



Meta-analysing the association between social dominance orientation, authoritarianism, and attitudes on the environment and climate change

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ABSTRACT

Recent research highlights the importance of considering how values, ideologies and worldviews inform attitudes on the environment and climate change. Although social dominance orientation (SDO) and right-wing authoritarianism (RWA) have been linked to environmentalism, the nature and extent of these relationships is unclear. We meta-analyse correlations between SDO, RWA and six indices of environmentalism from 53 independent samples identified from database searches and contact with researchers in the field. We show that SDO and RWA have comparable associations with environmentalism, regardless of how this is measured. We re-analyse data from 16 independent samples using regression to assess the unique relationships, finding that both ideologies independently predict environmentalism. For SDO, we show that the effect size depends on the sample type, with a weaker association in student samples than in the general population. These results highlight the role of ideological attitudes as a barrier to belief and action on environmental issues.

1. Introduction

Many environmental problems are related (at least in part) to human behaviour, such as littering, pollution, and resource depletion. Motivating action on these problems might therefore depend at least in part on individuals holding positive attitudes towards protecting the environment. While there has been a longer track record of research on general environmental attitudes, more recent efforts have focused on attitudes towards climate change as one of the most important global environmental crises.

Given the pressing nature of climate change, and the rapid developments in research on climate-related belief and behaviour, the need arose to systematically review research on the psychological foundations (predictors) of environmentalism. Responding to this task, [Hornsey, Harris, Bain, and Fielding \(2016\)](#) meta-analysed twenty-seven correlates of climate change belief. Among the variables they identified as relating to belief in climate change, political ideology and party affiliation showed stronger associations than demographic variables, even surpassing the predictive ability of intuitively related variables, such as knowledge about climate change. Summarizing the link reported in 20 papers, they show that conservative party voters are more likely to deny climate change, and liberal political party voters are more likely to accept it.

Two increasingly important measures related to political ideology

were not included in those meta-analyses: Social Dominance Orientation (SDO) and Right-Wing Authoritarianism (RWA). SDO is the preference for social hierarchy and inequality ([Sidanius & Pratto, 1999](#)), with individual's relatively higher in SDO tending to support a social system where dominant groups are rewarded over 'inferior' groups. The authoritarian personality values the power of perceived authority over others, with RWA comprised of three interrelated attitudes: preference to submit to authority, to conform to traditional norms, and to punish those who deviate from these norms ([Altemeyer, 1998](#)).

In his dual-process model, [Duckitt \(2001\)](#) theorises how different experiences of being parented can lead individuals to adopt certain personality traits, which in turn shape the way they see the world, ultimately leading them to endorse hierarchical and/or authoritarian thinking. The pathway to SDO stems from unaffectionate parenting, which fosters a tough-minded personality, in turn leading the individual to see the world as a competitive place, where one has to fight for resources and social power. This competitive worldview leads to the endorsement of SDO, as individuals seek dominance and superiority. The road to RWA instead begins with punitive socialization, which reinforces social conformity (thus the resistance of social change), and the perception of the world as a dangerous place. Viewing the world as threatening and dangerous makes salient the motivational goal of social control and security, characterised by support for authoritarian and

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conservative ideological beliefs (i.e., RWA). Both ideologies affect the way the individual perceives social groups, fostering favourable attitudes towards groups of people like themselves and hostility towards those unlike themselves (e.g. Duckitt & Sibley, 2010; Duckitt, Wagner, du Plessis, & Birum, 2002).

Despite similarities in predicting aspects of intergroup relations, SDO and RWA are characterised by different personality profiles. Endorsement of RWA relates positively to conscientiousness, while endorsement of SDO relates negatively to agreeableness (Heaven & Bucci, 2001). They also map onto Schwartz's (1992) values differently, with high levels of endorsement of SDO relating to self enhancement dimensions (e.g. power, achievement), and low levels relating to self-transcendence (e.g. benevolence). High RWA, on the other hand, is aligned with security, tradition, and conformity (conservation), opposing the self-direction, stimulation, and hedonism on the other end of the spectrum (openness to change; Duckitt, 2001). In fact, SDO and RWA are typically only weakly or moderately related, if at all. There is substantial variation in the strength of the correlation (e.g. r 's of -0.03 to 0.66), which is stronger in more strongly ideologised countries (Roccatto & Ricolfi, 2005). For example, the association is stronger in New Zealand, where politics is arranged in a left-right continuum more so than in less strongly ideologised countries, such as the United States (Duckitt, 2001).

SDO and RWA are both conceptually and empirically linked to political affiliation and ideology (Jost, Glaser, Kruglanski, & Sulloway, 2003; Wilson & Sibley, 2013), while also relating to environmentalism (Häkkinen & Akrami, 2014; Milfont, Richter, Sibley, Wilson, & Fischer, 2013). Indeed, Jyhlä, Cantal, Akrami and Milfont (2016) demonstrated that SDO fully mediates the association between conservatism and climate change belief, indicating that the relationship between political orientation and environmentalism is perhaps best explained by individual's endorsement of hierarchy and dominance.

Bain (2015, personal communication) noted that, at the time of analysis for the Hornsey et al. (2016) meta-analysis, there were relatively few published studies focusing on these constructs as predictors of climate change belief. However, previous research demonstrates that both ideologies are related to a range of anti-environmental sentiments. For example, people who score higher in SDO and RWA tend to be less convinced that climate change is happening or that humans contribute to the problem (Jyhlä & Akrami, 2015; Jyhlä, Cantal, Akrami, & Milfont, 2016; Häkkinen & Akrami, 2014; Milfont et al., 2013, Study 4). Social Dominants show less concern about the environment, and are more accepting of the exploitation of natural resources (Milfont et al., 2013; Milfont & Duckitt, 2010). Both SDO and RWA are related to weaker support for Green political parties (Sibley & Wilson, 2007; Van Hiel, Cornelis, Roets, & De Clercq, 2007). Furthermore, people who endorse these ideologies tend not to believe there are benefits from acting pro-environmentally (Van Hiel & Kossowska, 2007), or that we should preserve nature (Milfont et al., 2013). Authoritarians are more likely to agree that acting on environmental issues will be costly for their country (Caddick, 2016; Peterson, Doty, & Winter 1993) and believe that environmentalists (and *not* polluters) are the problem (Peterson et al., 1993). Ultimately, Authoritarians and Social Dominants seek to deflect responsibility for taking action on global warming (Vail & Motyl, 2010).

