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The Rivers Flow Through Us: Collective Effervescence Mediates the Effect of Nature on Wellbeing

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Abstract

Previous research suggests that experiencing wellbeing in nature fosters environmental stewardship and sustainable behaviors. That makes it important to understand what mediates the relationship between an experience in nature and wellbeing. In the past, researchers have found that a sense of awe predicts feeling wellbeing in nature. However, research also suggests that awe does not account for the full relationship between experiencing nature and enjoying nature, suggesting additional mediators are necessary to fully understand how experiencing nature affects sustainability. In the current research, we examined collective effervescence—a feeling of connection combined with a feeling of sacredness—as a pathway between nature and feelings of enjoyment. To do so, we utilized an experimental memory-recall paradigm in which participants were prompted to re-experience either a nature memory or a neutral everyday memory, and then completed measures of collective effervescence, awe, and wellbeing. We found that collective effervescence mediated the relationship between prime and all measures of enjoying nature. In other words, when people experience nature, they sometimes feel collective effervescence. Collective effervescence then predicts an enjoyable experience.

Keywords: collective effervescence; nature; wellbeing

1. Introduction

> *"The sun shines not on us but in us. The rivers flow not past but through us."*—John Muir

Previous research suggests that experiences in nature that increase individual wellbeing also foster environmental stewardship and sustainable behaviors [1–3]. That makes it important to understand what predicts whether an experience in nature will increase individual wellbeing. If future research hopes to increase sustainable behaviors via experiences in nature, it would be useful to understand what makes nature experiences impactful. One key pathway between nature and wellbeing is a sense of awe [4]. Research suggests that nature leads to the experience of awe and awe then leads to wellbeing [5]. However, awe alone does not explain all of the variance in the relationship between nature and wellbeing [6]. We propose that, in addition to awe, people may experience collective effervescence when experiencing nature. Furthermore, we propose that collective effervescence will mediate the relationship between nature and wellbeing.

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There is a great deal of research suggesting that experiencing nature, either by being in nature, thinking about nature, or watching videos of nature, is associated with stronger mental health and wellbeing (see [7] for a review). The more people experience nature, the higher their wellbeing. Specifically, dispositional tendencies to be connected to nature—defined as generally feeling close to and a part of nature (e.g., [8–11])—are associated with wellbeing (e.g., [12–14]). In addition, specific times of experiencing nature are associated with wellbeing. Experiencing nature is associated with positive wellbeing measures such as higher life satisfaction and a higher positive affect (e.g., [15–18]). Exposure to nature is also associated with lower levels of negative emotionality such as anger, tiredness, anxiety, and sadness [15].

Exposure to nature has been found to buffer the negative effects of conflicts on wellbeing in children [19]. Children who grow up with access to green spaces are less likely to suffer from psychiatric disorders as compared to those who grow up without green spaces [20]. Amongst adults, spending time in nature is associated with a higher positive affect [16,17], greater satisfaction with life [18], and lower levels of depression [21]. These effects are consistent across culture (e.g., [22–25] and age (e.g., [26–28]).

How Does Nature Affect Wellbeing?

There are many potential pathways between nature and wellbeing. For example, experiencing nature can increase wellbeing directly—in other words, without the necessity of complex psychological mechanisms. For example, experiencing nature increases the likeliness of engaging in physical activity, which directly leads to welling (e.g., [29–32]). A specific example, birdwatching—where one watches birds in their natural habitat—is associated with benefits such as increased wellbeing (e.g., [33,34]). In addition, the quiet of nature can provide a respite from the noise and pollution of urban centers (e.g., [35]). Finally, the peacefulness of nature can provide a break from the mental overstimulation caused by modern life (e.g., [27,36]).

However, there are also examples of nature leading to wellbeing even when it is experienced indirectly, such as though videos of nature (e.g., [37,38]). Watching a video of nature does not lead to physical activity or a long-term respite from urban areas. This suggests that there are also psychological mechanisms that mediate the effects of nature on wellbeing. The majority of the research that has examined the psychological mechanisms between experiencing nature and wellbeing has examined the mediating role of awe. Awe is a multifaceted emotional experience involving a number of concurrent experiences [4]. Awe arises when people encounter something vast that is beyond their usual frame of reference [39] and their focus is pushed away from the self [40]. Thus, awe experiences are defined by the need to accommodate the new information combined with a shrinking of the self [40–44].

Nature is strongly related to awe [4]. Awe experiences are most commonly reported in nature [4,40,45]. In other words, experiencing nature is one of the strongest predictors of an awe experience. Awe and nature are so tightly connected that videos of nature scenes are often used to elicit awe in a research laboratory (e.g., [41,42,44]).

Awe is also strongly associated with wellbeing [4]. For example, awe predicts increases in daily wellbeing [41], life satisfaction [43], and lower physiological markers of stress [41]. Some of the effects of awe on wellbeing are specific to experiences in nature. Awe experiences in nature are associated with increased wellbeing and spirituality [46]. In one study, participants took a 30 min walk through nature or a walk through an urban area [6]. The nature walks increased wellbeing and the effects on wellbeing were mediated by awe. However, the effects were not only due to awe—a significant relationship between experiencing nature and wellbeing still existed when accounting for awe. Thus, the research suggests that there is something else that can also lead to wellbeing other than awe.

