



The judged seriousness of an environmental loss is a matter of what caused it

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Abstract

Environmental losses, each described along with its cause, were judged for seriousness. Four types of cause were studied: illegal behavior, carelessness, economic and population growth, and natural events. Identical environmental losses (e.g., of a herd of elk or a large stand of trees) were considered most serious when caused by illegal behavior or carelessness, and only slightly less serious when caused by growth. Losses due to these three types of human causes were considered much more serious than when the same losses were caused by natural events. Naturally caused environmental losses were probably considered least serious because they do not provoke the sense of violation or responsibility commonly associated with human-caused losses, and because naturally caused losses are often considered unavoidable and in the natural scheme of things.

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1. Introduction

If something privately owned such as an automobile is insured for a specific value and is damaged or destroyed through no fault of the owner, the insured value and thus the payout to the owner is typically the same regardless of the cause of the loss. For example, the payoff for loss of the automobile typically would be the same whether the cause was a traffic accident, a garage fire, theft, or hail. Generally, how much the lost object was worth does not depend on what caused its loss. We would think that a similar principle would hold for environmental losses. For example, the value of a stand of trees lost to fire should probably not differ whether the loss was caused by a lightning strike, a careless camper, or an arsonist. Or the value of a lost herd of elk should probably not differ depending on whether the elk

died because of poaching, because of an unusually harsh winter, or because of disease.¹

Yet it is becoming increasingly clear that people's evaluations of losses—including their judgments of the importance or seriousness of the losses, and of the appropriateness of injured parties receiving compensation for the losses—are affected by more than just the magnitude or consequences of the loss. Chief among the other influences is the cause of the loss.

Three studies have documented the effect of cause in evaluations of environmental losses. Each evaluated how natural as opposed to human causes affected assessments of the losses. First, Kahneman, Ritov, Jocowitz, and Grant (1993) found that people judged

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¹What a lost resource is worth must be distinguished from how much compensation should be paid by the person who caused the loss. Compensation, if paid by the injurer, may include a penalty—especially if the action was avoidable—to be added to the cost of restoration. The penalty may both penalize the injurer and help to compensate the injured for the sense of violation they suffered (see Radin, 1993).

a series of environmental losses to be more “important” if caused by human action than if caused by a natural event. Second, DeKay and McClelland (1996) found that people placed higher priority on saving endangered species threatened by humans than on those threatened by natural forces.² Third, Brown, Nannini, Gorter, Bell, and Peterson (2002) found that the judged “seriousness” of several environmental losses was greater if they were caused by human action than if caused by a natural event.

This effect of cause on judgments of losses has also been found in assessments of personal injuries. Two sets of studies have documented this finding. First, Baron and Ritov (1993) and Baron (1993) asked subjects what they recommended regarding compensation to be paid to a person sustaining personal injury. Compensation was more often recommended when the injury was caused by another person or by a firm than when it was caused by nature. This was so even when subjects were told that the amount of compensation would have no effect on the amount of punishment, if any, that would be imposed on the injurer.

The second set of evidence relates to jury awards. Most states in the US use comparative negligence standards to determine the damage payments to injured parties. Juries are instructed to do two separate things: first they determine the responsibility of both the defendant and the plaintiff (the injured party), and then they estimate the total damage to the plaintiff, knowing that the court will reduce the ultimate award to the plaintiff below total damage if the jury found the plaintiff to be partly responsible for the injury. However, studies have found that juries’ estimates of total damage are inversely related to the degree to which the plaintiff was considered responsible (e.g., Feigenson, Park, & Salovey, 1997; Zickafoose & Bornstein, 1999). Even though specifically instructed to determine the gross amount of damages incurred by the plaintiff without regard to the plaintiff’s degree of negligence, jurors’ estimates reflected in part their assessments of negligence.³

In light of all this evidence it seems clear that people naturally associate losses with causes, and that human-caused losses are considered more serious or important than naturally caused losses. What has not been investigated is the relative importance of different kinds of human-caused loss. The three studies of environmental losses mentioned above, for example, did not

distinguish among kinds of human causes. Several kinds of human cause are possible. A loss may or may not be clearly attributable to a person or distinct group. A cause not attributable to a specific person or entity is economic and population growth. For example, a decrease in air quality might be attributed to the increase in automobile use that occurs with growth. And if attributable to a specific entity, a loss might be the result of either an illegal action or carelessness. For example, air pollution from emissions at an industrial plant may result from willful disregard of environmental laws or careless maintenance of pollution control equipment.