While Hornsey et al. (2016) focussed solely on determinants of climate change belief, we take a broader approach. Knowledge or belief in climate change does not necessarily lead to action (Kempton, Boster, & Hartley, 1995; Kollmuss & Agyeman, 2002), therefore it is useful to cast a wider net to include associations with constructs tapping different aspects of environmentalism. There is a growing pool of literature that demonstrates the importance of considering SDO and RWA as ideological barriers to belief and action on environmental issues. However, when both SDO and RWA are included as predictors in regression analyses, RWA tends to yield a weaker association with all indices of environmentalism than SDO (e.g. Häkkinen & Akrami, 2014;

Milfont et al., 2013), perhaps indicating that hierarchical attitudes more strongly underpin environmental attitudes than Authoritarian beliefs. However, some research reveals that the ideologies exhibit correlations with environmentalism of comparable sizes (e.g., Devine-Wright, Price, & Leviston, 2015), with some even showing RWA to be the stronger correlate (e.g. Sibley & Wilson, 2007).

To explore these discrepancies in the literature, we meta-analyse the associations between environmentalism, broadly defined, and SDO and RWA to see how the ideological attitudes relate overall to environmentalism. In Study 1, we do this by including correlation coefficients from the existing literature on the topic. We then use a subset of these studies to meta-analyse regression coefficients in Study 2, examining the unique contribution each ideological attitude makes in predicting environment-relevant variables.

2. Study 1

We collect correlations between environmentalism and SDO and RWA to estimate the average association between these variables. Overall, we expect that both SDO and RWA will have significant, moderate associations with environment-relevant variables (H1). On the balance of findings from previous studies, we hypothesize that the mean correlation with environmentalism is stronger with SDO than RWA (H2). We also consider the effect of several potential moderating variables to help explain inconsistent findings, such as the scale used to measure ideology and the type of sample studies draw from.

Some research revealing a weak, or null association between RWA and environmentalism measures RWA using a subset of items or an alternative measure (e.g., Flouri, 2004; Milfont et al., 2013), and those that employ the full scale do demonstrate that the variables are related (i.e. Peterson et al., 1993). Similarly for SDO, Häkkinen and Akrami (2014) conducted two studies, showing firstly a moderate association between SDO and environmentalism using a full scale measure, but in the second study the association was weak; one difference being that they changed to a shortened version of the same scale. Research to date is yet to systematically explore how well these ideological variables, measured in various forms, predict environmentalism. We include scale type as a moderating variable, tentatively predicting that full scale measures of SDO and RWA might yield slightly stronger relationships than shortened scales or alternative measures (H3). Furthermore, because general population samples might be more highly ideologised than student samples (based on a stronger association between SDO and RWA in these samples; Roccatto & Ricolfi, 2005), we expect general population samples to exhibit stronger associations between ideological and environmental variables (H4).

Research on environmental variables is somewhat unsystematic, with researchers using a variety of instruments to measure environmental attitudes in what Stern (1992) called an "anarchy of measurement" (p. 279). After our main meta-analyses, we conduct a series of separate, smaller meta-analyses to examine the associations between SDO, RWA, and a host of different types of environmental measures. For these, we expect SDO to more strongly relate to climate change belief, support for action on climate change, pro-environmental attitudes, and climate change anxiety (e.g. Dimdins, Sandgren, & Montgomery, 2016; Häkkinen & Akrami, 2014), however we predict that RWA will be more strongly related to Green politics (Sibley & Wilson, 2007). Environmentalists can be perceived as both derogated and dangerous – belonging to a group of low status (thus disliked by high-SDOs; Cantal, Milfont, Wilson & Gouveia, 2015), and presenting a threat to the economy and current way of life (thus disliked by high-RWA's; Hoffarth & Hodson, 2016). We therefore expect mean correlations between SDO, RWA and environmentalist threat will be comparable, though the associations may exist for different reasons.

Table 1
Summary of studies included in the meta-analyses of zero-order correlations (Study 1).

Authors	Measures			Correlation		Sample details		
	Environment	SDO	RWA	SDO	RWA	N/Type	% female	Country
Amérigo, Palavencinos, García, Román & Trizano-Hermosilla (2017)	5	Full scale	–	-.23	–	262 S	60	Chile
Caddick (2016)	1	–	ACT	–	-.32	445 G	64	US
	3				-.33			
	Overall				-.32			
Choma, Hanoch, Gummerum, and Hodson (2013)	6	Full scale	Shortened	-.29	-.26	387 G	59	US
Currie and Choma (2017)*	S1: 5	Full scale	Shortened	-.20	-.23	200S	83	Canada
	S2: 5	Full scale	Shortened	-.24	.01	150 G	50	US
Devine-Wright et al. (2015)	1	Shortened	ACT	-.22	-.20	576 G	57	Australia
Dimdins et al. (2016)*	S1: 5	Full scale	Zakrisson	-.36	-.21	320 S	67	Sweden
	S2: 5	Full scale	Zakrisson	-.29	-.01	264 S	76	Latvia
Duckitt et al. (2010)	4	–	ACT	–	-.34	209 S	76	NZ
Häkkinen and Akrami (2014)	S1: 1	Full scale	Zakrisson	-.53	-.33	135 G	68	Sweden
	S2a: 1	Shortened	Zakrisson	-.35	-.20	53 G	60	Sweden
	S2b: 1	Shortened	Zakrisson	-.47	-.40	48 G	60	Sweden
Hoffarth and Hodson (2016)	1	Full scale	Zakrisson	-.35	-.40	384 G	46	US
	2			-.50	-.43			
	3			-.57	-.59			
	5			-.40	-.33			
	Overall			-.42	-.40			
Hoffarth & Hodson unpublished*	S1: 1	SDO7	Shortened	-.37	-.44	200 G	51	US
	S2: 1	SDO7	Shortened	-.42	-.45	304 G	48	US
	3			-.62	-.70			
	6			-.48	-.49			
	Overall			-.49	-.52			
Hoot, 2014 (thesis)*	5	Full scale	–	-.12	–	103 G	34	US
+Howison (2005)	4	Full scale	Full scale	-.24	-.22	116/128 G	59	NZ
Jackson, Bitacola, Janes, and Esses (2013)	5	Full scale	–	-.59	–	72 S	68	Canada
Jylhä and Akrami (2013) unpublished*	1	Full scale	Zakrisson	-.37	-.23	102 G	71	Sweden
	5			-.31	-.16			
	6			-.21	-.11			
	Overall			-.28	-.15			
Jylhä and Akrami (2015)	1	SOD7	–	-.37	–	221 G	66	Sweden
	5			-.30				
	Overall			-.34				
Jylhä and Akrami (2015) unpublished*	1	SDO7	–	-.53	–	222 G	68	Sweden
	5			-.44				
	6			-.31				
	Overall			-.43				
Jylhä et al. (2016)	1	SDO7	–	-.25	–	367 G	59	Brazil
Kemmelmeyer (2016)*	S1: 4	–	Shortened	–	.11	126 G	44	US
	S2: 4	–	Shortened	–	.25	90 G	51	US
	S3: 4	–	Shortened	–	.08	79 G	49	US
Leftcourt (1996)	5	–	Full scale	–	-.14	304 S	57	Canada
Leung, Koh, and Tam (2015)	S1: 2	Shortened	–	-.18	–	309 S	69	Singapore
	5			-.23				
	Overall			-.20				
	S2: 2	Full scale	–	-.29	–	99 S	75	Australia
	5			-.26				
	Overall			-.28				
S3: 2	Full scale	–	-.41	–	251 G	55	US	
5			-.46					
Overall			-.42					

