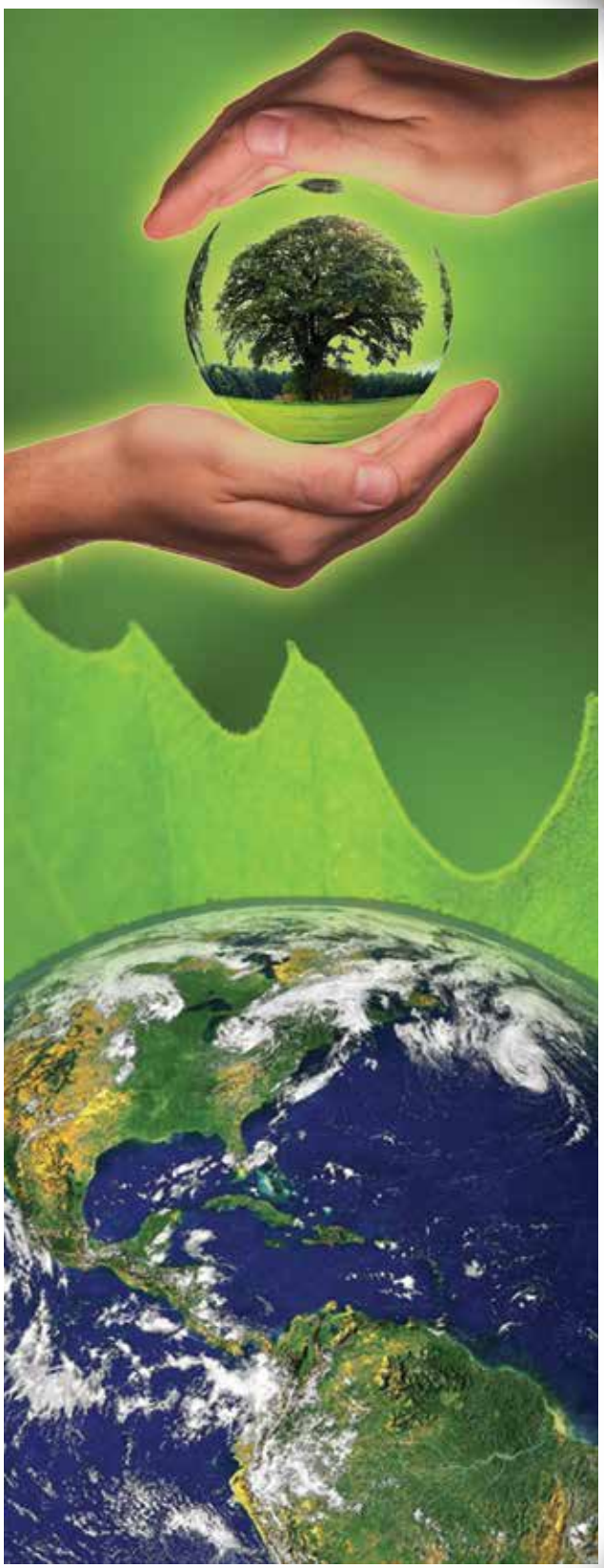
*The Profile Lumber figure assumes that the cost of extraction manufacture and transportation is already absorbed in the cost of the softwood lumber costs.

ECOLOGICAL AWARENESS

I WOOD is described as a “greener lumber” and becomes a public demonstration of ecological action. By showing there is a greener alternative, I WOOD invites builders of all types to join the bandwagon of environmentally-sound practices.

Trees from urban forests usually end up in landfills until they rot, releasing carbon. This is one reason why consumers care about the provenance of raw materials, and licensed I WOOD manufacturers always seek local wood, sourced from eco-forestry practices.

I WOOD building frames, made with a green approach, encourage the use of locally-sourced, sustainable raw materials to finish the building, while inspiring thoughts about the re-use and transformation of wood waste into meaningful solutions.



A greener lumber, for a greener planet

The environmental rewards of I-WOOD®

As an alternative to conventional wood, I WOOD "eco-lumber" boasts many environmental advantages.

SAVING OUR FORESTS

I WOOD reduces forest destruction by producing two construction-quality boards from the same small-diameter log that could only produce one poor quality traditional board.

SMALLER CARBON FOOTPRINT

Local production with I WOOD's reduced weight and volume, decreases shipping fossil fuel consumption and CO_2 emissions.

ENERGY WISE WOOD

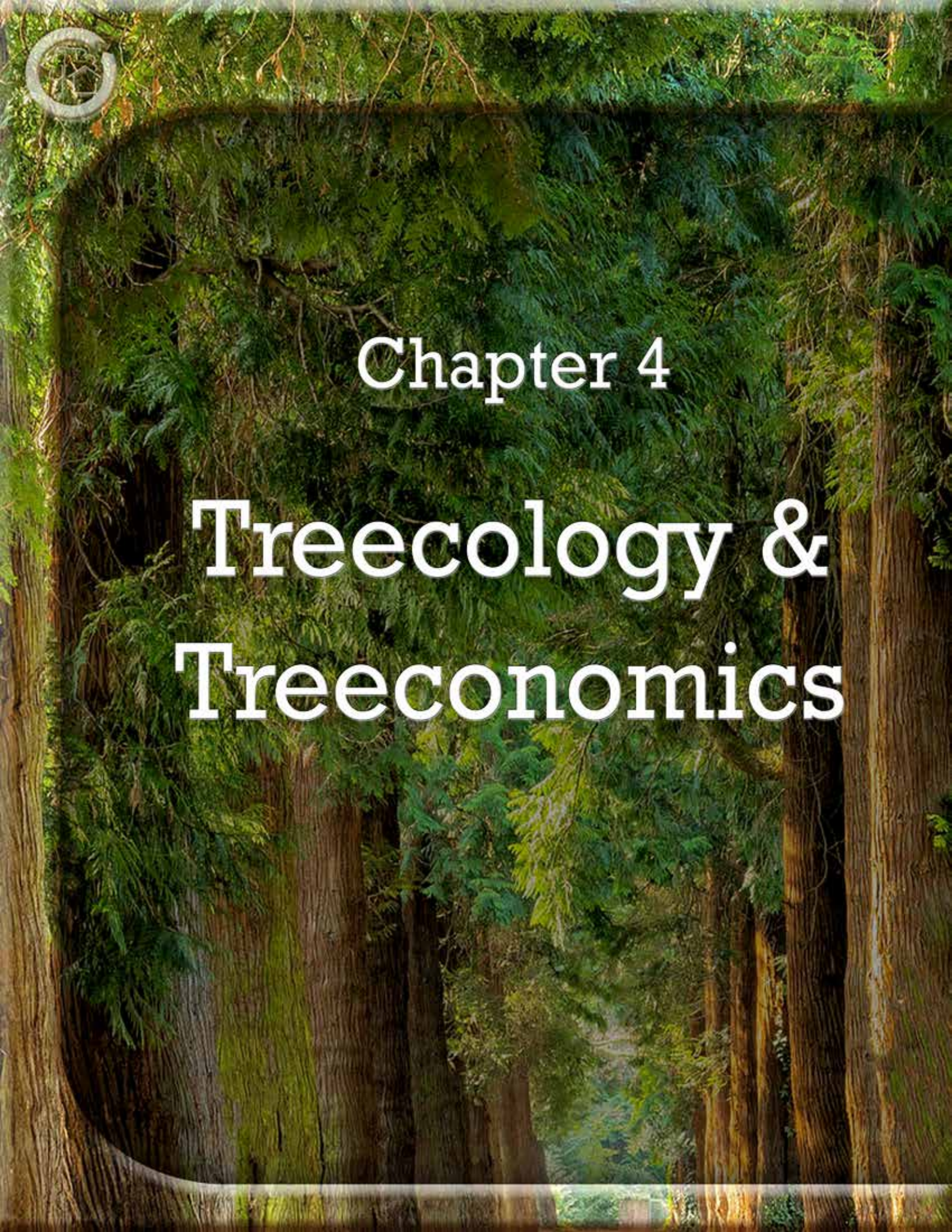
I WOOD manufacturing waste can easily be converted to bio-fuel. Efficient I WOOD kit assembly on site, using basic tools, minimizes electricity usage.

CLEAN BUILDING

Pre-cut I WOOD structure components delivered to the job site eliminate the mess and expense of job site waste left behind.

ECOLOGICAL AWARENESS

Manufacturing I WOOD components from locally sourced raw materials, recycled logging waste and environmentally conscious forest harvesting, puts I WOOD clearly at the forefront of the Green Movement.



Chapter 4

Treecology & Treeconomics

TREECOLOGY

Forests cover a third of all land on Earth, providing vital organic infrastructure for some of the planet's densest, most diverse collections of life. They support countless species as well as 1.6 billion human livelihoods, yet humans are also responsible for widespread deforestation, clearing millions of forested acres every year.

I WOOD is a greener and much more sustainable approach to marketing lumber for a number of reasons, as detailed in the previous chapter.

Associating wood products with eco-conscious manufacturing, eco-forestry sourcing and zero-waste building is a clear message sent to a whole industry, as well as an attractive sales pitch to the consumer base.

THE BENEFITS OF HEALTHY FORESTS

(sources: mnn.com, iefworld.org)

HUMAN LIFE

Some 300 million people live in forests worldwide, including an estimated 60 million indigenous people whose survival depends almost entirely on native woods. Many millions more live along or near forest fringes. In urban areas, it has been shown that even just a scattering of trees can improve air quality, raise property values and lower crime.

ANIMAL LIFE

Nearly half of all known species live in forests, including 80 percent of biodiversity on land. That variety is especially rich in tropical rain forests, from rare parrots to endangered apes, but forests teem with life around the planet: Insects and worms work nutrients into soil, bees and birds spread pollen and seeds, and keystone species like wolves and big cats keep hungry herbivores in check.

CLEAN AIR

Forests pump out the oxygen we need to live and absorb the carbon dioxide we exhale (or emit). A single mature, leafy tree is estimated to produce a day's supply of oxygen for anywhere from two to 10 people. We herald houseplants for purifying the air, but don't forget forests. They can clean up air pollution on a much larger scale, and not just the aforementioned CO2. Trees catch and soak in a wide range of airborne pollutants, including carbon monoxide, sulfur dioxide and nitrogen dioxide.

CLEAN WATER

Tree roots are key allies in heavy rain, especially for low-lying areas like river plains. They help the ground absorb more of a flash flood, reducing soil loss and property damage by slowing the flow of water to the rivers. On top of flood control, soaking up surface runoff also protects ecosystems downstream. Forests are like giant sponges, catching runoff rather than letting it roll across the surface, but they can't absorb all of it. Water that gets past their roots trickles down into aquifers, replenishing groundwater supplies that are important for drinking, sanitation and irrigation around the world.

CLEAN SOIL

A forest's root network stabilizes huge amounts of soil, bracing the entire ecosystem's foundation against erosion by wind or water. Not only does deforestation disrupt all that, but also the ensuing soil erosion can trigger new, life-threatening problems like landslides and dust storms. In addition to holding soil in place, forests may also use phytoremediation to clean out certain pollutants. Trees can either sequester the toxins away or degrade them to be less dangerous. This is a helpful function, letting trees absorb sewage overflows, roadside spills or contaminated runoff.

STAY HEALTHY

Forests provide a wealth of natural medicines and increasingly inspire synthetic spin-offs. The asthma drug theophylline comes from cacao trees, for example, while a compound in eastern red cedar needles has been found to fight MRSA, a type of staph infection that resists many antibiotic drugs. About 70 percent of all known plants with cancer-fighting properties occur only in rain forests.

Our innate attraction to forests draws humans to water, woods and other natural scenery, and exposure to forests has been shown to boost creativity, suppress ADHD, speed up recovery, and encourage meditation and mindfulness. It may even help us live longer.

STAY COOL

By growing a canopy to capture sunlight, trees also create vital oases of shade on the ground. Urban trees help buildings stay cool, reducing the need for electric fans or air conditioners, while large forests can tackle daunting tasks like curbing a city's "heat island" effect or regulating regional temperatures. Trees also have another way to beat the heat: absorbing CO2 that fuels global warming. Plants always need some CO2 for photosynthesis, but Earth's air is now so thick with extra emissions that forests fight global warming just by breathing. CO2 is stored in wood, leaves and soil, often for centuries.

MAKE IT RAIN

When the wind blows over the land it moves through the trees and the trees put water into the wind. When the wind goes through the trees, the trees also put excess heat from the sun into the wind. The heated, wet air then lifts up because hot air rises. When the hot, wet air hits the cooler wind above the land, it becomes clouds. If you cut down the trees there may be less rain and the land

may dry up; people will then not have enough water to drink or wash in and the crops will die.

GIVE THE WIND A BREAK

Groups of trees can also serve as a windbreak, providing a buffer for wind-sensitive crops. And beyond protecting those plants, less wind also makes it easier for bees to pollinate them. Near the coast, salt spray can poison the soil or harm the crops without the shelter of trees. The forest can also protect homes and villages from strong winds.

SOUNDPROOF, FIREPROOF

Sound fades in forests, making trees a popular natural noise barrier. The muffling effect is largely due to rustling leaves – plus other woodland white noise, like bird songs – and just a few well-placed trees can cut background sound by 5 to 10 decibels, or about 50 percent as heard by human ears. The healthy forest also reduces fires: when the forest is dead the land becomes dry, it can quickly catch on fire and burn away all the life.

REDUCING DEFORESTATION... STARTING AT THE SAWMILL!

The most dramatic impact of I WOOD is due to its grooves. Taking fiber out of a piece of lumber at the sawmill means that fewer machines have to enter the forest to acquire raw material for such products as particleboard, papermaking, wood pellets for heating and cooking and many other purposes. This intelligent use of lumber helps reduce deforestation, by changing practices at the manufacturing level.

Logging companies often overlook environmental considerations for the sake of profit, and environmentalists will hold protests in the forest to express their discontent. Both parties gain by embracing the I WOOD concept, while the public also gains, thanks to cleaner air

and less-expensive lumber.

We can help supply the world's need for construction materials while reducing the number of trees needed to do so. Protecting the forests is one of the many missions of the I WOOD revolution.

(sources: iefworld.org, greenandgrowing.org)

Since a healthy forest is able to renew itself, it should be possible to harvest from a forest indefinitely, in a way that can be sustained. Unfortunately, too often, this is not done. In the past, trees were cut down to clear the land for grazing and crops. Now, with modern, large-scale agriculture, the forests are being cleared faster than ever. Trees are also cut down to provide firewood. As population increases, the forests vanish faster and faster.

However, the worst problem for many forests is the timber industry. Trees are readily sold and exported to other countries. Most forests can grow fast enough to supply local needs, but the export market can never be satisfied. Timber companies easily and quickly strip the land of its forests while still suppling only a fraction of the world's desire for wood.

Thus, a forest resource which should be able to supply local people's needs forever (when carefully managed), is rapidly being destroyed. The most immediate and dangerous threat to forests is the open and limitless desire of the export market. Modern forestry equipment is very rapid and efficient, and many countries have already sold off most of their forests to timber companies for the export market.

Clearing the forest for large-scale agriculture or to make pasture for livestock is the second most dangerous threat. Clearing the forest for highways, buildings and firewood are also major contributors to deforestation in areas where the local population is growing quickly. These threats to the forest, from agriculture and the growing population, require careful land management programs, and this need is already recognized but not acted upon by many governments.

SUSTAINABLE FORESTRY

The first principle for sustainable use is that any harvesting of forest resources must remain within the limits of what the forest can replace. Some trees can be cut, but enough should be left behind to re-establish the same species. If only one kind of tree is being taken, it may be replaced in the forest by other less desirable species unless special efforts are made to ensure that young trees of the same species can grow back again.

The same principle of moderation applies to the percentage of forest area disturbed at any one time. Enough undisturbed forest should always remain to shelter wildlife and wild plant species and to allow them to repopulate forest that is growing back after being disturbed. Too often the economic pressures for rapid development go against respect of this principle, and the forest is destroyed or degraded.

The forest should always be left intact in vulnerable places such as on steep slopes, along stream banks and on shorelines where its importance in protecting against erosion outweighs

any other value. Examples all through the world show that the cost of repairing the damage done far outweighs any benefit from developing these forest areas.

Most forest areas can be developed for or serve several different uses at the same time. A watershed essential for a village water supply can also protect wildlife and be a place to collect fruits and medicinal plants.

A forest that is carefully and selectively logged while preserving the cover of trees may continue to build and protect the soil. Sites for tourism or recreation can be developed in a coastal forest while protecting its importance in sheltering the interior from storms.

A forest can also be used for agriculture, as shown by recent approaches to agroforestry. Many crops can be grown among or between trees, so the same area of land can produce both foods and tree products. This can be especially good on sloping land where fields cleared for agriculture would be subject to erosion.

Many countries have tree planting or reforestation programs. The trees that are planted may be fast-growing imported species like eucalyptus or Caribbean pine, or other important timber species. Often only one kind of tree will be planted in an area. They are almost always planted with the idea that they will be cut as a tree crop, to pay for the investment in planting them. The native trees that originally grew in the forest are seldom replanted because they grow too slowly to give an economic return. Such forest plantations may be an appropriate use for some lands, and they may help to protect the soil and hold water, but they rarely work as well as the original forest did, as some damage is always done when the trees are cut. They also do not shelter as much wildlife or medicinal plants, nor are they as valuable for tourism, recreation or protection from storms. Where indigenous species

are used to restore land that has been damaged or degraded, they make a valuable contribution to local resources. (sources: iefworld.org, greenandgrowing.org)

The I WOOD grooved approach to lumber products saves wood during the forestry stages and the production process, and increases the repurposing or recycling of wood products.

WHY RECYCLE WOOD?

- If allowed to rot in landfill sites, wood contributes methane to greenhouse gas production. Methane is 23 times more potent a greenhouse gas than carbon dioxide.

- Discarded wood is often in excellent condition, and is ideal for reuse, rather than being trashed. Because, whenever possible, I WOOD kits are assembled with dowels and glue rather than metal fasteners, recycling is more efficient.

- Growing, harvesting and processing of virgin timber uses energy and water; natural resources which are not as renewable as timber.

- Recycling/repurposing will eventually save money as the cost of disposing into landfill rises.

Wood waste is a growing problem that should not be ignored. I WOOD's approach tackles this problem from many different angles, including the production of wood pellets from manufacturing residue.

The global wood pellet market, both heating and industrial sectors, has seen significant growth in the past decade.

Growth rates over the most recent four years of data has been about 10 percent annually; from about 21.5 million tons

in 2012 to about 31 million tons in 2015. The expectations for the future of wood pellet markets are optimistic. If our forecasts are correct, over than 33 million tons per year of new demand by 2025 will drive more than $7 billion of investment in new production capacity worldwide.

(Source: canadianbiomassmagazine.com)

There is a staggering amount of waste in producing wood products. For all of the wood that ends up in newspapers or two-by-fours, a huge amount is left on the ground. Using data from the U.S. Forest Service, researchers at the Energy Biosciences Institute recently estimated that each year loggers leave behind about 52 million tons of so-called forest residue—stumps, branches, treetops and other leftovers—in Eastern forests alone. Of all of that material, roughly 22 to 33 million tons would be relatively easy to collect without undue expense.

About 40 percent of milled logs end up as either sawdust, trimmings and other miscellaneous items, representing another source of potential energy, says Steve Kelley, Ph.D., head of the department of forest biomaterials at North Carolina State University. “When you cut a cylinder into rectangles, you lose a lot of good wood in that process,” he says.

