Timber in Context

a guide to sustainable use

NATSPEC 3 GUIDE

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Cover: Circular hall at the Royal Agricultural Society Exhibition Centre, in Sydney's Homebush Bay. Radiata pine glulam beams, held together by steel tie-rods, create a web rising up to the tip of the dome. Architects: Ancher Mortlock & Woolley. Structural engineers: Ove Arup & Partners. Photo: Patrick Bingham-Hall.

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PREFACE

- **The approach taken**
- **Acknowledgments**

This book emerges out of a growing concern about the ecological impacts of building materials and construction processes. This concern is part of a wider recognition of a need to move away from the unsustainable models that have driven world development over the last 200 years. The negative effects of industrialisation and an expanding consumer economy are many — greenhouse gas-induced global warming, the thinning of the earth's ozone layer, air and water pollution, acid rain, depleted soils, raw material depletion, loss of biodiversity, chemically induced genetic changes. That these are global problems, not able to be contained within national boundaries, has been acknowledged by efforts to take international action, such as the 1992 Rio Earth Summit and the 1997 Kyoto Forum on Climate Change.

The building industry is just one sector responsible for using large amounts of raw materials and generating greenhouse gases. Its negative (and positive) impacts are multiplied many times over. This is because designers of buildings are also designers of consumption - of raw materials, finished products, construction energy and, to a large extent, the energy used over a building's life.

Increasingly architects, designers, builders and manufacturers are being asked to demonstrate ecological sustainability in their proposals, work and finished products, to individual, corporate, and especially government clients. For example, they are often asked whether a material has come from a sustainable source, whether it contributes to indoor air pollution, what its embodied energy value is or what contribution it might make to a building's energy use.

Although there is a widespread desire to do the right thing by selecting the least environmentally impacting materials and processes, there is also much confusion about how to do this.

Timber use has been particularly prominent, not least because of local and international environmental campaigns against logging of forests. Although harvesting timber is not the only reason for logging (clearing forests for agriculture is also significant), depletion of the earth's forest cover has complex effects at a local and a global level. Yet it is often difficult to make appropriate and immediate connections between

global environmental issues, the political struggles of conservationists versus the timber industry, and day-to-day architectural and building practices.

As a result people have reached for off-the-shelf solutions, but these are not easily found. For instance, it is sometimes claimed that timber is an inherently 'green' building material because it comes from a natural, renewable resource, and requires less processing and thus has significantly lower embodied energy than other materials such as aluminium, steel or concrete. But it doesn't therefore follow that timber *is* being renewed or that it will be used in ways that contribute to sustainability. Nor do such claims consider other possible negative impacts or differences between timber species, such as whether they are part of endangered ecosystems.

With timber, the biophysical complexities of forest ecology conflict with other sustainability considerations. Timber selection is made all the more complicated for designers and specifiers unless they are familiar with the relevant issues and have access to appropriate information. The book aims to provide this insight.

It was the desire to have a better grasp of these complex issues and to seek more ecologically responsible ways of using and specifying timber that prompted Interior Directions, a Sydney-based company specialising in management and construction of commercial interior fit outs, to sponsor the EcoDesign Foundation's research that has resulted in this book.

The EcoDesign Foundation (EDF) is a non-profit organisation set up to develop new knowledge and practices of ecological sustainment. EDF was keen to work through the problems and implications of the use of a particular material, by relating these to a wider picture of ecological sustainment. Timber is regarded as a material in its own right with unique characteristics and sustainability considerations, but it is also regarded as a lens through which to view the problems and challenges of developing ecological sustainability.

THE APPROACH TAKEN

This book doesn't claim to be the first Australian publication to deal with the ecological impacts of using timber, but its approach and agenda are distinctive. Most published material is either of a specialised technical nature (e.g. with a biological emphasis on forest ecology) or is subtly (sometimes overtly) promotional, having been generated in a competitive milieu, in which the imperative is to demonstrate the ecological superiority of one building material over another. This book rejects a score-card approach to judgments about sustainability, particularly ecological material assessments which do not take into account the application, use, site, projected life span and nature of the project in which the materials are to be used.

It aspires to be a guide to using timber sustainably by presenting a critically informed, relational approach to thinking through the ecology of timber. Timber use is positioned in relation to forest ecology, political and economic contexts, and an expanded understanding of environmental impacts as well as technical and constructional considerations. A major theme throughout the book is the significance of design and specification as activities that foreshadow perceptions of resources and materials,

values, uses, modes of living and working. The potential of these activities is massively under-recognised, an observation as true in general as it is in relation to timber.