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Table 1 (continued)

Authors	Measures			Correlation		Sample details		
	Environment	SDO	RWA	SDO	RWA	N/Type	% female	Country
McDermott (2007)	S1: 2	–	Shortened	–	.03	240 G	59	Argentina
	5				-.35			
	Overall				-.16			
	S2: 2	–	Shortened	–	-.20	105 G	100	UK
5				-.39				
Overall				-.30				
McFarland (unpublished)*	S1: 1	Full scale	Zakrisson	-.49	-.52	1767 G	41	Global
	3			-.56	-.54	1852 G		
	5			-.28	-.19	1276 G		
	Overall			-.46	-.44	1632 G		
	S2: 1	Shortened	Zakrisson	-.50	-.62	385 G	61	US
+ Milfont et al. (2013)	S3: 5	Shortened	Shortened	-.24	-.21	150 S	69	NZ
	S4: 1	Shortened	Shortened	-.36	-.38	3849 G	61	NZ
	4			-.36	-.36			
	5			-.42	-.36			
	Overall			-.37	-.36			
Peterson et al. (1993)	S2: 2	–	Full scale	–	-.06	278 S	67	US
	3				-.32			
	5				-.11			
	Overall				-.15			
S3: 3	–	Full scale	–	-.49	170 S	56	US	
Peterson, Smirles, and Wentworth (1997)*	2	–	Full scale	–	-.15	193 S	50	US
Richert, Boschetti, Walker, Price, and Grigg (2017)*	1	Shortened	Shortened	-.41	-.31	130 G	45	Australia
	5			-.43	-.15			
	Overall			-.42	-.23			
Sabbagh (2005)	2	Other	–	-.31	–	3331 S	44	Germany
Schultz and Stone (1994)	S1: 2	–	Shortened	–	-.51	80 G	40	US
	S2: 5	–	Full scale	–	-.54	87 S	46	US
Sibley and Wilson (2007)	S1: 4	Shortened	Shortened	-.25	-.32	259 S	76	NZ
	S2: 4	Full scale	Shortened	-.29	-.36	146 S	64	NZ
+ Sibley (2009–2015)	S1: 1	Shortened	Shortened	-.20	-.07	6301/6302 G	60	NZ
	2			-.22	-.07	6357		
	5			-.19	.01	6455		
	Overall			-.21	-.06	6371 G		
	S2: 1	Shortened	Shortened	-.33	-.27	10263/10260	63	NZ
	5			-.24	-.10	10343/10341		
	6			-.32	-.23	10226/10223		
Overall			-.28	-.17	10277/10274			
Stevenson, Peterson, Bondell, Moore, and Carrier (2014)	1	Other	–	-.23	–	378 S	55	US
	6			-.18				
	Overall			-.21				
Thibodeau (1998)	5	–	Full scale	–	.05	110 S	50	US
Vail and Motyl (2010)	2	Full scale	Full scale	-.37	-.29	231 S	57	Australia
	5			-.35	-.30			
	Overall			-.36	-.29			
Van Hiel and Kossowska (2007)	S1: 2	Other	–	-.47	–	176 G	39	Belgium
	5			-.32				
	Overall			-.37				
	S2: 2	Other	–	0.00	–	93 G	48	Poland
	5			-.15				
	Overall			-.10				
S3: 2	Other	–	–	-.27	–	93 G	38	Ukraine
	5			-.26				
	Overall			-.26				
Van Hiel et al. (2007)	4	–	Full scale	–	-.39	476 G	43	Belgium
Wang (1999)	S1: 5	Full scale	Full scale	-.38	-.36	97 S	100	US
	S2: 5			-.01	-.17	60 S	0	US

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Table 1 (continued)

Authors	Measures			Correlation		Sample details		
	Environment	SDO	RWA	SDO	RWA	N/Type	% female	Country
+Wilson (1998)	5	Full scale	–	-.21	–	245 S	70	NZ
+Wilson and Evers (2004)	4	Full scale	Full scale	-.31	-.38	161/205 S	71	NZ
+Wilson (2005a)	4	Shortened	Shortened	-.22	-.28	465 S	70	NZ
+Wilson (2013)	S1: 1	Shortened	Full scale	-.10	-.14	185/175	71	NZ
	2			-.04	-.03	273/256		
	4			-.12	-.16	274/256		
	5			-.26	-.23	188/177		
	Overall			-.12	-.14	230/216 S		
	S2:1	Shortened	Full scale	-.17	-.25	135/124	75	NZ
	2			.04	.02	263/236		
	4			-.09	-.22	263/236		
	5			-.32	-.39	139/127		
	Overall			-.15	-.22	200/181 S		
	S3:1	Shortened	Full scale	-.18	-.27	223	63	NZ
	2			.07	-.01	227		
	4			-.01	-.13	227		
	5			-.38	-.33	225		
Overall	-.14			-.21	226 S			
+Wilson (2014)	S1: 1	Full scale	Full scale	-.25	-.23	354	78	NZ
	2			-.02	-.11	361		
	4			-.16	-.17	352		
	5			-.30	-.43	357		
	Overall			-.19	-.23	356 S		
	S2: 1	Full scale	Full scale	-.09	-.13	280	67	NZ
	2			-.04	-.05	289		
	4			-.11	-.24	290		
	5			-.28	-.35	280		
	Overall			-.12	-.18	285 S		
+Wilson (2016)	1	Full scale	Full scale	-.17	-.19	621/622 S	67	NZ
+Wilson (2017)	5	SDO7	Full scale	-.36	-.44	560/555 S	73	NZ
+Wilson (2005b)	4	Full scale	Full scale	-.31	-.39	177/178	61	NZ
	5			-.11	-.20	178/179		
	Overall			-.26	-.34	178/179 G		
+Wilson (2005c)	4	Full scale	Full scale	-.23	-.38	208/207 G	66	NZ
+Wilson (2005d)	4	Full scale	Full scale	-.26	-.20	207	60	NZ
	5			-.31	-.09	201		
	Overall			-.27	-.17	204 G		

