

Supplementary Material for

Effects of Shinrin-Yoku (Forest Bathing) and Nature Therapy on Mental Health: A Systematic Review and Meta-Analysis

Appendix 1. Systematic reviews examined for manual reference searches, and identified articles added to the shortlisted articles.

Author(s) and Year*	Title of Review	Additional Shortlisted Articles
Hansen et al., 2017	Shinrin-yoku (forest bathing) and nature therapy: A state-of-the-art review	Chun, Chang & Lee, 2017; Han et al., 2016; McCaffrey, Hanson & McCaffrey, 2010; Shin, Shin & Yeoun, 2012; Stigsdotter, 2010; Ulrich et al., 1991
Tsunetsugu et al. 2010	Trends in research related to 'Shinrin-yoku' (taking in the forest atmosphere or forest bathing) in Japan	
Oh et al., 2017	Health and well-being benefits of spending time in forests: systematic review	Shin, Shin, Yeoun & Kim, 2011
McMahan & Estes, 2015	The effect of contact with natural environments on positive and negative affect: A meta-analysis	Berman et al., 2012; Hartig, Bök, Garvill, Olsson & Gärling, 1996; Johansson, Hartig & Staats, 2011
Payne & Delphinus 2019	The most natural of natural therapies: A review of the health benefits derived from Shinrin-Yoku (Forest Bathing)	
Meyer & Buerger-Arndt, 2014	How forests foster human health - Present state of research-based knowledge (in the field of Forests and Human Health)	Horiuchi et al., 2013; Kondo et al., 2008; Shin et al., 2013; Song, Shin, Yeoun & Choi, 2009; Tsunetsugu, Park, Lee, Kagawa & Miyazaki, 2011
Bolwer et al., 2010	A systematic review of evidence for the added benefits to health of exposure to natural environments	
Kamioka et al., 2012	A systematic review of randomized controlled trials on curative and health enhancement effects of forest therapy	
Park, Tsunetsugu, Kasetani, Kagawa & Miyazaki, 2010	The physiological effects of Shinrin-yoku (taking in the forest atmosphere or forest bathing): evidence from field experiments in 24 forests across Japan	

Barton & Pretty, 2010	What is the Best Dose of Nature and Green Exercise for Improving Mental Health? A Multi-Study Analysis	
Bratman et al., 2012	The impacts of nature experience on human cognitive function and mental health	
Hartig et al., 2010	Health Benefits of Nature Experience: Psychological, Social and Cultural Processes	
Shin et al., 2009	Forest experience and psychological health benefits: the state of the art and future prospect in Korea	
Lee et al., 2017	Effects of Forest Therapy on Depressive Symptoms among Adults: A Systematic Review	Hong, Kim & Cho, 2013
Frumkin, 2001	Beyond toxicity: Human health and the natural environment	

*Listed in order of our examination, therefore the same shortlisted articles found in later systematic reviews (lower rows of the table) were not noted to avoid duplicate.

