

Impact case study (REF3)

Institution: University of Exeter		
Unit of Assessment: UoA 2 Public Health, Health Services and Primary Care		
Title of case study: The value of nature for human health: transforming regional, national and international environmental and health policy		
Period when the underpinning research was undertaken: 2011 to present		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Benedict Wheeler	Senior Lecturer	2010 to present
Ruth Garside	Associate Professor	2012 to present
Mathew White	Senior Lecturer	2011 to present
Rebecca Lovell	Lecturer	2011 to present
Period when the claimed impact occurred: 2015 to present		
Is this case study continued from a case study submitted in 2014? No		
1. Summary of the impact		
<p>Until recently, recognition of the value of the natural environment as a health asset was lacking in health and environmental policy. Interdisciplinary research at Exeter's <i>European Centre for Environment and Human Health</i> led to a paradigm shift in how health policy, environmental planning and public health practice harness the potential of natural environments for supporting health. The impact of Exeter's research has included:</p> <ul style="list-style-type: none"> internationally: The research has influenced the work of the World Health Organisation (WHO) e.g. WHO urging member state action on urban green space for health; nationally: Policy decisions have been informed by research evidence e.g. UK Government investment of >£15million in natural environment-based population health promotion programmes and environmental social prescribing schemes; and locally: Research has changed public health practice in Dorset, Cornwall and the third sector, and stimulated foreign direct investment e.g. EU investment of £3.5m in urban Public Open Space in Cornwall for health and biodiversity gain. 		
2. Underpinning research		
<p>Previous health, environment and planning policy was not explicit about linking the health and wellbeing benefits from the natural environment nor on how to maximise them; our work has changed this. This case study is based on a decade of research led by interdisciplinary academics at the <i>European Centre for Environment and Human Health</i> ('the Centre'), at the University of Exeter Medical School. A targeted combination of approaches including observational epidemiological studies, lab-based experimental studies, field experiments, qualitative research, evidence synthesis (including systematic reviews), and policy and practice analyses have been used to build a coherent body of evidence. Our research has demonstrated, quantified and transformed understanding of the contribution of natural environments to human population health and well-being, including:</p>		
2.1 How natural environments can promote health		
<p>As core members of the UK Centre of the Collaboration for Environmental Evidence, we have pioneered the application of systematic review methodologies to environment and health issues. Our systematic review of the potential health impacts of environmental volunteering [3.1], the first ever mixed-methods Cochrane systematic review, clarified the key mechanisms for successful interventions and activities using natural environments for health and wellbeing. It found that environment-based interventions could result in health impacts through mechanisms including physical activity, social contact and personal achievement. Our systematic review of the health and well-being benefits of biodiverse environments [3.2] flagged the potential of thinking beyond</p>		

'green space vs grey space' for health and environment. It showed the mutual benefit of each and demonstrated significant inconsistencies and weaknesses in the evidence base, and the need for high quality, interdisciplinary research to better inform decision-making.

2.2 The scale of health economic values and wellbeing benefit of natural environments

In collaboration with Public Health England (PHE) and Natural England (NE), we showed that outdoor physical activity delivers an estimated £2.2bn worth of health benefits to adults in England each year [3.3]. This study used NE's unique Monitor of Engagement with the Natural Environment data to estimate physical activity associated with 1.13bn active visits per year to natural environments in England, and applied standard Metabolic Equivalent of Task ratios to estimate Quality-Adjusted Life-Year gains and their health-related economic values. Further analysis [3.4] identified a potential 120-minute/week threshold for outdoor activity to achieve health gains. This study estimated the relationship between actual time spent outdoors in nature (as opposed to residential proximity to green spaces) and self-reported health and subjective wellbeing. Our analysis identified this possible threshold, and the relationship was not solely explained through the increased physical activity associated with time outdoors. These studies established a more comprehensive set of health-related economic values of natural environments than was previously available, which led to the development of the *Greenkeeper* tool.

2.3 Moving to greener neighbourhoods improves health

Our studies using the 18-year British Household Panel Survey were among the first to use robust longitudinal approaches to demonstrate that people moving to greener urban neighbourhoods have subsequent better mental health outcomes, and that positive effects last for at least three years following a move [3.5]. The novel use of long-term panel data permitted intra-individual analysis, improving causal inference relative to existing evidence at the time. In particular the approach reduced the likelihood that the observed greenspace-health association is due to selective migration of healthy, wealthy individuals toward greener areas.