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We propose collective effervescence may be another psychological mechanism by which experiences in nature predict wellbeing. Specifically, we propose that experiencing nature may predict feelings of collective effervescence and that the collective effervescence may partially mediate the effects of nature on wellbeing.

Collective Effervescence

Collective effervescence was first named by Emil Durkheim to describe the experience that people sometimes had when in a crowd [47]. More recently, empirical studies on thousands of participants across a multitude of studies have concluded that it can best be defined as the psychological experience that sometimes occurs when people gather with others and that it involves the intertwining of a sense of connection to others and a sensation of sacredness (e.g., [48,49]). Across numerous studies, collective effervescence has been linked to multiple wellbeing outcomes [48–53]. For example, collective effervescence felt in religious events predicts feeling connected to others [54]; finding ways to feel collective effervescence during COVID-19 social isolation predicted maintaining psychological wellbeing during the pandemic [52]; the more people engage in collective effervescent experiences, the happier they tend to be with their lives, the more they feel like their lives have meaning, and the less likely they are to suffer from anxiety and depression [49]; and collective effervescence at a singing event predicted increases in including humanity in the self a full six months after the event [55]. Finally, research suggests that experiencing collective effervescence predicts positive outcomes even when controlling for dispositional personality traits (the Big Five) and individual differences in self-construals (collective and relational interdependence) [49].

Collective effervescence and awe have been examined together in multiple studies. Initial empirical research establishing scales to measure collective effervescence [48,49] used multiple measures of awe to establish discriminant validity. Those studies found that collective effervescence and awe were highly related but distinct [48,49]. More recent research has measured both awe and collective effervescence at concerts [51] and mass singing events [50] and found that, although they are highly correlated, they are unique constructs, each with their own predictive power.

Although it has yet to be examined, there is reason to believe that collective effervescence may occur in nature. First, collective effervescence events are strongly associated with events that center spirituality, such as Shabbat dinners [54] and events that center connection, such as singing events designed to increase connection between strangers [55]. Past research has linked experiencing nature to feelings of spirituality [56] and to feelings of connection to nature [57]. Although these variables are not the same as the sacredness and connection components of collective effervescence, they are similar enough to suggest that collective effervescence may be related to nature.

Second, although collective effervescence events almost always include other people, in particular groups of people, new research has found that people can feel collective effervescence even when they are alone. For example, research on protests found that people who did not attend the protests were able to feel collective effervescence simply by looking at images and videos from the protests posted online [58]. In addition, in interviews with people about their collective effervescence experiences, people sometimes list events in nature, by themselves, as ones in which they felt collective effervescence [49].

Therefore, we hypothesized that people may feel collective effervescence in experiences with nature and that collective effervescence may predict positive outcomes of wellbeing in nature above and beyond the effects of awe. To examine that hypothesis, we measured levels of collective effervescence and awe when people recalled events in nature (and control) and examined their mediating role in predicting the effects of nature on wellbeing.

2. Materials and Methods

370 participants (189 women; 179 men; 1 non-binary; 1 did not answer) from a large state university took part in this study. The sample was ethnically diverse (29 Black/African/African American, 111 Asian/Asian American, 13 Hispanic/Latino/a, 180 Caucasian/White, 5 Arab/Middle Eastern, 28 Bi/Multiracial, 1 Other, and 3 Did not answer) with an average age of 19.33 years old (SD = 5.40). The sample was religiously diverse (18 Atheist, 15 Agnostic, 7 Jewish, 178 Christian, 16 Hindu, 9 Buddhist, 34 Muslim, 3 Sikh, 9 other, 70 none, and 11 did not answer). Participants were compensated with partial fulfillment of a course requirement in a psychology course. Participants who indicated their willingness to participate in the study completed a survey and all questionnaires on the external website, Qualtrics. All participants who completed the study were included in the analyses.

We conducted a sensitivity analysis in G*Power 3.1.9 [55] for our primary outcome comparing the means of the nature and control groups with an independent samples t-test, assuming a two-tailed test and an alpha of 0.05. A sample of this size provides 80% power to detect a small effect (d = 0.25). Therefore, we were well-powered for this study. The guidelines set by Fritz & MacKinnon [59] were consulted to determine an ideal sample size to detect an effect with 0.80 power. To detect a small-to-medium effect size (d = 0.26 for the a and b paths) utilizing bias-corrected bootstrapping, a sample of 148 participants was recommended. We were generally well-powered to conduct mediation tests.

Participants were randomly assigned by Qualtrics experimental software to think about an experience in nature or their morning routine (control). After the prime, participants filled out scales assessing how much awe and how much collective effervescence (order randomized) their experiences during the event. Finally, participants filled out scales assessing their positive and negative mood, spirituality, and meaning in life during the event (order randomized).

We utilized an experimental memory-recall paradigm in which participants were prompted to re-experience either a nature memory or a neutral everyday memory (control) by recalling it, listing keywords, and then writing about it. This experimental memory-recall paradigm has been validated in past research as an effective technique for having participants recall and relive an event in a controlled setting to elicit similar emotional reactions to the actual event [51,53]. The nature prime asked participants to "think of a time when you were in nature—on a hike or walk or skiing or anything else." The control prime asked participants to "describe their morning routine." All participants were given two minutes to think about the experience (either experiencing nature or getting ready in the morning). They then listed four words about the experience. Finally, they were asked to immerse themselves in the experience and think about how it made them feel for four minutes.

