

Just how much time outdoors in nature is enough?

Harvey, D. J.¹, Montgomery, L. N.¹ & White, R.³

1 Department of Biological Sciences, Royal Holloway University of London; 2 Natural England; 3 School of Pharmacy and Biomolecular Science, University of Brighton

Overview

Teachers know that outdoor learning benefits their pupils. Here we show a one-off activity boosts children's mood and biodiversity knowledge; and an hour a week can also improve their mental wellbeing.

Abstract

Research has shown that spending time in nature is beneficial for children's mental wellbeing, but how long must they spend to gain some benefit? Here we present the results from two studies: the Schools' Biodiversity Project, which took place over a year, with children spending an hour a week exploring biodiversity in their school grounds; and a one-off BioBlitz activity, where children spent just one hour looking for species in their school grounds. Both studies showed significant improvement in the children's mood after taking part in nature activities, as well as an increased awareness of the species present in their grounds.

Introduction

Currently in the UK, the mental health of children and teenagers is in decline: in 2020, the rate of mental health issues in all children between the ages of 5 and 16 had increased to 1 in 6. Furthermore, over 50% of those aged between 11 and 16 currently suffering from a probable mental health problem reported their life was worse following the national lockdown (NHS Digital, 2020).

Alongside this decrease in mental health, nature is facing its own crisis: we are entering the sixth mass extinction with declines across all taxa. The causes of this decline have been attributed to largely anthropogenic, or human led, causes such as climate change and habitat destruction. This has led to calls for action but is not something that can be resolved quickly and will require greater human engagement with and commitment to the natural environment.

It is widely acknowledged that spending time outdoors in nature is good for our mental and physical wellbeing and this is particularly true for children and teenagers (Harvey et al., 2020; McCormick, 2017; Tillmann et al., 2018). The majority of this group spend a large part of their day in school, and many schools are associated with some greenspace in their grounds, which serve as a potential resource for boosting biodiversity (Harvey, Gange, & Harvey, 2019). Encouraging pupils to spend time in their schoolgrounds, not only engaging with the nature therein, but gaining the benefits to their mental health and increasing their knowledge and attachment to local biodiversity seems like a possible mechanism to produce future generations with a committed, meaningful and positive attitude to the environment.

However, is this feasible, when there are already many calls on teachers' time and the curriculum? This is particularly true for senior school pupils. Much of the research carried out on engaging children with nature focusses on primary school children. The transition to senior school is often seen as the point when spending time outside in nature should take a backseat to more academic activities. Here we report on two activities that have been designed to

engage primary and secondary school children with the biodiversity in their school grounds. One takes just over an hour and serves as a catalyst to initiate greater pupil engagement with school grounds, whilst the other takes place across a school year. However, both show an increase in mood of the participants and their awareness of biodiversity.

Method

Schools' biodiversity project

In 2017, we developed a long-term intervention to determine whether spending an hour a week, for 21 weeks, across the school year, working to monitor and improve the biodiversity in school grounds could improve pupils' subjective wellbeing and mood. These were assessed using the Kidscreen-27 (Ravens-Sieberer et al., 2007) to measure subjective wellbeing and PANAS-c (Positive and Negative Affective Scale - children; Watson, Clark, & Tellegen, 1988) to assess mood. Both surveys use self-report 5-point Likert scales and are validated for use with children within the programme age group. The activities were designed to cover all taxa present in school grounds, designed by Harvey and Montgomery, and were delivered by them and a team of post-graduate and undergraduate students and volunteers. The programme was designed to be curriculum-linked and age-appropriate. The project ran as a whole class activity for those in primary schools, and as an after-school club for pupils in years 7-13. Activities included building birdboxes and tables, bird and mammal feeding experiments, camera trap monitoring of nocturnal species, creating and monitoring ponds, including sink ponds, phonescopes (microscopes attached to tablet devices and mobile phone screens) to examine invertebrates, lightbox moth trapping and owl pellet dissection. See Figure 1 for some examples of photos taken in activity sessions. Mood surveys were completed weekly by the children, immediately before and after each activity. Wellbeing surveys were completed at the start and end of the school year.



