

# AN EAR FOR NATURE

PSYCHOACOUSTIC STRATEGIES FOR WORKPLACE  
DISTRACTIONS & THE BOTTOM LINE



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## CO-AUTHORS

William Browning      Terrapin Bright Green  
Dakota Walker        Terrapin Bright Green

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**TERRAPIN**  
BRIGHT GREEN

Terrapin Bright Green LLC  
New York NY | Washington DC  
[www.terrabinbrightgreen.com](http://www.terrabinbrightgreen.com)  
[biophilia@terrabinbg.com](mailto:biophilia@terrabinbg.com)

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# AN EAR FOR NATURE

## PSYCHOACOUSTIC STRATEGIES FOR WORKPLACE DISTRACTION & THE BOTTOM LINE

Over time, the human brain has evolved a sophisticated method of prioritizing the sound information that matters most. How we process auditory inputs from an open-plan office, though, is a relatively new provocation to our sensory system and a persistent industry challenge for designers, acousticians, and office managers.

Open-plan office designs are intended to support interaction and productivity. However, sound reflective surface materials and denser layouts amplify and reverberate office noise, contributing to workplace stress and distraction. Ringing telephones, office machinery, and co-worker conversations consistently rank highest among office distractors.<sup>1,A</sup>

### OPEN-PLAN OFFICE CULTURE

*Current trends in office design emphasize communal, flexible working spaces. But at what cost? A recent survey of office workers found 28% of respondents reported not having a quiet space to work in their office.<sup>21</sup>*

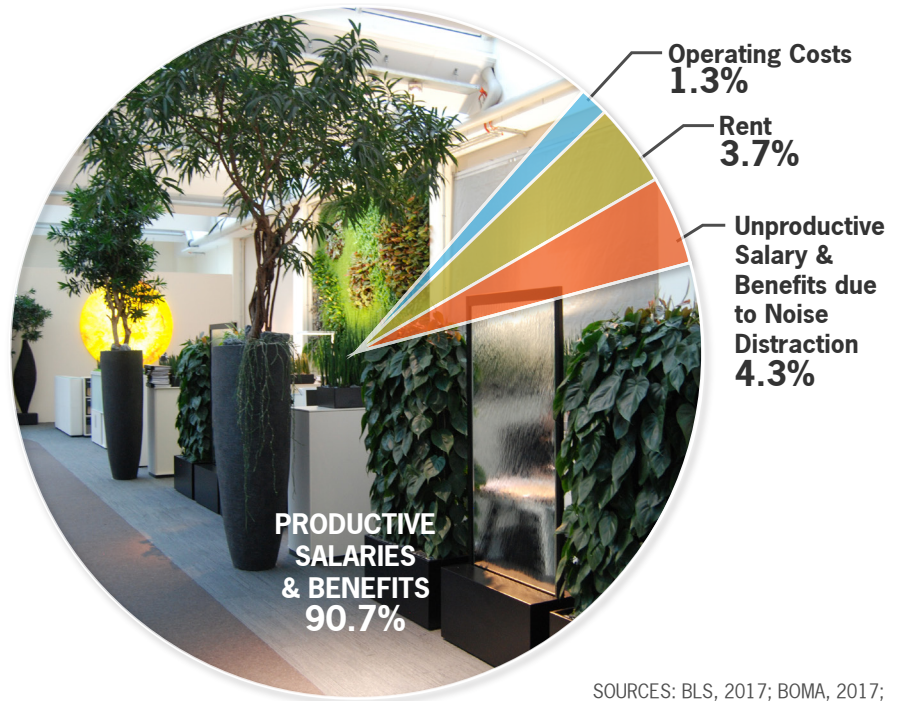
Image Credit: Plantronics



## ACTIVE ACOUSTIC TREATMENTS CAN REDUCE LOSSES FROM NOISE DISTRACTION

Employee compensation accounts for over 90% of operating costs per square foot. Noise distraction translates into less productive time at work and lower return on human resource investment. Conservatively, this can account for over 4% of a company's operating costs. Active acoustic treatment can improve acoustic satisfaction and the bottom line.<sup>c</sup>

