Using economics in conservation practice: Insights from a global environmental organization

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Abstract
Identifying and implementing successful strategies to conserve nature is a central goal of environmental practitioners. Conservation tools increasingly have an economic rationale to them, expanding the array of means available to trigger environmental actions. Missing is a comprehensive list of economic and financial instruments for conservation practitioners that highlights their current applicability, context, and relative success. To address this gap, we assembled such a list and surveyed units of The Nature Conservancy, a global conservation organization, to understand how these instruments are being used in varied contexts. We find that the majority of respondents have used economic or financial instruments, with the most common types being markets and price premiums, investments and funds, and payments for ecosystem services. A variety of factors influence the choice of instruments, including stakeholder interests, experience, and replication possibilities. Institutional constraints act as a significant barrier to implementation. These findings identify and offer insights on an expanded set of instruments that the non-profit conservation sector can use, replicate, and develop to meet conservation goals.

KEYWORDS
conservation tools, economic instruments, ecosystem services, impact investing, markets, offset schemes, policy, property rights, sustainable finance

1 | INTRODUCTION

Historically, environmental conservation entailed setting habitat aside for protection from human encroachment, often achieved through the creation of parks by government or through private designation of conservation easements. In the 21st century, global drivers such as climate change and pollution touch every corner of the earth, making traditional conservation instruments woefully inadequate to address the growing footprint of human activity in the face of planetary boundaries (Hoekstra & Wiedmann, 2014; Rockström et al., 2009). The emergence of the Anthropocene epoch confirms the inextricable and pervasive connection of natural and socioeconomic systems, prompting a call for fresh and innovative ways to overcome the global complexity and local heterogeneity of environmental problems to achieve conservation outcomes (Sterner et al., 2019).

Command and control policies, such as “fence and protect” or “bans or phasing out of substances,” have
seen some major successes (Albrecht & Parker, 2019; Gray et al., 2016). However, progress is often context-dependent (Ghosh-Harihar et al., 2019; Macintosh, Simpson, Neeman, & Dickson, 2020) and environmental regulations and policy agreements can be stymied by shifts in political will or financing (Sterner et al., 2019; Urpelainen & Graaf, 2018). Complementary strategies in the form of economic, financial, and behavioral instruments offer additional opportunities to drive environmental changes. These instruments can potentially influence market signals, incentivize private actions by motivating pro-environmental and pro-social behaviors, and create new financing for environmental goods and services (Blanchard, Sandbrook, Fisher, & Vira, 2018; Boisvert, Méral, & Froger, 2013; de Vries & Hanley, 2016; Panayotou, 1994; Reddy et al., 2017; Thaler & Sunstein, 2009).

Over the last three decades, awareness and acceptance of incentive-based environmental strategies have increased (Andersen & Sprenger, 2000). In contrast to regulatory directives, well-designed economic and financial instruments can help align individual and corporate interests with public goals, reducing the burden on firms and people, who vary in their ability to respond to policy decrees (Stavins, 2001). Successful implementation of carbon emission trading, water markets and payments for ecosystem services to conserve biodiversity are testimony to this growth in the use of economic instruments (Guerry et al., 2015; Hepburn, Stern, & Stiglitz, 2020; Leonard, Costello, & Libecap, 2019; Schmalensee & Stavins, 2017). Similarly, the vast funding gap for meeting environmental goals (Mattsson et al., 2020; Polasky, 2012) has sharpened interest in financial instruments that draw on non-traditional capital to fund conservation (Fankhauser, Sahni, Savvas, & Ward, 2016). Financial requirements for environmental conservation are vastly larger than the available public funding, making private financing essential (Clark, Reed, & Sunderland, 2018; Dinerstein et al., 2019). For instance, various estimates suggest a funding gap of 1.1 to 2.5 trillion for implementing the Paris Climate Agreement (Clark et al., 2018).

