Analyzing scientists' donations to measure their values for the Nutrient Network (NutNet)

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Abstract

This paper reports on a real money, economic experiment in which a broad group of ecological scientists were challenged to consider their own values within an economic framework, by considering whether to contribute financially (i.e., to donate) to support a global research initiative designed to investigate the implications of global change for grassland ecosystems. We use this experiment to illustrate the basic approach of economics as might apply to choices about and individual values for ecosystem services, particularly using an application to the potential to enhance scientific knowledge regarding grassland responses to the global distribution of nutrients. While scientists' choices and values were not significantly influenced by economic incentives embedded in the donation solicitation, donations were significantly associated with ecologists' specializations and career stages.

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1. Introduction

Scientific knowledge is considered a cultural ecosystem service, at least within the framework of the Millennium Ecosystem Assessment (MEA, 2005). The concept of ecosystem services captures the tangible and intangible ways by which Nature, or ecosystems, benefit humans. Ecosystem services have become a focal point for developing research and policy to aid society in balancing the contributions to quality of life from environmental resources and growth of the commercial economy (Kareiva, 2011). Scientists have invested substantial time and resources in better understanding the interactions of humans with the environment.

Recently, a group of scientists, several associated with the NSF-funded Long-Term Ecological Research (LTER) network (see https://lternet.edu), initiated a grass-roots, global network of colleagues to create an inter-continentially coordinated experiment concerning how alteration of the global nutrient budget affects grassland ecosystems, particularly through changes in the abundance and identity of consumers (Stokstad, 2011). At the All Scientists Meeting (ASM) of the LTER network, one of the leaders of this research cooperative, the Nutrient Network (NutNet, http://www.nutnet.org/home), provided a plenary-session introduction to the NutNet’s structure, procedures, and collaboration, presenting a well-illustrated picture of the potential contributions to science, including an initial record of peer-reviewed publications and policies for co-authorship across a truly large number of collaborators.

The audience reaction to this plenary session, as qualitatively observed, revealed that many (not necessarily all) in the audience viewed the NutNet approach and its potential contribution to science as a good that they (audience members as *Corresponding author.

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individuals) personally found interesting, important, and of potential value as something they personally would like to see enhanced. The presentation described a network of over 60 sites, primarily in North American and Europe, with some sites in Asia, Australia, Africa, and South America. A core of the NutNet approach is that individual investigators may decide, voluntarily, to invest a $4000 start-up cost to add a site to the network, simultaneously making a commitment to sustain $300–$600 in annual expenses and 6 person-days annually to implement a standard, experimental protocol at the individual’s contributed site. We use this setting both to illustrate how economists derive value estimates based on choices and to illuminate whether scientists actually hold a non-zero value for data that may advance ecological knowledge for the public good, separately from a professional benefit. That is, we examine whether scientists from a broad spectrum of ecological specialization, including these having little or no connection to grassland ecosystems, nonetheless place personal value — a personal willingness to pay — to enhance the Network’s effort.

The measurement of economic value derives from the choices that individuals make in pursuit of their own well-being, and is measured in relative terms (Hicks, 1943). In daily settings, when outcomes depend on individual choices, individuals reveal relative value based on their willingness to sacrifice something that could contribute to their well-being in order to have more of something else that, the individual believes, contributes more highly to their well-being. While relative value does not derive from money, economists often use a willingness to sacrifice money — a willingness to pay — as a means of measuring relative value. Willingness to pay offers the convenience to avoid listing the myriad items that each individual might be willing to contribute.

Community, including non-participants beyond investigators who are active participating within the NutNet. Individuals personally within the professional arena, as collaborators on future scientific reports. Yet the individual’s benefit from the public good — new scientific knowledge that may improve the happiness and well-being of many people simultaneously — is likely a substantial part of each collaborator’s motivation. This public-good value could exist across a broader scientific community, including non-participants beyond investigators who are active participating within the NutNet. Individuals might be willing to contribute — to sacrifice — from their personal resources to add a site to the NutNet, even though a simple financial donation would not put individual donors in a position to benefit professionally.

As part of a one-time effort to expand the NutNet by a site or two, and to understand scientists’ value for adding a site to the NutNet, we implemented the voluntary contributions mechanism (VCM) game as a devise to raise real donations at the LTER ASM. One of the methods used here was recently used in Swallow et al. (2018) in an application to grassland bird conservation. In economic literature, the VCM represents an economic institution (i.e., a set of rules for exchange) under which participants can donate to a public good (in our case, an additional site in the NutNet) voluntarily, regardless of the total cost needed to provide the public good. Also, individual contributions will not be returned. The VCM institution is often compared to the PPM (provision point mechanism) institution where participants can contribute to a public good knowing that there is a predetermined cost. But under PPM’s rules of exchange, the public good can only be provided if the total contributions reach the predetermined cost. Otherwise, individual contributions will be refunded. That is, the PPM includes a money-back guarantee of a full refund of donation if the public good cannot be delivered. The VCM has been well-studied in experimental economics (Poe et al., 2002; Rose et al., 2002). It mimics the familiar institution of philanthropic donations to provide a public good. In a laboratory setting, economists have found that changes to the VCM can stimulate individuals to make higher contributions relative to their personal value for a good (e.g., Spencer et al., 2009). The PPM is a well-studied modification that involves the addition of a provision point, or funding threshold (Rondeau et al., 1999, 2005; Spencer et al., 2009; Swallow et al., 2008, 2018; Liu et al., 2016), that must be reached before the public good — a new NutNet site — would be provided. Our experiment offers a chance to explore the role such modifications may play in altering the willingness to donate outside the laboratory.

2. Method

On Wednesday morning, September 12, 2012, one of the NutNet leaders gave a plenary presentation (as described above) to the ASM of LTER, with an audience numbering between 400 and 500 individuals. This presentation created an opportunity to both conduct an experiment to measure audience-members’ relative value for adding a site for collection of grassland
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