



“You don’t have to perform for the trees”: The longer-term effects of nature-based interventions on wellbeing

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ABSTRACT

The health and wellbeing benefits of engagement with the natural environment are well documented, but a lack of prospective research means that the sustainability of effects is unknown. Nature-based interventions (NBIs) seek to extend benefits to a wide, socially inclusive range of people. The primary aim of this study was to develop an improved understanding of one such initiative on personal wellbeing over time.

The study involved adults recruited from Actif Woods Wales, a pan-Wales woodland activity programme. A questionnaire using validated measures assessed participants at baseline ($n = 120$), end of course ($n = 74$) and three months later ($n = 57$), in terms of mental wellbeing, social trust, self-reported health, self-efficacy, self-esteem and physical activity. A parallel qualitative study sought in-depth appreciation of processes of change with five end of course and four follow up focus groups.

Significant positive increases were demonstrated in all psychosocial measures by end of course. These gains held at the follow up stage providing critical evidence of maintained change. Thematic analysis of the qualitative data revealed positive shifts in self-perspective that were reflected in wider lifestyle changes. Participant narratives showed how social processes and nature played an important role in supporting the wellbeing benefits experienced.

This mixed methods study addressed identified gaps for research that furthers understanding of how NBIs can support health and wellbeing longer term. Findings point to a need for sustainable funding and support for NBI projects to embed the role that they can play in delivering therapeutic and preventative outcomes.

Introduction

Issues with mental and physical health are important global health challenges which place a high demand on global health and social care systems and are a significant public health concern. Mental health conditions affect a significant proportion of the global population (Rehm and Shield, 2019), with evidence that mortality is significantly higher amongst those affected than the comparison population worldwide (Walker et al., 2015). Physical health conditions, in particular those arising from increasingly sedentary lifestyles and rising obesity cost society significantly. Over a quarter of the global population are not physically active enough to achieve or maintain health benefits (World Health Organization, 2022). Mental and physical health are interlinked, and issues with both are particularly pertinent in higher income

countries. Both are interconnected with personal wellbeing.

What is personal wellbeing?

Promoting health and wellbeing is one of 17 Sustainable Development Goals globally (United Nations, 2020) and personal wellbeing is increasingly being used to indicate the success of a nation in global metrics. For example, the UK government have been measuring wellbeing annually since 2011 in a nationally representative survey (Office for National Statistics, 2021) and in Wales in particular, the Welsh Government passed the Wellbeing of Future Generations Act (2015), necessitating public bodies to work towards wellbeing goals.

The growth in scientific interest in wellbeing is accompanied by many different definitions and measures (Linton et al., 2016) and much

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debate as to locating wellbeing at an individual or societal level (Searle et al., 2021). The focus of the current study is the personal wellbeing (PWB) of the individual, defined as a subjective assessment of how people feel about their own lives. This includes affective feelings (related to mood, feeling, attitude) and cognitive judgements in relation to a personal view on what makes a good life (Tessier et al., 2017). This view encompasses both hedonic (optimal psychological experience with a focus on attainment of pleasure and avoidance of pain) and eudemonic (optimal functioning with a focus on meaning and self-realisation) approaches (Ryan and Deci, 2001).

What influences personal wellbeing?

Physical health and mental health are not the same as PWB, however they both interact and have been shown to influence personal wellbeing. This is bi-directional and better wellbeing has also been associated with longevity (Stephoe et al., 2015) with strong associations with both physical (Appleby, 2016) and mental health (Tessier et al., 2017) reported. Physical health can be described as the condition of your body, including an absence of disease and fitness level (Eupati 2022) and encompasses a state of physical, mental and social well-being (WHO, 2022). Likewise, the WHO (2022) definition of mental health encompasses a state of wellbeing, as well as an absence of mental illness (such as depression, anxiety or schizophrenia and bipolar disorder). Therefore, improving PWB is in itself of benefit and improvements can potentially have a beneficial effect on these important outcomes.

As noted above, personal wellbeing is multifaceted, and many influences upon it have been identified. For example, increased physical activity, (World Health Organization, 2022), high self-esteem (Paradise and Kernis, 2002), positive social interactions (Bruine de Bruin et al., 2020) and increased social connectedness (Helliwell et al., 2016) have all been found to benefit wellbeing. With regards to the latter, social connectedness is thought to increase the resources individuals have, supporting them to “weather storms” (Helliwell et al., 2016:16). Other personal resource variables include self-efficacy, which, along with self-esteem, are belief states that can positively or negatively influence the decisions people make regarding their health behaviours (McAuley et al., 2011). Indeed Bandura (1986) has long asserted that positive well-being requires an optimistic sense of personal efficacy. However, both wider social influences and the environments in which individuals live have an important role to play in shaping personal wellbeing (Bagnall et al., 2023).

Nature and wellbeing

Natural environments are increasingly being recognised for their beneficial effects on physical and mental health and on wellbeing (Bratman et al., 2019; Hartig et al., 2014). With respect to the increased prevalence of lifestyle-related, non-communicable illnesses, the World Health Organization have acknowledged the value of greenspace to public health and wellbeing and the range of benefits that it can offer (WHO, 2017). Benefits include opportunities for physical activity (White et al., 2016) and reduced depression, anxiety and stress (Beyer et al., 2014). Trees, woods and forests in particular have been celebrated globally for their ability to provide not just food security and nutrition, but also health and wellbeing benefits (Goodenough and Waite, 2020; FAO, 2020). O’Brien and Morris (2014), for example, found nature connectedness, mental well-being and sense of place to be important themes relating to the wellbeing benefits of trees. Recent work has specifically addressed the concept of dose and spending two hours a week in nature has been associated with being more likely to report good health and higher psychological wellbeing (White et al., 2019).