The Sierra Club, among other environmental groups, opposes forestry biomass projects that contribute to the destruction of wild or natural forests or in which “excessive amounts of biomass are removed from the land” through in-wood chipping. Underscoring the importance of wood waste to a forest, about a dozen states have already established rules that require loggers to leave behind a certain amount of material after logging natural forests.

In Minnesota, the first state to enact such a requirement, 33 percent of the

woody material has to stay behind, which adds up to five tons of waste per acre. "The science behind that number is inexact, but it should be enough to sustain nutrients in most places," D'Amato says. He notes that Minnesota prohibits loggers from removing any waste material in areas with especially nutrient-poor soil.

Biomass plants in the California towns of Scotia, Tracy, Mecca and Wendel collect and burn woody and agricultural castoffs that have traditionally ended up in landfills and open burns: tree trimmings, agricultural waste, and clean construction and demolition debris.

"We're focused on one segment of waste that nobody wants and we're recycling it into energy," says Hugh Smith, president and CEO of Greenleaf Power LLD, a Sacramento-based company. "It makes all the sense in the world to take materials that have already been used once and turn them into electricity or fuel that can be used twice. And it's a direction we should be going as a society."

THE FOREST AND WATER CONNECTION

Forests are the most effective land cover for maintenance of water quality. They serve as natural sponges, collecting and filtering rainfall and releasing it slowly into streams. Forest cover has been directly linked to drinking water treatment costs - the more forest in a source water watershed, the lower the treatment costs.

Forests provide significant benefits by filtering sediments and other pollutants from water before it reaches the stream. Forest buffers of even moderate width provide numerous water quality benefits. Forest buffers slow down the flow of water, allowing suspended sediments to fall out. Their capture of sediment also reduces phosphorus loading in the receiving water body because many forms of phosphorus attach to sediment.

In addition, they will also filter nitrogen, pesticides, herbicides, and coliform bacteria, contributing to the water quality of the receiving stream.

WATER USE BY FORESTS

Factors influencing water use by forests include climate, forest and soil type, among others. In general, forests use more water than shorter types of vegetation because of higher evaporation; they also have lower surface runoff, groundwater recharge and water yield. Forest management practices can have a marked impact on forest water use by influencing the mix of tree species and ages, the forest structure and the size of the area harvested and left open.

DRY-SEASON FLOWS

Forests reduce dry-season flows as much as or more than they reduce annual water yields. It is theoretically possible that in degraded agricultural catchments the extra infiltration associated with afforested land might outweigh the extra evaporation loss from forests, resulting in increased rather than reduced dry-season flows - but this has rarely been seen.

FLOOD FLOWS

Forests can mitigate small and local floods but do not appear to influence either extreme floods or those at the large catchment scale. One possible exception is reduction of downstream flooding by floodplain forest, where hydraulic roughness (the combination of all elements that may cause flow resistance, such as forest litter, dead wood, twigs and tree trunks) may slow down and desynchronize flood flows.

WATER QUALITY

Natural forests and well-managed plantations can protect drinking-water supplies. Managed forests usually have lower input of nutrients, pesticides and other chemicals than more intensive land uses such as agriculture. Forests planted in agricultural and urban areas can reduce pollutants, especially when located on runoff pathways or in riparian zones. However, trees exposed to high levels of air pollution capture sulphur and nitrogen and can increase water acidification.

EROSION

Forests protect soils and reduce erosion rates and sediment delivery to rivers. Forestry operations such as cultivation, drainage, road construction and timber harvesting may increase sediment losses, but best management practices can control this risk. Planting forest on erosion-prone soils and runoff pathways can reduce and intercept sediment.

CLIMATE CHANGE

Global climate models predict marked changes in seasonal snowfall, rainfall and evaporation in many parts of the world. In the context of these changes, the influence of forests on water quantity and quality may be negative or positive. Where large-scale forest planting is contemplated for climate change mitigation, it is essential to ensure that it will not accentuate water shortages. Shade provided by riparian forests may help reduce thermal stress to aquatic life as climate warming intensifies.

ENERGY FORESTS

Fast-growing forest crops have the potential for high water demand, which can lead to reduced water yields. The local trade-off between energy generation opportunities and water impacts may be a key issue in regions where climate change threatens water resources.

URBAN FORESTS

I WOOD's implication in the valuation of wood waste and the use of locally available wood encourages the maintenance and development of urban forests. Inviting a city's woodworkers to maximize the use of local wood waste, and by promoting a better care for trees through eco-forestry, urban woodworkers become I WOOD's emissaries, inciting cities to expand and cherish their municipal forests.

Urban forests have a substantial monetary benefit to offer local, state and federal governments, including storm water attenuation, air quality mitigation, tourism, health care costs, etc. They also benefit residents with increased property value, energy conservation, etc. and business such as tree care companies and nurseries as well as enhancing the aesthetics of retail areas. Internationally, many cities are recognizing that their urban forests will play an important role in their competitiveness to attract business and industry.

TREECONOMICS

Beyond the economic benefits of I WOOD's business and social housing approach, its contribution to reducing deforestation, wood waste and promoting urban forests also has a direct impact on the economy.

Here are a few of the many measurable effects of healthy forest and urban trees on personal, local and world economies:

(sources: arborday.org, journalofcommerce.com, td.com, treenet.org)

Urban forests provide a broad array of well-known environmental, economic, and social benefits such as:

Sequestering of gaseous air pollutants and particulates

Energy conservation through transpirational cooling, shade, and wind reduction

Storm-water attenuation

Noise buffering

Provision of wildlife habitat

Increased property value

Improved aesthetics

Psychological well being

Worldwide, since forestry is only a portion of the agriculture category, a person might assume the forest products sector comprises less than 6% of the global economy. However, this is not necessarily accurate. While the CIA World Factbook lists forestry as a subsection under global agriculture, not all activity in the forest products sector is confined to forestry alone. Tree farming, logging and lumber production are considered forest products, but so are paper products, finished building articles such as wood panels, manufacturing pulp and mulch.

The EPA estimates that the forest products sector accounts for more than 5% of the total U.S. manufacturing output. Since the U.S. is an economic

outlier, this data is somewhat difficult to extrapolate further and extend to global production. The Food and Agriculture Organization, or FAO, of the United Nations maintains a database of more than 50 products and 20 product groups; its 2011 census on forest product facts and figures estimated that 8% of global production came from forest products. In the United States, 60 million street trees contribute an average value of $525 per tree.

A recent study published in the journal Ecological Modelling reported that in the 10 U.S. megacities studied, tree-based ecosystem benefits had a median annual value of US$505 million. That is about US$1.2 million per square kilometre of trees. From another perspective, the value was US$35 per capita for the average megacity resident. The study's lead author, Theodore Endreny, of the College of Environmental Science and Forestry, in Syracuse, N.Y, says the value of trees' services could easily be doubled by simply planting more trees. "Megacities can increase these benefits on average by 85 per cent," he says. "If trees were to be established throughout their potential cover area, they would serve to filter air and water pollutants and reduce building energy use, and improve human well-being while providing habitat and resources for other species in the urban area."

In Canada, urban forests within Halifax, Montreal and Vancouver have a combined replacement value of $51 billion. In addition, they provide environmental benefits of over $250 million per year, or more than $330 million per year when Toronto is included. These are estimates, which do not include the value of tourism, recreation, or increased property values. There are about 60- to 200-million spaces along American city streets where trees could be planted. This translates to the potential to absorb 33 million more tons of CO2 every year, and saving $4 billion in energy costs.

A mature tree can often have an appraised value of between $1,000 and $10,000. In one study, 83 percent of realtors believe that mature trees have a 'strong or moderate impact' on the salability of homes listed for under $150,000; on homes over $250,000, this perception increases to 98 percent. Landscaping, especially with trees, can increase property values as much as 20 percent.

Trees properly placed around buildings can reduce air conditioning needs by 30 percent and can save 20 percent in energy used for heating. The net cooling effect of a young, healthy tree is equivalent to ten room-size air conditioners operating 20 hours a day. Annual air conditioning savings from 3 trees, each 25-ft tall around a typical California residence, ranged from $23 in San Diego, California to $83 in El Centro, California.

If you plant a tree today on the west side of your home, in 5 years your energy bills should be 3 percent less. In 15 years the savings will be nearly 12 percent.

Direct shade from proposed planting of 11 million trees in the Los Angeles basin are predicted to result in $50 million reduction in annual air conditioning bills - cooling of air by these trees will save an additional $35 million annually. Cooler air temperatures reduce smog concentrations by 6 percent, resulting in an estimated savings of $180 million annually, assuming an offset commodity market existed for ozone.

Each year about 1,300 GWh (1GWh = 1,000,000 kWh) of electrical energy is used for air conditioning in Sacramento County, at a retail cost of about $105 million. The 6 million trees that comprise Sacramento's existing urban forest are responsible for annual savings of approximately 157 GWh of air conditioning electricity due to shading and cooling effects. Energy conservation stemming from trees saves Sacramento residents approximately $19.8 million each year. The 6 million trees in Sacramento County absorb 1,457 m tons of air pollutants annually (ozone, nitrogen dioxide, particulate matter) with an implied value of $28.7 million.

Through energy conservation, these trees reduce emissions of carbon dioxide from power plants, as well as directly remove atmospheric carbon dioxide during their growth process and store it as woody biomass. Approximately 238,000 m tons of CO2 are removed by the region's urban forest each year, with an estimated value of $3.3 million. These environmental benefits total approximately $8 per tree per year, and increase to about $90 once benefits such as increased property values, scenic beauty, wildlife habitat, community bonding, and recreation are added. Sacramento residents are estimated to spend about $5 to 10 per tree each year for watering, pruning, pest/disease control, and removal of dead trees. The Sacramento City Tree Services Division spends about $20 per tree to manage 150,000 street and park trees. Hence, initial research indicates that benefits are several times greater than costs.

Trees remove gaseous air pollution and some airborne particles. Some particles

can be absorbed into the tree and others returned to the atmosphere. New York City trees removed an estimated 1,821 metric tons of air pollution at an estimated value to society of $9.5 million in 1994. The value in other U.S. cities included Atlanta (1,196 t; $6.5 million) and Baltimore (499 t; $2.7 million).

TREES ARE GOOD FOR YOUR LOCAL BUSINESSES

(source: Canadian Forest Service / UBC Forestry)

Researchers have explored the ways in which improvements in the quality of urban environment can influence the location of local businesses, but only a handful of studies have looked specifically at the role of treed urban landscapes in a business context. Customer surveys have demonstrated higher ratings of visual quality, amenity and maintenance where trees are present. Product and merchants were judged more positively in forested places in terms of product value, product quality and merchant responsiveness. Studies conducted in retail areas have found that consumers are willing to pay approximately 11 percent more, on average, for products in downtown shopping areas with trees, compared to areas without trees, and are willing to pay more for parking on streets with trees. Average willingness to pay for equivalent goods and services differed between small cities (+9 percent) and large cities (+12 percent).

Customers in places with trees also report perceptions of better service, greater merchant helpfulness and higher product quality. Thus, consumers' experiences begin to be shaped before even entering a store. They also reported greater expectation of patronage to stores in places with trees, and are willing to travel more frequently, for longer durations and over greater distances to spend more time in a retail

district that has trees. More time spent in a retail location could translate into greater total spending.

Healthy forests not only create a more vibrant business environment, they also become the business environment as they become parks, tourist attractions and festivals. Urban forest-related festivals and events can also contribute to local economic activity: for example, the Cherry Blossom Festival in Washington DC generated $98.5 million in direct economic output.

TREECONOMICS

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A study conducted in Savannah, Georgia estimated the mean and median values of visits by tourists to urban forests, resulting in a total annual value of urban forests to tourists of $81 million (mean) or $11.5 million (median).

Chapter 5

Housing Solutions

Housing Solutions

The “tiny home” movement is gaining momentum, with increasing popularity across North America. I WOOD’s game-changing characteristics, allowing people to build small dwellings easily with minimal budget, time and effort, reinforces the notion that low-income families and homeless people could access home ownership by opting for tiny homes.

Small homes have truly positive characteristics, a fact that is usually lost on city planners and inspectors, who use their rule book to protect the neighborhoods from shacks, illegal additions, overcrowding, parking and who-knows-what. These rules were made when housing was relatively easily available, and there was plenty of land that could be built on. Times have changed.

Although city planners and developers have no problem with apartments and condominiums as small as 300 square feet, when it comes to detached homes, the trend is bigger is better. By- and-large, city planners and home builders tend to think the minimum size for a single family residence is fifteen hundred square feet or larger, and often much larger. The biggest problem today is that so many people are priced out of the housing market. Our society has built invisible barriers that make it almost impossible for too many non-homeowners to ever own a home.

Such barriers include:
the fear of existing home owners that inexpensive houses will reduce the value of their own homes;
the building regulations that add to the cost of homes;
unconscionable land prices;
lack of infrastructure;
bank qualifying limitations, and so on.

THE PERSONAL AND SOCIAL IMPACTS OF TINY HOME LIVING

The new trend is growing: the tiny home lifestyle is positively impacting individual lives and modern societies.

On a personal level, choosing a small home promotes a greater sense of freedom. Some tiny homes are mobile, they can travel on extended vacations, explore new areas of residence or be transported from city to city, opening up a better choice of career opportunities. Owning a home with a smaller mortgage (if any) and a low-price tag, gives more financial space to fulfill other basic needs. Tiny home dwellers also report the upshots of this psychological freedom, as in a de-cluttered, better designed environment and easier to keep tidy and clean.

On the social level, society benefits from the resurgence of tiny home living. Reducing homelessness gives social workers a head start when addressing other issues related to uplifting from poverty. The stability of owning a home enhances employability, upgrading the job market with motivated, skilled workers unaffected by housing crises.

A cleaner environment is another social consequence of tiny homes, because of terrific energy efficiency and a much lower carbon footprint, especially when adding up the numerous ecological advantages of I WOOD buildings mentioned in previous chapters.

I WOOD MODULAR KIT HOMES SOLVING HOUSING PROBLEMS

The development of a worldwide building system for low cost homes will:

Satisfy building inspectors that structures are safely designed.

Make possible the addition of rooms without bureaucratic hassles.

Encourage houses to be smaller initially, thus reducing mortgage costs.

Open the housing market to millions more people, including people currently homeless.

DIVERSITY

Families come in different shapes and sizes. So should houses. The flexibility of the I WOOD grooved lumber building system's family of products and kits takes into account these differing requirements.

FLEXIBILITY

Some people buy houses a little too big, anticipating growth. Others buy houses a bit too small, for affordability reasons. I WOOD grooved lumber offers optimal flexibility. Its program and products are tailored for changes in family, income levels, housing sizes, shapes and preferences.

CHANGES

I WOOD systems and shapes allow customers to buy smaller homes, qualify for mortgages earlier in a family's life cycle, and add rooms or architectural features later. As needs or incomes increase, expansion is easy.

DEVELOPMENT

The design and development of the I WOOD system has been a long, careful process, based on extensive international experience in the lumber and building industries. The system and shapes have been independently tested and evaluated by respected industry experts.

BUILDING CODES

I WOOD shapes and building systems can be standardized around the globe to suit local building codes and design preferences.

SIMPLICITY

I WOOD Building Systems are like Lincoln Logs® or Lego® for adults; attracting both building professionals and do-it-yourself-ers. I WOOD structures built in Southern California and Mexico demonstrate how well it works!

I WOOD International has been involved in various projects building tiny homes and shelters to house homeless people in Tecate, Mexico and the San Diego, CA area.

More recently, Amikas, a San Diego, non-profit, homeless advocacy group, erected several I WOOD shelters at St Luke's Episcopal Church, home of the Uptown Community Services Center which provides various services for people without a home. Amikas, formed in 2010, has been pushing for San Diego to allow homeless people to temporarily live in small houses instead of tents.

Amikas does not use the term "tiny houses" because some might have inferred it meant actual, permanent houses. There also was confusion with the "tiny houses movement" of people scaling down their lifestyles by choice. Instead, they use the term I WOOD sleeping cabins, using the name of the company that makes the building kits. Each of the completed cabins is furnished with a single cot, a colorful wooden table and matching chairs and posters. There is no plumbing or electricity, but sunlight comes in through small windows. The most important element of the cabin is a door that locks. While common in most every home, it is a luxury for homeless people who live in tents, ever unsure of their own safety and unable to protect their possessions.

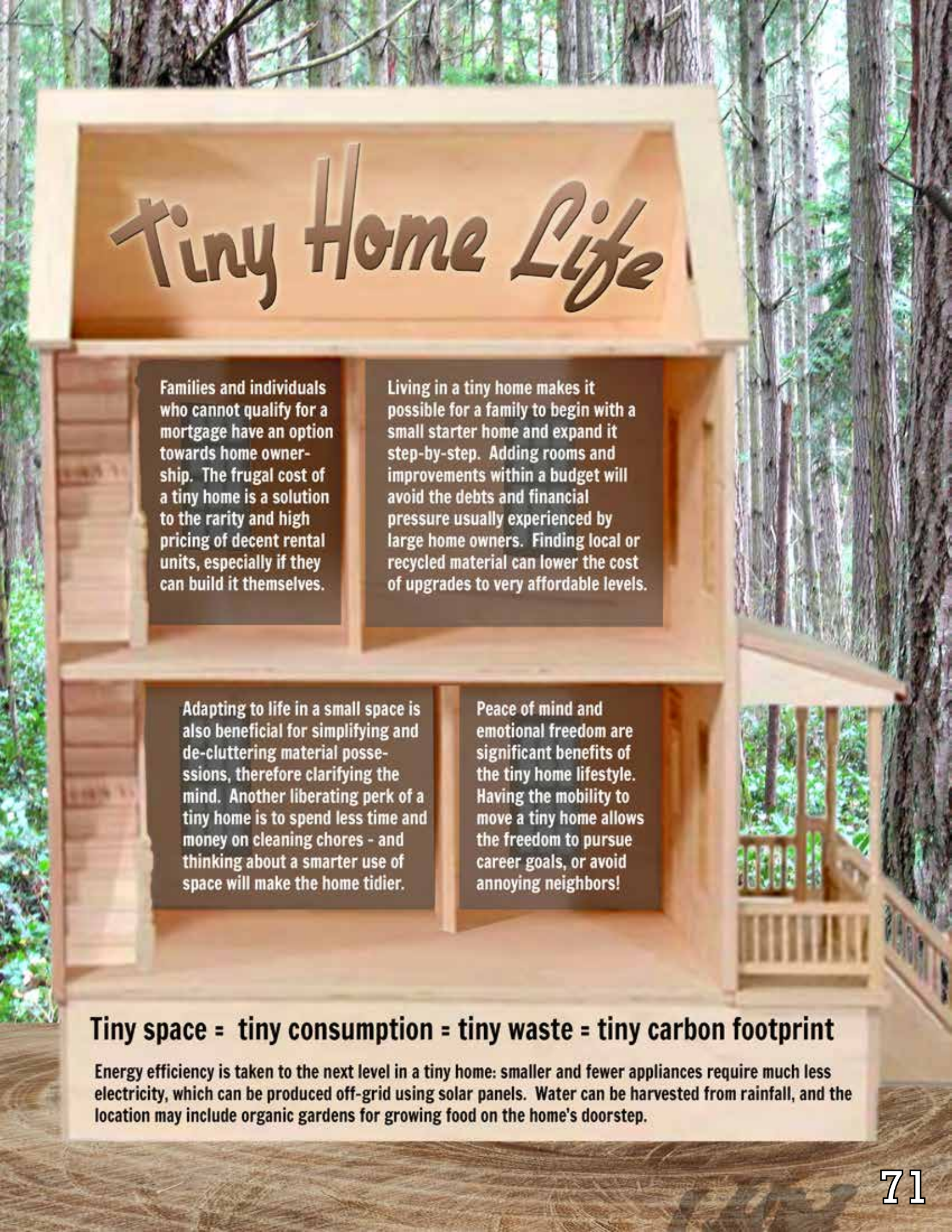
After garnering attention from the media and city officials, several groups initiated talks with the City of San Diego to overcome many hurdles to its vision, most notably the city ordinances prohibiting tiny shelters on public land, and building codes prohibiting people to live in those on private property. Because San Diego has a severe homeless problem, its municipal officials are opening up to new options to address such problems.

