Forest Bathing 2.0: The Art and Science of Shinrin-Yoku

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Keynote presentation

Forest Bathing and Forest Medicine
The Impact of Shinrin-Yoku on Wellness

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The book also was published in USA under the title of **Forest Bathing** on April 17, 2018 by Viking Books.

1. A Higher Loyalty
James B. Comey, Flatiron, $29.99, 9781250192455

2. Fascism: A Warning
Madeleine Albright, Harper, $27.99, 9780062802187

3. Educated
Tara Westover, Random House, $28, 9780399590504

4. I’ll Be Gone in the Dark
Michelle McNamara, Harper, $27.99, 9780062319784

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Mark Manson, Harper, $24.99, 9780062457714

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Neil deGrasse Tyson, Norton, $18.95, 9780393069394

7. Natural Causes
Barbara Ehrenreich, Twelve, $27, 9781455535910

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*9. Born a Crime
Trevor Noah, Spiegel & Grau, $28, 9780399588174

*10. BirdNote: Chirps, Querks, and Stories of 100 Birds from the Popular Public Radio Show
BirdNote, Emily Poole (Illus.), Sasquatch Books, $28, 9781611221666

Qing Li, Viking, $20, 9780525559856

12. 12 Rules for Life
Jordan B. Peterson, Random House, $25.95, 9780345816023

*13. The Gentle Art of Swedish Death Cleaning
Margareta Magnusson, Scribner, $18.99, 9781501173240

*14. So You Want to Talk about Race
Ijeoma Oluo, Seal Press, $27, 9781580056779

*15. Braving the Wilderness
Brene Brown, Random House, $28, 9780812995848
Why is Shinrin-Yoku so popular in the world?

Because Shinrin-Yoku has changed From a Feeling to a Science
What is forest bathing (Shinrin-yoku)?

- *Shinrin* in Japanese means ‘forest’, and *yoku* means ‘bath’. So *shinrin-yoku* means bathing in the forest atmosphere, or taking in the forest through our senses. This is not exercise, or hiking, or jogging. It is simply being in nature, connecting with it through our sense of sight, hearing, taste, smell and touch.

- Shinrin-yoku is like a **bridge**. By opening our senses, it bridges the gap between us and the natural world.
Why do people love (like) forests?

- The forest environment has been enjoyed by humans for a long time because of
  - The quiet atmosphere
  - The beautiful scenery
  - The mild climate
  - The clean fresh air in the forest
  - The special good smell
How to enjoy forest bathing

• People can enjoy forest bathing through five senses:
  • **Sense of sight**: green color, forest landscape
  • **Sense of smell**: special good smell, fragrance, phytoncides
  • **Sense of hearing**: forest sounds, birds song
  • **Sense of touch**: Touching trees, put your whole body in the forest atmosphere,
  • **Sense of taste**: Eating foods from forest, taste the fresh air in forest.
Why Shinrin-yoku? and the background
Stress and Shinrin-yoku

- **Stress** can induce almost all lifestyle-related diseases, such as:
  - cancers,
  - hypertension,
  - depression,
  - cardiovascular diseases (myocardial infarction),
  - stroke (cerebral haemorrhage),
  - gastric ulcer,
  - obesity,
  - alcoholism,
  - panic disorder,
  - eating disorder,
  - You name it.

- On the other hand, **Shinrin-yoku** can reduce stress.
Why Shinrin-yoku? and the background

- Based on the above background, in Japan, a national health programme for forest-bathing was proposed by the Forest Agency of Japan in 1982 for reducing stress in workers.

- In 2004, the Forest Agency of Japan organized the project team to investigate the effect of shinrin-yoku on human health (about 1.5 million dollars).

- I was invited as a main member of the project team.

- Some people study forest, some people study medicine, I study forest medicine to find the beneficial effects of forest bathing on Wellness.
My hypothesis

Relationship between Shinrin-yoku/forest bathing and immune function

- It is well known that immune system including natural killer (NK) cells plays an important role in defense against bacteria, viruses and tumors.
- It is also well known that stress inhibits immune function.
- Forest environment (Shinrin-yoku/forest bathing) may reduce stress.
- Therefore, I speculated that forest environment (Shinrin-yoku/forest bathing) may have beneficial effect on immune function by reducing stress.
Natural killer (NK)
The relationship between incidence rate of cancer and NK activity was studied by Kazue Imai et al. in Lancet 2000; 356: 1795–99. The study involved 3625 subjects and had a follow-up period of 11 years.

