

Why Care About the Polar Bear?
Economic Analysis of Natural Resources Law and Policy

By Lisa Heinzerling*

Cost-benefit analysis is all the rage in pollution control law. So far, however, it has not played as significant a role in the evolution of natural resources law and policy. Perhaps this is because U.S. natural resources law has, as a whole, been characterized by quite weak standards and even weaker implementation. To the extent that cost-benefit analysis is wheeled out, as I believe it often is, only to defeat regulation that might otherwise be thought a good idea, it may not have been a large feature of natural resources law only because natural resources law has not been substantively threatening enough to prompt the deployment of this economic tool.

Whatever the reason for the relative absence of cost-benefit analysis in the field of natural resources law, would it be a positive development if cost-benefit analysis were used more often in this context? I will argue here that the answer is no. I will develop this argument by considering a specific case study: how economic analysis might evaluate public policies to protect the polar bear. I will suggest that none of the most important reasons why we might want to protect the polar bear will be meaningfully reflected in economic analysis.

I have picked the polar bear as my example because it presents a puzzle. I do not think it can be denied that the public cares a great deal about the fate of the polar bear. Consider the public's reaction to the threat to the polar bear posed by climate change. Many different factors have combined to focus public attention on climate change, but surely one of the items at the top of the list must be the widely circulated photos of apparently struggling, perhaps even drowning, polar bears. More than one person has told me that the photos changed her life – inspired her to

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change her driving habits, her patterns of consumption, in one case even her professional purpose. If climate change has a face, it is the white-furred, black-nosed face of a polar bear.

Yet the overwhelming majority of us will never use a polar bear or even see one outside captivity. We will not eat its meat, wear its fur, or even travel to see it. Nor, in all likelihood, will we make any use of the Arctic marine resources – the ringed seal on which the polar bear feeds, the small fish and krill on which the seals feed, and so on down the ecological chain – which depend on the polar bear for their own flourishing and even survival. Our economic relationship with the polar bear, conventionally speaking, is nil.

There are exceptions among us, to be sure. Despite the odds against them, the Inuit of Canada have maintained a close economic connection to the polar bear. They continue to hunt the polar bear for subsistence purposes. They sell polar bear pelts. And they sell some of their hunting rights to trophy hunters. These hunters pay up to \$27,500 for the privilege of trying to kill a polar bear. In addition, growing numbers of tourists are traveling to the Arctic to observe the polar bear in its natural habitat.

Beyond these mainstream economic values lie the monetary value individuals place on “non-uses” of the polar bear, including having the option one day to see a polar bear in the wild, being assured that one’s descendants could make use (or non-use) of the polar bear if they wished, and simply knowing that the polar bear exists. These sources of value have produced exceedingly large estimates of the economic worth of species other than the polar bear. If similar values obtained for the polar bear, the non-use values of the polar bear would, first, be huge, and second, greatly exceed the conventional economic value of this animal.

Thus, despite the rather narrow direct economic uses of the polar bear, the polar bear has the potential to have a gigantic monetary value. But that is assuming that non-use values are

taken into account, which is by no means certain given current cost-benefit practices. Equally troubling for the polar bear's bottom line, moreover, is that the bear does not appear to be in imminent danger of extinction. Current research predicts that the polar bear, though doomed if we continue business as usual, will not actually become extinct for another 50 years or so. The way cost-benefit analysis is currently practiced, the government would calculate the benefits of protecting the polar bear *as of the time the bear would otherwise be materially harmed*. If that date lies in the future – as it appears to for the polar bear – then the government would discount those benefits over the interval between the present and the time when the harm will occur. The theory behind discounting is that costs and benefits that lie in the future are not as valuable as present costs and benefits. Discounting any benefits over a period as long as 50 years, particularly at the 7 percent rate favored by current government practice, will greatly diminish their apparent worth.

More fundamentally, asking questions about the monetary value we place on the very existence of the polar bear, and discounting that amount as if it were money and only money, misses the deepest and most profound reasons why we care about the polar bear. We can obtain very large economic values for the polar bear only by insisting that people reduce their admiration for and worries about the animal to monetary terms, but paradoxically, by doing so we cast aside or even denigrate the aesthetic, spiritual, and moral impulses that drive people to report large monetary values for animals like the polar bear. Discounting the future worth of the species as if it were money only compounds this basic mistake.

My discussion proceeds as follows. First, I will say a few words about the polar bear itself: the animal, its habitat, and the threats it faces. Second, I will discuss the economics of the polar bear: how to calculate how much it is worth if we use it and how to calculate how much it

is worth if we don't. I will also discuss how the likely temporal remoteness of the polar bear's demise affects the economic value of the animal. Finally, I will explain how seeing the worth of the polar bear in economic terms adds next to nothing to our understanding of how we value the polar bear, while at the same time subtracting a great deal. Cost-benefit analysis, in this context, is a way of *losing* information rather than generating it. As such, there is little to commend it.

I. The Polar Bear

Evolved from the brown (grizzly) bear 100,000 or more years ago,¹ polar bears now occur in 19 different populations in the Arctic.² The estimated 20,000-25,000 living polar bears³ can be found in five countries, often called the "polar bear nations": Canada, Greenland, Norway, Russia, and the United States.⁴ The polar bear is the largest living bear species and the largest land carnivore.⁵ It eats mostly ringed seals (and of these, mostly pups and their mothers),⁶ but it also eats other kinds of seals and sometimes walruses, narwhal, and belugas.⁷ Male polar bears live about 25 years, females often a few years longer than that.⁸ Females begin having cubs when they are 5-6 years old.⁹ Litters are small – typically two, rarely three, cubs.¹⁰ The cubs stay with their mothers until they are almost 2-1/2 years old.¹¹ As a consequence of their late sexual maturity, small litters, and prolonged period before weaning, polar bears have a

¹ IAN STIRLING, POLAR BEARS 22 (1988).