The objective of this study was to determine how the judged seriousness of environmental losses varies among these three types of human cause—illegal behavior, carelessness, and growth—and how judged seriousness differs between those causes and natural causes. Our basic approach was to obtain paired comparison judgments of seriousness of loss for a series of loss + cause descriptions, where the target losses were presented separately with each of the four different kinds of cause. Subjects were asked to judge the losses, not the causes, though each loss description included a cause. We attempted to present the various loss + cause descriptions so as to maintain independence among the various paired comparisons.

Before presenting our hypotheses regarding the effect of cause on the relative seriousness of the target losses, we must digress briefly and consider the question, Why does cause matter in people’s assessments of the seriousness of losses? We suggest that cause matters because when presented with a serious loss people naturally wonder who is responsible for it. As Shaver (1985, p. 1) states, “negative events demand explanation”. In Western societies the demand for an explanation may derive partly from legal systems that emphasize assigning punishment and providing restitution (Shaver, 1970), and it may derive partly from a need to assure ourselves that someone else is to blame (Walster, 1966). But in large part it probably results from the simple fact that events have causes, and that being the cause of a negative event implies some responsibility for the event.

Responsibility has been a topic of investigation by philosophers since at least Aristotle’s “Nicomachean Ethics” (Birnbacher, 2001), and is a pivotal concept within our legal system (Hart, 1968). As Shaver and Schutte (2001) explain, psychologists have long been interested in responsibility, and have contributed much to our understanding of the concept (e.g., Haider, 1958; Shaver, 1985; Weiner, 1995; Auhagen & Bierhoff, 2001). From such sources we learn that essential conditions for assigning full responsibility for a loss include: (1) a clear *causal link* from the person or group of persons performing the act to the responsibility for the act

²Subjects were asked “How much should we be doing right now to save the species?” The higher priority of species threatened by humans may have been due in part to subjects assuming that human-caused endangerment was more amenable to intervention than was naturally caused endangerment.

³These studies are only a few of those investigating how outcome severity affects judgments of responsibility. Robbennolt (2000) lists 33 other studies that have studied the phenomenon.

(i.e., that a responsible person or group can be identified), (2) *free will* (i.e., lack of coercion) in performing the act, (3) *awareness* of the likely consequences of the act, (4) *intention* to so act, and (5) a generally recognized *obligation* to act otherwise.

How do the four causes of loss selected for study here satisfy these conditions? At one extreme, losses caused by an act of nature satisfy none of the conditions because they lack a human agent. At the other extreme, illegal actions typically satisfy all five conditions. For example, when a hunter shoots and kills a deer without a hunting license, a direct causal link is obvious, the hunter acted with free will, was aware that shooting the deer could kill it, intended to shoot the deer, and had a widely recognized obligation not to hunt without a license. Carelessness and economic and population growth fall between these two extremes. With a careless act a causal link, free will, and obligation to act otherwise can be assumed, but awareness and intention are probably lacking. For example, consider a camper who fails to extinguish a campfire that leads to a wildfire; a causal link exists between the camper and the fire, the camper was not coerced into being careless, and there is an obligation to act otherwise, but the camper was probably unaware that the campfire was not sufficiently extinguished and probably did not intend to start a wildfire. Finally, with the general effects of growth, free will and intention are presumed but awareness of consequences cannot necessarily be assumed, there is no clear obligation to act otherwise, and the causal link is vague because many people contribute to the effects of growth and the relative contribution of each is difficult to determine. For example, consider a power plant that legally causes air pollution in the process of providing electricity to a growing nearby town. The town's people bear the cost of the pollution but also benefit from the electricity. Here the causal link between the act and responsibility for the loss is clouded by the fact that many people, through their need for electricity, bear some responsibility for the loss of clean air.

The relative importance of these five conditions is unknown in general and may in practice be highly context specific. However, the conditions offer rough guidance in establishing hypotheses about the relative seriousness of losses considered here. First, judged seriousness is clearly expected to be greater for human-caused than naturally caused losses. More importantly here, we expected that losses due to illegal acts would be judged most serious of all (because they satisfy all five conditions for assigning responsibility), followed by losses due to carelessness (which satisfy three of the conditions), and then by losses due to economic and population growth (which satisfy only two of the conditions). We formed no hypotheses about the relative distances between the four types of causes.

