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GREEN EXERCISE, PHYSICAL ACTIVITY AND HEALTH

–SCIENTIFIC EVIDENCE ON OUTDOOR RECREATION AND EXERCISE BASED ON SELECTED STUDIES

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Abstract

This report is a summary of 36 selected international scientific studies related to recreation, physical activity and exercise in connection to nature. The report has been written based on a large literature search on altogether 890 abstracts from years 1970-2009. Report presents scientific evidence on outdoor recreation and exercise (green exercise) in relation to health, compares doing exercise indoors and outdoors as well as presents participation motivations and affecting factors on green exercise. The recommendations for further study needs are presented at the end. Green exercise affects on health at three levels: by viewing nature, by being presence of nearby nature and, via active participation and involvement with nature. Active participation to green exercise seems to leads to significant improvements in self-esteem and total mood disturbances. These effects are not related to type, duration or intensity of activity. Exercising with nature view reduces blood pressure and heart rate and as a consequence of this the exercise with equal intensity is experienced lighter outdoors than indoors. Nature-related recreation brings joy and helps to escape from the pressures and cares of everyday life. Outdoor settings are rated as more restorative compare to indoors since natural environment reduces emotional and physiological arousal. Being alone and feeling safe in nature has added value. Perceived benefits of outdoor recreation are improved physical health, a sense of well-being, improved social relations or increased independence, and aesthetic nature experiences. Walk-able green space has been found to predict longevity, even after controlling of age, gender and socioeconomic status. Outdoor recreation participants detect fewer problems with outdoor recreation facilities and are more likely to respond positively on general attitudinal statements related to green exercise compared to non-participants. In medical treatments better control of pain has been achieved regardless of age, gender, race, education, health status and dose of narcotic medication when nature sights and sounds were part of examination. In the future the green recreation and exercise will be recognized even more important alternative and it has a growing potential in health promotion, since urban and indoor lifestyles increase mental and metabolic



health problems. “Nordic fitness and health” -concept could provide internationally valid and feasible model for outdoor recreation.

1. Introduction

The Ottawa Charter for Health Promotion did identify the importance of environments as supportive to health, stating that the inextricable links between the people and their environment are the basis for a socio-ecological approach to health (WHO 1986). The central theme was promotion of health by maximizing the health values of everyday settings. Studies in disciplines of ecology, biology, psychology and psychiatry have attempted to empirically examine the human relationship with the natural world. Conclusions were that as well as being totally dependent on nature material needs (food, water, shelter etc.) humans also need nature for psychological, emotional and spiritual needs.

This report presents the findings based on scientific articles related to exercise and recreation in connection to nature. This is a summary report of selected studies and not a scientific systematic review or meta-analysis (meta-analysis =systematic review with statistical analysis), since both of those require extensive amount of work. Due to the limited amount of studies in children this report emphasizes studies on done on adults. All references listed are not directly cited in report text.

The report is done for Frisk i Naturen –project and its member association to complete understanding in scientific evidence on benefits of outdoor recreation and exercise. Report can be used to generate visibility on green exercise. It provides evidence based arguments for financial support for promoting exercise in nature and concludes with new information collecting and research topic suggestions in this area. Report can be used for strategy meetings as well as in educational purposes.

Overall, the target of this report is to strengthen Frisk i Naturen- projects role as an expert in outdoor exercise.

2. Outdoor exercise and health

2.1. Measured mental and physiological health effects

There are not many studies measuring physiological effects in real-time nature settings. Rather many studies have been done in laboratories (e.g. Pretty et al 2005, Manley et al. 2007). The British authors claim these studies adding value based on three level engagements with nature: viewing nature, being presence of nearby nature and, active participation and involvement with nature. One hundred subjects were been exposed to nature scenes (Pretty). Exercise alone significantly reduced blood pressure, increased self-esteem, and had a positive effect on mood. Both rural and urban pleasant scenes produced greater positive effect on self-esteem than exercise-only. Based on this research it was concluded that green exercise has important public and environmental health consequences. In another study (Manley) the very same groups did report a significant post-exercise reduction of anger for rural pleasant scene participants, while urban unpleasant scene participants showed post-exercise increase in fatigue, systolic and mean arterial blood pressure. According to the authors this study provided support for green exercise in the prevention and treatment for physical and mental illness.