² Fish and Wildlife Service, Endangered and Threatened Wildlife and Plants; 12-Month Petition Finding and Proposed Rule to List the Polar Bear (*Ursus maritimus*) as Threatened Throughout Its Range, 72 Fed. Reg. 1068, 1068 (Jan. 9, 2007) ("Listing Proposal").

³ Listing Proposal at 1068.

⁴ Listing Proposal at 1066.

⁵ Stirling at 23.

⁶ Stirling at 120.

⁷ Stirling at 134-135.

⁸ Stirling at 139.

⁹ Stirling at 89-90.

¹⁰ Stirling at 84.

¹¹ Stirling at 81.

very low reproductive rate.¹² The polar bear is regarded as a keystone species in its Arctic ecosystem, one that has a large influence on the ecological community in which it lives.¹³

Polar bears live most or all of their lives on the Arctic sea ice; this is, indeed, why they are considered marine mammals.¹⁴ Many of the polar bear's physical characteristics – from its water-repellant guard hairs to its paddle-like feet – are adaptations to the animal's life on the ice.¹⁵ Polar bears are frequently on the move to adjust to moving sea ice; the movement of sea ice affects the distribution of the seal population on which they depend.¹⁶ In the areas where sea ice melts during the summer, the bears come ashore until the sea freezes over again.¹⁷ Female bears use their land habitat for digging their dens.¹⁸ While on land, the bears typically live off their fat reserves, sometimes going as long as eight months without food.¹⁹

Polar bears are, in short, utterly dependent on sea ice. They hunt from there, rest there, and mate there.²⁰ They use it as a surface for moving from place to place, including to their denning areas.²¹ As land is to humans and water is to fish, the sea ice is to the polar bear.

It should come as little surprise, therefore, that the changes in sea ice conditions due to climate change, both those already observed and those predicted for the future, are expected to take a terrible toll on the polar bear. Since 1978, scientists have reported a decline of 7.7 percent per decade in late summer Arctic sea ice and a decline of 9.8 percent per decade in perennial sea ice.²² It appears that the rate of decline has accelerated in recent years. The loss of sea ice has

¹² Stirling at 142.

¹³ I. Stirling & A.E. Derocher, *Possible impacts of climatic warming on polar bears*, 46 ARCTIC 240 (1993).

¹⁴ Listing Proposal at 1065.

¹⁵ Stirling at 24.

¹⁶ Stirling at 61.

¹⁷ Stirling at 159.

¹⁸ Stirling at 64-65.

¹⁹ Stirling at 146.

²⁰ Listing Proposal at 1067.

²¹ Stirling at 193.

²² Listing Proposal at 1071.

been accompanied by longer “melt seasons”; most dramatically, in 2005, the melt season arrived approximately 17 days earlier than usual.²³ About half of existing climate models predict that Arctic summers will be virtually ice-free by 2100.²⁴ Other researchers have predicted that the Arctic will be ice-free by 2060 if warming trends follow their current path.²⁵

The changes in sea ice affect the polar bear in many different ways. Weight loss,²⁶ lower reproductive rates,²⁷ reduced survival rates for cubs,²⁸ starvation,²⁹ and even drowning³⁰ are among the consequences. To the extent, moreover, that changes in the Arctic habitat also affect the polar bear’s prey, the polar bear will be affected, too.³¹

Climate change is not the only threat to the polar bear. Habitat loss and modification due to other causes such as oil and gas development, illegal hunting, and chemical contamination are all concerns, though some – especially hunting – vary greatly depending on the specific bear population under discussion.³² But in terms of gauging long-term survival of the species, climate change is the threat of greatest concern. In the words of the head of the U.S. Department of the Interior upon announcing a proposal to list the polar bear as a threatened species under the Endangered Species Act, “the polar bear’s habitat may literally be melting.”³³

The questions are: Why should we, why do we, care? Does economics help us to understand why we care and to decide what to do?

II. The Economics of the Polar Bear

²³ Listing Proposal at 1071.

²⁴ IPCC, *Climate Change 2007: The Physical Science Basis* 16 (Feb. 2007), available at <http://www.ipcc.ch>.

²⁵ Listing Proposal at 1072.

²⁶ Listing Proposal at 1072, 1073, 1076, 1080.

²⁷ Listing Proposal at 1072, 1073, 1076, 1080.

²⁸ Listing Proposal at 1075, 1076.

²⁹ Listing Proposal at 1076, 1085.

³⁰ Listing Proposal at 1076, 1077.

³¹ Listing Proposal at 1074-75.

³² Listing Proposal at 1081-85, 1091-94.

³³ Fish and Wildlife Service, Interior Secretary Kempthorne Announces Proposal to List Polar Bears as Threatened Under Endangered Species Act (Dec. 27, 2006), available at http://www.doi.gov/news/06_News_Releases/061227.html.

There are several possible components of the economic value of natural resources. First, most conventionally, is the value associated with actually consuming or using the resource. If we buy a plate of polar bear meat or a pelt of polar bear fur, we can look upon the market price of the meat or the fur as an indicator of its economic value. Sometimes this calculation is complicated by the fact that the resource use is not directly sold in markets. Thus, for example, if we travel to the Arctic to observe the polar bear in its natural habitat, our plane tickets have a market price but the animal itself does not. But by considering the price of travel, one can find at least some signal of the animal's economic value. Similarly, many natural resources play a role in ecosystems that, if the resources were depleted, would have to be performed (if this is even possible) by a manmade piece of equipment or other technology that itself has a market price. Here, too, therefore, one might take market prices as a sign of the economic value of the resource. This is, in simplified form, the economic component of the notion of "ecosystem services."³⁴

Beyond these quite traditional, if complex, market values, many economists have also recognized that people are willing to pay for the protection of natural resources even when they do not use them. People are willing to pay, for example, for having the option to use a resource in the future, to know that their descendants and future generations will have the opportunity to use the resource, and for the simple knowledge that the resource is still here. Known in the jargon as "option," "bequest," and "existence" values, these values are impossible to measure using market behavior because no market activity is associated with them. We might care deeply about the polar bear, for example, and yet engage in no economic transaction that expresses our concern.