2. Method

2.1. Participants

Participants were 253 undergraduates at Colorado State University in Fort Collins, Colorado. Participation satisfied part of an Introductory Psychology course research requirement.⁴

2.2. Stimulus materials and experimental design

To examine the effect of cause on peoples' judgments of the seriousness of environmental losses, we obtained comparative judgments for 24 loss+cause descriptions, which are called "items" herein. For example, one item was "Loss of 200 elk on National Forest land west of Fort Collins due to poaching (illegal hunting)," and another was "Loss of 1/2 square mile of large ponderosa pine west of Fort Collins due to a new housing development." Criteria for selecting losses and causes included: (1) believability (the items should make sense to the subjects); (2) brevity (capable of being conveyed in a single sentence); (3) variety (the losses should involve a mix of different resources); and (4) comparability (the losses should not be so different in seriousness that judgments are overly obvious). Similarity of description format was maintained by beginning each item with "Loss of ..." and transitioning to cause with "due to."

The 24 items consisted of 16 target items and 8 filler items. The 16 target items were created by crossing four losses with four types of cause. The types of cause, as mentioned earlier, were illegal behavior, carelessness, economic and population growth, and natural event. The four target losses—of air quality, elk in a national forest, large trees in a nearby forest, and aquatic life in a local river—were such that they could actually be caused by each of the four types of cause. The 8 filler losses (the role of which is discussed below) were different from each other and from the target losses. Type of cause was distributed evenly across the filler items such that each type of cause was represented twice. Of the 12 losses (4 target and 8 filler), most were biological entities, such as eagles, elk, fish, and trees, but the following three were conditions affecting human health or enjoyment of the surroundings: loss of clean air days, loss of the view of the mountains, and loss of nighttime quiet (Table 1).

The mechanism for obtaining judgments of seriousness (described in detail below) was to present the items

⁴The ranking of losses established in this study, which is based on the judgments of university students, may not transfer to other populations. The preferences of students may reflect, among other things, their stage in life. For example, students may be less sensitive to losses of nighttime quiet (one of the filler losses) than middle-aged adults. Nevertheless, we expect that the broad conclusions of this study, especially the relative seriousness of the four types of cause, will transfer well to adults in general.

Table 1
Items**A. Target items (and target group number)**

Loss of 200 elk on National Forest land west of Fort Collins due to

1. poaching (illegal hunting).
2. careless transmission of a disease from contaminated cattle.
3. deterioration of habitat caused by building new roads.
4. an unusually harsh winter.

Loss of 1/2 square mile of large ponderosa pine west of Fort Collins due to

4. illegal logging.
1. incomplete extinguishing of a campfire.
2. a new housing development.
3. extremely rare high winds.

Loss of all aquatic life in a 20-mile stretch of the Poudre River near Fort Collins due to

3. illegal dumping of industrial waste.
4. a petroleum spill from a careless driving truck accident.
1. runoff from a large construction site following heavy rain.
2. an extended dry spell.

Loss of 20% of the clean air days in Fort Collins due to

2. intentional violation of industrial emissions laws.
3. careless maintenance of industrial pollution equipment.
4. increasing automobile emissions from the growing city population.
1. lightning-caused forest fires in the West.

B. Filler items

1. Loss of 80% of all prairie dogs in Fort Collins due to illegal poisoning.
2. Loss of 60% of the bald eagles in northern Colorado due to illegal killing for their feathers.
3. Loss of all fish in City Park Lake due to an accidental herbicide spill.
4. Loss of 1/4-square mile of Douglas fir trees near the Poudre River to wildfire caused by a careless camper.
5. Loss of 25% of the view of the mountains from town due to housing development in the foothills.
6. Loss of nighttime quiet in your neighborhood due to a new freeway.
7. Loss of 10 large trees on the CSU oval due to old age.
8. Loss of 500 Canada geese in Fort Collins due to a natural bacterial infection.

in pairs and ask subjects to choose which loss in the pair was more serious. To minimize the chance of subjects using simplifying rules for making their choices, and thus to help maintain independence among the judgments, the target items were grouped into four sets so that a given pair never consisted of two causes of the same loss or two losses by the same cause. This was accomplished by arranging the 16 target items into four groups of four items each. Each group of four target items included each of the four losses and each of the four causes, as indicated in Table 1. The 8 filler items were included in each group of four target items to form four sets of 12 items (Tables 1 and 2). Each subject responded to all possible pairs of the items in a set, for a total of 66 pairs per set, and each subject responded to all four sets.⁵ Thus, each subject responded to $4 \times 66 = 264$ pairs.

