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Anticipating environmental losses: Effects on place attachment and intentions to move

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ABSTRACT

Environmental change is often accompanied by non-tangible, non-economic losses, including loss of valued attributes, connection to place, and social cohesion through migration in the face of such changes. Over two studies we sought to test whether imagining the loss of valued environmental characteristics influences intentions to migrate elsewhere and/or engage in place-protective actions, and whether this can be accounted for by changes to place attachment, using the city of Perth, Western Australia as a case study. In Study 1 ($N = 148$) we found imagined environmental loss significantly increased intentions to move away, and significantly decreased place attachment. There was no influence of imagining loss on place-protective action intentions. We replicated these findings in a representative community sample (Study 2: $N = 333$). In addition, we found that changes to moving intentions and place attachment related to the *type* of valued characteristic imagined loss, with characteristics that went beyond the explicitly environmental to encompass social relationships and lifestyle dimensions related to a tendency to stay, and lower reductions to place attachment. The implications of these findings include the inseparability of responses to environmental changes and perceptions of socio-cultural loss.

1. Introduction

Environmental changes, including climate change and altered biodiversity patterns, are increasingly perceived as losses in private or collective domains, and in local and regional contexts. They generate conditions that limit adaptation and mitigation, and cannot be insured against (Dow et al., 2013; Wrathall et al., 2015). The exploration of losses and damages (Mechler et al., 2020) due to climate change has become an arena for science and policy with an initial focus on economic and tangible values (McNamara and Jackson, 2019). However, losses extend to environmental features which are recognized and valued by communities, and contribute to people's attachment to place, thereby embracing non-economic values.

McNamara et al. (2021) consider categories of non-economic loss and damage to include those related to "human mobility and territory, cultural heritage and Indigenous knowledge, life and health, biodiversity and ecosystem services, and sense of place and social cohesion" (p1). These categories are inter-connected and are (often at the same time) the processes that lead to, and are the consequences of, the loss and damage,

and the features and values that are lost and damaged. For example, human mobility can be a process of loss as dislocation and alienation from territory, a consequence of losses of place-based values, and itself something that is lost when people leave the community.

In the current study, we explore the degree to which valued environmental characteristics influence the decisions people make about whether to stay or go when faced with losing them, and whether the influence of this environmental loss on migration decisions can be understood by changes to place attachment. In so doing, we position the different categories of potential loss associated with environmental change as follows: valued biodiversity and ecosystem services as the environmental feature that is lost, mobility as a consequence of this loss, and place attachment as the mediator between the lost features and the consequence.

Place attachment may be defined as the bond between individuals or groups with their environment, and is comprised of identity, dependency, and emotion (or 'affect' (Masterson et al., 2017)). It is an acknowledged constraining force in decisions to move elsewhere (e.g., (Adams, 2016)). Environmental change has the potential to diminish the

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real and perceived benefits of a given place and may fundamentally alter the characteristics of what makes a place unique, undermining the foundations of place attachment. At a certain point, these losses may become severe enough to prompt a decision to leave (Dandy et al., 2019).

The extent to which attachment to place is grounded in its environmental characteristics, unique or otherwise, is not fully understood. If environmental characteristics are integral to place attachment, then loss of these may prompt a decision to migrate, not only due to a decline in services that ecosystems provide, but via reductions in attachment to place.

Environmental loss might also influence decisions on the destination to which one migrates: if decline undermines place attachment, then one may seek out geographies that replicate what has been lost (Dandy et al., 2019). It is recognized that there are multiple interacting factors in people's migration decisions, including economic and social decisions (Black et al., 2011; Hugo, 2011). But there is a lack of detailed empirical work on the interacting role of environmental losses with these other factors in shaping migration decisions, including choices about where to locate to (Dandy et al., 2019).

Empirical studies exploring the nexus between place attachment, environmental change, and migration decisions have often been opportunistic, occurring after a major environmental loss event (e.g., (Zheng et al., 2019)), or have targeted areas vulnerable to acute environmental change such as bushfires or other natural disasters (e.g., (Anton and Lawrence, 2014; Bonaiuto et al., 2016)). This limits both what and who is studied, and overlooks the influence of more 'everyday' changes (Tschakert et al., 2017). Put another way, the impacts of the more gradual pervasive environmental decline that is likely to be the experience of most people as part of a changing and unpredictable climate, warrants close attention.

Other approaches relevant to understanding place attachment have studied regions experiencing long-term/chronic environmental degradation, such as geographies impacted by mining operations or drought (e.g., the Hunter Valley in Australia (Higginbotham et al., 2010)). A focus of this approach compares perceptions of how things are now with the 'way things used to be' (typified by Albrecht's concept of 'solastalgia' (Albrecht, 2006)). But anticipated future environmental loss may also be important, both in terms of wellbeing outcomes (Moratis, 2021), and in pre-emptive migration decisions.

An alternative behavioural response to migration in the face of anticipated environmental loss may be intentions to engage in 'place-protective' actions; behaviours designed to prevent changes that disrupt or threaten 'place' (Devine-Wright, 2009), or preparedness to respond to them when they arise. Voluntary actions on behalf of a place or community are thought to arise from an emotional bond to a place and its people (Manzo and Perkins, 2006), however the way in which place-protective actions relate to migration decisions (e.g., a 'stay and fight' versus 'flight' response) is unclear.

Importantly, action tendencies, including decisions to migrate, or to engage in place-protective actions, are dependant on specific emotions prompted by environmental loss (Böhm and Pfister, 2000). Prospective, future-based emotions, such as worry or fear, may prompt protective actions to prevent damage, whereas retrospective emotions such as sorrow may prompt avoidance and escape. Whether envisaging a loss that is yet to occur elicits prospective or retrospective emotions warrants investigation.

1.1. Imagined environmental loss

To examine the influence of anticipated loss on place attachment, visualisation techniques have been adopted, drawing on methodologies from interpersonal attachment studies. These methods include techniques in which the participant is explicitly prompted to visualize the attachment figure, such as through the presentation of the figure's face or by encouraging the participant to imagine interacting with them; or

through techniques to stimulate thoughts of the attachment figure unconsciously (Scannell and Gifford, 2017). Studies using these methods have supported their effectiveness in inducing feelings of attachment, which, in turn, have positive psychological outcomes for individual participants (e.g., decreased perceived threats to self-esteem) and in their motivations toward others, via, for example, increased compassion and helping behaviour (Mikulincer and Shaver, 2001; Mikulincer et al., 2005).