People with lower NK activity show higher incidence rate of cancer, whereas people with higher NK activity show lower incidence rate of cancer in both males and females. From these findings, one can find the importance of NK cells for human health.

Kazue Imai, et al.
Subjects: 3625
Periods of follow-up: 11 years
Mechanism of NK-induced tumor cell death

Granzymes, perforin and granulysin are anti-cancer proteins

GrA, GrB, Gr3/K, GrH, GrM

NK

Granzymes

Perforin

Granulysin

(Tumor cell)

Ca\textsuperscript{++}↑, K\textsuperscript{+}↓, AIF, Cyto-C release

Tumor cell death

Anti-cancer proteins
Today’s topics

1. Effect of Shinrin-yoku on human immune function
2. Effect of Shinrin-yoku on stress hormones
3. Effect of Shinrin-yoku on psychological responses
4. Effect of Shinrin-yoku on blood pressure and heart rate
5. What is Forest Medicine
6. The Impact of Shinrin-Yoku on Wellness
7. The future development of Forest Medicine
Effect of **Shinrin-yoku** on human immune function

Preventive effect of **Shinrin-yoku** on cancers
The first forest bathing/shinrin-yoku study in Japan (in the world)

- In 2005, I conducted the first forest bathing study in Iiyama city, Ngano

- The terms of forest bathing and Shinrin-yoku in English were first used and defined in this paper.
Subjects were taking a rest in the forest in 2005
Big Japanese cedar Forest
Shinrin-yoku significantly enhances human NK activity in males

* p<0.05, ** p<0.01, from before the trip, #: p<0.05 from Day 1

A trip to a place without forest does not enhance human NK activity in males

Question

• Q: Why do Shinrin-yoku increase human NK activity?

• A1: The number of NK cells increased.↑
• A2: The intracellular anti-cancer proteins increased.↑
Shinrin-yoku significantly increased the number of NK cells in males


**p<0.01, significantly different from before the trip, #: p<0.01 significantly different from Day 1
Shinrin-yoku significantly increased granulysin (GRN), perforin, granzyme (Gr) A/B-expressing cells

The 2\textsuperscript{nd} and 3\textsuperscript{rd} forest bathing/shinrin-yoku study in Japan (sustained effect of forest bathing)

- In 2006 and 2007, I conducted the second and third forest bathing study in Akasawa (the birthplace of forest bathing in Japan) and Shinano town, Ngano prefecture to investigate the sustained effect of forest bathing and the results were published as follows:
Japanese cypress (the birthplace of forest bathing in Japan)
The birthplace of forest bathing in Japan

There are no mosquitos in the forest!!
Learning breathing method
Female subjects enjoy the Forest Therapy
Shinrin-yoku increased NK activity and this effect lasted for 30 days in both males and females.

*: p<0.05, **: p<0.01, from before the trip

**Shinrin-yoku** increased the number of NK cells and this effect lasted for 30 days in both **males and females**.

![Bar chart showing the increase in NK cells](chart.png)

* *: p<0.05, **: p<0.01, from before the trip

**Shinrin-yoku increased** intracellular anti-cancer proteins and this effect lasted for 30 days in both males and females.

*:* p<0.05, **: p<0.01, from before the trip

Effect of **Shinrin-yoku** on stress hormones
Shinrin-yoku reduced urinary adrenaline, whereas a city tourist trip did not affect this.

Adrenaline is a stress hormone.

Shinrin-yoku reduced urinary adrenaline and noradrenaline in females

Adrenaline and noradrenaline are stress hormones.