³⁴ See, e.g., Peter Morton, *The Economic Benefits of Wilderness: Theory and Practice*, 76 U. DENV. L. REV. 465 (1999).

In these circumstances, economists have turned to the technique of contingent valuation.³⁵ Contingent valuation is, essentially, an elaborate opinion poll. Survey respondents are asked to report on the amount of money they are willing to spend to protect a particular natural resource. Results are tallied to estimate the monetary value associated with the resource's non-use values. The numbers obtained in these surveys can be enormous: a famous contingent valuation study conducted in the wake of the Exxon Valdez oil spill, for example, concluded that as a nation we would be willing to pay as much as \$9 billion to avoid the non-use losses associated with another similar spill.³⁶

Using these various valuation techniques as our guide, what is the polar bear worth? Given the paucity of quantitative data on the economic value of the polar bear, I will not attempt a precise estimate here. I will, instead, simply describe the ways in which the polar bear's worth could be measured in economic terms and offer quantitative figures where they are available.

A. Use Values

The market for polar bear products (meat, fur, teeth, claws, etc.) has been strictly regulated since 1973, when the international Agreement on the Conservation of Polar Bears was signed by the polar bear nations. This agreement generally prohibits hunting, killing, and capturing polar bears, but makes an exception for "local people using traditional methods in the exercise of their traditional rights."³⁷ In the United States, polar bears are also protected by the Marine Mammal Protection Act, which also generally prohibits hunting, killing, and capturing polar bears yet allows Alaska native populations to hunt polar bear for subsistence purposes or to

³⁵ For an excellent introduction to and defense of contingent valuation, see W. Michael Hanemann, *Valuing the Environment Through Contingent Valuation*, 8 J. ECON. PERSP. 19 (1994).

³⁶ FRANK ACKERMAN & LISA HEINZERLING, PRICELESS: ON KNOWING THE PRICE OF EVERYTHING AND THE VALUE OF NOTHING 156 (2004).

³⁷ Agreement on the Conservation of Polar Bears, Nov. 15, 1973, 27 UST 3918, 13 ILM 13 (1974), Article III(d).

create and sell traditional handicraft and clothing.³⁸ Thus, despite international and domestic protections, the polar bear has several conventional economic uses. Some of these depend on killing the bear; others do not.

1. Nonexistence Values

Native populations in Canada, Greenland, and the United States may hunt polar bears; in Norway and Russia they may not.³⁹ The native populations in Canada, Greenland, and the United States eat polar bear meat and fat; they make polar bear pelts into items like parkas and pants; and they use polar bear parts such as teeth and claws to make traditional handicrafts.⁴⁰ Because subsistence uses of the polar bear for meat or other purposes do not entail an economic transaction, placing a dollar value on these uses would be somewhat complicated. In theory, certainly, one could price the value of replacement meat, for example, and thus derive a rough estimate of the economic value of polar bear meat. (Notice, however, how complicated things are even here: the Inuit eat polar bear meat for spiritual as well as physical sustenance; a pork chop wouldn't quite cut it as a substitute.) Other consumptive uses of polar bear parts do involve economic transactions. For example, handicrafts such as jewelry may be sold to tourists in Alaskan native villages and brought home with the tourists.⁴¹

In Canada and Greenland, native populations are permitted to sell a portion of their polar bear harvesting quotas to non-residents.⁴² These rights come with a hefty price tag. Trophy hunters pay as much as \$27,500 for the privilege of participating in a polar bear hunt (no success guaranteed).⁴³ They, too, may bring their booty home with them. Some idea of the economic

³⁸ 16 U.S.C. 1371(b).

³⁹ Listing Proposal at 1081-82.

⁴⁰ Listing Proposal at 1081.

⁴¹ See U.S. Fish and Wildlife Service's polar bear fact sheet at <http://alaska.fws.gov/law/pdf/polarbear.pdf>.

⁴² Listing Proposal at 1082.

⁴³ Katherine Harding, Putting a chill on the polar bear hunt, *The Globe and Mail* (Canada) (Apr. 3, 2007).

scale of this market can be gleaned from the fact that from 2002-2005, the United States granted 252 separate requests to import polar bear trophies.⁴⁴ Recent estimates indicate that trophy hunters bring approximately \$2.9 million into the economy of Nunavit, the Canadian province that has the largest number of polar bears.⁴⁵

2. Ecovoyeurism

The polar bear has economic value even when it is not dead. In the United States, the gross economic value of live bear viewing (including the brown bear as well as the polar bear) was estimated at \$485 million in 1995.⁴⁶ If anything, it appears that this value has risen in recent years. Travel companies now offer Arctic “safaris” including “polar bear sightings (not guaranteed),” at a cost of as much as \$20,000 per person.⁴⁷ Remarkably, some travel entrepreneurs have turned climate change itself into a tourist opportunity: islands in Norway’s Svalbard archipelago, for example, advertise themselves as places to go to witness firsthand the already-dramatic effects of climate change on the Arctic.⁴⁸

Polar bears are also zoo favorites. Knut, the polar bear cub born in late 2006 and raised by a Berlin zookeeper after his mother rejected him, has become a worldwide phenomenon. Shares of the company that operates the Berlin Zoo climbed over 100 percent in value in the first months of Knut’s life.⁴⁹ Some observers speculated that the Knut “brand” could be worth as

⁴⁴ Listing Proposal at 1084 Table 2.

⁴⁵ Harding, *supra* note 43.

⁴⁶ Harvey Lemelin, Conservation strategies in North American bear viewing areas – A comparative analysis of management policies in connection with bear observation activities in bear congregation, 2001 Leisure Research Symposium, available at <http://216.239.51.104/search?q=cache:22BG3pA4RVkJ:www.ahs.uwaterloo.ca/~garls/2001abstracts/harvey.htm+polar+bear+viewing+%24485+million&hl=en&ct=clnk&cd=1&gl=us>.

