The impact of the COVID-19 pandemic on environmental values

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Abstract
Environmental values emphasize protection of the natural environment and promote behaviors that express this broad motivational goal. Thus, changes in these values at the community and individual levels are likely to have significant consequences for sustainability efforts. We examined the relative importance of environmental values in Australian adults at five time points over 4 years, including a period of stability (2017–2019) and a period of crisis (early and late in the 2020 COVID-19 pandemic). We found that the relative importance of environmental values increased from 2017 to 2019 and decreased during the pandemic. Importantly, the decrease in 2020 was lessened by individuals’ connection with nature.

Keywords Human values · Environmental values · Value change · Connection with nature · COVID-19 pandemic

Introduction
The current COVID-19 pandemic has brought sustainability efforts into sharp relief in multiple ways. In a positive vein, human impact on the environment has been both immediately apparent and highly visible during lockdowns implemented to halt the spread of the virus, including improved air quality and falling pollution levels (IEA 2021; Le Quéré et al. 2020, 2021). However, some governments appear to be using the pandemic as an opportunity to roll back existing environmental protections (Tollefson 2020; Vivid Economics 2021) and to support industries reliant on fossil fuels (Alers 2020). This suggests the view that economic development and environmental protection are at odds with one another (see Tienhaara 2010) has remained the case during the current pandemic, highlighting the importance of mobilizing community support for sustainability efforts during and beyond the COVID-19 crisis.

A challenge to garnering community support for sustainability efforts during crisis events is that there is evidence that concerns about the environment decreased during previous economic recessions (e.g., Dunlap 2010; The Nielsen Company 2009; Whitmarsh 2011) and the current pandemic (e.g., Kassam 2020). However, despite the importance of human values in motivating sustainability efforts (Dietsch et al. 2016; Manfredo et al. 2017a), little is known about the impact of crisis events on environmental values and factors that might promote or inhibit these values during crises.

Using a longitudinal study, we test whether values prioritizing the natural environment declined in the general population in response to COVID-19. In particular, we examine the impact of worry about COVID-19, which may shift overall life priorities, and hypothesize that the onset of the COVID-19 pandemic will be accompanied by a decrease in the relative importance of environmental values. Furthermore, we test whether connection with nature (i.e., the extent to which individuals feel closely connected to nature) mitigates any potential decrease in the relative importance of environmental values during the COVID-19 pandemic. In examining these broad trends, we offer insights into the opportunities and risks of the current and possible future pandemics.
Environmental values

The importance of transcendent human values within the sustainability context has been clearly recognized (Dietsch et al. 2016; Hicks et al. 2015; Manfredo et al. 2016, 2017a), including the dependence of environmental values on the larger values system within which they are embedded. This ‘systems’ approach to thinking about human values holistically (see Hicks et al. 2015) has been reflected in questions around value driven behaviors and environmental protection policies, which have been at the forefront of sustainability efforts (Jucker et al. 2018; Manfredo et al. 2020).

Values are desirable, motivational goals that transcend situations and reflect what is important to people in their lives (Schwartz 1992). They influence people’s beliefs, attitudes and behaviors across situations (see Sagiv et al. 2017). The values most frequently implicated in explaining environmentally significant attitudes and behaviors are those that emphasize the motivation to preserve the natural environment (i.e., universalism-nature; Schwartz et al. 2012 and biospheric values; Stern and Dietz 1994). Environmental values have been positively associated with pro-environmental attitudes (e.g., Ballantyne et al. 2018; Lee et al. 2019), environmental concerns (e.g., Schultz et al. 2005), and behaviors, such as donating to environmental organizations (e.g., Sneddon et al. 2020).

Values are relatively stable over time (Dobewall and Aavik 2016; Milfont et al. 2016; Vecchione et al. 2016) and across generations (Manfredo et al. 2016). However, some evidence of value change has been found in response to changes in life circumstances (e.g., Bardi et al. 2009; Gouveia et al. 2015; Lönnqvist et al. 2011) and external crisis events (e.g., Daniel et al. 2013; Sortheix et al. 2019; Verkasalo et al. 2006), including the COVID-19 pandemic (Daniel et al. 2022). This shows that values are responsive to larger external conditions at the societal level (Daniel et al. 2013, 2022; Manfredo et al. 2017a; Sortheix et al. 2019; Verkasalo et al. 2006). However, little is known about the effect of external crisis events on environmental values.