Treecycling and I WOOD are emphasizing the smallest versions of these buildings, up to 150 sq. ft. They can be built on concrete blocks, and then transferred onto a low bed trailer, or a flatbed truck, and moved to a new location. The maximum size for this type of unit to move around on public highways without special permits would be 16 ft long and 8 ft wide with an overall height, when being transported, of less than 13 ft.

These I WOOD units normally are available in 2 different forms - one made from I WOOD grooved lumber, manufactured from conventional 2X4's, and the other made from grooved lumber manufactured from 2X3's.

These I WOOD units are lighter and stronger than the conventional building system normally used. They are designed to be do-it-yourself projects with ease of assembly and installation of electrical fixtures, plumbing and insulation needing very little skill. They are designed to last as-long-as conventional housing, with proper maintenance.

The smallest unit we designed is a mere 4' x 8' footprint size and the height is 72 inches. It can be mounted on casters and moved in and out of a conventional garage. It makes a very good storage place for materials that might later go into tiny home, and can be used as a small workshop, either in the driveway or at the job site.



Tiny Home Life

Families and individuals who cannot qualify for a mortgage have an option towards home ownership. The frugal cost of a tiny home is a solution to the rarity and high pricing of decent rental units, especially if they can build it themselves.

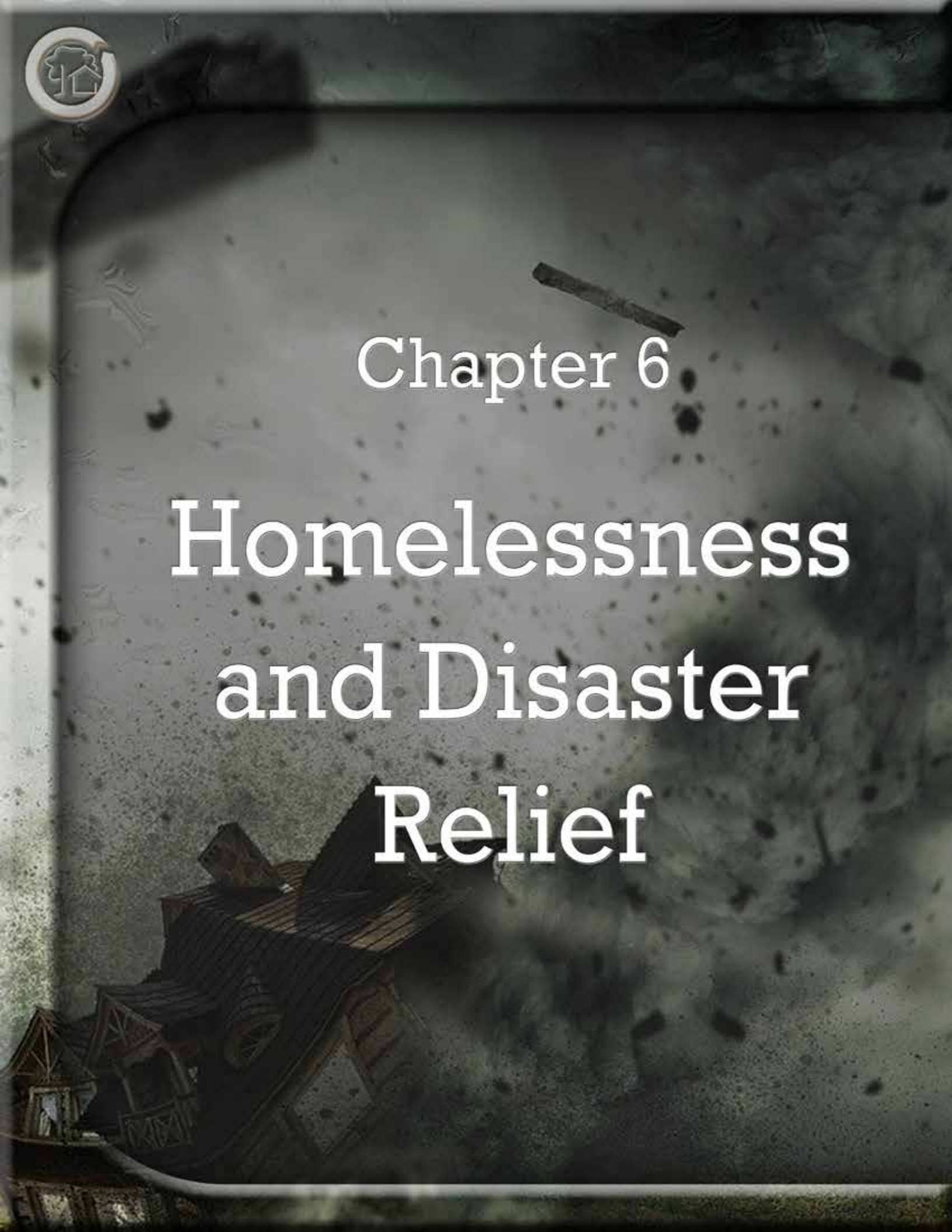
Living in a tiny home makes it possible for a family to begin with a small starter home and expand it step-by-step. Adding rooms and improvements within a budget will avoid the debts and financial pressure usually experienced by large home owners. Finding local or recycled material can lower the cost of upgrades to very affordable levels.

Adapting to life in a small space is also beneficial for simplifying and de-cluttering material possessions, therefore clarifying the mind. Another liberating perk of a tiny home is to spend less time and money on cleaning chores - and thinking about a smarter use of space will make the home tidier.

Peace of mind and emotional freedom are significant benefits of the tiny home lifestyle. Having the mobility to move a tiny home allows the freedom to pursue career goals, or avoid annoying neighbors!

Tiny space = tiny consumption = tiny waste = tiny carbon footprint

Energy efficiency is taken to the next level in a tiny home: smaller and fewer appliances require much less electricity, which can be produced off-grid using solar panels. Water can be harvested from rainfall, and the location may include organic gardens for growing food on the home's doorstep.



Chapter 6

Homelessness and Disaster Relief

AUXILIARY DWELLING UNITS AND GRANNY FLATS

There are many ways that I WOOD structures could make a difference in the way that we approach the housing crisis faced by such a large section of our population. Here are two:

MOBILE STORAGE UNITS (MSU's)

These very small structures offer a way of getting started on the way to home ownership, even from the very bottom of the financial and social ladder.

AUXILIARY DWELLING UNITS (ADU'S)

This is an approach that encourages infill within existing communities, to the benefit of family members, especially youth and seniors.

Although each type of housing can be built with conventional materials, there is significant advantage to using I WOOD lumber. This approach keeps material and labor costs down to a minimum, fewer tools are required, construction time is greatly reduced, the home design is customized to personal preferences, the loan/mortgage payments can be covered with a low income. Added to this, much of the work assembled from a properly designed kit can be done by the owners themselves.

MOBILE STORAGE UNITS

Mobile Storage Units could be the start of a solution to the homelessness problem. A private space, however small, is vastly better for a person's self-esteem than a mass charity shelter. It is possible to live very comfortably in a small space - think of boats and camper shells. The size, as in all I WOOD structures, for economic reasons, is dictated by the 4'X 8' building panel. The mobile storage units, MSU's, are aimed at "shopping cart" homeless people, first-time renters, students, enlisted military retuning to civilian life - all financially challenged. Local

authorities using this option will be asked to provide a “parking space” for a starter unit that measures 4’ X 8’, about the size of a tent. These could become 8’ X 8’ or 8’ X 16’, for couples, single parents with a child, or anyone else.

They are designed so they can be safely transported on public highways for relocation if the owner’s circumstances change.

These units should be clustered in small communities that also provide showers, toilets and kitchens as well as social services that the residents will need. The location of these mini communities should be close to public transportation.

They are most likely to get zoning approval if they are located in an area that is not valued by developers. Water supply and waste pump-out services can be provided by any portable toilet company.

The MSU shell, which is fully secure and safe from the elements, costs less than $1000 and, can be assembled in 2 to 3 hours from a pre-cut kit. Some storage, a bench, a folding table and a single bed, can fit into the unit - not unlike in a small camper.

These units can be insulated against the cold, making them a vast improvement over a tent. Having a door that locks, means that belongings can be safely left in the unit during the day, while the resident goes to work, appointments or a job search.

Electricity can be easily added (and should be). Solar powered plugs are an option. Like a boat or camper, toilet and cooking facilities can be incorporated in the unit.

The community would need to supply shower and toilet facilities, garbage removal, power, telephone and internet

access and some degree of security. The residents could be encouraged to self-police themselves to make their area acceptable to the local residents. The inclusion of social services and counseling will improve the success of residents in moving into more permanent housing.

AUXILIARY DWELLING UNITS (ADU) a.k.a GRANNY FLATS

As the name "Granny Flat," also known as "Mother-In-Law Units," suggests, the original purpose of this kind of unit was to house the homeowner's immediate family in an apartment added to an existing residence or on the same lot - offering added privacy for both parties. Having aging parents living on the same property, but not in the same house, is an attractive situation for many families. The grandparents can provide useful services as baby or dog sitters, as well as provide security at vacation times. Both groups maintain their privacy while being available to help each other out.

In fact, one can envision the older generation moving out of the family home with selected furniture and belongings into the detached, compact, easily maintained, modern unit on the same property when one of their children, with a growing family, is needing the live in the original home.

The reverse scenario is also valid and socially just as beneficial. Children could move from the main house to the smaller unit while they are at college or beginning to earn their own living. It would enable them to save enough for a down payment on their own home or reduce their student loans.

The key to adding a smaller unit to the existing lot is that the land is already paid for (or being paid for). The land cost, which is often the most expensive part of home ownership, is essentially free for the smaller unit.

There may be a period when the Granny Unit is rented out to a housekeeper, gardener or caregiver whose presence will extend the years that the owners can spend in their own home. Reduced rent in exchange for services could be in everyone's best interest. It would also significantly reduce the daily commute of a helper. Having a compact unit available to rent to the general public can help mitigate the expense of assisted living, or provide extra income.

Previously, granny flats were politically unpopular, largely because of unfounded fears about infrastructure impact and density. But as the costs of housing skyrockets, homeowners are rethinking their value as a housing option.

Here are some positive talking points:

A granny flat can be added to many properties on an individual case basis. By definition, each project is small, and only of interest to the people and properties immediately adjacent to it.

One-at-a-time, low-cost housing is not of primary interest to developers, so granny flats avoid the typical strident arguments about the acceptability of low-cost housing.

Their impact on traffic is markedly mild. An elderly couple would generally only need a single car, and if they live on the same lot as their children, often would not need their own vehicle at all.

In neighborhoods that still have shopping within walking distance, the granny flat makes even more sense.

I-WOOD HOME FRAME KITS

HOMELESS SHELTER AND DISASTER RELIEF

THE SAN DIEGO EXPERIENCE

Photo credit: Nelvin C. Cepeda
San Diego Union-Tribune

With a mild winter weather and a strategic border location, the city of San Diego, CA is facing a homelessness crisis. In 2017, I-Wood partnered with the nonproft homeless advocacy group Amikas to build multiple "I-Wood sleeping cabins" in North Park, intended to lodge homeless individuals and families. Media coverage helped spread the word, hoping to change city ordinances and building codes preventing such life-saving temporary housing.

There are many positive aspects to the concept of second dwellings, including:

-Elderly people will find it easier to maintain a small unit rather than rattling around in a big house with several unused rooms.

- A partial solution to homelessness.

- A solution to housing the elderly, particularly aging parents.

- A partial solution to the current rental housing crunch.

- Building just the shell of these ADU's in anticipation of their being needed at some time in the future makes a lot of sense. In the short term, they can be used as storage space, a home office, a workshop or studio, a home gym or yoga room, or just a quiet place to get away. The major expense of converting them into a residence can be addressed later when the living space is needed.

Residential zoning questions should be satisfied when the building is first being planned.

Most North American cities have ordinances and attitudes that actively limit or actually prohibit adding this kind of small home to existing lots. This resistance comes from the argument that the infrastructure is already old, roads are packed, and parking is a real problem. The thought is that adding units would increase these problems, thereby reducing property values. When the units are small and added one-at-a-time to existing lots, these concerns simply don't prove out. Using well-designed building kits that make use of I WOOD, makes this solution ideal.

DISASTER RELIEF

We hear news reports of natural disasters happening around the globe.

Earthquakes, wildfires, hurricanes, floods, tornadoes - the elements unleash their destructive power, and thousands of victims are displaced when their homes are destroyed or become uninhabitable. Since 1970, the number of disasters worldwide has more than quadrupled, to around 400 a year, according to The Economist.

In those times of shock, populations rely on whatever emergency shelter is provided by the authorities. In developing countries, the only help comes from international aid, after a painfully long wait.

I WOOD WORKSHOPS IN A CONTAINER

I WOOD's building structures could represent a leap forward for first response to disasters, because of their fast and simple assembly and practical shipping as packaged kits. For immediate disaster response, I WOOD can provide the components needed to assemble wind-resistant and quake-resistant emergency shelter frames.

I WOOD can also provide a self-contained, portable manufacturing workshop, including the necessary machinery and the know-how to allow first responders, whenever possible, a chance to produce I WOOD shelters on site. By doing so, portable workshops can be installed in the affected area, and disaster victims can join the construction efforts.

Each self-contained workshop, capable of outputting 500 sq. ft. of shelter per day, would cost approximately $10,000. After a brief training program, the workshop could be converted to a local woodworking business, using local labor. In addition to manufacturing kits for homes, they could produce kits for shops, workshops and furniture. In a few years, locally grown trees could be part

of the concept, with all the waste being converted to pellets for heating and cooking. If available, raw or salvaged local materials from the disaster area can be used to minimize costs, give shelter a regional flavor and accelerate the process.

If a disaster area is cut off from the electric grid, I WOOD structures can be assembled using a few hand tools, with little or no electricity required. A portable workshop would need minimal power to run the machinery, and a generator or power from a nearby village would be sufficient keep the workshop active.

Another practical advantage of I WOOD emergency shelters is their flexibility with regard to local weather conditions. For instance, frames can be built using the double wall design to hold insulation for cold winters.

As mentioned above, after the emergency housing needs are met, the portable workshop can be used by the local population to generate extra income, and used to upgrade the temporary shelters into permanent homes.

Prefabricated kits in the past have seldom been a good solution for a number of reasons. Expense, maintenance, flexibility of design and local building tastes are just a few of the concerns.

The I WOOD approach addresses many of these points favorably.

One of the keys to an adequate shelter is the provision of roofing material in line with climatic conditions and living habits of the refugees. If materials for a complete shelter cannot be located, provision of adequate roofing material will be the priority, as walls can usually be made of earth or other materials found on site or available locally. Local straw or palm leaves are just two options.

Wherever possible, refugees should build or assist in building their own shelter, with the necessary technical, organizational and material support. This will help to ensure that the shelter will meet their particular needs, promote a sense of ownership and self-reliance, and reduces costs and construction time considerably.

I WOOD/Treecycling can provide a universal basis for different shaped frames that can be earthquake, wind and termite resistant and modified to suit local tastes and available finishing materials. The platform can be adapted to many different hold-down situations: concrete and rebar, posts anchored in the ground, or tires embedded in earth. The siding can be covered in any traditional material according to local preferences and availability.

There are minimal eaves to the shell of I WOOD units, so the wall to roof connection is stronger than conventionally built homes and structural damage from high winds is greatly reduced.

TYPE OF SHELTER

Individual family shelter is almost always preferential to communal accommodation as it provides privacy, psychological comfort, and emotional safety. It also provides physical safety and security for people and their possessions and helps to preserve or rebuild family unity.

Emergency shelter needs are best met by using the same materials or shelter design that would normally be used by the refugees or the local population. Only if adequate quantities cannot be quickly obtained locally, should emergency shelter material be brought into the country. The simplest of structures are preferable. Materials should be environmentally friendly and obtained in a sustainable manner.

At the beginning of an emergency response, the aim should be to provide sufficient material to the refugees to allow them to construct their own shelter while meeting at least the minimum standards for floor space as follows: minimum of 100 sq. ft. per person in tropical, warm climates, excluding cooking facilities or kitchen (cooking will often take place outside), more space per person is required in cold climates or urban situations, including the kitchen and bathing facilities.

Whenever possible, the design of shelter should allow for later modification by its occupants to suit their individual needs. In cold climates, for example, it is very likely that people will remain inside their shelter throughout the day, thus more interior space will be necessary.

SUMMARY

Disasters come in all sizes and from all causes - earthquakes, hurricane, fires, floods. They can effect a few people or thousands. They could, and do happen anywhere in the world, including so-called developed nations. As the I WOOD/Treecycling concept evolves, we are developing a building system that provides emergency shelter as the starting point that leads to permanent housing, anywhere in the world, at very short notice.

Component parts for the frames of I WOOD homes can be shipped from anywhere wrapped in tarpaulins, providing almost immediate shelter from the elements. As time permits, the tarps can be replaced with locally available material for the walls and roofs. Thus, the temporary frame can become a permanent home, with services and insulation added into the open double walls. This can all happen while people are living inside their new home.

If an event happens in the US, concerned

groups could outfit a container with the appropriate materials and machinery and send it with a volunteer group to the disaster site. Volunteers can train local people to build there own tiny units, hopefully on the same plot of land they were living on before, and with the same neighbors participating in the process. If this happened fast enough, much of the material damaged in the disaster could be salvaged before the bulldozers are sent in to clean the area for health or other concerns.

If an individual already has a mobile I WOOD workshop, they might be able to drive to the disaster area, use the building materials supplied on site, and start the recovery process in hours, rather than months. If the insurance companies and building inspectors participate whole-heartedly in such a program, communities could be starting a return to normal almost as fast as the weeds take to return to their concept of normal.

ADVANTAGES OF THE I WOOD EMERGENCY SHELTERS

1. Sustainable
2. Volunteer Friendly
3. Re-usable material for permanent structures
4. Adaptable to use locally recycled materials
5. Flexibility to different door and window sizes
6. Open plan, area can be partitioned as needed
7. Assemble using simple tools
8. I WOOD components to build furnishings
9. Optional anti-termite protection available (additional cost)
10. Structure footprint per local preferences
11. External finishing not included
12. Volume pricing available
13. Locals can do the building
14. Starts rebuilding the community
15. Production set up and customized to local preferences and conditions
16. Hurricane/Earthquake survivable
17. Various sizes and designs available
18. Workshop and tools can be used later for income generation

MSU: Mobile Storage Units

Homelessness has become an ongoing disaster throughout most of the world, including most of the cities in the United States. While waiting for housing, people need a place to store what few possessions they had, including important documents photos and irreplaceable mementos.

