Wood

Nature Inspired Design

Key findings for Australian households from the full Wood - Nature Inspired Design report

MAKE IT WOOD
Do your world some good

PLANET ARK
Executive Summary

Modern society has changed its relationship with nature. In the space of a single generation children’s play has moved from outdoors to indoors, the iconic backyard has shrunk, parents have become increasingly anxious about children’s safety, working hours and stress levels have risen and technology (especially screens) has encroached into almost all areas of life.

The health and happiness benefits associated with spending time outside in nature are well known and have been studied extensively by the scientific community and reported on previously by Planet Ark. This love of time in nature has been termed ‘biophilia’ and explains our innate need to connect with the natural world. This relationship can be extended into the buildings where we live, work, rest and play.

This report outlines the importance of connecting buildings with the natural world and how with ‘nature connected design’ (also known as ‘biophilic design’) and using wood you can bring nature indoors and provide a healthier, happier environment.

Research has shown that the use of natural elements like wood in the interior of a building produce similar effects to those created by spending time in nature and can provide physiological and psychological benefits. Wood and nature connected design can help to lower blood pressure and heart rates, reduce stress and anxiety, increase positive social interactions and improve corporate image.

Surveyed Australians appear to be innately drawn towards wood. Even though many people don’t understand the health and wellbeing benefits of wood they instinctively respond to the feelings of warmth and comfort it creates and its natural look and feel.

This report was produced by Planet Ark’s Make It Wood program with support from Wood Solutions and Wood, Naturally Better.
Why Wood?

Wood comes from trees and is a natural, renewable resource, with no two pieces being identical. It is one of the oldest building materials and with recent technological developments it is also one of the most modern.

Responsibly sourced, certified timber is the only major building material that helps to tackle climate change. Timber is the only renewable building material. As trees grow they absorb carbon dioxide from the atmosphere and, through photosynthesis, convert this into sugars that form the compounds that comprise wood. Approximately 50 per cent of the dry weight of wood is carbon, which remains locked in the wood for the life of the product.

The energy consumed in the production of timber, called embodied energy, is much lower than other building materials, which means that by using wood as a replacement for carbon-intensive materials such as aluminium, steel or concrete, you can significantly reduce the carbon emissions in the construction of your home or apartment.

In addition, wood is increasingly being used for its positive impacts on health, wellbeing and productivity, producing similar effects to those created by spending time in nature.

A Disconnect with Nature

Over recent years there has been an increasing recognition of the benefits that humans gain from contact with trees and nature. In the space of a single generation children’s play moved from outdoors to indoors, the iconic backyard shrunk, parents became increasingly anxious about their children’s safety, working hours and stress levels rose and technology (especially screens) encroached into almost all areas of life.

Increasing urbanisation rates mean that many of us have less access to nature in our daily lives and Australians on average now spend over 90 per cent of their time indoors. This disconnect with nature and the outdoors corresponds with reports of increasing levels of obesity and nearly half of Australians experiencing a mental health condition within their lifetime.

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Bringing Nature into our Homes, Schools and Offices

Designing nature into our homes, schools and workplaces has been termed ‘biophilic design’ or ‘nature connected design’. It reflects the link between the natural and built environments and aims to provide a connection with nature even when we are indoors.

Nature connected design includes a number of natural elements that are used to enhance our buildings. Plants, natural views, light, water, airflow, and temperature are all part of the available repertoire.

Wood and Nature Connected Design

Timber is a natural, organic material, and it has many uses as a building material, including framing, flooring, fixtures and features. When used well wood creates buildings that combine many of key elements of nature connected design, including natural light, airflow and views of green spaces that can help in boosting our health and wellbeing.

Nature connected design is a response to the need to bring nature into the built environment.

In recent years wood has become the primary structural component in multi-level construction using engineered timber.
Health Benefits of Wood

Research on the health impact of natural materials, including wood, is a growing but still limited area of study. The objective of much of the research is to explore how wood can be used to enhance our buildings using its characteristics, be they visual, physical or tactile. We experience wood across the range of our senses and for many of us touching wood is not just for luck but also a response to the texture and warmth of the material.

Benefits on the Body

A number of studies, highlighted in the full Planet Ark report Wood – Nature Inspired Design, have examined the impact of wood upon our body. These studies have demonstrated that the presence of wood can have positive physiological effects, lowering blood pressure and heart rate, providing improved thermal comfort and reduced stress responses when compared to other material types.

Benefits on the Brain

A number of studies have also examined the impact of wood upon our brain. The results of these studies indicate that the presence of wood can have a positive psychological impact. In one study the behaviours of 44 elderly Japanese residents using wooden tables, chairs and tableware at a care home was examined and compared to those using plastic products. The results indicated that the use of wooden products increased the number of interactions between individuals (they were more talkative and willing to engage with one another), improved emotional state and expanded self-expression in a positive way.