Graphics credit: Terrapin Bright Green



SOURCES: BLS, 2017; BOMA, 2017; CoreNet Global, 2015; Haapakangas et al., 2008

**IT TAKES AN  
AVERAGE OF  
23 MINUTES  
TO RE-ENGAGE  
A TASK ONCE  
INTERRUPTED.<sup>20</sup>**

The prevalence of these sounds detract attention and lead to measurable reductions in higher-level tasks like ideation, reading comprehension, logical reasoning, and activation of prior knowledge in long-term memory.<sup>2,3,B</sup> Many field tests have shown a drop of 4–41% in cognitive performance due to these common office distractors.<sup>2,4</sup>

From a business standpoint, noise distraction and subsequent impaired productivity translates to measurable economic losses. On average, employee salaries and benefits account for more than 90% of a company's operating costs per square foot.<sup>5,6,7</sup> Conservative estimates indicate that office workers lose 21.5 minutes of productive time per day due to noise disturbance.<sup>8</sup> Given a company of 100 employees at an average yearly compensation of \$85,925, time lost due to noise distraction accounts for over \$386,000 squandered annually.<sup>5,8,D</sup>

## ACTIVE & PASSIVE ACOUSTIC MANAGEMENT

To recapture these losses and boost employee satisfaction, common practice has been to introduce passive or rudimentary active acoustic treatments into the workplace. Passive acoustic treatments leverage

the physical properties of a material to block, absorb, or deflect sounds. Examples include sound absorbent foam or flooring, acoustic panels, or earplugs. Active acoustic treatments generate additional sound to lower the intelligibility of speech. Strategies can include broad-band noise, music, or relying on ventilation systems to mask sound. Often, the two are used in tandem to address varying sound and room characteristics.

Effective acoustic treatment can significantly reduce noise distraction and associated dollars lost. In one study, self-reported time wasted decreased by more than 55% following the installation of an active acoustic treatment system.<sup>9</sup> Given the previously described scenario for a company of 100, the solution could translate to more than \$200,000 per year in productive salaries.<sup>F</sup>

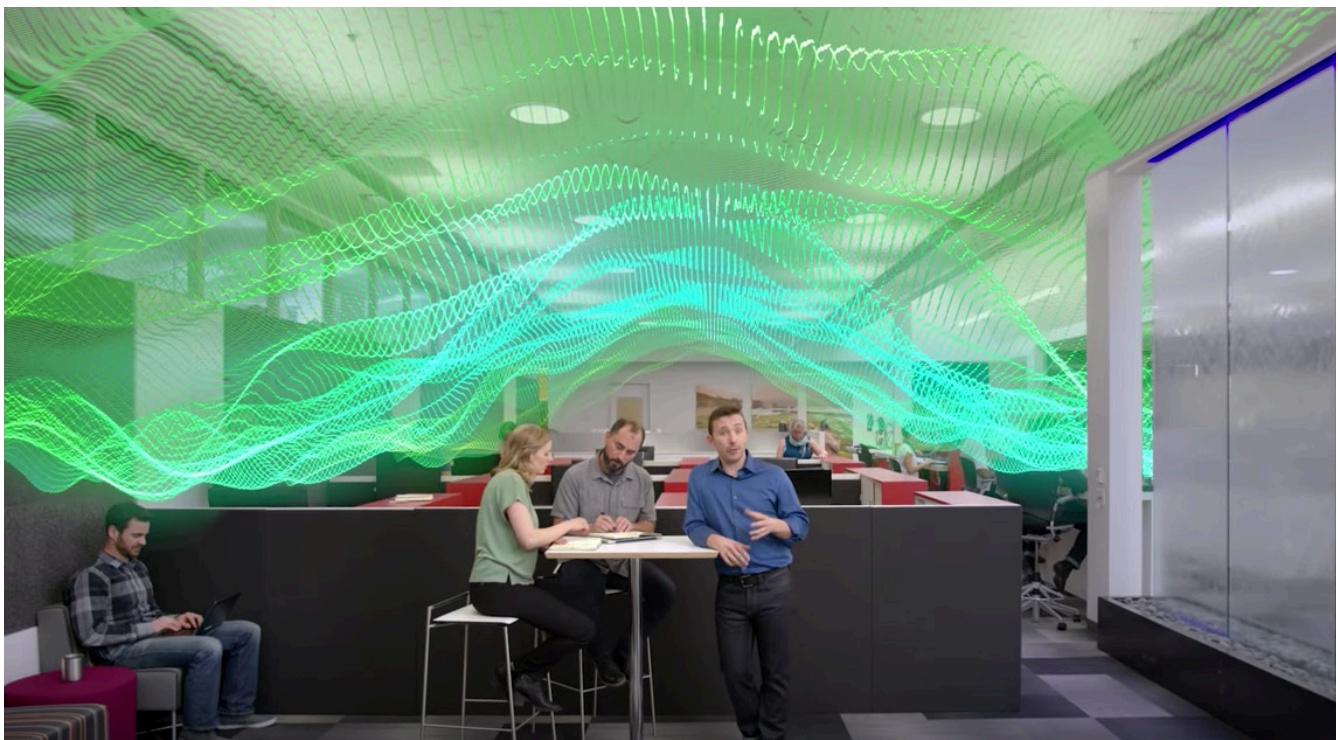
However, not all active acoustic treatments are the same. White or pink noise—broad-band noise commonly used in conventional sound-masking systems—can irritate listeners over time and may actually exacerbate stress and dissatisfaction in the workplace. Research has shown that prolonged exposure to broad-band noise can increase levels of corticosteroids and catecholamines. Chronic increases in these stress hormones and neurotransmitters can have effects ranging from

