

Health, Wellbeing and the Case for Timber

Research Briefing 2026

BY
W
AT
ER

Contents

HEALTH, WELLBEING AND THE CASE FOR TIMBER.....	1
CONTENTS	2
EXECUTIVE SUMMARY.....	4
How timber affects people	4
What the evidence shows	4
Business impact	5
The bottom line	5
INTRODUCTION	6
A note on what we can still expect	7
PERCEPTION	8
Sight.....	8
Aroma	9
Acoustics	9
Touch	10
PHYSIOLOGICAL RESPONSE.....	11
1. Cortisol Levels	11
2. Parasympathetic Activation	12
3. Heart Beats (Resting Heart Rate and Daily Heart Rate Load)	13
4. Prefrontal Cortex Deactivation	13
5. Survey Responses	14
6. Terpenes and Pinenes	15
BUSINESS BENEFITS.....	16
Increased Productivity and Creativity.....	16
Productivity.....	16
Creativity	17
Reduced Absenteeism Through Ill Health	17
Modelling the Scenarios	17
REFERENCES	19

Executive Summary

How timber affects people

Biophilic design works through four sensory channels — sight, aroma, acoustics, and touch — each with measurable physiological effects:

Sight. Wood grain delivers the fractal patterns the brain processes effortlessly. Rooms with roughly 45% wood surfaces produce the strongest physiological comfort ratings recorded, including measurable reductions in blood pressure.¹

Aroma. Freshly installed softwoods release phytoncides — natural compounds such as α -pinene. Controlled exposure has been shown to reduce cortisol by 24.9% and perceived stress by 9.3%,² while boosting Natural Killer cell activity central to immune defence.³

Acoustics. Timber absorbs frequencies in the 500–2,000 Hz range — the band of human speech — reducing reverberation and cognitive fatigue. Occupants in timber-rich offices report a 117% increase in acoustic satisfaction over equivalent concrete environments.⁴

Touch. Contact with uncoated wood produces an immediate drop in prefrontal cortex activity and a shift toward parasympathetic (recovery) dominance. Steel and marble produce a stress response or none at all.⁵ Across mass timber environments, exposure to wood is linked to a 10% reduction in blood pressure, 6% lower heart rate, and a 15% fall in stress hormones.⁶

What the evidence shows

Four physiological markers — cortisol, parasympathetic activation, heart rate, and prefrontal cortex activity — converge on the same conclusion. In a 2025 Scientific Reports study, 23 office workers moved from a concrete to a timber-rich office showed an average 11% reduction in hair cortisol over three months.⁷ A year-long Austrian school study found students in solid-wood classrooms averaged 8,600 fewer heartbeats per day with no decline in concentration.⁸ Survey evidence aligns: in a 1,000-worker Australian study, workers in high-wood offices reported 83% concentration ability versus 65% in low-wood offices, and were markedly more confident, optimistic, and satisfied.⁹

The research has real limits. Studies are often small, short-term, lab-based, and reliant on self-report. The precise size of the effect is uncertain. But the direction is consistent across countries, methods, and decades of research: timber helps.

Business impact

When these physiological benefits are realised at scale, the effects on business performance become measurable. For example, increased productivity, estimated to yield a 2% boost worth £5,000 per person per year¹⁰ is directly linked to improvements in workplace wellbeing.

1. 8–13% increase in self-reported productivity^{7,11}

Enhanced creativity and collaboration are also key outcomes of a healthier, timber-rich environment:

2. 15% increase in self-reported creativity¹²

Additionally, by supporting health and reducing stress, timber buildings help tackle rising absenteeism, now averaging 9.4 days per employee annually in 2025, and provide an opportunity for organisations to improve overall wellbeing.

3. 13% reduction in absenteeism through ill health¹³
4. Stress is directly linked to 29% of short-term sick leave (2.7 days per employee per year) and indirectly linked to minor illness (7.3 days per year)¹⁴

For organisations that embrace timber buildings, the reduction in stress leads to fewer sick days, higher productivity, and greater creativity, simultaneously reducing costs and boosting profits. In this way, the journey from perception, through physiological response, to business impact is a seamless progression, each stage reinforcing the next.

To put numbers on the absenteeism opportunity: at an assumed cost of £550 per person per day, a 50-person team modelled across three scenarios yields £7,425 per year under a conservative assumption (10% reduction in stress-linked days), £51,700 under a central assumption (20% reduction across all stress-linked days), and £90,475 under an optimistic assumption (35% reduction).

Supporting evidence for the productivity and creativity bullets above includes a 26% uplift in cognitive function test scores in LEED-certified buildings¹⁵ and wood grain texture as a significant independent predictor in regression models explaining 68% of variance in creative output.¹⁶

The bottom line

A timber building is not a transformation in itself. It is a better base — a sustained, low-level physiological advantage that reduces strain, supports recovery, and accumulates into measurable gains in attendance, performance, and wellbeing. The figures here are indicative rather than precise, but the direction of travel is clear and consistent. For an organisation choosing where its people will spend their working lives, the case for timber is biological, financial, and visible to anyone who walks through the door.