Environmental values reflect a long-term horizon of concern for the welfare of others (Joireman 2005). In major crisis events, such as the COVID-19 pandemic, people are faced with both social (i.e., protecting personal versus collective interests) and temporal (i.e., promoting short- versus long-term interests) conflicts. When an event that triggers uncertainty threatens an individual’s personal circumstances, people are likely to reduce their horizon of concern to focus less on collective and long-term interests (i.e., the preservation of nature) and more on individual and short-term interests (i.e., personal safety and security; Daniel et al. 2022; Naveh-Kedem and Sverdlik 2019). Therefore, we expect that the COVID-19 pandemic will be accompanied by a decrease in the relative importance of environmental values and that this decline will be greater amongst people who feel that their personal circumstances are threatened.

One potential factor that may lessen the impact of events like the COVID-19 pandemic on environmental values is a strong connection with nature. Connection with nature, defined as the degree to which a person includes nature in their self-concept (Schultz 2001), has been positively associated with environmental values (e.g., Mayer and Franz 2004; Schultz 2001; Schultz et al. 2004). It has also been suggested that connection with nature may contribute to the formation of environmental values (see Martin and Czellar 2017).

People who feel more connected with nature hold a broad self-construal that includes all living things (Arnocky et al. 2007; Schultz et al. 2005). This strong sense of including nature in one’s self-concept may act as a buffer to social and temporal conflicts arising from major crisis events that can impact value priorities.

We hypothesize that:

1. Environmental values will decrease during the COVID-19 pandemic.
2. The expected decrease in environmental values during the pandemic will be greater for those who worry more about COVID-19.
3. The expected decrease in environmental values during the pandemic will be less for those with a stronger connection with nature.

In this study, we examine change in the relative importance of environmental values at five time-periods over 4 years from 2017 to 2020. Specifically, we examine environmental values over 3 time periods prior to the pandemic (2017, 2018, and 2019) and 2 time periods during the pandemic (April 2020 and November 2020). We test whether connection with nature lessens the predicted decline in environmental values during the pandemic and whether worry about COVID-19 increases the expected decline in environmental values during the pandemic.

Methods

Participants and procedures

In 2017, respondents were recruited for a longitudinal survey from a large online commercial panel of Australian adults. At each time point (wave), respondents answered a series of short surveys, the first of which was about their personal values. The sampling frame was based on a cross-sequential
design, with a target of 500 respondents in each of 14 age categories from 18 to 75 years of age, intentionally over-representing older Australians. Despite this, the sample was largely reflective of many socio-demographic characteristics in the Australian population (see Table 1). This study was approved by the Human Research Ethics Committee at the corresponding author’s university and was conducted in accordance with the 2007 Australian National Statement on Ethical Conduct in Human Research.

The current study included 1442 Australian adults (mean age in November 2020 = 59.5 years, SD = 12.8; 61% female) who completed at least the last four waves of the Values Project (https://osf.io/w6uen/) survey, carried out in late 2017, 2018, and 2019 and in early and late 2020 (see Table 1 for sample demographics and Supplementary Materials S1 for a full description of data collection procedures).

The timing of the surveys during the 2020 COVID-19 pandemic captured very different phases of community response to the pandemic. Specifically, wave four of the survey began on 14th April 2020, during the onset of the COVID-19 pandemic, with 90% of the surveys being completed by April 26th. Immediately prior to the wave four data collection, much of Australia was in lockdown. In March 2020, with rising community transmission, the government introduced a range of restrictions including closing non-essential businesses and asking parents to keep their children home from school. These restrictions, along with local enforcement of social distancing measures, remained in place during the survey period.

Wave five began on 18th November 2020 and was completed by the 7th of December. Prior to the wave five data collection, COVID-related restrictions had eased across most of Australia, with very few cases of community transmission and responses to outbreaks being short (5–7 days), localized lockdowns.

**Measures**

Environmental values were measured with the Schwartz Best Worst Values Refined Survey (BWVr; Lee et al. 2019). This survey is based on best–worse scaling (see Louviere et al. 2015), which extends the method of paired comparisons to the multiple-choice situation. Specifically, the BWVr asks respondents to choose their most and least important values from 21 subsets of value items derived from a balanced incomplete block design that, across all subsets, shows each

