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Nollaig O'Sullivan  
*University of Limerick*

Aoife Donnelly  
*Technological University Dublin, [aoife.donnelly@tudublin.ie](mailto:aoife.donnelly@tudublin.ie)*

Tadhg MacIntyre  
*University of Limerick*

Giles Warrington  
*University of Limerick*

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# Investigating the Impact of Green Exercise on population health and well-being in a small community in Ireland – a novel approach using a natural laboratory ecosystem.

N. O'Sullivan <sup>1</sup>; A. Donnelly <sup>2\*</sup>, T. MacIntyre <sup>1</sup>, G. Warrington <sup>1</sup>

<sup>1</sup>Dept. of Physical Education and Sport Sciences, University of Limerick;

<sup>2</sup>Dept. of Food Science and Environmental Health, Dublin Institute of Technology;

\*Corresponding author address: [Aoife.Donnelly@DIT.ie](mailto:Aoife.Donnelly@DIT.ie); School of Food Science and Environmental Health, Dublin Institute of Technology, Cathal Brugha Street, Dublin 1, Ireland.

**ABSTRACT:** Green exercise is defined as undertaking physical activity whilst being directly exposed to nature (Pretty et al., 2005; 2007). Pretty et al. (2003) were among the first wave of researchers to investigate the synergistic benefits of incorporating physical activity and exposure to the natural environment to produce positive psychological affect. Over the past decade, investigations into the possible additive effects on well-being of green exercise and how it can be used as an influential tool to help combat the rising rate of both physical inactivity and non-communicable disease has gained prominence in scientific literature. However, there is still a need to investigate the mechanisms behind observed health benefits of the natural environment and to gain a deeper understanding of the benefits of environmental components and how this has potential to improve wellbeing and increase autonomous motivation in physical activity in a community setting. The research project GoGreenEx (Going Outdoors: Gathering Research Evidence on ENvironment and Exercise) aims to build engagement between expert researchers across interdisciplinary perspectives (psychology, physiology, biomechanics, environmental sciences and physical activity) and societal groups, both from the charity sector (Mental Health Ireland-a charity that promotes positive mental health) and the sporting domain (Local Sport Partnerships and commercial entities-e.g., Clarisford Park). This novel research in the field of public health will use the natural laboratory of Clarisford Park to study the impacts and underlying processes that surround green exercise and further add to our understanding of its potential effects on population health and well-being.

**Key words:** *Self-Regulation; Community health and wellbeing; Green Exercise; Physical Activity; Behaviour Change*

## 1. INTRODUCTION

### 1.1 Green Exercise

Research over a decade ago led to the coining of the term *green exercise* to account for the effects of activity in natural blue and green spaces (Pretty et al., 2003). Green exercise is a concept that explores the potential impact of physical activity, in conjunction with an immersion in nature based environments, on our mental and physical health (Pretty et al., 2005; 2007). Green exercise can be defined as undertaking physical activity whilst being directly exposed to nature (Pretty et al., 2005; 2007). Pretty et al. (2003) investigated the synergistic benefits of incorporating physical activity and exposure to the natural environment to produce positive psychological affect. Over the past decade, investigations into the possible additive effects of well-being on green exercise has gained prominence in the scientific literature and globally, there is an emerging consensus on ecosystem benefits for health and well-being (Gladwell et al., 2013; [www.phenotype.eu](http://www.phenotype.eu) 2012-2015; Hartig & Kahn, 2016). For instance, the European Union funded a €3.5m multi-study investigation of the explanatory mechanisms that link exposure to the natural outdoor environment and human health and well-being ([www.phenotype.eu](http://www.phenotype.eu) 2012-2015) and have now expanded to exploring blue health (the positive health impact of our connectedness to water)

in a €6m study ([www.bluehealth2020.org](http://www.bluehealth2020.org)). Recently, leading scientific journals, *Science* (Hartig & Kahn, 2016) and *Nature* (Kardan et al., 2015), and similarly, high profile periodicals including *Scientific American* (Rodriguez, 2016) have all featured articles on the human nature interaction.