Next, in random order, participants completed the two possible mediators.

Awe. Awe was measured using the short form of the awe experience scale (AWE-SF) [60]. Research suggests that this shortened scale is an effective measure of awe that assesses all kinds of awe experiences and predicts life satisfaction and psychological richness [49]. It includes 12 items that assess six components of awe and can be used as a reliable omnibus measure of state level awe. Participants were asked to think about the event and then indicate on a seven-point scale the degree to which they felt the components of awe (α = 0.90).

Collective effervescence. Collective effervescence was measured using a modified version of the state collective effervescence scale [48]. The scale has two components: connection to others and sensation of sacredness. The sacredness subscale was not changed and contained items like "I felt as if there was something sacred about the event." The connection subscale was revised to not include connections to specific people at an event but,

instead, broader connections. For example, instead of asking for agreement with the statement "The event made me feel closer to the people who were there," this version asked for agreement with the statement "the event made me feel connected to other people." Instead of "I felt connected to others who were present at the event", it asked "I felt connected to everything." The sacredness scale had an alpha of 0.93 and the connection collective effervescence scale had an alpha of 0.88. The full scale had an alpha of 0.93.

After the possible mediators, we measured the outcomes, meaning in life, negative mood, positive mood, and spirituality in random order.

Meaning in Life. Participants responded to the five items that comprised the presence of the Meaning subscale of the meaning in life scale [61]. Example items include, "I understand my life's meaning" and "My life has a clear sense of purpose" on a scale from 1 (*Absolutely untrue*) to 7 (*Absolutely true*) α = 0.85.

Positive Affect. Five items from the positive and negative affect schedule (PANAS; [62]) were used to assess participants' positive affect during the recalled event. Participants were asked to, "Indicate to what extent you felt this way during the event…"—"Happy," "Pleasantly surprised," "Excited" "Content" and "Pleased"—on a scale from 1 (*not at all)* to 7 (*Extremely*). $\alpha = 0.92$.

Negative Affect. Four items from the positive and negative affect schedule (PANAS; [62]) were used to assess participants' negative affect during the recalled event. Participants were asked to, "Indicate to what extent you felt this way during the event…"—"Unfulfilled," "Annoyed," "Disappointed" and "Frustrated"—on a scale from 1 (*not at all)* to 7 (*Extremely*) ($\alpha = 0.93$).

Spirituality. Participants completed one item to measure spirituality [50,63]. They were asked to rate their agreement with the statement "the event felt spiritual to me." on a scale from 1 (*not at all)* to 7 (*Extremely*).

Other Measures

Finally, participants indicated how many people were at the event with them (either in nature or in the morning routine), completed demographic measures, and were debriefed.

3. Results

To assess whether the modified connectedness collective effervescence subscale preserved the psychometric properties of the original subscale, we examined its factor structure, reliability, and pattern of convergent correlations. A factor analysis confirmed that the altered subscale represented one factor with only one component having an eigenvalue above 1 at 2.97. An analysis of the scree plot confirmed the one factor solution. This factor accounted for 74.20% of the variance. Next, we examined the reliability of the scale both as a subscale ($\alpha = 0.88$) and as a part of the larger collective effervescence scale ($\alpha = 0.88$). Both were excellent. Finally, this modified scale showed very similar correlations to other variables (see Table 1) as the original subscale had in other research (e.g., [48–50,54]) suggesting that it was highly related, but distinct from awe, positive mood, spirituality, and meaning in life in the same manner as the original subscale.

Correlations can be found in Table 1. Many variables were strongly related to one another. Because of the high correlations, collinearity diagnostics were computed. All VIF statistics were well below 5, suggesting it was appropriate to examine multiple mediators in the models (see Supplementary Materials for details).

Table 1. Pearson correlations among study variables.

Variable	1	2	3	4	5	6	7	8	9

1. Crowd size	—	—	—	—	—	—	—	—	—
2. Awe	0.05	—	—	—	—	—	—	—	—
3. Collective effervescence (CE)	0.07	0.68 **	—	—	—	—	—	—	—
4. CE – Connectedness	0.07	0.60 **	0.94 **	—	—	—	—	—	—
5. CE – Transcendence	0.07	0.68 **	0.95 **	0.79 **	—	—	—	—	—
6. Positive mood	0.01	0.44**	0.67 **	0.66 **	0.60 **	—	—	—	—
7. Negative mood	0.01	0.02	−0.20 **	−0.24 **	−0.14 **	−0.29 **	—	—	—
8. Meaning in life (have)	0.03	0.40**	0.63 **	0.62 **	0.58 **	0.55 **	−0.32 **	—	—
9. Event felt spiritual	0.06	0.60**	0.64 **	0.58 **	0.64 **	0.48 **	−0.09	0.54 **	—

Note: $N = 370$ (362 for crowd size). CE = collective effervescence. Dashes indicate the diagonal. ** $p < 0.01$.

We predicted that the nature condition would be associated with increased collective effervescence relative to control. The nature prime was higher on sacredness collective effervescence, connection collective effervescence, and total collective effervescence relative to the control (see Table 2). The condition predicted all the mediators and the dependent variables (see Table 2). People in the nature condition were higher in awe, collective effervescence, positive mood, meaning in life, and the event feeling spiritual as compared to the control condition. They were also lower in negative mood.