Note. Where studies are marked with a *, this indicates that we contacted the author(s) to obtain additional information to include findings from their study in our meta-analyses in Study 1A. A + indicates that the raw datasets were available for inclusion in our meta-analyses in Study 1B. The measures of environmentalism included are coded such that 1 = climate change belief, 2 = support for action, 3 = environmentalist threat, 4 = Green politics, 5 = pro-environmental attitudes, 6 = climate change anxiety. The G after sample size indicates that the study used a general population sample, and the S a student sample. References for the studies included in the meta-analyses are in the Supplementary Material. US = United States, UK = United Kingdom, NZ = New Zealand. Where there are two sample sizes separated by a forward slash, this indicates that the sample size differed for each correlate, so the sample size is presented for SDO first then RWA (i.e. N_{SDO}/N_{RWA}).

2.1. Method

2.1.1. Data collection

We were interested in including any study that quantitatively measured either SDO or RWA, and at least one measure of environmentalism. Sources were predominantly drawn from databases of published literature (e.g. PsycInfo, Scopus, and Web of Science) and theses (ProQuest dissertations and theses global). We also consulted the reference lists of papers we include, as well as studies citing these papers, for additional records. Finally, we emailed researchers who have published or conducted theses in the area for unpublished research, to ameliorate publication bias influencing our results. In those cases where the same data were reported in more than one publication, we excluded the duplicate results so that information from the same sample was used only once. A full list and summary of the studies included in the meta-analyses is available in Table 1.

For further information about data collection for this study, the PRISMA summary in the Supplementary Materials also details how the final sample of 46 studies (in total) were identified, with correlations between environmentalism and SDO and RWA from 53 independent samples each. Each meta-analysis contained a similar total number of participants ($N_{SDO} = 33,411$, $N_{RWA} = 33,528$), and a similar average number of participants per study (SDO: $M = 642.52$, $SD = 1690.51$, RWA: $M = 632.60$, $SD = 1675.84$).

We also excluded studies where proxy or alternative measures of RWA were employed. This is because during moderation analyses, we found that a significant portion of the variance in the RWA-environmentalism association was attributable to scale type ($Q(4) = 26.23$, $p < .001$), with comparable associations between full and shortened measures of the RWA scale, as well as the Zakrisson measure and the ACT scale, however, our ‘other’ category, which included alternative measures of authoritarianism such as cultural or social

conservatism (as in Ray & Wilson, 1976; Van Hiel & Kossowska, 2007), preference for authoritarian child-rearing practices, and support for authority (e.g. Flouri, 2004), overall demonstrated no relation with environmentalism. Including correlations with RWA that are lower than usual could be misleading, therefore we excluded studies that used these types of measures, as they may not be tapping the same construct, and their results varied widely (a list of the excluded studies is available in the Supplementary Materials).

To maintain independence of effect sizes, we firstly computed an overall estimate by including the average of all relevant correlations for each sample, and use this model to test our proposed moderating variables. Where the sample size varied within the same study, we took the average N for the overall estimate. We then follow Cooper's (1998) recommendations, averaging across outcome types and including these in separate meta-analyses for six categories of environmental variables: belief in climate change, support for action, environmentalist threat, green politics, pro-environmental attitudes, and climate change anxiety (refer to Supplementary Materials for descriptions of these category definitions). We excluded some variables (e.g. support for nuclear power plants or fracking, endorsing environmental reasons for going vegetarian) as these were less direct tests of environmental attitudes, and were judged to not fit the main themes we created for categorizing the variables.

After initial coding and construction of the coding scheme for sorting the environmental variables by the first author, the second author independently coded the variables included in each study to fit the established coding scheme, with a good level of agreement between authors (88.2% agreement; $\kappa = 0.85$ (95% CI [0.79, 0.91]), $p < .001$, Landis & Koch, 1977). We discussed disagreements, and the code both authors agreed upon was used to separate the variables into the correct meta-analyses. Before combining correlations, all variables were converted to a pro-environmental direction. For example, associations with climate change belief were left unchanged, but associations with climate change denial were reversed.

2.1.2. Statistical analysis

We used Comprehensive Meta-Analysis software (CMA; version 2.2.064; Borenstein, Hedges, Higgins, & Rothstein, 2009) to conduct our meta-analyses, based on random-effects models. Briefly, our first meta-analyses included averages of the correlations between environmental variables and SDO, and separately RWA, and also included our tests of potential moderating variables. Supplementary Tables S1 and S2 contain forest plots showing the effect sizes included in these analyses. In the second set of meta-analyses, we entered the associations between SDO and RWA (separately), and the six categories of environmental variables into twelve smaller meta-analyses.

We judged that publication bias was not an issue in our main meta-analysis for SDO, based on visual examination of the funnel plots, and examination of bias indices, which all pointed towards an unbiased sample (Egger's regression: $t(51) = 0.36$, $p = .359$, Cooper's fail-safe N: 26,016; Trim and fill analyses did not impute any studies, Duval & Tweedie, 2000). The meta-analysis for RWA similarly appeared

unbiased according to examination of the funnel plot and the indicators (fail-safe N: 17,460; Trim and fill analyses leave the values unchanged), except in the case of the Egger's regression test (Egger's regression: $t(51) = 1.87$, $p = .034$), however Begg's test was not significant ($p = .128$). As a further test, moderation analyses testing whether the publication status (published versus unpublished) influenced the strength of the correlation was non-significant ($Q(1) = 0.56$, $p = .455$).