The filler items served two purposes: to make the systematic combinations of loss by cause among the target items less obvious, thereby helping to maintain

⁵If all possible pairings of t items are judged, $t(t-1)/2$ pairs are judged. Thus, among the four target items 6 pairs were judged, and among the eight filler items 28 pairs were judged. Adding the 32 pairs comparing a target item with a filler item brings the total number of pairs to 66.

Table 2
Experimental design

Set	Items
1	Target group 1 (4 items) plus the 8 filler items
2	Target group 2 (4 items) plus the 8 filler items
3	Target group 3 (4 items) plus the 8 filler items
4	Target group 4 (4 items) plus the 8 filler items

independence among judgments of the target items, and to allow measures of reliability based on the repeated judgments of the filler item-by-filler item pairs that were judged four separate times by each subject, once for each of the four sets of items. Reliability tests focused on two issues: whether responses to the filler items differed by set, and whether they differed by sequence of presentation (i.e., by whether they were encountered first, second, third, or last as the subjects proceeded through the four sets).

2.3. Procedure

The experiment took the average subject about 45 minutes to complete. Pretesting showed little or no drop in consistency as subjects proceeded through 264

comparisons. In any case, the repeated judgments of the filler items allowed us to test for a drop in consistency.

Subjects participated in the experiment in groups of 2 to 8 but they did not interact, with each seated at a separate computer. Subjects were instructed to choose the “loss you consider to be the more serious” for each of the 264 pairs of items. The items of each pair were presented to subjects on the left and right sides of their computer screens. Subjects indicated their choices using the left and right cursor keys, and could undo their choice with the backspace key in order to make a correction.

Presentation order was randomized across subjects by, separately for each subject, randomly ordering the presentation of the four sets, randomly ordering the presentation of pairs within each set, and randomly ordering the position (left versus right side of the screen) of the two items of a pair. The four item sets were presented without a break between them, and subjects were not informed that the pairs were organized into four different sets.

2.4. Data analysis

A subject’s vector of the numbers of times each item was chosen above the others is the set of *preference scores*. Preference scores were computed for each set of 12 items, yielding four sets of preference scores per subject. If a subject’s choices were perfectly consistent, the preference scores for a set would contain each integer from 0 to 11. Inconsistency in a subject’s choices causes some integers to disappear and others to appear more than once.

Inconsistency among a subject’s paired comparisons occurs as circular triads, which indicate intransitive choice. For example, the following circular triad could result from the three possible pairings of three items: $A > B > C > A$. An individual subject’s coefficient of consistency relates the observed number of circular triads to the maximum possible number (David, 1988). The coefficient varies from 1.0, indicating that there are no circular triads in a person’s choices, to 0, indicating the maximum possible number of circular triads.

The means (across subjects) of the preference scores for each item are considered to approximate an interval scale measure (Dunn-Rankin, 1983), and can be used as scale values of the items. We used this simple approach for measuring group preference, but for presentation we converted mean preference scores to mean estimated probabilities of choosing the items, by dividing the mean preference score of each item by the number of pairs in which the item appeared (which is $t-1$ for a set of t items if all possible pairs are judged). This linear transformation removes the dependence of preference score on the number of items in the set. These choice probabilities were estimated separately for each set of items.

3. Results

3.1. Reliability

3.1.1. Test–retest reliability

The 28 filler item-by-filler item pairs were judged four times by each subject, once for each set of items. Aggregate preference scores for each filler item were computed for each set (Table 3), allowing a comparison across the sets. The six correlation coefficients comparing the four sets of filler item aggregate preference scores are all above 0.998, indicating that changing the target items from one set to the next had no effect on the relative seriousness of the filler items.