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### **DYNAMIC SOUNDSCAPES**

*As opposed to examining sounds in isolation, soundscapes encompass the many varied and dynamic sounds that form an acoustic environment. Plantronics Habitat Soundscaping system monitors workplace acoustics and adjusts speaker volume according to changing noise levels. Those surrounding a conversation experience an indiscernible increase in sound volume to counterbalance the noise distraction of the conversation.*

Image credit: Plantronics



higher blood pressure and increased incidence of coronary disease, to impaired higher brain functioning, learning, and short-term memory.<sup>10,11</sup> In at least two field experiments that introduced these sound-masking systems to office workers, participants rejected sound-masking systems altogether in favor of unmasked background noise.<sup>12,13</sup>

## SOUND PERCEPTION & HUMAN RESPONSE

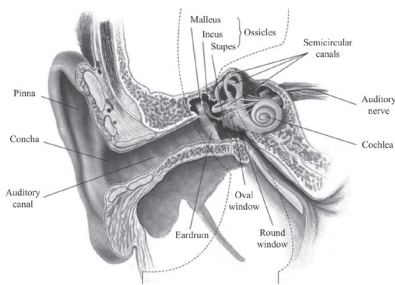
Conventional active acoustic strategies adhere to two key factors that conflict with their intended impact on the open-plan workplace experience: they frequently generate a fixed sound level and they do not take into account the difference between pure acoustics (properties of sound and sound transmission) and *psychoacoustics* (the science of sound perception and human response to sound).

Sound levels and spectrum are only partially responsible for characterizing an acoustic experience. More complex examinations of perception of sound have confirmed that sound level typically accounts for only 25% of the variance of a participant's annoyance with the sound.<sup>14</sup> The remaining 75% relies, in large part, on the subjective meaning we attach to each incoming sound—the way we *perceive* each sound.

For instance, at a crowded party, a room can be filled with conversations, music and other sounds, and yet we are able to focus on a specific conversation; this phenomenon is known as *the cocktail party effect*. While pure acoustics might explain the process of each sound in the room entering our ears, psychoacoustics grants us greater insight into why we are able to remain focused on the conversation at hand. The human voice is one sound we intuitively attach importance to—much to the detriment of office environments where job performance relies on tuning out co-worker conversation.