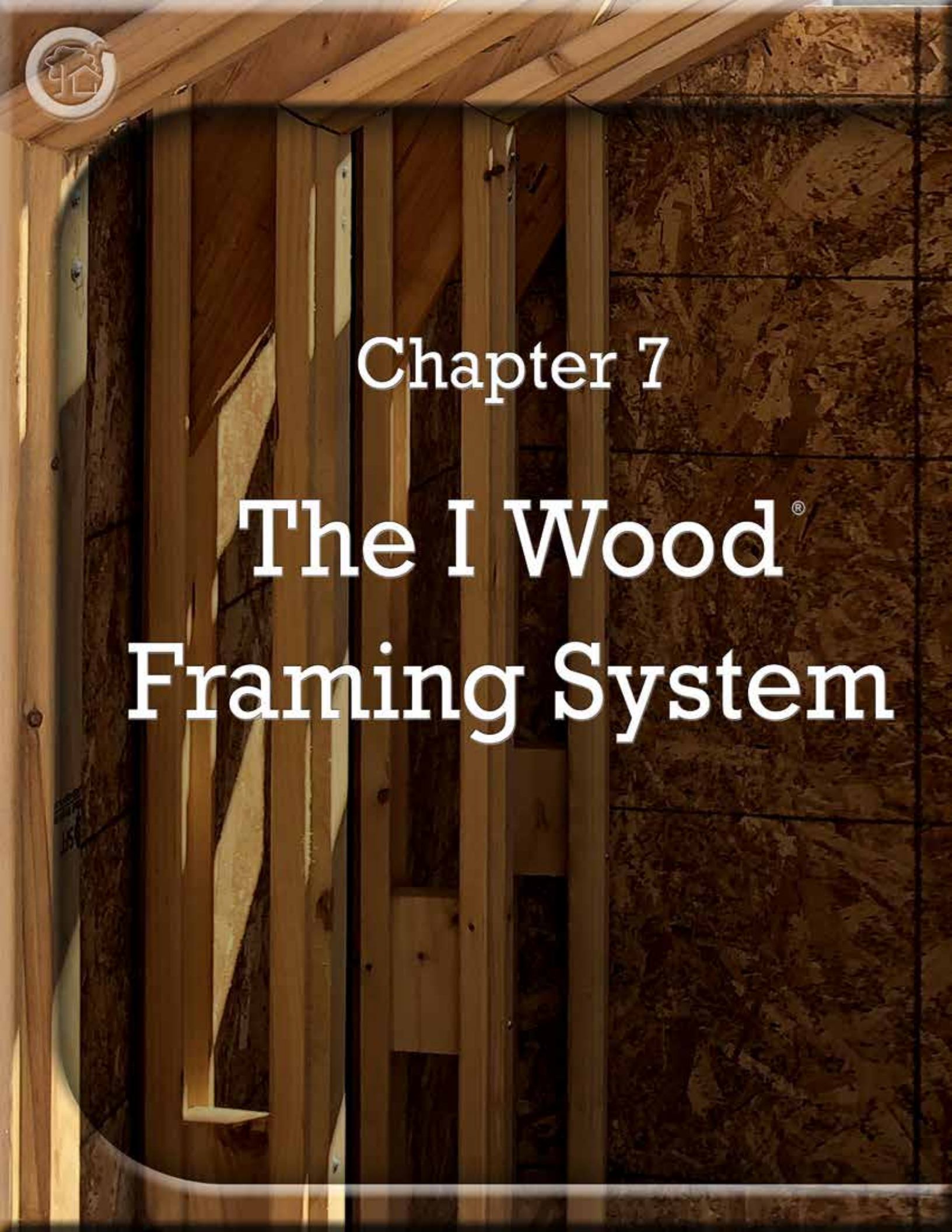
A new facility recently opened in San Diego's El Cerrito neighborhood where people who are homeless in San Diego can store their belongings. Combined with two prior storage centers, storage is at full capacity, with 1,130 bins and 304 lockers. These bins are the same garbage bins provided by the city for residents to put out their trash for pick-up, with the addition of a lock.

Aside from the subliminal equation of their personal belongings being treated as trash, this ability to safely store their possessions has had a dramatically beneficial impact on people who have no place to live.

Proposed as a follow-on to this storage program, the I WOOD Mobile Storage Unit (MSU) is a small, portable storage kit on wheels (large casters) that could be used for storage instead of these trash bins. MSUs are easy to build at a very low cost. What's more, they could be modified from being used as a storage unit to be a temporary sleeping cabin. While much smaller than a tiny home, people who are currently trying to survive in tents, huddled in doorways, or under tarps, could at least be as safe as their stuff.

Constructed with I WOOD kits, these small structures (approx. 100 sq. ft.) could be parked on safe parking lots for people who don't have a vehicle to sleep in at night. As part of a Housing First program, these cabins can serve as individual, safe shelter until permanent housing is available, and would provide some privacy and safety that isn't possible in a giant shelter, such as the current COVID-19 use of the San Diego Convention Center, and more protection from the elements and criminals than a tent.
Often, with the security of knowing there is a private, safe place to go to sleep at night, with a door that locks, a person can get a decent night of sleep so they can face the day prepared to take the actions needed to improve their lot in life.

Where someone has the wherewithal to assist in the assembly of their own unit, building an I WOOD MSU could be an empowering first step to a career in construction. Assisting the people building these units, along with building bathrooms, showers and dinning facilities for communities of people waiting for permanent housing, could provide a workforce pool for the construction trades.



Chapter 7

The I Wood® Framing System

Pasta would be very dull if it came in one size and shape. The same can be said about wood. At the moment, it generally comes in two shapes: square or rectangular, and smooth on all sides. Instead, I WOOD would use grooved wood wherever possible, for buildings and furniture, taking advantage of the grooves that, like pasta, can me created in a wide assortment of shapes.

HOW I WOOD IS MADE

I WOOD is a family of grooved lumber produced with only two blade shapes, a male and matched female. Alternately, you could call them “Inies” and “Outies” (compared to the traditional 2x4 “smoothies”).

The smooth, flat shape of traditional lumber is achieved with a straight blade. Male and female blades can easily be substituted for the flat one and can be installed in existing machinery for little additional cost. Extra power may be required to remove the material from the grooved shape, but this “waste” has considerable value in itself and saves around 30 percent in shipping and storage.

These two blade shapes in 3 sizes are all that are required to make all of the I WOOD shapes. When produced in volume, this brings the cost of manufacturing I WOOD grooved lumber is comparable to that of conventional material. Machinery to manufacture traditional lumber into grooved lumber (like the I WOOD system) is readily available.

NAMING I WOOD SHAPES IS EASY AS ABC

The variety of the shapes in the I WOOD family is far greater than that of the dimensional lumber, which relies on X to differentiate between products - i.e. 2X4, 2X6, 4X4 etc.

Although an almost endless variety of grooved shapes can be made using the 3 sets of blades, I WOOD uses the letters of the alphabet to describe the most common grooved shapes, based on the profile of the board (looking at it from the end with the length of the board going away from you) often looks like a letter of the alphabet.

Here are a few examples:

a 4X4 stud grooved with a male blade on all four sides has an "H" profile and is called: 4H4

a 1X2 strip grooved with a male blade on one side, and a female blade on the opposite side has a "C" profile and is called 2C4

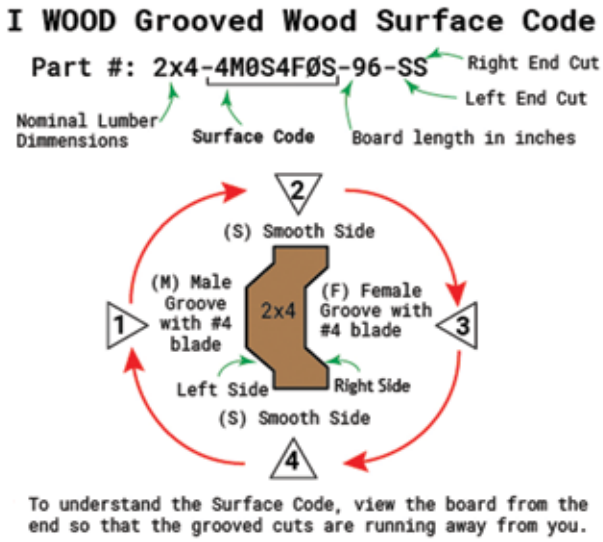
a ½" x ¾" strip grooved on one side with a female blade has a "D" profile and is called 1D1.

The component parts of the I WOOD system are designed to be used in as many different products as possible and cut to usable lengths rather than being sold in 8', 10' and 12' lengths, thus reducing the waste factor built into the current system.

The most common I WOOD lumber can easily be named using the dimensional lumber size prior to making the grooves, and replacing the "X" with the profile letter.

To describe more complex shapes, particularly required in some I WOOD furniture kits, we combine the dimensional lumber size with a surface

code, length, and end cuts, as illustrated here:



The most commonly used sizes that form the basic I WOOD components are called out in the following sizes which approximate the number of inches in length but actually refer to the functional lengths of wood needed for most projects.

As an example, a length of 2X4 is very seldom used in a length of 96" even as a stud which is usually around 93" when used on a building site.

Buying wood in the usual 8', 10' or 12' lengths guarantees terrific waste both in the sawmill cutting the wood for shipment convenience in increments of 2', and the end user cutting it further down to the sizes they need. 214-96-SS could in our nomenclature be 94" in length.

All these shapes come in THE three sizes discussed above for use in the construction industry, the furniture industry and for making toys, models or used as edge treatment for end grain of boards, Plywood or painted particleboard.

USING THE I WOOD ALPHABET

By grooving logs into a few basic shapes designed to be used in buildings and furniture, we make much better use of the wood and have a shape that makes the item being produced stronger and

The I WOOD® Alphabet

As conventional lumber is referred to as 2X4, 2X6, 4X6 and so on... I WOOD shapes use a similar nomination. For example, a C-shaped beam that is 4" wide - 2C4 - or a U-shaped beam that is 6" wide - 2U6 - have an easy codename for quick reference in the assembly manual, and to ensure uniformity from all manufacturers. Length is added after the name, such as: 2C4-96 (inches).

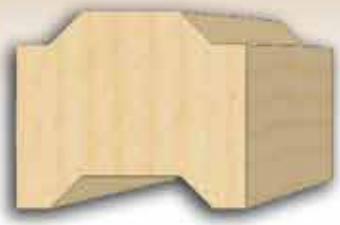
2C4
C-WOOD

2D4
D-WOOD

2H4 H-WOOD

2I4
I-WOOD

2L4
L-WOOD



2M4 M-WOOD

2O4 O-WOOD

2Q4
Q-WOOD

2U4 U-WOOD

2V4 V-WOOD

more functional, as well as being far more attractive.

C-WOOD is probably the most environmentally sustainable shape in the I WOOD alphabet; frequently, we can get two pieces of C-WOOD out of one small diameter tree, when it is only possible to get one conventional piece of rectangular lumber from the same material. C-WOOD is used very extensively for many of our buildings and a lot of our furniture. Other uses range from dunnage instead of pallets needed for shipping purposes, to wine racks and roadways for children's toys.

It plays an important part in some of our interior and exterior railings and handrails. It can also be used for making laminated beams.

D-WOOD has various specialty uses such as for formwork for concrete and certain roofing situations.

H-WOOD is usually used for corner posts and roof beams. It has a lot of uses for garden functions such as posts, parts of picnic tables etc. It lends itself to being decorated with different colored stains and paints and having tile glued to the grooves for a completely different and exciting look. Greenhouses made from H-WOOD are very functional, attractive and competitively priced.

I-WOOD is sometimes called the dog bone or I-beam shape. It is used in many areas ranging from studs in our full-size homes, to interior partitions.

L-WOOD tends to be used for decorative end uses, such as picture or mirror frames.

M-WOOD is used for making very strong, solid wooden walls with the components, one on top of the other, similar to the way log houses are made. One variation of the "M" is to leave one

side of the shape rounded showing the original shape of the log.

O-WOOD & P-WOOD are frequently used as dowels to connect studs and rafters together when building the trusses for emergency buildings and smaller garden storage cabanas.

Q-WOOD is used when joining two pieces of I-WOOD or C-WOOD together when extra strength is required for posts or rafters. It is useful when making laminated beams for extra-long rafters.

U-WOOD & V-WOOD have various uses as interior structural members in emergency shelters and cabanas. Used as interior trim for drywall, it is an alternative to the time-consuming and messy process of taping and spackling drywall. By using this approach, drywall can be ready for painting in less than 24 hours, rather than the 2 to 3 weeks using the "normal" approach.

W-WOOD is mainly used for wooden decks. The shape reduces warp and twist. W-WOOD has grooves in the top to hide the heads of screws and is a little less expensive to ship. It reduce the likelihood of slipping on wet wood and has the appearance of an expensive teak deck on a ship.

"Y", "Yh" & "Yo-WOOD are most frequently used as studs for the corners of 45º structures, hexagons and octagons. Using these as corner posts makes it possible to use standard 4' X 8' panels for the sides of the buildings, which are also used to "square" house frames.

As mentioned in the previous chapter, this selection of different shapes vastly increases the options the architects have when designing buildings and furniture, especially when time, skilled carpenters and specialized machinery are in short supply.

THE I WOOD BUILDING FRAME SYSTEM

One I WOOD framing systems uses notches on the bottom plates for studs to lock into, as easily as LEGO blocks. Rather than having carpenters frame the walls flat on the ground and then lift them up into place, wall studs are dropped into the notches.

The traditional framing method is a time-consuming process, making framing more complicated and requiring a significant amount of skill. It leaves the construction open to inaccuracy, thus making the framing even more complicated. The I WOOD framing system is a revolution in frame-building, using a top and bottom notched plate approach.

With notched plates, standard angles and sizes remain constant. Outstanding strength, accuracy, flexibility of design and higher insulation factors are some of the advantages over current building systems.

The sheathing overlaps the bottom and top plates - it provides both a sheer during the framing process and maximizes the strength provided by the 4X8 sheets of plywood which will be attached. The notches in the top and bottom plate can be routed with a conventional router, either freehand, or for larger quantities, using a template. Production runs can now be done on a CNC machine at very high speeds with complete accuracy.

The I Wood Framing System

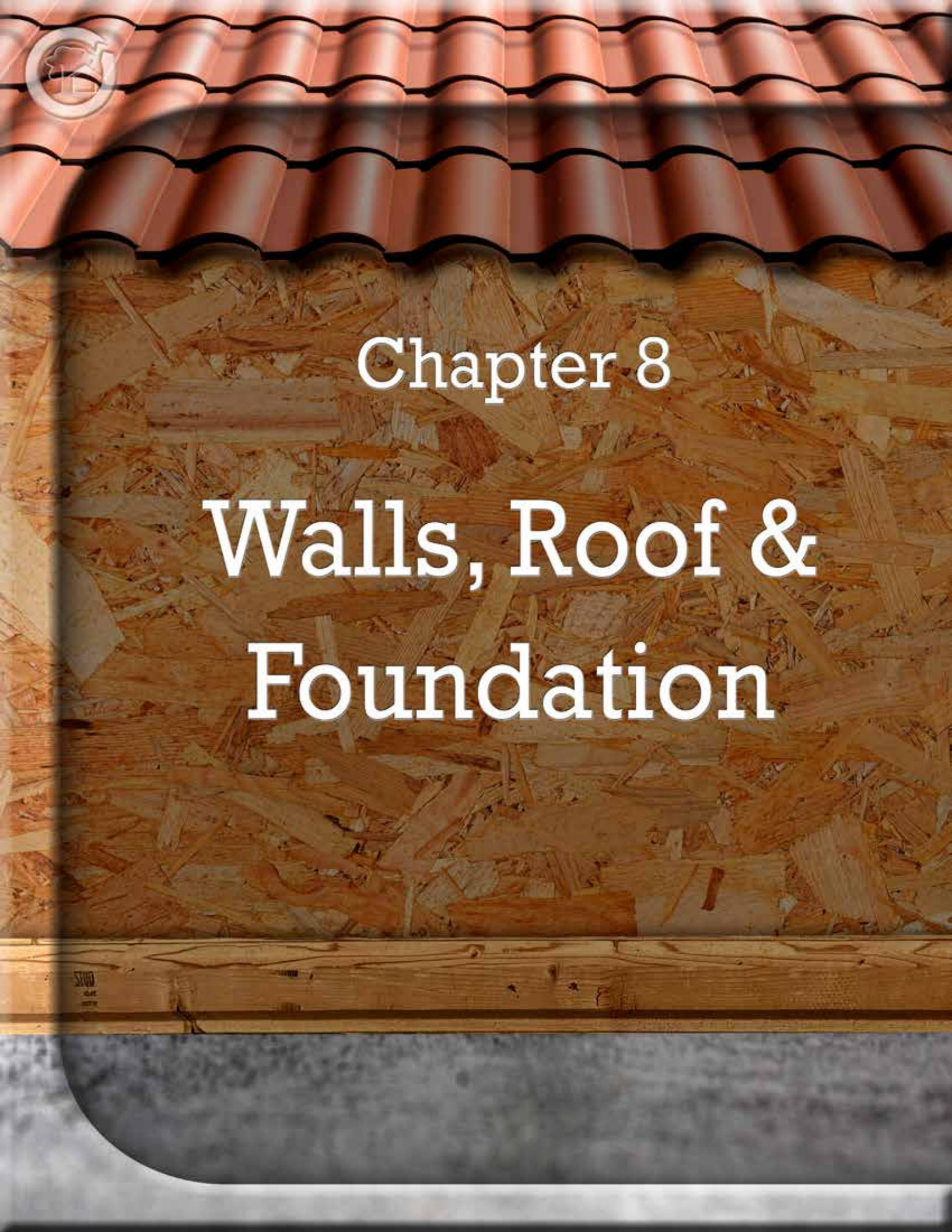
Another I WOOD framing system uses C-WOOD studs in a continuous truss arch. These arches can either be single units, for smaller buildings and temporary structures or they can be doubled up to form a very strong frame, with exceptionally high insulation characteristics and ease of installing plumbing, wiring and other services in the walls.

Framing using I WOOD shapes can substitute for existing 2X4 and 2X6 in most cases, showing clear advantages in cost, transportation, storage, insulation, speed of assembly, accuracy and many other areas.

The strength obtained through this process is higher than the traditional end nailing currently used to frame houses.

Until volume production levels are reached, I WOOD framing is a little more expensive, however, it is considerably cheaper than having high paid framers do the work in all weather, and having a group of men stopping work to tip the walls into position. Design modifications are also far less expensive than when framing conventionally. Who hasn't been challenged getting nails out without damaging the wood?

If a home that was built with I WOOD, using screws has to be demolished, a very large percentage of the wood materials can be reused.



Chapter 8

Walls, Roof & Foundation

The I WOOD grooved framing system is an innovative way of building houses, furniture, or almost anything you want to build out of wood.

I WOOD provides alternative ways to use wood as a framework for simpler and stronger assembly, that is also a more sustainable way of using wood.

The I WOOD system is designed to be incorporated seamlessly into the traditional manufacturing and building industries.

I WOOD furniture is finished with the same sandpapers, varnishes and paints as any other furniture. I WOOD foundations have demands identical to foundations for existing building. The roofs and walls on I WOOD structures (interior and exterior) cab be completed using any of the traditional materials used in the building trade.

I WOOD FOUNDATIONS

Every building around the world has a different set of conditions with regard to the ground where it is going to be built. Rock, sand, slope, moisture, wind, and earthquakes, are just a few of the considerations that have to be taken into account. Local conditions, customs and regulations will all influence how to approach the foundation.