| Table 1 Sample characteristics | Australian Census (2016) | Time 1 (2017) | Time 4 (April 2020) | Time 5 (November 2020) |
|--------------------------------|--------------------------|---------------|---------------------|------------------------|
| Mean age                       | 37 (median)              | 56.88 (12.7)  | 58.87 (12.8)        | 59.49 (12.8)           |
| Proportion of 18–75-year-olds  |                          |               |                     |                        |
| 18–32 years                    | 29%                      | 7%            | 7%                  | 7%                     |
| 33–47 years                    | 29%                      | 22%           | 23%                 | 19%                    |
| 48–62 years                    | 26%                      | 36%           | 37%                 | 39%                    |
| 63–75 years                    | 16%                      | 35%           | 33%                 | 35%                    |
| Female (18–75 years)           | 51%                      | 60%           | 63%                 | 61%                    |
| Residence (18–75 years)        |                          |               |                     |                        |
| New South Wales                | 32%                      | 29%           | 27%                 | 27%                    |
| Victoria                       | 25%                      | 25%           | 25%                 | 24%                    |
| Queensland                     | 20%                      | 22%           | 22%                 | 22%                    |
| Western Australia              | 11%                      | 11%           | 11%                 | 11%                    |
| South Australia                | 7%                       | 9%            | 11%                 | 11%                    |
| Tasmania                       | 2%                       | 2%            | 3%                  | 3%                     |
| Australian Capital Territory   | 2%                       | 2%            | 2%                  | 2%                     |
| Northern Territory             | <1%                      | <1%           | <1%                 | <1%                    |
| Environmental values (0–10) mean | 5.53 (1.85)             | 5.69 (1.87)  | 5.74 (1.83)         |                        |
| Sociometric status (1–10) median | 6                      | 6             | 6                   |                        |
| Religiosity (1–7) mean         | 2.46 (2.59)              | 2.18 (2.29)  | 2.17 (2.29)         |                        |
| Connection with nature (1–7) mean | 4.06 (1.81)             | 4.10 (1.78)  | 4.10 (1.78)         |                        |
| Worry about COVID-19 (3–14) mean | 7.55 (3.07)             | 7.55 (3.07)  | 6.02 (2.82)         |                        |

The sample for Time 4 includes the same participants that completed the survey at time 2 (2018) and time 3 (2019). Thus, the demographic characteristics are reported only once for times 2, 3, and 4, as completed in time 4. Standard deviations in parentheses.
value five times and every pair of values once. The validity of this scale for measuring values and specifically environmental values has been demonstrated in Lee et al. (2019). Benefits of using this approach for the measurement of values include the direct measurement of the relative importance of each value without the need for post hoc standardization when rating scales are used (as recommended by Schwartz 2005) and the minimization of response biases, such as acquiescence and extreme response biases (Lee et al. 2008).

The item measuring environmental values in the BWVr survey is protecting the natural environment from destruction or pollution (see also Schwartz et al. 2012). Following Lee et al. (2019), we produced a score for each respondent on this value by subtracting the number of times it was chosen as least important from the number of times it was chosen as most important across all sets (see Louviere et al. 2015). The 11-point scores for environmental values were then recoded to a 0–10 scale for ease of interpretation. Scores represent the relative importance of environmental values in comparison to all other human values.

Worry about the COVID-19 pandemic was measured in the fourth and fifth survey waves with three items adapted for the pandemic from the McCaul Brief Worry Scale (McCaul et al. 1996). Respondents were asked the following: During the past week, how often have you worried about getting COVID-19 (never, rarely, sometimes, or all of the time)? How bothered are you by thinking about getting COVID-19 (not at all, somewhat, moderately, a great deal, or extremely)? and How worried are you about getting COVID-19 (not at all, somewhat, moderately, a great deal, or extremely)? Reliability of the worry scale was high (Cronbach’s $\alpha_{T1} = 0.90$; Cronbach’s $\alpha_{T3} = 0.91$).

Connection with nature was also measured in the fourth and fifth survey waves using Schultz’s (2001) inclusion of nature in self (INS) scale. The INS asks respondents to select one configuration from a series of seven configurations of increasingly overlapping circles labeled ‘you’ and ‘nature’. Respondents were asked to select the configuration of circles that best described their relationship with the natural environment and how connected they are with nature. Scores ranged from 1 (the ‘you’ and ‘nature’ circles touch but do not overlap) to 7 (the ‘you’ and ‘nature’ circles almost entirely overlap).

Control variables, including gender, subjective socioeconomic status, and religiosity, were measured in each survey wave. Sociometric status was measured using the MacArthur Scale of Subjective Social Status (Adler et al. 2000) by presenting respondents with a picture of a ladder representing community standing and asking them to choose the rung that they feel best reflects their standing in the community. Religiosity was measured with the single item from the European Social Survey (2016; Regardless of whether or not you belong to a particular religion, how religious would you say you are?) on an eight-point scale (1 = not at all religious to 8 = very religious).