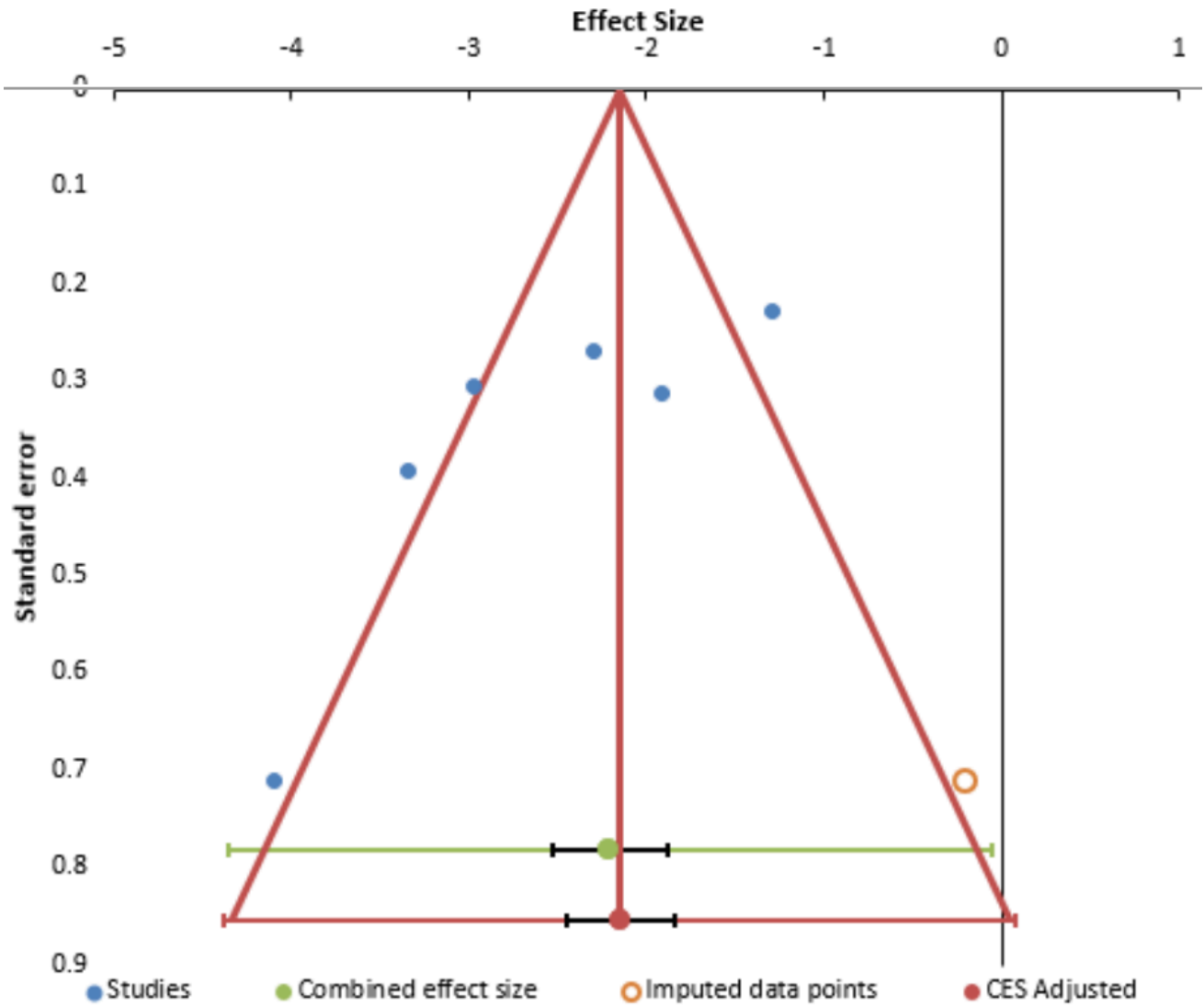
Appendix 2. Excluded studies and reasons for exclusion (n=40)

Author(s) and Year	Title	Reason for Exclusion
Morita et al., 2019	Frequency of forest walking is not associated with prevalence of hypertension based on cross-sectional studies of a general Japanese population	No mental health measures used.
Bielinis et al., 2019	The restorative effect of staying in a broad-leaved forest on healthy young adults in winter and spring	Not shinrin-yoku
Zhou et al., 2019	Effect of short-term forest bathing in urban parks on perceived anxiety of young-adults: A pilot study in Guiyang, Southwest China	Could not determine if intervention was shinrin-yoku
Arnberger et al., 2018	Health-related effects of short stays at mountain meadows, a river and an urban site-results from a field experiment	Not shinrin-yoku
Ramshini et al., 2018	The Effect of Family-Centered Nature Therapy on Interactions Between Parent and Child With Autism Spectrum Disorder	Not shinrin-yoku
Yu et al., 2018	The effect of virtual reality forest and urban environments on physiological and psychological responses	Not shinrin-yoku
Zhao et al., 2018	Effects of auditory-visual combinations on perceived restorative potential of urban green space	Not shinrin-yoku
Bang et al., 2017	The effects of a campus forest-walking program on undergraduate and graduate students' physical and psychological health	Not shinrin-yoku
Korpela et al., 2017	Nature exposure predicts well-being trajectory groups among employees across two years.	Not shinrin-yoku