Nature-based Interventions (NBIs), that is, structured or led activities in nature with a direct intention to improve health and wellbeing, are becoming established in some countries as a way to benefit those with health and social care needs. In recent years, the role NBIs can play in

encouraging access to greenspace and improving wellbeing has been increasingly recognised, particularly for marginalised communities (WHO, 2017). Studies have identified benefits to mental health and wellbeing that are proposed to be consequent to an NBI’s impact on factors including affect and cognition, attentional processes, anger, fatigue and sadness (Bloomfield, 2017) and their role in facilitating behavioural changes beneficial to physical, mental and social health and wellbeing (Shanahan et al., 2019). Work has begun to explore other pathways that may contribute to these impacts such as how they provide a feeling of escape from the stresses of daily life (Maund et al., 2019; O’Brien and Forster, 2017), or group-based factors, such as learning new skills and creative and sensory engagement (O’Brien, 2018).

Rationale and study aims

Whilst the immediate impacts and effectiveness of contact with nature are becoming ever clearer, independent evaluations of the effectiveness of NBIs are rare (Husk et al., 2020; Maund et al., 2019). Studies that examine the maintenance of benefits are rarer still, thus the length of any effects post-intervention is largely unknown. The few existing prospective NBI studies have indicated that benefits to wellbeing accrued by programme end may not have held beyond the support and structure of the programme (Husk et al., 2016). Additionally, Meyer and Arndt (2014) suggest that whilst positive social interaction and support have been reported in research as important benefits of NBIs, more evidence is needed as to the role they play in maintaining wellbeing.

This study specifically examined:

- 1) the hypothesis that participation in a nature-based intervention would be associated with improved wellbeing and associated psychosocial (dependant) variables (DVs) which are sustained longer term;
- 2) the influences of demographic and psychosocial (independent) variables (IVs) on change in wellbeing and the maintenance of change (DVs); and
- 3) what influenced change in wellbeing and whether and how social processes and the natural environment played a role in change processes.

Methods

Actif Woods Wales (Coed Lleol - Small Woods Wales)

The focus of this study is Actif Woods Wales (AW), a project managed by Coed Lleol (Small Woods Wales) and funded, at the time of the study, by Active Inclusion (WCVA, European Structural Investment Fund). Coed Lleol (Small Woods Wales) are part of the Small Woods Association, a national charity, and have been running woodland health and wellbeing programmes for adults since 2010, with varied programmes organised by county level project officers in woodlands across eleven Welsh counties. Sites include those owned and managed privately, by local councils or by Natural Resources Wales. One course may take place in several locations whilst others are more site based. Some participants self-refer, but more usually, project officers broker partnerships with health and social care organisations in the local area who then refer people with a wide range of health conditions and support needs. Examples include mental health charities such as Mind, sheltered housing projects, recovery from addiction communities and domestic violence programmes. The number of participants on each programme varies with a maximum of 12. During the study period, they reached approximately 700 people per year. Programmes aim to improve individual health and wellbeing, by leading activities in nature in a supportive group environment. Activities include bushcraft, woodland walks, conservation, campfire cooking, foraging, and outdoor mindfulness. Some sessions are delivered by project officers and some draw on a pool of local activity leaders with particular skills. Each programme is adapted

to suit the group and according to leader availability. They last from 4 – 12 weeks with individual sessions lasting between 2 and 4 hours.

Study design

An interdisciplinary and mixed methods approach was taken, combining methodological and theoretical insights from the fields of health psychology and social geography. Questionnaires identified baseline wellbeing and included a range of assessments that enabled quantification and statistical interrogation of a range of potentially associated factors. A within subjects design examined the impact of independent variables (the intervention, demographic factors) on the dependant variables of mental wellbeing and on the secondary psychosocial measures of social trust, self-reported health, self-efficacy, self-esteem and physical activity.

Focus groups offered a broader understanding of experiences of wellbeing and processes of change and were selected to generate accounts of both individual and collective experience. Whilst they may not give the same depth of richness and detail as a one-to-one interview, they enable the group experience to be captured, which was considered to be an important part of the programme. A drawback can be that participants may not readily voice challenging or opposing experiences. However, advantages pertinent to this study are that they can diffuse power relationships as researcher control is reduced compared to individual interviews (Braun and Clarke, 2013). This makes them highly suitable for marginalised groups as a group environment can create a space where people can be more themselves. This was deemed suitable for a group where mental health challenges like anxiety were prevalent.

Longitudinal qualitative research with focus groups is unusual, however useful in that they can give depth, insight and direction that may not be evident at one time point (Grossoehme and Lipstein, 2016). Use of the repeated focus group methodology aimed to provide insight into change experienced over time and how any impacts had, or equally valuably, had not been integrated or embedded into lifestyles of participants, in the wider context of any changes in their personal lives. Quantitative and qualitative data collection and analysis occurred in parallel and the equally weighted data sets were later critically analysed during the interpretation phase. A benefit of mixed methods is in allowing study participants to raise what is pertinent to them that may lie outside the scope of a particular scale. Using both methods draws on both their potential strengths and provides “multiple ways of knowing” (Creswell, 2016:217).

Questionnaire procedure

Prior to data collection commencement, ethical approval for the study was granted by the University of Bangor School of Psychology ethics committee (2017–16,105) and by the NHS (2017/WA/0297). Eligibility included adults (over 18 years old) participating in the programmes who were able to provide consent and reflect on their wellbeing, as determined by AW. Their staff introduced the study to programme participants and where possible the researcher attended week one of each programme to administer questionnaires to those who wished to participate and provide Informed Consent. All eligible programmes taking place at the time of the study were invited to take part and all those attending these programmes were invited to participate. Very few of those invited declined to participate, however, if participants were not present at the beginning of the course or when the researcher visited, they were less likely to return a questionnaire. Several programmes were not included in the study as they were aimed at participants with learning difficulties who may not have been able to provide informed consent and reflect on their own wellbeing in the form that the study took.