Introduction

Perception → Physiological Response → Business Impact

The way we experience our surroundings, through sight, smell, acoustics, and touch, whether consciously or unconsciously, directly influences our physiological state. Sensory perceptions act as a trigger, setting off physical responses in the body that then have a demonstrable impact on our behaviour, productivity, and interactions at work. By making these links explicit, we can see how each stage builds upon the last: perception leads to physiological response, which ultimately shapes business outcomes.

A timber building alone will not transform a business, but studies show that it can help build a better base-level for a business.

A timber building is here to make an organisation excel. Whether that's a step change or a reaffirmation of values. It's a public commitment of being a good custodian, proving that you care about your people and our planet. A timber building can be the momentum of your business.

The Limits of the Evidence — What We Know and What We Don't

Most studies are small. A lot of the experiments in this field involve a handful of participants, sometimes fewer than 25. Small studies can point us in the right direction, but they are not reliable enough to give us precise figures. When a study says timber reduces stress by a specific percentage, that number should be treated as a rough indication, not a firm fact.

Many rely on people's own opinions. The most common way researchers measure impact is to simply ask people how they feel, whether they feel more productive, more relaxed, more focused. People often rate themselves more positively when they are in nicer-looking spaces, regardless of whether their actual output has improved. This makes it hard to know whether timber is genuinely boosting performance or whether people just like the look of it.

Lab conditions don't reflect real life. Many studies are conducted in controlled laboratory settings, often using students as participants. Real workplaces are messier, they involve noise, management pressures, varying workloads, and dozens of other factors that labs can't replicate. Results from a quiet experiment room may not translate directly to a busy open-plan office.

It's hard to isolate timber from everything else. Timber buildings are often newer, better-designed, and better-lit than the concrete offices they are being compared to. Separating the effect of the wood itself from good ventilation, better acoustics, or simply a nicer overall environment is genuinely difficult.

We're still missing long-term data. Almost all studies observe people over short periods, days or months. We don't yet know whether the benefits of timber persist over years, or whether people simply adjust and the effect fades.

A note on what we can still expect

Despite these limitations, the evidence points consistently in the same direction across many different studies, countries, and methods. Wood appears to trigger a genuine physiological response, calming brain activity and activating the body's recovery systems in ways that other common building materials do not. The research doesn't yet tell us exactly how large that effect is, but it does tell us the direction: timber helps. This report explores what research is out there and what impacts we can expect to measure.

Perception

Our spaces are designed to connect the occupants with nature, echoing the patterns and atmosphere that are rare within our cities. This is the essence of biophilic design, creating spaces that trigger the same feelings in occupants as they would within nature.

To do this, we utilise the four key environmental senses, sight, aroma, acoustics, and touch, to leverage our bodies’ understanding of its surroundings, creating spaces that echo nature.

Perception at a Glance			
45%	24.9%	117%	15%
Wood surface ratio producing strongest physiological comfort	Cortisol reduction from phytoncide (aroma) exposure	Increase in acoustic satisfaction vs concrete environments	Fall in stress hormones from mass timber touch exposure
<i>Tsunetsugu et al., 2007¹</i>	<i>Heo et al., 2023²</i>	<i>Coupe Studios, 2024⁴</i>	<i>Mercer International, 2023⁶</i>

Sight

What is it:

The visual dimension of biophilic design works through three mechanisms: natural light and circadian synchronisation, direct views of nature, and the perception of fractal geometries.¹⁷ Natural light regulates serotonin production and melatonin levels, directly shaping mood, sleep quality, and mental sharpness throughout the day.¹⁸ Views of nature prompt a shift from sympathetic to parasympathetic nervous system activity, moving the body from a state of alert tension toward calm recovery. Fractal patterns, the self-repeating geometries found in wood grain, foliage, and water, are handled by the brain with remarkable efficiency, a response known as ‘fractal fluency’.¹⁹

Why is it important:

The evidence spans healthcare, education, and commercial settings. Post-surgical patients with a tree view recover 19 hours faster and need less pain medication than those facing a blank wall.²⁰ Learning rates in daylight classrooms run up to 26% higher than in artificially lit equivalents,¹ and 93% of retail customers prefer naturally lit environments when given the choice.²¹ In workplaces, integrating greenery is linked to a 15% increase in both creativity and productivity.²²

What is the timber impact:

Few materials match timber’s visual biophilic power. The grain, knots, and figuring of wood surfaces deliver the organised complexity and fractal patterning that trigger ‘soft fascination’, a state of effortless attention that gives the brain space to recover from sustained cognitive effort.¹⁹ And because no two timber panels are identical, exposed wood offers the variety of a natural landscape without the visual noise that causes fatigue.²³ Rooms with a 45% wood ratio consistently produce the strongest physiological comfort ratings of all conditions tested, with measurable reductions in blood pressure.¹

Aroma

What is it:

Of all the senses, smell is the most direct. Scent signals bypass the thalamus and are processed by the limbic system before the conscious brain is even involved, creating an immediate emotional and physiological response.²⁴ In biophilic environments, this pathway is activated primarily through phytoncides, Volatile Organic Compounds (VOCs) such as α -pinene, β -pinene, and limonene, produced by trees as part of their natural defence systems.²⁵ The result is a sensory channel that acts faster, and more consistently, than sight or sound.²⁴

Why is it important:

Phytoncide-rich air actively improves immune function, boosting the activity of Natural Killer (NK) cells, the body's frontline defence against cancer and viral infection.³ In controlled settings, phytoncide exposure reduced perceived stress by 9.3% and cortisol levels by 24.9%, alongside significantly lower adrenaline and noradrenaline output, a measurable, body-wide calming effect.^{3,2} Scent also has a long reach: an environment's aroma becomes embedded in spatial memory, shaping how occupants feel about a place long after they've left it.²⁴

What is the timber impact:

Timber is a living source of phytoncides within the built environment. Freshly installed or exposed species, particularly cypress, cedar, and pine, release beneficial VOCs that replicate the calming chemistry of a forest.²⁴ The catch is that this effect is time-limited: as timber stabilises, the scent fades. To maintain the olfactory benefit, timber's initial contribution works best when supported by living plants, moss walls, or diffusion systems tuned to natural circadian and seasonal patterns.²⁴

Acoustics

What is it:

Before people consciously register a space, their nervous system is already reading its soundscape—assessing whether the environment feels safe and restorative.²⁴ 'Sonic biophilia' addresses this by weaving in natural sounds—birdsong, flowing water, rustling foliage—that replicate the acoustic richness of the outdoors.²⁶ Unlike artificial white noise, these sounds are complex enough to mask disruptive urban noise without demanding any cognitive effort to filter out, keeping occupants in a state of quiet, sustained focus.²⁷

Why is it important:

Noise pollution raises blood pressure and erodes concentration; natural soundscapes counteract this directly.²⁸ EEG studies show that biophilic audio environments boost alpha and theta brainwave activity—indicators of relaxed alertness—while suppressing the beta waves associated with stress.²⁹ Material choice plays an equally important role: hard, reflective surfaces extend reverberation times and amplify the cognitive load of processing speech in open-plan spaces.⁷ Acoustic environment is not just a comfort consideration—it directly shapes performance and long-term health.²⁸

What is the timber impact:

Timber's cellular structure gives it a warm acoustic quality—one reason it has long been favoured in concert hall design. Wood selectively absorbs and scatters frequencies in the 500–2,000 Hz range, the critical band for human speech, reducing reverberation and the mental fatigue that comes with it.⁷ Timber surfaces also diffuse rather than reflect sound, breaking up the flutter echo that makes harder rooms feel noisy and tiring. The numbers tell the story: occupants in timber-rich offices report a 117% increase in acoustic satisfaction compared to equivalent concrete environments.⁴

Touch

What is it:

Touch is the most continuous of the senses—occupants are in constant, largely unconscious contact with their environment from the moment they enter a space. Haptic experience covers the sense of touch, surface texture, and the body’s response to thermal conditions.²⁴ Biophilic design uses natural material surfaces to create a grounding physical connection between person and building. It also introduces thermal variability—gentle fluctuations in temperature and airflow that mirror outdoor conditions—countering the ‘thermal boredom’ of rigidly controlled environments, which increases fatigue and dulls alertness.²²

Why is it important:

Contact with natural materials has an immediate, measurable effect on the nervous system. Touching uncoated wood causes a rapid decrease in prefrontal cortex activity—a direct marker of mental relaxation—alongside a shift toward parasympathetic dominance as measured by heart rate variability.⁵ Touching steel or marble, by contrast, provokes a stress response or no effect at all.²⁴ Since this contact is constant throughout the working day—across floors, desks, walls, and door handles—the cumulative biological impact of material choice on sustained well-being is far greater than it might first appear.³⁰

What is the timber impact:

Wood’s low thermal conductivity is the reason timber feels warm to the touch. Unlike stone or metal, it doesn’t pull heat from the body quickly, so surfaces feel comfortable at temperatures where harder materials read as cold.³⁰ Occupants in wood-panelled rooms consistently rate their thermal comfort as closer to ‘neutral’—and more pleasant—than those in equivalent painted spaces.³¹ Direct contact with timber has also been shown to reduce prefrontal cortex oxyhaemoglobin and increase parasympathetic nervous activity, both clear markers of physiological relaxation.⁵ Across mass timber environments more broadly, exposure to wood is linked to a 10% reduction in blood pressure, a 6% decrease in heart rate, and a 15% fall in stress hormone levels.⁶

Physiological Response

The clearest evidence that timber affects wellbeing comes from the body itself. This chapter examines the measurable physiological responses that occur when people occupy timber-rich environments — the stress markers, autonomic changes and self-reported impacts that together indicate whether a space keeps the body under strain or allows it to recover, and that help separate momentary, day-to-day stress from sustained underlying trends.

Measuring these effects with certainty is difficult. Robust conclusions require comparing two otherwise-similar environments that differ only in their materials, which is rarely achievable in practice. The available studies tend to be small and limited, and it is hard to isolate the influence of timber from other environmental factors such as thermal comfort. Findings from controlled conditions are also tricky to scale up to whole buildings. What can be said with confidence is that measurable benefits have been observed in other natural spaces, and there is good reason to expect the same response in ours.

The sections that follow set out the principal measures researchers use to capture this response — cortisol levels, parasympathetic activation, heart rate and daily cardiac load, and prefrontal cortex activity — alongside survey evidence of how occupants themselves experience these spaces, and the role of the aromatic compounds that timber releases into the air.