Research examining green exercise has led to findings that provide tentative evidence for an array of psychological and physiological consequences (Brymer, Cuddihy, & Sharma-Brymer, 2010), including improvement in self esteem and commensurate reductions in total mood disturbances (Thompson Coon, Boddy, Stein, Whear, Barton, & Depledge, 2011; Barton & Pretty, 2010), mental health benefits and wellbeing (Bowler, Buyung-Ali, Knight, & Pullin, 2010; Bauman, 2004; Bodin & Hartig, 2003; Hug, Hartig, Hansmann, Seeland, & Hornung, 2009.; Pretty et al., 2005; Thompson Coon et al., 2011), facilitating social interaction within communities which can foster social inclusion and social connectedness (Hug, Hartig, Hansmann, Seeland, & Hornung, 2009), improving restorative attention effects (Bodin & Hartig, 2003; Hug et al, 2009; Pretty et al., 2007; Pretty, Peacock, Sellens, & Griffin, 2005; Thompson Coon et al., 2011), and decreases in stress and negative affect (Barton, Griffin, & Pretty, 2011). Furthermore, increased feelings of vitality (Kaplan & Kaplan, 1989), improvements in concentration (Pretty et al., 2007), heightened perceptions of connectivity with nature (Mayer & Frantz, 2004; Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2008) and increased prosocial behaviour (e.g., positive environmental behaviours) (Balseviciene et al., 2014) are among the other factors that have been linked to green exercise.

Environmental Psychologists have found links between access to green environments and decreases in mood disturbances (Pretty, Peacock, Hine, Sellens, South, & Griffin, 2007; Takano, Nakamura, & Watanabe 2002) as well as increases in self esteem, cognitive functioning and specific physiological changes (Bodin & Hartig 2003; Felsten 2009; Kaplan 1995; Pretty, Peacock, Sellens & Griffin, 2005). A number of physiological effects were also highlighted. These include significantly reduced blood pressure (Ochiai et al., 2015), significantly enhanced human immune function and reduced levels of stress hormones (Li, 2009; Tam, Astephenon Wilson, Noakes, & Tucker, 2013) and decreased levels of perceived physical exertion (Wolf & Wohlfart, 2014). The positive physiological and psychological effects of exercising in green environments despite some inconsistencies among the findings have inspired action amongst policymakers and key stakeholders. As a result, green spaces are increasingly regarded as an important component of health-promoting environments (Nilsson, Sangster, Gallis, Hartig, De Vries, Seeland, & Schipperijn, 2010). "Green exercise provides us with the idea that physical and mental health programs need not necessarily be "pursued," as such opportunities are essentially innate to the natural environment and, thus, readily available" (Garrin, 2015, p.18).

## **1.2 Why promote Green exercise?**

Green exercise research is beneficial in addressing a number of health issues as it provides practical, non-invasive methodologies for proselytising positive health ideals which can aid in addressing health issues such as physical inactivity. Physical inactivity has been recognised as the fourth leading risk factor for global mortality (Yeh, Stone, Churchill, Wheat, Brymer, & Davids, 2015). The World Health Organization have provided physical activity guidelines but levels of physical activity are still declining in the general population (WHO, 2014). This has been linked to an increase in a number of health related problems such as obesity, coronary heart disease, stroke, cancer and diabetes (Goldstein et al., 2001; Hamilton, Hamilton, & Zderic 2007; Lakka, Laaksonen, Lakka, Niskanen, Kumpusalo, Tuomilehto, & Salonen, 2002). Encouraging physically active lifestyles remains a crucial element of preventive health strategies (Walsh, 2011).

## **2. RESEARCH DIRECTIONS**

A number of systematic reviews investigating the effects of being physically active in the natural environment (Thompson Coon et al, 2011; Bowler, Buyung-Ali, Knight, & Pullin, 2010; Calogiuri & Chroni, 2014) and the mental health benefits of being in nature (Gascon et al., 2015) have been conducted in recent years. The consensus appears to be that being physically active in the natural environment shows some promising effects on psychological and physiological health. However, the systematic reviews combined with contemporary research demonstrate some contrasting findings. The research can be hampered by a number of gaps in the literature and there remains a paucity of high quality evidence. Given that our interactions with nature are complex and multifaceted it is not surprising

that many of the concepts are blurred and the field of research has numerous methodological limitations (Gladwell et al., 2013).