Still, despite significant efforts by governments and intergovernmental agencies to apply economic and financial instruments to address environmental problems (UNEP, 2004b), the utility of these instruments to practitioners in the nongovernmental organization (NGO) sector remains unclear. While there is a large literature on how economic instruments can address environmental problems (for early work, see Kneese & Schultze, 1975 and Baumol & Oates, 1988) and their use by governments (Andersen & Sprenger, 2000; Barde, 1994; Schmalensee & Stavins, 2017), assessment of their deployment by NGOs, a major stakeholder in the environmental space, is limited. While the sector is smaller, NGOs work alongside governments and international organizations, and are instrumental in procuring funding and implementing conservation actions across the world (Ferraro & Pressey, 2015; Tallis & Lubchenco, 2014). Thus, effective use of economic and financial instruments by NGOs is arguably a good test of their utility and replicability under a range of circumstances and scales. A number of typologies of environmental-oriented economic and financial instruments identify available options to practitioners (see Section 2.1). However, providing practitioners with these options is not useful without providing a parallel understanding of how and where they can be applied successfully. Conservation managers also tend to rely on tools offered by the large spatial planning literature, which is less cognizant of economic and financial instruments (Schwartz et al., 2018). Thus, there is a divide between the needs of conservation managers for practical information on mechanisms to address complex environmental problems at multiple scales and available tools and taxonomies (Arlettaz et al., 2010; Rode, Wittmer, Emerton, & Schröter-Schlaack, 2016).

This study addresses this need by building a comprehensive typology of economic and financial instruments applicable to conservation organizations and using this typology in a survey of employees of The Nature Conservancy (TNC) to understand which instruments are being deployed by practitioners to meet practical conservation goals. Our main aim is to identify the diversity of instruments in use, as well as answer several additional questions: when, where and what types of instruments are being used; what conservation problems do they address; why do managers choose particular instruments; what are some implementation challenges; and which type of instruments are perceived to be more successful. By examining the instruments used by a large conservation organization, identifying implementation challenges, and exploring which stakeholders can be targeted by various instruments, we hope to catalyze further collaborative research as well as innovation and expansion in the use of economic and financial instruments for successful conservation.

2 | METHODS

2.1 | Building an instrument typology

As a first step towards identifying the usefulness of economic and financial instruments at TNC, we developed a typology of available instruments. We began by surveying the literature for existing typologies of economic,
financial, and behavioral instruments in conservation practice (Andersen & Sprenger, 2000; Ayoo, 2008; Barde, 1994; Barton, 2014; Casey, Vickerman, Hummon, & Taylor, 2006; Ekpe, 2012; Emerton, 2000; Feitelson & Lindsey, 2001; OECD, 2020; Panayotou, 1994; Pirard, 2012; Rietbergen-McCracken & Abaza, 2000; Rode et al., 2016; UNEP, 2004b; UNEP, 2004a, p. 2004). See Table S1 for a comparison of instruments across available typologies.

Substantial differences in the comprehensiveness and structure of available typologies prevented us from simply choosing one as the basis for our survey. Some include broad categories of instruments with a few examples in each, while others provide a unique classification scheme targeting distinct policy objectives (biodiversity, environmental management, ecosystem service provision). Conceptual underpinnings also differ, with some typologies focusing on expansive policy actions, while others emphasize market-based or financial instruments. As none of the typologies in the literature includes a distinct category for behavioral instruments, we limited our typology to economic and financial instruments.

Given multiple lists, we instead identified representative instruments for similar categories, using the most recent typology as a baseline (Rode et al., 2016). For instance, “user charges” was chosen to represent a variety of fee-based instruments. We also added specificity for conservation contexts (such as “Insurance for Nature”) or combined names (such as “Environmental/Green Bonds”), as appropriate. We created relatively broad categories for government-centric instruments (such as taxes), as these are generally relevant in non-profit contexts only as part of collaborative initiatives (ballot measures, for instance) or for advocacy. To reduce publication bias and ensure inclusion of instruments used in practice but not discussed in the literature, we searched TNC’s web-based publications in November 2017, applying the same criteria for adding or merging instruments. This process resulted in a typology of 31 economic and financial instruments applicable to environmental conservation (see Table S2), hereafter referred to as simply economic instruments. We grouped the 31 instruments into eight categories to provide further analysis of similar types of instruments: credit and insurance (5 instruments), investments and funds (4), fiscal transfers (2), offset schemes (3), payments of ecosystem services (3), markets and price premiums (9), property rights (3), and other areas (2). Table S2 includes definitions of each instrument and instrument type.