Physiological Response at a Glance			
–11% Reduction in hair cortisol after 3 months in timber office (317.2 → 286.4 pg/mg) <i>Whyte et al., 2025⁷</i>	8,600 Fewer heartbeats per day in timber vs standard classrooms <i>Kelz et al., 2009⁸</i>	83% vs 65% Concentration ability: high-wood vs low-wood workplaces <i>Knox & Parry-Husbands, 2018⁹</i>	–10% Blood pressure reduction linked to mass timber exposure <i>Mercer International, 2023⁶</i>

1. Cortisol Levels

What is it:

Cortisol is a hormone produced by the adrenal glands that helps the body regulate blood pressure, blood sugar, and immune function. It is widely known as the “stress hormone” because levels rise and fall in response to physical, psychological, and emotional stress. Crucially, cortisol can be collected and measured from saliva, urine, or, most conveniently for long-term studies, from hair, where it accumulates over weeks and provides an average record of a person’s chronic stress load rather than a snapshot of one moment.³² This makes it a particularly valuable objective marker in workplace research, where researchers want to understand sustained rather than momentary stress.

Why is it important:

Cortisol is one of the few biological markers that gives researchers hard, physical evidence about stress rather than relying solely on what people say they feel. This matters because people's self-assessments of their own stress levels can be unreliable: someone may not recognise or report that they are stressed, or conversely may exaggerate it. Cortisol cuts through that ambiguity. Elevated chronic cortisol has well-established links to cardiovascular disease, impaired immune function, disrupted sleep, and reduced cognitive performance.³² In a workplace context, lower average cortisol indicates that the body is genuinely spending less time in a physiological state of strain, not just that workers feel they are less stressed.

What is the timber impact:

A 2025 pilot study by Whyte et al., published in Scientific Reports, moved 23 office workers from a standard concrete workplace to a timber-rich office and measured hair cortisol before and three months after the move. Average cortisol levels fell from a mean of 317.2 pg/mg (log 5.33) to 286.4 pg/mg (log 5.23) following the transition to the timber environment, indicating lower chronic stress in the timber space.⁷ An earlier study cited in Wood and Human Stress in the Built Indoor Environment³² found that plasma cortisol levels decreased for participants staying in a hospital room redecorated with wood panels compared to a standard room, providing corroborating evidence from a different setting and measurement method.

2. Parasympathetic Activation

What is it:

The human nervous system has two modes: the sympathetic system, which drives the “fight or flight” response, and the parasympathetic system, sometimes called “rest and digest.” When the parasympathetic system is active, the heart rate slows, blood pressure drops, and the body enters a state of recovery and repair. The degree of parasympathetic activation can be measured through heart rate variability (HRV), specifically the high-frequency (HF) component of the interval between heartbeats, which reflects respiratory sinus arrhythmia, the natural speeding and slowing of the heart with breathing.⁵ A higher HF component indicates greater parasympathetic activity, meaning the body is in a more relaxed, restorative state.

Why is it important:

Parasympathetic activation is the physiological foundation of recovery. It is during this state that the body and brain restore resources depleted by stress and effortful concentration. For workers, this matters because the ability to recover, even briefly, within the working day is directly linked to sustained cognitive performance, mood, and resilience. A work environment that keeps the sympathetic system constantly active prevents the micro-recoveries that support productivity over the course of a day. Higher vagal tone (the term for strong parasympathetic activity mediated by the vagus nerve) is also associated with reduced risk of heart disease and better overall health.³³

What is the timber impact:

Ikei, Song, and Miyazaki (2017) measured the autonomic nervous activity of 18 female university students as they touched plates of white oak, marble, tile, and stainless steel. Touching white oak produced a significantly higher ln(HF) value, the measure of parasympathetic activation, compared to both marble and stainless steel, with the effect appearing immediately on contact and persisting throughout the 90-second exposure.⁵ Wood's scent also plays a role: inhalation of α -pinene, a major volatile compound found in Japanese cedar and cypress, has been found to increase parasympathetic nervous activity and decrease heart rate compared to clean air as a control.⁵

3. Heart Beats (Resting Heart Rate and Daily Heart Rate Load)

What is it:

Heart rate, the number of times the heart beats per minute, is one of the most basic and accessible indicators of physiological stress and effort. Beyond a single resting measurement, researchers sometimes look at the total cardiac load over a full day, measured by continuous ECG (electrocardiogram) monitoring. This approach captures not just how fast the heart beats at rest, but how much cumulative work it performs across all activities from waking to sleeping, a more holistic picture of how much strain the cardiovascular system is under in a given environment.⁸

Why is it important:

A persistently elevated heart rate, even modestly, is associated with higher lifetime risk of cardiovascular events, reduced cognitive performance, and poorer recovery from stress. The heart's workload is regulated by both the sympathetic and parasympathetic nervous systems, so a lower sustained heart rate in a given environment is a proxy for the whole-body physiological state. In practical terms, occupants who spend hours in an environment that keeps their heart rate needlessly elevated are spending physiological resources that could otherwise be available for concentration, memory, and creative thinking.³³

What is the timber impact:

The clearest evidence comes from a year-long field study of 52 secondary school students at Haus im Ennstal in Austria, conducted by Joanneum Research and Kelz et al. (2007–2009). Four classrooms were fitted, two with standard materials (linoleum, plasterboard, chipboard) and two almost entirely with wood (walls, floor, ceiling, and cupboards). Students wore 24-hour ECG monitors periodically throughout the school year. By March–May 2009, students in the wood classrooms showed an average of 8,600 fewer heartbeats per day than students in the standard classrooms, without any corresponding decline in concentration test performance.⁸ The wood classroom students' heart rates actually reduced below even their own holiday baseline once lessons began each morning, while standard classroom students maintained an elevated heart rate throughout the school day.