Measures

Questionnaires were completed at baseline (T1), end of programme (T2) and follow up at approximately three months later (T3). At T1, demographic data (gender, age, ethnicity, employment, education status) was collected and participants were asked to list any health conditions. The T3 timepoint ascertained the sustainability of any reported changes in the day to day lives of participants following the programme end. The primary study outcome was personal wellbeing measured using the Short Warwick and Edinburgh Mental Well-being Scale (SWEMWBS) (Stewart-Brown and Janmohamed, 2008). This 7-item scale assesses wellbeing via statements about feelings and thoughts such as positive feelings (optimistic, relaxed), sense of meaning (usefulness) and closeness to others. Each item has five response categories ranging from 1 to 5 which are summed to give a score from 7 to 35 with higher scores indicating more positive mental wellbeing. Scale reliability in the current study was excellent (Cronbach’s alpha coefficient 0.894). It is well validated and has been extensively implemented both nationally and internationally to measure mental wellbeing (Warwick Medical School, 2023). It is also widely used in the field (The Mersey Forest, 2016; C.J.C Consulting, 2016). A further factor for selection was that it has been used by AW for their national reporting since project inception.

The secondary psychosocial measures hypothesised as potentially associated with personal wellbeing were assessed using pre-validated scales with short versions of scales selected where possible to minimise participant burden. Social trust used a single question measured on an 11 point Likert scale (New Economics Foundation, 2012); self-reported health used a single question adapted from the SF-12 questionnaire (Quality Metric Inc., 2012); self-efficacy used the 10 item Generalised Self-efficacy Scale (Schwarzer and Jerusalem, 1995); self-esteem used the 10 item Rosenberg Self-esteem Scale (Rosenberg, 1965); physical activity used a single question from the Global Physical Activity Questionnaire (Milton et al., 2011). Taken together, there were 31 items across the six measures used. The approximate time it took to complete the questionnaire was 10 - 15 minutes.

Focus group procedure

Focus groups were conducted at T2 and T3 with a subset of groups who had taken part in the quantitative phase. All those who had taken part in five groups, representing a selection of multi-activity and single activity groups in geographical proximity to the researcher, were invited to participate. The same participants were invited at both time points. Where possible, they were conducted in the woods as part of an AW session and project and support staff were asked not to be present. Participants were first asked to draw a picture in response to the question ‘In what ways has coming to Actif Woods impacted on you, if it has at all?’. This provided a short space for individual reflection prior to a focussed discussion on any wellbeing impacts from the programme using the picture question and four further guide questions (What, if any benefits have you seen to your wellbeing as a result of attending AWW? What is it about attending that has led to these changes? Have those impacts changed over time? If it has, how has it made a difference to your life outside the programme?). The researcher took the role of moderator with minimal intervention, using the topic guide to introduce themes whilst allowing other topics to arise and be discussed.

Methods of analysis

Quantitative analysis of the questionnaire data was conducted using IBM SPSS Statistics Version 24. Multi-factor scales were summed to provide single scores which were transformed where necessary (Stewart-Brown and Janmohamed, 2008). Cronbach’s Alpha coefficient scores for multi-item scales were calculated and checked for reliability within the study samples and all data were analysed for normality. Attrition analysis was conducted twice, to compare the characteristics at

baseline of those who left the study with firstly, those who continued to T2 and secondly, with those who completed questionnaires at all three time points. This was completed for both demographics (using chi-squared tests for independence for gender, with Yates' continuity correction for gender as a two category variable) and for age, educational level, type of health condition and the psychosocial variables (using independent sample t-tests to compare each time point to baseline).

Change from T1 to T2 on wellbeing and the secondary psychosocial variables was investigated using paired-samples t-tests, and change at all three time points, was assessed using a one-way repeated measures ANOVA test. In order to examine the effect of demographic influences on mean change scores in the psychosocial measures, t-tests (gender) and ANOVAs (age, education and type of health condition) were employed. These analyses were selected in order to examine between group differences one at a time. To avoid Type 1 errors by conducting multiple t-tests, the p value was set at <0.01 . To further examine the contribution of demographic factors and of change in psychosocial variables as independent variables on variance in wellbeing scores, hierarchical multiple regression was employed.

Focus groups were recorded and transcribed verbatim, using Microsoft Word for data management. Thematic analysis was used, taking an inductive approach that is 'data-driven', guided by a theoretical interest in the research questions. Textual data within transcripts were coded, that is, broken down into small distinct parts and labelled, then organised into initial themes which were then amalgamated into core and sub-themes (Braun and Clark, 2013). In recognition of the active role of the researcher another member of the research team examined the coding and development of themes at various stages to discuss ideas, reflect on assumptions and identify anything that might have been overlooked. At T3 the themes from the T2 focus groups were used deductively to structure subsequent analysis, purposively searching for the presence or absence of change over time.

Results

Programmes and participants

20 programmes were included which were largely multi-activity groups (e.g., bushcraft, foraging, campfire cooking, woodland crafts), but also included two more focussed groups ('mindfulness in the woods'; 'coppice products'). Courses included varied in length from 4 to 14 weeks. 120 adults completed questionnaires at T1 between May 2017 and November 2018. Of these participants, 74 completed T2 questionnaires (June 2017 - February 2019) and 57 completed questionnaires at all three time points (T3, December 2017 - April 2019).

The cohort comprised of slightly more women (54%) than men (45%) and was predominantly white British (96%). Most fell into either the young (49%, 18-44) or middle-aged category (51%, 45 - 65) with a smaller number who were over 65 years (20%). 48% of those that answered the question about employment ($n = 94$) were unemployed. In terms of self-reported health status, 23% disclosed no health issues, 23% reported physical health issues only, 27% reported mental health issues only and 28% reported having both mental and physical health issues. Attrition analysis found that the demographic characteristics (gender, age, level of education and type of health condition) of those who continued with the study at both time points were similar to those who did not. In addition, there were no significant differences in scores on mental wellbeing, social trust, self-reported health, self-efficacy, self-esteem and physical activity. Overall these analyses allow us to infer that the sample who continued with the study at the end of course stage were representative of the whole sample.