A two-way (item-by-set) analysis of variance on individual subject preference scores of the filler items showed no significant difference among the four sets, $F(3, 8064) = 0.296$, $p = 0.828$, $\eta^2 < .01$, and no significant two-way interaction. In addition, an item-by-sequence two-way analysis of variance showed that sequence did not significantly affect judgments (i.e., that responses to the first set encountered did not differ from responses to the second set, etc.), $F(3, 8064) = 0.022$, $p = 0.996$, $\eta^2 < .01$.

3.1.2. Consistency

Mean coefficients of consistency across the 253 subjects were 0.85, 0.87, 0.86, and 0.85 for the first, second, third, and fourth sets, respectively, that subjects encountered. A one-way analysis of variance of coefficient of consistency showed that sequence did not significantly affect consistency, $F(3, 1008) = 0.815$, $p = 0.486$, $\eta^2 < .01$.⁶ Mean coefficients of consistency for the four sets (regardless of the order in which the sets appeared) ranged from 0.84 to 0.87. An analysis of variance showed no significant difference among the four sets, $F(3, 1008) = 1.692$, $p = 0.167$, $\eta^2 < .01$.

3.2. Cause of loss

Fig. 1 shows the effect of cause of loss on the judged seriousness of the four target losses. All four of the losses were judged as more serious if caused by a human action than if caused by a natural event. There was little difference, however, among the three types of human-caused loss, although growth resulted in a slightly lower judgment of seriousness than did illegal action or carelessness. A two-way (cause-by-loss) analysis of variance including main effects and two-way interactions of the preference scores from the individual subjects found significant differences among types of

⁶Coefficient of consistency is not normally distributed, suggesting that a nonparametric test may be more appropriate. A Kruskal–Wallis test shows no significant effect of sequence on coefficient of consistency, $\chi^2 = 2.19$, $df = 3$, $p = 0.533$.

Table 3
Mean estimated choice probabilities of filler items

Item ^a	Set 1	Set 2	Set 3	Set 4
1	0.53	0.52	0.52	0.54
2	0.89	0.89	0.88	0.88
3	0.53	0.53	0.53	0.54
4	0.47	0.50	0.48	0.48
5	0.38	0.38	0.39	0.38
6	0.26	0.25	0.27	0.26
7	0.15	0.15	0.14	0.16
8	0.36	0.37	0.35	0.36

^aItems are listed in Table 1.

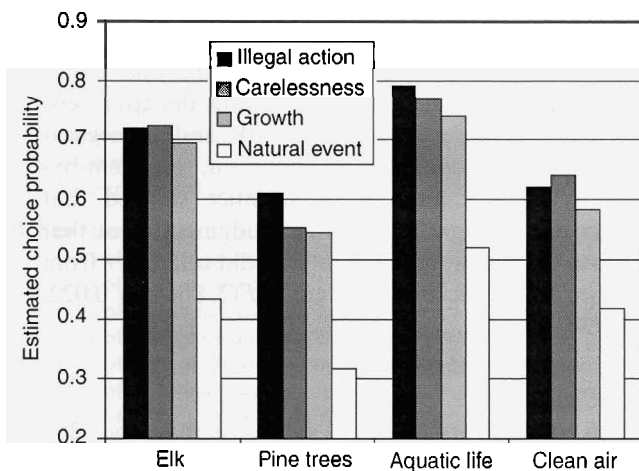


Fig. 1. Effect of cause of loss.

cause, $F(3, 4032) = 362$, $p < 0.001$, $\eta^2 = .21$, as well as a significant cause-by-loss interaction, $F(9, 4032) = 3.02$, $p = 0.001$, $\eta^2 < .01$. (Significant differences were also found between losses, as reported in the next section.) A Scheffe' test found that the seriousness of losses caused by illegal behavior was not significantly different from the seriousness of losses caused by carelessness ($p = 0.476$) but that the seriousness of losses caused by growth was significantly lower than that caused by illegal behavior ($p < 0.001$) or carelessness ($p = 0.011$), and that the seriousness of losses caused by natural events was significantly lower than that caused by any of the human causes ($p < 0.001$ for each of the three human-caused losses).⁷

⁷Because multiple responses were obtained from each subject, a statistical procedure that controls for repeated measures may be more appropriate. We reanalysed the data using the Mixed procedure in SAS to test for treatment differences, and reached the same conclusions about main effects and interactions. In addition, because of the significant cause-by-loss interaction, we ran multiple comparison tests separately for each loss, using the Tukey–Kramer multiple comparisons test with a Bonferroni adjustment to the alpha level to account for performing numerous separate tests. This approach confirmed that human-caused losses were always judged to be more serious than naturally caused losses; this was the case for each of the four target losses. However, among the human causes, losses due to