The instruments identified seek to change underlying incentives in a variety of ways, including by changing policy and governance frameworks, creating markets, making direct payments, or expanding available funding. Since instruments can be used to target different stakeholder actions, we also mapped each instrument to three important stakeholders: individuals (or groups of individuals), firms, and governments. If a given instrument could be used to influence the decisions of any of these three stakeholder groups, we added that group as an attribute of the instrument (Table S2).

### 2.2 Survey design and administration

To understand how the identified 31 economic instruments are used in practice, we undertook a survey of conservation practitioners at TNC, a large environmental NGO that operates in 72 countries and supports environmental actions related to biodiversity conservation and climate change. Since several co-authors are employees of TNC, we were able to obtain unique access to TNC’s workforce. The full survey includes 28 questions (see Supplementary Information), with nine questions related to the main aims and research questions of this study (questions 9, 10, 11, 12, 13, 15, 16, 20, and 24).

We presented respondents with the typology of economic instruments and began with three key questions: (a) are you using, have you used, or are you planning on using any economic instruments in your work (hereafter referred to as “multiple” instruments), (b) which instruments have you used in the field (including the option to add suggested instruments to the list, to be categorized post-survey), and (c) which instrument do you have the most experience using (hereafter referred to as the “primary” instrument)? We then asked six additional questions regarding this primary instrument to determine (d) when the instrument was used, (e) the region/country of application, (f) the targeted conservation problem, (g) the main reason for choice of instrument, (h) key implementation challenges, and (i) the level of success. For (d), we used three general time periods: the past, present, or future. For (f), we gave respondents a list of seven common conservation issues (forests, freshwater quality, freshwater quantity, wildlife, fisheries, soil, and clean air) and provided the option to specify their own. For (g), we offered a menu of six reasons why they may have chosen their instrument (project stakeholder interest, potential for replication, cheaper relative to alternative, other instruments successful, and easy to implement), again allowing them to provide their own reason. For (h), we asked respondents to rank order three broad groups of challenges to implementation: institutional, financial, and technical. For (i), we asked respondents to specify their instrument implementation as highly successful, successful, or unsuccessful.

The survey was pretested on a subset of employees. It was then distributed to 3,398 employees as an online
survey with cover letters from the Chief Scientist and the Chief Conservation Officer of the organization.

2.3 | Analyses

We produced cross-tabulations of economic instruments and groups with the responses to these six additional questions (Tables S5–S9). We also ran an ordinal logit regression with a subset of the response data (Table S10) to find predictors of implementation success. The dependent variable was ranked as highly successful = 1, successful = 0.5, and unsuccessful = 0. Four independent categorical variables were modeled as sets of dummy variables: the instrument group, region of implementation (with five broad regions of Africa, Asia-Pacific, North America, South America, and Global), main reason for instrument choice, and targeted conservation problem. A fifth ordinal variable, challenges to implementation, was ranked 1–3 for technical, institutional, and financial challenges.

3 | RESULTS

3.1 | Survey summary statistics

The results of the main survey questions are presented in Table S3. We received 632 responses during January and February 2018, an 18.5% response rate. Response rate by region was 7.7% for North America, 7.9% for Latin America, 6.7% for Asia-Pacific, and 15.9% for Africa. Of these responses, 78% of survey respondents indicated whether or not they use economic instruments for conservation actions. The response rate is reasonable because the survey went to a broad array of employees that includes staff members whose responsibilities may not have included the need to implement practical conservation actions.