Impact and influence on wellbeing and secondary psychosocial measures

There was statistically significant positive change in wellbeing and

the associated psychosocial variables over the time period from baseline (T1) to course end (T2) (Table 1). Mental wellbeing, the primary outcome, had increased by 2.21 points ($t = -3.47$, $df 69$, $p = 0.001$), moving the group mean firmly into what constitutes average mental wellbeing (21-27), rather than bordering on possible or probable depression (below 20) (Warwick Medical School, 2020). Gender, age and educational effects on change in wellbeing and the secondary psychosocial variables measured were not significant. Those with mental health issues or with both mental and physical health issues benefited significantly more than those with either physical health issues alone or no health issues with an increase in the group mean of 3.61 and 2.47 respectively ($F(df) = 5.8(69)$, $p = .001$).

There were no significant changes in wellbeing or on any of the psychosocial measures in either direction between the end of the course and the follow up at T3, suggesting that benefits realised at T2 were sustained longer term (Table 2). On many measures at T1, the group mean was below the UK norm, but by T3 some measures, such as self-efficacy exceeded the UK average.

Hierarchical multiple regression, conducted to explain variance in wellbeing change scores, included variables significant in previous t-tests and ANOVAs (type of health condition, self-esteem, social trust and self-efficacy). After controlling for the influence of type of health condition, self-esteem at T2 ($\beta = 0.28$, $p = .02$) and self-efficacy at T3 ($\beta = 0.33$, $p = .02$) emerged as key predictors of change in mental wellbeing.

Understanding change

In the five focus groups (Table 3), group size ranged from three to five with 24 participants in total (Table 4). The intention was for participants from the quantitative study to participate in focus groups at T2 and T3, however five participants had joined programmes later. At the T3 timepoint, group size ranged from three to four, with 15 participants in total, nine of whom had participated in the first round. One group (2) was lost to the longer-term follow-up despite several attempts to meet.

The focus group data specifically addresses the research questions of what influenced change in wellbeing and what role social processes and the natural environment may have played. Three main themes identified were used to better understand some of the within course and maintained changes seen in the quantitative findings. These were namely *personal change*, in the context of *social processes* and *nature as balm* which explored the integral role that nature played (Fig. 1).

Personal change

Important personal changes influencing wellbeing manifested as *perspective shifts* - more positive self-appraisal and increased confidence, and *lifestyle changes* - feeling able to do things and behave differently. These gains were particularly salient for those participants with health and social care needs. *Perspective shifts* appeared to arise from skills gained, which instilled a sense of capability and pride. There was also a shift in perception of possibilities as participants reported how attending had 'opened their eyes' or supported them to 'come out of their shells', for example, "your bubbles got bigger instead of smaller" (Janet, T2). This had led to increased feelings of hope, such as Wayne (T2), "you think to yourself, through coming here...I've got a future now". At T3 there were repeated examples of how this had led to a more positive self-view becoming embedded, like Sarah, recovering from addiction: "I'm a totally different person. I am more confident, it (AW) has helped immensely".

Lifestyle changes sprang from the weekly commitment of attending a course which was given as a reason to get up: "...there's days I wouldn't have got out of bed, but you know, I've got out of bed because of this, so that's been an important thing..." (Mike, T2). This was described as a lifeline at certain times of the year, "January, February, March...um having this to come to every week, has kind of got me through the darkness of the winter..." (Anna, T2) and an important part of keeping busy for two men in

Table 1
Paired-samples *t*-test results on psychosocial measures.

	Scale	<i>n</i>	T1 Mean	SD	T2 Mean	SD	<i>t</i>	<i>df</i>	<i>p</i>	Effect size
Mental wellbeing	7–35	70	20.98	4.23	22.61	3.78	−3.47	69	0.001	0.09
Social trust	0–10	72	5.53	2.42	6.33	2.35	−2.71	71	0.009	0.09
Self-rep. health	1–5	70	2.56	1.07	2.87	0.96	−3.8	69	0.000	0.17
Self-efficacy	4–40	70	27.7	5.85	28.98	5.26	−2.54	69	0.013	0.09
Self-esteem	0–30	67	16.49	5.19	18.1	5.12	−2.96	66	0.004	0.12
Phys. Activity	0–7	73	3.37	2.23	4.01	2.08	−2.78	72	0.007	0.10

Note: Effect size guidelines: 0.01 = small, 0.06 = moderate, 0.14 = large (Pallant, 2016).

Table 2
One-way repeated measure ANOVA results on psychosocial measures.

	<i>n</i>	T1		T2		T3		<i>P</i>	<i>F (df)</i>
		M	SD	M	SD	M	SD		
SWEMWBS^a	54	20.97	4.51	22.37	3.66	22.55	3.90	0.004	2, 53
Social trust^a	56	5.63	2.51	6.48	2.40	6.20	2.28	0.032	2, 55
Self-rep. health^a	53	2.52	1.04	2.80	0.88	2.93	0.91	0.002	2, 52
Self-efficacy^a	53	27.28	5.62	28.63	4.67	29.70	5.61	0.000	2, 52
Self-esteem^a	52	16.62	5.49	17.95	5.08	18.75	5.83	0.001	2, 51
Phys. activity	55	3.39	2.27	3.89	2.14	3.54	2.24	0.114	2, 54

^a Significant between T1 and T2.

^b significant between T1 and T3.

^c significant between T1 and T2 and T1 and T3.

Table 3
Focus groups.

Group	Group type	Length	Referral route
1	Coppice products	8 wks	Mental Health services
2	Multi-activity	12 wks	Mixed - mental health, self-referral
3	Mindfulness	6 wks	Mixed - mostly self-referral
4	Multi-activity	13 wks	Mixed - mental health and domestic violence services
5	Multi-activity	12 wks	Mixed - mostly addiction recovery, also youth homelessness

recovery from addiction. One group reported that being picked up by a minibus was integral to their motivation and to getting into a routine of attending and getting out of a rut of sedentariness. This weekly structure led to wider *lifestyle changes* such as newly exercising daily, overcoming prior fears that physical activity might exacerbate health concerns, or developing independence, “*It’s helped me a lot yeah. Like before, I never used to go on the bus or anything on my own, but like I’ve started being able to do it, so it has helped in that sense*” (Fiona, T2).