There is mixed evidence to date on the utility of visualisation techniques in place attachment research. Wallis et al. (2021) found that mental visualisations of disaster did not have the anticipated effect of increasing mitigation or preparedness behaviours. Conversely, Scannell and Gifford (2017) found that visualising a place of emotional importance led to increased belonging and greater attachment to place. Extending on this, Reese et al. (2019) found that visualising a particular place without its meaningful social and physical characteristics reduced subsequent levels of place attachment. Visualising environmental losses to one's own place of residence may also elicit strong negative emotions, including worry, anger, guilt, and hopelessness (Wullenkord et al., 2020).

Here, we extend Reese et al.'s methodology to investigate the role of imagined loss of valued *environmental* characteristics in changes to place attachment and migration decisions. In so doing we seek to address some of the limitations of previous place attachment research that focusses on immediate responses to acute environmental loss events. We also seek to better understand which *types* of environmental loss most strongly influence levels of place attachment and migration decisions.

1.2. Case study context

The study context is Perth, Western Australia. The city, home to approximately 2 million people, is idiosyncratic, easily characterised as the only metropolitan area of this size in the western half of the Australasian continent, with an equitable Mediterranean climate facilitating year-round outdoor lifestyles (Jones and Newsome, 2015). Widely recognised as one of the most geographically isolated cities in the world (Weller, 2009), residents view isolation as both an asset and a vulnerability: the benefits and disadvantages during modern times of a pandemic for example with the capacity to develop forms of autonomy and social control (see (Pforr et al., 2021)), yet vulnerable to transport failure, and distance from national decision-making and access to markets.

Residents of the city include Indigenous peoples belonging to the Noongar (and other) nations; characteristic place names derived from Noongar language are literally throughout the region (Thieberger, 2004), as a reflection of the colonial reliance upon place-based geographically distinct and superior Noongar knowledge (Collard 2013). The city's population is predominantly constituted by an ongoing series of settler migrant communities, making up a multicultural society.

Types of change and losses of values are also easily articulated in Perth. With water shortages for the city's residents experienced almost decadal, exemplified by dramatically declining stream runoff driven by rainfall declines (McFarlane et al., 2020), Perth is said to be in the part of Australia where climate change was first demonstrated, and where these changes are expected to intensify. It is recognised as being in one of the world's biodiversity hotspots (a region of exceptional biological diversity threatened by human habitation), with a diverse and distinctive flora and fauna, where colonial misunderstandings of ancient landscapes led to widespread clearing of native vegetation, followed by hydrological change, loss of biodiversity, and salinization of landscapes (see (Horwitz et al., 2008)).

Together these attributes make Perth an ideal case study; indeed many of these attributes are expressed for Perth as the basis for George Seddon's seminal work on the nexus of sense of place and the local environment (Seddon, 1972).

1.3. Research aims

Over two studies we sought to test whether imagined loss of valued environmental characteristics influences intentions to migrate elsewhere, and/or engage in place-protective actions, and whether this might be attributable to changes to place attachment. Further, we explore whether particular types of environmental characteristics are more consequential for changes to place attachment and moving intentions than other characteristics. Specifically, the following hypotheses were tested over two studies:

- H1. Place attachment to Perth will be significantly lower after, compared to before, an imagined environmental loss exercise.
- H2. Intentions to move away from Perth will be significantly higher after, compared to before, an imagined environmental loss exercise.
- H3. Place-protective intentions of participants will be significantly higher after, compared to before, an imagined environmental loss exercise.

In Study 2, in addition to determining whether Hypotheses 1 – 3 would replicate with a community sample, we sought to test whether changes to intentions to move away from Perth in the context of imagined environmental loss are related to changes in place attachment, and further, how changes in intentions to move relate to place-protective intentions. We also explored whether particular types of environmental characteristics are associated with changes in intentions to move away when imagined lost.

Finally, we sought a fuller understanding of the importance of environmental characteristics for place attachment, including common thoughts and emotions accompanying imagined loss, by performing a thematic analysis on open-ended responses collected during the imagined-loss exercise.

Specific additional hypotheses for Study 2 were:

- H4: Changes in desire to move (specifically, shifts from intentions to stay to intentions to move away) will be associated with greater reductions in place attachment.
- H5: Replicating the environmental characteristics of Perth will be an important consideration in where to move to, for participants who shift toward an intention to move after an imagined loss task.

2. Method

We incorporated a 2×1 within-subjects design to test hypothesis 1 (pre-imagined loss place attachment vs post-imagined loss place attachment) and hypothesis 2 (pre-imagined loss moving intentions vs post-imagined loss moving intentions). For hypothesis 3, we incorporated a 2×1 between-subjects design, whereby participants were randomly assigned into one of two groups: place-protective intentions before imagined loss vs place-protective intentions after imagined loss. For hypothesis 4, we used between-group analysis of variance to compare place attachment reductions across different moving intention groups. For hypothesis 5, repeated-measures analysis of variance is used to compare the relative importance of different factors in deciding where to move to.

The method used for the current studies builds on Reese et al. (2019) novel experimental manipulation of imagined loss. In their studies, Reese and colleagues direct participants to envisage the loss of important place-based social and physical characteristics and observe the exercise's effects on subsequent levels of place attachment. The manipulation provides a systematic and causal test of a place's characteristics on attachment levels. However, it is not yet clear whether similar effects would be observed when i) imagining environmental characteristics, or ii) administered in a different cultural context (both of Reese et al.'s studies were conducted in Germany). Thus, we trial Reese et al.'s approach with a sample of Australian undergraduate students,

before administering a second study to a larger community sample.

2.1. Participants

Study 1: We conducted an online survey using the Edith Cowan University Psychology and Criminology undergraduate recruitment scheme in which students participate in research in exchange for course credit. Participants were required to be currently living in the greater Perth metropolitan region, and to have resided there for at least the previous two years. Participants completed the survey between 1 March 2020 and 26 April 2020. The Edith Cowan University Human Research Ethics Committee approved our ethics protocol (approval number 2019–01025) and participants provided consent by agreeing to participate in the study after reading a Participant Information Sheet. Participants ($N = 148$) skewed female (84.0% female, 12.7% male, 2.0% not otherwise stated, with 1.3% providing no response), with the average age 30.26 ($SD = 9.79$; median = 27).