Table 2. Independent samples t-tests comparing groups on all outcome variables.

Variable	*t*	df	*p*	Mean Difference	95% CI	
					Lower	Upper
Spiritual	7.85	368	<0.001	1.42	1.06	1.77
Awe	8.89	368	<0.001	1.02	0.80	1.25
CE	9.52	368	<0.001	1.25	0.99	1.50
CE connection	8.52	368	<0.001	1.18	0.91	1.45
CE transcendence	9.25	368	<0.001	1.31	1.03	1.59
Positive Mood	10.07	368	<0.001	1.39	1.12	1.66
Negative Mood	−2.87	368	0.004	−0.48	−0.81	−0.15
Meaning in Life	3.88	368	<0.001	0.50	0.25	0.76
Event size	1.25	360	0.213	138.62	−79.92	357.15

Note: All tests used equal variances assumed. CI = confidence interval. CE = Collective Effervescence. Negative *t*-values indicate that the nature condition was lower than the control condition.

We then examined mediation models using Process Model 4. The condition was dummy coded with participants in the nature condition coded as 1 and those in control coded as 0. We predicted that collective effervescence would mediate the relationship between prime and meaning in life (see Figure 1), positive mood (see Figure 2) negative mood (see Figure 3), and spirituality (see Figure 4). As predicted, collective effervescence mediated the effect of nature prime on all four outcomes (see Figures S1–S4 for relevant statistics and Supplementary Materials for full statistics). Awe also mediated the effect of

condition on negative mood. Specifically, more collective effervescence predicted less negative mood and more awe predicted more negative mood. Awe also mediated the effect of the condition on spirituality. Collective effervescence and awe both predicted higher spirituality.

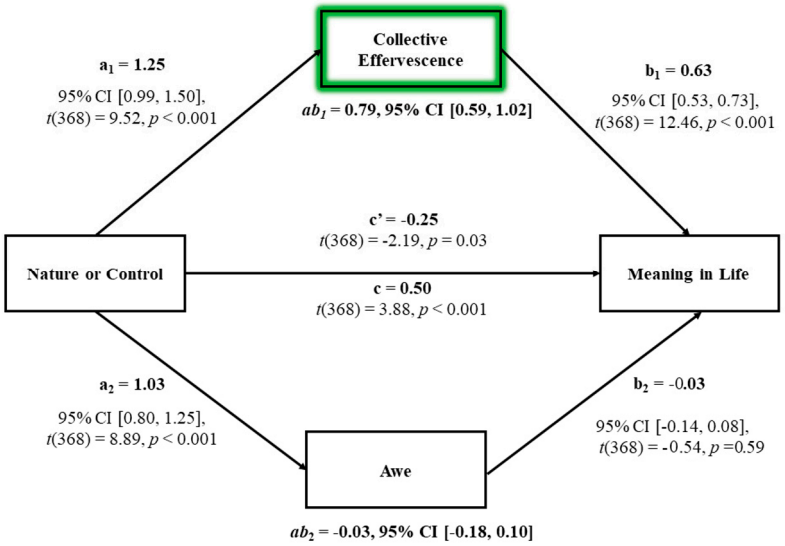

Figure 1. Collective effervescence mediates the relationship between nature prime and meaning in life.

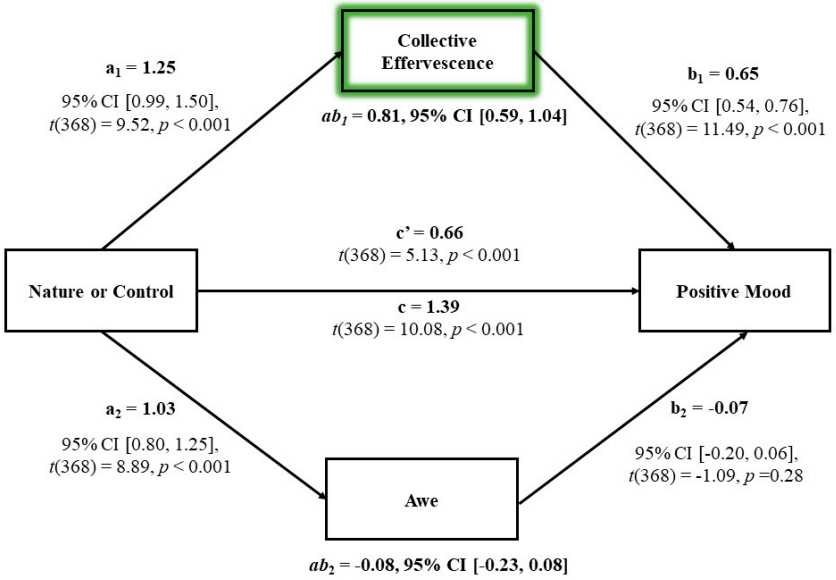

Figure 2. Collective effervescence mediates the relationship between nature prime and positive mood.