4. Prefrontal Cortex Deactivation

What is it:

The prefrontal cortex (PFC) is the region at the front of the brain most closely associated with conscious, effortful cognitive processing: decision-making, planning, self-regulation, working memory, and, critically, the mental experience of stress and anxiety. When the prefrontal cortex is highly active, it typically indicates heightened mental effort or psychological arousal. Conversely, a reduction in prefrontal cortex activity (measured by lower concentrations of oxyhemoglobin, or oxy-Hb, in the tissue) is associated with a state of calm, effortless attention, the kind of mental state found during relaxation or when engaging with natural environments.⁵ This can be measured non-invasively using near-infrared spectroscopy, which detects how much oxygen-carrying blood is flowing to different parts of the brain.

Why is it important:

Sustained high activation of the prefrontal cortex is both a symptom and a cause of stress. When the brain is running hot in this region, it consumes cognitive resources rapidly, leading to the kind of mental fatigue that accumulates over a working day. Research on Attention Restoration Theory proposes that natural environments engage a different, lower-effort mode of attention that allows the prefrontal cortex to recover, which is why time in nature reliably improves concentration on return to demanding tasks.³⁴ A building material or environment that even modestly reduces prefrontal activity during non-demanding periods could therefore extend workers' cognitive capacity across the day.

What is the timber impact:

The clearest evidence comes again from Ikei, Song, and Miyazaki (2017). Using near-infrared time-resolved spectroscopy to track oxy-Hb in both left and right prefrontal cortex while participants touched different materials, the study found that contact with white oak produced significantly lower oxy-Hb concentrations in both hemispheres compared to marble, tile, and stainless steel. In the right prefrontal cortex, the mean oxy-Hb concentration during contact with white oak was significantly lower than marble, tile, and stainless.⁵ Stainless steel actually caused oxy-Hb concentrations to increase throughout the contact period, in other words, touching a synthetic industrial surface actively aroused the brain. The oxy-Hb drop with white oak began immediately on contact and persisted for the full 90 seconds of measurement. These findings are consistent with earlier studies showing that visual exposure to forests (as opposed to urban views) also reduces oxy-Hb in the prefrontal cortex, suggesting the mechanism is not unique to touch but reflects a broader biological response to natural stimuli.⁵

5. Survey Responses

What is it:

Survey-based research asks participants to rate their own experiences of their environment, how productive they feel, how concentrated, how stressed, how satisfied with their workplace. These are typically administered as questionnaires using Likert scales (e.g., 1–7 from very poor to very good) and may cover topics including indoor environmental quality (temperature, air, lighting, acoustics), perceived productivity, mood, and overall wellbeing. While surveys cannot provide objective physiological data, they are valuable because they capture what actually matters to building occupants: their lived experience.⁹

Why is it important:

Survey data are the most practically actionable form of evidence for building owners, designers, and employers. Physiological measurements tell us that something is happening in the body; surveys tell us whether occupants notice, care, and are deriving real benefit. They also capture outcomes, like concentration and creativity, that no physiological sensor can easily measure. The limitation is that people's self-reports can be influenced by expectations, social desirability, and general positivity about a new or attractive environment, which means survey findings need to be interpreted alongside objective measures where possible.⁷

What is the timber impact:

Multiple studies using surveys report consistent positive associations between timber and occupant experience. The largest Australian study, conducted by Knox and Parry-Husbands (2018) for Forest & Wood Products Australia, surveyed over 1,000 indoor office workers. It found that workers in workplaces with more than 60% of surfaces in natural-looking wood reported an ability to concentrate of 83%, compared to 65% in workplaces with less than 20% wood, a 28-percentage-point difference that persisted after controlling for gender, age, income, occupation, and education.⁹ The same study found that workers in high-wood environments were more optimistic about the future (68% vs 49%), more confident (65% vs 42%), and more satisfied with their working environment (81% vs 47%).⁹

The Whyte et al. (2025) Scientific Reports field study found that 75% of participants in the timber-rich office reported an increase in productivity (compared to 43% in the non-timber office before the move), and no participants in the timber group rated their health at the lowest two points on the scale, compared to 16% in the concrete office.⁷ The study also found that the subjective sense of “feeling healthy in the building” was a highly significant positive predictor of reported productivity in regression analysis, suggesting a clear pathway from environmental wellbeing to perceived work output.⁷

6. Terpenes and Pinenes

What are they:

Terpenes are naturally occurring compounds produced by trees, particularly softwoods like pine, spruce, and cedar. When timber is used indoors, these compounds evaporate gently from the wood surface into the surrounding air, they are what gives pine forests, and pine-clad rooms, their characteristic scent. The most studied are α -pinene and β -pinene, which together dominate the emissions of common softwood species such as Scots pine and Norway spruce.³⁴ The broader family of these tree-derived aromatic compounds is known as phytoncides. Crucially, the concentrations found in timber buildings are low, consistently well below levels considered harmful, and in the range where the compounds can be smelled but cause no irritation.³⁴

Why is it important:

Terpenes matter because they represent a pathway through which timber can affect occupants that has nothing to do with how the building looks. Someone sitting in a timber office is not just seeing or touching wood, they are also breathing in trace amounts of its natural chemistry.