⁴⁷ Advertised as the “Great Canadian Expedition,” at http://www.hilton.com/en/hi/hotels/hotelpromo.jhtml?ctyhocn=TORHITW&promo=Great_Canadian_Expedition_Package.

⁴⁸ Arctic islands pitch climate tourism, Sydney Morning Herald (May 17, 2007), available at <http://www.smh.com.au/news/World/Arctic-islands-pitch-climate-tourism/2007/05/17/1178995330288.html#>.

⁴⁹ Andreas Hippin, Berlin Zoo Stock Jumps on “Knut” Polar Cub Brand Bets (Apr. 3, 2007), available at <http://www.bloomberg.com/apps/news?pid=20601100&sid=adjAaVeZ5wRU&refer=germany>.

much as \$13 million to the zoo.⁵⁰ Knut has drawn over a million visitors.⁵¹ Lesser-known polar bears also attract many visitors to zoos every year. As of February 2007, Polar Bears International estimated that there were 246 polar bears in captivity at 104 different zoos around the world.⁵² And Baltimore's Magnet the polar bear won the computer game Zoo Tycoon's national "Beast in Show" award in 2001.⁵³ It is hard to know, of course, exactly what the economic value of captive and virtual polar bears says about the economic value of the polar bear as a species, but at the least it is suggestive.

3. Ecosystem Services

Polar bears are the largest land predator in the Arctic, and indeed in the world.⁵⁴ Their status as a species affects all of the species situated below them on the ecological pyramid. Imbalance in the polar bear population would likely create imbalance in the seal populations on which they depend, which would create imbalance in the krill and fish populations on which the seals depend, and so on. I am not aware of any attempt to measure the economic value of the polar bear's contributions to the Arctic ecosystem, and I will not make such an attempt here. The simple point for present purposes is that the polar bear's economic worth extends beyond the animal itself to include the ecosystem to which it contributes.

B. Non-Use Values

I am also unaware of any economic research on the non-use value of the polar bear. There are, however, quite a few studies attempting to elicit the non-use value of other, similarly "charismatic" species. As noted above, these studies use the technique of contingent valuation to

⁵⁰ Ibid.

⁵¹ Adam Williams, Berlin welcomes polar bear Knut's millionth visitor (July 5, 2007), available at <http://www.reuters.com/article/lifestyleMolt/idUSL0585860220070705>.

⁵² This calculation was based on information provided by Polar Bears International, at <http://www.polarbearsinternational.org/zoos-with-polar-bears>.

⁵³ Baltimore Bear's Animal Magnetism Earns Stardom, Job Offer (Dec. 13, 2001), available at http://pc.gamezone.com/news/12_13_01_10_20AM.htm.

⁵⁴ Stirling at 23.

try to identify the value people place on species even when they do not use them. According to such studies, the average household would be willing to pay \$216 to protect bald eagles, \$173 to protect humpback whales, and \$67 to protect gray wolves.⁵⁵ Tallied across the whole U.S. population, this means \$23 billion for bald eagles, \$18 billion for the humpbacks, and \$7 billion for the wolves.⁵⁶ To put these numbers in perspective, we could observe that the total budget for the U.S. Department of the Interior – charged with protecting not only all threatened and endangered species, but also with managing about 500 million acres of public lands – was less than \$11 billion in 2006.⁵⁷ The numbers gleaned from contingent valuation studies also show that the non-use values associated with resources are often larger than the use values. In the case of the Exxon Valdez spill, the \$9 billion figure gathered from the contingent valuation surveys dwarfed the \$300 million in traditional economic damages claimed from the spill.⁵⁸

We will return in a moment to the usefulness of contingent valuation studies in natural resources policy. For now, it seems safe to say that a contingent valuation survey aimed at eliciting the value of protecting the polar bear would come up with a large number, and one that would overwhelm the conventional economic value of the polar bear as reflected in amounts spent on eating, wearing, hunting, and viewing this animal. Yet it is not clear that any number calculated based on a contingent valuation study would be included in a government analysis of policies to protect the polar bear; the economic analysis of recent federal regulations aimed at protecting fish, for example, excluded non-use values.⁵⁹

C. Polar Bear Futures

⁵⁵ Ackerman & Heinzerling, *Priceless*, at 159.

⁵⁶ Ackerman & Heinzerling, *Priceless*, at 159.

⁵⁷ Budget numbers are available at <http://www.doi.gov/budget/2007/07Hilites/overview.pdf>.

⁵⁸ Ackerman & Heinzerling, *Priceless*, at 154-55.

⁵⁹ Ackerman & Heinzerling, *Priceless*, at 172.

The U.S. Fish and Wildlife Service has proposed listing the polar bear as a threatened species under the Endangered Species Act. Although the Service finds that polar bear populations are already under stress due to climate change, the Service does not believe that the species is now in danger of extinction, the trigger for finding a species “endangered” rather than threatened.⁶⁰ Rather, the Service believes that the polar bear is likely to become endangered – that is, will be in danger of extinction – “within the foreseeable future.”⁶¹ The Service defines the “foreseeable future” for the polar bear as approximately 45 years, which is three polar bear generations.⁶² “Populations would be affected differently in the rate, timing, and magnitude of impact,” the Service has written, “but within the foreseeable future, the species is likely to become endangered throughout all or a significant portion of its range due to changes in habitat.”⁶³

Guidelines for economic analysis performed by federal agencies direct the agencies to apply a discount rate to costs and benefits that will occur in the future, on the theory that future costs and benefits are not as valuable as costs and benefits that occur today.⁶⁴ The guidelines state that 7 percent is the preferred discount rate, but that agencies should also show the results of analysis using a 3 percent rate.⁶⁵ According to these guidelines, federal agencies charged with protecting the polar bear would discount the benefits of protecting the bear over the interval between now and the time when those benefits would occur – that is, the time when the bear would otherwise perish.

