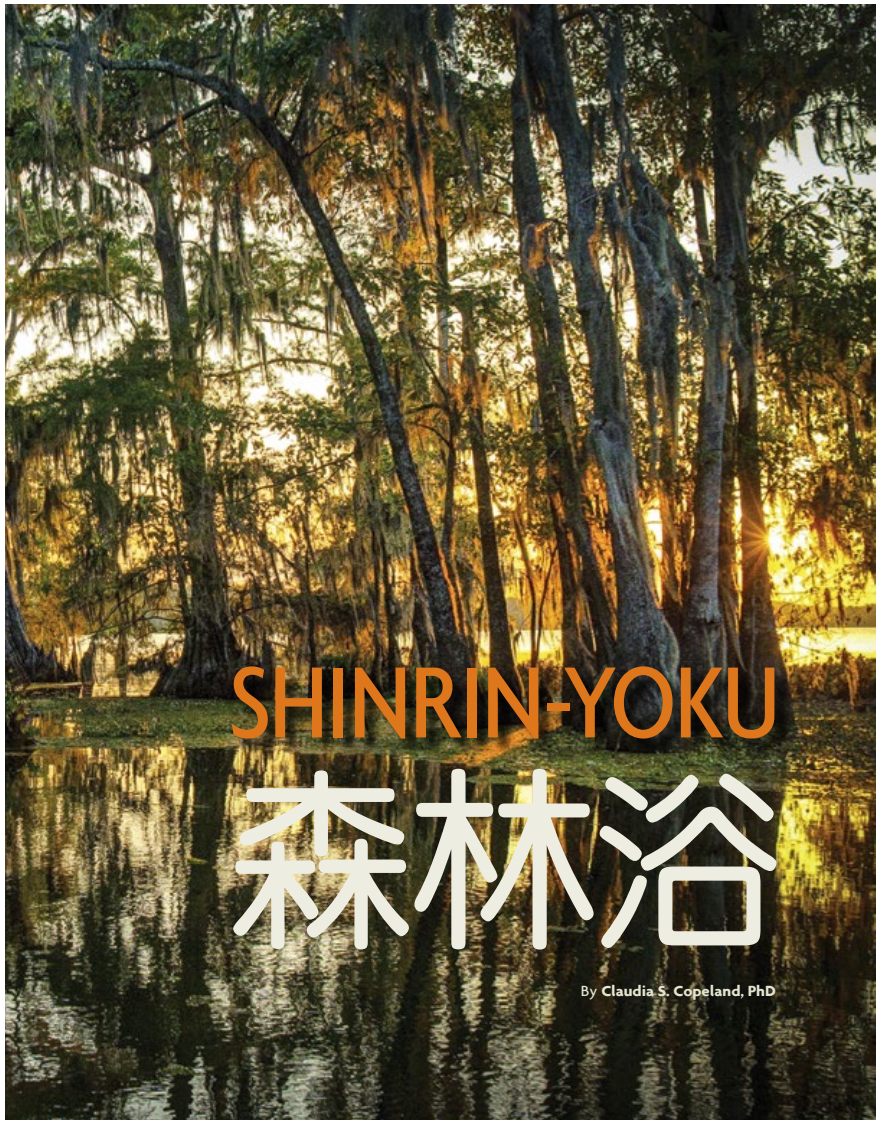
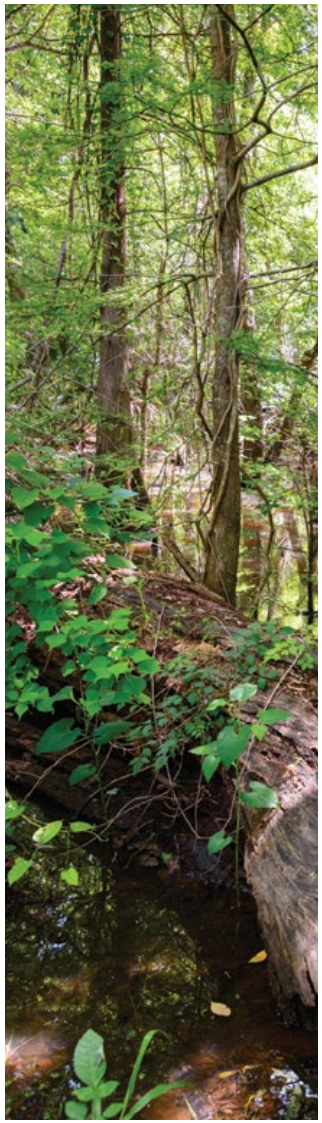