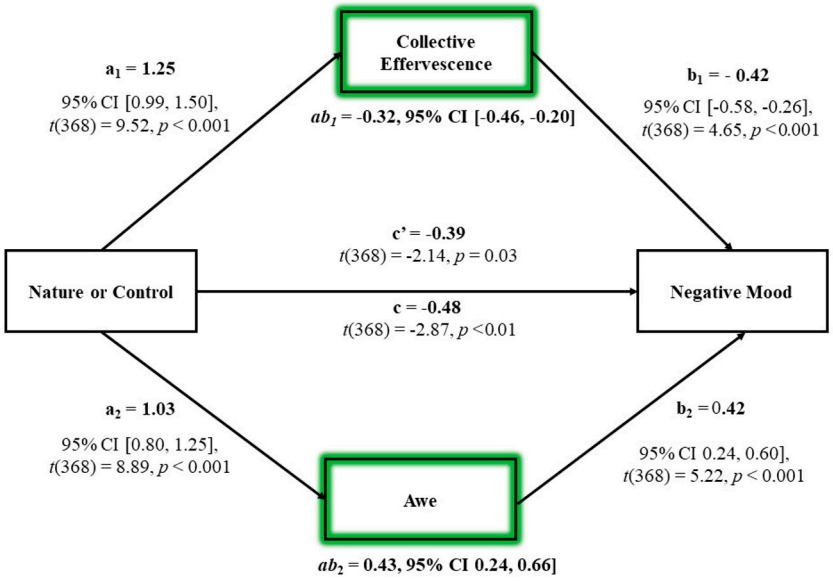

Figure 3. Collective effervescence and awe mediate the relationship between nature prime and negative mood.

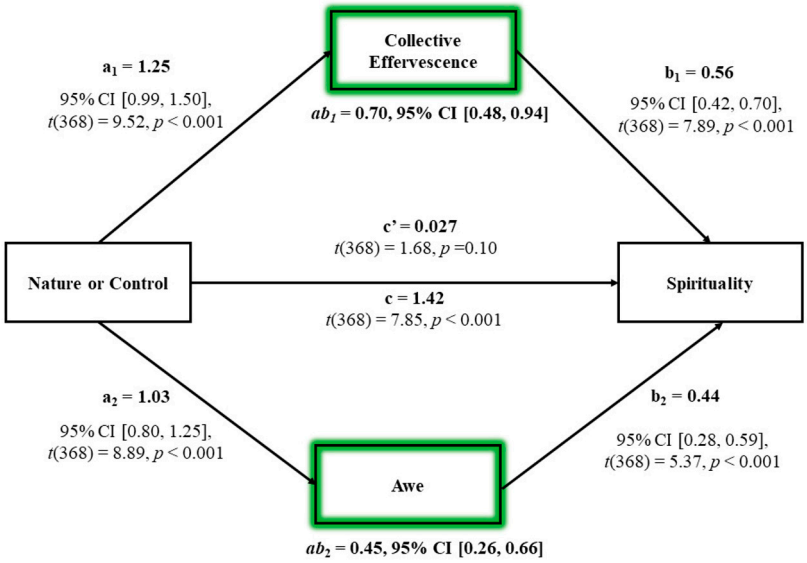

Figure 4. Collective Effervescence and Awe Mediate the Relationship Between Nature Prime and Spirituality.

Next, we examined the two different aspects of collective effervescence separately in the mediational analyses. Because the connection component was new, it was possible that the effects were just due to the more established sacredness component. This was not the case. (See Figures S5–S8 for relevant statistics and Supplementary Materials for full statistics). Both components of collective effervescence mediated the relationship between the nature prime and meaning in life (Figure 5) and the nature prime and positive mood (Figure 6). Connection, but not sacredness, mediated the relationship between nature prime and negative mood (Figure 7). The more connected people felt, the less negative mood they felt. Finally, sacredness, but not connection, mediated the relationship between nature condition and spirituality (Figure 8). The more sacredness people felt, the more they felt spiritual.

