ABSTRACT. This paper reports on the responses of 646 individuals to environmental risk information involving different forms of risk ambiguity. Recipients of more than one set of risk information do not simply average the risk levels provided. Rather, a variety of aspects of the nature of the risks that are communicated influence their probabilistic beliefs. Individuals' perceptions of the risk levels to which they are exposed are likely to be greater: (i) for more ambiguous risks, (ii) for risks for which the unfavorable risk evidence is presented last even when there is no temporal order, (iii) for risks for which the most unfavorable risk studies have been performed most recently, and (iv) for risks where there is asymmetry in the risk ambiguity that imposes substantial potential downside risks. Although these effects are modest for the median individual, the potential for extreme responses that reflect only the most adverse or the most favorable piece of information provided is quite prevalent. These findings are of interest more generally in that they indicate how individuals form their risk perceptions in the presence of risk ambiguity.

Keywords: ambiguity, uncertainty, Ellsberg Paradox, information.

1. AMBIGUITY AND RISK COMMUNICATION

Risk communication efforts provide risk information to individuals so that they can make more informed decisions about the risks they face. Informational policies can affect behavior when there is a difference in the risk information of the two parties. One party, typically the government or the producer, has more information about a particular risk than does the individual exposed to the risk. The purpose of risk communication policies is to transfer this information to the parties that can use the information to improve their decisions.

In situations in which the provider of the risk information has perfect knowledge, the question is primarily one of conveying this knowledge to the user in the most effective way possible. In many important instances of risk communication, however, even the better informed party does not have perfect information. There will necessarily be considerable uncertainty regarding the exposure level of the
affected individuals and differences in the risk according to individual sensitivity. Even more fundamentally, there may be underlying scientific uncertainty.

Suppose, for example, that the government believes that there is a potential risk of cancer from a particular environmental exposure, but it is not sure of the extent of the risk. Some studies indicate that the risk is small, but others indicate a larger risk. How should the government attempt to convey this information? Should it indicate the upper end of the risk range? Should the government communicate the lower end of the risk range? Should it simply provide the mean or the median estimate of the risk value and not indicate that there is ambiguity pertaining to the risk?

Choosing among these various alternatives often creates important problems from the standpoint of long-term credibility. If we tell individuals of a specific risk now and then must change our risk assessment in the future, then the credibility of the information provider will be undermined. Moreover, the manner in which this credibility is undermined may depend on whether the subsequent information provided is more or less favorable than was originally given. Truthful disclosure of information would require that we convey the presence of ambiguity pertaining to the risk, but the danger is that individuals may not be able to process ambiguous risk information reliably, and thus their resulting decisions will not be sound.

The problem in communicating ambiguous risks stems from the difficulties individuals have in dealing with probabilities that are not known with precision. The paper by Ellsberg (1961), for example, highlighted the potential role of individual aversion to ambiguous probabilities of winning a prize, as compared with comparable probabilities known with precision. In the case of environmental risks, the reference point is not hypothetical lotteries but instead scientific studies. More importantly, the ambiguity pertains not to the chance of winning a positively valued outcome as in the Ellsberg experiment, but the chance of suffering a negatively valued loss. It also may be that individuals' attitudes toward ambiguity depend on whether they are facing gains or losses.

From the standpoint of a single decision, individuals seeking to maximize subjective expected utility should be indifferent to a prob-