**p<0.01  Li Q. et al., J Biol Regul Homeost Agents 2008;22(1):45-55.
Shinrin-yoku reduced cortisol in serum in males

Cortisol is another stress hormone

N=16, mean ± SE.
**: p<0.01, #: p=0.053

Li Q, et al. A day trip to a forest park increases human natural killer activity and the expression of anti-cancer proteins in male subjects.
Stress and immune response

Shinrin-yoku
↓
Reducing stress
↓
Recover in NK activity
↓
NK activity increased
Effect of Shinrin-yoku on psychological responses
Shinrin-yoku reduces the scores of anxiety, depression, anger, fatigue and confusion, whereas increase the score of vigor.

**POMS test  Mean+SE (n=53)**

**Before**  **After**

Anxiety  Depression  Anger  Vigour  Fatigue  Confusion

****: p<0.01 significantly different from before

Li Q. Forest Medicine, 2012
Effect of Shinrin-yoku on blood pressure and heart rate
Control experiment (urban tour)
Shinrin-yoku significantly reduces blood pressure compared with city walking

Blood pressure was decreased about 7-8mmHg by forest bathing

SBP: Systolic blood pressure, DBP: Diastolic blood pressure

*: p<0.05, **: p<0.01 forest vs city (n=16)

Shinrin-yoku reduced heart rate

Heart rate is a basic index of activity of the autonomic nervous system, the decrease in heart rate indicates a state of relaxation with a higher activity of parasympathetic nerve and lower activity of sympathetic nerve.

* p<0.05, ** p<0.01 vs shinrin-yoku (n=19)

Mechanism of Shinrin-yoku on blood pressure

Shinrin-yoku

- Adrenaline↓
- Noradrenaline↓
- Cortisol↓

- activity of sympathetic nerves ↓
- activity of parasympathetic nerves ↑

Stress ↓

Blood pressure↓
New science
Forest Medicine
On July 5, 2010, The New York Times reported our studies and cited 4 papers:


After this report, a publisher in NY invited me to write a book: *Forest Medicine* and the book was published in 2012.
What is Forest Medicine

• Since 2004, we have conducted many studies to investigate the effect of forest bathing on human health.
• We have established a new science, Forest Medicine and published the book: Forest Medicine in 2012.
• Imagine a new medical science that could let you know how to be more active, more relaxed and healthier with reduced stress and reduced risk of lifestyle-related disease and cancer by visiting forests. This new medical science is called Forest medicine.
• Forest Medicine is a new, interdisciplinary science, belonging to the categories of environmental medicine and preventive medicine, which studies the effects of forest environments on human wellness.
Forest Medicine (Editor: Dr. Qing Li)

English edition (2012 in USA)


The Impact of Shinrin-Yoku on **Wellness**

◆ Increase the activity of natural killer cells—immune cells that play an important role in defense against bacteria, viruses, and tumors;

→ has a potential preventive effect on cancers

◆ Reduce blood pressure and heart rate;

→ has a potential preventive effect on hypertension, cardiovascular diseases

◆ Reduce stress and stress hormones;

→ has a effect on stress management

◆ Increase the activity of the parasympathetic nervous system (part of rest and recover) and reduce the activity of the sympathetic nervous system (part of fight or flight), producing psychologically calming effects;

→ has a potential preventive effect on depression and mental disorders
The Impact of shinrin-yoku on **Wellness**

◆ Reduce symptoms of anxiety, depression, anger, fatigue, and confusion;
→ **has a potential preventive effect on depression**

◆ Improve sleep;
→ **has a potential preventive effect on sleep disorder**

◆ Increase energy;
→ **keeps health status**

◆ Potential preventive effects on lifestyle related diseases by reducing stress.
The future development of Forest Medicine

Based on the above background, I would like to propose the future development of Forest Medicine.

