Perspectives of forest therapy in cardiac and pulmonary rehabilitation

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Certifed Forest therapy guide in Lithuania

Aim of presentation

- Forest therapy (*Shinrin-yoku*) represents a promising frontier in integrative medicine, with growing evidence of benefits for cardiovascular and respiratory health.

Definition

Shinrin-yoku or Forest therapy (FT)

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BENEFITS OF FOREST THERAPY

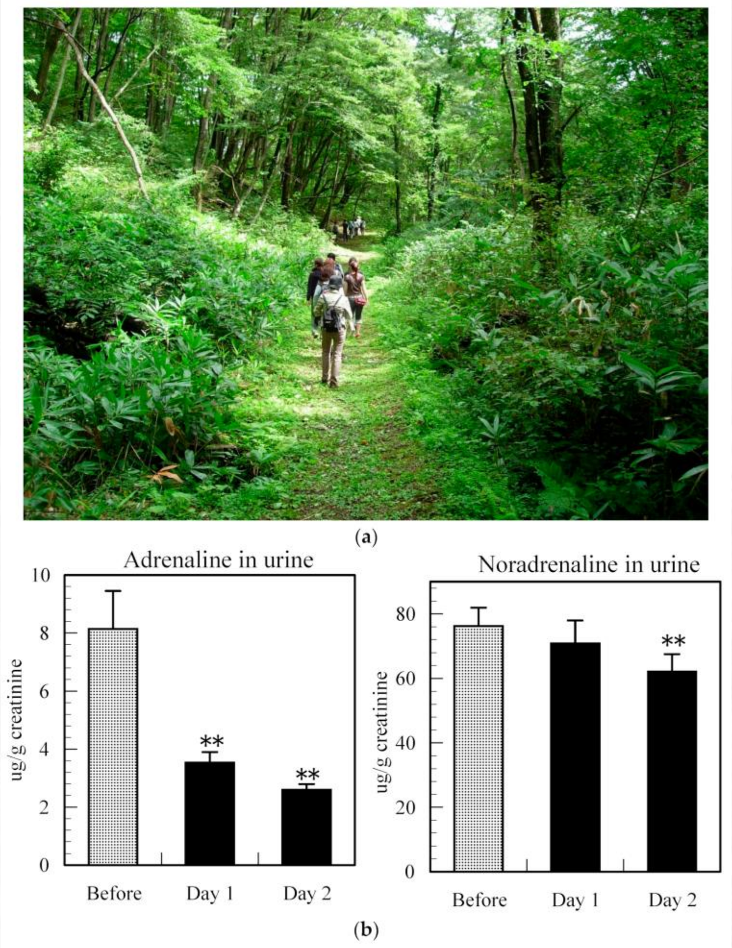
Stress reduction

Reduction of stress hormones and physiological stress

- Forest bathing ***reduces levels of adrenaline, noradrenaline, and cortisol,*** which can mediate stress responses and have preventive effects on cardiovascular disease (Li,2025).
- The meta-analysis found significant ***reductions in systolic and diastolic blood pressure***, consistent with lower stress tone. (Qiu, 2022).

Li, Q. (2025). *Preventive Effects of Forest Bathing/Shinrin-Yoku on Cardiovascular Diseases*. *Forests*, 16(2), 310. https://doi.org/10.3390/f16020310
Qiu, Q., et al. (2022). *The Effects of Forest Therapy on the Blood Pressure and Heart Rate: A Meta-analysis*. *PMC*. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9819785/