⁶⁰ 16 U.S.C. 1532(6), (20).

⁶¹ 16 U.S.C. 1532 (20).

⁶² Listing Proposal at 1070-71.

⁶³ Listing Proposal at 1094.

⁶⁴ OMB Circular A-4, at 32, available at <http://www.whitehouse.gov/OMB/circulars/a004/a-4.pdf>.

⁶⁵ OMB Circular A-4, at 34.

Suppose that the economic value of preserving the polar bear is calculated to be \$20 billion. Discounted at OMB's preferred 7 percent rate over 45 years, this value shrivels to less than \$1 billion in present-value terms. Even at a rate of 3 percent, the value shrinks to just over \$5 billion due to discounting. Because the polar bear is not expected to go extinct for decades, therefore, economic analysis as currently practiced by the federal agencies would, through the use of discounting, take a huge chunk out of whatever monetary value could be attached to the protection of this species.

D. Conclusion

The polar bear appears to be worth very little in conventional economic terms. A small number of individuals are willing to pay a great deal to hunt or to view the polar bear, but most people will never use or even see one of these animals in the wild. If values similar to those obtained through surveys concerning other popular species obtained for the polar bear, the polar bear's "non-use" value would be high. Yet current guidelines on economic analysis would call for a dramatic reduction in this value through discounting. It appears, therefore, that economic analysis would tell us that the polar bear is not worth very much. But this answer cuts against the intuitive grain; if the polar bear doesn't matter much to us, it is hard to make sense of the species' salience in public awareness of and discourse on climate change. Perhaps economics does not tell us, after all, why we care about the polar bear? Moreover, even if economic analysis – discounting and all – somehow produced a monetary valuation for the polar bear that seemed commensurate with the public's level of concern, would it be helpful in deciding what to do about the bear? I believe the answer is no.

III. Why We Care

There are several reasons why economic analysis will not give us a meaningful answer about what natural resources, including the polar bear, are worth to us. These reasons, which I discuss below, have to do with the “public goods” character of most natural resources; the importance of the future in valuing natural resources; the interconnectedness of natural resources; the possibility of irreversibilities and discontinuities in effects on natural resources; and the moral dimension of natural resources protection.

A. Public Goods

Natural resources are classic examples of public goods, “not available for purchase in individual portions.”⁶⁶ I cannot buy the polar bear’s survival through my own behavior; even if I spend extra money on a Prius to decrease my carbon footprint, someone else can buy a Hummer and completely offset the effects of my actions. Even natural resources that have some characteristics of private goods (and many do) often also bear traits that are in the nature of public goods. If I buy timber rights to a forest, for example, certainly I can exclude others from taking the lumber itself away from me. But by cutting down the trees, I harm the water flows, species habitat, natural beauty, and other “goods” that are bound up in the forest along with the timber. These are the kinds of things that are difficult to reduce to private ownership, and difficult to protect on an individual basis.

The public goods character of natural resources poses a difficulty for economic analysis of natural resources because economic analysis asks people, individually, what they are willing to pay to protect a resource. If I am the rational character economic analysis assumes (and prefers) me to be, however, I will pay nothing individually to protect a common resource, since I have no expectation that my expenditure will do any good. Economic analysts, in fact, have long

⁶⁶ Lisa Heinzerling & Frank Ackerman, *Pricing the Priceless: Cost-Benefit Analysis of Environmental Protection*, 150 U. PENN. L. REV. 1553, 1566 (2002).

asserted that rational people will not sacrifice anything, individually, to protect resources held in common.⁶⁷ Even if I am willing to spend nothing on my own to protect a common resource, however, this does not mean that I am unwilling to spend money on a collective effort to protect that resource. The former response might reflect nothing more than an expectation that the expenditure will be futile. As Frank Ackerman and I have paraphrased a point by Amartya Sen, “if your willingness to pay for a large-scale public initiative is independent of what others are paying, then you probably have not understood the nature of the problem.”⁶⁸

One might reasonably wonder, then, what economic analysts are thinking when they design surveys aimed at eliciting individuals’ willingness to pay to protect public goods. Since analysts also try to design these surveys, and interpret the results, by reference to standard economic theory, one would expect them to expect that no one would pay anything, individually, to protect a commonly held resource. But the analysts have not been deterred. The way they have tried to skirt this problem is by formulating the questions in these surveys to mimic a collective decision. They ask, for example, how much survey respondents would be willing to pay in additional taxes to protect a resource.⁶⁹

There is evidence, however, that survey respondents are not fooled by this gambit. Researchers who have explored the motivation behind respondents’ answers to contingent valuation surveys have found that people have a hard time valuing public goods in isolation from other people, even when questions are framed in terms of collective choices. Detailed interviews of participants in a survey designed to assess the value of an important marsh in England

⁶⁷ WILLIAM F. BAXTER, *PEOPLE OR PENGUINS: THE CASE FOR OPTIMAL POLLUTION* 34 (1974).

⁶⁸ Heinzerling & Ackerman, *Pricing the Priceless*, at 1567, citing Amartya Sen, *The Discipline of Cost-Benefit Analysis*, 29 J. LEGAL STUD. 931, 949 (2000).