Pretty et al. (2007) summarized the effects of 10 green exercise case studies (walking, cycling, horse-riding, fishing, canal boating, conservation activities) in four regions of the UK on 260 participants. Even though participants were generally active and healthy group, it was found out that green exercise led to significant improvements in self-esteem and in total mood disturbance. The effects were not found to be affected by the type, intensity or duration of the green exercise.



(Same finding has been done regarding effects of exercise on mental fitness). The authors concluded that these activities generated mental health benefits indicating the potential for a wider health and wellbeing dividend from green exercise.

Matsouka et al (2005) did compare effects of 12-week recreational exercise program on mood state of 55 sedentary elderly women (60-75 yrs old). Exercise was performed three times a week for 45 minutes. Those who participated 2-3 times weekly had significantly more positive mood profiles and non-exercisers and those participating once. Thus participation at least twice a week was needed for mood alterations. Mood profiles in this study included positive engagement, revitalization, tranquility, and physical exhaustion.

2.2. Perceived health effects

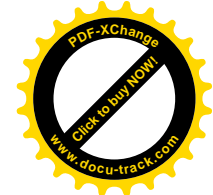
Paronen reported (2005) the results of a big Finnish study aiming to clarify perceived effects on well-being of participation in nature-related outdoor activities. The data was collected by three postal cross-sectional surveys in autumn 1999 and in winter 2000 as a part of a national survey of Finns aged 15-74. The number of respondents was 1418. Perceived effects of the latest recreation close to home and the latest nature trip on well-being was measured. According to the results the experience of nature was the most important effect of the latest nature trip. Especially participation in hiking, cross-country skiing, and spending time in cottage were strongly associated with enjoyment of the scenery and feelings of being close to nature. Downhill skiers felt stronger than other participants of recreational activities that a nature trip helped to escape the pressures and cares of everyday life. Nature trips also gave more self-confidence and offered more excitement than nature-related recreation activities close to home. For young people, being together with other people during the trip was a stronger experience than for older age groups. The results of this study suggested that psychological resources have the moderating role in producing positive effects within recreation activities. Individuals whose psychological resources were above average perceived more positive effects on well-being of nature-related recreation activities than subjects whose resources were below average. In summary, perceived benefits of outdoor recreation to individuals included improved physical health, a sense of well-being, improved social relations or increased independence, and aesthetic nature experiences.

In another study in Finland (Tyrväinen&Tuulentie 2007) recreation in nature was shown indirect positive effects on mental wellbeing and productivity at work. Altogether 1300 responders were divided into following categories according to answers: genuine urbans (5%), conventional urbans (22%), genuine naturals(19%), conventional naturals (21%), urban naturals (8%) and others (25%). For "urbans" urban environment was appealing and for "naturals" the nature. For the group "others" either one environment was appealing. Interestingly "urbans" experienced short nature visit improving mental well-being. Effects were clear if the duration of a visits was over 5 hours per month or took place 2-3 times monthly.

3. Comparisons on doing sports indoors and outdoors

Doing exercise indoor and outdoor has been compared in outdoors and in laboratory walking and running (Focht 2006,Ceci and Hassmen 1991). Results by Focht reported that although both walks resulted improvements in affective (feelings and arousal like revitalization, physical exhaustion, and engagement) responses, participants reported greater pleasant affective states, enjoyment, and intention for future participation with outdoor walking. Affective responses were consistently related to enjoyment in the outdoor environment. Interesting note was that even the self selected speed of walking was slightly higher outdoors the rating on perceived exertion (RPE, Borg 1985) outdoors was less.

Ceci and Hassmen compared RPE-guided exercise indoors and outdoors. The findings were that speed, HR and also blood lactates differed in these environments at all RPE-levels (11=light exertion, 13=somewhat hard and 15=hard exertion). Physiological responses were higher



outdoors (e.g. HR 20-50 bpm). These results indicate that in order to describe the same exercise evaluated by perceived feeling the guidance should be two RPE-units less for outdoors. (The very same effect- less RPE with same speed) has been found in comparing cross-country skiing to jogging and Nordic walking to regular walking- all outdoors).

In a Swiss study (320 subjects) on restorative quality of indoor and outdoor exercise settings as predictors of exercise frequency it was found that outdoor settings were rated as more restorative. For each type of environment the restorative quality predicted the frequency of exercise in past 30 days, independent of socio-demographic characteristics, expectations of exercise benefits (health and social) and personal barriers.

Herzog et al (2002) studied on over 600 people what people knew about the restorative potential of natural and other settings. They concluded that knowledge about environment and well being can be obtained when researchers are sensitive to context effects and that restorative potential of natural settings is probably underappreciated.