SHINRIN-YOKU
森林浴

By **Claudia S. Copeland, PhD**

Time in nature as a wellness practice is as old as history itself. Hippocrates, more than 2,000 years ago, stated it plainly: "Nature itself is the best physician". However, in today's high-tech world, we tend to view time in nature as a pleasant pastime at best and, at worst, an irresponsible indulgence—a guilty pleasure when there are so many more important things to do. When pressed, though, even the busiest of us would concede that health should be among our topmost priorities. So, can spending time in nature truly be considered a high-priority wellness activity, alongside other lifestyle health practices like exercise and good nutrition? According to recent research from Japan, the answer to that question is a resounding "yes", at least when it comes to spending time in a forest.

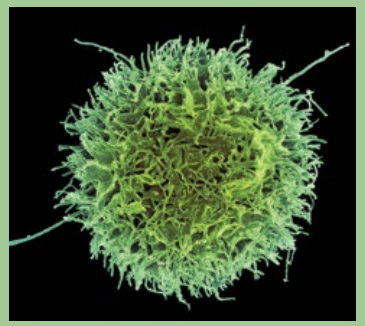


Lake Fausse Pointe State Park, Louisiana

THE JAPANESE PRACTICE of shinrin-yoku (森林浴), translated into English as "forest bathing", is the practice of mindfully walking in the environment of a forest for the sake of one's health. Somewhat different from hiking, shinrin-yoku is a slow, meditative immersion in the forest environment. Intrinsic to the practice is taking time to appreciate the richness of a living ecosystem, with all the senses: breathing the air, mindfully seeing the forest's natural beauty, feeling the roughness of bark or smoothness of stones, and listening to the sounds of the living and nonliving elements that make up an arboreal ecosystem. On a shinrin-yoku walk, you might stop to watch a column of leaf-cutter ants on the march, or take in the glint of sunlight on a spider weaving her web. You might slow your pace to listen to the rapid-fire tapping of a woodpecker hidden in the foliage overhead, or the gentle murmur of a stream flowing through rocks and logs, all while mindfully breathing in the scents of the forest air. Recently, the physiological effects of this practice have been studied scientifically, and biomedical researchers have found significant health benefits, ranging from lowered blood pressure to increased immune cell activity and expression of anticancer proteins.

Volatile Organic Compounds

One prominent explanation for the health benefits of shinrin-yoku is immersion in the volatile organic compounds–experienced as smells–of the forest. Many of these compounds, known as phytoncides or wood essential oils, are antimicrobial, and laboratory evidence has supported their ability to stimulate the immune system. Researcher Qing Li of the Nippon Medical School in Tokyo has looked into this aspect of forest bathing, both in the lab and in the field. In the lab, he and his associates have found that compounds such as alpha-pinene, 1,8-cineole, and d-limonene enhance antimicrobial immune activity in cell culture. The compounds do this in a dose-dependent manner, and are also able to partially counteract



By NIAID (Human Natural Killer Cell)

"Looking at measures of immune function before and after walking in a forest, they found increased numbers of natural killer (NK) cells, which kill tumor or virus-infected cells, as well as increased NK activity and intracellular perforin-, GRN-, and GrA/B-expressing lymphocytes, known mediators of NK activity."

a decrease in immune activity induced by dichlovos, an organophosphorus pesticide. In cell culture, they also worked as preventatives: pretreatment of the cells with the phytoncides lowered the immune activity reduction induced by subsequent dichlovos exposure. Brazilian researchers da Silva et al. found that volatile oil from Zanthoxylum rhoifolium, used in South American traditional medicine as an anti-inflammatory and malaria treatment, and the phytoncide compound beta-caryophyllene, increased anti-tumor immune activity and significantly increased survival time in tumor-bearing mice. Similar positive effects, including improved immune activity and reduced oxidative stress, have been identified from several other phytoncides.