⁶⁹ Hanemann at 24; see also Ty Raterman, *On the Role of Preferences and Values in Public Decisions*, 33 SOCIAL THEORY & PRACTICE 251, 260 (2007) (suggesting that the way out of the dilemma posed by Sen is to ask each respondent “what amount she would be willing to pay if she had an assurance that everyone else would pay that amount as well”).

revealed that a number of participants' answers were influenced by their sense that their own individual monetary contribution would not protect the marsh. "[W]hat good would it be," asked one participant, "if I had said 'oh yes, I'd give a thousand pounds?' I mean, in isolation that is absolutely no good anyway, is it?"⁷⁰ Other participants expressed a desire for a truly collective process of decision making, in which "local knowledge and local values" informed a process in which experts also played a role.⁷¹ In another study, respondents were asked to state their willingness to pay for policies to address climate change.⁷² While doing so, they were also asked to "think aloud" about their responses to the survey questions.⁷³ Several respondents stated that they were unsure what their individual contribution would imply for the general problem of climate change,⁷⁴ and others stressed the importance of a collective effort: "[I]f you're paying you feel it has to be part of a joint effort with everyone else, it can't just be selectively done."⁷⁵

In attempting to elicit economic values for goods not traded in markets, therefore, contingent valuation has not solved the problem of public goods; it has merely glossed over it. Many survey respondents have been clever enough to see the device of asking about increased taxes for what it is: a way of pretending that public goods can be valued by individuals acting in isolation from one another. Economic analysts, to be sure, have recently been hard at work trying to design valuation studies that will capture the collective reflection many respondents have been so anxious to see. But the closer contingent valuation comes to an exercise in collective deliberation, the further it moves from the central economic tenets on which it was

⁷⁰ Judy Clark, Jacquelin Burgess & Carolyn M. Harrison, "*I struggled with this money business*": respondents' perspectives on contingent valuation, 33 *ECOL. ECON.* 45, 50 (2000).

⁷¹ Clark at 56.

⁷² Henrik Svedsäter, *Economic Valuation of the Environment: How Citizens Make Sense of Contingent Valuation Questions*, 79 *LAND ECON.* 122 (2003).

⁷³ Svedsäter at 125.

⁷⁴ Svedsäter at 129.

⁷⁵ Svedsäter at 129; see also David A. Schkade & John W. Payne, *How People Respond to Contingent Valuation Questions: A Verbal Protocol Analysis of Willingness to Pay for an Environmental Regulation*, 26 *J. ENVTL. ECON. & MGT.* 88, 99 (1994)

founded. More fundamentally, once contingent valuation becomes a means for people to decide, together, on collective means and ends, then one must seriously ask what role this technique has to play in shaping policy. After all, collective deliberation on collective means and ends lies at the heart of our government structure. Yet a major consequence of cost-benefit analysis has been to upend the legislative products of that structure, to question the goals laws set by reference to individuals' supposed preferences. But if the direction of contingent valuation is to make the technique look like a public referendum, why not skip contingent valuation and have the referendum? Or why not skip contingent valuation and respect the laws in place?

Weirdly, instead of asking the question this way, some researchers have suggested that perhaps a “democratically legitimized” dialogue should precede contingent valuation, so as to make more likely the production of “well-founded estimates of WTP.”⁷⁶ This strikes me as just exactly backwards. Democratic deliberation is not a tool that serves WTP; WTP is a tool that (in theory) serves democratic deliberation.

In any event, the public-goods character of many natural resources (including the polar bear as a species) means that accounts of how much individuals are willing to spend, as individuals, to protect these resources will reveal little about the resources' real worth. Cost-benefit analysis using such accounts will give us bad information.

B. The Future

One of the central struggles in natural resources policy has been between those who favor short-term exploitation of natural resources and those who favor long-term preservation of them. The trouble with cost-benefit analysis in this context is that it inherently, but almost invisibly, favors the former perspective. Discounting – universally favored among cost-benefit analysts – makes protection of natural resources into the far future seem like a bad idea. Yet

⁷⁶ Svedsäter at 134.

discounting is also a quite arcane methodology, difficult for a layperson to understand or even to discern in operation. Thus, cost-benefit analysis with discounting could undo the case for long-term preservation of natural resources, without most people even understanding why.

This result would be directly contrary to a central thrust of U.S. natural resources law. Every major modern U.S. law on natural resources is written with an eye on the far future. None of these laws dictates the short-term exploitation of natural resources at the expense of long-term protection. To be sure, in operation, these laws have often condoned, if not encouraged, short-term destructive use. But their aspirations are mostly to the contrary.

Consider, for example, the Endangered Species Act, under which the polar bear may soon be protected. This law does not require protection for listed species for just a little while, or for as long as seems convenient. Rather, it contemplates, and seeks to ensure, the continued existence of species into the indefinite future.⁷⁷ This is a law built for the long haul. By trivializing the benefits of protecting species into the far future, discounting mocks the very premises of the Endangered Species Act.

The same is true of numerous other modern natural resource laws. The laws protecting national parks,⁷⁸ national monuments,⁷⁹ and wilderness areas⁸⁰ likewise aspire to long-term protection of natural resources. Even other, less overtly preservationist laws at least take long-term protection as a central theme. The Multiple Use-Sustained Yield Act of 1960, for example,

⁷⁷ See, e.g., 16 U.S.C. § 1531(b) (declaring purpose of statute to be conservation of species and ecosystems on which they depend, without any temporal qualification).

⁷⁸ See, e.g., National Park Service Organic Act, 16 U.S.C. § 1 (purpose of national parks, monuments, and reservations “is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations”).

⁷⁹ Antiquities Act of 1906, 16 U.S.C. § 431 (providing for “proper care and management” – without temporal limit – of designated “historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest” situated on the public lands).

⁸⁰ Wilderness Act of 1964, 16 U.S.C. § 1131(a) (“it is hereby declared to be the policy of the Congress to secure for the American people of present and future generations the benefits of an enduring resources of wilderness”).

aims to protect sustainability of the forest resource into the indefinite future.⁸¹ The Federal Land Policy and Management Act has a similar goal for other public lands.⁸² Examples could be multiplied. The basic point is this: modern U.S. laws on natural resources were written in the hope of protecting these resources, not just for our generation, but for many generations to come. They do not have an expiration date, a date on which protection of natural resources becomes undesirable.

Discounting is inconsistent with this forward-looking purpose. It puts a large (probably crushing) thumb on the scales in favor of short-term exploitation and against long-term preservation. Cost-benefit analysis using the technique of discounting – and all cost-benefit analyses undertaken by the federal government currently use this technique – will systematically undercut the case for long-term protection of natural resources. Perhaps equally bad, it will do so underhandedly, in a way only experts (or very motivated and numerate laypeople) can understand.