At T3, it was evident that most participants’ improved wellbeing had sustained and that they had continued to build on these positive lifestyle changes engendered during the course independently (like finding reasons to get up, the structure of the course, having got out of a rut). This was seen in stories of how trying new things and remembering successes on the programme had enabled them to push themselves outside their comfort zones. New actions supportive to wellbeing became normalised as perceived barriers diminished, here illustrated by Fiona (T3) talking about now feeling more able to leave her house: “*without having to have that thought of oh my god, am I going to be able to do this, just being able to do it without having second thoughts, which is massive actually.*”

Social processes

Social exchanges experienced during the programme were seen as key influences on the positive changes in wellbeing outlined above, with sub-themes of *group care* and *social connectedness*. Views within the *group care* sub-theme showed the perceived importance of feeling supported by both peers and support staff: “*being part of a team, doing stuff*” (Angie,

Table 4
Focus group participants.

Group	Pseudonym	Age	Gender	Employment	Health issues?
1	Janet	25–44	Female	Not stated	Mental health
1	Marian ^a	45–64	Female	Unemployed	Physical/mental health
1	Louise	45–64	Female	Unemployed	Mental health
1	Jim ^a	45–64	Male	-	-
1	Wayne	25–44	Male	Unemployed	Mental health
1	Ralph ^b	45–64	Male	Unemployed	Mental health
1	Mandy ^c	45–64	Female	Unemployed	-
2	Roger ^{a,b}	45–64	Male	-	-
2	Anna ^b	45–64	Female	Retired (illness)	Mental health
2	Mike ^{a,b}	45–64	Male	-	-
2	Gemma ^b	18–24	Female	Unemployed	Physical health
3	Derek	45–64	Male	Retired	Physical health
3	Jane	25–44	Female	Employed	Mental health
3	Dafydd	45–64	Male	Employed	Physical health
3	Sue ^c	45–64	Female	Employed	None
4	Dylan ^{a,b}	25–44	Male	-	-
4	Angie ^b	25–44	Female	Unemployed	None declared
4	Diana	45–64	Female	Unemployed	Physical health
4	Cath ^b	25–44	Female	-	Mental health
4	Emrys ^c	65–74	Male	Retired	Mental health
5	Dave	25–44	Male	Unemployed	None stated
5	Arthur ^{a,b}	45–64	Male	Not stated	None stated
5	Fiona	18–24	Female	Not stated	Mental health
5	Sarah	45–64	Female	Unemployed	Mental health

^a Indicates those not in the quantitative study.

^b T2 focus group only.

^c T3 focus group only.

T2) or having an external focal point “...instead of focussing on the people ourselves, we’re focussing on the activity that we’re doing, and it’s the common ground where we’re all sharing” (Roger, T2). A social context where people felt they could “*be themselves*” had led to increased confidence, particularly pertinent to those with mental health issues for whom feeling safe and non-stigmatised was valued, “*There’s no judgement is there? No one’s judging you*” (Louise, T2); “*not labelled*” (Janet, T2).

A strong emphasis was placed on *social connectedness*, for example

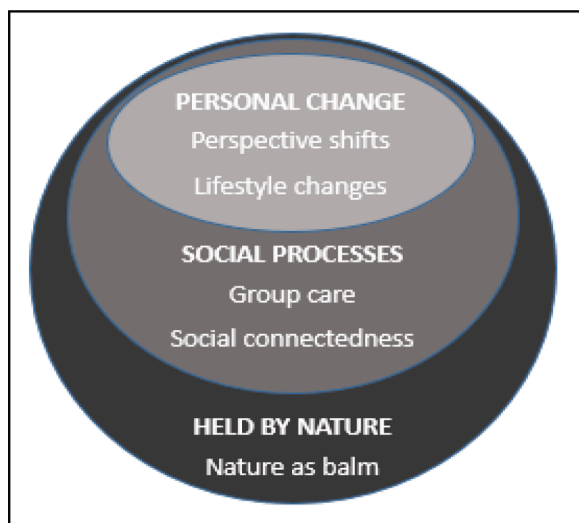


Fig. 1. Summary diagram of themes presented.

“not being stuck in the house” (Sarah, T2) or “I think I had become socially isolated...so to have the plans to get out on a Tuesday, and to come and mix and to get along with people, and...feel part of a group...yeah, it does make you think, what else is out there...” (Marian, T2). This led to positive change beyond the programme, for example women from a domestic violence project reported feeling less wary of people: “Confidence being around strangers, getting back to going out, meeting people, fresh air as well, yeah” (Angie, T2). Some benefits were related to being in the safety of a group yet simultaneously in a public space, affording an opportunity for wider connections. These blurred boundaries allowed for more relaxed encounters at the edges of the group, for example, there was some banter in focus group five about a participant and her rapport with a regular passer-by/dog walker and whether they were going to go on a date.

Spurred on by new-found confidence it was evident at T3 that these positive social processes instigated on the course had continued and contributed to maintaining wellbeing benefits. Meeting people on the programme that one would not normally interact with, “or even be wary of” (Fiona) as part of a safe group was cited as an important catalyst to wider interaction. A new openness to making new connections was reported, highlighted as particularly important by those in recovery from addiction: “It’s given me more confidence getting out, um, meeting people... Its just, like she says, it’s not as scary as we actually think before we do get out” (Sarah, T3). Throughout the focus groups there were very little dissenting or conflicting views, with accounts predominantly reflecting positive experiences on the course and resulting impacts on wellbeing. An exception to this however was that whilst most people reported being able to maintain behavioural changes, the loss of the regular support provided by the course meant that one participant had struggled without this reinforcement: “It’s a bit like when you’re in work and you know you’ve got to get up and get out...whereas you know, when you’re not, and you don’t have to, it’s easy to stay in your room” (Louise, T3).