The use of wooden products increased the number of interactions between individuals and expanded self-expression in a positive way.

The presence of wood can have positive physiological effects, including lowering of your blood pressure and heart rate.

The use of wooden products increased social interactions among elderly people.

Figure 6. Wood provides a material connection with nature.

Figure 7. School students have lower heart rates and decreased perception of stress.

Figure 8. The use of wooden products increases social interactions among elderly people.
Benefits on the Air

Wood products in a room have been shown to improve indoor air quality by moderating humidity. This effect occurs due to wood absorbing and releasing moisture in order to maintain equilibrium with the surrounding air. As a result wood absorbs moisture from the air in humid conditions and releases moisture in dry conditions.

A key consumer benefit of this is that wood can help to reduce peak indoor air humidity within bedrooms at night, providing an increased level of satisfaction to their occupants.

Visual Appeal, Natural Look

Australians appear to be innately drawn towards wood. When Planet Ark presented surveyed participants with images of two rooms, one furnished with a wooden chair, desk, blinds and other items made from wood, while the other showed the same items made from plastic, two out of every three people said they preferred the wooden room. This result occurred despite one in two people saying they were unaware that wood had associated health benefits.
Table 1, left, highlights the positive associations that wood induces in people, where an overwhelming 96 per cent of Australians agreed that wood is ‘visually appealing’ and ‘has a natural look and feel’. Eight out of ten people also thought that wood is versatile, recyclable, renewable and long lasting. Australians, however, appear to be less aware of the environmental benefits of wood, with only six out of ten survey participants understanding that wood stores carbon and creates less carbon emissions during production than steel and concrete.

The positive views of wood continue even when compared to other material types (Table 2). Wood was viewed as the material that creates a natural look and feel, warm and cosy environments, is visually appealing and is nice to touch by nine out of ten people, and as being the most environmentally friendly by seven out of ten people.

By comparison the second most popular material, brick, received an average of 34 per cent less positive feedback. Plastic was seen as the cheapest material but it also scored lowest in four out of five categories related to creating pleasant surroundings and being environmentally friendly.

Even though many people may not understand the health and wellbeing benefits of wood they instinctively react to the feelings of warmth and comfort it creates and its natural look and feel.

Table 1. Results of the Planet Ark survey on whether Australians ‘agree’, ‘disagree’ or ‘don’t know’ when asked questions about wood.

<table>
<thead>
<tr>
<th>Material</th>
<th>Perception</th>
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<tbody>
<tr>
<td></td>
<td>Creates a natural look &amp; feel</td>
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<td></td>
<td>Creates a warm &amp; cosy environment</td>
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<td>Visually appealing</td>
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<td>Feels nice to touch</td>
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<td>Aluminium</td>
<td>17</td>
</tr>
<tr>
<td>Plastic</td>
<td>14</td>
</tr>
</tbody>
</table>

Table 2. Results of a Planet Ark survey asking how participants perceive different material types.
Certification ensures that wood comes from legally harvested and well-managed forests and plantations. Certified forests are managed with environmental, social and economic factors as a priority, and ensure that when a tree is harvested another one is planted in its place. It also ensures the wood is tracked though the supply chain – from forest to shop. As a consumer it can be difficult or impossible to know whether wood was taken illegally or from high conservation value forests. Certification means you can be sure your choices are sustainable.

**Certification ensures that wood comes from legally harvested and well-managed forests and plantations, so you can be sure your choices are sustainable.**

**What About Fire and Durability?**

Some people have concerns about the risk of fire as well as the durability of wood. In both cases good design mitigates against risk.

**Dousing Doubt**

The structural stability of timber in the event of fire is well understood and, importantly, it is predictable, allowing timber constructions to be created that meet the same fire safety codes as steel and concrete buildings.

In light timber frame constructions the walls and floors are typically encased in non-combustible, fire-protective grade plasterboard to provide protection from fire. This can provide the same level of fire resistance as a completely non-combustible material.

Mass timber constructions have an inherent level of fire resistance, which increases with the thickness of the wooden elements. When timber is exposed to fire the outer layer can ignite but turns to char. Charring creates a protective layer that acts as insulation and delays the onset of heating for the cold layer below. With continued exposure to fire the char layer grows but as the burning rate is predictable, the wooden elements can be designed to provide greater time for escape or intervention.

**Be Certain it’s Certified**

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**Figure 12. FSC, AFS and PEFC logos displayed on products made from timber and paper products derived from certified forests.**

**Figure 13. Products displaying tags to indicate they are made from FSC certified timber.**

**Figure 14. Deformed steel beams after a fire.**
Design to Last

Wood can be attacked by a range of organisms including fungi, termites, beetles and a range of marine creatures as well as being subject to weathering and natural processes.