Research has linked α -pinene specifically to a wide range of health-relevant effects: reducing anxiety, supporting sleep, dampening inflammation, and boosting immune function.³⁵ The compound appears to work partly through the same neurological pathways as some prescribed anti-anxiety medications, binding to receptors in the brain associated with calm and rest.³⁵

What is the timber impact:

In a study by Li et al. (2009) at Nippon Medical School, Tokyo, twelve men spent three nights in a hotel room where hinoki cypress oil, principally α -pinene and β -pinene, were diffused into the air at concentrations comparable to a timber-rich indoor environment. By the end of the stay, natural killer (NK) cell activity had significantly increased. NK cells are the immune system's front-line defenders against viruses and abnormal cells. Measured levels of noradrenaline, a stress hormone, fell significantly during exposure.³ In short, breathing tree-derived compounds for three nights measurably strengthened participants' immune response and reduced their stress chemistry.

Separate studies have shown that inhaling α -pinene and d-limonene, both common in softwood timber, increases parasympathetic nervous activity (the body's recovery mode) and lowers heart rate, producing a physiologically measurable state of relaxation.^{34,5} This mirrors the findings from the touch and visual exposure studies described in earlier sections, suggesting the same calming response can be triggered through the nose as well as the eyes and hands.

Business Benefits

The health and wellbeing benefits of working in a timber building is not just a benefit to the occupants, but also the business as a whole. A healthy workforce promotes tangible efficiencies that can manifest financial savings.

The demands of work and life will invariably create an ebb and flow of stress, related to a multitude of factors that are beyond the control of a building. However, through the creation of a biophilic space, we can create a space that promotes healing and restoration. While the research suggests only moderate improvements in measured stress levels in biophilic spaces, over the course of a week, a month, a year, this can be the difference between a manageable level of stress and compounding stress levels.

This accumulation of stress can lead to increased absenteeism, decreased productivity, and can be linked to increased staff turnover.

Business Impact at a Glance			
8–13% Increase in self-reported productivity in timber offices <i>Whyte et al., 2025⁷ / World GBC, 2015¹¹</i>	15% Increase in self-reported creativity in biophilic environments <i>Human Spaces, 2015¹²</i>	9.4 days Average UK annual sick leave — 29% directly stress-linked <i>CIPD, 2025¹⁴</i>	£90,475 Max annual saving for 50-person team (optimistic scenario) <i>Scenario modelling</i>

Increased Productivity and Creativity

Productivity

The headline figure, cited across several documents and originating from a Terrapin Bright Green economic synthesis, is a 15% productivity increase from biophilic office design.⁹ The World Green Building Council places this more conservatively at 8%.¹¹ An Australian survey of 1,000+ workers⁹ found a clear dose-response: workers in high-wood-visibility offices (>60% of surfaces) reported an 83% ability to concentrate vs 65% in low-wood offices, with similar patterns for mood, optimism, and satisfaction — effects that held after controlling for gender, age, income, and occupation.

A 2025 Scientific Reports pilot study⁷ moved 23 office workers from a concrete to a timber-rich office and found improved self-reported productivity and wellbeing, plus an average 11% reduction in cortisol levels (a chronic stress biomarker), though the effect wasn't statistically significant given the small sample. Green building research¹⁵ found workers in LEED buildings scored 26% higher on cognitive function tests vs comparable non-certified buildings.

The Austrian Joanneum Research school study⁸ is the most physiologically rigorous: students in solid-wood classrooms averaged 8,600 fewer heartbeats per day, a measure of reduced physiological stress, without any decline in concentration test performance.

Creativity

McCoy & Evans (2002, *Creativity Research Journal*)¹⁶ provide the most direct evidence: a regression model of physical environment characteristics explained 68% of the variance in creativity potential scores, with wood grain texture as a significant independent predictor. Rooms with natural materials outperformed those dominated by manufactured/composite surfaces on actual creative output (collage measure). The Human Spaces global survey¹² found workers in offices with greenery were 78% more likely to feel inspired on entering the workplace.

Mechanisms running through all these effects include prefrontal cortex deactivation (documented by Ikei et al., 2017),⁵ parasympathetic nervous system activation, Attention Restoration (Stevenson et al., 2018 meta-analysis of 46 studies),³⁴ and stress reduction as a prerequisite for both types of performance.

Reduced Absenteeism Through Ill Health

Sickness absence is a significant and measurable cost to employers. The average employee in the UK takes 9.4 days of sick leave each year. Stress is directly linked to 29% of short-term sick leave (around 2.7 days per employee per year) and indirectly linked to minor illness (a further 7.3 days per year).¹⁴ Because a timber-rich environment lowers stress, it can act on one of the underlying causes of this absence, reducing the days lost to both stress-related and stress-aggravated illness.