At the laboratory settings the video of nature settings resulted in lower mean heart rate and increased parasympathetic nervous system ("calming down") activity compared to urban video group (Laumann et al. 2003). They explained that since natural environment reduces emotional and physiological arousal and this makes subjects less spatially selective, one could expect that subjects would perform better in nature on tasks requiring a broad attention focus. This explains also why nature is experienced as restorative.

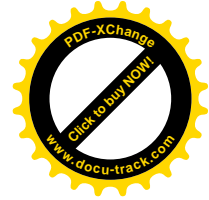
Sydney boy's school study on 160 young participants for 20 week program concluded that the physical education program with outdoor activities resulted in significantly better results in fitness, body composition, cardiovascular and muscular endurance, strength and flexibility than traditional physical education (Jelley 2005).

In Japanese study on airline pilots and engineers the outdoor exercise (golf) helped in recovery from jet lag and resynchronization of the circadian rhythm better than being active indoors (Shiota et al. 1996).

4. Outdoor exercise and diseases treatment

Two American summary papers (Kennedy 1987 and Kelley 1993) have reviewed the leisure and outdoor adventures therapeutic results on mentally ill persons. Kennedy reviewed both the wilderness studies as well as physical fitness studies. The reviews suggest a variety of benefits, including reduced symptoms and enhanced ability to function in the community. The wilderness studies suggest that properly designed programs can and do result in positive changes in the self-concept, personality, individual behavior and social functioning of participants. In physical fitness studies exercise has shown to be effective for stress management and ability to cope with stress. However, in both of these reviews a critical summary is presented on the evidence because of methodological problems and challenges. More rigorous research is needed to demonstrate the benefits.

Interesting finding on effects of outdoor exercise to the vitamin D deficit and obesity has been reported by Florez et al 2007. It is a known fact that obesity is associated with the lower levels of serum D vitamin. Obese individuals may for various metabolic purposes need higher doses of D than general population. They did study effect by hospital records of 300 obese and non-obese individuals in Florida. Overall, 63% of obese individuals had D-vitamin deficit compared to the 36% of non-obese. Outdoor exercise had a significant effect on the prevalence of D-vitamin deficit (outdoor exercisers 24% and non-outdoor exercisers 48%). After adjusting for age, gender, and ethnicity those reporting outdoor exercise were 47% less likely to have D-vitamin deficit, while those with obesity had more than twice the risk. They concluded that prevention programs



involving higher doses of vitamin D and/or outdoor exercise may result in additional metabolic and functional benefits in overweight individuals.

In hospital settings a study by Diette et al. (2003) provides a good example on how nature can “heal”. They did evaluate the effects of nature sights and sounds in pain reduction during medical invasive and painful examination. They found out that a better control of pain was achieved regardless of age, gender, race, education, health status and dose of narcotic medication when nature sights and sounds were part of examination.

Beringer (2004) reported a summary of 70 studies on outdoor experiences in spinal cord injury patients. The sentiments of freedom, equality, being able and fun were noted when asked the impact of outdoor activities on identity and self-esteem. Activities like kayaking, sailing or gliding were included. Review concluded that nature experiences and outdoor pursuits are valued ingredients in spinal cord injury rehabilitation programs in particular for those who were outdoor enthusiasts pre-injury and /or who sustained their injury during outdoor pursuits. He also concluded that systematic research is needed to document how contact with blue-green nature may assist in the identity reconstruction process and in adjustment to life with physical disability.

5. Motivation and environmental factors affecting outdoor recreation participation

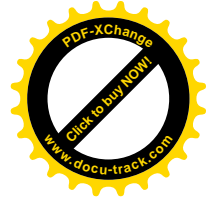
In a study done at Luxembung and France by Rubenstein (1987) the differences between elderly (over 60 years old) participants and no participants in outdoor recreation were examined. Participants were more likely to be healthier, younger, male, married, better educated, and owner-occupants, and were less likely to live alone and have housework as former occupation. Participants detected also fewer problems with outdoor recreation facilities and were more likely to respond positively on general attitudinal statements. This study concluded the need for outdoor programs for relatively poor, frail and isolated elderly individuals.