The significant cause-by-loss interaction can be explored by analyzing the causes two at a time. Two-way analyses of variance showed that the cause-by-loss interaction was significant ($p < 0.05$) for three pairs of causes: 1 and 2, 1 and 4, and 3 and 4. The interaction for causes 1 and 2 (illegal action and carelessness) is most evident in Fig. 1 because order reverses: loss of clean air was judged as more seriousness if caused by carelessness than by illegal action, whereas for two of the other losses the reverse is true. The interaction is likely due to the details of the descriptions of cause. For example, perhaps the use of “pollution” to describe the loss of clean air due to carelessness caused the loss to be more salient than did the use of “emissions” to describe that loss when due to illegal behavior. If we are correct about the cause of the interactions, they are of relatively little interest here, except to highlight the importance of wording in describing the causes of losses.

3.3. Relative seriousness

Fig. 2 shows the estimated choice probabilities of the 24 items. Illegal killing of eagles was considered the most serious loss. Losses of aquatic life by each of the three types of human action were next most serious, followed by losses of 200 elk by the three types of human action. The six next most serious losses were those of clean air and 1/2 square mile of pine trees by each of the three types of human cause. Accidental loss of the fish in City Park Lake (a small stocked lake) was next, followed by illegal poisoning of prairie dogs. The last nine losses included six naturally caused losses, partial loss of a view and loss of nighttime quiet both due to growth, and loss of 1/4 square mile of fir trees due to carelessness.

A two-way (item-by-set) analysis of variance on individual subject preference scores for the filler items showed that item was highly significant, $F(7, 8064) = 1052$, $p < 0.001$, $\eta^2 = .48$, but that the item-by-set interaction was not significant, $F(21, 8064) = 0.304$, $p = 0.999$, $\eta^2 < .01$. A Scheffe' test showed that each filler item was significantly different from each other filler item ($p < 0.003$) except for item 1 vs item 3 ($p = 1.0$) and item 5 vs item 8 ($p = 0.660$). And a two-way (cause-by-loss) analysis of variance on individual subject preference scores for the target items (mentioned in the previous section) showed that loss was highly significant, $F(3, 4032) = 181$, $p < 0.001$, $\eta^2 = .12$. A Scheffe' test showed that each target loss was significantly different

(footnote continued)

illegal behavior were considered more serious than losses due to growth for only three of the four losses, and more serious than losses due to carelessness for only one of the losses. Also, losses due to carelessness were considered more serious than losses due to growth for only one of the losses. Thus, in comparison with the Scheffe' tests reported in the text, there is less evidence for differences among the three types of human-caused losses.