Though there is considerable research it does not provide a single “timber reduces stress by X%” figure that can be used with establish a reduction in absenteeism directly. However, by combining the evidence it allows us to construct a reasonable range of reductions:

Cortisol. Whyte et al. (2025, *Scientific Reports*)⁷ found that workers moving from a concrete to a timber-rich office showed an average 11% reduction in hair cortisol levels over three months.

Workplace satisfaction and sick leave. Knox & Parry-Husbands (2018)⁹ found that workers in high-wood workplaces took on average 4 fewer sick days per year than those in very low-satisfaction workplaces, and that workers satisfied with their physical environment were significantly less likely to take unplanned leave (22% incidence vs 48% in very dissatisfied workers).

Biophilic design and absenteeism. Van der Voordt & Jensen’s review of healthy workplace evidence³⁶ found that green building interventions produced drops in employee sick days of 25–58% across 11 case studies. Separately, a European Agency for Safety and Health study cited in the same review estimated that 30% of sickness absence is directly caused by stress.

Timber-specific stress reduction. The Austrian school study⁸ demonstrated that students in solid wood classrooms had significantly lower physiological stress measures than those in standard rooms, sustained across a full school year. The Stora Enso white paper cites a real-world office in a timber building reporting a 13% reduction in staff sickness compared to their previous premises.

Modelling the Scenarios

Given the evidence, three scenarios are modelled, differing in the assumed reduction in stress-linked absence achievable through moving to a timber workplace. These are deliberately conservative to avoid overstating the case. An assumed cost to the business is £550 per person per day.

Scenario A — Conservative (10% reduction in stress-linked days) Grounded in the Whyte et al. cortisol reduction signal and the lower bound of the green building evidence. Assumes only the direct stress-related sick leave (2.7 days) responds to the timber effect.

Scenario B — Central (20% reduction in stress-linked days) Reflects the midpoint of the evidence: timber demonstrably reduces cortisol, heart rate, and self-reported stress. Applies the reduction across both direct (2.7 days) and a portion of indirect stress-related absence (part of the 7.3 minor illness days), consistent with immune function evidence from terpene research.

Scenario C — Optimistic (35% reduction in stress-linked days) Consistent with the lower end of the green building case studies (25–58% reduction) and the Terrapin Bright Green biophilic economics analysis, and with the 13% whole-workforce sickness reduction observed in the real timber office case. Applied across all 10 stress-linked days.

Scenario	Reduction assumed	Days saved/employee	Saving per employee/yr	Saving: 50-person team
A — Conservative	10% of 2.7 direct days	0.27 days	£149	£7,425
B — Central	20% of all 9.4 days	1.88 days	£1,034	£51,700
C — Optimistic	35% of all 9.4 days	3.29 days	£1,810	£90,475

These figures are inferences, not predictions, and should be treated as indicative of the order of magnitude rather than precise forecasts.

References

1. Tsunetsugu Y, Miyazaki Y, Sato H. Physiological effects in humans induced by the visual stimulation of room interiors with different wood quantities. *J Wood Sci.* 2007;53(1):11–16.
2. Heo S-J, Park S-K, Jee Y-S. Effects of phytoncide on immune cells and psychological stress of gynecological cancer survivors: Randomized controlled trials. *J Exerc Rehabil.* 2023;19(3):170–180.
3. Li Q, Kobayashi M, Wakayama Y, Inagaki H, Katsumata M, Hirata Y, et al. Effect of phytoncide from trees on human natural killer cell function. *Int J Immunopathol Pharmacol.* 2009;22(4):951–959.
4. Coupe Studios. Biophilic sound design – Google’s mass timber project [Internet]. 2024 Dec 9 [cited 2026 May 1]. Available from: <https://coupestudios.com/biophilic-sound-design-googles-mass-timber-project/>
5. Ikei H, Song C, Miyazaki Y. Physiological effects of touching wood. *Int J Environ Res Public Health.* 2017;14(7):801.
6. Mercer International. The biophilic beauty of mass timber [Internet]. 2023 Oct 27 [cited 2026 May 1]. Available from: <https://mercerint.com/news/the-biophilic-beauty-of-mass-timber/>
7. Whyte S, Skillington K, Candido C, Zhang Y, Fatourechi D, Finlay S, et al. Understanding the effects of timber rich workplaces on occupants’ perceived productivity and health: a pilot study. *Sci Rep.* 2025;15:39480.
8. Kelz C, Lackner H, Avian A, Moser M. Gesundheitliche Auswirkungen einer Massivholzausstattung in der Hauptschule Haus im Ennstal [Health effects of solid wood furnishings in Haus im Ennstal secondary school]. Weiz: Joanneum Research; 2009.
9. Knox A, Parry-Husbands H. *Workplaces: Wellness + Wood = Productivity.* Victoria: Forest & Wood Products Australia; 2018.
10. Office for National Statistics. Output per hour worked, UK [Internet]. London: ONS; 2022 [cited 2026 May 1]. Available from: <https://www.ons.gov.uk>
11. World Green Building Council. *Health, Wellbeing and Productivity in Offices: The Next Chapter for Green Building.* London: World Green Building Council; 2015.
12. Human Spaces. *The Global Impact of Biophilic Design in the Workplace.* London: Interface; 2015.
13. TRADA. *Timber and Healthy Buildings: Indoor Air Quality.* London: Exova UK Ltd; 2018.
14. CIPD. *Health and Wellbeing at Work Survey Report.* London: CIPD; 2025.
15. Lowe G. *Wood, Well-being and Performance: The Human and Organizational Benefits of Wood Buildings.* Vancouver: Forestry Innovation Investment Ltd; 2020.
16. McCoy JM, Evans GW. The potential role of the physical environment in fostering creativity. *Creat Res J.* 2002;14(3–4):409–426.
17. Kellert SR, Heerwagen J, Mador M, editors. *Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life.* Hoboken: John Wiley & Sons; 2008.
18. Xing Y, Stevenson N, Thomas C, Hardy A, Knight A, Heym N, et al. Exploring biophilic building designs to promote wellbeing and stimulate inspiration. *PLoS ONE.* 2025;20(3):e0317372.
19. Browning WD, Ryan CO, DeMarco C. *The Nature of Wood: An Exploration of the Science on Biophilic Responses to Wood.* New York: Terrapin Bright Green; 2022.