Nature as balm – the role of the natural environment

The qualities or characteristics of natural places perceived as underpinning the health and wellbeing impacts of the programme were multi-faceted and included having a positive effect on emotion regulation, lifting spirits on a bad day, or providing a sense of peace or relaxation. Participants’ language frequently employed words like settling, soothing, harmonising, relaxing or conversely, stimulating and exciting. This capacity to shift a person’s frame of mind positioned nature as having balm like qualities with the capacity to smooth away difficulty, for example, “I think if you’re comfortable in the woodland it sort of settles you...” (Jim, T2), “...being out in the natural environment, amongst

the trees, just gives you that sense of belonging, or just relaxing” (Dafydd, T2) and “...it’s exciting, because nature, in itself, is a harmony, to feeling down and depressed” (Janet, T2).

Emphasis was placed on how the sensory experience of being in nature could lead to feeling good, for example, “It’s lovely to hear the bird song and the trees rustling” (Diana, T2). Being in nature was also described as having retrospective benefits, where thinking back to the experience could lift mood, “...and I’ve often thought of that colour just every now and then and it makes me smile” (Jane, T2). Nature was variously framed as an escape, a break, freedom or an opportunity to get away from it all: “...so it’s that sort of scenario where you’re away from it all...on holiday, that’s how I feel when I’m here” (Wayne, T2); “When I’m here...I forget the rest of the world...and it’s very, very peaceful” (Roger, T2). This provided an opportunity to go back ‘there’ refreshed: “you’re re-charging your batteries” (Janet, T2).

Whether on the mindfulness course or not, the sensory environment of the woods and the relaxed feelings that people experienced there enabled them to connect with their present moment experience: “I’d say being in nature it’s quite easy to be mindful...because you’ve got tactile stuff that you can concentrate on...even just looking at how things are growing at this time of year...stopping and looking at the buds and everything” (Jim, T2). This kind of experience led to participants who had taken mindfulness courses in the past tapping into prior learning: “...I’ve done a mindfulness course a couple of years ago, and I thought, it was very good... but it’s not something I found easy, but...since coming here I’ve found that I’m able to practice” (Marian, T2).

Participants reported feeling that the woodland environment was an integral and essential part of the course, allowing benefits to occur in a way not possible in an indoor space. For those with mental health challenges, some spoke of how they would have felt shy or nervous indoors, but trees provided a screen and a sense of spaciousness that made participating in a group feel possible, feeling “more comfortable” outside (Dave, T2) or at ease, “you can relax more outside than you can inside” (Jim, T2). Furthermore, the woodland space was described as harmless and non-threatening and perhaps compared to ‘life’, nature was thought of as “common ground” or a place that “doesn’t hurt” (Angie, T2). Intersecting with the lack of judgement described in the *group care* theme, it was referred to as a place where you did not have to ‘put on a front’, for example, “you can be yourself in the fresh air” (Diana, T2). Trees were depicted as a caring presence, contributing to a relaxed space, “you don’t have to perform for the trees, do you?” (Louise, T2) or as a source of fortitude, with there being “something about the strength of trees” (Anna, T2). Linking to the increased feelings of confidence described under the *perspective shifts* theme, more positive self-views were often nature related, for example one participant likened himself to “some kind of Bear Grylls” (Dave, T2).

At T3 there were many reports of behaviours supportive to wellbeing having been maintained, such as newly accessing or appreciating nature on a regular basis through daily walks or as part of a commute. It was evident that this perception of the ‘balm’ like qualities of nature had continued and many examples were given of how participants continued to use or draw on nature to support themselves. Louise (T3) for example, reported giving sycamore leaves a ‘high five’ on a daily walk in the woods. Related to the *social processes* theme, the discussions within two different groups raised the ease of relating to others in an outdoor space and how it affected the quality of the interaction, giving insight into how the benefits of the programme had endured. One group discussion concerned how the sensory experience took the pressure off talking, which was described as a relief, or as Dafydd (T3) said, indoors, “you feel maybe more compelled to talk”. Conversely in another group, the calming environment that nature provided was attributed to allowing conversation to flow more freely: “It makes you more relaxed, so you know, you’re more likely to be social and make new friends” (Cath, T3). Discussion also revealed how woods gave a feeling of privacy, making a more open and freer connection easier “I think it’s like you’re not being watched by anyone, or, you know, nobody can hear what you’re doing” (Diana, T3).

Discussion

Participating in NBI improves wellbeing

Our study demonstrated that participation in the Actif Woods NBI was associated with improved wellbeing outcomes which was evident from both statistically significant shifts in psychosocial measures and in experiential accounts. This is consistent with expectations (Bragg and Atkins, 2016; Shanahan et al., 2019), however this study also provides new findings around what influenced change and who benefits. Those with mental health challenges in particular have previously been shown to respond disproportionately well to greenspace (Gascon et al., 2015; Bowler et al., 2010) and this study has provided insight into the personal, social and environmental influences on this.

A longer-term perspective

Critically, our findings provide evidence that improved wellbeing can be sustained longer-term, beyond the support and structure of NBI programmes and give an understanding of what influences this. Statistical change was mirrored in a continued 'upward' trajectory reported in the qualitative analysis. Such findings are contrary to those of one of the few studies to follow up with participants (the Branching Out Project), where no evidence that mental wellbeing and self-reported health benefits of their woodland activity interventions were maintained was found (CJC C.J.C Consulting, 2016). However, this difference in findings may be because Branching Out primarily work with those with more severe mental health issues than those attending AW.