Figure 1. Example sessions from the School's biodiversity project

BioBlitz

In spring 2019, 20 primary and secondary schools (ages 5-15) across Surrey and Sussex were invited to take part in a BioBlitz activity, coordinated by Harvey and White, scheduled for a week in June (19th-26th). A BioBlitz is an activity carried out in a specified time that identifies as many wild species as possible. Participating schools were sent details on how to create an iNaturalist account and register to become part of the project. This was followed by full instructions sent to the lead teacher, detailing the requirement that students should spend at least one hour in their school grounds searching for wild flora and fauna in their grounds. To aid identification, we encouraged the use of Seek by iNaturalist. This is a free app, designed specifically for young people, and identifies organisms on a seven-point scale to species level, using common English names (see Figure 2). For those schools that felt unwilling or unable to use Seek, we recommended identification guides that were readily available, free of charge from the internet and encouraged them to record and submit written records of their findings. As part of the activity, we requested that schools complete a grounds survey where they made an inventory of wildlife habitats and features such as trees, hedgerows, ponds and bird feeders. Immediately before and after the BioBlitz, pupils were also asked to fill a mood survey, as above, as an indication of their short-term mental wellbeing.

We repeated this activity in 2020, however, within Covid restrictions, we suggested that participants could take part in their own safe space, such as their garden, as well as within school, and the only method of species recording offered was Seek. We again asked for a modified grounds survey and ran an evaluation survey asking parents and teachers to rate the participants enjoyment of the activity.



Figure 2. The Seek iNaturalist app in use.

In addition to the mood and wellbeing surveys, we asked participants to list or create a pencil sketch (time limit 5 minutes), of the species they believed to be present in the school grounds before and after our activities (biodiversity perception). Therefore, the biodiversity project participants carried out this activity at the beginning and end of the year and the BioBlitz participants (2019 only) carried it out immediately before and after the activity.

Data analysis

Statistical analysis was carried out using R 4.0.3 (R Core Team, 2020). Data were tested for normality using the Shapiro-Wilk method, and t-tests or Wilcoxon signed rank tests carried out for comparisons as appropriate.

Results

Schools Biodiversity Project

Mood and wellbeing

Of the children taking part in the project, 298 children from school years 2-13 fully completed the wellbeing survey, of these 89 were in years 7-13. Overall, wellbeing improved significantly from before to after ($V = 15774$, $p\text{-value} < 0.01$).

443 children, from school years 2-13 (ages 6-18) completed mood surveys (Fig. 3). Overall, mood was significantly improved immediately after each activity ($V = 24164$, $p\text{-value} < 0.001$).

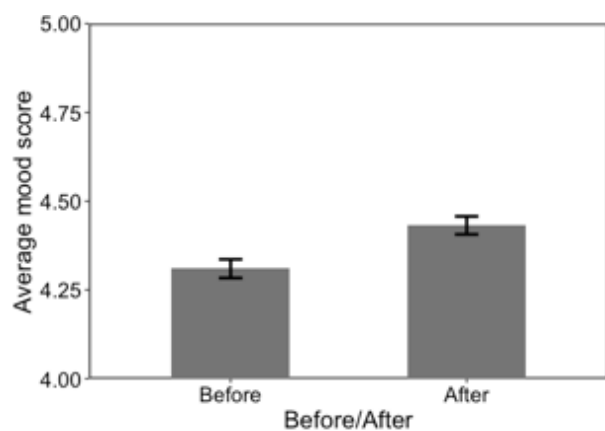
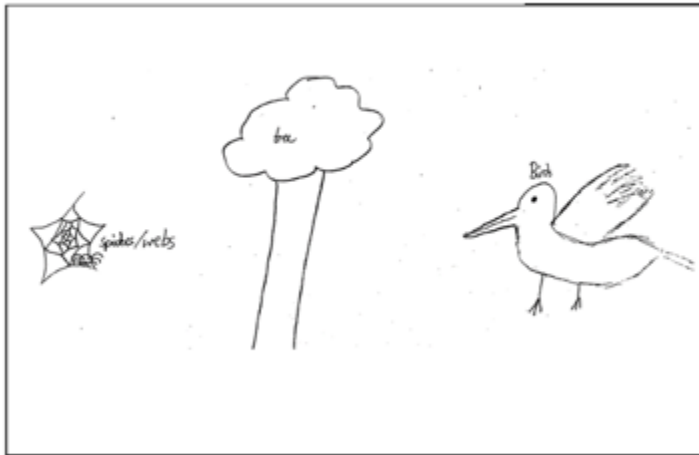