Gentle rocky slopes, unsuitable for agriculture, facing the sun in colder latitudes, or away from the sun in warmer climates, present additional considerations. We prefer pilings embedded into the ground, rather than concrete slabs, for environmental reasons. An insulated floor is also important. Water treatment and water storage tanks are highly recommended. If it is possible to collect and store water under the house this should be compulsory. The reuse of gray water

should also be considered at this point. In an ideal world, the home should be off the grid with power perhaps from solar panels or biomass.

If you really want to dream big, household food waste and sewage should be part of a composting system that supports growing food for the household.

If you choose to use a slab, it must be flat and exactly the right size - preferably with treated 4 x 4 lumber edges embedded in the sides, to which the siding can be attached. Using this approach has a definite advantage in that traditional formwork is not required.

Because a building's foundation is a very complicated subject, local customs, authorities and codes must be incorporated into the decision.

WALLS

I WOOD homes can be built using 2I4s, 2I6s or 2C4s with conventional top and bottom plates or the I WOOD continuous truss arch. The picture here shows 2I6s being used for the top plate, instead of 2X6s.

Our preferred approach is a double-wall system using 2C4s as the main structural members, positioned to provide six-inch walls. This approach makes very light, strong and easy to assemble building frames, and makes installing the services through the walls remarkably simple. As always, all standard finishing products, including cabinets, windows, and doors, can be obtained from the local hardware store.

Because I WOOD structures are assembled with wood braces or dowels and screws, changes in design, such as the positioning of doors and windows, is simply a matter of taking out a few screws and repositioning the components.

Not everyone is qualified to install electrical wires and/or plumbing. In such cases the wiring, boxes and/or pipes can be threaded through the spaces in the double wall studs prior to getting professional help in these areas.

ROOFING

Any standard roofing options available in the market can be used on an I WOOD building frame. The I WOOD system uses pre-cut component parts which are accurate to about 1/16 of an inch, so roofing can be pre-cut and delivered to the site, ready for installation.

If plywood sheathing is used, it can also be precut. Spacers are provided with the kits, which can be pre-fastened to the panels enabling the panels to be positioned on the roof and slotted in position on the rafters, in the exact spot to be fastened down. The actual roofing can be complicated, as you are working on a sloped surface, 8 feet or so above the ground. Common sense and safety considerations are essential to complete the process - experienced help is recommended, depending on your level of skill and experience.

ADOBE, STRAW BALE, COB AND HEMP

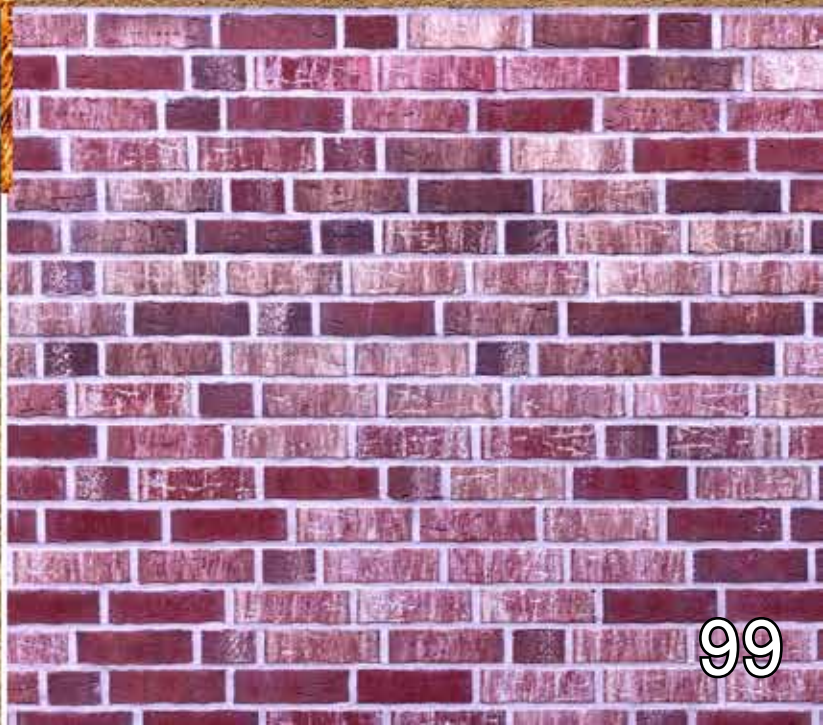
I WOOD frames are fantastic when

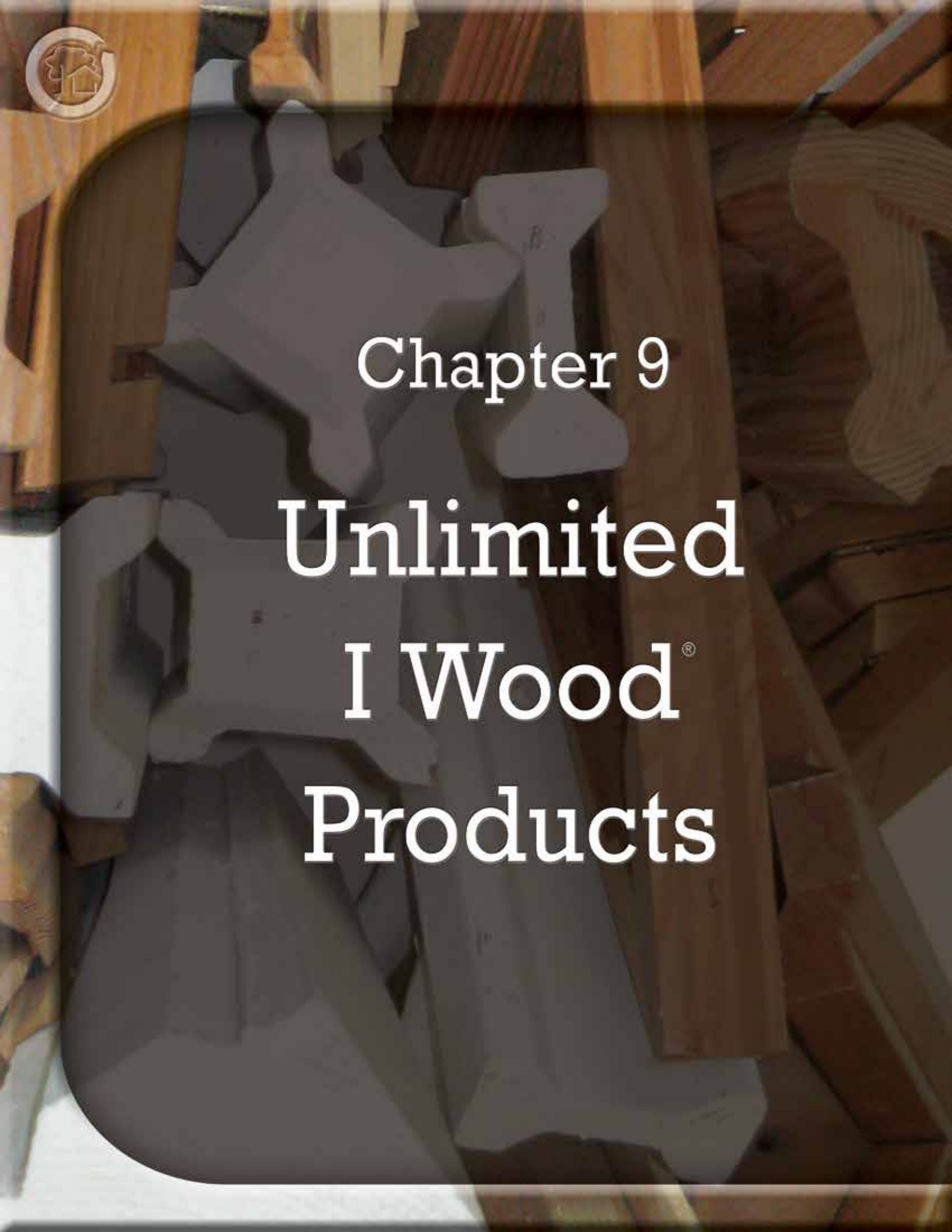
incorporating adobe, cob, straw bale and hemp in the finished home. The width of the wall gap can be modified as needed for these materials.

Virtually all questions about accuracy, exterior and interior finish, and roofing, become much easier to solve with I WOOD framing, often significantly reducing the time it takes to be able to move in.

I WOOD YURTS AND DOMES

We are beginning to think in terms of practical yurts and geodesic domes. If anyone is interested in joining us on this, or anything else discussed here, please get in touch at treecycling.com.





Chapter 9

Unlimited I Wood® Products

Unlimited I Wood Products

Any woodworker adopting I WOOD grooved wood, opens up an infinite corridor of possibilities, ranging from home building, to furniture and toy making, to miniature models. As the I WOOD shapes can be milled in various shapes and thicknesses, the only limit to the development of new I WOOD products is the woodworker's imagination.

Grooved and interlocking wood components (braces and dowels) confer optimal stability and solidity to square, rectangular, hexagonal or octagonal objects.

The IKEA concept of easily assembly and disassembly, is taken to a whole new level.

Starting to use I WOOD grooved wood can be a little bit like learning to use an update on a computer program. Everything is a little different, and it often takes some time to appreciate the advantages.

Some things are obvious. The grooves provide extra strength by interlocking with wood braces and dowels. They also provide a ledge if used as a shelf, which keeps items from falling off or lets air circulate underneath books. Cutting time with a saw is reduced by up to 30 percent and you can stack more wood in your workshop.

The list goes on and on as you start to enjoy the new design possibilities.

Guinness used to have an advertisement that went, "I haven't tried it so I don't like it." For most people Guinness never became their favorite drink. We think the opposite will happen when you use I WOOD

for some of your projects, especially when you take the environmental benefits into account.

DO YOU WANT TO SELL YOUR PRODUCTS?

If you find you enjoy woodworking, you might like to consider becoming a licensed manufacturer of I WOOD kits and components.

For a small fee, you will have access to manufacturing plans and manuals, together with suggestions about the tools you need and the standards you will be expected to adhere to. I WOOD will send you orders that come through our websites, www.IWOODKits.com and www.Treecycling.com. And you can generate your own sales as well.

You can start out working on I WOOD in your free time until the orders come rolling in on a more regular basis. You can also sell your I WOOD creations to

HOW TO DESIGN A NEW PRODUCT

1 - Define the new product
2 - Analyze similar products already available
3 - Draw a general idea of the product's structure
4 - Determine where are the joints, corners, and surfaces
5 - Decide which I WOOD shape is best suited for each joint and corner
6 - Draw a detailed plan of the product's structure
7 - List each component part, and determine the assembly process
8 - Re-draw a final plan adjusting the product's style and appearance
9 - Get the necessary tools and fasteners to make each component
10 - Build a first prototype
11 - Assemble the prototype & disassemble it
12 - Correct any mistakes and irregularities
13 - Sand, paint and varnish the product to your standards.
14- Give your creation to family, friends or neighbors if you don't have room in your own home or sell it on www.iwooddkits.com/associates

friends and neighbors, local charity events, local craft markets and stores. You also have the option of selling completed items as an I WOOD Associate through www.iwoodkits.com

THE I WOOD ONLINE COMMUNITY

On top of the numerous beneficial properties and the dozens of possible products explained in previous chapters, the creative freedom of I WOOD makers is not only limitless, but empowered by interactive communities of innovative licensed woodworkers.

Reinforced by the support of like-minded I WOOD developers, any new product idea can be bounced back and forth through a network of other licensed woodworkers, to collectively experiment with every detail of the design process.

By doing so, woodworkers volunteer to connect virtually, from any location, to help each other's product development: they comment, criticize, correct inaccuracies, suggest different thinking, validate manufacturing methods and find solutions to technical problems.

The whole being greater than the sum of its parts, it is inspiring to see different I WOOD aficionados joining forces for innovation. An interesting "mix-and-match" effect takes place between woodworkers, where different product ideas blend together to create improved versions or a completely new product never imagined before.

Another "mix-and-match" occurrence might also occur; adapting a product idea to conveniently fit into someone else's plans, in order to market them together. When a woodworker planning to build chairs gets in touch with another woodworker designing a table, they can adjust the height and style of their respective products to offer a complete dining room set.

The individual creation of I WOOD products, supported within a community of innovative experimenters, will effectively crowdsource the "Research & Development" (R&D) of I WOOD's infinite potential.

An important aspect of such teamwork is the testing phase. For example:

- a licensed woodworker located in Florida can connect with another located in Vermont to determine if his product can withstand a cold, snowy winter climate;

- a licensed woodworker can have several "virtual colleagues" manufacturing and trying a new product in different contexts, to realize that the product does well in an urban context but not in a farming one;

- a licensed woodworker can ask others to test two different manufacturing processes, and get input about which one is faster, easier, simpler.

THE GROOVE AND DOWEL SYSTEM

When experimenting with various shapes and grooves during the conception phase of your new design, it is possible to strengthen its structure by adding dowels into the groove.

One of the advantages of I WOOD's groove is that it becomes part of a tongue and groove joint that provides mechanical strength, rather than the friction that nailing depends on when joining two pieces of wood together. The LEGO® system, when compared to traditional square building blocks used by children

many years ago, demonstrates this difference. LEGO buildings tend to stay in one piece, regardless of the amount of shaking they experience, while building blocks collapse very easily when experiencing even the slightest shaking.

It should be noted that the I WOOD grooves allow for a little “wiggle”room. Wood expands and contacts and it would be impossible guarantee the degree of uniformity required by say tongue and groove flooring manufacturers. If a male and female I WOOD joint does not match perfectly at least on the visible side a relatively small amount of planing or sanding should rectify the problem.

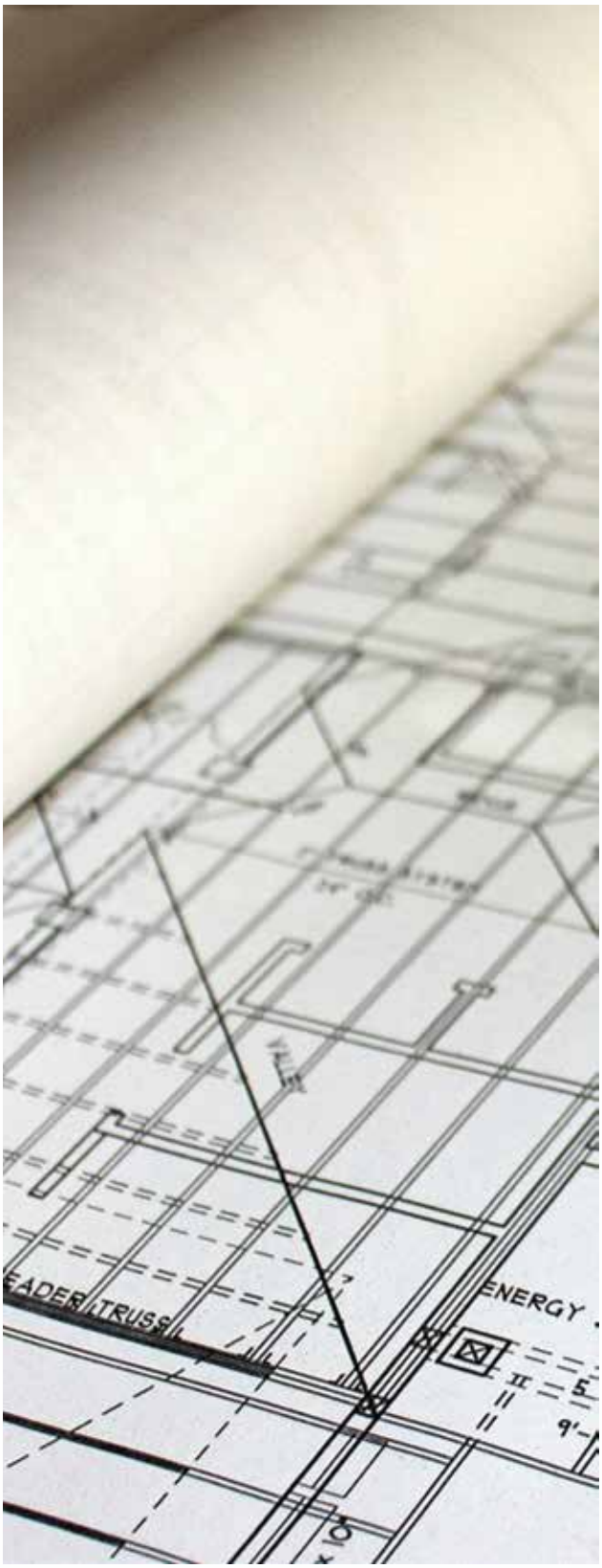
Dowels have long been used to make fine furniture and provide fastening advantages in modern furniture. For example, IKEA® has incorporated them in their solid wood products, as well as their kitchen and storage cabinet boxes. The I WOOD system combines the basic tongue and groove approach with the 32mm doweling concept. While held together in the groove, the I WOOD components cannot be twisted out of alignment. In the case of furniture, gravity keeps the pressure on the material to give a very strong joint which, in permanent structures, could be glued.

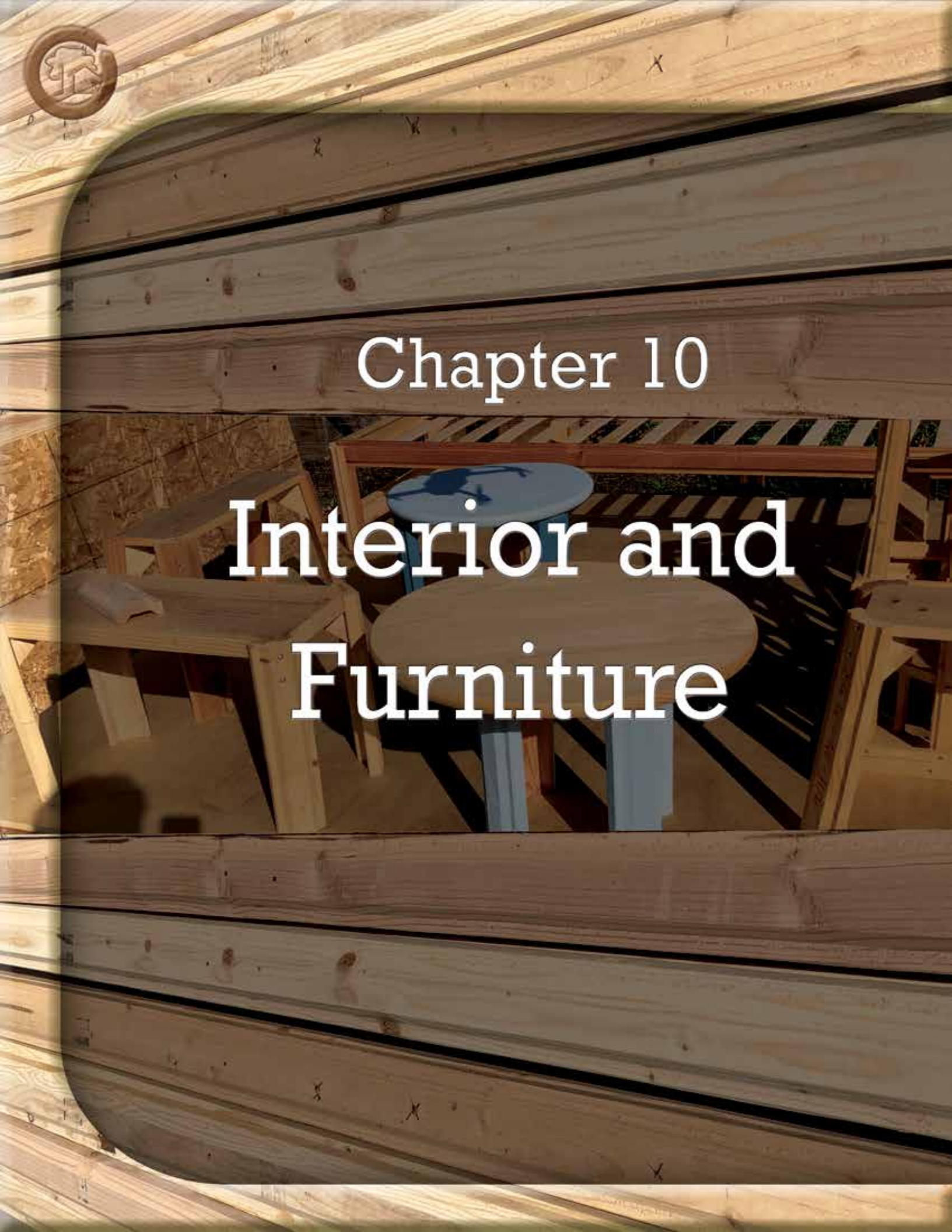
Angled doweling reduces the need for clamps when gluing 2 pieces of wood together. However, it also creates a number of challenges to the manufacturer to ensure the dowel holes are in the correct positions for total accuracy. The I WOOD grooved lumber and angle doweling system that we have created, together with our plans and suggestions, are all up for debate and discussion and everybody involved in the development is encouraged to participate.