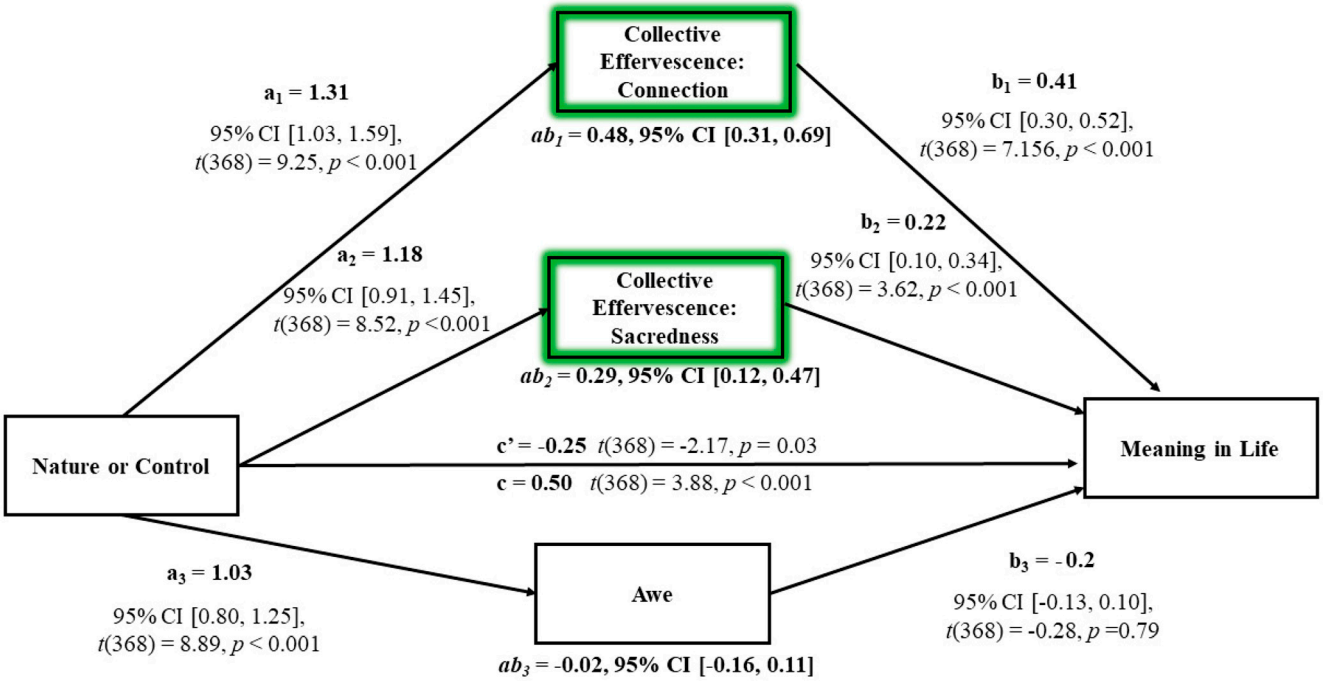

Figure 5. Both components of collective effervescence mediate the relationship between nature prime and meaning in life.

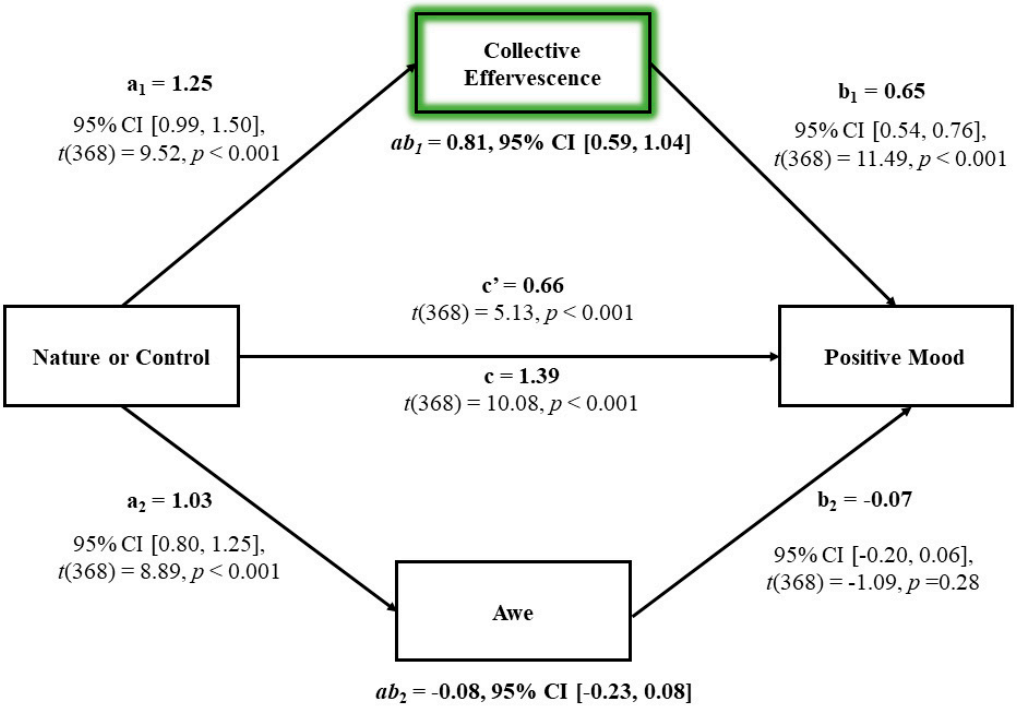

Figure 6. Both components of collective effervescence mediate the relationship between nature prime and positive mood.