We observed significant heterogeneity for both SDO ($Q(52) = 311.75$, $p < .001$; $I^2 = 83.32$) and RWA ($Q(52) = 759.75$, $p < .001$; $I^2 = 93.16$), similar to that reported in Hornsey et al.'s (2016) meta-analyses. We conduct moderation analyses in order to explore whether the types of sample and scales used in individual studies could account for some of this variation. We entered sample type (general versus student population) and scale type (SDO: full, shortened SDO scales (Pratto, Sidanius, Stallworth, & Malle, 1994), SDO₇ (Ho et al., 2012), other; RWA: full, shortened RWA scale (Altemeyer, 1998), Zakrisson (2005) scale, ACT (Duckitt, Bizumic, Krauss, & Heled, 2010) as categorical moderators using random-effects models in CMA.

2.2. Results and discussion

We identified a total of 33 studies using 53 independent samples to include in our main meta-analysis on SDO and environmentalism, and 32 studies using 53 independent samples for the meta-analysis on RWA and environmentalism. Here we discuss the results of our meta-analyses: firstly with the average of all environmental variables included for each ideological correlate, and then with environmentalism separated into climate change belief, support for action, environmentalist threat, Green politics, pro-environmental attitudes, and climate change anxiety.

Our overall meta-analyses of the associations between environmentalism and SDO, and separately RWA, were conducted using the average correlation of this relationship for each unique sample. As predicted in H1, both mean correlations were significant, with SDO ($r = -0.294$, 95% CI [-0.322, -0.266], $p < .001$) and RWA ($r = -0.261$, 95% CI [-0.304, -0.217], $p < .001$) each relating negatively to pro-environmentalism. As shown in Table 2 and Fig. 1, the confidence intervals for these estimates overlap, thus SDO was not a statistically stronger correlate than RWA, contrary to our second hypothesis. Instead, it suggests that SDO and RWA are comparable correlates of environment-relevant variables.

Contrary to our expectation from H3, the associations were not sensitive to variation in measurement of ideological attitudes, yielding equivalent associations when full, shortened, or alternative (but validated) scales were employed (SDO: $Q(3) = 6.470$, $p = .091$; RWA: $Q(3) = 2.19$, $p = .533$). This is important, as it is sometimes necessary to include only a subset of items to measure a construct to avoid participant fatigue in large scale surveys. Instead, we show that the choice of measure is unlikely to affect results. Care should be taken, however, in using proxies for authoritarianism (such as social conservatism or preference for authoritarian child-rearing) as initial analyses including

Table 2

Results of the meta-analyses of the correlation between SDO, RWA, and six environment-relevant variables.

Measure of environmentalism	Social dominance orientation				Right-wing authoritarianism			
	k	Mean r [95% CI]	Q	I ²	k	Mean r [95% CI]	Q	I ²
Overall	53	-.29 [-.32, -.27]	311.75	83.32	53	-.26 [-.30, -.22]	759.75	93.16
Belief in climate change	24	-.32 [-.37, -.27]	301.18	92.36	21	-.31 [-.38, -.24]	602.84	96.68
Support for action	15	-.21 [-.28, -.14]	173.35	91.92	13	-.14 [-.22, -.06]	93.40	87.15
Environmentalist threat	3	-.57 [-.60, -.55]	1.93	0	6	-.51 [-.61, -.39]	71.07	92.97
Green politics	14	-.21 [-.28, -.14]	83.34	84.40	19	-.24 [-.30, -.17]	115.63	84.43
Pro-enviro attitudes	35	-.30 [-.33, -.26]	248.27	86.31	29	-.24 [-.30, -.17]	586.50	95.23
Climate change anxiety	6	-.31 [-.38, -.23]	21.46	76.70	4	-.33 [-.47, -.17]	27.26	92.66

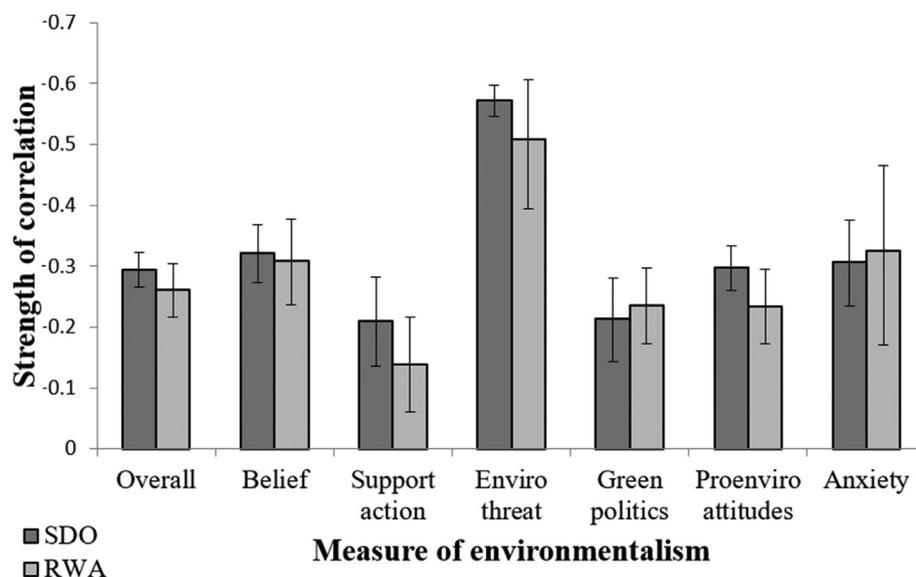


Fig. 1. Mean correlation between ideological variables and environmental variables.

such proxies found that alternative measures of authoritarianism overall were unrelated to environmentalism, and showed a large amount of variability (and were therefore excluded from analyses reported here).

Providing support for H4, population type was a significant moderator of the relationship between SDO and environmentalism ($Q(1) = 9.86, p = .002$), with a stronger association in general population samples ($r = -0.335, 95\% \text{ CI } [-0.374, -0.294]$) as compared to student samples ($r = -0.247, 95\% \text{ CI } [-0.284, -0.210]$). We elaborate on this finding in the general discussion. For RWA, there was no effect of population type ($Q(1) = 0.16, p = .689$; general population $r = -0.268, 95\% \text{ CI } [-0.331, -0.202]$; student $r = -0.251, 95\% \text{ CI } [-0.301, -0.200]$).

In our next set of meta-analyses, also reported in Table 2 and Fig. 1, we show that SDO and RWA are negatively related to all six aspects of environmentalism, consistently demonstrating that the more that people endorse socially dominant or right-wing authoritarian attitudes, the less likely they are to endorse climate change, support action on climate change, support or vote for Green political parties, or report pro-environmental attitudes. Instead, they are consistently more likely to feel threatened by the environmental movement, and are less anxious about the threat of climate change itself.