Using fit-for-purpose timber species and the correct construction techniques can help avoid unnecessary problems. For example, fungi will attack wood for food but require moisture, oxygen and a suitable temperature. Removing these factors will extend the longevity of your timber.

A number of species of termite are known to attack wood; for some this is via the tunnels that they build to create safe conditions for travel and transport of their food. Prevention of bridging or access points and chemical treatment can prevent the termites gaining pathways to their food.

Design guides and online training are available with information showing how to design for durability with timber.

Proof of Age

When cared for properly wood can last a very long time. The Pagoda of Fogong Temple is a nine-story, 221-foot-tall pagoda located in the Shanxi province of northern China. It was constructed in 1056 and is the world’s oldest existing multistorey timber building. The Urnes Stave Church in Norway was built around 1130 and is believed to be the oldest of its kind. It has been storing carbon in its structure for nearly 900 years.

Figure 15. The Pagoda of Fogong Temple in China dates back to 1056.

Figure 16. The Urnes Stave Church in Norway dates back to 1130.
Tempe House, Tempe, NSW

Tempe House was intentionally designed to be small to minimise its environmental impact and construction budget. The designer was able to do this by careful retention and restoration of the existing dwelling, including the original kitchen and bathroom locations, and the rationalisation of the floor plan to create a single line of circulation and a small, efficient staircase. Importantly, the orientation of the design maximised the northern and western openings to capture winter sunlight and summer breezes.

A number of other design features helped to ensure that the design had the least possible impact on the environment, including the use of double-glazing and increased insulation, including floor insulation. The house also has a 2000 litre rainwater storage tank which was located internally so that its thermal mass could be used to regulate the internal temperature of the home, and to store the heat from penetrating winter sunlight.

The majority of the project was hand-crafted onsite, which ensured a high level of control of waste and an opportunity for maximum reuse and recycling. The timber elements were screw, bolt or threaded rod fixed to enable simple disassembly and potential reuse at the end of life.

Careful use exposed timber elements and outdoor views has created a calming, tranquil home and an exquisite example of nature connected design.
Swadling House, Matraville, NSW

This is a one-of-a-kind house in Australia as it not only combines recycled and reclaimed hardwood timber floor boards, stairs, internal and external cladding, furniture and doors, but also the roof, walls, ceiling and flooring are produced from sustainably sourced cross-laminated timber (CLT).

The sustainability of this home also extends into the garden with a reclaimed hardwood pool decking and entrance walkway. Native planting in recycled bridge timber garden beds are fed by the collection and use of rain and bore water, which enhances the site biodiversity.

The use of CLT significantly enhanced the environmental performance of this home: onsite waste was eliminated through digital design and factory prefabrication; the near airtight nature of CLT construction makes the building more efficient to heat and cool and reduces energy demand; and the embodied energy used to produce the building materials are approximately 30 per cent less than for an equivalent conventional building.

As the owner pointed out, the ground floor (using concrete and brick) took four months to build; the first floor (using CLT) took three days to build!

Light House, Aireys Inlet, Vic

Light House is a small residence that has incorporated a dual use of space to minimise the building footprint and retain outdoor space and existing vegetation. The widespread use of timber enabled the building to be prefabricated offsite, providing higher construction tolerances that reduced waste and site impacts of noise and light pollution. The project was then built offsite and allowed for frequent visits by the owners prior to transportation to site.

Various certified timbers were used throughout the project, including Western Red Cedar shiplap external cladding, oriented strand board structural flooring and LVL for the floor and roof structure. The timber framed construction system was designed for disassembly to facilitate end of life recycling and/or adaptive re-use.

Other materials and environmental features included are a pergola and planters for passive solar control, rainwater tanks, water saving appliances and fixtures, vented cavity wall construction, high performance air tightness wall and roof membranes, low wattage heating panels, ceiling fans and LED lighting.
Conclusion

Wood has entered a new era where, with good design and modern engineering techniques, it can be used to create extraordinary structures. By incorporating it into nature connected design, it can help to create positive and healthy environments.

Research has shown that the use of natural elements like wood in the interior of a building produce similar effects to those created by spending time in outside in nature and can provide physiological and psychological benefits. Wood and nature connected design can help to lower blood pressure and heart rates, reduce stress and anxiety, increase positive social interactions and improve corporate image.

Responsibly sourced, certified timber has proven health and happiness benefits, as well as being a weapon in the struggle against climate change by both storing carbon and reducing carbon emissions.

Wood is one of the oldest and most versatile building materials used by humanity, but now more than ever it has a large part to play in the design and construction of healthy buildings for us to live, work, learn and recover in.

About This Report, Acknowledgements and References

This is an abbreviated, version of the Planet Ark report Wood – Nature Inspired Design, published on 21st March 2017. See the full report for acknowledgements and references.