Over the time of writing the book there have been significant developments, many of which are ongoing, such as

- the emergence of international schemes for certification of sustainable timber;
- the blurring of the distinction between plantation and native forest timber introduced by the concept of sustainable forest management; and
- in Australia, the Commonwealth and state government backed process of comprehensive assessment of the nation's forests and the negotiation of long-term regional forest agreements (RFAs).

There has also been new information on environmental aspects of products and processes, as well as new design methods for sustainability. In regard to the latter, the book draws on EDF's direct experience as an environmental consultant on several Sydney 2000 Olympics design projects. Sydney's undertaking to stage a Green Games has provided a unique opportunity to 'learn for sustainability', with most projects requiring comparative ecological assessments of design concepts and choice of materials.

ACKNOWLEDGMENTS

First, thanks must go to Kim Marsh, Leanne Marsh and Bill Lowe of Interior Directions, whose foresight and generosity in sponsoring the project is unfortunately all too rare among smaller companies in Australia. Second, we must acknowledge Alison Tate, an architect now based in Northern NSW, who completed the initial, substantial phase of research while working with EDF in 1995-96.

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Harry Partridge, John Gelder and John Schooling are to be thanked for reviewing drafts of the manuscript and for prompting further lines of enquiry; Miles Attenborough is to be thanked for reviewing a draft. Stuart Whitelaw's reviewing and technical advice were especially appreciated. Also to be thanked are: Jane Silcock for additional research; Deborah Singerman of Construction Information Systems for meticulous and sensitive editing; Jocelyn Chan and Katy Wright for its production, and last, but not least, EDF Director Tony Fry for insights and guidance throughout the project. But despite all this most welcome input from many people, the authors take final responsibility.

In researching the book we consulted a lot of product literature, and every attempt has been made to present information that is as accurate as possible. Readers, however, need to be aware that many of the developments outlined in the book are in a state of flux and that data relating to many of the issues are continually being gathered and modified.

Product development is a fast moving area. We do not wish the book to date too rapidly, nor do we wish to be interpreted as endorsing specific branded products (though we do express preferences for particular processes or genres of products). Therefore throughout the text we refer to timber products by type and generally have avoided product and company names. As stated already, the book is the outcome of independent research, supported by a company that uses timber in its day-to-day work (as opposed to a producer or marketer of timber), and carried out by a non-profit organisation.

Anne-Marie Willis and Cameron Tonkin
October 1998

ABBREVIATIONS

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
ACF	Australian Conservation Foundation
ACQ	Ammoniacal Copper Quarternary
APAS	Australian Paint Approval Scheme
AWPA	Australian Wood Panels Association
BCA	Building Code of Australia
CAR	Comprehensive, Adequate and Representative
CCA	Copper Chrome Arsenic
CRA	Comprehensive Regional Assessment
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DES	Developing Ecological Sustainment
EDF	EcoDesign Foundation
EMP	Environmental Management Plan
EPA	Environment Protection Authority
ESD	Ecologically Sustainable Development
FOE	Friends of the Earth
FSC	Forest Stewardship Council
IEAust	Institution of Engineers, Australia
ISO	International Organization for Standardization
JAS-ANZ	Joint Accreditation System of Australia and New Zealand
LCA	Life-cycle Assessment

LOSP	Light Organic Solvent Preservative
LVL	Laminated Veneer Lumber
MDF	Medium-Density Fibreboard
MRTFC	Multi-Residential Timber Frame Construction
NAFI	National Association of Forest Industries
OCA	Olympic Coordination Authority
OSB	Oriented Strand Board
PA	Pine Australia
PAA	Plywood Association of Australia
RAC	Resource Assessment Commission
RACAC	Resource and Conservation Assessment Council
RAIA	Royal Australian Institute of Architects
RFA	Regional Forest Agreement
TDA	Timber Development Association
TPAA	Timber Preservers Association of Australia
VOC	Volatile Organic Compound
WWF	World Wide Fund for Nature
WWPA	Western Wood Products Association

INTRODUCTION

- **The forest depletion problem**
- **The forestry debate**
- **Ecologically sustainable development — and beyond**
- **Timber and the building industry**
- **Using this book**

At the end of the twentieth century, the negative environmental impacts of our industrial activities are becoming increasingly apparent. The United Nations has responded by hosting the 1992 Rio Earth Summit, at which member nations, including Australia, undertook to pursue policies of ecologically sustainable development (ESD). Since then, international organisations (such as the World Bank), companies and professional bodies have incorporated principles of ecological sustainability into their codes of practice (e.g. RAIA 1995). This means that the specification of timber (and of all building materials) can no longer be determined only by considerations of fitness for purpose, aesthetics and cost. There is now a demand that designers and specifiers take sustainability into account.