Analysis plan

We estimated the longitudinal pattern of environmental values change over time, with a two-level random effects model using the lme function in the nlme package in R (Pinheiro and Bates 2021) and Mplus 8.4 (Muthén and Muthén 2017). We estimated a set of nested models. First, we estimated an empty model to investigate the partitioning of variance between the time and the individual levels. Next, we added the control variables of religiosity and subjective socioeconomic status (SES). These variables were centred within individuals across survey waves. In the third model, we estimated the role of time in environmental value importance. Specifically, we estimated (1) a linear time-period effect (coded as 0 = 2017, 1 = 2018, 2 = 2019, 2 = 2020a, 2 = 2020b), (2) an early pandemic onset time-period effect (coded as 0 = 2017, 0 = 2018, 0 = 2019, 1 = 2020a, 0 = 2020b), and (3) a later pandemic time period effect (coded as 0 = 2017, 0 = 2018, 0 = 2019, 0 = 2020a, 1 = 2020b). These were estimated to assess independent effects of value change prior to and during the pandemic in 2020. We provide robustness checks with alternative specifications in Supplementary Materials S3 (Tables S3.1–S3.3).

To predict environmental value change effects during COVID-19, we ran bootstrapped residualized multiple regressions (with 1,000 replications). In two separate models, we (1) regressed Time 3 (2019) environmental values on Time 4 (early pandemic) environmental values and (2) regressed Time 4 (early pandemic) environmental values on Time 5 (later pandemic) environmental values, together with the effects of connection with nature and worry about the COVID-19 pandemic, controlling for sociometric status and religiosity. The residualized regressions implied that we estimated later environmental value importance, while controlling statistically for previous environmental value importance.

Results

We first estimated the patterns of environmental value change using repeated measures ANOVA in SPSS V27. The mean of environmental values at the sample level differed significantly over time ($F_{4, 964} = 10.81, p < 0.001; \mu_{\text{partial}}^2 = 0.043$). Specifically, environmental values increased prior to the pandemic and decreased during the pandemic in 2020 ($\mu_{T1} = 5.53$ (SD 1.85), $\mu_{T2} = 5.75$ (SD = 1.91), $\mu_{T3} = 5.82$ (SD 1.87), $\mu_{T4} = 5.70$ (SD
1.90), mean_T5 = 5.74 (SD 1.84). Correlations between all study variables can be found in Supplementary Materials S2.

**Longitudinal analysis**

The intraclass correlation (ICC) for the empty model, with no predictors, indicated that 70% of the variance in environmental values was due to differences between individuals, with the rest due to temporal effects within individuals. This implies considerable change in environmental values within individuals, over time.

**Control variables**

Model 1 revealed that females had higher environmental values than males (b = −0.25, p = 0.005). These results held when environmental value change (Model 2) was added to the analyses (see Table 2).

**Environmental value change over time**

Over time, the relative importance of environmental values were increasing prior to the pandemic (b = 0.14, p < 0.001). However, as hypothesized, early in the pandemic (April 2020) environmental values decreased significantly (b = −0.11, p = 0.003) and this decrease continued to be significant later (November 2020) in the pandemic (b = −0.08, p = 0.03).

### Table 2

|                | M1 adds control variables | M2 adds change with time |
|----------------|---------------------------|--------------------------|
| **Fixed effects** |                           |                          |
| Wave–person level |                           |                          |
| SES             | 0.01                      | 0.02                     |
| Religiosity     | −0.03                     | −0.02                    |
| Individual level |                           |                          |
| Intercept       | 5.81***                   | 5.64***                  |
| Gender          | −0.25**                   | −0.25**                  |
| Linear slope    |                           |                          |
| COVID-19 early  |                           |                          |
| COVID-19 late   |                           |                          |
| **Random effects** |                         |                          |
| Wave–Person level |                           |                          |
| Residual variance | 1.02***              | 1.01***                 |
| Individual level |                           |                          |
| Intercept residual variance | 1.56***          | 1.56***                 |

Gender coded as male = 1, female = 0
*p < 0.05; **p < 0.01. ***p < 0.001. CI confidence interval, SES sociometric status. For an alternative method of analysis see Supplementary Materials S3, Tables S3.1–S3.3

**Predictors of environmental value change**

The results support hypothesis 3, in that connection with nature had a positive effect on the change in environmental values during the pandemic, both early (b = 0.13, p < 0.001) and late (b = 0.12, p < 0.001) in 2020. Thus, connection with nature lessened the decline in environmental values during this period of crisis. However, hypothesis 2 was not supported. The effect of worry about the pandemic on environmental values was not significant in either pandemic time period (see Table 3).