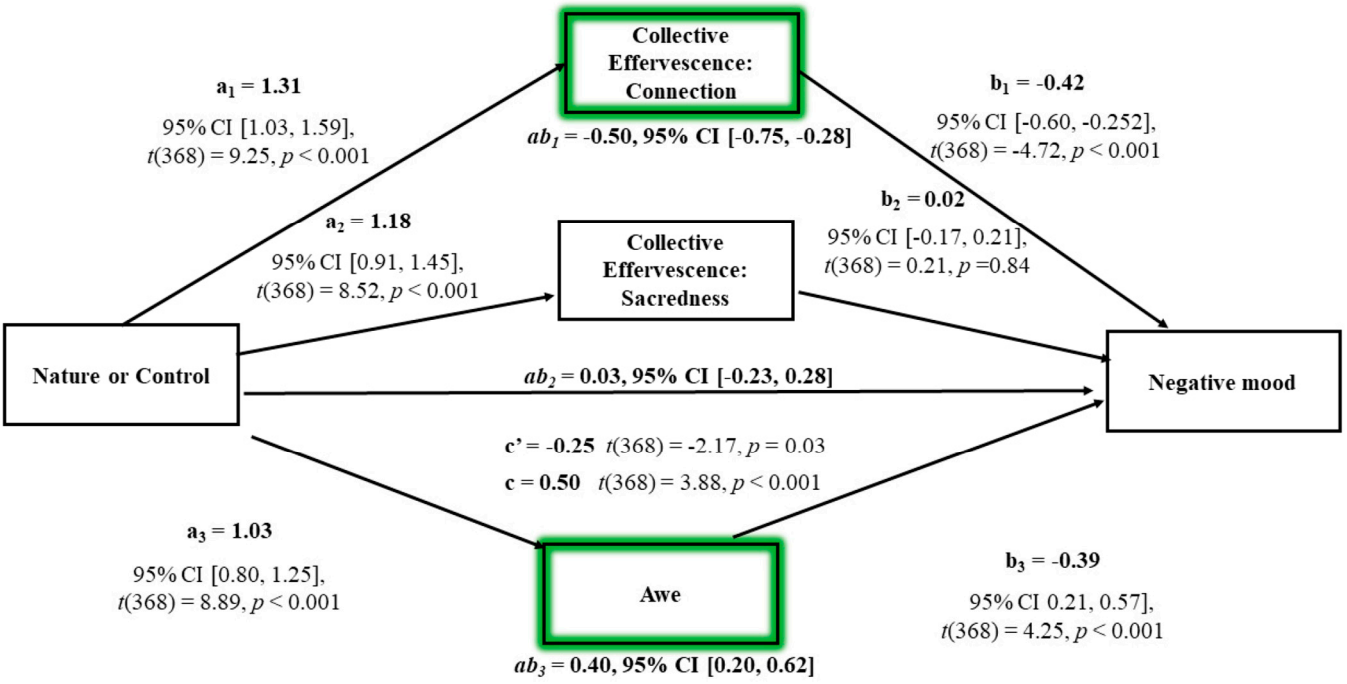

Figure 7. Connection collective effervescence and awe mediate the relationship between nature prime and negative mood.

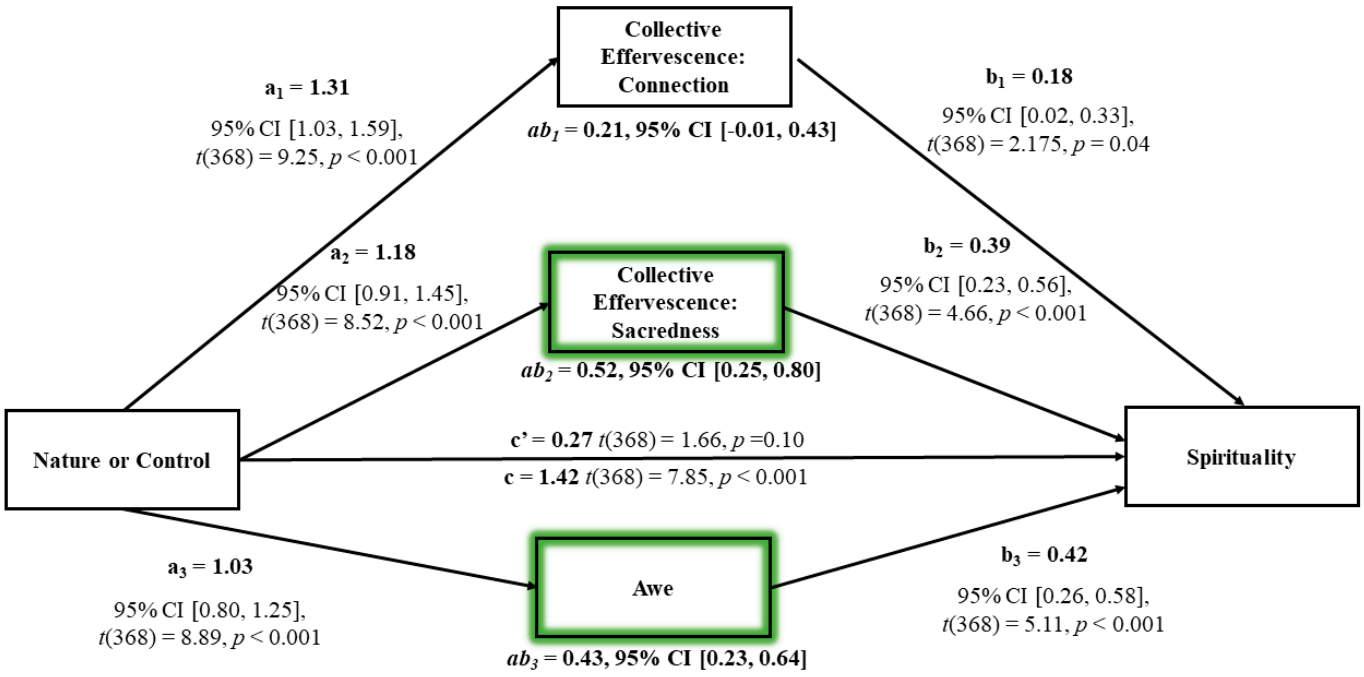

Figure 8. Sacredness collective effervescence and awe mediate the relationship between nature prime and spirituality.

Although the t-tests and mediation models strongly supported our hypothesis that collective effervescence occurred when in nature and that it predicted positive outcomes, it was still possible that the effects were driven by connections felt to the other people at the nature events rather than the broader feelings of connection the scale attempted to measure. To examine that hypothesis, we did two things. First, we examined the number

of people there as a potential confounding variable. We found no difference between control and experimental conditions in number of people who were there (see Table 2). There was also no correlation between number of people there and any other variables (See Table 1). Finally, we re-ran all analyses with the number of people entered as a covariate into all of the mediation models. When including the number of people as a covariate, all models were still significant in the exact same ways as they were without the covariate (see Supplementary Materials). This suggests that the effects were not driven by connections felt to the other people at the nature events but to the broader feelings of connection the scale attempted to measure.