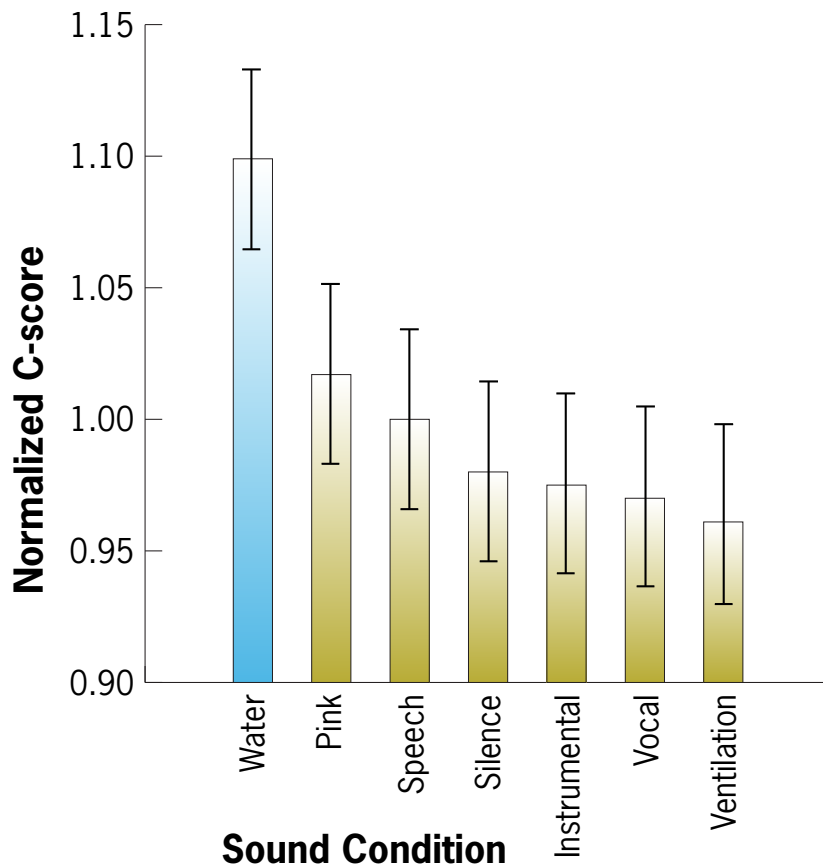
In addition to being able to give selective attention to human voices, we are particularly attuned to nature sounds. When compared to conventional white noise, natural soundscapes have shown to increase performance on tasks and improve positive perception of wellbeing.<sup>15</sup>

### PSYCHOACOUSTICS



Graphic Credit: Lin & Abdulla, 2015

Psychoacoustics is the science of sound perception. The peripheral auditory system, responsible for capturing sound, is just the first step in a complex neurological process needed to hear something. Our perception of a sound is based not just on sound spectrum and volume level, but also on the meaning we attach to the sound. The positive perception we attribute to most nature sounds allows these sounds to mask distracting noises more effectively, even at low volumes.<sup>15,19</sup>



## CREATIVITY

C-score is a measure of ideational originality, a key indicator of creativity. Participants in one study were given typical objects and asked to come up with alternative uses for each of the objects. The answers that were least common—i.e., more original or creative—among participants corresponded to a higher C-score. A score above 1.00 indicates better ideational originality than the mean of all seven sound conditions.

Data Source: Haapakangas et al., 2011

Natural water sounds, specifically that of a small stream, are reportedly the most effective at attracting our attention. From an evolutionary standpoint this makes sense; we can survive several weeks without food, but only three days without water. The cleanest drinking water tends to be in a stream flowing over rocks, so it is no surprise that such a sound would get a strong response. In a study of speech masking and cognitive performance, water outperformed four other masking sounds for serial recall and creative thinking.<sup>3</sup>

The masking properties of water are not the only characteristic that make for effective acoustic treatment. The perception of a water sound as being 'natural' has been identified as the key determinant to whether study participants perceived the sound as tranquil.<sup>16</sup> While water pouring into a basin has the highest acoustic masking characteristics, from a psychoacoustic standpoint, it is not as effective as water naturally flowing like a stream or small waterfall.

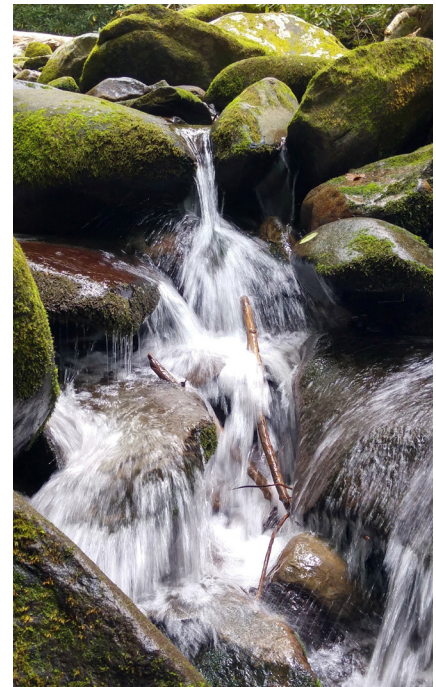


Image Credit: Anvesh Uppunuthula/Unsplash

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# For an office of 100 employees, 1 minute per worker per day of unproductive time due to noise distraction translates into \$18,000 per year\* in unprofitable employee compensation.