Takayama, Fujiwara, Saito & Horiuchi, 2017	Management effectiveness of a secondary coniferous forest for landscape appreciation and psychological restoration	Not shinrin-yoku
Takayama, Saito, Fujiwara & Horiuchi, 2017	The effect of slight thinning of managed coniferous forest on landscape appreciation and psychological restoration	Not shinrin-yoku
Ohe et al., 2017	Evaluating the relaxation effects of emerging forest-therapy tourism: A multidisciplinary approach	Combined with other approaches
Akpinar et al., 2016	Does green space matter? Exploring relationships between green space type and health indicators	Not shinrin-yoku
Combs et al., 2016	Adolescent self-assessment of an outdoor behavioral health program: Longitudinal outcomes and trajectories of change.	Combined with other approaches
Gladwell et al., 2016	A lunchtime walk in nature enhances restoration of autonomic control during night-time sleep: results from a preliminary study	No mental health measures used.
Jakubec et al., 2016	Mental well-being and quality-of-life benefits of inclusion in nature for adults with disabilities and their caregivers.	Combined with other approaches
Song et al., 2016	Effects of VOCs from leaves of <i>Acer truncatum</i> Bunge and <i>Cedrus deodara</i> on human physiology and psychology	Not shinrin-yoku
Igarashi et al., 2015	Physiological and psychological effects of viewing a kiwifruit (<i>actinidia deliciosa</i> 'hayward') orchard landscape in summer in Japan	Not shinrin-yoku