The Theory of Stress and Coping (Lazarus and Folkman, 1984) provides a possible framework for understanding these findings on improved and maintained wellbeing. Increasing personal and social resources (perceived or actual) such as improved self-efficacy or increased social connectivity, supports a person's ability to meet the demands or perceived demands of mental or physical health challenges or life stress. It was evident that participants' resources had been augmented by the AW programme through changes in their self-appraisal coupled with the wider benefits derived from being in woodlands. This presented newfound ways to approach life and manage any feelings of anxiety and stress. Drawing also from Bandura's Social Cognitive Theory (1986) the findings point to the importance of self-efficacy - a form of situational self-confidence. The increase in self-efficacy and its importance as a predictor of maintaining wellbeing gains was reflected in the lived examples of participant experiences obtained from the focus group data. Self-efficacy has a malleable quality that changes as a consequence of personal or vicarious experience and feedback on past successes and failures. Higher levels have been associated with lower levels of negative behaviours such as sedentariness (Szczuka et al., 2020; Kwasnicka et al., 2016), hence bolstering it is paramount to the continuation of new positive health behaviours. Highlighting the role of self-efficacy in behaviour change, many psychological models have addressed this construct. For example, the Health Action Process Approach model (Schwarzer et al., 2007; Voils et al., 2014) helpfully considers the *continuation* of new health behaviours as well as their adoption, highlighting the necessity of personal belief in the capability - phase specific self-efficacy - to carry out and continue carrying out a particular action.

Building on decades of research examining behaviour change, Michie et al. (2011) developed the 'COM-B' model which recognises the vital role of capability (perceived and actual), motivation, and opportunity if one is to effect behaviour change, i.e. 'capability, opportunity and motivation interact to generate behaviour that in turn influences these components' (Michie et al., 2011:4). This framework is useful in understanding how AW affects behaviour change. The opportunity of the programme provides access to an unfamiliar or forgotten habitat that can enable certain behaviours, the motivation to act is offered by the all-important routine and structure, and the capability is developed

through new skills and learning providing the ability for new behaviours to be enacted. The increased feelings of confidence so evident in the *perspective shifts* theme clearly showed how these feelings of capability and self-agency had led to more lasting positive actions (*lifestyle changes* theme) that had become habitual. The converse was an evident reduction of behaviours that compromise wellbeing, such as socially isolating or being physically inactive.

Moving out of isolation – the role of social processes

Helpful insight was gained into the role of social processes in wellbeing change and significant positive gain on the measure of social trust was illuminated by narratives collated under the '*social processes*' theme. The sense of feeling accepted for who you are and the establishment of connections on the course seemed to have evoked a sense of valency and the power to go forward and make new connections, further growing participants' resources to support their own wellbeing. These increased connections and new supportive relationships had led to a move out of isolation for some. Mixing outside your usual social group and making connections are important first steps in developing social networks. Conversely, social isolation is proven to be detrimental to mental health (McManus et al., 2016) and loneliness a risk factor for morbidity and mortality (Cacioppo et al., 2014). Studies on subjective wellbeing have been criticised for overfocussing on individuals (Atkinson, 2011), however O'Brien has pointed out that paying attention to social interactions alongside wellbeing can usefully highlight the potential of projects to provide wider benefits for groups and communities. Without losing sight of the value of therapeutic gains for individuals, "*a more communal concept*" can be encompassed by doing so, inclusive of the wider development of inter-personal "*reciprocity, networks and trust*" (O'Brien et al., 2011:72), potentially impacting on how a person engages in the wider communities they are part of.

It was clear that social processes were particularly instrumental to the maintenance of participants' improved wellbeing with extensive evidence of continued and deepening friendships, doing things together and supporting each other. Whilst social connections can be a protective resource, it is the strength or quality rather than the number of social relationships that is particularly important for happiness (Diener and Seligman, 2002). This can be defined as social support, promoting feelings of confidence, and being able to manage things, or emotional support in terms of feelings of not coping alone and having someone to share fears with (McDowell, 2010). This had particular resonance for those in recovery from addiction, whereby in order to maintain abstinence, supportive friendships and relationships are vital to the development of a 'recovery identity' rather than an 'addiction identity' (Buckingham et al., 2013), augmenting resources to support a healthy and fulfilling life beyond addiction. Of course, not everyone felt resourced enough to continue without the support of the programme, demonstrating the challenges presented by short term funding for the most vulnerable. Schwarzer et al. (2007) highlights the importance of relapse prevention strategies in successfully maintaining newly adopted health behaviours, vital he says to stabilising them. Indeed, getting people back together for the follow up focus group seemed to have some therapeutic value, whereby participants who had lost touch re-connected and wellbeing gains were reflected on and consolidated in their minds. Whilst AW is not a behaviour change intervention as such, nor does it offer homogenous, manualised or standardised interventions, many of the different social drivers outlined in these results align very clearly with the social influence domain of the Theoretical Domains Framework, particularly the social support, social/group norms and learning and modelling constructs (Atkins et al., 2017).

Nature as a 'bumping place'

Our study has begun to elucidate the role that the natural environment can play in supporting social processes on an NBI. Specifically, the

way that woodlands can provide a unique social space, promoting feelings of relaxation conducive to social relations and connectedness was evident. It was also apparent that factors like finding the woods a more private space where you can be more open, or somewhere it feels acceptable to spend quiet time with others were supportive to the development of deeper friendships. How the programme functioned as a liminal space between group safety and the confidence to engage in chance encounters with a wider public was an important stepping-stone to being more social. The way that woodland activities can benefit the development of new networks and friendships is something that has been highlighted previously (Maund et al., 2019). For example, a common ground of shared activity can ease connections being made, (O'Brien et al., 2012) and the perceived neutrality of outdoor space can promote a feeling of being able to talk freely (Tabbush, 2008). The natural environment has been described as a 'bumping place' for impromptu meetings with others (Bagnall et al., 2017), offering opportunities to make a 'positive but undemanding human connection' (Bell et al., 2015:62). The way that a structured programme such as AW can encourage and support participants to subsequently access this resource independently has been explored (Gittins et al., 2023).