Study 2: A total of 333 participants was recruited via the panel aggregator Qualtrics. Participants completed the survey online between 17 November 2020 and 29 November 2020.¹ Participants were required to be currently living in the greater Perth metropolitan region, and to have resided there for at least the previous two years. The Australian National University Human Research Ethics Committee approved our ethics protocol (approval number 2020/687) and participants provided consent by agreeing to complete the study after reading a Participant Information Sheet. Participants ($N = 333$) were 51.7% female (48.3% male), with the average age 58.95 ($SD = 16.55$; median = 65).

2.2. Measures and procedure

Imagined loss exercise. For the exercise, following Reese et al. (2019), participants were instructed to list up to five environmental characteristics of Perth that were *particularly important and valuable to them*, and then asked to nominate which of these was the most valuable. Participants were then asked to *imagine that those environmental characteristics of Perth you just mentioned no longer exist in Perth...how would it feel, what would you notice, what would change in your everyday life?* (for full instructions, and frequency of characteristics nominated as most important in Study 1, see Supplementary material). Participants were also provided with an additional text box to write down any thoughts they had during the exercise.

Initial Place Attachment ('Initial PA') was measured before the imagined loss exercise with a 14-item scale following Reese et al. (2019), with six items measuring place identity (e.g., *I feel Perth is a part of me*), six items measuring place dependency (e.g., *Perth is the best place for what I like to do*), and two items measuring place affect (e.g., *I feel happy in this place*). Responses were recorded on a scale from '1 - strongly disagree' to '5 - strongly agree', with higher scores denoting stronger place attachment (Study 1: $\alpha = 0.91$; Study 2: $\alpha = 0.96$).

Post imagined loss Place Attachment ('Post PA') was measured as for Initial Place Attachment, but completed after the imagined loss exercise, with participants instructed to answer the statements *thinking of Perth without those characteristics you listed*. Minor tense amendments were made to the statements (e.g., *Perth is very special to me* was amended to *Perth would be very special to me*) (Study 1: $\alpha = 0.93$; Study 2: $\alpha = 0.96$).

Intentions to move were assessed with two items. For initial intentions to move ('Initial MI') participants were asked before the imagined loss exercise *Do you have intentions of moving away from Perth in the next five years?* Responses were recorded on a scale from '1 - no intention at all' to '5 - strong intentions'. For post imagined loss moving intentions ('Post MI'), after completing the imagined loss exercise, and after being prompted to imagine Perth without important environmental

¹ While this coincided with the Covid pandemic, Perth citizens were not subject to lockdown restrictions during this time.

characteristics, participants were asked *To what extent would you have intentions of moving away from Perth in the next five years?*, with responses measured on the same scale as previously.

Place-protective actions were measured with two items, one measuring policy support ('PP - policy'): *How likely are you to support government policies designed to protect aspects of Perth's natural environment?*, and one measuring protest ('PP - protest'): *How likely are you to join a protest about protecting aspects of Perth's natural environment?*, both measured on a scale from '1 - extremely unlikely' to '5 - extremely likely'. As the two items did not scale ($\alpha = 0.44$), they were treated separately for the analyses. Participants were randomly assigned to complete the measures either prior to or after the imagined loss exercise.

Reasons for leaving. For study 2, in addition to *intentions to move*, a further measure was included to record the most important considerations in deciding *where* to move to. Participants who scored above the midpoint on the Post MI item were asked the following: *How important would the following considerations be when deciding where to move to?* followed by five considerations (e.g., *A place that was located close to Perth*) rated from '1 - not at all important' to '5 - extremely important'.

Demographics. The demographic variables of age, gender, time lived in Perth, whether born in or outside of Australia, whether one had raised a family in Perth (no, partly, or wholly), and political orientation (as measured on a scale from '1 - very left wing' to '5 - very right wing') were also included.

3. Results

Table 1 displays descriptive statistics and correlations between the key study variables. Across both studies, Initial PA was rated well above the midpoint. Of note are the medium strength negative correlations between both Initial PA and Initial MI, and between Post PA and Post MI, compared to the relatively modest negative correlations between Initial PA and Post MI.

In Study 2, Initial PA was significantly though modestly positively associated with length of time lived in Perth ($r = 0.25, p < .001$), but not with age ($p = .302$), gender ($p = .802$), political orientation ($p = .060$), or whether the participant was born in or outside of Australia ($p = .978$). Those born in Perth ($M = 3.94, SD = 0.76$) had higher Initial PA than those born outside of Perth ($M = 3.75; SD = 0.95$), but the difference was small, $p = .038, d = 0.23$. A one-way analysis of variance showed that those who had raised a family wholly in Perth had higher levels of Initial PA ($M = 4.00; SD = 0.76$) than those who had not raised a family in Perth, $M = 3.60, SD = 0.96, F(2, 323) = 6.85, p = .001, \eta^2 = 0.04$. Those who had raised a family partly in Perth did not significantly differ on place attachment to the other two groups.

3.1. Pre- and post-imagined loss levels of place attachment, moving intention, and place-protective action (Studies 1 & 2)

Paired-samples *t*-tests showed that Post PA - when considering Perth without environmental characteristics of importance - was significantly lower than Initial PA, with large effect sizes in both studies (Study 1: $t(1,$

149) = 17.66, $p < .001, d = 1.44$; Study 2: $t(328) = 17.40, p < .001, d = 0.96$) supporting hypothesis 1.

Paired-samples *t*-tests showed that Post MI was significantly higher than Initial MI, (Study 1: $t(1, 149) = -13.57$; Study 2: $t(1, 332) = -12.95$). Again, the effect size was large for Study 1 ($d = -1.11$) with a moderate effect size in Study 2 ($d = -0.71$), supporting hypothesis 2 - that intentions to move away from Perth would be significantly higher after the imagined loss exercise.

Independent samples *t*-tests revealed there were no significant differences in place-protective policy support rated before the imagined loss exercise (Study 1: $M = 4.09, SD = 0.91$; Study 2: $M = 4.07, SD = 1.03$) compared with ratings after the exercise (Study 1: $M = 4.36, SD = 1.03, t(148) = -1.72, p = .087$; Study 2: $M = 4.27, SD = 1.00; p = .071, t(331) = 1.81, p = .071$). Similarly, there were no significant differences in intentions to protest for participants who rated place-protective actions before the exercise (Study 1: $M = 2.76, SD = 1.21$; Study 2: $M = 2.33, SD = 1.38$) compared with those who rated intentions after the exercise (Study 1: $M = 2.97, SD = 1.22, t(148) = -1.51, p = .291$; Study 2: $M = 2.54, SD = 1.28; t(331) = 1.40, p = .162$). Hypothesis 3 - that imagined loss will increase place-protective action intention - was not supported.