As we expand internationally, we would like to see agreement on the exact dimensions of the grooves in the blades and bits that create them. The great advantage of this would be that component parts offered from small workshops and manufacturers around the world would be interchangeable.

It is our intention to license small manufacturers with small workshops using local materials for the local markets as well as to encourage larger groups to make I WOOD products.

The jobs created in local areas will have a competitive edge over larger manufacturers primarily because of reduced transportation costs and the ability to use local materials, perhaps recycled or rescued from the off-cuts of construction sites. They will also know exactly what their local customers are looking for and be able to fulfill their specific needs.





Chapter 10

Interior and Furniture

The endless possibilities of I WOOD are particularly exciting when designing furniture and other household items. In an I WOOD tiny home, much of its interior furniture could be made using the same I WOOD grooved material. Because of its interlocking parts, most furniture will have greater strength than its conventional counterparts. Plus, putting together an I WOOD furniture kit is great training for building your own I WOOD home!

I WOOD built-in cabinets and shelving result in very efficient use of space, a premium consideration when living in a small area.

On a larger scale, even a more spacious home would benefit from I WOOD's aesthetic appeal and ease of assembly, utilizing the wooden grace of its shapes for railings, finishing trim, and a multitude of other applications.

Pre-cut I WOOD component parts also lead to the greater use of hexagon and octagon angles, which add even more to the features of a room.

THE BEDROOM

BED

An I WOOD bed frame can be assembled for a very low cost, and its size can be adjusted according to the desired mattress size. Joining 2C4 shapes for the legs with a combination of shapes for the long bed rails allows small 1l4 or 1X4 boards to be aligned together as removable frame slats - these can also be purchased ready-made, often at very competitive prices. Ensuring maximum strength by having two rows of slats covering the width of the bed, it is then possible to be creative when conceiving a great-looking headboard using various shapes. I WOOD has an interesting way of

attaching these to the walls using what is called a French cleat.

NIGHT TABLE

The fun of creating your own night table using I WOOD shapes begins by determining all your most important uses for it. If a quickly built square table is all you need for your lamp, it can be done in a jiffy.

However, if you can imagine a small bookshelf on the side, an opening for a tissue box, a special drawer opening sideways, a secret compartment for valuables in the back, it all becomes possible using I WOOD's versatile shapes and flexible possibilities.

Sliding 1C4 or 2C4 shapes are especially useful for building small drawers, and 2I4 shapes can become useful racks or attractive sidings.

BENCHES AND CHAIRS

I WOOD makes it possible to design chairs and benches of all sizes, with the interlocking parts offering stability to all models, from big reading chairs to very narrow benches. Using various shapes can help create multi-functional benches that can serve as storage chests, toy racks, play areas, and more.

CLOSET

If your bedroom does not already have a closet, you can build a freestanding one! It is quite straightforward to assemble a rectangle frame and add doors, a drawer, a clothes rack, a show rack and any other addition you can imagine. Again, sliding 1C4 or 2C4 shapes are great for making small drawers, and 2I4 shapes can become useful racks.

THE KITCHEN

KITCHEN TABLE

An I WOOD kitchen table can be a convenient solution for small or irregular kitchens, serving both as a dining table and an island on wheels. The interlocking nature of its components make it practical to design an extendable kitchen table with a shelf. For more elaborate dining rooms, an I WOOD base structure can provide an elegant support for a thick glass tabletop or a distinguished slab of fine wood.

PANTRY AND SHELVES

Building your own pantry, storage shelves and racks with the I WOOD shapes provides a maximum of customization opportunities to perfectly suit storage for canned good, spices, fruit and staples. These shelves can also be used in pullout form on casters if you have a gap about 4 inches wide beside the refrigerator. Many kitchens have a wall space behind a door a space of about 4 inches deep where an I WOOD rack can be fixed to store around 100 cans of soda or other canned goods. Whether you are a baker, a gourmet chef, or a rural citizen who must store weeks-worth of supplies, the flexibility of I WOOD grooved wood lets you design a highly-functional food storage area, tailored to your kitchen and your needs. Where conventional shelves rely on fasteners and 90-degrees angles to hold together, the LEGO-like capabilities of I WOOD will help even an unskilled person create shelves that are strong, long-lasting and good-looking.

MUG AND BOTTLE RACKS

When designing mug or bottle racks, 2C4

shaped beams naturally become perfect mug holders, wine bottle racks or racks to safely display plates and bowls.

THE LIVING ROOM

MODULAR TABLE

In similar fashion to the night table mentioned previously, the conception of a modular table for the living room is enhanced by the multi-purpose possibilities of I WOOD's grooved wood. The living room table can be extendable, feature one or many drawers, storage boxes, snack trays and other additions.

BOOKSHELVES

I WOOD bookshelves are the next generation of modular, customizable storage cabinets. The ability to combine 2C4 and 2I4 shaped edges sliding on each other can generate new ideas for movable parts such as drawer sides.

AROUND THE HOUSE

RAILINGS

I WOOD's aesthetics are becoming increasingly popular for all sorts of railings. 2I6s can become very attractive staircase handrails, and the 2C4s versatility is a sought-after style for mezzanine or deck railings.

FINISHING TRIM

Using various shapes of I WOOD profiled lumber as finishing trim can improve the elegance of a home while fulfilling specific practical purposes such as concealing cables or electric wires, framing glass, paintings or mirrors, or

other unusual uses that flat finishing trim cannot satisfy.

BABYPROOFING

I WOOD's interlocking faculties can help parents prevent accidents when baby is crawling around the house.

Quickly assembled baby gates can be designed around specific areas, or extra safeguards can be added to close the gap between existing staircase railings.

Flexible design can also be adapted to children's beds and play areas to prevent falls or opening doors. Using dowels may also allow parents to build items without any screws or sharp ends, for complete peace of mind.

Please note that not all of these products are currently available beyond initial drawings. We are actively encouraging wood-workers and designers to participate with their ideas, advice and suggestions.

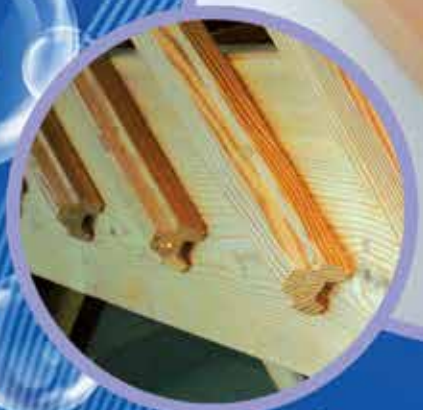
As the I WOOD system evolves, we will be setting up a program I WOOD Innovators will be rewarded for their design ideas and solutions.

Details can be found at www.iwoodkits.com

I WOOD® interior

Furnishing your new I WOOD home can be a breeze with easy, DIY assembly kits for making your own tables, chairs, benches, shelves, bed frames, and more. Be your own interior designer!

staircase railing



railing

finishing trim

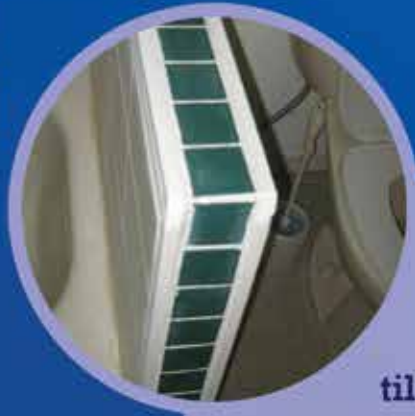
table

Small items such as wood boxes inspired by I WOOD shapes add function and style to your home.

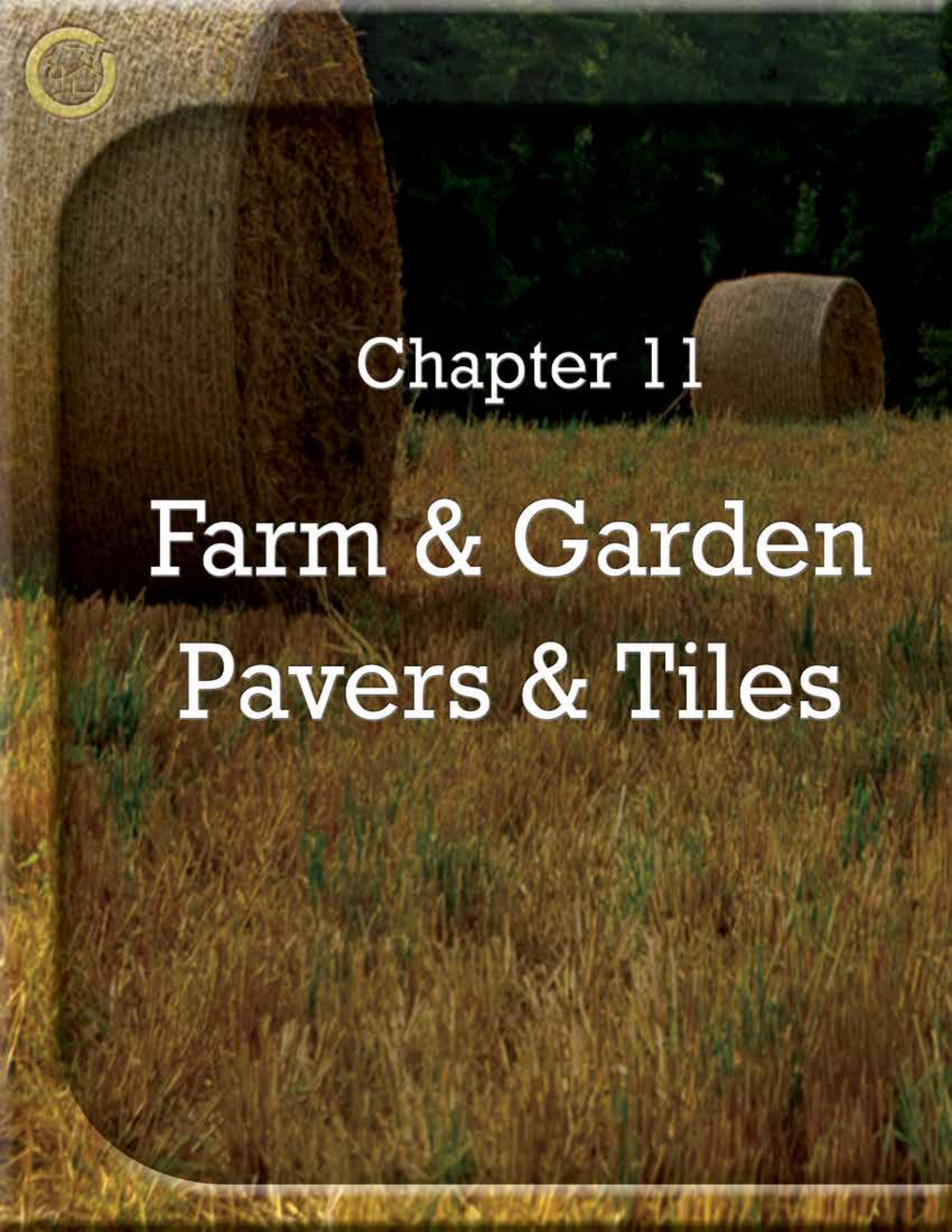
bed frame

wine/mug rack

I-Wood boxes



I WOOD's shapes can also be well used as grooves for bathroom tiles or other ornaments.



Chapter 11

Farm & Garden Pavers & Tiles

URBAN VICTORY GARDENS, RAISED BED GARDENS AND LANDSCAPING

A very important part of the Treecycling focus is the encouragement to produce more locally grown food. It may start with small herb gardens and tomato plants grown on people's decks, and continue to the point where one of the key decisions about what sort of tree to plant considers the full value of the fruit and nuts that goes along with other environmental benefits.

Our aim is to work hand-in-hand with organizations already involved in this area.

Many tree-planting organizations are doing a fantastic job with exactly the same objectives that we have. Saving a tree from being cut down today has the same mission as planting tree seedlings that reach maturity in 10 to 15 years. Independently, our goals are identical and make a big difference - working together we multiply the progress we can make.

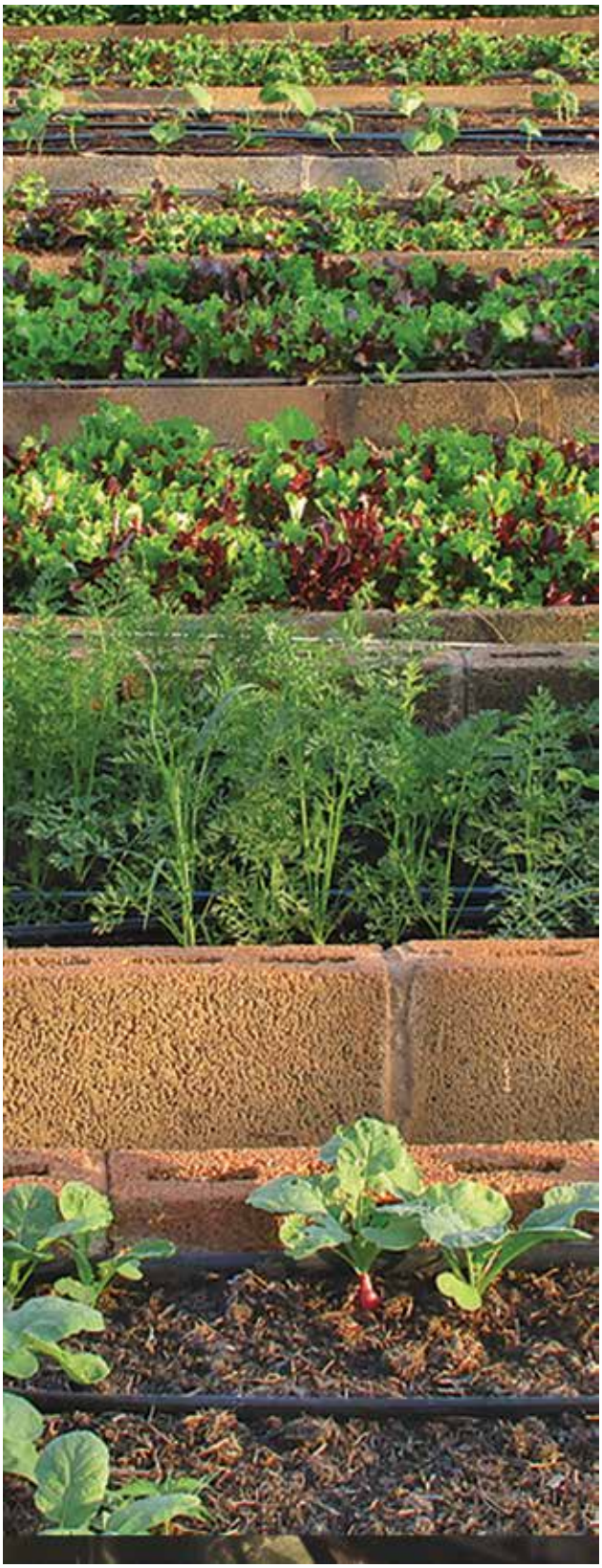
The versatility of I WOOD's building system becomes significant for farmers, gardeners and landscapers in need of outdoor improvements. The need for new wood solutions for farms and gardens is constantly evolving, ranging from raised beds, compost bins, greenhouses, fencing , tool sheds, and more.

When agricultural improvements can executed using a rural area's resources and workforce, milling locally sourced I

WOOD with mobile sawmills, and building farm and garden structures, we see how grooved wood is a real a game-changer for farmers and gardeners.

Building with I WOOD fosters a spirit of community and self-sufficiency, bringing people together in a modern-day barn-raising type of effort. By sharing the minimal equipment needed to mill the grooved lumber in one workshop, a whole village can benefit from having I WOOD kits made using local labor and local wood selected sustainably from local forests.

The kits not only reduce costs, transportation and building time - they also increase food security and quality, by increasing the quantity of food produced locally. Treecycling, for the same reasons, could be beneficial in developing countries, by enhancing health and well-being through more sustainable food supplies.



GREENHOUSE

The same framing system used to create I WOOD tiny homes, adapts perfectly to building a greenhouse. The construction of an I WOOD greenhouse is very straightforward and can be easily enlarged to expand production. The framing can be used to fit ventilation and irrigation pipes overhead, suspend certain crops, or develop an aquaculture system.

TOOL AND POTTING SHED

When using I WOOD to build a minimal structure for a tool shed, the flexibility of the interlocking grooves allows for a fully customized interior layout, placing shelves and hooks according to a persons needs. It can be outfitted with full insulation and electricity, or kept rudimentary. Knowing exactly which tools are most often used will determine their placement in the most practical way, allowing the gardener to plan a storage space for the lawnmower, a corner dedicated to various toolboxes, a workbench or counter for small parts, and so on.

CHICKEN COOP

Building a predator-proof chicken coop can take a lot of time and effort - however, with I WOOD's tight and solid components in place, the process becomes more practical and enables a farmer to expand to meet the market demand. By taking advantage of I WOOD's LEGO-like features, a chicken coop can include movable parts to contain feed or water tanks. I WOOD grooved wood can be used to easily build a chicken tractor - a movable enclosure that changes the chickens' outdoor access to greener

pastures or to put them to work for weeding and pest control.

GARDEN BED

Wood raised garden beds are often used to create efficient, productive and good-looking gardens in a wide variety of contexts. Again, I WOOD's flexible construction system is a prime choice for the gardener wishing to build attractive, practical and adaptable raised beds as landscape features and garden enhancements. I WOOD raised bed kits can be easily disassemble or modified as the seasons change, maximizing the output of each crop.

COMPOST BIN

Old-fashioned compost bins, made of wood, are still very popular in farms and gardens across the world. Their simplicity of use and classic looks are here to stay. Because the front wall is usually built with removable boards, that get stacked higher as the compost pile grows, I WOOD structures can be expanded as the need for compost increases.

I WOOD TILES AND PAVERS

Wood has been used for hundreds of years for flooring, roadways and bridges. Railroad ties, boardwalks and covered New England bridges are just a few examples where wood has been used in the past. Although concrete and steel have taken over many of these functions, could we now be seeing a trend back toward using wood?

Wood rounds, sliced from tree trunks, may be one starting point. They have been used for stepping stones for many years, however, their irregularity in size makes them complicated to use. When carefully dried, these rounds can be cut into hexagonal and isosceles triangle

shapes or into standard sizes (for example: 12 inch, 16 inch and 24 inch sided components).