Figure 3. Showing significant improvement in mood of children participating in the schools' biodiversity project over one year

Biodiversity perception

The total number of organisms drawn showed a significant increase in number ($V = 1750$, $p < 0.001$) within all taxa categories; changes were particularly apparent in numbers of insects and other invertebrates, nocturnal mammals, fungi, and amphibians. An example from a child drawing before and after the program can be seen in Figure 4.

Example diagram from before intervention



Example diagram from after intervention



Figure 4. Biodiversity perception drawings by a child before and after the program.

BioBlitz

Mood

In 2019, 105 children, from school years 1-9 (ages 5-15) completed the mood survey before and after the BioBlitz. Overall, positive mood improved significantly from before to after ($V = 1417$, $p\text{-value} = 0.04$).

In 2020, 224 children from school years 3-11 (ages 8-16) took part. Of the parents or teachers who completed our post-activity evaluation survey, 85% agreed or strongly agreed that their children enjoyed participating. The remainder of respondents neither agreed nor disagreed. All respondents felt they would like to take part in the BioBlitz again, with 55% saying they would like to take part in more than one season.

Biodiversity perception

There was a significant increase in the number of species drawn or listed by participants ($t = 4.2125$, $df = 79$, $p < .001$). This increase demonstrated both an increase in the number of organisms and the range of taxa featured; especially invertebrates, mammals, amphibians and fungi. Plants were the most frequently drawn taxa before the BioBlitz, whereas after their participation the number of insects and invertebrates was higher; reflecting a more realistic appreciation of biodiversity in the grounds. Insects and invertebrates were also represented

at a more detailed level of identification in *After* diagrams, e.g. species such as woodlice, crickets and grasshoppers where Seek had allowed them to identify these organisms to species level.

Discussion

The rationale behind these two activities was two-fold: to engage pupils with the local nature in their school grounds in a fun but informative way that would engage them with local nature, and to monitor whether such activities could benefit the pupils' emotional wellbeing.

The first programme, the schools' biodiversity project, was able to monitor the effect over a whole school year and was therefore able to more broadly appraise the effect of the programme. By utilising activities that focussed on different taxa and different learning techniques and engaging undergraduate and post graduate students in the delivery of the programme, we were able to give the project a more 'youth-led' feel that seemed particularly pertinent to those in years 7-13. We demonstrated that all age groups had significantly increased wellbeing and mood.

For the BioBlitz, our aim was to see if spending a short time outside could improve the mood of the participants and whether schools would engage in an activity focussed on species identification. We also wanted to assess whether this would enthuse them sufficiently for them to wish to take part in further BioBlitzes and more targeted long-term programmes. We demonstrated that spending only an hour outside, engaging with nature, boosts mood in all age groups surveyed. In both 2019 and 2020, pupils responded well to the activity across all participating school years and teachers were keen to take part in the BioBlitz in the future. As a result of the pandemic, we were unable to engage schools in longer term projects, so have been unable to determine whether long-term engagement is improved. One positive factor that needs to be emphasised here is the use of technology to identify species, which allowed students to interact with the unfamiliar, using a method that they felt comfortable with. Since practical classification of species has been removed from the senior school curricula, and therefore examinations, the number of pupils engaging with species identification has fallen. This worrying trend means that pupils are becoming more disconnected with local biodiversity and feel less connected to it (e.g. Balmford, Clegg, Coulson, & Taylor, 2002; Bragg, Wood, Barton, & Pretty, 2013). This disconnect does not bode well for either young people or the environment. Using Seek by iNaturalist, as a platform to engage with biodiversity provides a less formal approach which we proved can work when students are out of school and isolated at home, with many benefiting from spending time outside in local nature.