\*Assuming avg. salary for Professional and Business Services (Bureau of Labor Statistics, 2017)

## ECONOMICS OF NOISE DISTRACTION

*Given an office of 100 employees, employers spend \$8,592,500 per year, or approximately \$69 per minute on employee compensation.<sup>5</sup> Losing one minute per day can add up to over \$18,000 per year in unprofitable employee compensation. Effective acoustic treatment has been shown to decrease time lost due to noise distraction, allowing businesses to profit on a greater percentage of their investment in employees.*

Data Source: Bureau of Labor Statistics, 2017

## A MULTISENSORY WORKPLACE EXPERIENCE

Beyond addressing office acoustics, the key to an improved workplace environment is to recognize wellbeing as the aggregate of all our senses. A 2010 study showed that our judgement of tranquility relies on the harmonization of both auditory and visual inputs.<sup>17</sup> Water sounds broadcast synchronously with a video of running water resulted in participants reporting greater restoration, and outperformed all other tested sounds, even that same water sound without video pairing.<sup>18</sup>

Active acoustic treatments that combine visual and auditory experiences of water, like the Plantronics Habitat Soundscaping, leverage our innate multisensory connection with nature to enhance the workplace experience. Such enhancements can create dynamic work environments and promote a satisfied and productive workforce.

## DOLLARS & SENSE

While companies may easily quantify savings associated with workplace densification, the subsequent dollars lost to noise distraction can be a more subtle drain on yearly profits. Additionally, employees themselves consistently favor job opportunities that emphasize improved quality of life. In fact, in one survey of 7600 office workers, 33% of respondents noted workplace design as influencing their decision to work at a company.<sup>21</sup> These findings signify actionable insight that could aid in the recuperation of hundreds of thousands of dollars in productive time spent in the workplace.

To effectively improve the acoustic environment—and, thus, the return on investment—technological solutions should consider the meaning we attach to sound and our associated psychological response. Using multisensory technology and insights from psychoacoustics to create



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effective soundscapes in office settings may be the next innovation to both enrich our wellbeing and differentiate the open-plan workplace experience. □

## FOOTNOTES

- A. *Workplace Distraction Reporting*: A recent survey by Udemy (2018) found that 70% of office worker respondents cited office noise as the top distractor in offices.<sup>1</sup>
- B. *Sound Transmission Index*: Sound Transmission Index (STI), or the degree to which background speech is intelligible, is used to quantify distraction. Measured on a scale of 0–1, STI has been found to predict degraded cognitive performance starting at 0.2 with the greatest effects at 0.6.<sup>2,4</sup>
- C. *Pie Chart Calculations*: The pie chart illustrates annual operating expenses per square foot, comprised of rent, office operational costs, and total employee compensation. BOMA (2017) found average office rent to be \$21.98/sqft and office operational expenses to be \$8.07/sqft. To determine employee compensation per square foot per year, the average total compensation (salary and benefits) for an employee in the Professional and Business Services sector (\$85,925) was divided into expected average space per worker (151sqft by 2017) to get \$569.04/sqft.<sup>5,8</sup> On average, time lost due to noise distraction amounts to 21.5 minutes per employee per day, equivalent to 4.5% of employee compensation or 4.3% of a company's annual operating expenses.<sup>8</sup>
- D. *Money Wasted Due to Noise Distraction*: Given an office with 100 employees at an average yearly compensation of \$85,925, we determined annual employee costs to equal \$8,592,500. With noise distracting employees for 21.5 minutes per day, or 4.5% of their time working, approximately \$386,663 is squandered as unproductive time due to noise distraction.<sup>5,8</sup>
- E. *Recouped Losses Due to Effective Sound Masking*: Self-reported noise distraction was found to decrease from 14 to 6 minutes.<sup>9</sup> Given this 55% decrease, and the calculated cost of noise distraction for a 100 employee office, we calculated noise distraction abatement to potentially grant \$212,665 in recouped losses due to time wasted.