## **2.1 GoGreenEx research**

At present, there is a pressing need for more robust evidence through sophisticated research designs and a focus on illuminating the underlying mechanisms of green exercise. Research is now being carried out by the University of Limerick (UL) in conjunction with Dublin Institute of Technology (DIT) as part of the GoGreenEx project to further our understanding of the effects of Green Exercise. This research aims to address these methodological limitations and provide conceptual clarity through transdisciplinary collaboration. The combination of expertise from researchers in social, cognitive, organizational and sport psychology and those in allied fields (e.g., sport science and environmental science) may yield new knowledge which can be translated from theory to practice across a range of contexts. This approach transcends previous paradigms by exploring research questions from a new viewpoint, one which is transdisciplinary and based on theory-driven investigation of well-being and pro-environmental behaviour from action in natural settings.

This research idea was developed from the Lead Postgraduate Researchers experience and knowledge from being a Sport and Exercise Psychologist and as a Community Hub Facilitator in Clarisford Park, a position developed from funding from the Irish Sports Council Dormant Account Fund. The research draws on the Researchers knowledge on the psychological aspects of self-regulation strategies, lifestyle behaviours and green exercise on wellbeing and combines with the knowledge developed from being a Community Hub Facilitator, the promotion of physical activity and how sport and recreation can facilitate change in community lives whilst improving health and wellbeing. This combination of expertise and knowledge complements the vision of achieving a community in which everyone can enjoy physical and mental health and wellbeing to their full potential whilst incorporating the natural environment as a source of psychological and physical wellbeing.

## **2.2 Clarisford Park**

This research also incorporates Clarisford Park and its natural environment as a natural laboratory, collaborating with local communities to gather valuable research. Clarisford Park is an all-inclusive community sports facility set in 10 hectares of open grassland and mature woodland on the banks of the River Shannon in Killaloe, Co. Clare. The setting provides the backdrop for a range of sport and community facilities including a full size soccer and rugby pitch, 3G all-weather pitch, sand based all-weather pitch, scouts paddock, training areas, multipurpose sports pavilion, 1km running/walking trail, open space and parking facilities. Clarisford Park is an example of how sport and recreation can facilitate change in community lives whilst improving health and wellbeing. The mission of Clarisford Ltd, stems from three core values of Sport & Recreation, Quality of Life and Collaboration & Partnership.





Figure 1 Clarisford Park Aerial view (left) and lake view (right)

This park is about harnessing the potential of people and place and it is based on a defined need, it is change centric, it is innovative and it is sustainable. For a community project like Clarisford Park, the key viability indicator is the existence of a demographic that can support the facility and create a sustainable longevity for the lifespan of the project. Clarisford Park facilitates a municipal intergenerational sports facility which promotes sport and recreation as a catalyst for a healthy lifestyle, and it positively contributes and improves health, well-being and quality of life in the community whilst providing a natural laboratory for the research programme.



Figure 2 Walking/running track in Clarisford Park (left) and Aerial view of sports pitches (right)

Encouraging the sustainable use of ecosystems services for physical activity and managing the ecosystems is central to the ethos of Clarisford Park. It is an example of managing an ecosystem by using the natural environment to promote physical activity within the towns of Killaloe-Ballina and it creates an awareness and appreciation of the natural environment where sport, recreation and physical activity and environment and biodiversity work together. Exploring the interaction between the landscapes, the quality of the environment, affinity towards the natural world, perceived benefits of interacting with the environment with the emergence of pro-environmental behaviour are central themes in this research.



Figure 3 - Natural eco-systems in Clarisford Park

### 3. CONCLUSIONS

This research will address a number of scientific questions designed to determine what the impact and specific health benefits of exercising in the natural environment are. This work proposes to gain a deeper understanding of the benefits of environmental components and how this has potential to improve wellbeing and increase autonomous motivation in physical activity in a community setting. The research will augment conventional interventions with innovative strategies that focus on the potential of understanding the link with ecosystems in order to see the benefits it may have for health. This research addresses both H2020 societal challenges (e.g., mental health; sustainable environment) and national priorities (e.g., Healthy Ireland initiative). This research ultimately aims to improve our understanding of how interacting with the environment can influence pro environmental behaviour and it presents an opportunity for incorporating citizen science into the research methods in addition to the more traditional approaches.