C. Interconnectedness

Economic analysis tries very hard to isolate the particular commodities it is aiming to value and to ensure that the value of these commodities is not entangled, in the valuing group's mind, with other commodities. Thus, to take the polar bear again as our example, economic analysts trying to figure out what the polar bear is worth would work hard to make sure that their estimates did not include values for ringed seals, krill, or the Arctic itself. A significant part of

⁸¹ 16 U.S.C. § 529 (forest resources to be developed for purpose of achieving “multiple use and sustained yield”); id. § 531(b) (“sustained yield” is “the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land”).

⁸² 43 U.S.C. § 1743(b) (Secretary of the Interior directed to manage public lands so as “to prevent unnecessary or undue degradation of the lands”).

the literature on contingent valuation, in fact, has focused on ways to avoid this kind of misestimation – or, in the view of economic analysts, overestimation.

But the polar bear eats the ringed seal, the ringed seal eats krill, and all depend on a stable Arctic environment for their survival. At the same time, “the Arctic” as we have come to know it includes, as central constituents, the polar bear, the seals, and the ice that is melting under their feet. Economic analysis does not work well without reductionism – practitioners of contingent valuation serve constant reminders that valuation questions must be precise, targeted, and limited, in order to work tolerably well – but the reductionism it insists upon does not exist in the real world. You cannot have the polar bear without the Arctic, and you cannot have the Arctic without the polar bear. Thus asking questions about how much the polar bear, in isolation, is worth is an unrealistic, and possibly meaningless, exercise. As Aldo Leopold famously put a similar idea: “Everybody knows . . . that the autumn landscape in the north woods is the land, plus a red maple, plus a ruffed grouse. In terms of conventional physics, the grouse represents only a millionth of either the mass or the energy of an acre. Yet subtract the grouse and the whole thing is dead.”⁸³

Many respondents in contingent valuation surveys understand this point, just as they understand the concept of public goods. Some respondents recognize that nature cannot be separated into discrete chunks, with each valued as if it were not part of a greater whole.⁸⁴ Similarly, they understand that the specific resource being valued is often just one, “inseparable part” of a larger environmental issue.⁸⁵ To state it another way: “Butterfly species in the Amazon are becoming extinct because of the loss of habitat. The only way to save one species is

⁸³ ALDO LEOPOLD, *A SAND COUNTY ALMANAC* 146 (Oxford Press 1966 ed.).

⁸⁴ N. A. Powe *et al.*, *Mixing methods within stated preference environmental valuation: choice experiments and post-questionnaire qualitative analysis*, 52 *ECOL. ECON.* 513, 517 (2005).

⁸⁵ Svedsäter at 125.

to save them by saving the forest as well.”⁸⁶ The idea makes a good deal of sense, yet contingent valuation surveys continue to strive to isolate the specific resource of concern from its larger context. This cannot help but befuddle numerous respondents, and to lead to strangely acontextual estimates of value.

D. Irreversibilities and Discontinuities

Economic analysis is designed to evaluate problems at the margins, to discern the effect of rather small changes in outcomes on the prices of various commodities. Relatedly, economic analysis is also tailored to stable problems, with predictable signs and magnitudes. Neither of these features of economic analysis makes it well suited to natural resources policy.

Consider, again, the Endangered Species Act. The goal of the law is to ensure that species do not become extinct. Extinction is not a problem at the margin. Figuring out what preventing the extinction of a species is worth to us is not a matter of deciding what one more polar bear, or ten more, or 100 more, are worth to us. It is a matter of deciding what avoiding a world entirely devoid of polar bears is worth to us. Particularly coupled with discounting, economic analysis is not a good way of making this kind of decision. Discounting, like economic analysis more generally, assumes stable problems. Irreversibilities and discontinuities are inconsistent with this comfortable mindset.

One way to appreciate how little economic analysis has to say about irreversible and/or discontinuous calamities is to examine the way it goes about valuing human lives. Economists have long conceded that it is not possible to place an economic value on certain death. If asked what they would pay to avoid certain death, most individuals would pay whatever they had; in that case, “willingness to pay” would measure only ability to pay and would be a poor reflection

⁸⁶ Arild Vatn, *Environmental Valuation and Rationality*, 80 LAND ECON. 1, 6 (2004), quoting W. Schulze *et al.*, *Methodological Issues in Using Contingent Valuation to Measure Non-Use Values*, EPA/DOE Workshop Paper, Herndon, VA (1994).

of true value. If asked what they would accept to allow certain death most individuals would be unlikely to make a deal, opting instead to go on living; in that case, economic analysis would come up with no useable number at all. For these reasons, economists long ago turned to the device of “statistical lives” to measure the value of human life. A statistical life is a collection of small risks in a population such that, when totaled together, they will result in one death; for example, one million risks of 1 in 1 million add up to one statistical life (or death). The fact that economists have resorted to this contrivance – which ends up measuring the value only of risk, not of life – is one important indication that economic analysis does not work well when it comes to irreversible and discontinuous events, like death.

Certainly, not all natural resource problems present issues of irreversibility and discontinuity. But many do; they include, among others, the extinction of species, the destruction of original wilderness, and the contamination of land and other resources with persistent and, for all purposes, permanent toxins. In these cases, which are numerous, economic analysis will fall short in valuing the resources at stake.

This problem is more than technical. It is not just that economic analysis, as presently constituted, has a hard time dealing with irreversibilities and discontinuities. It is also that, particularly with respect to irreversibilities, a thoroughly non-economic perspective comes into play in this context. Consider this passage from Peter Matthiessen’s *Wildlife in America*:

The finality of extinction is awesome, and not unrelated to the finality of eternity. Man, striving to imagine what might lie beyond the long light years of stars, beyond the universe, beyond the void, feels lost in space; confronted with the death of species, enacted on earth so many times before he came, and certain to continue when his own breed is gone, he is forced to face another void, and feels alone in time.⁸⁷

⁸⁷ PETER MATTHIESSEN, *WILDLIFE IN AMERICA* 22 (Viking Press 1959).