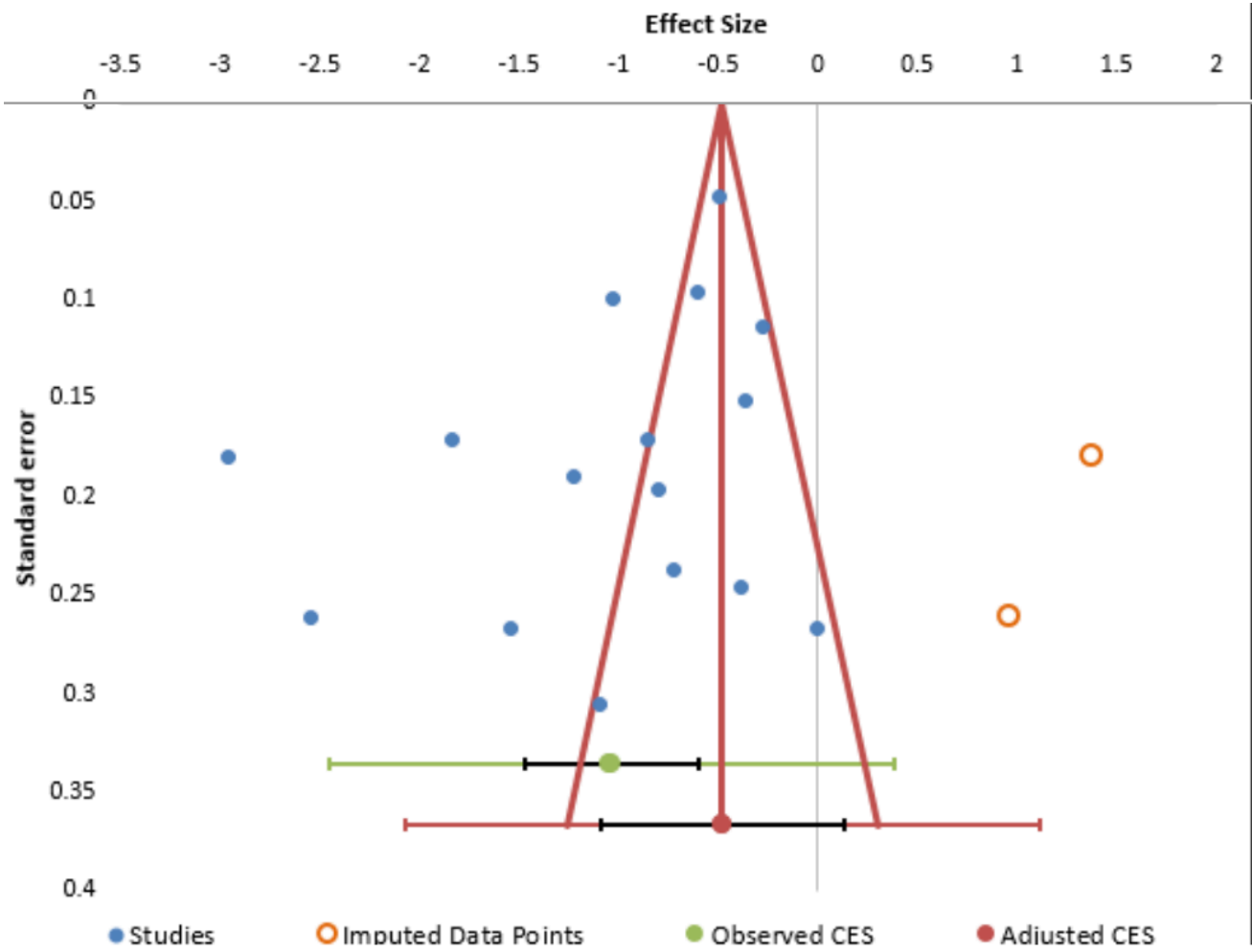
Joung et al., 2015	The prefrontal cortex activity and psychological effects of viewing forest landscapes in autumn season	Not shinrin-yoku
Kim et al., 2015	The influence of forest experience program on physiological and psychological states in psychiatric inpatients	Not in English
Rogerson & Barton, 2015	Effects of the visual exercise environments on cognitive directed attention, energy expenditure and perceived exertion	Not shinrin-yoku
Sandifer et al., 2015	Exploring connections among nature, biodiversity, ecosystem services, and human health and well-being: Opportunities to enhance health and biodiversity conservation	Not shinrin-yoku
Song et al., 2015	Physiological and psychological effects of a walk in urban parks in fall	Not shinrin-yoku
Song et al., 2015	Effect of forest walking on autonomic nervous system activity in middle-aged hypertensive individuals: A pilot study	Not shinrin-yoku
Horiuchi et al., 2014	Impact of viewing vs. Not viewing a real forest on physiological and psychological responses in the same setting	Not shinrin-yoku
Song et al., 2014	Physiological and psychological responses of young males during spring-time walks in urban parks	Not shinrin-yoku
Hong, Kim & Cho, 2013	The effects of forests healing for cognitive function	Not in English
Shin et al., 2013	Differences of psychological effects between meditative and athletic walking in a forest and gymnasium	Not shinrin-yoku
Berger & Tiry, 2012	The enchanting forest and the healing sand—Nature therapy with people coping with psychiatric difficulties	Not empirical.
Berman et al., 2012	Interacting with nature improves cognition and affect for individuals with depression	Could not determine if intervention was shinrin-yoku
Johansson, Hartig & Staats, 2011	<u>Psychological benefits of walking: moderation by company and outdoor environment</u>	Not shinrin-yoku
Miyaura et al., 2011	A before and after comparison of the effects of forest walking on the sleep of a community-based sample of people with sleep complaints	Not shinrin-yoku
Shin, Shin, Yeoun & Kim, 2011	The influence of interaction with forest on cognitive function	Could not determine if intervention was shinrin-yoku
Tsunetsugu, Park, Lee, Kagawa & Miyazaki, 2011	Psychological relaxation effect of forest therapy: results of field experiments in 19 forests in Japan involving 228 participants	Not in English
McCaffrey, Hanson & McCaffrey, 2010	<u>Garden walking for depression: A research report</u>	Not shinrin-yoku
Stigsdotter et al., 2010	Health promoting outdoor environments - Associations between green space, and health, health-related quality of life and stress based on a Danish national representative survey	Not shinrin-yoku