To better understand the effects of forest immersion on humans in realistic conditions, Dr. Li and his associates followed their cell culture experiments with field studies. One group of subjects spent time walking in a forest, shinrin-yoku style, while a comparison "city tourist" group walked in an urban setting for the same amount of time, to control for the effect of exercise. Looking at measures of immune function before and after walking in a forest, they found increased numbers of natural killer (NK) cells, which kill tumor or virus-infected cells, as well as increased NK activity and intracellular perforin-, GRN-, and GrA/B-expressing lymphocytes, known mediators of NK activity. These increases were not fleeting; they lasted for more than 7 days, with some increases still evident 30 days later. The control subjects, who spent time walking in a city, did not show any of the increased immune indicators.

Stress management and psychological well-being

Although volatile organic compounds have been shown to increase NK activity, another factor may be at work in the forest: stress. The stress hormones adrenaline and noradrenaline (epinephrine and norepinephrine) are associated with decreased immune function, including NK activity. Qing Li's group compared levels of these neurohormones in the "city tourist" walkers and forest bathers, and found significantly lower levels of both stress hormones in the forest bathers. The decrease in adrenaline after spending 1-2 days in the forest was particularly dramatic in female subjects: adrenaline levels had dropped to nearly 1/3 of their baseline levels by the end of the second day spent in the forest.

Another group of Japanese researchers, Chiba-based University and Forestry Institute collaborators Park at al., also compared subjects spending time in a forest vs. a city area (sitting and walking for timed periods). To ensure that their results were not restricted to any specific location, they conducted the studies in 24 different Japanese forest environments. As an added control, they switched the groups so that comparisons could be made between the same subjects in the different environments, as well as between groups. Before, during, and after sitting and walking in the urban or forest environment, a number of parameters were measured, including salivary cortisol concentration, heart rate variability (time between R waves on an electrocardiogram), sympathetic and parasympathetic nervous activity, blood pressure, and heart rate. In addition, psychological response was measured using the Profile of Mood States (POMS).

When the subjects spent time in the forest environment, several of the measures of stress went down. Cortisol concentrations, pulse rate, blood pressure, and sympathetic nervous activity were significantly lower, and parasympathetic nervous activity was higher, after subjects spent time in the forest, compared with time in the city. Psychologically, as measured by the POMS, subjects showed improved psychological condition on the scales of tension, depression, anger, fatigue, and confusion, as well as enhanced psychological vigor, when spending time in the forest, compared with their scores after spending time in a city environment.

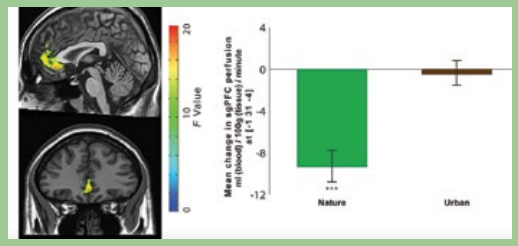
In Zhejiang, China, a mixed team of hospital-based and forestry-based researchers, Xiang et al., conducted a similar study, comparing students who were immersed in a forest environment, the Wuchao Mountain Forest, or an urban environment located nearby (15 km away). In accord with the results from Japan, they found that the forest-immersion group had significantly better immune profiles, lower stress indicators, and more positive psychological states as measured by the POMS, including tension-anxiety, depression-dejection, anger-hostility, vigor-activity, and fatigue-inertia. In addition, they looked at the cardiovascular indicator ET-1, a powerful vasoconstrictor associated with cardiovascular disease. ET-1 levels were significantly lower in the forest bathers than in the urban group.

Outside of East Asia, other research has supported the folk wisdom that time in nature builds psychological well-being. Stanford researcher Gregory Bratman and an international team of collaborators looked at activity in the subgenual prefrontal cortex, which is associated with a maladaptive pattern of self-referential thought that heightens the risk for depression and other mental illnesses. After a 90-minute walk in a natural environment, differences in regional cerebral bloodflow in the subgenual prefrontal cortex could be detected by neuroimaging, compared with control subjects who walked the same distance along an urban street in the same time frame. They also found, in a separate study, that subjects who had just completed a nature walk had better scores in certain cognitive and affective measures, including verbal working memory and anxiety, than those who had just completed an urban walk.