3.2. Changes in intentions to move and place attachment (Study 2)

Prior to the imagined loss exercise, 31% ($n = 102$) of the sample indicated they had some (ratings of 2 to 5) intention of moving away from Perth in the next five years, and this more than doubled to 68% ($n = 225$) after the imagined loss task. Specifically, 38% ($n = 127$) of participants shifted from no intention to some intention (forming a 'stay-leave' group). The other 61% ($n = 202$) were unchanged in their intentions, and less than 1 percent ($n = 4$) moved from some intention to none. The unchanged group was approximately evenly split between those who intended to leave Perth both before and after the task ($n = 98, 29%$, a 'leave-leave' group), and those who reported no intention to leave both before and after ($n = 104, 31%$, a 'stay-stay' group).

To test how changes in moving intentions related to place attachment, an analysis of variance showed Initial PA was significantly different between the three moving intentions groups ('stay-stay', 'leave-leave', and 'stay-leave'), $F(2, 323) = 30.47, p < .001, \eta^2 = 0.23$. Post-hoc tests using Games-Howell showed the 'stay-stay' ($M = 4.04; SD = 0.79$) and 'stay-leave' ($M = 4.09; SD = 0.66$) groups both had significantly higher Initial PA than the 'leave-leave' group ($M = 3.31; SD = 0.96$), both at $p < .001$.

Changes to place attachment scores were calculated by subtracting Post PA from Initial PA, such that higher scores indicated greater reductions in place attachment as a consequence of the imagined loss exercise. A between-groups analysis of variance comparing the three moving intention groups showed the 'stay-leavers' experienced a greater drop in place attachment ($M = 1.64; SD = 1.03$) than the 'leave-leavers' ($M = 0.73; SD = 0.86$), who in turn experienced a greater drop than the 'stay-stayers' ($M = 0.42; SD = 0.61$), $F(2, 323) = 62.35, p < .001$. The effect size was large, $\eta^2 = 0.28$. This supports hypothesis 4.

Table 1

Pearson correlations between the key study variables (Study 1 is presented above the diagonal, Study 2 beneath the diagonal).

	Study 2 M (SD)	1.	2.	3.	4.	5.	6.	7.	8.
Study 1 M (SD)									
1. Initial PA	3.80 (0.86)	-	.46**	-0.53**	-0.26**	.04	-0.05	.23**	.12
2. Post PA	2.57 (1.08)	.48**	-	-0.24**	-0.62**	.01	.05	.04	-0.06
3. Initial MI	1.63 (1.13)	-0.41**	-0.13*	-	.48**	-0.00	.25**	-0.29**	-0.12
4. Post MI	2.69 (1.48)	-0.18**	-0.63**	.37**	-	.07	.15	-0.21**	.03
5.PP - Policy	4.16 (1.02)	.23**	-0.03	-0.10	.09	-	.29**	.09	-0.40**
6.PP - Protest	2.43 (1.34)	.21**	.03	.01	.18**	.21**	-	-0.15	-0.36**
7. Age	58.95 (16.55)	.06	.11*	-0.35**	-0.32**	.02	-0.29**	-	.01
8.Political orientation	3.25 (0.97)	.12	.08	-0.11	-0.04	.02	-0.06	.23**	-

* $p < .05$; ** $p < .01$.

Together these two analyses suggest that high PA is associated with lower intentions to leave, but that intentions to leave in the face of imagined loss are facilitated by reductions in place attachment.

To explore associations between place attachment, moving intentions, and place-protective behaviours, a further between-groups analysis of variance compared the moving intention groups on support for place-protective behaviours. This showed that the ‘stay-leave’ group ($M = 2.68$; $SD = 1.34$) was *more* likely to join a protest about Perth’s natural environment than both the ‘leave-leave’ group ($M = 2.49$; $SD = 1.37$) and the ‘stay-stay’ group ($M = 2.11$; $SD = 1.25$), $F(2326) = 5.45$, $p < 0.01$, $\eta^2 = 0.03$. There were no significant differences for supporting policies to protect Perth’s environment between the moving intention groups, $F(2, 326) = 2.98$, $p = .052$, $\eta^2 = 0.02$, however, an inspection of the means revealed a similar pattern to the protest measure, with the ‘stay-leave’ group ($M = 4.34$; $SD = 0.98$) higher in intentions to support policies to protect than the ‘leave-leave’ ($M = 4.04$; $SD = 1.02$) and ‘stay-stay’ ($M = 4.08$; $SD = 1.06$) groups.

A follow up two-way between-groups analysis of variance was conducted to test whether the ‘stay-leave’ group’s higher intention to protest interacted with whether the place-protective action was asked about before or after the imagined loss exercise. No significant interaction effect was found, $p = .707$, suggesting deciding to leave in the face of imagined loss was not associated with changes in intentions to protest. Rather, the results indicate that the ‘stay-leave’ group has higher action intentions independent of loss.

3.3. Considerations of where to move to (Study 2)

Those who scored 3 or above for Post MI were asked to rate the importance of several considerations in deciding *where* to move. Table 2 presents importance ratings, in order of most highly rated to least highly rated, for the 96 participants in the ‘stay-leave’ group scoring 3 or above on Post MI.

A follow-up repeated-measures analysis of variance was conducted with the participants in the ‘stay-leave’ group to test for differences in the ratings of factors they would consider when leaving. There was a significant difference in ratings (as sphericity was violated, Greenhouse-Geisser corrected scores are reported), $F(3.67, 480) = 10.93$, $p < .001$, $\eta^2 = 0.10$. Post hoc tests with Holm’s correction indicated that moving somewhere with similar environmental characteristics was rated as significantly more important than all other considerations, supporting hypothesis 5 (See Table 2: Close, $p < .001$; Culture, $p = .029$; People, $p = .002$; Built Env, $p = .017$; Job, $p < .001$). Moving to a place located close to Perth was rated as significantly less important than Env ($p < .001$), Culture ($p = .002$), People ($p = .032$), and Built Env ($p = .004$).