1. To expand the philosophy of Forest Medicine into global wellness field in the world.
2. To verify the preventive effects of Forest Medicine on lifestyle-related diseases in the world.
3. To establish an international certification system for Forest Medicine specialist and Forest Therapist.
4. To establish the Shinrin-yoku/Forest bathing as a treatment for some lifestyle-related diseases.
5. To apply the Shinrin-yoku/Forest bathing into rehabilitation medicine.
The Society of Forest Medicine established in 2007
President: Dr. Qing Li
International Society of Nature and Forest Medicine (INFOM) established in 2011

http://infom.org

President: Dr. Michiko Imai

Vice-President & Secretary-General: Dr. Qing Li
Forest Therapy Society in Japan
http://www.fo-society.jp
Chairman: Dr. Kiyotaka Segami
Director: Dr. Qing Li
驚異の「森林パワー」
ストレスを解消

ガント細胞を傷害する
機能が高められた
‘Forest therapy’ taking root

Researchers find that a simple stroll among trees has real benefits

Akira Nakamura

For stressed-out workers, this may sound like a prescription: Walk around in the woods.

Scientists in Japan have been learning a lot in recent years about the relaxing effects of forests and trees on mental and physical health. Based on their findings, some local governments are promoting ‘forest therapy.’

Experience shows that the scents of trees, the sounds of brooks and the feel of sunshine through forest leaves can have a calming effect, and the conventional wisdom in sight, right, Yoshifumi Miyazaki, director of the Center for Environmental Health and Field Sciences at Chiba University.

Japan’s leading scholar on forest medicine has conducted physiological experiments in examine whether forests can make people feel ease.

A study he conducted on 360 people at 50 sites in 2005 and 2006 found that the average concentration of salivary cortisol, a stress hormone, in people who gazed on forest scenery for 30 minutes was 24 percent lower than that of people in urban settings. Miyazaki said that forests can lower stress and make people feel ease, he said, noting that findings in other physiological experiments, including fluctuations in heart beats and blood pressure, support this conclusion.

“Humans have lived in nature for 5 million years. We were made to fit a natural environment. So we feel stress in an urban area,” Miyazaki said. “When we are exposed to nature, our bodies go back to how they should be.”

Taking a walk in a forest, or “forest bathing” as it is sometimes called, can strengthen the immune system, according to Li Qing, a senior assistant professor of forest medicine at Nippon Medical School in Tokyo.

Li conducted experiments to see whether spending time in a forest increases the activity of people’s natural killer (NK) cells, a component of the immune system that fights cancer.

In one, 12 men took a two-night trip in a forest in Nagano Prefecture in 2005, during which they ran on three-lei morning and stayed in a hotel in the woods. Thirteen female volunteers made a similar trip to another forest in the prefecture in 2007.

NK activity was boosted in the subjects in both groups, and the increase was observed as long as 30 days later, Li said.

“When NK activity increases, immune strength is enhanced, which boosts resistance against stress,” Li said, adding that forest therapy for immune-compromised patients may be developed within a few years.

Li said the increase in NK activity can be attributed partly to inhaling air containing phytoncides, or essential oils given off by plants.

Miyazaki of Chiba University said forests greatly the five senses by providing the sounds of birds, cool air, green leaves, the touch of trees, wild plants and gruzzes.

“The atmosphere of forests makes people calm,” he said.

Based on studies on the effects of forests, the public and private sectors are now promoting forest therapy: The Forest Therapy Executive Committee, a group of researchers, other intellectuals and the government-affiliated National Land Afforestation Promotion Organization, started officially recognizing certain forests by granting the designations of Forest Therapy Base and Forest Therapy Route in 2006. The titles are given to places that have been found by researchers through scientific evidence to have relaxing effects.

Officials from the Forest Agency and the Health, Labor and Welfare Ministry participate in the group as observers. A forest therapy base comprises a forest and walking paths typically managed by local governments.

In Japan and four road nationwide have gained such recognition.

Visitors to some of the therapy bases and roads have the option of taking part in various health programs, including medical checkups, breath analysis and aromatherapy classes, and guided walks with experts on forests and health care.

At the Akama Natural Recreation Forest in Aomori Prefecture, which was recognized as a forest therapy base in 2009, visitors can get free medical checkups among Japanese cypress trees on Thursdays.

The forest is known as the Japanese birthplace of the concept of forest bathing in health care.

Some companies have come to use forest therapy for their employees’ health care.

The Shimano Municipal Government in Nagano Prefecture, which manages the Yarishino No Mori (Healing Forests) forest therapy base, has contracts with four companies, a town office and a hospital.

