Economic Damage from Water Resource Contamination

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We can protect the quality of our nation's water resources in two basic ways – through prescriptive regulations and liability laws. The first method, prescriptive regulation, limits emissions of pollutants and governs the technologies of production and pollution control. For example, The Clean Water Act has regulated discharges of organic materials and other non-persistent substances in this way for many years.

However, as Love Canal, Times Beach, Exxon Valdez, and the less publicized Superfund sites have illustrated, a legacy of discharged hazardous substances from pre-regulation polluters still remains to be cleaned. In addition, existing regulations often do not cover accidents, which will definitely continue to occur.

To help prevent accidents, firms that engage in risky activities must receive a strong message to take all appropriate precautions. Liability, a long-standing approach to regulating risky behavior, sends that message by holding agents financially responsible for damage when accidents do occur. As it applies to environmentally risky activity, such as the storage and transportation of hazardous material, liability assigns responsibility to the individual who has perpetrated the accident. When environmental damage does occur, the government assumes the role of trustee for the environmental resources and acts as the injured party.

The basic problem facing a trustee is to determine the damage to the environment. Water resources such as groundwater, rivers, lakes, and coastal areas can be accidentally or intentionally damaged by many pollutants, through storage tank leaks, pipeline leaks, and surface discharge of wastes. For example, the Guadalupe Dunes in California were damaged when pipelines in an oilfield leaked diluents over many years, causing surface water and groundwater contamination. But how does one determine the monetary value of that damage?

Damage Assessments

It is important to recognize that the overall cost of environmental damage does not simply equal the cost of cleaning up the contamination and returning the resource to its original state. If you are injured in an auto accident and take one year to heal, the totality of your damage includes both the cost of restoring your health and the value of a temporary loss in quality of life. Similarly, if a beach is out of commission for a year during an oil spill clean up, then damage includes the temporary loss of services from that beach.

To an economist, a natural resource is considered damaged when individuals or firms would be willing to pay to avoid the change, for whatever reason. The damage claim could be based on use value, a temporary or permanent loss in access to the resource. When a beach is closed for a year, for example, it is not available for sunbathing, swimming or similar use. A more subtle type of damage is called non-use value, principally existence value. For instance, consider a hazardous waste spill that harms an endangered species of fish. Few if any people actually *use* the endangered fish or even encounter it in their life, yet many people are willing to pay to protect an endangered species. Consequently, when an endangered species is harmed, damages may occur, regardless of how much contact people have with the species.

When water resources are damaged, how is the damage assessed? It may be couched in monetary terms (dollars) or in terms of replacement services, such as a project that will supply similar environmental services as those that were lost. In the latter case, the substitute project may provide physically similar services or broadly-defined equivalent services. In the case of groundwater contamination, a project may provide additional water resources (surface or subsurface) by replacing inefficient agricultural irrigation equipment with more efficient equipment, freeing up water that would otherwise have been consumed. Or a project may be proposed that enhances the survivability of an endangered frog. The economic benefit of enhancing the survivability of the frog may be determined to be the same as the economic loss from the damaged water resources. In this case, the project is provided as compensation for the damaged water resources.

Resource Valuation

In most of these cases, it is important to quantify the broadly-defined economic value of the damaged water resources or the alternative project offered as compensation. Economists typically take one of the following two approaches. One is to conduct a detailed analysis of the project in question, measuring the resource value as determined by affected individuals and firms. Another, less costly, approach is termed benefits transfer. This method relies on detailed resource valuation studies that have been completed elsewhere on similar natural resources. Using these estimates, one can infer the appropriate valuation for the damaged resource under consideration.

When conducting analyses for a specific case of natural resource damage, economists use either the revealed

preference method or contingent valuation. The revealed preference method relies on observations of changes in individual behavior in actual market settings, while contingent valuation relies on direct questioning of individuals. In either case, it is important to realize that the analysis is valuing a change, not determining an absolute value. In other words, it would be inappropriate to try to come up with the value of a section of the Colorado River. What would be appropriate would be to value a specific change in water quality for the Colorado River.

Methods that rely on revealed preference are usually preferred for generating estimates of damage. For instance, in determining the demand for access to a beach for recreation, one can observe how much money people spend to travel to the beach and from this infer how beach visitation costs effect the beach visitation rate.

Contingent valuation involves the careful construction of questionnaires, which posit a scenario of environmental change. Respondents are asked their willingness to pay in order to avoid the environmental change. Although this method can apply to virtually any type of environmental damage, it suffers from the hypothetical nature of the questionnaire. Some consider this a serious flaw; others consider it only a minor problem.

Revealed preference methods require the existence of a market that is coupled with the environmental asset, a market that does not always exist. Contingent valuation has no such restriction and can be apply in nearly all situations.

Changing Nature of Environmental Litigation

There is a great deal of activity and research in the field of quantifying natural resource damage. With these methods, economists have been able to make profound progress in placing substantial economic value on non-marketed environmental resources. This progress has, in turn, shaped the legal debate over environmental protection and, as illustrated by prominent cases such as the Exxon Valdez, changed the nature of environmental litigation.

For additional information see page 31.