3.4. Most valuable environmental characteristics, changes to place attachment and moving intentions (Study 2)

Participant nominations of the most valuable environmental characteristic were analysed; Table 3 displays the most common categories.

Table 2

Ratings of importance of different considerations when deciding where to move to, for participants who shifted from ‘stay’ to ‘leave’ after the imagined loss exercise.

Consideration when moving	M (SD) ‘Stay-Leavers’
A place that has environmental characteristics similar to those Perth currently has (‘Env’)	3.84 (1.11)
A place that was culturally similar to Perth (‘Culture’)	3.37 (1.30)
A place where the built environment was similar to Perth (‘Built Env’)	3.34 (1.22)
A place where I knew the people who lived there (‘People’)	3.23 (1.36)
A place where there were good job opportunities (‘Job’)	2.97 (1.64)
A place that was located close to Perth (‘Close’)	2.77 (1.22)

Table 3

Themes for most important environmental characteristic nominated by participants.

Characteristic	Includes	Frequency	Valid %age
Bushlands / parklands / greenspace	Kings park/green parks/open space/natural surrounds/Bushland/Darling Range/The Hills/forest/National Parks	48	15.8
Climate / weather	Climate/weather/sun/temperature/blue sky/dry summers/mild winters	45	14.8
Beaches / coast / waterways	Beaches/beach/ocean/waterways/rivers/Swan/Herdsman/river foreshore	42	13.8
Family / friends	Family members happy / family lives here or nearby/neighbours	36	11.8
Clean environment	Fresh air/clean air/fresh water/clean water	29	9.5
Fauna / flora	Native animals/native plants/wildlife/sea life/trees	21	6.9
Lifestyle / culture	relaxed/friendly/comfortable/friendly/peaceful	20	6.6
Built environment / planning	Infrastructure/buildings/Fremantle/convenient planning/governance	8	2.6
Safety	Safety/low crime	8	2.6
Miscellaneous		29	10.2
Missing / Don’t know		48	14.4

Characteristics categorised as ‘bushland/parklands/greenspace’, ‘climate/weather’, and ‘beaches/coast/waterways’ were the most commonly-rated.

A one-way between-groups analysis of variance for associations between the most important environmental characteristic and reductions in place attachment revealed a significant difference, $F(9, 289) = 3.43$, $p = 0.001$, $\eta^2 = 0.10$. Those unable to nominate a characteristic ($M = 0.35$, $SD = 0.58$) had significantly lower reductions in place attachment compared with those who nominated characteristics categorized under ‘climate/weather’ ($M = 1.22$, $SD = 1.14$), ‘bushlands/parklands’ ($M = 1.32$, $SD = 1.00$), a ‘clean environment’ ($M = 1.12$, $SD = 1.08$), and ‘beaches/coast/waterways’ ($M = 1.08$, $SD = 1.01$).

Further tests (see Supplementary material) showed those who nominated ‘lifestyle/culture’ characteristics had higher Initial PA than those who could not nominate anything and those nominating ‘fauna/flora’. Moreover, those nominating ‘lifestyle/culture’ characteristics retained significantly higher Post PA levels than those nominating climate, bushland, and fauna/flora characteristics.

Table 4 shows the most commonly valued characteristic type for each of the three main moving intention groups. There was relative consistency in the most commonly valued characteristics between the groups, with the exception that ‘family and friends’ only figured amongst the most valuable for the ‘stay – stay’ group.

To explore further, as many of the types of characteristics listed in Table 3 were not specifically environmental (e.g., family/friends; lifestyle/culture; safety) a binary characteristic variable was created to denote valued characteristics that were clearly ‘environmental’ (i.e., bushlands, climate, beaches, clean environment, fauna and flora), with the remaining categories denoting ‘non-environmental’. Table 5 shows the proportion within each moving intention group who selected an ‘environmental’ or ‘non-environmental’ valued characteristic. The highest proportion of participants selecting ‘non-environmental’ characteristics was amongst the ‘stay-stay’ group.

3.5. Thematic analysis of imagined loss exercise responses (Study 2)

Open-ended responses directly after the imagined loss exercise were examined. Common themes were identified by one researcher using a

Table 4
Most commonly valued characteristic type for each of the moving intention groups and levels of relative levels of place attachment.

Response to imagined loss exercise	Proportion of Study 2	“Environmental” characteristics considered important	Initial place attachment	Changes to place attachment
Stay → Stay	31%	1. Climate (21.7%) 2. Family friends (17.4%) 3. Bushlands (14.5%) 3. Beaches (14.5%)	High	Low reduction
Leave → Leave	29%	1. Bushland (18.3%) 1. Beaches (18.3%) 3. Climate (14.1%) 3. Fauna/flora (14.1%)	Moderate	Moderate reduction
Stay → Leave	38%	1. Bushlands (21.4%) 2. Climate (17.0%) 3. Beaches (16.1%)	High	High reduction

Table 5
Binary characteristic type for each of the moving intention groups.

Response to imagined loss exercise	Proportion of Study 2	Proportion of ‘environmental’ vs ‘non-environmental’ characteristic mentioned	Initial place attachment	Changes to place attachment
Stay → Stay	31%	Environmental: 65.2% Non-environmental: 34.8%	High	Low reduction
Leave → Leave	29%	Environmental: 74.6% Non-environmental: 25.4%	Moderate	Moderate reduction
Stay → Leave	38%	Environmental: 73.2% Non-environmental: 26.8%	High	High reduction

subset of responses and validated by two other researchers. All responses were then coded independently by two researchers. Where there was disagreement, a third researcher independently coded the response, and if no consensus could be reached at this point, the response was coded as ‘Miscellaneous’.

Fig. 1 shows the themes, with the most common being ‘negative emotions’, ‘loss of place differentiation’, and ‘intentions to move’. For examples of responses included under each theme, refer to Table S2 in Supplementary material.