**Explained variance**

To understand sources of the within-individual variance in environmental values related to fluctuations of the values of individuals across time points, we used the Rights and Sterba (2019) method for partitioning variance in multilevel models. We first computed $R^2_w$, the proportion of within-individual variance explained by the estimated effect of change in environmental values over time (prior to and during the COVID-19 pandemic), on average, across all individuals (via fixed slopes; Rights and Sterba 2019). This suggested that on average 1% of the variability within individuals could be explained by our time dummy codes. Next, we computed $R^2_v$ which is the proportion of within-individual variance explained by variability between individuals in their estimated effect of change in environmental values over time (prior to and during the COVID-19 pandemic, via random slope variation/covariation; Rights and Sterba 2019). A
value of 7% suggested that there was substantial individual variability in how much values changed over time.

Focussing specifically on changes during the pandemic, we calculated the change in total explained variance in the residualized regression (see Table 3). After controlling for demographic variables and COVID-19 worries, we found that connection with nature accounted for 3% of variance during the early pandemic and 1% later in the pandemic in the residuals of environmental values. Therefore, connection with nature accounted for a significant amount of the variance in change in environmental values during the pandemic, with slightly larger effects early in the pandemic.

**Discussion**

We found that environmental values increased from 2017 to 2019, then decreased during the COVID-19 pandemic in 2020. Importantly, we also found that the decrease in environmental values associated with the pandemic (April and November 2020) was lessened by individuals’ connection with nature. Thus, the current study extends prior research examining the impact of crisis events on environmental concerns to the impact on more deeply held human values that have implications for a wide range of sustainability efforts. It also extends prior research by examining within-individual environmental value change over time and how connection with nature impacts this change.

It is important to note that the positive yearly increase that we found in the importance of environmental values from 2017 to 2019 was reversed by the decrease in the relative importance of these values during the pandemic in 2020. However, these effects were not explained by differences in worry about COVID-19 either early or late in the pandemic in our sample. Our results are consistent with Daniel et al.’s (2022) findings that worry about COVID-19 was not associated with change in transcendental values early in the pandemic; however, they found a small effect of worry on these values late in 2020. Our results should be interpreted in light of relatively low COVID-19 infection and death rates in Australia, in comparison with many other countries during this time period. Indeed, the respondents’ level of worry in our sample was below the midpoint on the worry scale both in early and late 2020 (see Supplementary Materials S2).

The change in environmental values that we found over a relatively short time period contributes to the ongoing debate in the sustainability and conservation literature as to whether it is possible to deliberately change people’s values to effect positive environmental outcomes (see Ives and Fischer 2017; Manfredo et al. 2017a, b). While our study did not directly manipulate events that led to value change, we did show environmental value change within the context of a natural experiment in periods of relative stability and crisis. These results contribute to the discussion raised by both Manfredo et al. (2016) and Kenter et al. (2019) regarding value stability and change, specifically how quickly and to what extent values adapt to dramatic social-ecological changes.

Importantly, connection with nature had a positive effect on the change in environmental values during the pandemic. These results extend previous findings of positive relations between environmental values and connection with nature found in cross-sectional studies (e.g., Mayer and Franz 2004; Schultz 2001; Schultz et al. 2004). Given the longitudinal nature of our data, our results also go some way to support the proposition that connection with nature may even contribute to the formation of environmental values (Martin and Czellar 2017). However, further research, possibly using cross-lagged panel analysis models, is required to examine reciprocal relations between connection with nature and environmental values over time.
During times of crisis, connection with nature may lessen societal declines in environmental values. We show important individual differences in the extent of environmental value change that is associated with connection with nature. Specifically, our results show that there is a significant, but not substantial, change in environmental values over time at the sample level, with most of the differences existing between individuals. Importantly, connection with nature played a role in explaining differences between individuals during this period. Simply knowing that there are substantial individual differences in environmental value change over time (in this case, during periods of relative stability and crisis) has limited practical application. In contrast, understanding the role that connection with nature may play in explaining differences between individuals in their environmental value change over time offers a more fruitful approach for institutions aiming to promote environmental values (see also Jucker et al. 2018).

Research has shown that connection with nature can be increased by spending more time in nature (e.g., Kals et al. 1999; Mayer et al. 2009), especially if individuals can create some meaningful interactions with nature by focusing on their sensory experiences (Colléony et al. 2020). This may be particularly important in the COVID-19 crisis, given the impact of restrictions, such as mask wearing, social distancing, and confinement, on people’s ability to pursue social connections. Increasing connection with nature may also be an effective alternative means of increasing well-being during this and potential future crises (see Jackson et al. 2021; Martin et al. 2020; Mintz et al. 2021; Nisbet et al. 2011; Pritchard et al. 2020).