Second, we looked to see if the effects were still significant if we only looked at people who experienced the event alone (N = 104). For each variable, the effects were still significant. For example, even when just examining the people who reported being alone, people primed to think about nature felt more collective effervescence connection as compared to the control condition (see Supplementary Materials). This suggests that even experiencing nature alone leads to feelings of connection and that the connection is broader than just to the people with one on a walk.

4. Discussion

Previous research has found that experiencing nature has positive effects on wellbeing and mood and increases feelings of spirituality (e.g., [15–18]). We replicated those findings in this research. People who were primed with an experience in nature reported higher positive mood, lower negative mood, increased spirituality and increased meaning in life. We also found that they experienced increased awe.

The current research increased what was known by past research by finding that participants reported experiencing collective effervescence in nature and that collective effervescence mediated the effects of nature prime on all of the outcomes. This is the first research that suggests that collective effervescence can be measured for events in nature and for events that do not directly include other people. We hypothesized that the connection component of collective effervescence would also be felt when in nature—as a sense of general connection. We found support for this. General connection items formed a reliable scale. Furthermore, collective effervescence mediated the effects of nature on all four variables with both forms of collective effervescence mediating positive mood and meaning in life, collective effervescence connection mediating negative mood and collective effervescence sacredness mediating spirituality.

Collective effervescence played a significant role in explaining the positive effects of experiencing nature even when the number of people accompanying the participants was accounted for and even when only examining participants who were by themselves. This suggests that the connection that is felt in nature is not specific to the other people present but instead broader to the world, all of humanity, or even the entire universe. This is the first research to demonstrate that the connection felt during a collective effervescence experience can go beyond the connection to the other people present. However, it is consistent with research showing that collective effervescence predicts increases in identification with all of humanity [55].

When collective effervescence and awe were concurrently included in the mediation models, the medication of awe between nature and spirituality remained significant. However, awe no longer significantly mediated the relationships between nature and meaning in life and nature and positive mood. The current research used the 12-item short form of the awe experience scale, which provided an excellent omnibus awe score but only has two items for each of the six subscales of awe. Future work may benefit from an expanded awe scale, which will allow researchers to examine whether some components of awe become especially important, whereas others drop out, when the overlapping var-

iance between awe and collective effervescence is accounted for. This may be particularly true for the small-self component of awe as this is the area where awe and collective effervescence tend to diverge the most strongly. A key component of awe is an experience of a small self, whereas a key outcome of collective effervescence is an expansion of self [50,51]. The small-self component of awe is more strongly associated with negative awe experiences [64]. This may be the reason for the somewhat surprising finding that although awe was negatively correlated with negative emotions, it positively predicted negative emotions when examined concurrently with collective effervescence in the mediation model. Perhaps the small-self component of awe increases its relative predictive power when collective effervescence is in the same model. Future research will be necessary to examine this hypothesis.

Although these findings are novel and potentially important, there are limitations to the findings and much room for future research. For example, the current study is limited by the retrospective nature of the nature experience. Although previous research examining the effects of nature on wellbeing has had participants write about/recall the experience [65,66] and imagine the experience [67,68], it might be useful for future research to examine actual experiences in nature. Future research will also want to examine the role of ecospirituality [69] as potentially working in tandem with collective effervescence in predicting wellbeing in nature.

Finally, future work may want to directly manipulate collective effervescence experiences in nature to increase confidence in the mediational models. Some of the outcomes examined (positive mood, spirituality, and meaning in life) were highly related to the mediators; thus, the causal role of the mediators could not be expressed with confidence. In particular, the sacredness component of collective effervescence has some semantic similarities to an increased feeling of spirituality, suggesting that further research may be necessary to increase confidence in the findings. That research might also benefit from a more comprehensive measure of spirituality. Previous research does suggest that manipulating collective effervescence increases positive mood, spirituality, and meaning in life, which increases our confidence that the mediation models may reflect the actual psychological processes. However, those priming studies were done outside of nature experiences so future studies will want to examine the causal role of collective effervescence more directly.

5. Conclusions

There is perhaps no issue more important to the survival of the human species than increased preservation of the earth as a place where humans can live and thrive. Encouraging humans to engage in environmental stewardship is essential to our survival. Research suggests that enjoyable experiences in nature provide a pathway to environmental stewardship and sustainable behaviors. A fuller understanding of the psychological mechanisms leading nature experiences to be enjoyable will allow for more precision in designing nature experiences that impact sustainability attitudes and behaviors. The current research suggests that collective effervescence may be a potent pathway between nature and feelings of enjoyment. In other words, when experiencing nature, collective effervescence is sometimes felt. Collective effervescence then predicts an enjoyable experience. This raises the possibility that interventions that foster collective effervescence in nature may be able to increase pro-environmental behavior and opens up a new area for future research.

Supplementary Materials: Data, syntax, and statistical details and additional analuses can be downloaded at: https://osf.io/b5j3f/files/osfstorage accessed on 2 June 2026.

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Data Availability Statement: Data can be found at https://osf.io/b5j3f/files/osfstorage accessed on 2 June 2026.

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