A one-way between-groups analysis of variance was run to test for associations between the theme expressed and changes in place attachment. There was a significant and moderate association, $F(6, 183) = 4.80, p < .001, \eta^2 = 0.13$. Post-hoc tests using Tukey’s HSD revealed those who expressed a theme of ‘status quo’ ($M = 0.20, SD = 0.48$) had lower reductions in place attachment than those expressing themes of ‘negative emotions’ ($M = 1.43, SD = 1.08$), ‘aesthetic loss’ ($M = 1.35, SD = 1.21$), ‘recreation’ ($M = 1.25, SD = 0.97$), ‘intentions to move’ ($M = 1.36, SD = 0.91$), and ‘loss of place difference’ ($M = 1.44, SD = 1.06$). Further analyses (see Supplementary material) showed those coded under the ‘negative emotions’ theme had significantly higher Initial PA than those coded under ‘status quo’ and ‘heat/temperature/climate’.

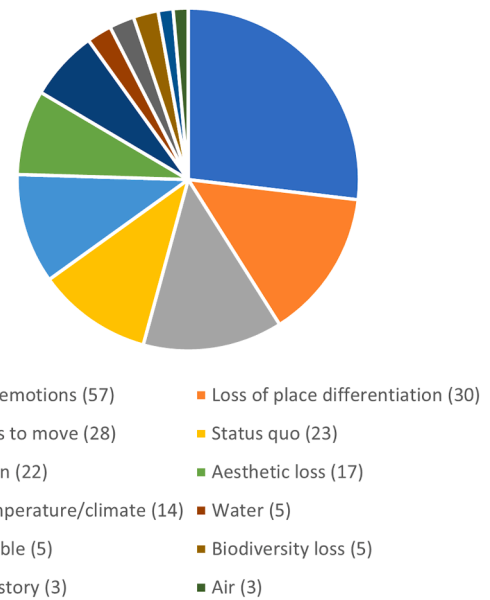


Fig. 1. Common themes emerging from imagined loss exercise comments.

4. Discussion

We used an imagined loss task to explore how the prospect of losing valued environmental characteristics of one’s home city shapes place attachment and decisions to stay or move away. Results across two studies supported our hypotheses that imagined loss of valued environmental characteristics would i) significantly reduce levels of place attachment, and ii) significantly increase intentions to move elsewhere. However, our hypothesis that imagined environmental loss would prompt greater place-protective intentions was not supported.

In a representative community sample, we demonstrated a significant proportion of people (38%) with intentions to stay in Perth suggested they might leave if important environmental characteristics were lost. The most important consideration for these participants when deciding *where* to move to was a place that replicated their lost environment. These participants were also more likely to report an intention to engage in place-protective actions.

Our expectation was that our instructions for the imagined loss task would elicit characteristics that were clearly related to the natural environment. The most commonly valued characteristics were classified as bushland, climate, and beaches, but other common responses included aspects beyond the natural environment, such as family, friends, and lifestyle. The blue cells in Table 6 illustrate the additional ways in which participants have interpreted “environmental characteristics”.

Whether this reflects people’s tendency to value the environment through its affordances for social activities, or reflects a methodological limitation of the task itself, is difficult to determine. Notwithstanding this, our findings demonstrate that imagining the loss of valued characteristics led to a greater willingness to envision leaving, and that this was concurrent with greater reductions in place attachment. Moreover, this tendency was more pronounced for those who thought about the loss of explicitly environmental characteristics.

Those with current intentions to leave Perth also have the lowest levels of place attachment, consistent with previous literature (e.g., Barcus and Brunn, 2010). Although this group frequently nominated clearly environmental characteristics, imagining them lost had a relatively modest influence on subsequent place attachment, suggesting losses are of little consequence for those with an eye to moving already.

Conversely, those with no current intentions to leave Perth had high levels of place attachment, but the consequences for imagining loss were

Table 6

Framing of the relationships tested in these studies (environmental characteristics imagined lost, mediated by place attachment, resulting in intention to move) shown in green, with additional environmental characteristics used by the participants shaded in blue.

Dimensions of Environmental Loss	human mobility and territory	cultural heritage	Indigenous knowledge	life and health	biodiversity and ecosystem services	Place attachment	social cohesion
Processes							
Consequences							
Features							

Nb. Categories of non-economic loss and damage from [McNamara et al. \(2021\)](#).

to an extent associated with the type of loss envisaged. Those for whom imagined loss did not alter their intentions to stay were more likely to reference non-environmental characteristics such as friends and family, suggesting these people have reasons for staying beyond the solely environmental. This could in part reflect this group’s stronger association between environmental and social characteristics, even their reluctance to distinguish between them, and the culturally-determined assumptions of environmental characteristics as ‘other’ ([Plumwood, 1991](#)). Under these circumstances a strong place attachment predicated on intimate and personal (and even embodied) relationships, can result in a compulsion to stay. Perhaps a reciprocal of this is that environmental losses can have socio-cultural consequences. While our data suggest that place attachment for those who choose to stay may remain intact in the immediate term, deleterious consequences to mental wellbeing may arise through loss of sovereignty, identity and dignity, traditions, and social cohesion due to others’ decisions to leave ([McNamara et al., 2021](#)).

Those for whom imagined loss *did* alter moving intentions (more than one-third of participants) tended to concentrate on more natural aspects of the environment, and this was also the group who experienced the greatest drop in place attachment, supporting the idea that place attachment mediates between environmental change and decisions to stay or leave ([Dandy et al., 2019](#)). This group was also the most disposed to engaging in place-protective action, whether asked before or after imagining loss. This suggests that moving away from place, and protecting place, are not mutually exclusive behavioural responses. Rather, this may reflect that those who choose to move are also better resourced (either psychologically or economically), enabling them to act to mitigate loss.

4.1. Negative emotions and anticipated solastalgia

An analysis of responses to the imagined loss exercise revealed negative emotions were most commonly expressed. This is consistent with previous findings showing visualising environmental loss to one’s place elicits negative emotions, but does not necessarily impel environmental action intentions ([Wullenkord et al., 2020](#)). The discrete emotions listed in the present study (e.g., sad, depressed, lonely, see Table S2) are consistent with retrospective loss-based emotions embedded in the concepts of ‘solastalgia’ or ‘anticipated solastalgia’ ([Moratis, 2021](#)), rather than prospective loss-based emotions such as fear and apprehension ([Böhm and Pfister, 2000](#)). This reflects the potential for the pre-emptive migration of people based not just on current environmental states, but future imagined ones. This is consistent with experiences described in the literature, for example the consideration of environmental distress in [Higginbotham et al. \(2006\)](#). Indeed [Tschakert et al. \(2013\)](#) described, for northern Ghana, a suite of environmental transformations that shape embodied experiences in ‘landscapes of everyday life’, triggering acute negative emotions, and a disproportionate out-migration, exacerbating “the figurative and literal

desiccation of self and place in these landscapes” (p24).