In all cases, the confidence intervals for the mean correlations between SDO and environmentalism and RWA and environmentalism overlap. Therefore, for each of the six types of environmental variables, SDO and RWA show comparable correlations. The mean associations with environmentalist threat and both SDO and RWA are stronger than for any other category of environmentalism. This might indicate that the aspect of environmentalism that Social Dominants and Authoritarians most strongly oppose is environmentalists themselves, instead feeling that action on climate change is a burden. This is perhaps because environmentalists can be perceived as both deviant and derogatable, therefore attracting negative attention from both high-SDO's and high-RWA's (Cantal et al., 2015).

Although the association with environmentalism overall was weaker, our meta-analyses yielded mean correlations with climate change belief ($r_{\text{SDO}} = -0.32; r_{\text{RWA}} = -0.31$) that were comparable to those reported by Hornsey et al. (2016) on the associations between climate change denial and political affiliation ($r = 0.30$), objective knowledge on climate change ($r = 0.25$), and both public ($r = 0.25$) and private ($r = 0.32$) pro-environmental intentions. Our findings therefore establish SDO and RWA as consistently important correlates of environmentalism.

However, these results cannot tease apart exactly how much of the relationship between each ideological variable and environmentalism is unique, and how much is attributable to the shared association between SDO and RWA (see, for example, Roccato & Ricolfi, 2005). To do this, in Study 2 we meta-analyse regression of measures of environmentalism onto both SDO and RWA to examine the independent contributions of SDO and RWA.

3. Study 2

3.1. Introduction

The literature to date, and our meta-analyses presented in Study 1, demonstrate that both SDO and RWA are important ideological correlates of environmentalism. However, our first set of meta-analyses fail to establish the *unique* association between the ideological attitudes and environmentalism. This is because they rely on Pearson's correlation coefficients, which describe a relationship between variables without controlling for the effects of any other variables.

One reason why we expected SDO to more strongly relate to environmentalism than RWA was based on findings from studies employing regression analyses. These show that when controlling for the effects of SDO, the association between RWA and environmentalism becomes weaker or disappears (Häkkinen & Akrami, 2014; Milfont et al., 2013), therefore suggesting that the relationship between RWA and environmentalism may be driven in part by RWA's shared association with SDO (Duckitt, 2001). In Study 2, we test this by calculating the standardized regression coefficients for SDO and RWA as they simultaneously predict environmentalism, and meta-analyse these results.

Following the same rationale as in Study 1, we expect that both SDO and RWA will explain unique variance in environmentalism, however the association with SDO (while controlling for RWA) will be stronger than the relationship between RWA (controlling for SDO; H1). We also test for the potential moderating effect of population type, as this was a significant moderator in Study 1, expecting to replicate the finding that SDO is more strongly related to environmentalism in general population samples than in student samples. We also meta-analyse the association between SDO, RWA, and four separate indices of environmentalism assessed in these data sets: Climate change belief, support for action, Green politics, and pro-environmental attitudes. For these smaller meta-analyses, we expect to find a similar pattern of results as in Study 1: SDO will be a stronger predictor of climate change

belief, support for action, and pro-environmental attitudes, and RWA a stronger predictor of Green politics (H5).

3.2. Method

3.2.1. Sample of studies

We needed to conduct additional analyses in order to calculate the effect sizes used in our meta-analyses in Study 2. This meant that we could only include the studies from Study 1 that we had access to the raw data. This includes 16 independent samples (fourteen from the second author's personal collection, as well as two from a colleague), totalling data from 23,856 participants. In these samples, only four indices of environmentalism were measured (climate change belief, support for action, Green politics, and pro-environmental action). Full details of these samples are available in the Supplementary Materials (Table S3).

3.2.2. Overview of analyses

Because we are interested in the unique associations that SDO and RWA have with environmentalism, we decided to use standardized regression coefficients as our effect size measure in these meta-analyses, as standardized estimates are comparable across studies. We ran each regression in SPSS with SDO and RWA as the *only* predictor variables, and ran analyses for each environmental variable included in the data sets. We then repeated the analyses from Study 1 using the regression coefficients as the measure of effect size in the meta-analyses (using the formula $t = \beta/SE_{\beta}$ to compute the standard error associated with this estimate from the t -statistic; Kim, 2011).

We again use random-effects models, which is supported by significant heterogeneity in both main meta-analyses (SDO: $Q(15) = 46.83, p < .001, I^2 = 67.97$; RWA: $Q(15) = 162.37, p < .001, I^2 = 90.76$). We attempt to explain some of this variability through inclusion of sample type as a potential moderating variable.

3.3. Results and discussion

In our first set of meta-analyses, we entered an averaged beta weight from each study on the relationship between SDO and environmentalism (while controlling for RWA), and between RWA and environmentalism (while controlling for SDO). As shown in Fig. 2 and Table 3, both SDO and RWA are significant independent predictors of environmentalism. Surprisingly, while we believed SDO would have a stronger unique relationship with environmentalism, both predictors instead showed comparable associations (SDO: $\beta = -.168, 95\% \text{ CI } [-0.203, -0.132], p < .001$; RWA: $\beta = -0.193, 95\% \text{ CI } [-0.252, -0.135], p < .001$).

Further analyses reveal that sample type again moderated the SDO-environmentalism link. Specifically, SDO more strongly relates to environmentalism in general population samples than student populations ($Q(1) = 18.09, p < .001$), while it appears from Fig. 2 that for RWA, the pattern is reversed, though not significant ($Q(1) = 1.87, p = .17$). Hierarchical and anti-egalitarian attitudes therefore appear to be more foundational for environmental attitudes in the general population than they do for students.

Fig. 3 reveals that RWA has a stronger unique relationship with opposition to Green politics than SDO. Therefore, RWA more strongly underlies rejection of Green political parties and policies than the preference for inequality. This makes sense, as Authoritarians support existing legitimate authorities, and Green parties represent a substantial threat to tradition and established social and political authority. However, for the other environment-relevant measures included in these analyses, SDO and RWA have roughly equivalent relationships.

Both SDO and RWA are significant predictors of all aspects of environmentalism, except when this is indexed as support for action: where RWA is a significant predictor, and SDO is not. As well as having the fewest studies including measures of support for action, this

category of environmentalism was only included in student samples, which again could explain why findings diverge from the correlations in Study 1 (where SDO and RWA are significant correlates, and these findings come from a mix of general population and student samples).