3.2 | Increasing prevalence of economic instruments

Over half of survey respondents (332, or 52% of respondents) use economic instruments in their work (Table S3), with 262 (41%) specifying multiple instruments (1,453 total) used in their work. Conservation easements were the most cited instrument, used by 53% of the respondents (Table S4). Other common instruments included action related to forest carbon payments (50%), water funds (40%), and impact investing (35%). Four additional instruments not in the survey typology were used by respondents: reciprocal exchanges, renewable energy credits, awards/competitions, and resource rights. Most respondents identified the use of economic instruments in current projects (70%) or future projects (16%), illustrating that the deployment of economic instruments is relatively new.

The multiple instruments TNC practitioners have been “most actively” engaged in are those associated with markets and price premiums (21%), propelled by interests in ecotourism, certification, and sustainable markets (Figure 1). Investments and Funds were a close second (20%), mainly driven by water funds, or funds created to protect watersheds and secure water quality and quantity for conservation (Brauman, Benner, Benitez, Bremer, & Vigerstøl, 2019), and impact investments, or investments undertaken with the explicit goal of generating both private and social return (Ginn, 2020). Payments for ecosystem services (PES) were the third most used type (15%), driven by forest carbon and watershed payment instruments. We note that the broad instrument groups may not be mutually independent.

This ranking is slightly different for the primary instruments, with 260 respondents (41%) specifying the primary instrument used in their work (Figure 1). Investments and funds were the chosen primary instrument for 24%, again driven by water funds and impact investing. Property rights were second (23%) driven by conservation easements and PES was once again third (16%) due mainly to forest carbon payments.

3.3 | Deployment across geographies and resource sector

Economic instruments have been largely used in North America, with 70% of the applications emerging from respondents working in this region (Table S5). Other regions showed more limited use with (Latin America (10%), Asia-Pacific (8%), and Africa (4%)). A small proportion of the instruments (8%) were used in multiple regions.

The types of instruments used regionally varies (Figure 2). In North America, property rights instruments dominated (35%) due to the usage of conservation easements, which were not used anywhere else. Investments and funds predominated in Latin America (38%), although these were also popular in Asia-Pacific (26%). PES instruments were most popular in both Asia-Pacific (42%) and Africa (37%), driven by forest carbon payments.

Nearly half (46%) of the economic instruments were used to address two conservation problems: forests (26%) and freshwater quality (20%), mainly through investments and funds, property rights instruments, and payments for ecosystem services (Table S6). Freshwater...
quantity is mainly addressed through investments and funds (83%), clean air through payments for ecosystem services (66%), and wildlife through property rights (52%). The others, fisheries and soil, were addressed by multiple types of instruments.

3.4 Opportunities, challenges, and success

The main reasons respondents used particular instruments were due to project stakeholder interest (27%), the potential for replication (23%), and previous contextual knowledge or experience (21%) (Table S7). Only 4% of respondents identified ease of implementation as the main motivation for using an instrument. Working in similar contexts was particularly important for property rights instruments (40%). Project stakeholder interest was most important for investments and funds (33%) and property rights instruments (30%). Potential for replication was also important for investments and funds (33%) and PES instruments (25%).

Survey respondents identified institutional challenges as the most common barrier to successful implementation (55%), followed by financial (27%) and technical challenges (18%) (Table S8). Institutional challenges emerged as dominant obstacle for most instrument types (Figure 3), with the exception of markets and price premiums, where
financial challenges dominate. There is, however, variation in challenges across specific instruments.

Nearly all respondents reported success with the instruments they used (95%), although only 30% reported that they were highly successful (Table S9). As a percentage of instruments used, property right instruments showed the most perceived success (47% highly successful), followed by offset schemes (36%) and PES instruments (35%).

The regression results (Table S11) highlight significant but relatively low explanatory power of the independent variables on implementation success. The regression has an $R^2$ (McFadden) of 0.116 but is statistically significant (Chi² log-likelihood) at 90% confidence interval. The detailed breakdown by question shows only instrument rationale being significant (pr > Wald chi-squared = 0.010) and none of the individual coefficients are statistically significant.