This introduction discusses the most publicly prominent sustainability question for timber, namely the logging of forests. It looks at both sides of the forestry debate and suggests a third way forward. It also explains some of the dilemmas of ESD and why designers and specifiers may be particularly well-placed to contribute to the development of sustainability. The book's approach is compared with other timber publications such as the Good Wood Guides. The areas of knowledge to be drawn on to develop a substantial understanding of timber and sustainability are laid out. And finally, a summary of each chapter is presented so that different kinds of readers can carve their own pathways through the text depending on their particular knowledge and concerns.

THE FOREST DEPLETION PROBLEM

Increased logging activity over the last one hundred years has progressively reduced the world's forest cover.

The reasons for logging are varied, from land clearing for agriculture to the provision of raw materials for the products of industrial culture. The negative impacts of logging are complex, and include the following:

- Climate change due to a reduction in the number of trees available to process carbon dioxide, and the release of carbon dioxide into the atmosphere from the burn-off of cleared land and forest waste.

- Loss of animal and plant habitats, resulting in loss of biodiversity.
- Loss of human habitats and communities reliant on economies of forest ecology.
- Damage to the land in terms of soil structure, drainage and fertility.
- Transformation of waterways and reduced ability of the land to hold water.

Forests currently cover approximately 21% of the world's landmass. Of this, 33% is estimated to be rainforest[1], which supports 80% of the world's vegetation and 50% of all bird and animal species. If the current rate of deforestation continues, it has been estimated that these remaining rainforests will have disappeared in 40 years (Joss 1994: 6-10).

Take Indonesia, home to the second largest tract of tropical rainforest in the world after Brazil and the world's largest exporter of plywood, producing 55% of world supply. More than a third of Indonesia's landmass is covered by logging concessions and tropical forest cover is now only 53% compared to 82% in the 1960s. Although the Indonesian government is no longer issuing logging concessions and is encouraging the establishment of plantations, this often means clearing forests *for* plantations (Williams 1996: 21).

THE FORESTRY DEBATE

Although many scientific arguments have been mobilised to condemn most current logging activity as ecologically unsustainable, there are also emotional investments in the forestry debate. To describe them as such is not to condemn them, but to bring them out into the open. On the one side of the debate, for many people directly involved in forestry there is an emotional investment in wishing to continue a particular way of life regarded as inseparable from the economic activity of logging.

In parts of rural Australia, the viability of entire communities is based on logging. The perception in such places is that if you take logging away, other businesses directly and indirectly dependent on logging will go, followed by the breakdown of the community's social relations as unemployment increases, opportunities shrink and people move away. Timber workers who oppose conservation are likely to characterise their position as defending communities, not just jobs. A particular kind of outdoor life is being defended, with its own distinctive skills and knowledge, considered to be markedly different from urban lifestyles. This difference is a source of pride for many timber communities.

Where such ways of life are threatened, the sustainability of social ecologies (e.g. towns) and biophysical ecologies (e.g. old-growth forests) are likely to be regarded by timber communities as mutually exclusive. The political challenge of such situations is to find ways of establishing support for new kinds of economic activities which are able to sustain both biophysical and social ecologies, and which are appropriate to the cultures of the communities concerned.

On the other side of the debate, a different set of emotional investments are in play. A major reason logging has become a *cause célèbre* for the environmental movement is the visibility of its impact. Consider the most extreme example - clear-felling of native forests.

1. The Macquarie dictionary definition of a rainforest is: "A dense evergreen forest found in tropical and temperate areas with high humidity and heavy rainfall occurring throughout the year, characterised by the occurrence of a great many species forming a number of crown layers and supporting a wide variety of plant and animal life."