Other common themes to emerge were a loss of place differentiation, and intentions to move somewhere else. This supports the notion that environmental characteristics are a fundamental part of a place’s identity, and that without such differentiation one might as well live elsewhere. Under an imagined environmental loss scenario, we found that replicating the environmental characteristics of what used to be was the chief consideration of where to move to.

4.2. Limitations and future research

We acknowledge several limitations of our current approach. First, our research design does not enable a true test of place attachment mediating between environmental loss and decisions to migrate. While it is reasonable to suggest that reductions in place attachment is a ‘mechanism’ through which environmental loss precipitates a decision to leave, it is also plausible that defensive ‘anticipatory detachment’, via imagining oneself to be living elsewhere, may also co-occur ([Brown and Perkins, 1992](#)). Similarly, place detachment may occur for those with limited mobility options: our design assumes there is choice (and equality of choice) for people facing environmental change and loss.

Second, we did not address the potential moderating role of culture in the nexus between place attachment, environmental loss, and decisions to stay or go. Our measure of place attachment, and indeed what is considered the environment, is constrained by its colonialist construction, which brings into question the measures’ validity for what constrains and prompts migration in Indigenous cultures especially and raises many more questions. For instance, do Indigenous concepts of Country and kinship cut across the colonial envisioning of environment as ‘other than human’? Relatedly, we did not examine the possibility that some in our study may have already migrated to Perth (due to environmental or other stressors). Investigating how migration history influences future mobility responses is worth considering.

Third, our within-group imagined loss design introduces an element of artificiality (or even impossibility) in what was imagined lost. Imagining a city dominated by coastline without its beaches is arguably very different to imaging the same city with its beaches under future threat. Future research might include between-group framing studies, whereby more nuanced climate scenarios that threaten the quality of valued environmental attributes are presented to ascertain their influence on intentions to move and levels of place attachment (compared with intentions to move and place attachment in the absence of such scenarios).

Fourth, our case study approach demonstrates associations between environmental loss, place attachment, and intentions to move in a place with many unique environmental attributes. Future research could examine whether these associations hold in areas with very different environmental conditions and stressors. Relatedly, though we demonstrate Reese et al.’s (2019) experimental manipulation produces similar effects to a German sample, generalising results beyond these

populations should be done cautiously. It is not clear for instance whether the current method used to elicit environmental loss would translate across diverse cultural contexts, or whether alternative methods (e.g., perspective-taking, storytelling) might be more suitable.

5. Conclusion

Environmental change is accompanied by losses that extend beyond the tangible and economic, to encompass loss of valued attributes, loss of connection to place, and the loss to social bonds through migration prompted by these changes. We found that imagining the loss of valued environmental characteristics of where one resides led to a significant decrease in anticipated place attachment, and a significant increase in migration intentions. Moreover, these intentions depended on the type of environmental loss envisaged, suggesting the loss accrued by change is cumulative and multi-faceted.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