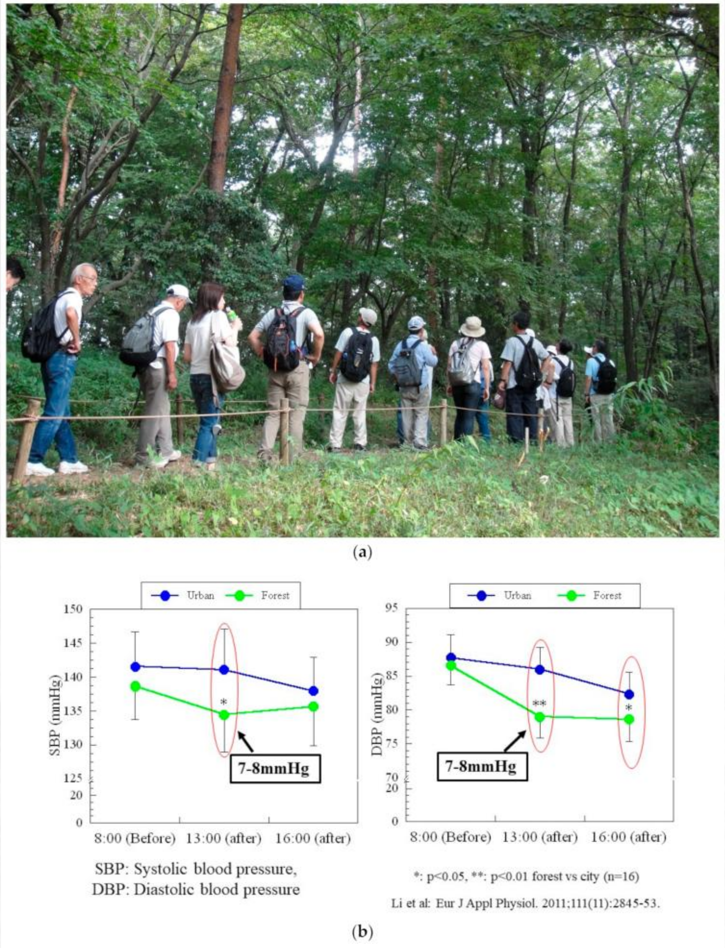
Stress reduction in women



(a) **Female subjects enjoyed forest bathing/shinrin-yoku in a Japanese cedar forest** in Nagano prefecture in Japan (provided by the author); (

(b) Effect of the forest bathing/shinrin-yoku (3-day/2-night) on urinary adrenaline and noradrenaline concentrations in female subjects shown in **Figure 1**a. Data were presented as the mean + SE (n = 13). Two-way ANOVA with no-repeated measures indicated that forest bathing/shinrin-yoku significantly ***affected the adrenaline concentration in urine*** ($p < 0.01$). **: $p < 0.01$, significantly different from before the trip by paired t-test. Cited from Li et al. J. Biol. Regul. Homeost. Agents. 2008; 22: 45–55 [8].

Stress reduction in men



- Male subjects enjoyed forest bathing/shinrin-yoku in a Japanese forest park in Saitama prefeture in Japan (provided by the author);
- (**b**) Forest bathing/shinrin-yoku ***significantly reduced blood pressure compared with city walking*** in male subjects shown in **Figure 2**a. Blood pressure was decreased by about 7–8 mmHg by forest bathing/shinrin-yoku. Cited from Li et al. Eur. J. Appl. Physiol. 2011; 111(11): 2845–2853 .

Healthy heart (1)

Lower blood pressure, heart rate, and improved autonomic balance (heart rate variability)

- review reports that forest bathing reduced blood pressure and pulse rate, and increased HRV indices (i.e., greater parasympathetic activity) (Yau, Loke, 2020)

Yau, K. K. Y., & Loke, A. Y. (2020). *Effects of Forest Bathing on Pre-hypertensive and Hypertensive Adults: A Systematic Review and Meta-analysis*. *Environmental Health and Preventive Medicine*, 25, Article 8. https://environhealthprevmed.biomedcentral.com/articles/10.1186/s12199-020-00856-7

Healthy heart (2)