Kondo et al., 2008	A physio-psychological research on shinrin-yoku	Not in English
Yamaguchi, Deguchi & Miyazaki, 2006	The effects of exercise in forest and urban environments on sympathetic nervous activity of normal young adults	No mental health measures used.
Ulrich et al., 1991	Stress recovery during exposure to natural and urban environments	Not shinrin-yoku
Hartig et al., 1996	Environmental influences on psychological restoration	Not shinrin-yoku

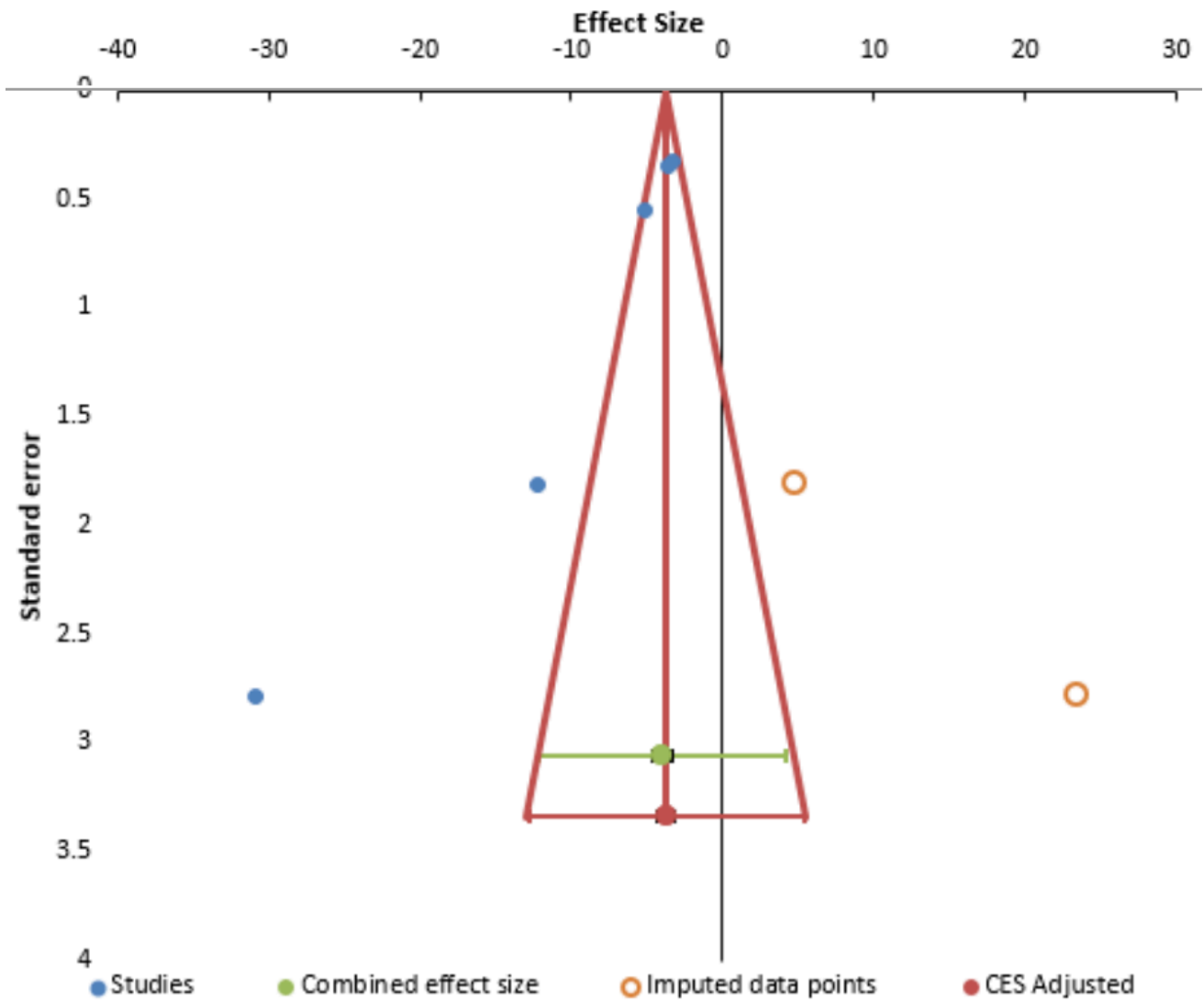
Appendix 3: Funnel plot of Heterogeneity for the effects of shinrin-yoku on depression in RCTs