Kaplan and Kaplan (2003) introduced a reasonable person model (RPM), which is a conceptual framework linking environment factors to human behavior. People are more reasonable, cooperative, helpful, and satisfied when the environment supports their basic informational needs. According them the same environmental supports are important factors in enhancing human health. In the context of RPM physical activity in elderly Australian population has been shown significantly been influenced by availability of safe footbaths and access to parks, as well as in a study from England where walking to school was beneficial to children behavior at school.

A special role of nature was emphasized in a Japanese study (Takano et al. 2002) where in a 5-year follow-up cohort study of older people, perceived access to walk able green space was found to predict longevity, even after controlling of age, socioeconomic status, gender and marital status.

The work by Kuo and Sullivan (2001) has shown the role of vegetation in context of public housing. They have shown that presence of natural areas is related to reduced crime, aggression and violence. Citizens desire more natural areas and trails. Having natural areas nearby can provide incentives for walking and bicycling, increase pedestrian activity and enhance the likelihood that people will became familiar with each other. Participation in local nature activities can increase the sense of pride in one’s community and strengthen urban neighborhoods.

In a big Australian study (Sugiyama et al. 2009) the attractiveness, street connectivity, access to outdoor recreational facilities and access to places of interest were significantly associated with neighborhood street use. According the authors enhancing attributes and perceptions about environment may be effective in promoting residents physical activity. Additionally in South Carolina study (Sharpe et al. 2004) the perceived safety, conditions of sidewalks and quality of street lighting had an impact on residents meeting the physical activity recommendations.



Staat and Hartig (2004) studied how the company of one's close relatives or friends affect on stress reduction and exercise environment. Study was done on 100 students in The Netherlands. They found out that natural environment is preferred over the urban environment and the difference is largest for those being fatigued compared to those feeling themselves as mentally alert. Social stimulation was considered more likely in urban environment and was favored more by participants not being fatigued. The conclusions of this study included that social context influences environmental preferences and influences are different for different environments, being alone and feeling safe in the natural environment are favorable conditions for attentional restoration, and securing and creating accessible natural spaces where people can be alone and feel safe are needed to help people to reduce fatigue and stress.

6. Future perspectives in participation of outdoor exercise

The future and trends in participation in outdoor recreation activities in United States has been studied by Murdock et al. (1991). Even the analysis was done 20 year ago, it provides an interesting approach on how to predict participation development, since it takes into consideration the populations growth (birth, mortality and migration rates) as well as ethnic race (white, black, Spanish- origin) together with the questionnaire data on current participation.

In this study the general finding was that the growth (from 1990 to 2025) in recreational activities equal to the rates of population growth. The total growths for bird watching, hunting, day hiking, camping, pleasure walking and picnicking was estimated to vary between 3-24%, being most in bird watching and smallest in camping. Backpacking was the only activity predicted to decrease (less than 1%) due to decrease in participation in white population. However, in most outdoor activities the rate of increase was predicted to slow. This was because population growth will slow and population will grow older and be composed of a larger proportion of persons with minority groups. The results of this study indicate that the knowledge of the effects of demographic characteristics as well as total population changes are useful for evaluating the number of participants likely to be involved in different types of recreational activities in the future.

Since the physical and mental health problems in general population are to increase the challenges are:

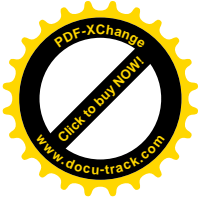
- 1) to increase the number of people taking part in green exercise, including especially those social groups suffering the most ill-health through sedentary life-styles and those currently not having access to the country-side and
- 2) to increase the rate of use by those people already participating in green exercise.

Recreation is a multi-phase experience rather than the activity itself. Each of the phases has a potential to offer various levels of satisfaction to recreations and all the phases should be taken into consideration when researching, planning and managing outdoor activities and offerings. Hammit (1980) describe the phases in this paper as follows:

- anticipation –envisioning and planning the trip
- travel to –getting to the recreational site
- onsite –the actual activity or experience at the site
- travel back –the return back to home and
- recollection –recall of memory of experience.

7. Suggestions for further studies

1. Does Nordic outdoor fitness and physical activity promote health? E.g. comparison with a Nordic country to Central European country based on existing participation and health statistics).
2. Long term outdoor activity participation and health (weight management, MBO).



3. Ecological values and green-blue exercise.
4. Development of outdoor activity in the future (trends in terms of different activities, participation rates and participants profiles, legal aspects, etc.) in Scandinavian countries.