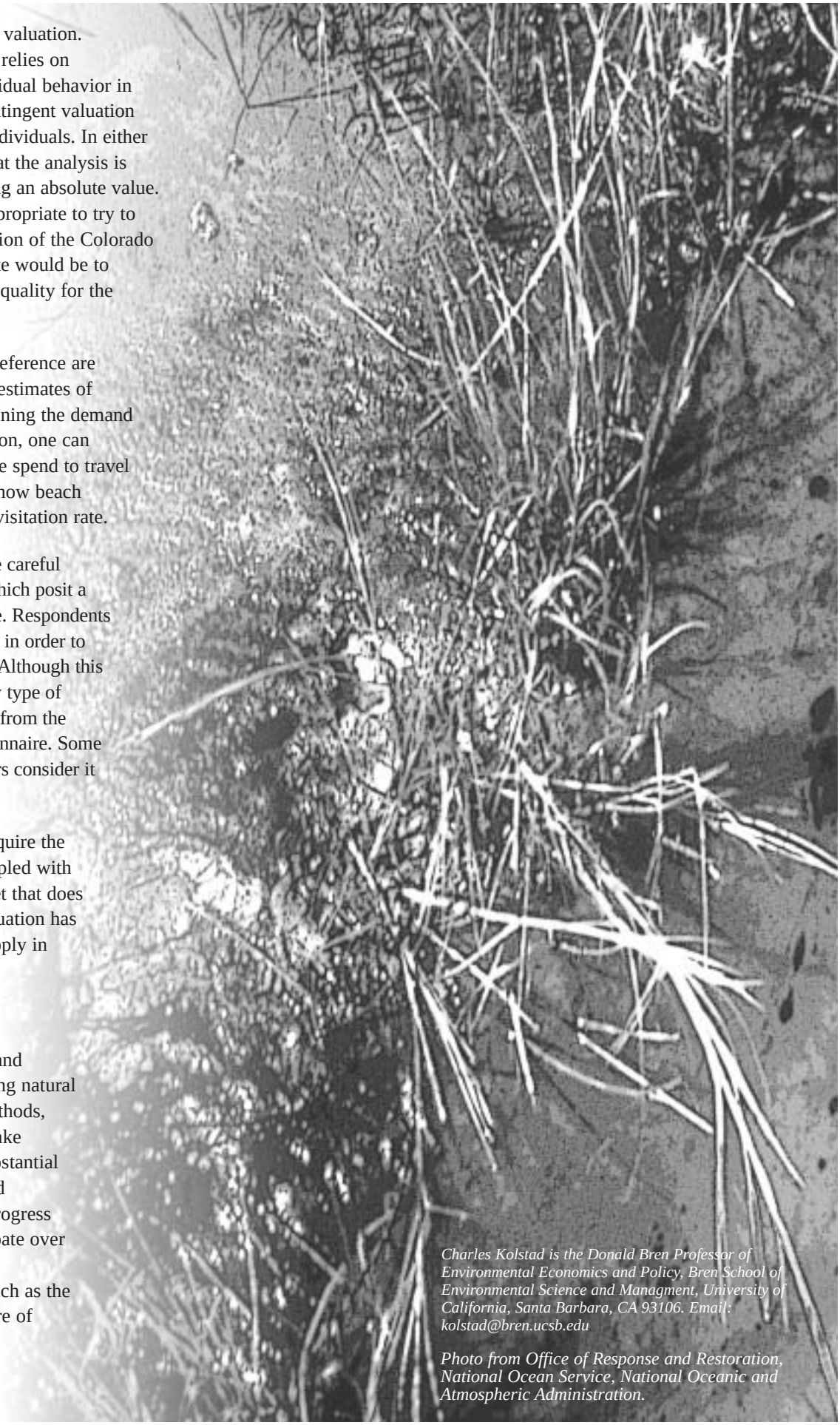

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Photo from Office of Response and Restoration, National Ocean Service, National Oceanic and Atmospheric Administration.

SOURCES FOR ADDITIONAL NRDA NFORMATION

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- *National Resource Council, 1997. Valuing Ground Water - Economic Concepts and Approaches, , National Academy Press.*
- *.National Oceanic and Atmospheric Administration, 1997. Natural Resource Damage Assessment Guidance Document: Scaling Compensatory Restoration Actions (Oil Pollution Act of 1990).*

Web Sites for Department of Interior Regulations and NRD assessments in general:

- *DOI Natural Resource Damage Assessment and Restoration Program: restoration.doi.gov*
- *CERCLA Natural Resource Damage Assessment Regulations: www.doi.gov/oepc/frlist.html*
- *NRD-related statutory information: www.epa.gov/superfund/programs/nrd/statute.htm*

Economics aspects:

- *Carson, Richard, in press. Contingent Valuation: A Comprehensive Bibiography and History. Edward Elgar, Cheltenham, UK.*
- *Kolstad, Charles, 2000. Environmental Economics. Oxford University Press, New York.*
- *Deacon, Robert, and Charles Kolstad, 2000. Valuing Beach Recreation Lost in Environmental Accidents. J. Water Resources Planning and Management, 126:374:81.*