20. Ulrich RS. View through a window may influence recovery from surgery. *Science*. 1984;224(4647):420–421.
21. Yin J, Zhu H, Yuan J. Health impacts of biophilic design from a multisensory interaction perspective: Empirical evidence, research designs, and future directions. *Land*. 2024;13(9):1448.
22. Hutson J, Hutson P. Neuroinclusive workplaces and biophilic design: Strategies for promoting occupational health and sustainability in smart cities. *Glob Health Econ Sustain*. 2023;1(1):0549.
23. Tekin BH, Tunahan GI, Disci ZN, Ozer HS. Biophilic design in the built environment: Trends, gaps and future directions. *Buildings*. 2025;15(14):2516.
24. Ma P, Shi Q, Xie T, Xu X, Zeng N, Teng Q, et al. Materials selection in biophilic building design: Multisensory perception and psycho-physical mapping of wood materials. *Buildings*. 2026;16(4):726.
25. Antonelli M, Donelli D, Barbieri G, Valussi M, Maggini V, Firenzuoli F. Forest volatile organic compounds and their effects on human health: A state-of-the-art review. *Int J Environ Res Public Health*. 2020;17(18):6506.
26. Lima E, Mateus L, Arruda A. Bio-acoustic design principles through the integration of sound, nature and multisensory features into bio-architecture. *Preprints.org* [Internet]. 2025. Available from: <https://doi.org/10.20944/preprints202506.1249.v1>
27. Benway E. Biophilic design – for your ears [Internet]. *Living Architecture Monitor*. 2024 Sep 13 [cited 2026 May 1]. Available from: <https://livingarchitecturemonitor.com/articles/fa24>
28. Didier M. Designing for all senses: Acoustics in biophilic spaces [Internet]. *Trinity Consultants* [cited 2026 May 1]. Available from: <https://trinityconsultants.com/resources/designing-for-all-senses-acoustics-in-biophilic-spaces/>
29. Kim N, Gero JS, Jung D. Harmonizing with nature: Unpacking the neurophysiological impacts of biophilic sound in virtual classroom design. In: *DRS2024: Boston*; 2024.
30. Ikei H, Song C, Miyazaki Y. Physiological effects of wood on humans: A review. *J Wood Sci*. 2017;63(1):1–23.
31. Blankenberger D, Van Den Wymelenberg K, Stenson J. Visual effects of wood on thermal perception of interior environments. In: *ARCC Conference Repository*; 2019.
32. Fell D. Wood in the human environment: restorative properties of wood in the built indoor environment [dissertation]. Vancouver: University of British Columbia; 2010. Reviewed in: Nyrud AQ, Bringslimark T. Is interior wood use psychologically beneficial? *Wood Fiber Sci*. 2010;42(2):202–218. Published in collection: *Wood Hum Stress Built Indoor Environ*. *Wood Sci Technol*. 2015;49:969–986.
33. Moser M, Frühwirth M, Messerschmidt D, Goswami N, Dorfer L, Bahr F, et al. Cardiorespiratory Interaction and Sleep in Wooden Beds. *Int J Environ Res Public Health*. 2021;18:9749.
34. Stevenson MP, Schilhab T, Bentsen P. Attention Restoration Theory II: a systematic review to clarify attention processes affected by exposure to natural environments. *J Toxicol Environ Health B*. 2018;21(4):227–268.
35. Park BB, An JY, Park SU. Recent studies on pinene and its biological and pharmacological activities. *EXCLI J*. 2021;20:812–818.
36. Van der Voordt T, Jensen PA. Healthy workplaces: What we know and what else we need to know. *J Corp Real Estate*. 2021;23(3–4):268–290.
37. Yildirim M, Gocer O, Globa A, Brambilla A. Investigating restorative effects of biophilic design in workplaces: A systematic review. *Intell Build Int*. 2023;15(5):205–247.
38. Montjoy V. Biophilic response to wood [Internet]. *naturally:wood* [cited 2026 May 1]. Available from: <https://www.naturallywood.com/resources/biophilic-response-to-wood/>