4. General discussion

We use a meta-analytic approach to demonstrate that both SDO and RWA are important correlates of a range of environment-relevant variables, both together and independently. This reinforces the idea that information about climate change is selectively sought after, remembered, and used in ways that are consistent with people's ideological stances (Hornsey et al., 2016). For those endorsing authoritarian, hierarchical or dominance-based attitudes, this is more likely to mean rejecting climate change and opposing action on environmental issues, thus representing a more significant barrier to motivating action on climate change than simply a lack of knowledge.

The analyses reported in Study 1 show that SDO and RWA are related as strongly as political affiliation and orientation, which were highlighted as the strongest demographic correlates of climate change denial. We also show that these ideologies relate to a greater range of aspects of environmentalism than just belief in climate change. To disentangle the effects of SDO, RWA, and political orientation, we took the analyses reported in Study 2 one step further to include political orientation in a second step of the regression. These additional analyses, reported in Supplementary Table S4, show that in many cases, political ideology is not a significant predictor, does not explain a significant portion of additional variance over and above SDO/RWA, and when it does, it does little to diminish the stronger associations SDO and RWA have with the environmental variables. These results ultimately reinforce the idea that SDO and RWA remain important correlates of environmentalism when controlling for the effects of political orientation. Indeed, it appears that each variable is uniquely associated with attitudes on the environment and climate change.

Importantly, in both Study 1 and 2 we show that SDO is more strongly related to environmentalism in general population samples, with the association significantly weaker when measured among student samples. This finding helps explain why longitudinally, SDO is unrelated to increased climate change denial over time in a student population (Stanley, Wilson, & Milfont, 2017), despite research indicating that SDO is a stronger cross-sectional predictor than RWA (Häkkinen & Akrami, 2014; Milfont et al., 2013). Research that attempts to generalise findings on the SDO-environmentalism link that draw from student populations may therefore underestimate the true size of the relationship in the general population. However, across both samples, the overall association is similar and in the same direction, consistently indicating that regardless of how the association is measured, or the type of sample used, those who endorse hierarchical and anti-egalitarian attitudes tend to be less pro-environmental.

There are two possible reasons for this apparent moderating effect. The first is that sample type is a substantive moderator, meaning that the differences in the strengths of the associations are due to real differences that exist between general population and student samples. An explanation for this could be that general population samples are more ideologised than student samples. Across cultures, the association between SDO and RWA is stronger in more ideologised countries (Duckitt, 2001; Roccato & Ricolfi, 2005). Interestingly, Roccato and Ricolfi (2005) found that this relationship is also stronger among adults than in student samples, which can perhaps similarly be interpreted as a difference in how ideologised the samples are. If adult samples are more heavily ideologised, then this may imply that they rely on their political beliefs and ideological stances to inform their opinions on environmental issues and climate change to a greater extent. Students, on the other hand, might base their attitudes less strongly on ideology. Environmental issues may be more salient to students by virtue of the fact that they are exposed to questions about the environment in multiple

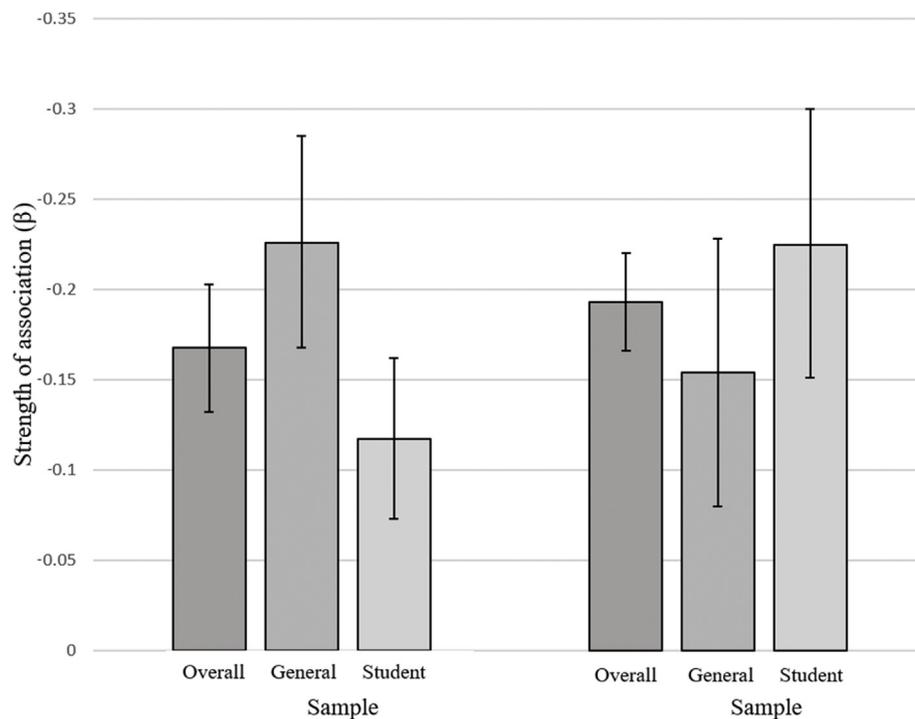


Fig. 2. Meta-analysed regression coefficients on the associations between SDO, RWA, and environmentalism using different sample types.

modalities (e.g. secondary/tertiary education), and these sources of information might shape their environmental attitudes.

While these and other theoretical explanations may account for this finding, we also acknowledge that restriction of range might contribute to this effect, where students are relatively lower in SDO than general population samples (e.g. Stanley et al., 2017). An anonymous reviewer pointed out that we could potentially test for this by correcting each effect size for restriction in range prior to running the moderation analyses, a method that is detailed in Hunter and Schmidt (2004). This requires examination of the standard deviations of SDO from each sample, however several studies we included did not report standard deviations, and those that did report them did so using different scales (e.g. 5-, 6-, or 7-point scales). This meant that the information we required to do these corrections was not available for every study included in the meta-analysis.

We consulted Frank Schmidt (2018, personal communication), who confirmed that based on the amount of missing data, we were limited to using the artefact distribution method to correct for issues associated with range restriction. This method only corrects the meta-analytic correlation (i.e. the overall relationship between SDO and environmentalism from the meta-analysis), and therefore cannot test whether a moderating effect of sample type remains once restriction of range is corrected. Without being able to disentangle whether the difference in the association is due to substantive or artefactual differences between student and general population samples, this limits the conclusions we are able to make about this moderating effect.