It is important to note that the current design included measurement of connection with nature and worry about COVID-19, during but not prior to the 2020 pandemic. For that reason, we could estimate the role of these variables in environmental value change during the COVID-19 pandemic, but not in the initial level of environmental values, or in their change prior to COVID-19. Additional longitudinal studies are needed to explore these effects, as well as appropriate mechanisms for interventions designed to influence the relative importance of environmental values.

Our focus on value change over time is significant because the extent to which people endorse environmental values is likely to shape human decision making around sustainability efforts both during and beyond the COVID-19 pandemic (see Bennett et al. 2017; Kendall and Raymond 2019). This study adds to the limited knowledge of how environmental values change within individuals and suggests promising directions for those interested in promoting environmental values in society though enhancing people’s connection with nature. This may be critical given the importance of nature for the survival of human societies, especially in the face of climate change (IPCC 2018, 2019).

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**References**

Adler NE, Epel ES, Castellazzo G, Ikovich JF (2000) Relationship of subjective and objective social status with psychological and physiological functioning: Preliminary data in healthy, White women. Health Psychol 19:586–592

Akers M (2020) How clean energy can power a COVID-19 recovery. United Nations Development Programme. https://www.undp.org/blog/how-clean-energy-can-power-covid-19-recovery. Accessed Jun 2020

Arnocky S, Stroink M, DeCicco T (2007) Self-construal predicts environmental concern, cooperation, and conservation. J Environ Psychol 27:255–264

Ballantyne R, Hughes K, Lee J, Packer J, Sneddon J (2018) Visitors’ values and environmental learning outcomes at wildlife attractions: implications for interpretive practice. Tour Manag 64:190–201

Bardi A, Lee JA, Hofmann-Towfigh N, Soutar G (2009) The structure of intravindividual value change. J Personal Soc Psychol 97:913–929

Bennett NJ, Roth R, Klain SC, Chan K, Christie P, Clark DA, Greenberg A (2017) Conservation social science: understanding and integrating human dimensions to improve conservation. Biol Conserv 205:93–108

Colléony A, Levontin L, Schwartz A (2020) Using ‘cues to experience’ to promote meaningful nature interactions and enhance positive effect when visiting green spaces. Conserv Biol 34:1373–1382

Daniel E, Fortuna K, Thurk SK, Cioban S, Knafo A (2013) Brief report: Early adolescents’ value development at war time. J Adolesc 36:651–655

Daniel E, Bardi A, Fischer R, Benish-Weisman M, Lee JA (2022) Changes in personal values in pandemic times. Soc Psychol Personal Sci. https://doi.org/10.1177/19485506211024026

Dietsh AM, Teel TL, Manfredo MJ (2016) Social values and biodiversity conservation in a dynamic world. Conserv Biol 30:1212–1221

Dobewill H, Aavik T (2016) Rank-order consistency and profile stability of self-and informant-reports of personal values in comparison to personality traits. J Individ Differ 37:40–48. https://doi.org/10.1027/1614-0001/a000186

Dunlap RH (2010) At 40, environmental movement endures, with less consensus. Gallup, Washington D.C. https://news.gallup.com/poll/127487/environmental-movement-endures-less-consensus.aspx. Accessed May 2020

European Social Survey. 2016. ESS Round 8 Source Questionnaire. http://www.europeansocialsurvey.org/docs/round8/fieldwork/source/ESS8_source_questionnaires.pdf. Accessed Jan 2016

Gouveia VV, Vione KC, Milfont TL, Fischer R (2015) Patterns of value change during the life span: Some evidence from a functional approach to values. Personal Soc Psychol Bull 41:1276–1290

Hicks CC, Cinner JE, Stoeckl N, McLanahan TR (2015) Linking ecosystem services and human-values theory. Conserv Biol 29:1471–1480

IEA (2021) Global energy review: CO2 emissions in 2020. IEA, Paris. https://www.iea.org/articles/global-energy-review-co2-emissions-in-2020. Accessed 11 Jul 2021

IEA (2021) Global energy review: CO2 emissions in 2020. IEA, Paris. https://www.iea.org/articles/global-energy-review-co2-emissions-in-2020. Accessed 11 Jul 2021

IEA (2021) Global energy review: CO2 emissions in 2020. IEA, Paris. https://www.iea.org/articles/global-energy-review-co2-emissions-in-2020. Accessed 11 Jul 2021
IPCC (2018) Global Warming of 1.5 °C. An IPCC Special Report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. World Meteorological Organization, Geneva, Switzerland. https://www.ipcc.ch/sr15/. Accessed Dec 2020

IPCC (2019) Climate change and land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. https://www.ipcc.ch/srccl/. Accessed Dec 2020

Ives CD, Fischer J (2017) The self-sabotage of conservation: reply to Manfredo et al. Conserv Biol 31:1483–1485