2.4 Identified opportunities and strategies for cross-sectoral policy and service delivery

Collaborative synthesis and policy-focussed research with Defra, NE and other Governmental partners identified opportunities to transform Defra's role in promoting public health and the integration of health into the new Green Infrastructure Standards for England [5.1]. Similarly, collaborative research with PHE and Local Authorities in the South West has informed how PHE works with local authorities to deliver health improvement through local government planning, environment and land use policy and delivery [5.2; 5.3; 5.4]. Supporting linkage of environmental policy and social care practice, our systematic review on the value of natural environment engagement in care home settings [3.6] demonstrated promising evidence of reduced agitation in care home residents with dementia who spend time in a garden.

This large interdisciplinary body of research has shown that the natural environment plays a critical role in delivering health and wellbeing benefits. We have also shown that the scale and likely causal pathways of these benefits have previously been underestimated and undefined.

3. References to the research

- 3.1 Husk, K., Lovell, R., Cooper, C., Stahl-Timmins, W., Garside, R., 2016. Participation in environmental enhancement and conservation activities for health and well-being in adults: a review of quantitative and qualitative evidence. *Cochrane Database of Systematic Reviews*, CD010351. doi:10.1002/14651858.CD010351.pub2
- 3.2 Lovell, R., Wheeler, B.W., Higgins, S.L., Irvine, K.N., Depledge, M.H., 2014. A systematic review of the health and well-being benefits of biodiverse environments. *J Toxicol Environ Health B Crit Rev* 17, 1-20. doi:10.1080/10937404.2013.856361
- 3.3 White, M.P., Elliott, L.R., Taylor, T., Wheeler, B.W., Spencer, A., Bone, A., Depledge, M.H., Fleming, L.E., 2016. Recreational physical activity in natural environments and implications for health: A population based cross-sectional study in England. *Prev Med* 91, 383-388. doi:10.1016/j.yjmed.2016.08.023
- 3.4 White, M.P., Alcock, I., Grellier, J., Wheeler, B.W., Hartig, T., Warber, S.L., Bone, A., Depledge, M.H., Fleming, L.E., 2019. Spending at least 120 minutes a week in nature is

associated with good health and wellbeing. *Scientific Reports* 9: 1, 7730. doi:10.1038/s41598-019-44097-3

- 3.5 Alcock, I., **White, M.P., Wheeler, B.W.**, Fleming, L.E., Depledge, M.H., 2014. Longitudinal effects on mental health of moving to greener and less green urban areas. *Environ Sci Technol* 48, 1247-1255. doi:10.1021/es403688w
- 3.6 Whear R., Thompson-Coon J., Bethel A., Abbott R., Stein K., **Garside R.** 2014 What is the impact of using outdoor spaces such as gardens on the physical and mental wellbeing of those with dementia? A systematic review of quantitative and qualitative evidence *Journal of the American Medical Directors Association* 15 (10); 697-705. doi: 10.1016/j.jamda.2014.05.013

4. Details of the impact

Human health and wellbeing depend on the environment and well-functioning ecosystems. This linkage was historically poorly recognised in both environment and health policy. Research from the Centre has changed policy mind-sets, strategies and practice. Our evidence has strengthened conservation, environmental management and investment policy at scales from local to international by clarifying the role of 'natural capital' in supporting human health and wellbeing.

Traditionally, environmental policies relating to human health have been dominated by hazards; our evidence means these are now balanced by the recognition of the health and wellbeing benefits of good quality natural environments. Our research impact has been amplified through active engagement and close collaborations with policy bodies who have recognised our expertise and invited participation in a range of expert advisory roles and joint projects.