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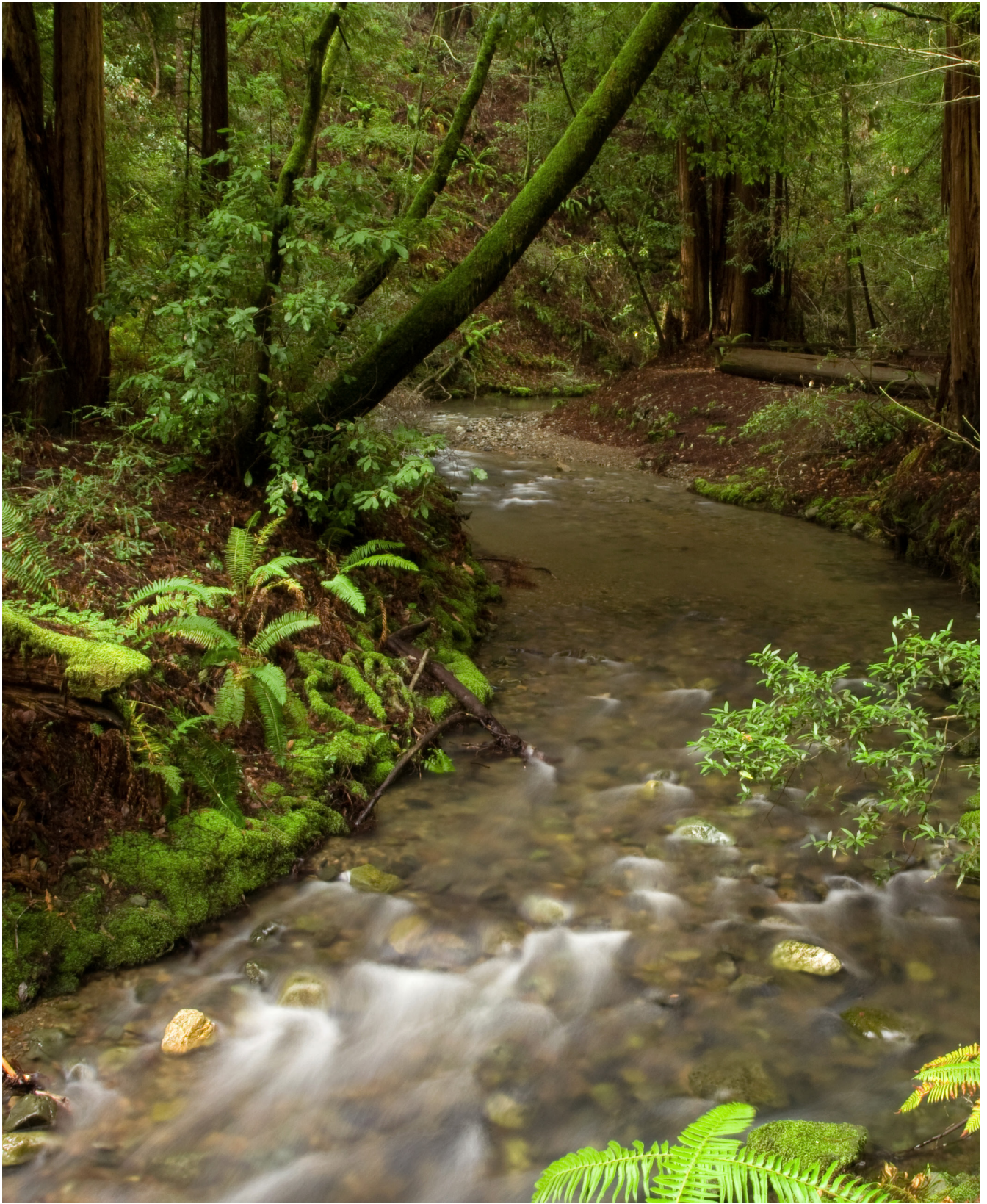


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