In a new "take" of traditional tongue and groove, I WOOD grooves can be routed in the slab sides so that they can lock together when assembled on the surface to be covered. Where necessary, the wood can be chemically treated against damage from moisture and rot.

I WOOD grooved boards could renew interest in using wood for exterior paving situations and interior floors instead of cement pavers, tiles, linoleum and "click-it" type of flooring - none of which can be described as particularly sustainable. Wood tiles also add a warm and natural look to your décor.

There are many advantages to using I WOOD tiles instead of ceramic tiles. These would include relative ease of installation, fewer tools, warmer overall feeling, less critical surface preparation, greater feeling of randomness and ultimately, far easier disposal. When the cost of excavating for raw material, required production energy and transportation expenses are compared, I WOOD tiles are an even more attractive alternative.

A potentially large and exciting market for urban trees could be pavers made directly from trunks of trees and their larger branches. These would be cut to the thickness of 3 ½ inches and grooved on all sides, so that they interlock. Cutting the grooves in the sides may

reduce the splitting during the drying process.

Various sizes can be made, so that interesting and unusual patterns can be developed on a garden path leading up to the front door of a house, or even on the usually cement area in front of a garage.

Exterior wooden pavers could be a very lucrative market for trees growing in urban forests. The material is bulky and difficult to transport, therefore any market close to the growing area has significant advantages. These slabs should only be made from material considered inappropriate to make buildings and furniture.

Theoretically, the cost of a driveway or pathway shouldn't be very different than concrete costs and the life expectancy could be very similar, especially if the slabs are pre-treated and regularly treated against termites and rot. The cost of removing the driveway in the future would be significantly lower, from both the time and environmental perspectives. Maintenance on the wooden paver system should be a lot easier than with concrete, for example when new drainage or water pipes have to be installed.

I WOOD FLOORING

I WOOD components can also be used as an alternative to conventional tile or tongue and groove wood flooring, with the I WOOD boards using a similar attachment to the floor. A less exact connection between the grooves might mean that the floor will have to be sanded after installation. The ends of the boards are treated in the same way, with a male groove at one end and a female groove at the opposite end.

This is exactly how conventional flooring

is manufactured, so that when boards are assembled correctly they tend to nest together.

Remarkably, only a few I WOOD pre-cut component parts need to be manufactured for a terrific range of shapes and patterns to be incorporated into home projects, and they can be completed with professional results in relatively short periods of time.

This leads to low-cost production in small workshops, with inexpensive machinery and competent entry-level workers, keeping dust, noise, space and accidents to a minimum. When used for furniture, all these component parts can be produced with pre-drilled dowel holes on the sides, so that they can be fit together in a similar fashion to LEGO blocks. They can be glued together, sanded and finished as permanent functional items or works of art. Without glue, they could be dismantled and reassembled like a puzzle.

While these products can be manufactured anywhere trees grow, this new approach could become interesting in urban areas where trees are cut down or die fairly infrequently, where there is not a reliable material readily available for large-scale production. These urban trees are also a liability due to their often excessive size and the likelihood that the trunks are far from straight.

By cutting the trunks and larger limbs into sizes that can be easily handled, it becomes practical to transport the material to local workshops that can create locally needed products at a competitive price.

Added to the pricing advantage is the fact that these urban woods frequently have beautiful grains, comparable to many tropical species, and have the distinction of being locally grown. Being able to say: “This tree spent 50 years on Main Street!” or “This tree was once growing in our garden!” will add significant interest.

Appendix

Plans & Diagrams

Plans & Diagrams

Tools and machines are already in place for all production levels of the I WOOD family of products. In volume production I WOOD will be lower in cost than traditional lumber.

$ 50? For the Purist with patience!

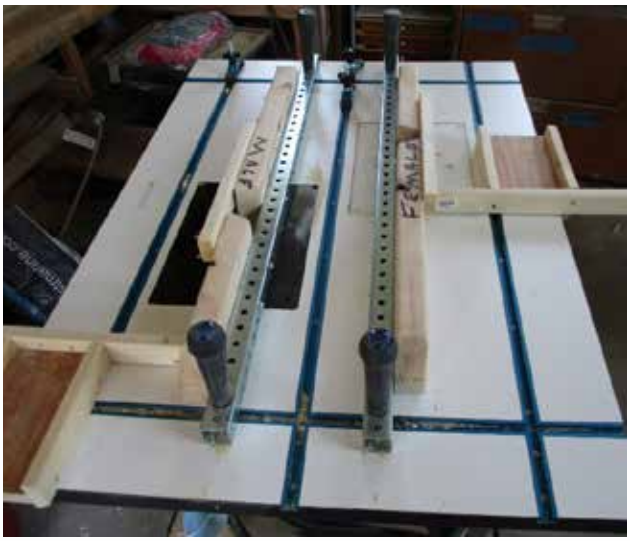
$ 100 For the beginner (Harbor Freight)

$ 1,000 For the homeowner making craft furniture for home, family and friends.

$5,000 For the "Enabler" who wants to make kits, templates and jigs as a small business whose market focus includes the groups above.

$500.000? For the serious entrepreneur.

The I WOOD grooves are standardized to 3 different sizes as explained in this book. They can be made in all faces of the wood and can be mixed and matched to suit different end uses. The I WOOD grooves are not as exact as the grooves in flooring have to be. We have built in a little bit of "wiggle" room to allow for "minor operator error", moisture variation and room for glue.



As explained in previous chapters the I WOOD component parts are all produced very inexpensively using only two blades for each of the three sizes of lumber we traditionally use.

Small	¾" stock
Medium	1X2" stock
Large	2X4" stock

These are just some of the shapes and components that can be produced on inexpensive machinery and provided for the use of the handyman at home.

Just as meat is packaged at supermarkets in portion size packages the precut components are provided for the handyman to create beautiful pieces of art or furniture according to his own imagination and taste.

The finishing that he or she decides to use depends on the end-use of the object they are making and their personal preferences.

Router tables

Router tables are the start of the manufacturing process for people interested in taking advantage of the I WOOD concept.

This table is designed specifically for routing I WOOD male and female component parts "On Demand". Once properly set up the male and female grooves will match perfectly when glued requiring little of no planeing or sanding. A little like using a pencil sharpener.

Using I WOOD precut component parts to make furniture opens the possibility of making hundreds of different pieces of furniture without the necessity of having a woodshop with expensive tools that create dust, noise and perhaps when used inappropriately, health hazards.

I WOOD Columns Components

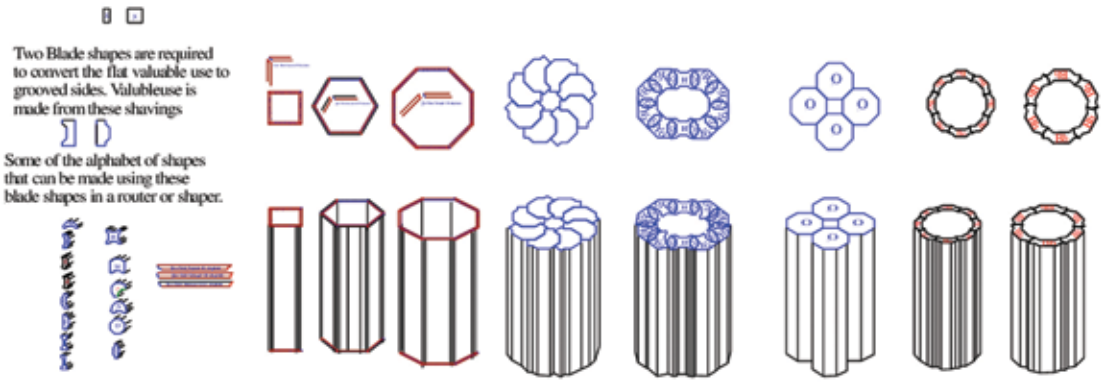
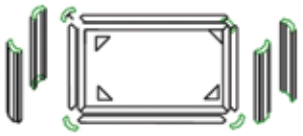
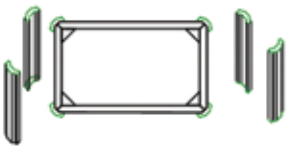


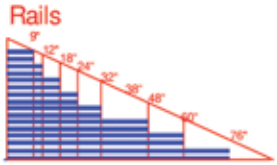
TABLE FRAMES 1

Leg Shape Option

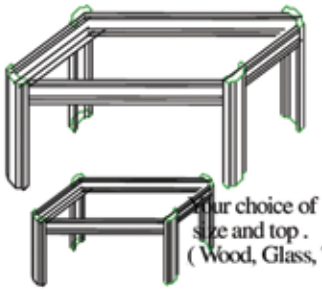




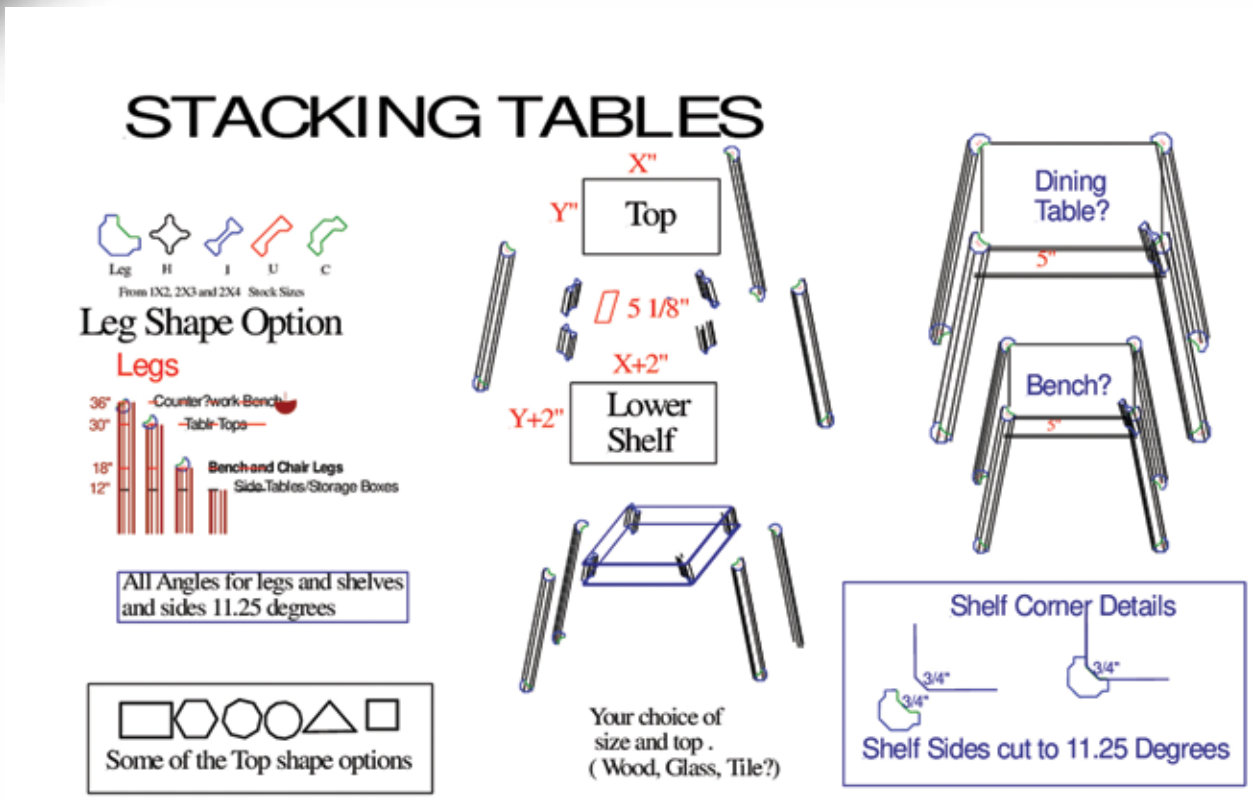
All Angles for legs and shelves and sides 90 degrees



Your choice of size and top . (Wood, Glass, Tile?)



Your choice of size and top . (Wood, Glass, Tile?)



Cutting Boards

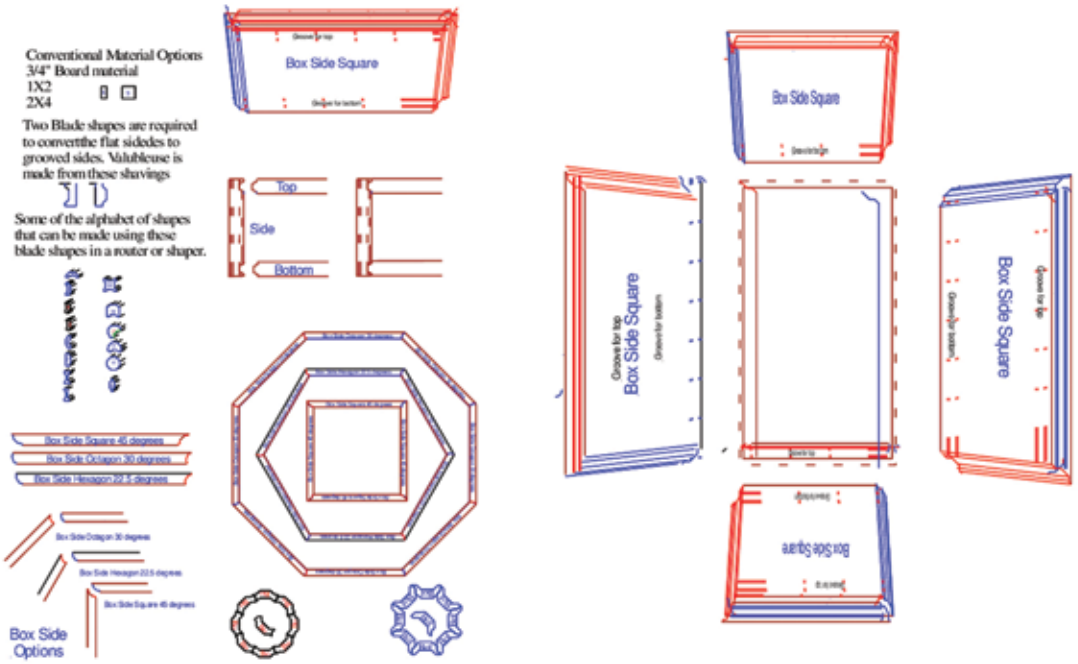
To make angled grooves for boxes or columns, an angled jig needs to be made to guide the material through.

Boxes / Veneer / Puzzles

These can be made with total accuracy in large quantities, from ½" birch plywood for starter woodworkers who want to do the finishing but don't yet have the skill to make the boxes themselves.

The sides of these containers, in standard 2 inch, 4 inch, 6 inch, 8 inch, 10 inch, and 12 inch boards. The top and bottom of the boards have the option of being square cut or grooved, the ends of the boards have got the I WOOD male shape cut at the appropriate angle at one end and a female shape cut at the other end. The angles on the end of 45°, 30° and 22 ½° depending on the shape of the container being made.

I WOOD Boxes



The lengths of these boards varies from 2 inches through 4 and 6 inches up to 36 inches and maybe even longer for the 2 x 4 stock. The market demand will establish the actual sizes people want to build together for small, medium or large lumber sizes.

Please remember that this approach to using wood more effectively, sustainably and creatively to produce household items designed to meet personal requirements is very much in the development stage and will be evolved dramatically in the future as people suggest new designs, new approaches, new shapes, new end treatments and new ideas.

Machinery that has been developed for the industry over the past few years makes it possible to cut the component parts absolutely accurately and at very low costs. This makes it possible for a large number of new people to start using wood and making items they need with little noise or mess in apartments, their own room or other area without disturbing the people around.

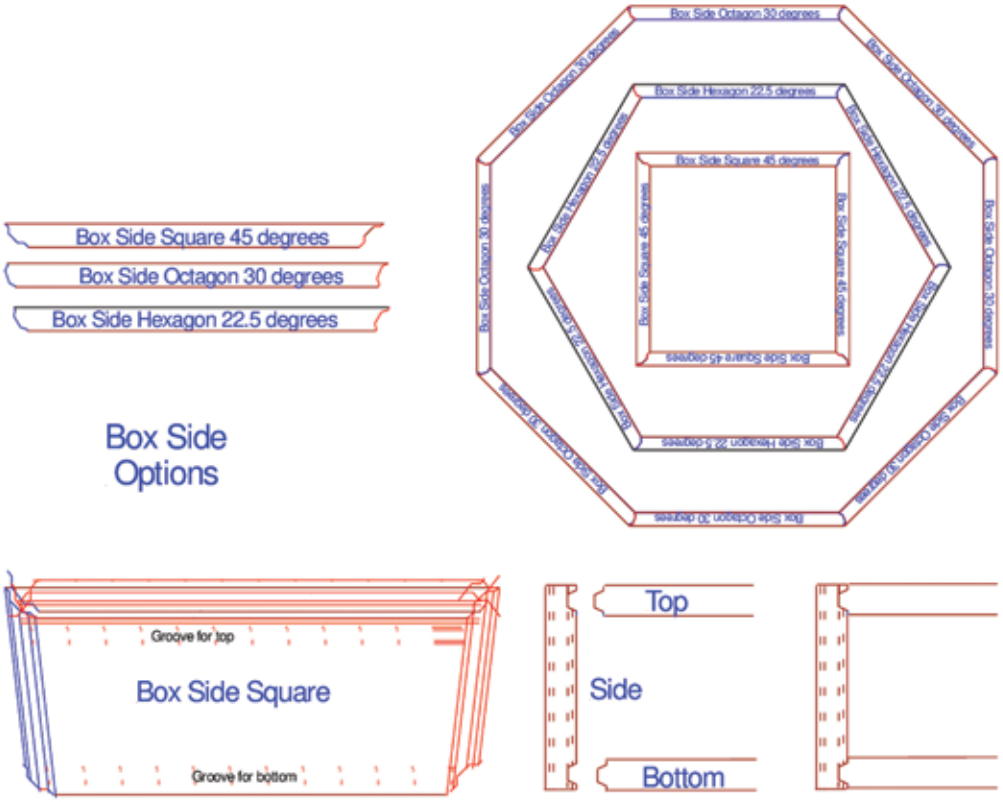
Square and rectangular boards will probably be more frequently used however the machinery that makes the components can just as easily make hexagonal and octagonal shapes which can open up new furniture designs that up till now have been only possible to create in well-equipped workshops by experienced carpenters.

The following drawings show how simple it is to make a small container or box. It takes six boards to make the box and there is no waste material left at the end of the process.

For the smaller units, glue is probably all that is needed to complete the project, and elastic bands can be used to hold everything together until glue is dry. Screws, staples and any other fastener can be used according to the taste of the builder.

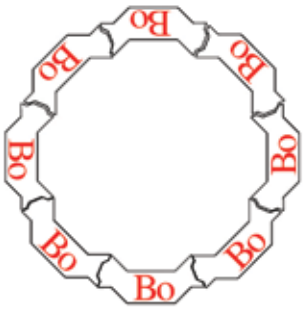
These drawings are just the starting point for ideas and many variations, improvements and personal preferences can be envisioned by anyone reading this draft. One option.

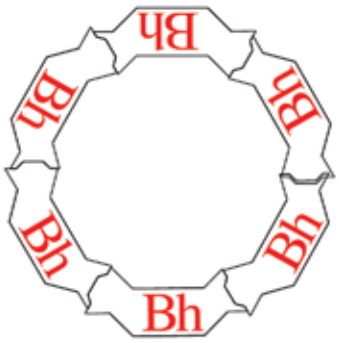
The tops and bottoms of the containers all have an I WOOD shaped groove around the outside that slots into the sides of the container, which have grooves already cut in place.