4.1 Influencing international policy on natural environment and health

Our research has led to changes in international policy and strategy in both the health and environment sectors. Since 2015, we have worked with the WHO Regional Office for Europe and the Convention on Biological Diversity (CBD) on urban greenspace, biodiversity and health. Our 2014 systematic review [3.2] of links between biodiverse environments and 'good' health was used to inform the ratification of two key CBD decisions on biodiversity and human health, with a joint CBD/WHO report co-authored by Lovell [5.5]. These decisions invite the 195 nation state signatories, and the European Union, to act on the linkages in developing health and environmental strategies (COP12 decision XII/21; COP13 decision XIII/6). These international decisions set the context for national policymaking, including the UK Government 25 Year Plan for the Environment [5.6]. The CBD/WHO report was also used to inform the implementation of the relevant 2030 UN Sustainable Development Goals adopted in 2015 by all UN member states (especially SDG3 (health), but also SDGs 7 (water quality) and 11 (nature-based solutions to challenges related to urban well-being). The WHO's Technical Officer said "[The systematic review by ECEHH] was instrumental in getting the WHO to pick up that theme [benefits of nature/biodiversity for health], to make this a WHO topic." [5.7].

Recognition of our research outputs and expertise led to Depledge and Wheeler contributing one of three chapters of the key 2016 WHO evidence review, on *Urban green spaces and health*, underpinning WHO urban greenspace action [5.8]. Wheeler was subsequently a member of an Expert Group advising WHO, ultimately resulting in WHO's *Urban green spaces: a brief for action* for authorities promoting and supporting action for urban greenspaces. WHO's Technical Officer on this programme said

"...this understanding of what matters is something where Exeter was different to many academic actors. There was a stronger understanding of what it takes on a local level to work on it and fund [green space] to make it functional and operational. This is where Exeter made a difference in terms of how the outputs and the research work were positioned, and how they can be useful to local practitioners." [5.7]

4.2 Influencing national policy on natural environment and health

At the national scale, the Centre's research resulted in a joint report and Departmental briefing that informed the Government's position on natural environment and health. The report was produced by a collaboration between the Centre, Defra, PHE and related stakeholders, who synthesised existing evidence (including from Centre researchers) and conducted primary research. This report, along with the key WHO report [5.8], were the key sources underpinning the health aspects of the UK Government 25 Year Plan for the Environment [5.6]. Consequently, Defra has established policy commitments including the creation of national standards for Green Infrastructure, the transformation of agricultural subsidies to a focus on public goods (including health), environmental investments (e.g., planting 11m trees by 2022), and large-scale initiatives. Approximately £10 million has been committed to these health and nature programmes, reaching significant populations including over 500 schools [5.6]. The Research Adviser, at Defra explained:

“Defra wouldn't be picking up on this agenda if there wasn't some evidence underpinning it... I don't think the evidence would be available to us in the same form if it wasn't for your Centre... There's a major value to society from understanding the health benefits - health costs and benefits are absolutely huge. So, if we can get a better handle on the health costs and benefits linked to the environment, then that's part of a much broader agenda that Defra has realised it should be doing more on” [5.1].

Our evidence is influencing public health processes at the national scale, in part through our collaboration with PHE and the Health Protection Research Unit in Environmental Change and Health. Our research findings (e.g. [3.5]) were used to establish the basis for the value of investing in urban green spaces for population mental health in PHE guidance to local authority planners *Spatial Planning for Health* [5.2]; and in PHE guidance (co-authored by Lovell) on accessible greenspace, leading to the prominence of health in the new Green Infrastructure standards for England associated with the 25 Year Plan [5.6]. Our work with Defra, PHE and the NHS, and evidence reviews of the impacts of nature-based health interventions [3.1; 3.6] have contributed to additional Government investment of £5m in social prescribing [5.6].

4.3 Influencing local policy and practice on natural environment and health

The Centre's research directly led to the creation of a commercial tool, *Greenkeeper*, to evaluate the multiple economic values of urban green infrastructure. Prior to our longitudinal studies [3.5], there was no robust estimation of the magnitude of the positive impact of urban greenspace on population mental health, contributing to the under-valuing of urban nature. This work led to our collaboration with Vivid Economics and Barton Willmore on the Innovate UK-funded *Greenkeeper* project. This involved the development and application of our studies of mental health and physical activity values [3.3; 3.4] to incorporate health-related values in the tool. *Greenkeeper* has already been used for a range of purposes, including to support a 2020 call from National Trust and Heritage Lottery Fund to press the Government for £5.5bn green infrastructure funding as part of a 'green recovery' to address inequalities in access to nature highlighted by the Covid-19 pandemic [5.9].