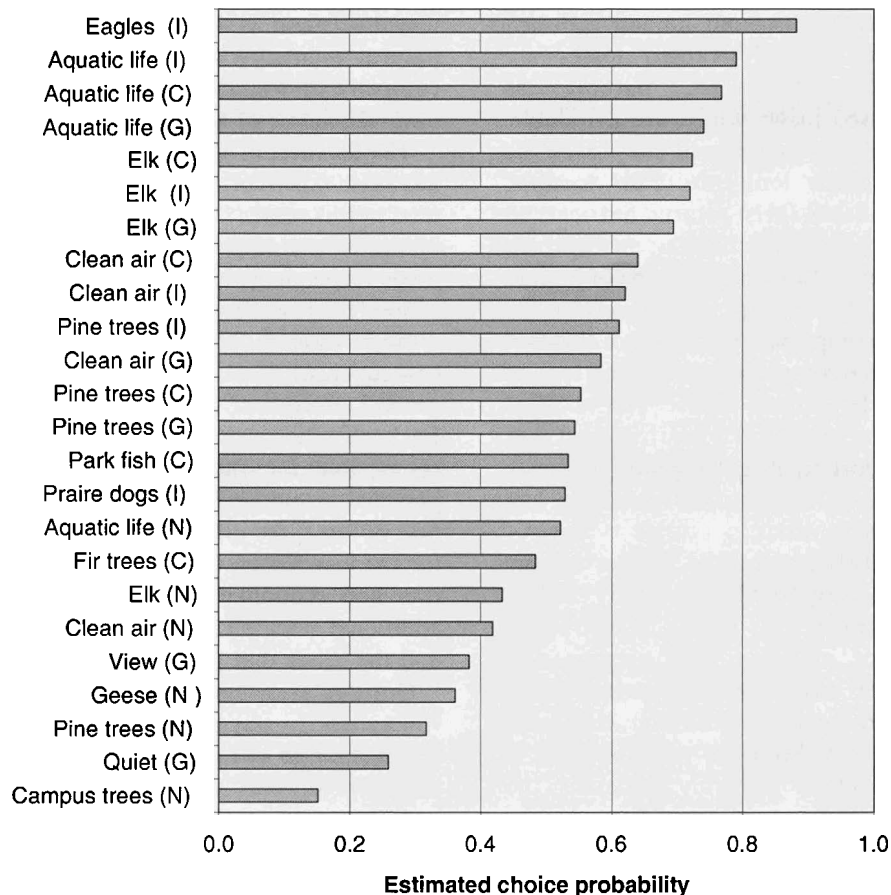


Fig. 2. Relative seriousness of losses. I = illegal, C = carelessness, G = growth, N = natural.

from each other target loss ($p < 0.001$). Thus, there was sufficient agreement among subjects to yield clear distinctions among the losses.

4. Discussion

Judged seriousness of environmental losses was clearly affected by the cause of loss as well as the nature and magnitude of the loss. Environmental losses were considered much more serious when they were caused by human actions than when caused by natural events. This finding is similar to that of prior studies (mentioned in the Introduction) that focused on “importance” of environmental losses or on how much society should be doing or is willing to pay to protect endangered species, and to studies that focused on compensation for personal injuries. Thus, the finding that human-caused losses are of greater consequence or concern than naturally caused losses appears to be robust to considerable variation in both the type of loss and the evaluation criterion.

In contrast to the strong distinction between human and natural causes, distinctions among the three types

of human cause—illegal behavior, carelessness, and the effects of growth—were relatively minor. Losses were significantly but only slightly more serious when they were clearly attributable to an individual or entity (as are illegal acts and carelessness) than when not clearly attributable (as are losses due to growth). And there was no consistent distinction between illegal behavior and carelessness.

It is perhaps not surprising that people’s judgments of the seriousness or importance of losses vary with the cause of the losses. All losses have causes, and judgments of losses may naturally lead to considerations of their causes. Judgments of the seriousness or importance of loss clearly allow cause to play a role, and that role may naturally lead people to separate between losses over which humans have some control and those, like naturally caused losses, over which they have little or none.

Losses can provoke a sense of violation, or a sense of responsibility (Baron & Ritov, 1993; Kahneman et al. (1993); Walker, Morera, Vining, & Orland, 1999). When environmental losses are caused by natural events, the sense of violation that is provoked, or the sense of responsibility for the loss that we may feel, is certainly

less than when the loss results from human actions.⁸ This may be because naturally caused losses are considered unavoidable and, indeed, “natural,” as opposed to human-caused losses which are avoidable. Further, some naturally caused losses may even be considered beneficial in the long run. For example, wildfire reduces accumulated fuels, returns nutrients to the soil, and can improve wildlife habitat. In contrast, human-caused losses, no matter what the type of human cause, may be considered unnatural impositions on the ecological order. It is perhaps partly because of this fact that the law provides no compensation for the loss of natural entities caused by natural events. The sense of violation at the loss of large trees in a nearby forest that one feels if they were lost to illegal logging is largely (though perhaps not totally) absent if the trees were lost to naturally occurring high winds.⁹

Kahneman et al. (1993) ascribe the greater importance of human-caused, as opposed to naturally caused, losses to a sense of outrage. This feeling of outrage is linked to the sense of violation that accompanies human-caused losses of environmental assets. When someone harms an environment we hold dear, they have taken something from us without our permission. It is this sense of violation that probably underlies the damage compensation codified in such laws as the Clean Water Act or the Oil Pollution Prevention Act, which Baker (1995) has argued is akin to the pain and suffering awards of torts.