To clear-fell a forest is to destroy it in the most obvious way possible, transforming it into a stretch of bare land, a non-place, with its particular combinations of microclimate, topography, flora and fauna, now eradicated. Regeneration may occur, but *that* place will never come back; it is gone forever.

With the realisation that this has happened simply so that trees can be turned into woodchips for export to provide raw material for the packaging and paper industries, a sense of pointlessness is added to these feelings of loss. This is exacerbated when one compares the time taken for trees to grow to maturity — often hundreds of years — with the short-term human uses to which trees are so often put. To the craftsperson, in particular, who seeks to create enduring objects that express the beauty of timber, it seems to be sheer waste and desecration to use trees from old-growth forests as feedstock for paper mills or for other short-lived applications such as plywood for movie sets.

In contemporary Australia, the argument against logging of timber, especially native timbers, stems from a conservationist world-view. This argues that forests purify the air, play a vital role in the water cycle and are diverse ecosystems providing habitat to a vast array of species, and therefore should be left largely untouched.

Although a great deal about these arguments is valid, they operate within a limited perspective which excludes the variables and complexity of the growing impacts of human habitation. Conversely, timber users argue that, historically, human beings have modified the natural environment and have created artificial environments in which to live. To do this, they have had to clear land and source building materials, timber being just one choice, though one that is widely considered to be perpetually available. The timber industry supports this view but with its own agenda which includes increasing profits from timber products.

To move forward, we need to explore the shortcomings of each of these positions. What follows combines a consideration of these shortcomings with arguments for a different approach to ESD.

In the simplest characterisation, at one end of the spectrum is a conservationist vision of pristine nature which has no place for human beings except as environmental saviours. At the other end of the spectrum is an industry vision of a prosperous economy maintaining and improving ‘standards of living’. In recent years the timber industry and environment groups have sat down around the negotiating table (for example in the forum of the Forest Stewardship Council (FSC), discussed in Chapter 3), but this has been in the spirit of finding a compromise rather than of leap-frogging beyond entrenched positions. The irreconcilability of the negotiating parties’ world-views has resulted in some pragmatic horse-trading. For example, in negotiations between government, industry and conservation groups, forest coupes set aside for conservation in some areas are traded for a guaranteed timber supply in others.

This means that two unsustainable approaches are perpetuated. The timber industry’s position of business-as-usual, even if tempered by measures to reduce environmental damage, is ecologically unsustainable in the long term because it remains predicated

upon a conventional model of economic growth. The standards of living it wishes to protect are at the root of ecological unsustainabilty.

The conservationist position is unsustainable because its naturalist emphasis fails to recognise the artificiality of drawing a boundary around an area and calling it the natural environment. The error of 'the natural' as a reference point is apparent in debates about what constitutes natural conditions in a regrowth forest (i.e. one that has already been logged).

Many people in the conservation movement have not fully grasped two points: first, the entire planet is now in a post-natural condition (for example, the effects of industrialisation have substantially altered the earth's atmosphere [McKibben 1990: Chapter 1]); second, and more fundamentally, the concept of nature is nothing more than a creation of Western knowledge as it sought ways of naming and classifying 'what is'. Furthermore, these abilities of naming (i.e. language) and transforming (i.e. technology from its simplest to its most complex forms) are what make human beings 'naturalised artificial' creatures who have come to depend upon the artificial environments they have created. This means we need to conserve and find ways of sustaining both the artificial environments we have created and the environment which is already given. (Further implications of conventional understandings of nature are addressed in Chapter 2.)

Aesthetics and science collide and collude in the conservationist vision of nature as a photogenic green spectacle abundant in classifiable life forms. Arguments over which forests to preserve, about which are the most pristine or which contain the most rare species take on a connoisseurship with the advocated solution amounting to the preservation of selected areas as wilderness museums.

To criticise this approach is not to sanction untrammelled exploitation of forests, nor to suggest that there should not be preserved regions. Rather, it is to suggest that this strategy is failing to see environmental problems relationally and to address the causes of forest destruction. One significant cause is the demand for material goods, services and experiences from an ever-growing number of increasingly affluent human beings, and the means by which this demand is met. This economy of desire, and the way commerce panders to it, is the most important focus of ecological action.

ECOLOGICALLY SUSTAINABLE DEVELOPMENT — AND BEYOND

In between the mutually exclusive world-views of conservationists and the timber industry are timber users i.e. every one of us. Whether as building designers, specifiers, purchasers of housing and furniture, or users of paper products, no-one can escape responsibility for the impact of their everyday actions on the condition of the world's forests.