Visitors to the forest therapy base can take part in various programs, including dietary management, hydrotherapy and aromatherapy.

The formal designations have drawn more people to such towns.

The Ogata Municipal Government in Yamagata Prefecture said 1,280 people visited the Narakamibara beach forest there in fiscal 2007, including some 38 people who took part in forest walking tours with “natural” traditional hunters.

“The increase in visitor numbers is becoming apparent,” said Juno Watanabe, a town official in charge of forest therapy.

Speculation: A big help

Chiba University’s Miyazaki said he hopes that forest therapy will draw more people into nature and spread the benefits of walking in the woods.

“Some people like broadleaf forests and others prefer forests of coniferous trees like cedar,” Miyazaki said. “But we are all human beings and we all have a strong bond with nature.”

For more information about forest therapy bases and roads, visit the Japan Forest Therapy Association or the Ministry of the Environment’s website for lists and directions.

Visit the Japan Times at www.japantimes.co.jp for more information on the environment, health and safety topics.
An interview from Bloomberg TV
July 1, 2009
A Walk in the Woods

Evidence builds that time spent in the natural world benefits human health.

For the month of April, I decided to ride the Elvira River, which flows near where I live, every day. But I hadn’t held up my end of the bargain, so I set out to make up for lost time—alas, unceremoniously, of course—by doing less. Some days I took a leisurely walk with friends along the river, and on other days I rode the rail car bridge to brush the river, fish from my buree, and to smell the distinctive, nutty smell of the water mingled with that of the banks—aromatics, friggin’ honeydew. On others, coming home late at night, I drove straight down to the bridge and realized out to make sure the lake’s the same water, a sense that felt a bit like the natural world equivalent of staring a doorframe from which I’d just walked.

I did this because I hadn’t been spending much time on the river, even though it’s a short walk from home, and even though I like being there. The river of my youth is wondrously small. I did, in fact, feel better—calmer, more relaxed, cleaner, stricter. I suspect that many people have similar feelings about the effects of spending time in the wilder places near where they live. Perhaps that’s why Richard Louv’s 2005 book Last Child in the Woods, which explores the tension between the natural world and children’s development, became a bestseller in the United States.

But to know scientifically that these experiences are beneficial—and to know exactly how they might help us—requires more than pitting the physical and mental health of children against the pressures of our everyday lives.” Researchers at the Woods, who are studying the effects of forest bathing, have found that spending time in a forest can improve mental health and reduce stress levels. The study, which involved 104 participants, showed that those who spent 40 minutes in a forest had a decrease in cortisol levels and an increase in positive mood compared to those who spent the same time in a urban setting. The results of this study have significant implications for the design of urban areas, as it suggests that incorporating natural elements such as green spaces and trees can improve the mental health and well-being of city dwellers.

One such body of work is accumulating in Japan, where researchers are investigating the physiological effects of "forest bathing"—forest bathing, or to put it plainly, taking walks in the woods. Qin, a professor in the Department of Hygiene and Public Health at Nippon Medical School, has been involved with several such studies. He and his colleagues recently measured specific physical parameters before and after study subjects took walks in a forest and in an urban environment. The study’s sample size was small—16 male subjects—and the time was short—only 50 minutes. The results, however, showed that the forest bathing group had significantly lower blood pressure than the urban group, and that the subjects in the forest bathing group showed a decrease in heart rate and an increase in blood oxygen levels. These findings support the idea that forest bathing may be a valuable tool for improving cardiovascular health and reducing stress.

The results of these studies suggest that spending time in nature can have significant health benefits, but more research is needed to fully understand the mechanisms behind these effects. It’s clear, however, that incorporating nature into our daily lives can have a positive impact on our physical and mental health.
Dr. Qing Li, the Vice-President and the Secretary-General of INFOM received an interview by BBC Radio on Forest Medicine.
BBC world news (April 25, 2018)

French radio (April 16, 2018)
German TV interview (2016.11)
French TV interview (2016.11)
NHK program on 2018.04.27 about Phytoncide
Nippon Medical School website
Let’s go to shinrin-yoku!