

Promoting Sustainable Behavior through the Use of Environmental Indicators:

An Application to Mercury Control in New England

What motivates people to act sustainably?

We are at a point in our history in which individual action is required more than ever to achieve lasting and equitable environmental protection. However, individual actions to protect the environment usually require a personal investment of time, effort, or money. This seems to imply that such actions are not in one's self-interest, yet people undertake them voluntarily all the time: we recycle, contribute to environmental organizations, refrain from littering, and pay premiums for eco-friendly products. Understanding what motivates such voluntary pro-environmental behaviors is essential for developing effective incentives for further promoting sustainable action



One of the most prominent explanations of voluntary pro-environmental behavior that has emerged from social scientific research is a concept called **values-beliefs-norms (VBN) theory**. This theory recognizes that moral motivations, including personal values, beliefs, and norms, strongly induce many of our environmental actions – at least within the boundaries imposed by certain practical constraints, such as time and money.

The **Sustainable Environmental Decisions Group (SEDG)** at Dartmouth College has received a grant from the U.S. EPA to study how VBN theory can help scientists to improve the way they communicate information about the environment to industry, the public, and government officials. The goal of the study is to enhance the effectiveness of one of the most common and direct methods for providing environmental information: environmental indicators. In particular, SEDG is focused on constructing and testing meaningful indicators of mercury pollution in New England.

Why is mercury a concern to New Englanders?

Mercury is a toxic substance which, when released into the environment, can accumulate in fish. This creates health risks, especially for people who rely on fish for a large part of their diet, such as subsistence fishers. Mercury has been associated with harmful effects on the nervous system, particularly in the developing fetus and in young children, who may experience learning and developmental problems. In addition, mercury has adverse impacts on wildlife, including disorientation and poor feeding and mating, with resulting impacts on growth and reproduction. Fish-eating wildlife, such as loons, eagles, and otters, are especially at risk.

Mercury levels in the environment are elevated across the United States, however New England is especially impacted. Ninety-six percent of the lakes in the Adirondack region of New York and forty percent of the lakes in New Hampshire and Vermont exceed the recommended EPA action level for mercury in fish. Fish consumption advisories are in place for all lakes in New England because of mercury concerns.

Mercury is used in a variety of products including thermometers, switches, batteries, and compact fluorescent light bulbs. Historically, incinerators, especially medical waste incinerators, were the largest emitters of mercury. However, by the year 2000, this source had been reduced by 90% due to federal regulations. Releases from electric utilities, on the other hand, have remained largely uncontrolled, making power plants the largest remaining source of mercury to the environment.

Can indicators of mercury release and impacts provide motivation for people to act sustainably?

Though their exact details vary, **environmental indicators** are simply quantitative measures that convey information about the natural environment. Indicators have been suggested for use at local, national, and global scales, especially in the context of sustainability. In the U.S., the



most recent and prominent example of indicator development and reporting is the EPA's Report on the Environment. Although environmental indicators are widely regarded as essential tools for informing decision making, they have also been criticized for their lack of salience to non-scientists. Specifically, these criticisms point to the failure of most indicators to link individual actions to their impacts on the environment. Our study aims to address this weakness. In particular, we are testing whether indicators can be designed according to VBN theory to provide information that actively encourages sustainable behavior.

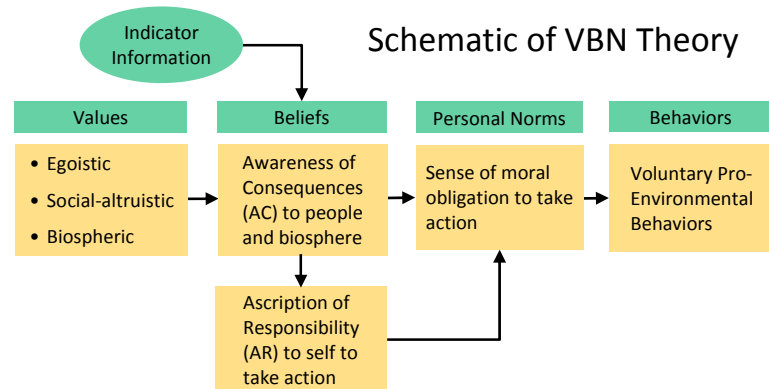
The basic idea behind VBN theory is that pro-environmental behavior is primarily motivated by altruistic moral norms. These behavioral norms are "activated" only when a person: (i) believes his or her action has consequences for the welfare of valued objects (referred to as AC beliefs), and (ii) feels a sense of personal responsibility for that action's consequences (referred to as AR beliefs). In such situations, the person then feels a **sense of moral obligation**, which generates pro-environmental behavior.

We hypothesize that environmental indicator information that strengthens AC and AR beliefs will increase the willingness of individuals to undertake pro-environmental behaviors by strengthening their sense of moral obligation. Correspondingly, we argue that conventional indicators that simply describe the state of the environment do not strongly influence these types of beliefs and are therefore relatively ineffective in influencing behavior.

What is the role of personal values in determining indicator effectiveness?