#### 4. REFERENCES

- Balseviciene, B., Sinkariova, L., Grazuleviciene, R., Andrusaityte, S., Uzdanaviciute, I., Dedele, A., & Nieuwenhuijsen, M. (2014). Impact of residential greenness on preschool children's emotional and behavioral problems. *International Journal of Environmental Research and Public Health*, 11(7), 6757–6770. doi:10.3390/ijerph110706757
- Barton, J., & Pretty, J. (2010). What is the best dose of nature and green exercise for improving mental health? A multi-study analysis. *Environmental Science & Technology*, 44(10), 3947-3955. doi:10.1021/es903183r
- Barton, J., Griffin, M., & Pretty, J. (2011). Exercise-, nature- and socially interactive-based initiatives improve mood and self-esteem in the clinical population. *Perspectives in Public Health*, 132(2), 89-96. doi:10.1177/1757913910393862
- Bauman, A. E. (2004). Updating the evidence that physical activity is good for health: An epidemiological review 2000–2003. *Journal of Science and Medicine in Sport*, 7(1), 6-19. doi:10.1016/s1440-2440(04)80273-1
- Bodin, M., & Hartig, T. (2003). Does the outdoor environment matter for psychological restoration gained through running? *Psychology of Sport and Exercise*, 4(2), 141-153. doi:10.1016/s1469-0292(01)00038-3
- Bowler, D. E., Buyung-Ali, L. M., Knight, T. M., & Pullin, A. S. (2010). A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health*, 10(1), 456. doi:10.1186/1471-2458-10-456
- Brymer, E., Cuddihy, T. F., & Sharma-Brymer, V. (2010). The role of nature-based experiences in the development and maintenance of wellness. *Asia-Pacific Journal of Health, Sport and Physical Education*, 1(2), 21-27. doi:10.1080/18377122.2010.9730328
- Calogiuri, G., & Chroni, S. (2014). The impact of the natural environment on the promotion of active living: An integrative systematic review. *BMC Public Health*, 14(1), 873. doi:10.1186/1471-2458-14-873
- Felsten, G. (2009). Where to take a study break on the college campus: An attention restoration theory perspective. *Journal of Environmental Psychology*, 29(1), 160-167. doi:10.1016/j.jenvp.2008.11.006
- Garrin, J. M. (2015). Green Exercise and Rural America: Cultural, Ecological, and Ideological Implications for Positive Social Change. *Journal of Social Change*, 7(1), 1.
- Gascon, M., Triguero-Mas, M., Martínez, D., Dadvand, P., Forn, J., Plasència, A., & Nieuwenhuijsen, M. J. (2015). Mental health benefits of long-term exposure to residential green and blue spaces: A systematic review. *International Journal of Environmental Research and Public Health*, 12(4), 4354-4379. doi:10.3390/ijerph120404354
- Gladwell, V. F., Brown, D. K., Barton, J. L., Tarvainen, M. P., Kuoppa, P., Pretty, J., ... Sandercock, G. R. H. (2012). The effects of views of nature on autonomic control. *European Journal of Applied Physiology*, 112(9), 3379-3386. doi:10.1007/s00421-012-2318-8
- Goldstein, L. B., Adams, R., Becker, K., Furberg, C. D., Gorelick, P. B., Hademenos, G., ... Members (2001). Primary prevention of Ischemic stroke: A statement for healthcare professionals from the stroke council of the American heart association. *Circulation*, 103(1), 163-182. doi:10.1161/01.cir.103.1.163
- Hamilton, M. T., Hamilton, D. G., & Zderic, T. W. (2007). Role of low energy expenditure and sitting in obesity, metabolic syndrome, type 2 diabetes, and cardiovascular disease. *Diabetes*, 56(11), 2655–2667. doi:10.2337/db07-0882
- Hug, S.-M., Hartig, T., Hansmann, R., Seeland, K., & Hornung, R. (2009). Restorative qualities of indoor and outdoor exercise settings as predictors of exercise frequency. *Health & Place*, 15(4), 971–980. doi:10.1016/j.healthplace.2009.03.002
- Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology*, 15(3), 169-182. doi:10.1016/0272-4944(95)90001-2
- Kaplan, S., & Berman, M. G. (2010). Directed attention as a common resource for executive functioning and self-regulation. *Perspectives on Psychological Science*, 5(1), 43–57. doi:10.1177/1745691609356784
- Kaplan, R. & Kaplan, S. (1989). *The Experience of Nature: A Psychological Perspective*. New York: Cambridge University Press.
- Lakka, H.-M. (2002). The metabolic syndrome and total and cardiovascular disease mortality in middle-aged men. *JAMA*, 288(21), 2709. doi:10.1001/jama.288.21.2709
- Lee, J., Park, B. ., Tsunetsugu, Y., Ohira, T., Kagawa, T., & Miyazaki, Y. (2011). Effect of forest bathing on physiological and psychological responses in young Japanese male subjects. *Public Health*, 125(2), 93–100. doi:10.1016/j.puhe.2010.09.00
- Li, Q. (2009). Effect of forest bathing trips on human immune function. *Environmental Health and Preventive Medicine*, 15(1), 9-17. doi:10.1007/s12199-008-0068-3
- Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology*, 24(4), 503–515. doi:10.1016/j.jenvp.2004.10.001
- Mayer, F. S., Frantz, C. M., Bruehlman-Senecal, E., & Dolliver, K. (2008). Why is nature beneficial? The role of Connectedness to nature. *Environment and Behavior*, 41(5), 607–643. doi:10.1177/0013916508319745
- Nilsson, K., Sangster, M., Gallis, C., Hartig, T., De Vries, S., Seeland, K., & Schipperijn,