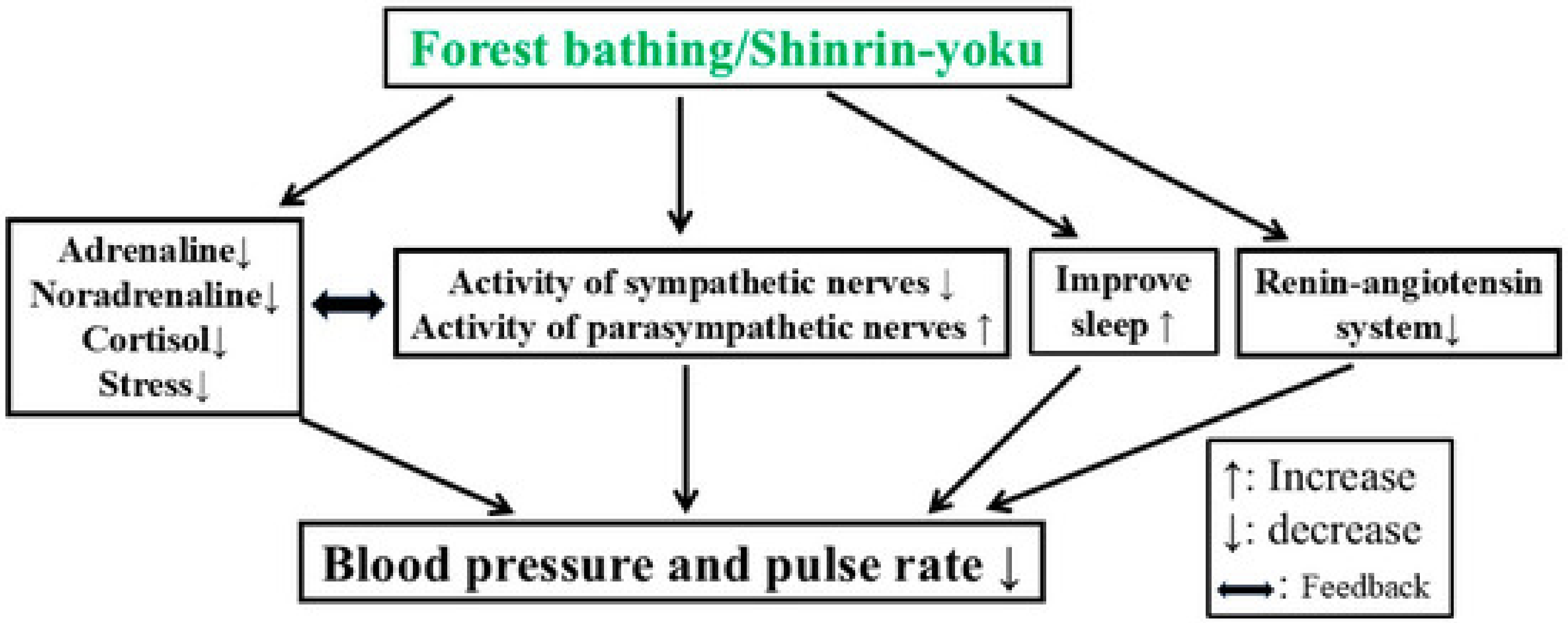
- Walking in a forest environment was associated with increased high-frequency HRV (parasympathetic) and lower heart rate vs. urban walking.(Lee, 2014)

Lee, J., Park, B.-J., Tsunetsugu, Y., Kagawa, T., & Miyazaki, Y. (2014). *Influence of forest walking on autonomic nervous system activity and blood pressure*. *Public Health*

Fot. From unsplash.com

Summary of mechanisms

Mechanism of forest bathing/shinrin-yoku on the prevention of CVDs from the perspectives of stress hormones, autonomic nervous system, sleep, blood pressure and heart rate, and other factors



Li, Q. (2025). *Preventive Effects of Forest Bathing/Shinrin-Yoku on Cardiovascular Diseases*. *Forests*, 16(2), 310. https://doi.org/10.3390/f16020310

Improved mood

Improved mood, lower anxiety and depressive symptoms

- In the meta-analysis, forest therapy showed a significant reduction in depression measures (SMD = –1.46) (Yi et al, 2022)
- Presents evidence that forest therapy alleviates symptoms of depression, anxiety, and negative mood states. (Chen et al., 2025).