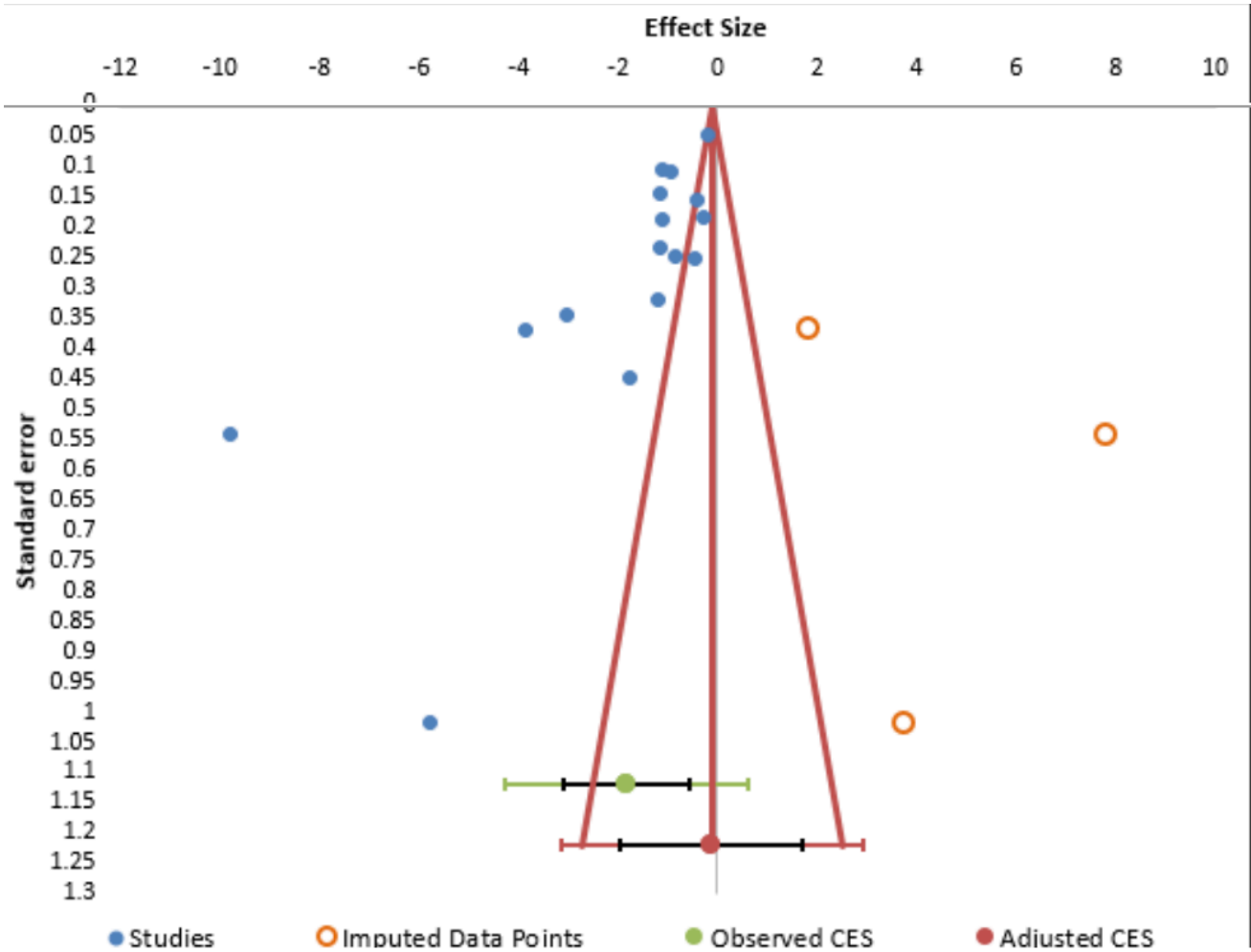
Appendix 4: Funnel plot of Heterogeneity for the effects of shinrin-yoku on depression in studies reported pre-post scores