Profound anxieties and longings come to the fore when one contemplates the prospect of irreversible loss. These anxieties and longings are not well reflected – nor even much respected – in economic analysis.

E. Morality

The moral dimension of natural resources protection is complex and subtle, ranging from beliefs in the rights of other living things not to suffer at our hands to metaphysical questions about humans' place in the universe. I cannot hope to describe all of its intricacies here. What I hope to do, however, is to show that economic analysis slights this moral dimension and thus fails to grasp a large part of the reason why we protect natural resources in the first place.

The part of natural resource valuation that has the best hope of capturing its moral dimension is contingent valuation. It is hard to see how market values – the price we might pay for polar bear trinkets, say, or the airline fare required for a visit to polar bear habitat – reveal any kind of moral stance. To be sure, we might value the trinket or the visit partly because of the reverence we feel for the species, and reverence – a close cousin of the humility borne of an appreciation of our own small place in the universe – has a moral dimension. But the market cost of the symbols of our reverence must pale in comparison to the worth of the object of our reverence. To say otherwise would be like saying that the price of rosary beads signals the value of Catholicism to their owner. The moral dimension of natural resource valuation is captured, I think, not so much in the ways we use or consume natural resources – which can be reflected in market exchanges – but more in the ways we do not use them. This is where contingent valuation comes in. As we have seen, it is the only method for identifying non-use values.

Yet even here, economic analysis falls short. Respondents in contingent valuation surveys frequently express moral qualms about “buying” or “selling” natural resources, and these

qualms confound the results of the surveys. Some respondents express moral outrage by stating an exceptionally high willingness to pay for natural resource protection. Others, interestingly, express the same kind of sentiment by refusing to pay anything at all.⁸⁸ Either way, the estimation of economic value is unsettled by the presence of respondents who recoil at the very prospect of monetary valuation in this setting.⁸⁹

Some scholars have argued that the injection of moral impulses into responses to contingent valuation surveys renders the whole enterprise meaningless from an economic perspective. They believe that respondents giving voice to such impulses are “purchasing,” not a public good, but “moral satisfaction,” and that “[t]he amount that individuals are willing to pay to acquire moral satisfaction should not be mistaken for a measure of the economic value of public goods.”⁹⁰ Or, put another way, existence values should be used in economic analysis only if “people’s individual existence values ... reflect only their own personal economic motives and not altruistic motives, or sense of duty, or moral obligation.”⁹¹ As Michael Hanemann has trenchantly observed, however, “[t]his criticism hardly comports with the standard view in economics that decisions about what people value should be left up to them.... When estimating demand functions for fish prior to Vatican II, no economist ever proposed removing Catholics because they were eating fish out of a sense of duty. Nor, when estimating collective choice models, do we exclude childless couples who vote for school bonds because they lack a personal economic motive.”⁹²

⁸⁸ Thomas H. Stevens *et al.*, *Measuring the Existence Value of Wildlife: What Do CVM Estimates Really Show?*, 67 *LAND ECON.* 390, 397 (1991).

⁸⁹ *Id.* at 399; Clark at 60.

⁹⁰ Daniel Kahneman & Jack L. Knetsch, *Valuing Public Goods: The Purchase of Moral Satisfaction*, 22 *J. ENVTL. ECON. & MGT.* 57, 69 (1992).

⁹¹ Paul Milgrom, *Is Sympathy an Economic Value? Philosophy, Economics, and the Contingent Valuation Method*, in *CONTINGENT VALUATION: A CRITICAL ASSESSMENT* at 431 (J.A. Hausman ed., 1993).

⁹² Hanemann at 33.

Hanemann's critique seems to me on target as far as it goes. Indeed, it strikes me as nothing short of bizarre that in a world where economists would most certainly include the sale of Chanel's \$260,000 handbag⁹³ in a calculation of gross domestic product – without any question whether a hunger for status through conspicuous consumption reflects “a measure of the economic value” of the handbag – moral values would be barred from admission into the economic sphere. Yet I think Hanemann does not go far enough. Contingent valuation simply cannot process individuals' unwillingness to put nature up for sale. If individuals feel very strongly about protecting natural resources, at some point their willingness to pay will be bounded by their ability to pay, and “willingness to pay” will reflect only ability to pay. Or, as noted above, individuals who feel very strongly might refuse to participate in the economic valuation at all, reporting an answer of “zero” that completely misrepresents the true worth of the resource to them.

Worse still, economic valuation itself compounds the moral uneasiness associated with depletion or destruction of natural resources. When we give a price at which we would be willing to “sell” the polar bear, or we say that we are unwilling to pay above a certain price to “buy” the protection of the bear, we become complicit in the species' demise. Economic valuation is not a way out of the moral dilemmas surrounding natural resource protection; it is a way of creating new ones.

Conclusion

Cost-benefit analysis has not yet steamed through natural resources policy the way it has through the policy of pollution control. Given its popularity in the latter context, however, it is worthwhile to consider whether it would be a good idea to extend the use of cost-benefit analysis to natural resources law and policy. I have argued that this would not be a good idea. Using the

⁹³ I am not making this up. See Ylan Q. Mui, Exclusive Statute: It's in the Bag, Wash. Post, at D1 (Aug. 21, 2007).

polar bear as my example, I have shown that the conventional economic value of a species the public appears to regard as extremely valuable is probably quite low. Moreover, even if the value derived from economic analysis were high, economic analysis would miss many of the reasons why we might care about the polar bear and thus would provide a poor reflection of true value. Public goods, the future, natural interconnectedness, irreversible and discontinuous events, and the moral dimension are all poorly captured, if at all, by economic analysis. Yet these characteristics and consequences lie at the heart of the resource protection mission. Cost-benefit analysis captures the small things tolerably well but misses the large ones. The picture it gives of value is distorted, and we are better off – and have better information – without it.