Yi, Y., et al. (2022). *Does Forest Therapy Have Physio-Psychological Benefits? A Systematic Review and Meta-analysis*. *International Journal of Environmental Research and Public Health*, 19(17), 10512. https://www.mdpi.com/1660-4601/19/17/10512

hen, H., et al. (2025). *Is forest bathing a panacea for mental health problems? Frontiers in Public Health.* https://www.frontiersin.org/journals/public-health/articles/10.3389/fpubh.2025.1454992/full

Enhanced immune function

- Reviews evidence that forest bathing can ***upregulate immune functions***, including NK cell activity, which may have long-term health implications (Li, 2025; Krala-Szkaradowska,2024).

Li, Q. (2025). *Preventive Effects of Forest Bathing/Shinrin-Yoku on Cardiovascular Diseases*. *Forests*, 16(2), 310. https://doi.org/10.3390/f16020310
Krala-Szkaradowska, M. (2024). *Effect of forest bathing on human health: A literature review*. *Environment & Medicine*. (link) https://www.environmed.pl/Effect-of-forest-bathing-shinrin-yoku-on-human-health-a-literature-review%2C187812%2C0%2C2.html

Reduced inflammation / better antioxidant markers

- Summarizes studies that show reductions in pro-inflammatory markers and better oxidative status after forest exposure (Li, 2025).
- In hypertensive older adults, forest bathing reduced hs-CRP (a marker of systemic inflammation).

Li, Q. (2025). *Preventive Effects of Forest Bathing/Shinrin-Yoku on Cardiovascular Diseases*. *Forests*, 16(2), 310. https://doi.org/10.3390/f16020310
Li, A., et al. (2025). *Therapeutic effects of forest bathing on older adult patients*. *Frontiers in Public Health*. https://www.frontiersin.org/journals/public-health/articles/10.3389/fpubh.2025.1631613/full

Greater uptake of physical activity, "green exercise" synergy

- study showed that forest walking (versus a built environment) led to greater reductions in BP and HR among female participants (He et al, 2024`).
- Combining light exercise (walking) with forest immersion may augment both physiological and psychological benefits (Zhang, 2023)
- The review emphasizes that much of the effect is likely due to a combined intervention of walking + environment.

He, M., et al. (2024). *The Impacts of Forest Therapy on the Physical and Mental Health*. *MDPI*. https://www.mdpi.com/1999-4907/15/4/682
Zhang, Y. (2023). *The Impact of Forest Therapy Programs on Stress Reduction*. *MDPI*. https://www.mdpi.com/1999-4907/14/9/1851
Rajoo, K. S., et al. (2020). *The physiological and psychosocial effects of forest therapy: A systematic review*. *Science of The Total Environment*. https://www.sciencedirect.com/science/article/abs/pii/S1618866720304039

EVIDENCE OF FOREST THERAPY IN CARDIAC REHABILITATION

Forest therapy in cardiovascular and metabolic contexts

- In middle-aged participants (some with higher BP), forest programs significantly reduced pulse rate and improved mood states (POMS), suggesting favorable cardiovascular / metabolic effects (Li, 2016)

Li, Q., et al. (2016). *Effects of Forest Bathing on Cardiovascular and Metabolic Parameters*. *PMC.*
https://pubmed.ncbi.nlm.nih.gov/PMC4963577/

Conceptual proposals for CR

- prior forest healing studies show improvements in psychoemotional stability, autonomic/hormonal activity, immune function, and cardiovascular conditions; they ***propose that forest therapy might be integrated into rehabilitation,*** but do not provide large clinical trials in CR (Lee, 2024).