4 | DISCUSSION

This study accomplished our main aim of identifying the diversity of instruments in use, illustrating their wide-spread deployment and apparent growth in the non-government sector, exemplified by TNC. Not all instruments are used equally, with geographic and sectoral variations likely reflecting historical presence and regulatory differences. Choice of instruments appears to be based on multiple considerations, including contextual needs, experience, and the possibility of replication. The results point to the importance of factors such as knowledge, stakeholder requirements, and institutional constraints in how and why economic instruments are used.

There is extensive use of economic instruments throughout TNC. While traditional property rights instruments such as conservation easements still dominate, new instruments are emerging. A growth area relates to financial instruments that deploy blended capital, tying private and philanthropic resources together to meet conservation needs (Ginn, 2020).1 For instance, water funds, used in at least 30 regions in Latin America alone and reflecting a trend that extends far beyond TNC (Bremer et al., 2016), are financed by private and public actors, including utilities. These funds link downstream water users with upstream managers and protect source waters by improving the governance of watersheds (Brauman et al., 2020). Payments for ecosystem services is another instrument type that has seen significant growth globally (Salzman, Bennett, Carroll, Goldstein, & Jenkins, 2018), particularly with the recent strengthening of forest carbon payments.

Not all economic instruments are a good fit for NGO action, particularly since instruments such as emissions trading or taxes and subsidies do not fall within their direct domain. Still, NGOs can act as advocates for such regulatory instruments. For example, a coalition of stakeholders, including TNC, advocated for a recent ballot measure to support carbon taxes in the state of Washington in the United States (Worland, 2018), which raised significant awareness about carbon taxes and climate change even though the measure failed. Given the array of available instruments, it useful to identify how practitioners can engage with specific stakeholders in deploying different instruments. Figure 3 illustrates this mapping, showcasing which instruments are more suitable for public policy versus those that require engagement with private firms or individuals and community actions. Credit and insurance instruments, investments and funds and markets, and price premiums almost always require partnerships with firms in the private sector. Fiscal transfers require government actions, though many of the instruments, such as offset and payment schemes or property rights, will need to be underpinned by specific regulations. Some instruments, such as payment schemes, can be implemented directly by NGOs to incentivize individual or community environmental actions.
Although the environmental policy literature often points to the cost-effectiveness of economic instruments (Harrington & Morgenstern, 2007), in the practical world, this is not the defining issue. Important considerations include project stakeholder interest (reflecting demand by external stakeholders, such as communities and funders, as well as internal stakeholders), the availability of previous knowledge, and the desire to identify replicable opportunities so impacts can be scaled. Institutional challenges are in fact a significant barrier to cost-effectiveness as, in many cases, instrument implementation may require multi-sectoral coordination and multiple levels of governance, creating high up-front transaction costs. For example, in the Rio Camboriú payment for watershed services project that the TNC has actively supported in Brazil, transaction costs associated with efficient targeting and creating new collaborative institutions accounted for over half of the program costs (Kroeger et al., 2019). Context specific governance conditions can affect the distribution of benefits and costs, influencing program success. As our results show that the rationale for choosing an instrument is correlated with instrument success, an area for further research is understanding the institutional conditions that enable the selection and effective use of various instruments.

Understanding the longer-term conservation outcomes associated with the use of economic instruments is an important area for additional effort. Factors such as design elements, local contexts, and implementation style influence instrument effectiveness (Börner et al., 2016). Surveyed respondents perceive successful results from their use of economic instruments, but assessing success is challenging as it requires comparison with business-as-usual scenarios (Börner et al., 2016; Börner, Schulz, Wunder, & Pfaff, 2020). Conservation interventions are infrequently evaluated (Ferraro & Pattanayak, 2006; Fisher et al., 2014) and there is relatively limited documentation of successes and learning from failures (Catalano, Lyons-White, Mills, & Knight, 2019). Thus, a next step in the evolution of economic instruments is systematic evaluation of their impacts so that successful strategies can be replicated. For instance, when instruments such as PES are used, practitioners can use experimental or quasi-experimental strategies to identify causal outcomes (Börner et al., 2016; Jayachandran et al., 2017; Sharma et al., 2020). In other cases, careful monitoring of a range of indicators while qualitatively learning from and documenting successes and failures may instill enough confidence in outcomes to enable scaling. Careful evaluation, however, can be thwarted by practical considerations such as lack of funding.