- J. (Eds.). (2010). *Forests, trees and human health*. Springer Science & Business Media.
- Ochiai, H., Ikei, H., Song, C., Kobayashi, M., Takamatsu, A., Miura, T., ... Miyazaki, Y. (2015). Physiological and psychological effects of Forest Therapy on middle-aged males with high-normal blood pressure. *12*(3), Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4377916/>
- Pretty, J. (2004). How nature contributes to mental and physical health. *Spirituality and Health International*, *5*(2), 68–78. doi:10.1002/shi.220
- Pretty, J., Peacock, J., Hine, R., Sellens, M., South, N., & Griffin, M. (2007). Green exercise in the UK countryside: Effects on health and psychological well-being, and implications for policy and planning. *Journal of Environmental Planning and Management*, *50*(2), 211–231. doi:10.1080/09640560601156466
- Pretty, J., Peacock, J., Sellens, M., & Griffin, M. (2005). The mental and physical health outcomes of green exercise. *International Journal of Environmental Health Research*, *15*(5), 319–337. doi:10.1080/09603120500155963
- Takano, T. (2002). Urban residential environments and senior citizens' longevity in megacity areas: The importance of walkable green spaces. *Journal of Epidemiology & Community Health*, *56*(12), 913–918. doi:10.1136/jech.56.12.913
- Tam, N., Astephen Wilson, J. L., Noakes, T. D., & Tucker, R. (2013). Barefoot running: An evaluation of current hypothesis, future research and clinical applications. *British Journal of Sports Medicine*, *48*(5), 349–355. doi:10.1136/bjsports-2013-092404
- Thompson Coon, J., Boddy, K., Stein, K., Whear, R., Barton, J., & Depledge, M. H. (2011). Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A systematic review. *Environmental Science & Technology*, *45*(5), 1761–1772. doi:10.1021/es102947t
- Walsh, R. (2011). Lifestyle and mental health. *American Psychologist*, *66*(7), 579–592. doi:10.1037/a0021769
- WHO. (2010). *Global recommendations on physical activity for health*. Switzerland:WHO
- Yeh, H.-P., Stone, J. A., Churchill, S. M., Wheat, J. S., Brymer, E., & Davids, K. (2015). Physical, psychological and emotional benefits of green physical activity: An ecological dynamics perspective. *Sports Medicine*. doi:10.1007/s40279-015-0374-z