ESD is one way of attempting to deal with this that has emerged in recent years. This seeks to develop ways of accommodating the "needs of the present without compromising the ability of future generations to meet their own needs", a relation that is referred to as "inter-generational equity" (Brundtland Report, World Commission on Environment and Development 1987).

ESD is a relatively recent concept and is still subject to different interpretations. There is no consensus on what is being sustained or on how sustainability might be achieved. *Sustainable* from a timber industry perspective generally refers to continuity of supply of economically valued species (also referred to as resource security). From an environmentalist perspective it means sustainability of the biophysical ecology, the objective being to maintain a forest's biodiversity, rather than a particular species. Because these different objectives are often not sufficiently foregrounded, specious arguments are mounted such as protection of biodiversity will be economically beneficial, whereas in some cases it will, in some cases it will not (this is discussed in Chapter 3).

While governments, industry and conservation groups have worked at developing tools for sustainability, such as life-cycle assessment (LCA), environmental management systems and certification schemes for environmentally preferred materials, debate and thinking about the meaning of sustainability is much less developed. Incommensurable meanings coexist, and these differences need to be brought out into the open rather than be papered over if ESD is to become a *new* form of economic development.

At the moment, ESD does signal a desire for different kinds of economic development, but exactly what that might be remains unclear. At its most basic, ESD signifies an acknowledgment of the need

- to alter current developmental directions;
- to have a long-term view of benefits and costs, beyond the present generation;
- to avoid damage to the biophysical environment (environmental economists put dollar costs on damage to waterways, forests, soil whereas traditional economics treats these as externalities, outside the money economy);
- to develop sustainable, non-polluting industries; and
- to eliminate polluting processes and to conserve resources, such as timber, and to adopt practices that conserve the given environment, such as the world's remaining old-growth forests.

As a result of ESD, increasing demands are being placed on building designers and builders to confront the ecological impact of their decisions. This applies to all stages from the initial design concept to production of materials, construction, occupation, maintenance and demolition (or disassembly and reuse). An example of such a demand is the environmental tender specification applied to all companies bidding for work for the Sydney 2000 Olympics, including design, construction, project management, product and service contracts (see Chapter 4).

There are instances in which ESD makes conventional economic sense. For example, measures to reduce greenhouse gas such as insulating buildings or installing energy-efficient lighting systems can save dollars. But at a more fundamental level there are inherent contradictions in attempting to reconcile ecological sustainment with economic development which is currently allied with industrial growth. For this reason we believe it is more useful to reverse the hierarchy of the terms, and to strive instead towards developing ecological sustainment (DES). In this formulation, ecological sustainment becomes the goal to which economic development is

subsumed, as a means. In other words, DES is a means of changing the development-oriented status quo rather than of just reforming it, as in ESD. But because DES is not a concept in general circulation, we will continue to use the term ESD throughout the book.

TIMBER AND THE BUILDING INDUSTRY

In architecture and other building professions the question of the relationship between timber usage and forest conservation has collided with other sustainability issues such as energy consumption and the comparative ecological assessment of all building materials and construction systems.

The development of this type of ecological assessment has been accompanied by a call for comprehensive and reliable information. Yet to date the information on offer has been fragmentary, lacking in detail, not available in a consolidated form and, not surprisingly, often overdetermined by the interests of the information supplier.

It will be argued that comparative environmental data alone is not sufficient; that its meaning and significance will always change depending on the application. Also, it is very difficult to compare different environmental parameters e.g. embodied energy versus volatile organic compound (VOC) emissions. Decision-making needs to be informed by a relational understanding of environmental effects, with design as the key means of making visible, and of working on, the relational condition of environmental problems.

The building industry is ideally placed to make a positive contribution to the sustainability debate by taking up ESD as pragmatic theory and practice and embodying it in methods of design, manufacture and construction. For example, it can drive

- design for long life and multiple use;
- reduced usage of energy and water;
- materials' minimisation;
- lower toxicity materials, with less offgassing;
- selection of fit-for-purpose materials;
- design for repairability and ease of maintenance; and
- design for future disassembly and reuse of materials.

The building and construction industry is one of the most significant sectors of the Australian economy, in 1996 producing a turnover of $43.5 billion. A recent government report stated "the industry … has a significant impact on the efficiency and productivity of other industries. It is an enabler of investment activity, both relying on and generating investment in the broader economy" (DIST 1998: 5).