The typology of instruments that we present in this paper can serve as a guide for practitioners to help them identify mechanisms germane to their own geographies and contexts. Based on the set of stakeholders NGOs are working with or interested in engaging, Figure 4 can be used to further narrow the list of feasible instruments. Two non-traditional instruments, water funds and carbon payments, are widely used and may be of particular interest as they seem practical in multiple contexts. However, it is important to underscore the institutional challenges associated

**FIGURE 4** Economic instruments organized by type (legend) and the actors they target. The size of the circle is proportional to the number of survey respondents who are using or have used that particular instrument (see Figure 1 as well). Note that the instrument “Renewable Energy Credits” is in group “Offset Schemes”
with successful implementation (Figure 3). Practitioners may need to examine the requirements posed by existing regulations and laws, cross-sector coordination considerations, and transaction costs associated with creating robust trades between buyers and sellers of environmental services in identifying appropriate instruments for their own work.

This typology also represents a working structure that would benefit from input from the conservation community. A practical step forward would be the creation of a community accessible and editable list, such as on a wiki or semantic web platform, to enable updates and new examples. This platform, based upon the typology presented here and informed by other resources such as Database on Policy Instruments for the Environment (OECD, 2020), could also be used to identify linkages among the instruments. Forest carbon payments, for instance, are critically dependent upon land tenure security (Duchelle et al., 2017). Similarly, incentive-based mechanisms, such as PES instruments, may need to be employed along with financial instruments, such as water funds. This community structure would likely present additional challenges in consensus, terminology, and orderliness of instruments, but these can potentially be resolved by building and maintaining semantic dictionaries and ontologies that specify definitions of instruments and relationships among them (Pauliuk, Majeau-Bettez, Müller, & Hertwich, 2016; Walls et al., 2014).

5 | CONCLUSION

This paper, based on the examination of practitioner activities in a large global NGO, seeks to provide the global conservation community with an expanded conservation tool kit, ready for testing, utilization, and innovation in multiple settings. This tool kit includes a typology of instruments in use, along with information on the challenges and successes associated with deployment in diverse contexts. While the paper draws its evidence from the experience of TNC, the insights it offers on the availability of an array of economic instruments should be of practical relevance to NGOs across the globe. Many of these instruments are deployed and can be replicated by smaller organizations.

A community platform that identifies relationships and interdependencies among instruments would help create a rich practical typology that could build upon the toolkit presented in this study. If the use of economic and financial instruments by the conservation community continues to grow, the sharing of knowledge through such platforms can only improve the chances of successful implementation of economic instruments and long-term achievement of conservation goals.

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CONFLICT OF INTEREST

The authors declare no potential conflicts of interest.

AUTHOR CONTRIBUTIONS

Priya Shyamsundar conceived the foundation of the study. Nathaniel Springer, Jessica Musengezi, Eric O. Hunter, and Priya Shyamsundar contributed to the conceptualization of the study, design of the methodology, and collection of the data. Nathaniel Springer, Jessica Musengezi, Eric O. Hunter, and Priya Shyamsundar performed the analyses. Nathaniel Springer led the writing of the manuscript. All authors contributed to the preparation and revision of the manuscript at all stages.

DATA AVAILABILITY STATEMENT

The survey data used for the analysis can be found in Table S3.

ETHICS STATEMENT

The authors are not aware of any ethical issues regarding this work.

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ENDNOTE

1 As many transactions are too small or new to attract mainstream institutional capital, multiple sources of capital are blended, whereby public or philanthropic investors are able to take a lower rate of financial return in exchange for higher impact and the ability to attract large amounts of more traditional investment capital.

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**SUPPORTING INFORMATION**

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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