Table 3

Results of the meta-analyses of regression coefficients between SDO, RWA, and four environment-relevant variables.

Measure of environmentalism	k	Social dominance orientation		Right-wing authoritarianism	
		Overall effect size [95% CI]	Variability	Overall effect size [95% CI]	Variability
Overall	16	-0.17, $p < .001$ [-0.20, -0.13]	$Q(15) = 46.83$ $I^2 = 67.97$	-0.19, $p < .001$ [-0.25, -0.14]	$Q(15) = 162.37$ $I^2 = 90.76$
Climate change belief	9	-0.18, $p < .001$ [-0.23, -0.13]	$Q(8) = 52.93$ $I^2 = 84.89$	-0.17, $p < .001$ [-0.26, -0.11]	$Q(8) = 171.10$ $I^2 = 95.32$
Support for action	6	-0.03, $p = .71$ [-0.16, .11]	$Q(5) = 49.27$ $I^2 = 89.85$	-0.03, $p = .008$ [-0.05, -0.01]	$Q(5) = 3.24$ $I^2 = 0.00$
Green politics	12	-0.11, $p = .003$ [-0.18, -0.04]	$Q(11) = 53.16$ $I^2 = 79.31$	-0.23, $p < .001$ [-0.27, -0.19]	$Q(11) = 14.96$ $I^2 = 26.49$
Pro-environmental attitudes	11	-0.20, $p < .001$ [-0.24, -0.16]	$Q(10) = 26.75$ $I^2 = 62.61$	-0.18, $p < .001$ [-0.26, -0.10]	$Q(10) = 164.89$ $I^2 = 93.94$

One take home message from our smaller meta-analyses is that SDO and RWA are consistently related to the multiple dimensions of environmentalism. In every case, the direction of the association is the same: the more that people endorse hierarchical or authoritarian attitudes, the less they hold pro-environmental attitudes. From a measurement perspective, this finding indicates that while utilizing multiple measures of environmentalism might demonstrate subtle differences in the strength of the relationship, they all show roughly equivalent (and indeed, at least not significantly different) associations with SDO and RWA.

Consistent with research showing evidence for generalized prejudice (prejudiced attitudes towards one out-group tend to extend to other out-groups: Duckitt, 2001), the anti-environmentalism associated with SDO and RWA is similarly generalizable across multiple aspects of environmentalism. Through extending studies on the link between ideology and prejudice into the environmental domain, it appears that the anti-environmentalism associated with SDO and RWA is similarly generalizable to multiple aspects of environmentalism. While SDO and RWA explain up to half of the variance in prejudice (Altemeyer, 1998; McFarland & Adelson, 1996), they are certainly less strongly related to environmentalism, while still making an important contribution, both together and independently. This in itself is surprising, given that the two ideological variables were created to explain intergroup attitudes (Adorno, Frenkel-Brunswik, Levinson, & Sanford, 1950; Altemeyer, 1998; Sidanius & Pratto, 1999).

Our findings on the relationship between ideology (indexed by

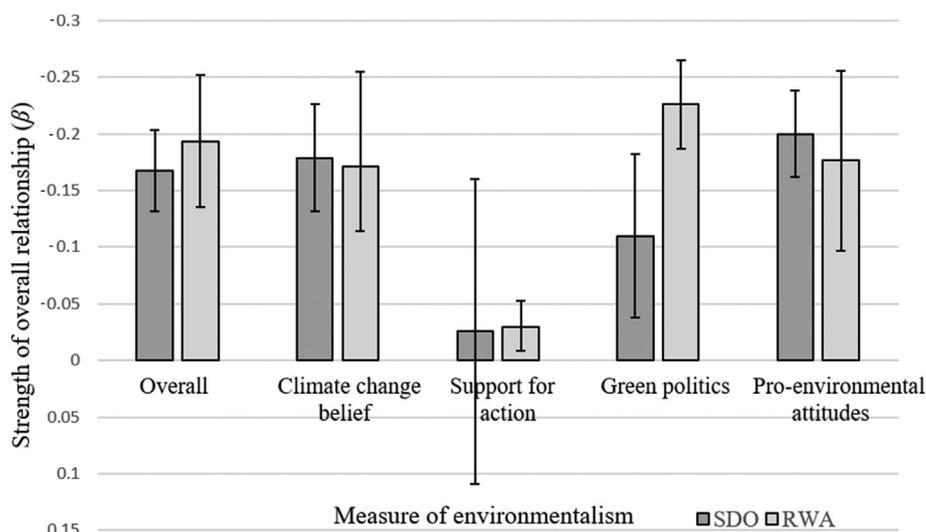


Fig. 3. Meta-analysed regression coefficients on the associations between SDO, RWA, and several indices of environmentalism.

endorsement of SDO and RWA) and environmentalism are similar in strength to those described by Hornsey et al. (2016) on the association between one's political loyalties and their belief in climate change. One interesting next step in this research is to tease apart the independent contributions SDO, RWA, and political orientation have with environmentalism. In eight of the datasets used in Study 2, political ideology (indexed by self-identification from very liberal to very conservative) was also measured. When included in a regression model, political ideology does not often explain a significant amount of additional variance over and above that explained by SDO and RWA, and weakens their associations with pro-environmental attitudes only slightly (see Table S4).

Taken together, our findings highlight the importance of considering ideological attitudes in relation to environmental attitudes, as both SDO and RWA are consistent correlates, comparable in strength to the key determinants of climate change belief highlighted in Hornsey et al.'s (2016) study. Indeed, high-SDO's endorse environmental exploitation when the dominant group is assured a disproportionate amount of natural resources, working to strengthen the social hierarchy (Milfont & Sibley, 2014). Messages need to be careful in how they portray the issue and solutions, such as avoiding framing action on climate change as threatening to the social hierarchy, as this might make Social Dominants especially unlikely to act (Häkkinen & Akrami, 2014). Authoritarians may also need tailored communication strategies, although it is as yet unclear why they endorse anti-environmental attitudes – likely a combination of authoritarian aggression and traditionalism (e.g., Reese, 2012; Schultz & Stone, 1994). Further research will clarify the reasons individuals who endorse SDO and RWA are less pro-environmental, in order to develop targeted messages to motivate them to act.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jenvp.2018.12.002>.

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