Lee, J. Y., et al. (2024). *Cardiac rehabilitation using intensive lifestyle habituation. JY Lee et al.* https://www.e-jcpp.org/journal/view.php?number=91

Al Ghanim, S., et al. (2025). *A scoping review of the impact of nature-based interventions on cardiovascular & cardiometabolic diseases. Journal of Public Health.* (Oxford)

Clinical trials in populations with cardiovascular risk / disease

- ClinicalTrials.gov. *Effects of Nature and Forest Therapy in Patients With Manifest Metabolic Syndrome and Cardiovascular Risk* (NCT04781491). https://clinicaltrials.gov/study/NCT04781491
- This registered trial is specifically testing forest therapy in subjects with metabolic syndrome / cardiovascular risk, which is conceptually close to secondary prevention / rehabilitation, though results are not yet published.

BENEFITS FOR PATIENTS WITH PULMONARY / RESPIRATORY DISEASES

Inflammation and biomarkers

Reduction of airway and systemic inflammation

- In COPD or people at risk, forest bathing has been shown to reduce levels of inflammatory markers such as CRP, IL-6, fibrinogen, α_1-antitrypsin (Li, 2025)
- This suggests that forest exposure attenuates systemic and pulmonary inflammation, which is key in COPD pathogenesis.

Li, Q., Sun, C., & Morimoto, K. (2025). Forest bathing reduces inflammation and improves pulmonary outcomes in older males at risk of COPD: A randomized crossover study. *International Journal of Environmental Research and Public Health*, 22(1), 112.

Improved oxygenation (SpO_2)

- Walking or staying in a forest environment improved **percutaneous oxygen saturation (SpO_2)** in COPD-risk participants compared to urban walking.
- Higher SpO_2 is clinically meaningful in patients with compromised lung function.

Li, Q., Sun, C., & Morimoto, K. (2025). Forest bathing reduces inflammation and improves pulmonary outcomes in older males at risk of COPD: A randomized crossover study. *International Journal of Environmental Research and Public Health*, 22(1), 112.

Relief of respiratory symptoms, fatigue, and sleep problems

- Patients reported **less cough, sputum, and breathlessness**, improved **sleep quality**, and reduced **fatigue** after forest immersion.
- Suggests not only physiological but also symptomatic relief.

Li, Q., Sun, C., & Morimoto, K. (2025). Forest bathing reduces inflammation and improves pulmonary outcomes in older males at risk of COPD: A randomized crossover study. *International Journal of Environmental Research and Public Health*, 22(1), 112.
Li, Q., Otsuka, T., Kobayashi, M., Wakayama, Y., Inagaki, H., Katsumata, M., … Kagawa, T. (2016). Health effect of forest bathing trip on elderly patients with chronic obstructive pulmonary disease. *Biomedical and Environmental Sciences*, 29(8), 540–550. https://pubmed.ncbi.nlm.nih.gov/27109132/

Reduced stress and improved psychological wellbeing

- COPD patients showed **lower stress hormone levels** and **better mood states (POMS scores)** after forest therapy compared to urban settings.
- This is important because chronic stress worsens symptom perception and quality of life in pulmonary disease.

Li, Q., Sun, C., & Morimoto, K. (2025). Forest bathing reduces inflammation and improves pulmonary outcomes in older males at risk of COPD: A randomized crossover study. *International Journal of Environmental Research and Public Health*, 22(1), 112.
Li, Q., Otsuka, T., Kobayashi, M., Wakayama, Y., Inagaki, H., Katsumata, M., … Kagawa, T. (2016). Health effect of forest bathing trip on elderly patients with chronic obstructive pulmonary disease. *Biomedical and Environmental Sciences*, 29(8), 540–550. https://pubmed.ncbi.nlm.nih.gov/27109132/

Modulation of immune function

- Forest therapy reduced the expression of **cytotoxic molecules** (perforin, granzyme B) in immune cells of COPD patients.
- This may lower excessive immune activity that contributes to tissue damage in COPD.