Diabetes

While little research has been done specifically on diabetes and shinrin-yoku, one study by Hokkaido University researchers Ohtsuka et al. found that blood glucose levels declined by 74 and 70 mg/dl in diabetic patients taking short and long walks in a forest. The decreased blood glucose levels were significant, but there was no control group, so the improvement could have been due simply to the exercise, rather than the forest. The authors do discuss this issue, however. They present expected levels of glucose decline based on the amount of exercise activity from the walks, and compare this with the greater decrease seen in the forest-walking patients. They conclude that the levels of blood glucose decline that they saw are greater than those that would be expected solely from the exercise of the walks.

Regardless of whether the effects are due to exercise, time in the forest, or a combination of both, what is clear is that shinrin-yoku walks can lower blood glucose levels in diabetic patients–all without any



Regional cerebral bloodflow in the prefrontal cortex is significantly different after walking in nature, compared with walking along an urban road.

Image originally published in: Bratman et al., 2015: Nature experience reduces rumination and subgenual prefrontal cortex activation. PNAS; 112(28):8567-72. Used by permission.

"After a 90-minute walk in a natural environment, differences in regional cerebral bloodflow in the subgenual prefrontal cortex could be detected by neuroimaging, compared with control subjects who walked the same distance along an urban street in the same time frame."

Both Arkansas and Louisiana are home to large swaths of forest, including the Ouachita and Ozark National Forests in Arkansas and the Kisatchie National Forest in Louisiana.

But you don't need to go far to go forest bathing: smaller tracts of forest can be just as conducive to shinrin-yoku as large wildlife reserves. In less than 45 minutes' driving time, New Orleanians can reach the Bayou Sauvage national wildlife refuge or the Barataria Preserve of Jean Lafitte National Park. Other trails throughout Louisiana can be found at: ‹https://www.alltrails.com/us/louisiana›.

negative side effects and substantial positive side-effects in terms of enhanced mental health and immunity.

Beyond Japan — the growing practice of global shinrin-yoku

While the Japanese may have been the first to formally propose shinrin-yoku as a practice, the general idea that being outdoors is healthy has long been around in other cultures. Throughout the world and throughout history, the belief that spending time in nature is healthy has been strong, despite its lack of a formal name. So, it should not be surprising that the more deliberate Japanese version of the practice–which combines elements of meditation with light exercise and time in nature–is catching on rapidly throughout the world.

The North American Association of Nature and Forest Therapy, the Spanish Asociación Europea Shinrin-Yoku, and the Australian In My Nature all provide training programs and support for the global practice of this Japanese art. Shinrin-yoku guides are increasingly advertising their services in corners of the world far from the centers of the practice in Japan, Europe, and the United States. If you're in Johannesburg, shinrin-yoku South Africa will be happy to provide guided natural immersion walks nearby; in Ontario, Ben Porchuk of Restorative Nature Experiences can guide you in the Canadian forest; in Siem Riep, Cambodia, the Navutu Dreams wellness resort provides guided forest bathing in the Angkor Archeological Park.

Closer to home, in Abita Springs, Louisiana, Rue McNeill, the executive director of the Northlake Nature Center, gives guided shinrin-yoku tours, as well as a number of focused forest walks: "We do several 'walks' in the woods, " she explains. "Our 'Nature Walk & Titivation' is done about three times a month–it goes with trimming the trails. Our 'Walk in the Woods' program is done four times a year–a seasonal tree and plant identification walk. Our 'Bird Watch thru the Woods' is done twice a year, with bird migration in the spring and fall, with avid bird guides." In addition, "we take people into the woods via biking with our 'Biking the Back Trails', a 7 mile bike ride, and kayaking or canoeing on our bayou goes through very scenic woody areas. The benefits are amazing; as participants comment afterwards, 'How invigorating and uplifting!'" ■