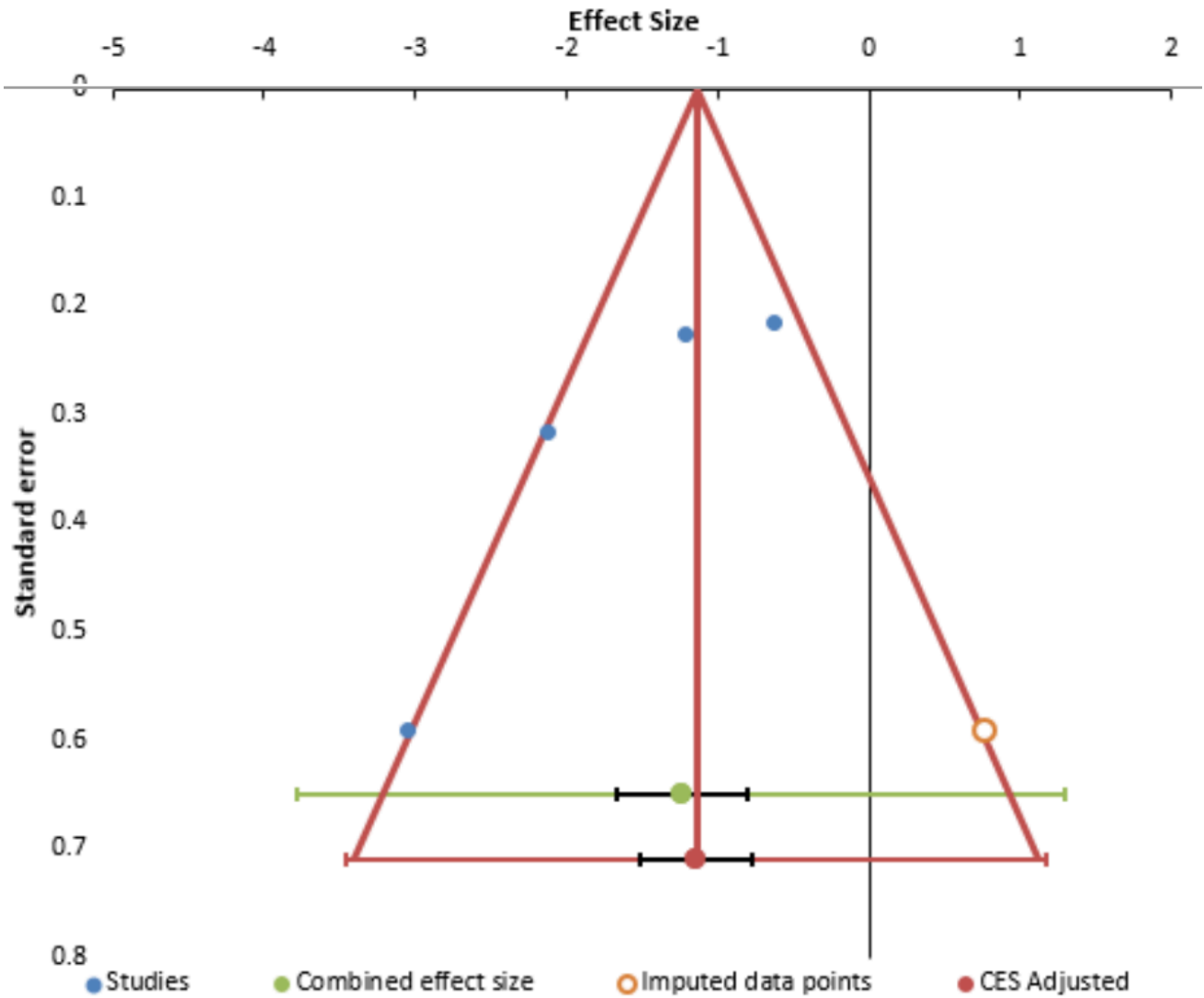
Appendix 5: Funnel plot of Heterogeneity for the effects of shinrin-yoku on anxiety in RCTs