Jackson SB, Stevenson KT, Larson LR, Peterson MN, Seekamp E (2021) Connection to nature boosts adolescents’ mental well-being during the COVID-19 pandemic. Sustainability 13:12297

Joireman JA (2005) Environmental problems as social dilemmas: the temporal dimension. In: Strathman A, Joireman JA (eds) Understanding behavior in the context of time: theory, research, and application. Lawrence Erlbaum, New Jersey, pp 289–304

Jucker T, Wintle B, Shackelford G, Bocquillon P, Geffert JL, Kas-oar T et al (2018) Ten-year assessment of the 100 priority questions for global biodiversity conservation. Conserv Biol 32:1457–1463

Kals E, Schumacher D, Mondata L (1999) Emotional affinity toward nature as a motivational basis to protect nature. Environ Behav 31:178–202

Kassam N (2020) Understanding Australian Attitudes to the World. Lowy Institute Poll 2020. https://www.think-asia.org/bitstream/handle/11540/12144/lowyinstitutepoll-2020.pdf?sequence=1. Accessed Jul 2020

Kendal D, Raymond CM (2019) Understanding pathways to shifting people’s values over time in the context of social–ecological systems. Sustain Sci 14:1333–1342

Kenter JO, Raymond CM, Van Riper CJ, Azzopardi E, Brear MR, Calcagni F, Thanhkappan S (2019) Loving the mess: navigating diversity and conflict in social values for sustainability. Sustain Sci 14:1439–1461

Le Quéré C, Jackson RB, Jones MW, Smith AJP, Abernethy S, Andrew RM, De-Gol AJ, Willis DR, Shan Y, Canadell JG, Friedlingstein P, Creutzig F, Peters GP (2020) Temporary reduction in daily global CO2 emissions during the COVID-19 forced confinement. Nat Clim Change 10:647–653

Le Quéré C, Peters GP, Friedlingstein P, Andrew RM, Canadell JG, Davis SJ, Jackson RB, Jones MW (2021) Fossil CO2 emissions in the post-COVID-19 era. Nat Clim Change 11:197–199. https://doi.org/10.1038/s41558-021-01001-0

Lee JA, Soutar GN, Louviere JJ (2008) The best–worst scaling approach: an alternative to Schwartz’s values survey. J Pers Assess 90:335–347

Lee JA, Sneddon JN, Daly TM, Schwartz SH, Soutar GN, Louviere JJ (2019) Testing and extending Schwartz Refined Value Theory using a best–worst scaling approach. Assess 26:166–180

Lönnqvist JE, Jasinskaja-Lahti I, Verkasalo M (2011) Personal values before and after migration: a longitudinal case study on value change in Ingrian-Finnish migrants. Soc Psychol Personal Sci 2:584–591

Louviere JJ, Flynn TN, Marley AJ (2015) Best-worst scaling: theory, methods and applications. Cambridge University Press.

Manfredo MJ, Teel TL, Dietsch AM (2016) Implications of human value shift and persistence for biodiversity conservation. Conserv Biol 30:287–296

Manfredo MJ, Bruskotter J, Teel TL, Fulton D, Schwartz SH, Arlinghaus R, Oishi S, Uskul AK, Redford K, Kitayama S, Sullivan L (2017b) Revisiting the challenge of intentional value shift: reply to Ives and Fischer. Conserv Biol 31:1486–1487

Manfredo MJ, Teel TL, Don Carlos AW, Sullivan L, Bright AD, Dietsch AM, Bruskotter J, Fulton D (2020) The changing sociocultural context of wildlife conservation. Conserv Biol 34:1549–1559. https://doi.org/10.1111/cobi.13493

Martin C, Czelar S (2017) Where do biospheric values come from? A connectedness to nature perspective. J Environ Psychol 52:56–68

Martin L, White MP, Hunt A, Richardson M, Pahl S, Burt J (2020) Nature contact, nature connectedness and associations with health, wellbeing and pro-environmental behaviors. J Environ Psychol 68:101389

Mayer FS, Frantz CM (2004) The connectedness to nature scale: a measure of individuals’ feeling in community with nature. J Environ Psychol 24:503–515

Mayer FS, Frantz CM, Bruhelman-Senecal E, Doliver K (2009) Why is nature beneficial? The role of connectedness to nature. Environ Behav 41:607–643

McCaul KD, Schroeder DM, Reid PA (1996) Breast cancer worry and screening: some prospective data. Health Psychol 15:430–433

Milfont TL, MIlojev P, Sibley CG (2016) Values stability and change in adulthood: a 3-year longitudinal study of rankorder stability and mean-level differences. Pers Soc Psychol Bull 42:572–588. https://doi.org/10.1177/0146749116639245