For a person to be motivated by indicator information that promotes a sense of moral obligation, he or she must first have a set of morals that value environmental protection. VBN theory asserts the existence of three relevant moral persuasions, corresponding to three valued "objects" affected by environmental change: **egoistic values** (with *self* being the valued object), **social altruistic values** (with *other humans* being the valued object), and **biospheric values** (with *nonhuman species* being the valued object). VBN theory then hypothesizes that personal norms are activated by: (i) the awareness of consequences (AC beliefs) of environmental change on each valued object, and (ii) the ascription of personal responsibility (AR beliefs) toward alleviating those consequences.

Studies have consistently found that egoistic value orientations are negatively related to pro-environmental behavior, while environmental altruistic values (both social altruistic and biospheric) are positively related. The former result is consistent with classical economic theory that suggests that individuals interested in maximizing their self-interest will not contribute to public goods. Based on these arguments, **our second hypothesis is that indicator information that increases the sense of moral obligation (by influencing AC and AR beliefs) is more likely to influence the behavior of individuals with strong environmental altruism values than those with egoistic value orientations.**



Does VBN theory hold in the real world?

To test our hypotheses, we are conducting a survey of a random sample of approximately 2000 households in New England. Half the respondents are receiving a conventional state indicator ("...**40% of New England's lakes have mercury fish tissue concentrations exceeding environmental guidelines...**") while the other half are receiving an indicator designed to induce AR beliefs ("...**30% of all mercury released to the environment in New England can be attributed to households such as yours...**").

Respondents are then asked about their willingness to engage in certain mercury reducing behaviors, including: writing a letter to support mercury control policies, recycling products containing mercury, and signing up for renewable energy programs.



Our first hypothesis will be supported if, after controlling for other variables, the respondents who receive AR indicators are more likely to engage in mercury-reducing behaviors than the respondents who receive conventional indicators.

To test our second hypothesis, our survey also includes questions regarding people's environmental values. For this purpose, we developed a novel 15-item scale to measure value orientations (see box). Other questions on the survey ask about individual characteristics such as household income range, household size, age, gender, existing AC and AR beliefs, perceptions of ease and effectiveness of the three elicited behaviors, sources of information on mercury, and trust in those sources.

Our survey included 15 value items, which respondents were asked to rate on a five-point scale ranging from **Strongly Agree** to **Strongly Disagree**.

Examples of items for each value orientation include:

Egoism: "I am not concerned about depletion of natural resources as long as I can find suitable substitutes for myself and my family."

"I contribute to environmental protection only if I see personal benefits commensurate with personal costs."

Altruism: "We have a duty to ensure that future generations can live a life at least as fulfilling as the current generation."

"It is my duty to act to protect people who may not have the power to protect themselves from environmental harm."

Biospherism: "Plants and animals have as much right as humans to exist."

"Species of plants and animals have intrinsic value, even if they are not of any use to humans."

We are currently in the process of receiving completed surveys. However, preliminary results confirm that values play a strong role in determining a person's willingness to engage in pro-environmental behavior. The perceived cost and effort of the behavior are also strong influence factors. The type of indicator received is clearly a secondary effect, and accurately estimating the strength of this effect will require us to wait until we receive the remainder of the surveys.

Is the provision of indicator information effective at reducing mercury impacts?

To assess the ecosystem and human health effects of individual behaviors aimed at reducing mercury, we are constructing an integrative synthesis model. Our focus is on assessing the effects of individuals' decisions to reduce household energy use or to enroll in green energy programs. To do this, we are performing an **Environmental Input-Output Lifecycle Analysis** to connect household energy use to total mercury emissions. These results are then linked to **MERGANSER (MERcury Geo-spatial AssessmentNs for the New England Region)**, which is a regional scale assessment model of mercury sources, fates, exposures, and risks being developed by a consortium of government, university, and private researchers. Finally, these results are linked to ecological and human health impacts using a meta-modeling approach building on published scientific studies. Our expectation is that by explicitly connecting meaningful and motivational indicators to mercury reductions and resultant impacts, our model will forge a critical link in the feedback chain necessary to promote sustainable behavior.

Are the results of the study applicable to the diverse set of stakeholders affected by mercury contamination?

A particular focus of our project is on identifying value orientations and indicator sets that are acceptable to traditionally under-represented fractions of the American population, including Native and African-American communities. These groups have historically been alienated both legally and socially from the institutions that frame environmental policy in the US. They may also have unique livelihoods, cultural traditions, and exposure situations relating to mercury in the environment. We believe that only by explicitly involving such groups can the full implications of sustainability be properly addressed.

Acknowledgments

The research described here has been funded in part by the USEPA through the Collaborative Network for Sustainability. It has not been subjected to the Agency's peer review and therefore does not necessarily reflect the views of the Agency, and no official endorsement should be inferred. Additional support for the survey was provided by the Rockefeller Center of Dartmouth College.

For more information, please contact:

Mark Borsuk, Ph.D.
Assistant Professor of Engineering
Thayer School of Engineering
Dartmouth College
Hanover, NH 03755-8000

Phone number: 1-603-646-9944
Email: mark.borsuk@dartmouth.edu