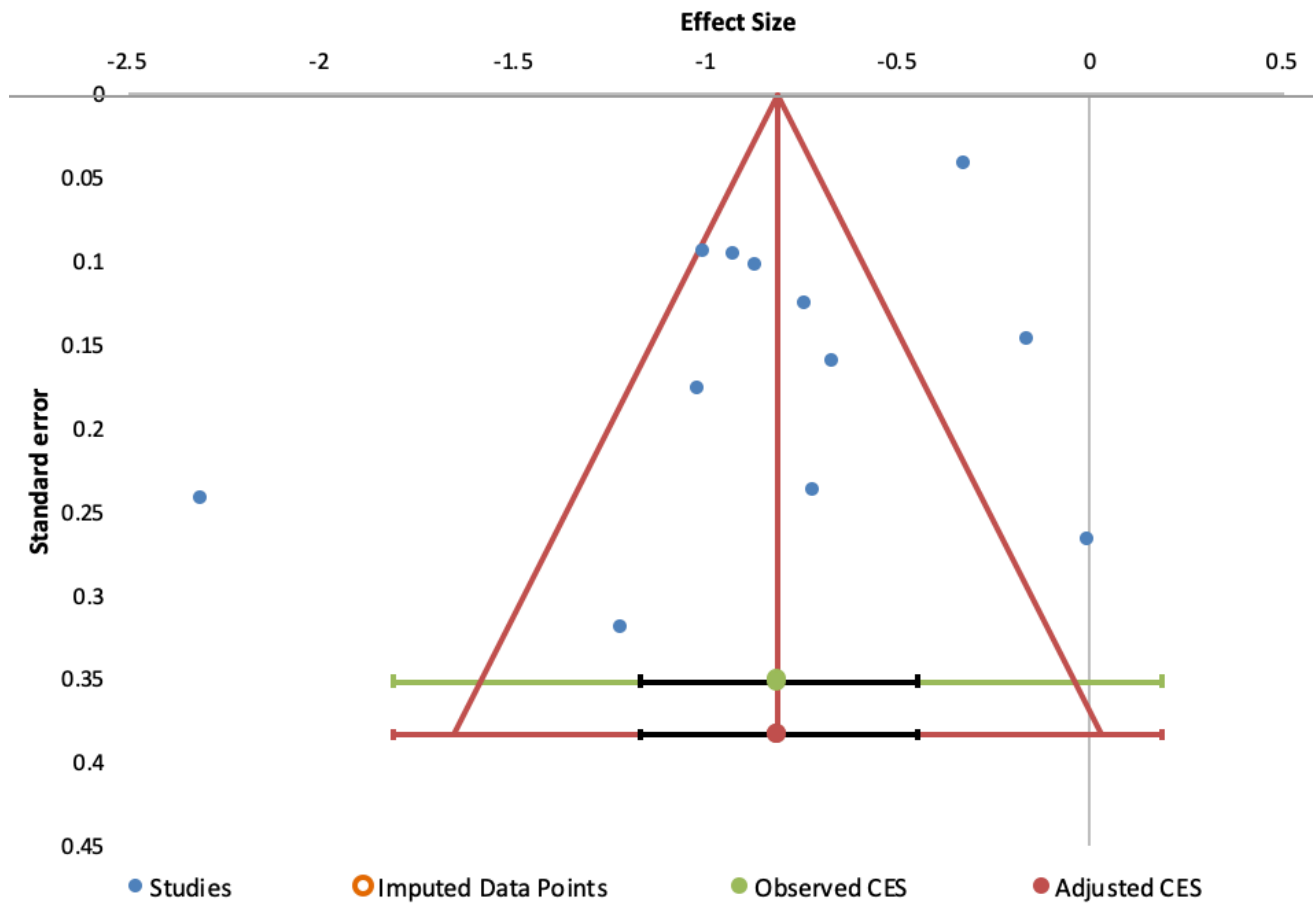
Appendix 6: Funnel plot of Heterogeneity for the effects of shinrin-yoku on anxiety in studies reported pre-post scores.



Appendix 7: Funnel plot of Heterogeneity for the effects of shinrin-yoku on anger in RCTs



Appendix 8: Funnel plot of Heterogeneity for the effects of shinrin-yoku on anger in studies reported pre-post scores



Appendix 9. List of Peer-Reviewed Journal Articles in Japanese, Measured Mental Health Outcomes 2009-2019.

- Tsunetsugu, Y., Park, B., Lee, J., Kagawa, T. & Miyazaki, Y. (2011). Psychological relaxation effect of forest therapy: Results of field experiments in 19 forests in Japan involving 228 participants. *Japanese Journal of Hygiene*, 66, 670–676. <https://doi.org/10.1265/jjh.66.670>
- Koyama, Y. (2007). Naganoken no shinrin niokeru shinrin-yoku no kouka [Effects of shinrin-yoku in a forest in Nagano Prefecture]. *Research Report for Nagano Forestry Center*, 22, 63-84.
- Takayama, N., Tsutsui, S. & Nakano, H. (2010). Riyousha no kojintokusei ga shinrin-yoku no iyashikouka ni ataeru eikyou [Impacts of personality on the healing effects of shinrin-yoku]. *Journal of Health Sciences of Mind and Body*, 6(2), 42-51. https://doi.org/10.11427/jhas.6.2_42
- Kondo, T., Takeda, A., Takeda, N., Shimomura, Y., Yagata, M. & Kobayashi, I. (2008). A physio-psychological research on shinrin-yoku. *The Journal of Balneology, Climatology and Physical Medicine*, 71(2), 131-138. <https://doi.org/10.11390/onki1962.71.131>

This list does not include conference papers.