Outrage applies best to illegal acts, and perhaps also applies well to carelessness, as in the case of the Exxon Valdez oil spill. It applies less well to the general effects of economic and population growth, to which we all to some extent contribute. Indeed, what remains surprising about the results is that loss caused by growth was judged as only slightly less serious than loss caused by

illegal acts and as so much more serious than loss from natural events. What is it that places growth in the company of willful unlawfulness, and so far from the natural scheme of things?

The location of this study—an area of Colorado that has been experiencing rapid growth—may have contributed to this result. Perhaps the frequent public discussion of the effects of growth that one finds in Fort Collins made respondents unusually sensitive to the issue. In this context a sense of outrage is probably less salient than is a sense of concern, or even in some cases guilt, about the consequences of our own actions or at least about the general process of human activity and consumption.¹⁰ Each of the respondents was in some small way responsible for the effects of growth. A feeling of personal responsibility may affect judgments of seriousness of loss if the judges are themselves partly responsible for the loss. Given the expected continuation of population and economic growth in the US and elsewhere, additional research on people’s attitude toward growth and the losses that growth brings seems warranted.

Outrage also may not be the full explanation when willingness to pay (WTP), rather than seriousness or importance, is at issue because questions of WTP raise the issue of *who* should pay. Some evidence of the importance of attribution in WTP judgments is found by comparing the study by Kahneman et al. (1993), mentioned above, with that by Walker et al. (1999). Most of the losses used by Kahneman et al., when described as human-caused, were not easily attributable to specific individuals.¹¹ Kahneman et al. found for those losses that willingness to pay increased with judged importance. Walker et al. qualify the Kahneman et al. finding by showing that WTP to restore human-caused losses depends also on who caused the loss. In their study, subjects were willing to pay less when the cause was human than when it was natural if the human cause was “a corporation dumping waste.” In this case the responsible party was clearly identifiable and clearly at fault, and illegal behavior was implied.

As this WTP example highlights, seemingly minor differences in the description of a loss or its cause may have important effects on judgments. To further illustrate the point, consider a category of human cause of loss that we did not evaluate in this study—intentional but legal loss with a clear causal link, such as the loss of a view of the mountains from growth of trees in a neighbor’s yard

⁸Responsibility for the occurrence of a damaging natural event may be absent, but humans are often considered at least partly responsible for losses caused by natural events if they could have taken reasonable defensive actions to lessen or avoid the loss. For example, to avoid loss from floods we may avoid building in the flood plain, to lessen personal damage from tornadoes we may fund warning systems that alert people of impending strikes, and to lessen the chance of loss from wildfire we may fire-proof homes and limit vegetation near the homes.

⁹In our study, there was no mention of punishment of the injurer. Because the possibility of punishment was unspecified, subjects were left to make whatever assumptions they chose. Such assumptions could have enhanced the judgments of seriousness of human-caused, as opposed to naturally caused, environmental losses. We do, however, have a suggestion, in the work of Baron, that the possibility of punishment of the injurer is not essential to a distinction between judgments of naturally caused and human-caused losses. As mentioned in the Introduction, Baron (1993) controlled for the possibility of punishment in his study of personal injury losses by instructing subjects that compensation would have no effect on the injurer, yet he still found that some subjects’ assessments of compensation for injured parties were higher for human-caused injuries than for naturally caused injuries.

¹⁰A sense of violation may also help to explain the results of studies of compensation for personal injury. If subjects desire to compensate victims for the violation they have suffered as well as for the physical loss, more compensation would be due following a human-caused loss than following a naturally caused loss.

¹¹Of the eight human causes, five were very general (e.g., “pollution”, “pesticides”) and two were more specific but still involved numerous people (“hunters”, “arsonists”). The remaining, more specific cause was “offshore oil spills”.

(in the absence of covenants prohibiting such obstructions). With this loss, four of the conditions for assigning responsibility—a causal link, free will, awareness and intention—can be assumed, but there is no obligation for the tree owner to top or remove the offending trees. Other categories of loss are also feasible, and each different category, with its unique blending of the five conditions for assigning full responsibility, may imply a different level of responsibility.

As a considerable literature in philosophy and psychology attests, and this study corroborates, cause and responsibility are many-faceted concepts. Apparently subtle differences in the cause of a loss can affect judgments of the seriousness or importance of a loss, or WTP to lessen or avoid the loss. Additional research is needed to better understand the complicated links among loss, cause, and responsibility as applied to environmental as well as other kinds of losses.

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