7.1 Selected terminology

Green exercise (exercise in parks and forests, also exercise in nature)

Green-blue exercise (exercise connected to forests and water)

Restorative environment (helps to reduce stress and restore)

Reasonable person model, RPM (people are more cooperative, helpful and constructive)

Attention restoration theory, ART (person having difficulties in concentrating, increased irritation, commit errors in tasks requiring concentration)

RPE (rating of perceived exertion)

Indoor lifestyle

Nordic outdoor fitness

Nordic health

MBO (metabolic syndrome; elevated body weight, blood pressure, blood lipids and blood sugar)

8. Conclusions

This report shows that nature affects on health and well-being in various ways. Physical activity outdoors is a multi-phase experience and has added value compare to exercise indoors. Importance of green exercise will grow in the future, since provides needed alternative for sitting indoor lifestyle increasing mental and metabolic health problems. There is a good reason to state that "nature is a gold mine for health promotion". This review resulted lot of studies from Australia, USA and UK but surprisingly less from Nordic countries. More longitudinal studies could strengthen the role of green exercise in health promotion. Based on previous a systematic and strong approach in greeting and publishing the Nordic outdoor fitness and health -concept is highly recommended.

9. References

Beringer A. International Journal of Rehabilitation Research 2004, 27:7-15. Spinal cord injury and outdoor experiences.

Borg G, Ljunggren G, Ceci R. European J Applied Physiology 1985, 54:343-349. The increase of perceived exertion, aches and pain in the legs, heart rate and blood lactate during exercise on a bicycle ergometer.

Breitenstein D, Ewert A. Health Education Jan-Feb 1990, Vol 21,1,16-20, Health Benefits of outdoor recreation: implications for health education.

Ceci R, Hassmen P. Medicine and Science in Sports And Exercise 1991, Vol 23(6), 732-738. Self-monitored exercise at three different RPE intensities in treadmill vs field running.

Diette GB, Lechtzin N, Haponik E, Devrotes A, Rubin HR. Chest 2003, 123:941-48, Distraction therapy with nature sights and sounds reduces pain during flexible bronchoscopy. A complementary approach to routine analgesia.



Florenz H, Martinez R, Chara W, Strickam-Stein N, Levis S. *Journal of Steroid Biochemistry and Molecular Biology* 2007, 103:679-81, Outdoor exercise reduces the risk of hypovitaminosis D in the obese.

Focht BC. *Research Quarterly for Exercise and Sport* 2009, Sept 80, 611-20, Brief walks in outdoor and laboratory environments: effect an affective responses, enjoyment, and Intentions to walk for exercise.

Hammit WE. *Journal of Leisure Research*, 1980, 12, 2,107-115 Outdoor recreation: is it a multi-phase experience.

Herzog T, Chen HC, Primeau JS. *Journal of Environmental Psychology* 2002, 22, 295-306. Perception of the restorative potential of natural and other settings.

Hug S-M, Hartig T, Hansmann R, Seeland K, Hornung R. *Health&Place* , 2009, vol 15, no 4, 971-980. Restorative qualities of indoor and outdoor exercise settings as predictors of exercise frequency.

Jelley S, *J. of Science and Medicine in Sport*, 2005, Vol 8, no 4, Suppl. p.91. Outdoor education physical activities: a primary prevention for adolescent male obesity?

Kaplan R., and S. Kaplan. *American Journal of Public Health* 2003, 93(9), 1484-1489. Health, supportive environments, and the Reasonable Person Model.

Kelley M. *Therapeutic Recreation Journal*, 1993, 27:110-125. The Therapeutic Potential of Outdoor Adventure: a review, with focus on adults with mental illness.

Kennedy DW. *Therapeutic Recreational Journal* 1987, 21:45-50. Leisure and Mental Illness: a literature review.

Krenichyn K. *Health & Place* 2006, Dec 12, 631-43, "The only place to go and be in the city": women talk about exercise, being outdoors, and the meanings of a large urban park.

Kuo FE, Sullivan WC. *Environment Behav* 2001;33:534-571. Aggression and violence in the inner city: impacts of environment via mental fatigue.

Laumann K, Gärlig T, Stormark KM. *Journal of Environmental Psychology* 2003, 23,125-134, Selective attention and heart rate response to natural and urban environments.

Maller C, Townsend M, Pryor A. et al. *Health Promotion International* 2005, vol. 21,1: 45-54. Healthy nature healthy people: "contact with nature" as an upstream health promotion intervention for populations.