New Possibilities

The things that can be made using component parts are basically limited only to the imagination of the person using the parts. Trays, drawers, table bases, stalls, benches, chests, trunks, packing cases and toys are just a few come to mind... Also, masts for boats, windmills, lamp/communication posts.





Dowelpentry

We are working on an approach to building furniture almost exclusively without the use of metal fasteners. Dowels together with the grooved I WOOD make a remarkably strong product.

It's only recently that machines have been developed that make the precision in the manufacturing process to position the dowels perfectly. This is one of the many areas we are looking for help.

For instance how can we position dowels in the sides of boxes during the manufacturing process so that the 2 component parts can be introduced together and slid into place after gluing the sides. The angle of the dowel should be sufficient to clamp the 2 component parts together long enough for the glue to set.

We have adapted one of the many toolssold by Rockler to make the 45 degree dowel drilling process remarable simple by attaching it to a template.

Hawkstails

One of the new products we are developing we are calling the Hawkstail joint. Made individually it is remarkably complicated needing skill and patience however if the correct jigs and templates are made it can be reproduced in large quantities very fast. Dowling and gluing are the only fasteners required. It has the potential to be used in a wide range of products from tables to shelving and even a very lightweight alternative for kitchen cabinets which could be assembled as fast or even faster than IKEA style cabinets. An added benefit would be that they are probably 10% of the weight of conventional kitchen cabinets. This results in tremendous savings in material and shipping costs.

Basic components for a live edge table base

This small coffee table is composed of just two precut components the legs and the rail so that once the templates and jigs a set up construction is very very simple. The example on the left has been taken apart and put back together many times. Dowels and some glue would make a very strong long-lasting table.

For shipping purposes it is remarkably compact, light and easily packaged. As an I WOOD RTA (ready to assemble) product it is almost perfect. The assembly process is almost full proof and very fast. The actual top can be anything the customer wants. This joint can be used in many different creations ranging from kitchen cabinets, shelving systems through benches and tables.

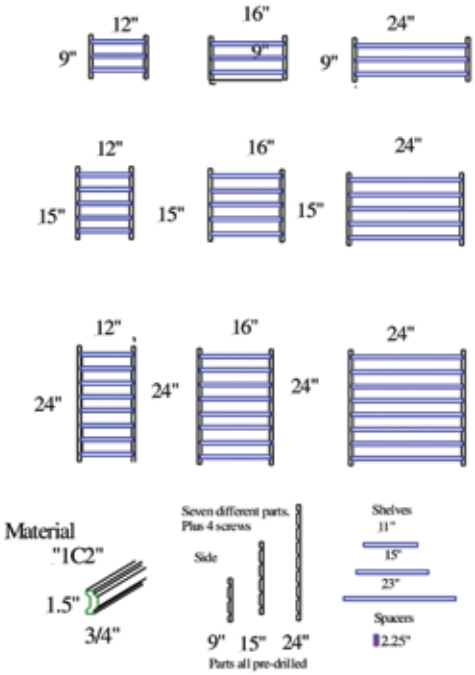
I WOOD Interlocking Storage Racks

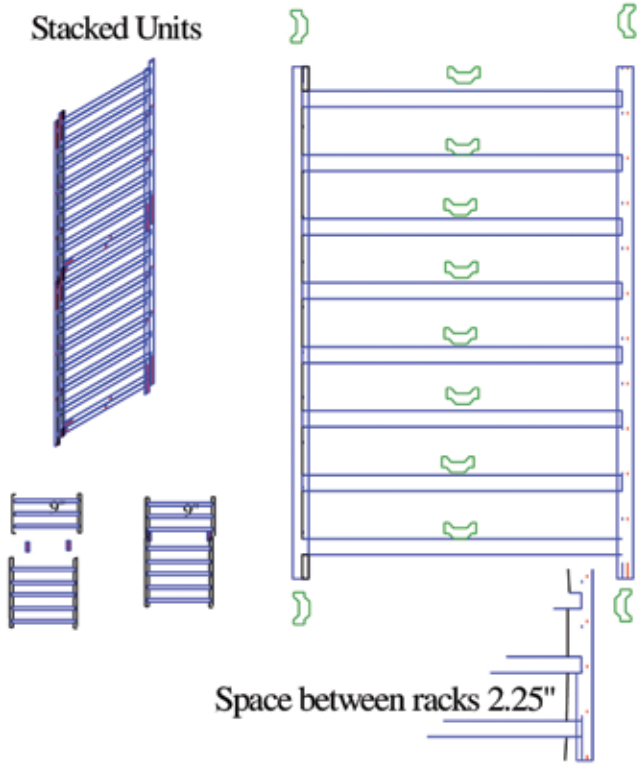
There are a number of products that can be made using routers or CNC machines. This is one of them.

The shelves can be made from all three sizes of wood to hold products ranging from pencils through storage for cotton reels, bottles, cans or mugs.

They are also very useful in a workshop as the grooves prevent anything from falling out.

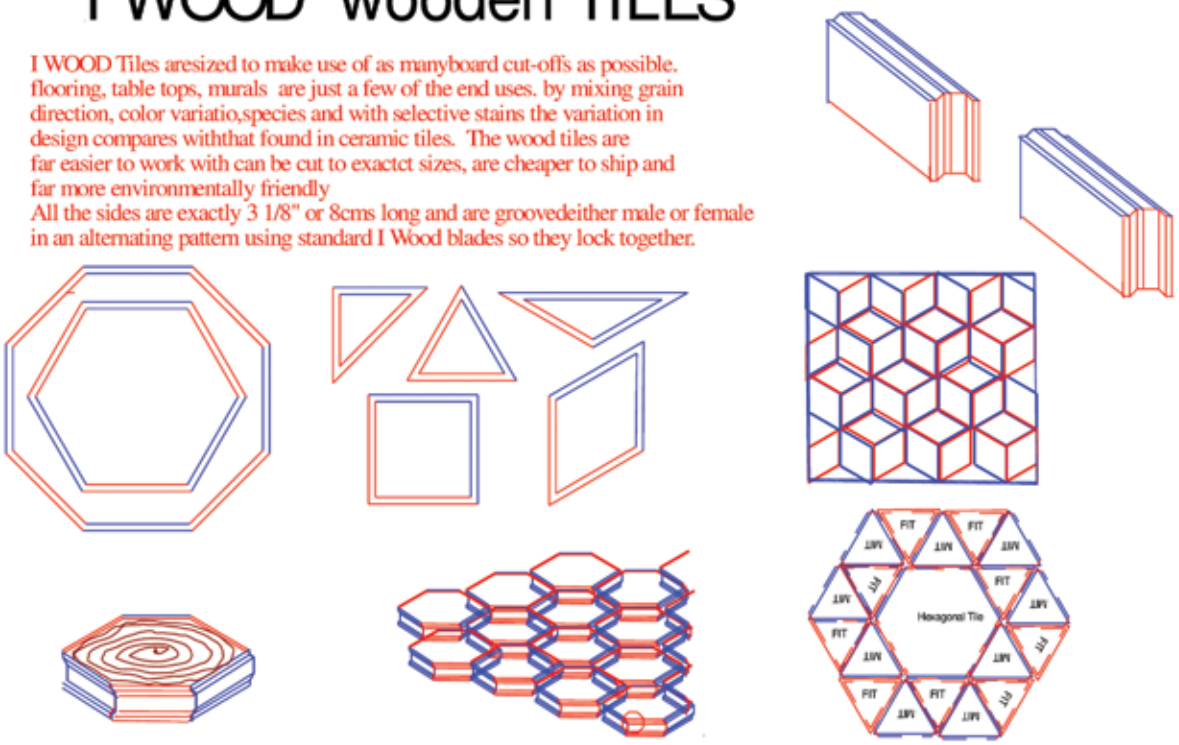
I WOOD Display Racks





I WOOD wooden TILES

I WOOD Tiles aresized to make use of as manyboard cut-offs as possible. flooring, table tops, murals are just a few of the end uses. by mixing grain direction, color variatio,species and with selective stains the variation in design compares withthat found in ceramic tiles. The wood tiles are far easier to work with can be cut to exactct sizes, are cheaper to ship and far more environmentally friendly
All the sides are exactly 3 1/8" or 8cms long and are groovedeither male or female in an alternating pattern using standard I Wood blades so they lock together.



This is a very interesting product to get rid of small cutoffs - too many of which can lead to marital strife!

This exciting product can be used for flooring, walls, tabletops, cutting boards, just about anything that ceramic tiles can be used for.

Wooden tiles are much more user-friendly than the process of using ceramic tiles.

The cost is a lot less to manufacture and ship, and wood has as much or more variety in that no two pieces of wood have exactly the same grain.

All the pieces shown here together with many more can be produced using just one router with the 2 #1 I WOOD router blades. The example shown here was made by gluing the tiles to a wood backing. The frame around the edge was made using 1 of the #2 I router blades shown above.

With the appropriate finish flooring and walls can be decorated in this way.

Using 2 router blades, male and female, all of the component parts shown above can be produced after one careful setting up of the router table.

They are all made from three-quarter inch board stock much of which can be left over from cutoffs from other jobs.

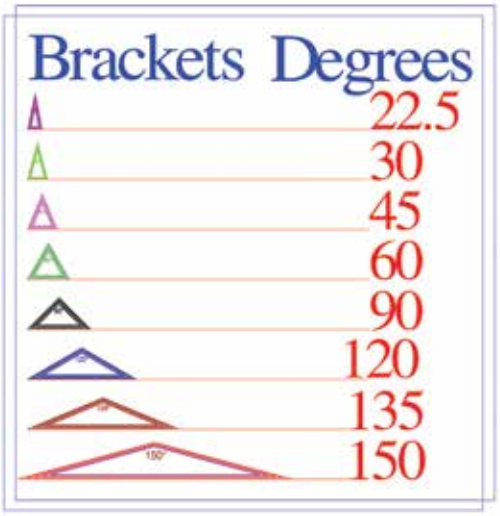
Aesthetics: New Design Features

The grooves add a new dimension to wood with the angles creating attractive shadow lines and other features. Products made from I WOOD are lighter to move and cheaper to ship.

The smallest I WOOD shapes make excellent edge banding material for plywood and particle board considerably stronger and more attractive than the traditional ribbon banding.

The I WOOD concept includes the aim to make the assembly of component parts as simple as possible and to use the minimum of metal fasteners.

We employ wooden blocks or gussets that are pre-drilled so that component parts can be attached using dowels spaced along the lines of the Scandinavian 32mm system. As mentioned above our aim is to make a crude approach to the way a branch is attached to a tree which is probably the best example of a joint in the world. some redwood branches have been constantly, 24/7 for 2000 years!



Our attempt is based on reinforcing our joints with a block or gusset that fits tightly into the I WOOD grooves to lock everything together ideally with an organic waterproof glue.

Using I WOOD Grooved edges to make smooth running, inexpensive drawer sets.

Making drawer sides and drawer runners from I WOOD grooved number is a remarkably good solution to smooth running drawers.

Chopping Boards and Panels

The grooves make products such as chopping boards much less likely to fall apart if the glue does not have to do all the work, mechanical forces help holding it together. The gluing surface is also significantly greater.
The chopping board is in fact purely a panel made from wood. The extra strength provided by the I WOOD grooves in the chopping board may make it possible to produce larger panels from solid wood for cabinets, bed heads, table tops and other end uses. Currently specialty plywood and surface finished medium density fiberboard usually perform these functions. I WOOD boards would be an interesting alternative as well as reducing pressure on landfill where large percentage of fiberboard ends up on average perhaps within 10 years.

It's the groove that makes a difference!

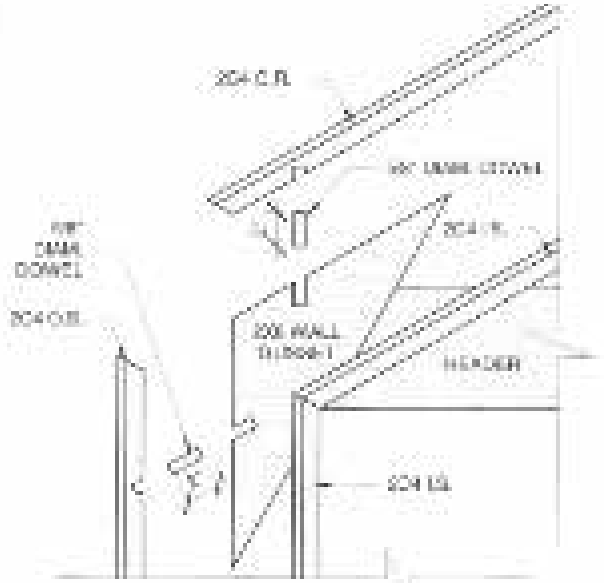
The following are examples of grooved I WOOD joined together with dowels locking them together.

The first is a cutting board and if you look carefully you can see the male and female grooves in the board which is made up of five grooved one by twos, about a dollars worth of material. The second photo shows two grooved one by twos joints together with a dowel and a corner block.

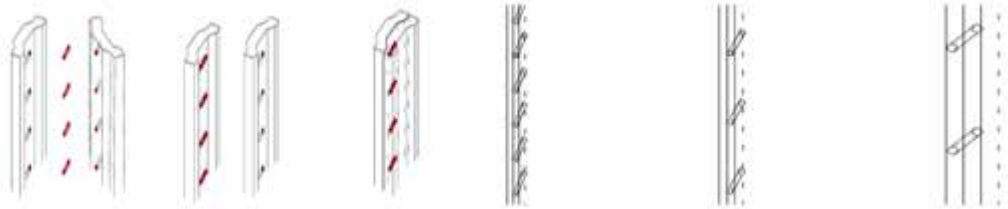
These photos show another two pieces of grooved I WOOD joined together with the dowel groove combination.

These are more diagrams of the dowel/grooved I WOOD combination.

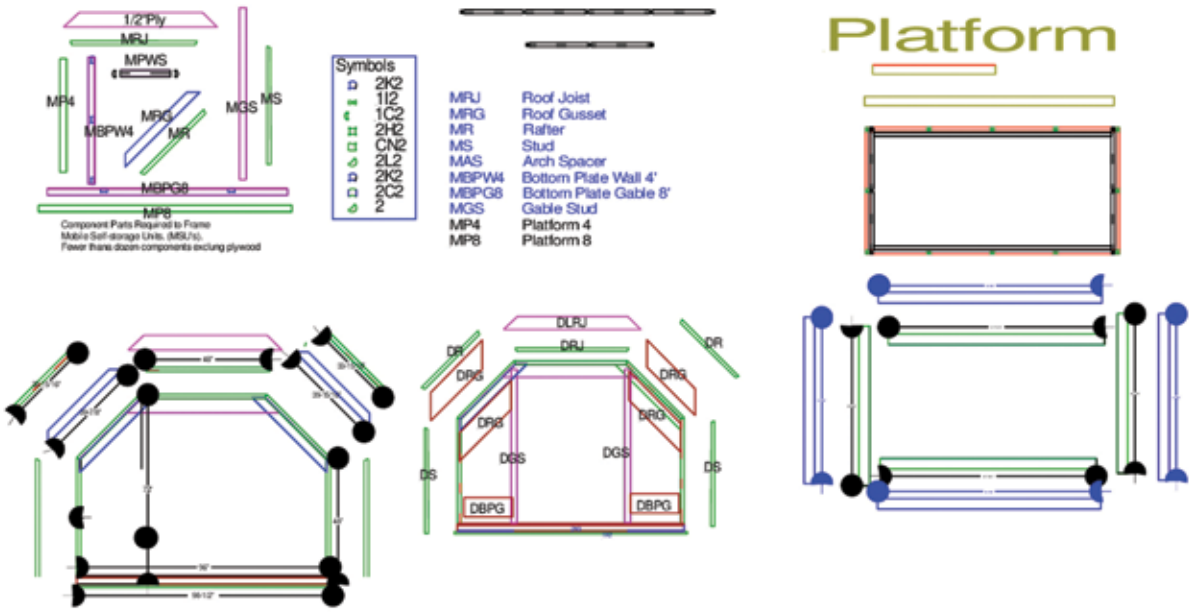
The first shows the corner treatment for an insulated house wall. The diagram shows clearly the positioning of the dowels which also provide clamping feature if adhesives are used. Screws are recommended if there is any possibility that the building will be taken apart and assembled elsewhere. Nail guns can be used, however the use of hammers and conventional nails is not recommended.



Precut component parts can be manufactured with the angle dowel holes predrilled ready to accept brackets which you make a whole series of bookcases some shelving systems as well as tables and structures.



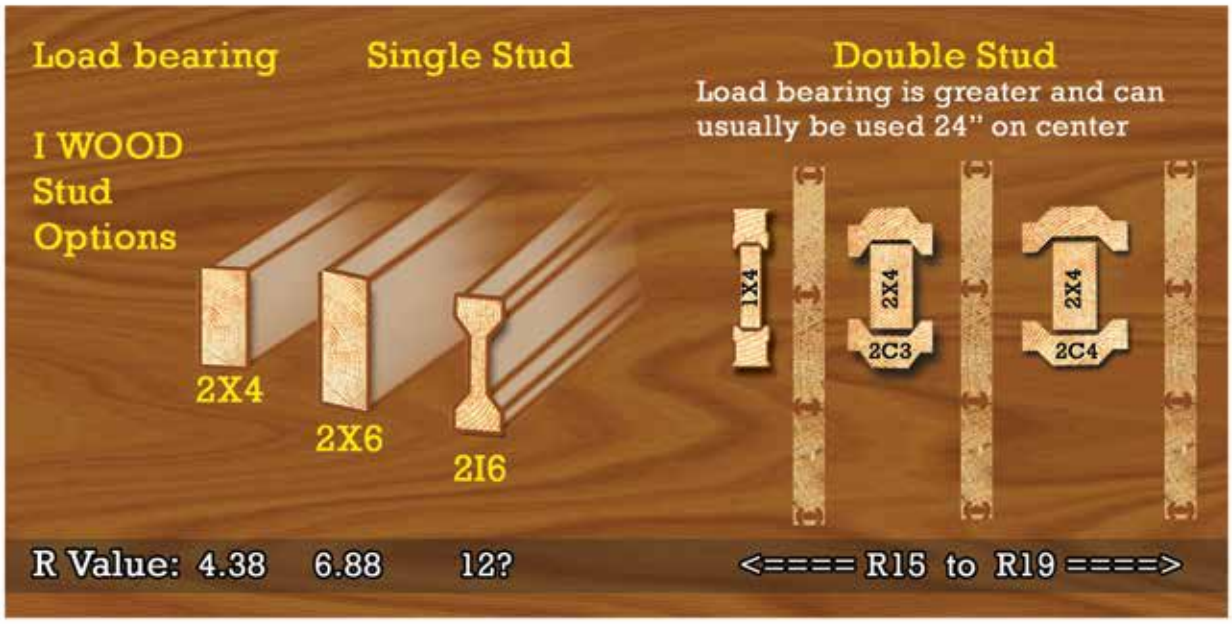
Mobile storage units



Storage, Office, Workshop, Tiny Houses

Insulation and load bearing

Energy costs can be reduced dramatically and the load bearing of walls increased just as impressively.



Simple and inexpensive buildings

The number of component parts for the frame can be remarkably few and they can all be precut ready to assemble in a small workshop also resulting in tremendous savings and the knowledge that you know the job was done properly