"You don't have to perform for the trees"

Our findings showed the role that the natural environment played in change processes for improved wellbeing. It clearly functioned as an additional layer in the processes of supporting the personal and social changes experienced, such as participants feeling less judged in nature. The belief that support could come from trees as well as from people and how woods were experienced as supportive spaces seemed to inform wellbeing benefits. This is in line with literature which identifies a more active agency of non-humans, going beyond them simply being passive objects (Cloe and Jones, 2020; Stuckey, 2010; Tsing, 2012). These 'more than human' interactions with nature are also referred to in socio-geographic literature where the active role that nature can play in promoting healing (Lea, 2008) and 'relational assemblages' of human-nature interactions are acknowledged (Bell et al., 2015).

Engaging with the sensory aspect of nature has been identified as important in other studies on natural wellbeing (Moran and Turner, 2019) and with providing a sense of peace and restfulness in other woodland-based research (O'Brien and Morris, 2014). This embodied, present moment experience has potential to provide a mental break from anxious or ruminative thoughts. Whilst the 'mindfulness in the woods' programme was aimed at developing the capacity for awareness more deliberately, it was of note that being mindful was highlighted as important by other groups too. Nature appeared to act as a conduit to this as outdoors was reported to be a place where it was easy to stop and 'just be', away from pressure of things to do. Both a natural human capacity, and something that can be trained, mindfulness is a technique that has many proven benefits for health and wellbeing (Keng et al., 2011).

It was apparent from our findings that a break from the norm provided by being in the woods was perceived as an important part of the wellbeing benefits experienced, with balm-like qualities (affective, sensory, mindful, connected) contributing to a holiday feeling. This is in line with other studies, where feelings of escape and freedom or getting away from everyday life (Maund et al., 2019; O'Brien and Forster, 2017) were found meaningful. That people gain marked benefit from nature as an escape aligns with longstanding theories on its therapeutic value such as attention restoration and stress recovery theories (Kaplan and Kaplan, 1989; Hartig et al., 1996).

However, it is worth considering whether or not framing nature as an escape, as something separate from society, is problematic, in that it could constitute avoiding difficulty or challenge (avoidant coping). It would appear not from this data, instead seeming to promote the formation of a healthier sense of self and new positive behaviours which supported participants to find new tools with which to return to their

daily lives more resourced. This is also evident in other studies, for example time out in the woods helped disabled participants to cope with sometimes restricted lives (O'Brien et al., 2012) or assisted those with mental health problems to cope with the stress of discrimination (Burns et al., 2008). In this sense, the time out that an NBI offers can be an opportunity to sift, prioritise and gain a better understanding of what gives life meaning. This encompasses the eudemonic element of wellbeing, that which gives life a sense of purpose (Ryan and Deci, 2001).

Study limitations

One limitation of this study was the time period for follow up. Whilst the data gives good insight into maintained change, ideally research would follow up at longer intervals from baseline. However, three months was deemed to provide enough time for any immediate impacts of the course to have subsided in the daily lives of participants. Although the intention was to have the same participant groups at both time points in both the survey and the focus groups, this was a challenge logistically, one that is well recognised in the field of long-term qualitative research (Grey et al., 2017). However, as far as possible, consistency was maintained and as the study explored self-perceived retrospective reflections rather than comparing change in individual trajectories this did not present an issue. Despite these potential biases our study design and results gave definitive answers to the research questions, with particularly useful insights into maintained change post-intervention.

Conclusion

This study meets a gap in knowledge regarding the maintenance of wellbeing impacts of nature-based interventions whereby our findings show that benefits were sustained well beyond programme attendance. A review of NBIs for improving health and wellbeing (Shanahan et al., 2019), called for research to identify the drivers of enhanced health and wellbeing. Complementing each other, the qualitative data presented here gave an in-depth understanding of processes of change identified in the quantitative analysis. Key themes of personal 'resource' change, the intrinsic value of positive social processes, the supportive role of the woodland environment and the interdependent roles of all three elements were identified. Findings gave good insight into the primary role of self-efficacy for change maintenance.

In terms of practical implications on what makes an intervention successful, it is clear that structured and routine implementation (e.g., through weekly provision) is very important for breaking old and damaging habits and replacing them with new, healthier habits. Furthermore, noting the therapeutic value follow up activity can have, a further recommendation is to build this into funding bids and planning. A final recommendation is that strategies to develop self-efficacy within NBIs are prioritised where appropriate. This could be for example, incorporating the promotion of independence as a flexible goal, bearing in mind that some very vulnerable people take part for whom leaving the house is a major step. It could also be through encouraging participants to be incrementally more proactive throughout the course of a programme, from co-designing programmes to taking an active role in setting up the site. In terms of research implications, a recommendation is to monitor longer term outcomes of similar projects to build the evidence body on barriers and facilitators of maintained lifestyle changes to support wellbeing.

In conclusion, in an arena where there is so little understanding of the post-NBI experience, these results show that projects like AW can have a profound and lasting effect on the health and wellbeing of some of the most vulnerable members of society. However, whilst attention to the role that NBIs can play in improving health and wellbeing has gathered pace (Shanahan et al., 2019; Bloomfield, 2017) they are far from secure in terms of funding and sustainable support. Therefore, whilst celebrating the gains, change is needed at a structural level to

capitalise on their potential to provide long-term preventative and therapeutic care, for example through government funding. Hence these results support AW's vision to improve health and wellbeing by embedding woodland activity programmes within the National Health Service (NHS) through social prescribing, a means of enabling health professionals to refer people to a range of local, non-clinical services.

CRedit authorship contribution statement

Heli Gittins: Writing – original draft, Project administration, Data curation, Conceptualization, Methodology, Formal analysis. **Dr. Norman Dandy:** Conceptualization, Methodology, Formal analysis, Supervision, Writing – review & editing. **Dr. Sophie Wynne-Jones:** Conceptualization, Methodology, Formal analysis, Supervision, Writing – review & editing. **Prof. Val Morrison:** Conceptualization, Methodology, Formal analysis, Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Dr Heli Gittins reports a relationship with the Small Woods Association/Coed Lleol that includes: Dr Heli Gittins (corresponding author) has since become an employee of the Small Woods Association/Coed Lleol (from 04.01.22) who run the Actif Woods programme but was not employed by them at the time of the study.

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