Manley AJ, Pretty J, Griffin M, Peacock JL, Cleary TW. *Journal of Sports Sciences* 2007 25, no 3, p.316. Green exercise: The role of exercise environment in enhancing physical and physiological well-being.

Matsouka O, Kabitsis C, Harahousou Y, Trigonis I. *Perceptual and Motor Skills* 2005, 100:707-15, Mood alterations following an indoor and outdoor exercise program in healthy elderly women.

McClaskie SL, Napier TL, Christensen JE. *Journal of Leisure Research* 1986, Vol 18 (3):190-205, Factors influencing outdoor recreation participation: a state study.

Mills A. *Journal of Leisure Research* 1985, 17:184-199. Participation motivations for outdoor recreation: a Test of Maslow's Theory.



Murdock SH, Backmann K, Hoque N, Ellis D. *Journal of Leisure Research*, 1991, Vol 23(3), 238-259. The implications of a change in population size and composition on future participation in outdoor recreational activities.

Paronen O. Perceived effects on well-being of outdoor recreation. Abstract in Gallis C.Th (ed), *Proceedings of the 1st European COST E39 Conference "Forests, trees, and human health and well-being" 2005, Thessaloniki*, ss. 333-335.

Pretty J. *Spirituality and Health International* 2004, 5,2, 68-78. How nature contributes to mental and physical health.

Pretty J, Peacock J, Sellens M, Griffin M. *International journal of Environmental Health Research* 2005, 15.5:319-337. The mental and physical outcomes of green exercise.

Pretty J, Peacock J, Hine R, Sellens M, South N, Griffin M. *Journal of Environmental Planning and Management*, Vol 50, no 2:211-231, March 2007. Green exercise in the UK countryside: effects on health and physiological well-being, and implications for policy planning.

Rubenstein JM. *International Journal of Aging and Human Development* 1987, 25,129-46, Outdoor recreation in two European countries.

Shiota M, Sudou M, Ohsihima M, *Aviation, Space, and Environmental Medicine* 1996, 67,12:1155-60 Using outdoor exercise to decrease jet lag in airline crewmembers.

Scully D, Kremer J, Meade MM, Graham R, Dudgeon K *British Journal of Sports Medicine* 1998, 32,111-20, Physical exercise and psychological wellbeing: a critical review.

Sharpe PA, Granner ML, Hutto B, Ainsworth B. *America Journal of Health Promotion* 2004, Jan-Feb 18, 251-7, Association of environmental factors to meeting physical activity recommendations in two South Carolina counties.

Staats H and Hartig T. *J Environmental Psychology*, 2004, 24,199-211. Alone or with a friend: a social context for psychological restoration and environmental preferences.

Sugiyama T, Leslie E, Giles-Corti B, Owen N. *Health Place* 2009, Dec 15, 1058-63, Physical activity for recreation or exercise on neighborhood streets: associations with perceived environmental attributes.

Suija K, Pechter U, Kalda R, Tähepold H, Maaros J, Maaros HI. *International Journal of Rehabilitation Research* 2009, Jun 32,132-8, Physical activity in depressed patients and their motivations to exercise: Nordic Walking in family practice.

Takano T, Nakamura K, Watanabe M. *J Epidemiol Community Health* 2002:56:913-918. Urban residential environments and senior citizens' longevity in megacity areas; the importance of walkable green spaces.

Tyrväinen L, Tuulentie S. *Metlan työraportteja* 2007:52. Luonnon merkitys kaupunkilaiselle ja vaikutus psyykkiseen hyvinvointiin. (Effect of nature for city dwellers).

10. About the author

Dr. Raija Laukkanen got her PhD at University of Kuopio, Department of Medicine in 1993. Dr. Laukkanen has acted as a Docent (Adjunct Professor) in health-related fitness at University of



Oulu, Department of Medicine since 1999. She has published in the fields of cardiovascular training and dose-response issues as well as in evaluation of cardiovascular fitness and sports technology. Dr. Laukkanen is a Fellow of American College of Sport Medicine and a member of European College of Sport Science. She is also a member of exercise and sport science evaluation board of the Ministry of Education in Finland, a founding member and a Scientific Advisor for International Nordic Walking Association and a Board member of Finnish recreational Ski-track Association (Suomen Latu). Raija Laukkanen is a member of an advisory panel in EU-PREVE (prevention of lifestyle diseases)-program during 2009-2010. Dr. Laukkanen works as a Director, Sport Science in Polar Electro Oy.

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