Mintz KK, Ayalon O, Nathan O, Eshet T (2021) See or be? Contact with nature and well-being during COVID-19 lockdown. J Environ Psychol 78:101714

Muthén LK, Muthén BO (2017) Mplus User’s Guide. Eighth Edition. Muthén & Muthén, Los Angeles. https://www.statmodel.com/download/usersguide/MplusUserGuideVer_8.pdf

Naveh-Kedem Y, Sverdlik N (2019) Changing prosocial values following an existential threat as a function of political orientation: understanding the effects of armed conflicts from a terror management perspective. Pers Individ Diff 150:109494

Nisbet EK, Zerlinski J, Murphy SA (2011) Happiness is in our nature: exploring nature relatedness as a contributor to subjective well-being. J Happiness Stud 12:303–322

Pinheiro J, Bates D (2021) Nlme: linear and nonlinear mixed effects models. R package

Pritchard A, Richardson M, Sheffied D, McEwan K (2020) The relationship between nature connectedness and eudaimonic well-being: a meta-analysis. J Happiness Stud 21:1145–1167

Rights JD, Sterba SK (2019) Quantifying explained variance in multilevel models: an integrative framework for defining R-squared measures. Psychol Methods 24:309–338

Sagiv L, Roccas S, Cieciuch J, Schwartz SH (2017) Personal values in human life. Nat Hum 1:630–639

Schultz PW (2000) The structure of environmental concern: connections for self, other people, and the biosphere. J Environ Psychol 21:327–339

Schultz PW, Shriver C, Tabanico JJ, Khazian AM (2004) Implicit connections with nature. J Environ Psychol 24:31–42

Schultz PW, Gouveia VV, Cameron LD, Tankha G, Schmuck P, Franek M (2005) Values and their relationship to environmental concern and conservation behavior. J Cross Cult Psychol 36:457–475

Schwartz SH (1992) Universal values in the content and structure of values: theoretical advances and empirical tests in 20 countries. Adv Exp Soc Psychol 25:1–65

Schwartz SH (2005) Human values. European Social Survey Education Net. URL: http://essedunet.nsd.uib.no/cms/topics/1/44.html

Schwartz SH, Cieciuch J, Vecchione M, Davidov E, Fischer R, Beierlein C, Ramos A, Verkasalo M, Lönnqvist JE, Demirutku K, Dirilen-Gumus O (2012) Refined the theory of basic individual values. J Pers Soc Psychol 103:663–688
Sneddon JN, Evers U, Lee JA (2020) Personal values and choice of charitable cause: an exploration of donors' giving behavior. Non-profit Volunt Sect Q 49:803–826. https://doi.org/10.1177/089974020908339

Sortheix FM, Parker PD, Lechner CM, Schwartz SH (2019) Changes in young Europeans' values during the global financial crisis. Soc Psychol Person Sci 10:15–25

Stern PC, Dietz T (1994) The value basis of environmental concern. J Soc Issues 50:65–84

The Nielsen Company (2009) Nielsen Global Omni Online Survey - Oct 2009–Oct 2007. Nielsen Global, New York. https://www.nielsen.com/wp-content/uploads/sites/3/2019/04/global-climate-change-survey.pdf, Accessed May 2020

Tienhaara KA (2010) A tale of two crises: what the global financial crisis means for the global environmental crisis. Environ Policy Gov 20:197–208

Tollefson J (2020) Five ways that Trump is undermining environmental protections under the cover of coronavirus. Nat. https://www.nature.com/articles/d41586-020-01261-4. Accessed May 2020

Vecchione M, Schwartz SH, Alessandri G, Döring AK, Castellani V, Caprara MG (2016) Stability and change of basic personal values in early adulthood: an 8-year longitudinal study. J Res Pers 63:111–122. https://doi.org/10.1016/j.jrp.2016.06.002

Verkasalo M, Goodwin R, Bezmenova I (2006) Values following a major terrorist incident: Finnish adolescent and student values before and after September 11, 2001. J Appl Soc Psychol 36:144–160

Vivid Economics (2021) Green Stimulus Index. An assessment of the orientation of COVID-19 stimulus in relation to climate action and biodiversity goals. https://www.vivideconomics.com/wp-content/uploads/2021/02/Greennes-of-Stimulus-Index-5th-Editon-FINAL-VERSION-09.02.21.pdf. Accessed 11 Jul 2021

Whitmarsh L (2011) Scepticism and uncertainty about climate change: Dimensions, determinants and change over time. Glob Environ Change 21:690–700

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