At the local scale, our research has also been used to inform decision making and investment to promote the health and well-being of Dorset's population, and reduce pressure on its health and care services. Our existing research and green space access mapping, carried out in collaboration with Public Health (PH) Dorset, underpinned the Healthy Places Strategy applied within PH Dorset's Sustainability and Transformation Partnership and Integrated Care System. Their Head of Programmes said:

“accessibility mapping has helped to inform the identification of pilot parks...for accessibility enhancement through a blended programme of community engagement and activation, and infrastructure improvements. Research from the European Centre was instrumental in...direct investment by Public Health Dorset of £77,900...to increase engagement with natural environments/greenspaces through enhancements to physical infrastructure and social engagement” [5.4].

Cornwall Council, under significant financial pressure due to austerity, identified a need to recognise the health value as well as biodiversity benefits of the almost 2000 parks, amenity and natural open spaces managed by the Council. Collaborative work resulting from the ESRC-funded Beyond Greenspace project [3.5] led to co-produced outputs appended to the Council's Open Space Strategy and has supported investment in and sustainable management of public open spaces for community health benefit in the future [5.3]. Health evidence input from the Centre contributed to a successful bid led by the Council (with Exeter as a Knowledge Exchange partner) to the European Structural and Investment Fund resulting in a £3.5m green space development project (with an additional £2.9m follow-on project), currently delivering >60 hectares of improved urban green space quality and accessibility in Cornish towns [5.3].

Our evidence has also directly supported improvements in care settings and built confidence in staff to support residents to make use of their outdoor spaces. Our evidence synthesis of the beneficial impacts of gardens in care homes for people with dementia [3.6], together with a co-produced systematic review with the Sensory Trust (a third sector organisation), about older people's sensory engagement with nature, has informed practice in care homes in the South West. The Sensory Trust is a nationally leading authority on inclusive and sensory design, which works on delivery of large-scale UK government programmes. Our collaboration produced an evidence-based information and activity kit, *My Nature*. The Sensory Trust's Director said:

"... we've developed something that's really valuable for [care homes] to have...we were aware that they were continuing to implement activities on the basis of [My Nature] so...that's positive... It's a result of that relationship and seeing the skills that you bring [that] opened up those opportunities for us...we definitely see a real value in having collaborations that bring research and practice together." [5.10].

In summary, our research outputs have directly informed policy and practice at international, national and local scales, and have led to substantive collaborations embedding Exeter researchers within decision making. This was recognised in November 2019, with the designation of the Centre as a *WHO Collaborating Centre on Natural Environments and Health*.

5. Sources to corroborate the impact

- 5.1 Testimony from: Defra (Social Research Adviser) 24/3/2020
- 5.2 Public Health England (2017) Spatial Planning for Health: An evidence resource for planning and designing healthier places. London: PHE.
<https://www.gov.uk/government/publications/spatial-planning-for-health-evidence-review>
- 5.3 Cornwall Council (County Ecologist) – partner benefit report form 9/5/2017
- 5.4 Testimony from: Public Health Dorset (Head of Programmes – Research & Intelligence) 16/9/2020
- 5.5 World Health Organization and Secretariat of the Convention on Biological Diversity, 2015. Connecting Global Priorities: Biodiversity and Human Health.
<https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=1785&menu=35>
- 5.6 Defra, 2018. A Green Future: Our 25 Year Plan to Improve the Environment. HM Government. <https://www.gov.uk/government/publications/25-year-environment-plan>
- 5.7 Testimony from: WHO Europe (Technical Officer, Urban Health Equity) 13/3/2020
- 5.8 WHO Regional Office for Europe (2016). Urban green spaces and health: a review of evidence. Copenhagen: WHO Regional Office for Europe
<http://www.euro.who.int/en/health-topics/environment-and-health/urban-health/publications/2016/urban-green-spaces-and-health-a-review-of-evidence-2016>
- 5.9 Greenkeeper (2020) Greenkeeper supported call to Government for £5.5bn Green Infrastructure Funding. <http://www.greenkeeperuk.co.uk/2020/07/06/greenkeeper-supported-call-to-government-for-5-5bn-green-infrastructure-funding/> 6 July 2020.
- 5.10 Testimony from: Sensory Trust (Director) 4/9/2020