Li, Q., Otsuka, T., Kobayashi, M., Wakayama, Y., Inagaki, H., Katsumata, M., … Kagawa, T. (2016). Health effect of forest bathing trip on elderly patients with chronic obstructive pulmonary disease. *Biomedical and Environmental Sciences*, 29(8), 540–550. https://pubmed.ncbi.nlm.nih.gov/27109132/

PERSPECTIVES OF FOREST THERAPY IN CARDIAC AND PULMONARY REHABILITATION

Recommendations (1)

- **Evidence support is suggestive but not definitive**: In non-cardiac and pulmonary or at-risk populations, forest therapy has beneficial cardiovascular effects (BP, HRV, stress) as well as pulmonary. These provide a theoretical justification for trialing forest therapy in rehabilitaion settings.

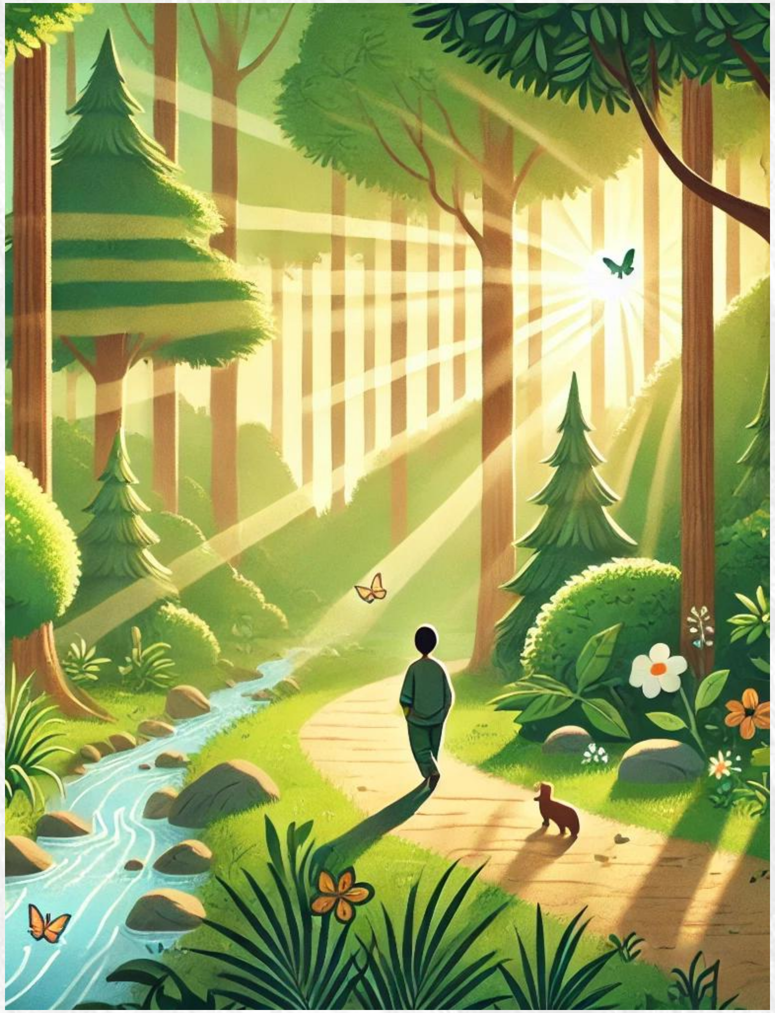
Recommendations (2)

- **As an adjunct, not replacement**: Given the demonstrated strong evidence base for standard exercise-based cardiac rehabilitation (which clearly reduces mortality, hospitalizations, and improves function) (Dibben et al., 2023) — forest therapy should be considered a complementary, adjunctive modality rather than a substitute.

Recommendations (3)

- **Next steps needed**: RCTs enrolling cardiac patients, pulmonary patients embedding forest therapy into CR protocols, measuring hard outcomes (functional capacity, quality of life, rehospitalization, biomarkers) are needed.

Synergy of both?