Building activity touches everyone, whether professionally, or simply as owners and occupiers of buildings. This means that ESD taken up in the building and construction industry will have flow-on effects to many other sectors. It can be the basis for a major educational effort directed towards tradespeople, industry and the public. Some effects of the building industry taking up ESD will be material, such as increasing the demand

for building products with a lower environmental impact e.g. timber from sustainably managed sources or woodpanels with lower levels of free formaldehyde.

Other effects are less measurable and direct, but equally important. Included here is the way in which environmentally responsible design, specification and building practices can generate an ethos of sustainability. They can do this by demonstrating the advantages of lower impacting products (water and energy conserving technologies, for instance) and by creating structures and spaces that communicate and make desirable their low-impacting nature, as with naturally lit and ventilated spaces which are well-designed, comfortable and pleasant.

A major challenge for the building industry is to take up, promote and make visible in its projects the application of sustainably produced timber products, and in its design and specification practices to ensure that timber is used in ways which maximise its value, extend its useful life span and draw attention to its inherent advantages. Timber needs to acquire more appropriate economic and symbolic value. By extending current ESD thinking to reduce the future negative impact of design and specification decisions and by providing ongoing leadership, the building industry could be instrumental in the development not only of new materials, processes and products, but also of new construction methods and viable economic practices. More generally the outcome of all this activity has the potential to transform perceptions, symbolic values, practices and uses.

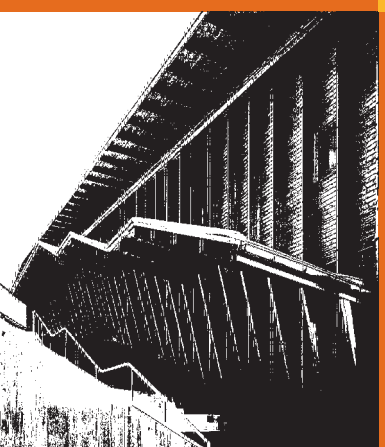
This publication's focus on timber is not meant to imply a preference for it as a building material. There is clearly a need for all the materials we use to be critically viewed and employed to bring about ESD.

This book approaches the issue of timber in the context of the high profile public debate between the timber industry and the conservation movement over the protection of Australia's forests. The visibility of this debate has created the situation in which specifiers feel they need to be informed about the timbers they are using. A number of organisations have produced Good Wood Guides but these mostly focus on forest ecosystems and endangered species (e.g. Counsell [1990], Low and Gladman [1993]). The stated or implied message to specifiers is often reducible to 'use plantation timbers exclusively and you will be doing the right thing'. This presents a number of problems:

- The number of plantation timber species is limited (in Australia, overwhelmingly the plantation timber is radiata pine) and these do not cover all building applications.
- This message does not address the environmental effects of timber use beyond forestry impacts.
- The negative effect on the fauna ecology of a single species plantation is not taken into account, nor is the prior use of the land.
- The message does not consider timber use and specification relationally within the larger task of ESD by design, for example by considering the influence of the materials specified on a building's use of energy, water and other resources.

Anne-Marie Willis, assistant director of the EcoDesign Foundation, has extensive experience in ecological assessment of products and building materials. She has also developed and implemented environmental management plans for major design projects. Cameron Tonkin is an educator and researcher at EcoDesign Foundation.

In association with Interior Directions



This book is the outcome of research by the EcoDesign Foundation, a non-profit organisation founded in 1991 with the aim of developing sustainability by design.

As the negative environmental impacts of our industrial activities become increasingly apparent, building designers, regulators and owners are facing the often bewildering task of making sound choices of environmentally sustainable materials and processes.

***Timber in Context - a guide to sustainable use* - sets out to demystify the debate about the harvesting of timber and its use for construction.**

It reviews the use of timber in relation to forest ecology, the political and economic contexts, an expanded understanding of environmental impacts and the key design, technical and constructional factors. While these factors are considered in a global context, the focus is on the timbers and timber products most commonly used in Australia.

***Timber in Context* is a balanced guide to the making of informed decisions about the selection and use of timber based on the application, the anticipated life span and the nature of the project for which it is to be used.**

As well as giving guidance on preferred timbers for particular applications the properties of more than 50 species are tabulated and commented on.

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