We have also shown that spending time outside in the school grounds leads to a significant improvement in the pupils' knowledge of the species in their grounds and, importantly, this is seen whether the activity takes place across a year, or after spending an hour observing the nature present in the grounds.

We have challenged the perception that nature is for only primary school children, since both the biodiversity project and BioBlitzes were enjoyed across primary and secondary schools

with all age groups reporting a significant improvement in mood and becoming more engaged with their school grounds.

So, to answer the question of this article – how much time in nature is enough - the answer is that even a single hour is enough to give the benefits of improved mood, and the confidence to interact with the environment. It also significantly raises pupil awareness of the range of biodiversity in their schoolgrounds. Most importantly this effect is not limited to those in the primary school setting. Short bursts of activity, as suggested here are also sufficient to enthuse pupils to want to spend more time outside. Such a requirement should fit easily into any school timetable, giving the essential dual benefit to mental health and the environment that will be critical for the future of both.

Acknowledgements

We are very grateful to the pupils and teachers who took part in our studies, the undergraduates and postgraduates who helped deliver the activities, and to Prof Dawn Watling for her invaluable guidance and support throughout the project.

References

- Balmford, A., Clegg, L., Coulson, T., & Taylor, J. (2002). Why Conservationists Should Heed Pokemon. *Science*, 295(5564), 2367b – 2367.
<https://doi.org/10.1126/science.295.5564.2367b>
- Bragg, R., Wood, C., Barton, J., & Pretty, J. (2013). *Measuring connection to nature in children aged 8-12: A robust methodology for the RSPB*. Essex.
- Harvey, D. J., Gange, A. C., & Harvey, H. (2019). The unrealised potential of school grounds in Britain to monitor and improve biodiversity. *Journal of Environmental Education*.
<https://doi.org/10.1080/00958964.2019.1693330>
- Harvey, D. J., Montgomery, L. N., Harvey, H., Hall, F., Gange, A. C., & Watling, D. (2020). Psychological benefits of a biodiversity-focussed outdoor learning program for primary school children. *Journal of Environmental Psychology*, 67, 101381.
<https://doi.org/10.1016/j.jenvp.2019.101381>
- McCormick, R. (2017). Does access to green space impact the mental well-being of children: A systematic review. *Journal of Pediatric Nursing*, 37, 3–7.
<https://doi.org/10.1016/j.pedn.2017.08.027>
- NHS Digital. (2020). Mental health of children and young people in England, 2020: Wave 1 follow up to the 2017 survey. *NHS Digital*, (July), 1–5.
- R Core Team. (2020). R: A language and environment for statistical computing. Vienna.
- Ravens-Sieberer, U., Auquier, P., Erhart, M., Gosch, A., Rajmil, L., Bruil, J., ... Phillips, K. (2007). The KIDSCREEN-27 quality of life measure for children and adolescents: Psychometric results from a cross-cultural survey in 13 European countries. *Quality of Life Research*, 16(8), 1347–1356. <https://doi.org/10.1007/s11136-007-9240-2>
- Tillmann, S., Clark, A., Gilliland, J., Tillmann, S., Clark, A. F., & Gilliland, J. A. (2018). Children and Nature: Linking Accessibility of Natural Environments and Children’s Health-Related Quality of Life. *International Journal of Environmental Research and Public Health*, 15(6), 1072. <https://doi.org/10.3390/ijerph15061072>
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS Scales. *Journal of Personality and Social*

Psychology, 54(6), 1063–1070. <https://doi.org/10.1037/0022-3514.54.6.1063>