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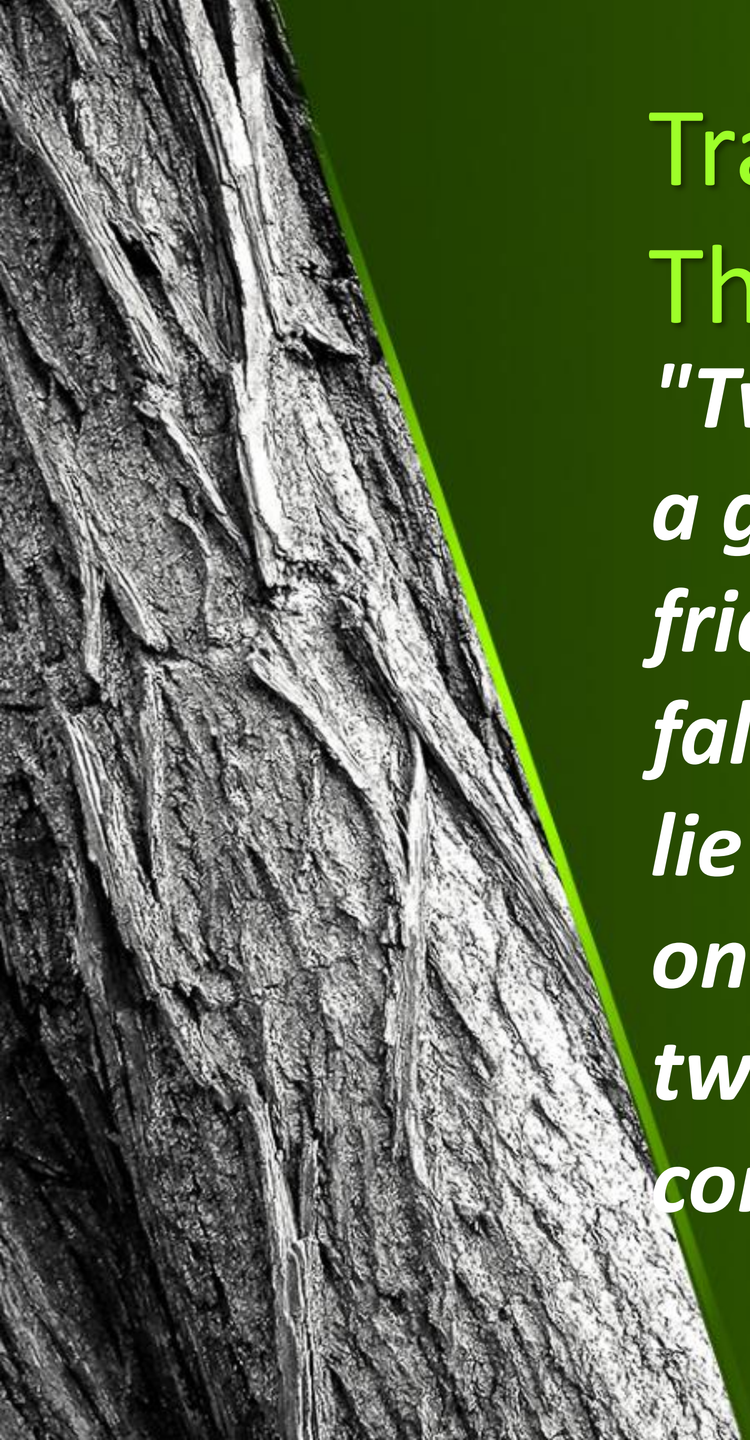

Traditional rehabilitation and Forest Therapy

"Two are better than one because they have a good return for their work: if one falls, his friend can help him up. But pity the man who falls and has no one to help. Besides, if two lie together, they will warm up. But how does one warm up? While one can be overcome, two can defend themselves. A three-stranded cord is not quickly broken" (Teacher 4:9-12)

Let's invite ourselves to a mindful presence in nature

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