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References

- Devine-Wright, P., 2009. Rethinking NIMBYism: the role of place attachment and place identity in explaining place-protective action. *J. Community Appl. Soc. Psychol.* 19, 426–441. <https://doi.org/10.1002/casp.1004>.
- Dow, K., Berkhout, F., Preston, B.L., Klein, R.J.T., Midgley, G., Shaw, M.R., 2013. Limits to adaptation. *Nature Clim. Change.* 3, 305–307. <https://doi.org/10.1038/nclimate1847>.
- Wrathall, W.D.J., Oliver-Smith, A., Fekete, A., Gencer, E., Reyes, M.L., Sakdapolrak, P., 2015. Problematising loss and damage. *Int. J. Glob. Warm.* 8, 274–294. <https://doi.org/10.1504/IJGW.2015.071962>.
- Mechler, R., Singh, C., Ebi, K., Djalante, R., Thomas, A., James, R., Tschakert, P., Wewerinke-Singh, M., Schinko, T., Ley, D., Nalau, J.L.M., Bouwer, C., Huggel, D., Huq, J., Linnerooth-Bayer, S., Surminski, P., Pinho, R., Jones, E., Boyd, A., Revi, A., 2020. Loss and damage and limits to adaptation: recent IPCC insights and implications for climate science and policy. *Sustain. Sci.* 15, 1245–1251.
- McNamara, K.E., Jackson, G., 2019. Loss and damage: a review of the literature and directions for future research. *WIREs Clim. Change.* 10, e564. <https://doi.org/10.1002/wcc.564>.
- McNamara, K.E., Westoby, R., Chandra, A., 2021. Exploring climate-driven non-economic loss and damage in the Pacific Islands. *Curr. Opin. Environ. Sustain.* 50, 1–11. <https://doi.org/10.1016/j.cosust.2020.07.004>.
- Masterson, V., Stedman, R., Enqvist, J., Tengö, M., Giusti, M., Wahl, D., Svedin, U., 2017. The contribution of sense of place to social-ecological systems research: a review and research agenda. *Ecol. Soc.* 22. <https://doi.org/10.5751/ES-08872-220149>.
- Adams, H., 2016. Why populations persist: mobility, place attachment and climate change. *Popul. Environ.* 37, 429–448. <https://doi.org/10.1007/s11111-015-0246-3>.
- Dandy, J., Horwitz, P., Campbell, R., Drake, D., Leviston, Z., 2019. Leaving home: place attachment and decisions to move in the face of environmental change. *Reg. Environ. Change.* 19, 615–620. <https://doi.org/10.1007/s10113-019-01463-1>.
- Black, R., Adger, W.N., Arnell, N.W., Dercon, S., Geddes, A., Thomas, D.S.G., 2011. The effect of environmental change on human migration. *Glob. Environ. Change Hum. Pol. Dimen.* 21, S3–S11. <https://doi.org/10.1016/j.gloenvcha.2011.10.001>.
- Hugo, G., 2011. Future demographic change and its interactions with migration and climate change. *Global Environ. Change. Hum. Pol. Dimen.* 21, S21–S33. <https://doi.org/10.1016/j.gloenvcha.2011.09.008>.
- Zheng, C., Zhang, J., Guo, Y., Zhang, Y., Qian, L., 2019. Disruption and reestablishment of place attachment after large-scale disasters: the role of perceived risk, negative emotions, and coping. *Int. J. of Disaster Risk Reduct.* 40, 101273. <https://doi.org/10.1016/j.ijdrr.2019.101273>.
- Anton, C.E., Lawrence, C., 2014. Home is where the heart is: the effect of place of residence on place attachment and community participation. *J. Environ. Psychol.* 40, 451–461. <https://doi.org/10.1016/j.jenvp.2014.10.007>.
- Bonaiuto, M., Alves, S., De Dominicis, S., Petruccioli, I., 2016. Place attachment and natural hazard risk: research review and agenda. *J. Environ. Psychol.* 48, 33–53. <https://doi.org/10.1016/j.jenvp.2016.07.007>.
- Tschakert, P., Barnett, J., Ellis, N., Lawrence, C., Tuana, N., New, M., Elrick-Barr, C., Pandit, R., Pannell, D., 2017. Climate change and loss, as if people mattered: values, places, and experiences. *Wiley Interdiscip. Rev. Clim. Change.* 8, e476. <https://doi.org/10.1002/wcc.476>.
- Higginbotham, N., Freeman, S., Connor, L., Albrecht, G., 2010. Environmental Injustice and Air Pollution in Coal Affected Communities. Hunter Valley, Australia, pp. 259–266. <https://doi.org/10.1016/j.healthplace.2009.10.007>. *Health & Place.* 16.
- Albrecht, G., 2006. Solastalgia. *Altern. J.* 32, 34–36.
- Moratis, L., 2021. Proposing anticipated Solastalgia as a new concept on the human-ecosystem health nexus. *EcoHealth.* 1–3. <https://doi.org/10.1007/s10393-021-01537-9>.
- Manzo, L., Perkins, D., 2006. Finding Common Ground: the importance of place attachment to community participation in planning. *J. Plan. Lit.* 20, 335–350. <https://doi.org/10.1177/0885412205286160>.
- Böhm, G., Pfister, H.R., 2000. Action tendencies and characteristics of environmental risks. *Acta Psychol.* 104, 317–337.
- Scannell, L., Gifford, R., 2017. Place attachment enhances psychological need satisfaction. *Environ. Behav.* 49, 359–389. <https://doi.org/10.1177/0013916516637648>.
- Mikulincer, M., Shaver, P.R., 2001. Attachment theory and intergroup bias: evidence that priming the secure base schema attenuates negative reactions to out-groups. *J. Person. Soc. Psychol.* 81, 97–115. <https://doi.org/10.1037/0022-3514.81.1.97>.
- Mikulincer, M., Shaver, P.R., Gillath, O., Nitzberg, R.A., 2005. Attachment, caregiving, and altruism: boosting attachment security increases compassion and helping. *J. Person. Soc. Psychol.* 89, 817–839. <https://doi.org/10.1037/0022-3514.89.5.817>.
- Wallis, A., Fischer, R., Abrahamse, W., 2021. Does place visualisation increase household preparedness for natural hazard events? A longitudinal intervention. *J. Environ. Psychol.* 73, 101556. <https://doi.org/10.1016/j.jenvp.2021.101556>.
- Reese, G., Oetler, L., Katz, L.C., 2019. Imagining the loss of social and physical place characteristics reduces place attachment. *J. Environ. Psychol.* 65, 101325. <https://doi.org/10.1016/j.jenvp.2019.101325>.
- Wullenkord, M.C., Heidbreder, L.M., Reese, G., 2020. Reactions to environmental changes: place attachment predicts interest in earth observation data. *Front. Psychol.* 1442.
- Jones, C., Newsome, D., 2015. Perth (Australia) as one of the world's most liveable cities: a perspective on society, sustainability and environment. *Int. J. Tour. Cities.* 1, 18–35. <https://doi.org/10.1108/IJTC-08-2014-0001>.
- Weller, R., 2009. Boomtown 2050: Scenarios for a Rapidly Growing City. UWA Publishing.
- Pförtner, C., Volgger, M., Cavalcanti Marques, S., Cahya Nusantara, A., 2021. The context: western Australia's visitor economy. *Understanding and Managing the Impact of Airbnb*. Springer, Singapore. https://doi.org/10.1007/978-981-16-2952-5_2.
- N. Thieberger, Linguistic report on the single Noonang Native Title claim. <http://hdl.handle.net/11343/27658/>, 2004 (accessed 13 March 2021).
- Collard, 2013 South West celebration aboriginal place names, 2013, <https://www.youtube.com/watch?v=pjvv7Ys9Jf0>.
- McFarlane, D., George, R., Ruprecht, J., Charles, S., Hodgson, G., 2020. Runoff and groundwater responses to climate change in South West Australia. *J. R. Soc. West. Aust.* 103, 9–27.
- Horwitz, P., Bradshaw, D., Hopper, S., Davies, P., Froend, R., Bradshaw, F., 2008. Hydrological change escalates risk of ecosystem stress in Australia's threatened biodiversity hotspot. *J. R. Soc. West. Aust.* 91.
- Seddon, G., 1972. Sense of Place a Response to an Environment, the Swan Coastal Plain. Western Australia, UWA Press, Perth.
- Barcus, H.R., Brunn, S.D., 2010. Place elasticity: exploring a new conceptualization of mobility and place attachment in rural America. *Geogr. Ann. Ser. B Hum. Geogr.* 92B, 281–295. <https://doi.org/10.1111/j.1468-0467.2010.00353.x>.
- Plumwood, V., 1991. Nature, self, and gender: feminism, environmental philosophy, and the critique of rationalism. *Hypatia* 6, 3–27. <https://doi.org/10.1111/j.1527-2001.1991.tb00206.x>.
- Higginbotham, N., Connor, L., Albrecht, G., Freeman, S., Agho, K., 2006. Validation of an environmental distress scale. *EcoHealth* 3, 245–254. <https://doi.org/10.1007/s10393-006-0069-x>.
- Tschakert, P., Tutu, R., Alcaro, A., 2013. Embodied experiences of environmental and climatic changes in landscapes of everyday life in Ghana. *Emot. Space Soc.* 7, 13–25. <https://doi.org/10.1016/j.emospa.2011.11.001>.
- Brown, B., Perkins, D.D., 1992. *Disruptions to place attachment*. I. Altman, S. Low (Eds.). *Place Attachment*. Plenum, New York, pp. 279–304.