CHAPTER TWO

Why Birds Matter Economically

Values, Markets, and Policies

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The concept of ecosystem services[1] was originally conceived as a metaphor to increase the visibility of societal dependence on ecosystems in a language that reflects dominant political and economic views (Gómez-Baggethun and Ruiz-Pérez 2011; Norgaard 2010). As Costanza (2003) notes, the first formal efforts to bring ecologists and economists together was in 1981, when Ann-Mari Jansson organized a symposium in Saltsjöbaden, Sweden, funded by the Wallenberg foundation, entitled "Integrating Ecology and Economics" (Jansson 1984). In the last 20 years the concept of ecosystem service values has been mainstreamed in the field of ecological economics (Gómez-Baggethun et al. 2010). Ecological economists developed methods to value ecosystem services in monetary terms to foster understanding of the economic benefits of conservation (Costanza et al. 1997, 2014). This economic framework gained international policy prominence with the release of the Millennium Ecosystem Assessment (MA 2005) and the report *The Economics of Ecosystems and Biodiversity* (*TEEB*; Kumar 2010). The result has been increasing on-the-ground application of policy instruments rooted in ecosystem service values (e.g., Balmford et al. 2002; Tallis et al. 2008; Barbier et al. 2009). We review this history as it relates to the conservation of birds.

First, we distinguish ethics and values that give rise to the valuation of ecosystem services provided by birds. Next, we offer a brief primer of the environment in economics, with attention especially to the groundwork for the monetization of ecosystem services provisioned by animals. We then describe examples of the economic valuation of birds, drawing attention to advances and shortcomings in the practice. Lastly, we conclude with recommendations for future directions and a plea for a rigorous, innovative, and ethical approach to the interdisciplinary integration of economics and ornithology.

Value and Ethics

At its core, economics is concerned with the problem of allocating scarce resources among competing uses, and a good economy should allocate limited resources to reflect the value system of its society (Hackett 2011). Philosophers distinguish two values of nature: instrumental and intrinsic (Callicott 1986). The instrumental value of something is its utility as a means to some end. The intrinsic value of something is its inherent value as an end itself. The instrumental values of birds include not only their obvious economic "use value" as goods traded in conventional markets (e.g., food and feathers), they also extend to less obvious "nonuse values" as providers of ecosystem services that can, in some cases, be monetized (Sekercioglu 2006a). Newcomers to the field of environmental ethics sometimes wrongly ascribe the aesthetic value of birds—citing the beauty and grace of their plumages, songs, or behaviors—as intrinsic value, and often regard it as "higher" or "better" than use value (Nash 1973; Justus et al. 2008). But aesthetic value is nonetheless instrumental, a means for human fulfillment. The intrinsic value of a bird, of course, does not depend on its beauty. Instead, intrinsic values for birds have philosophical foundations in society's valuation of sentience, theology, and kinship (Callicott 2008).

The growth in the economic valuation of birds and other components of biodiversity has triggered a heated debate. We briefly review the controversy, clarify some common misconceptions, and point the reader to some additional literature (drawing from recent reviews by Gómez-Baggethun and Ruiz-Pérez 2011 and Luck et al. 2012). Competing viewpoints in this debate range from an outright rejection of utilitarian rationalization for conservation (e.g., McCauley 2006; Child 2009) to the endorsement of valuation and markets as the only viable solutions to current environmental problems, which are framed as market failures (e.g., Heal et al. 2005; Engel et al. 2008). In between, many conservation organizations now embrace valuation of ecosystem services as a practical short-term conservation tool to influence policy (Daily et al. 2009; de Groot et al. 2002; Justus et al. 2008; Gómez-Baggethun and Ruiz-Pérez 2011).

Understanding the debate requires clarifying three interrelated but well-differentiated stages of an economic argument for conservation: economic framing, monetization, and commodification (Gómez-Baggethun and Ruiz-Pérez 2011). Economic framing employs the metaphor of ecosystems as (natural) "capital," and ecosystem functions as "services," to communicate the value of biodiversity in a way that reflects dominant political and economic views (e.g., Natural Capital Project of the World Wildlife Fund, 2013). Monetization takes place when natural capital or ecosystem services are expressed as exchange values (e.g., in dollars), which has become increasingly common since the publication of the much-discussed paper by Costanza et al. (1997) that estimated the total worth of the earth's natural capital. Finally, commodification of ecosystem services refers to the inclusion of previously nonmarketed ecosystem functions into pricing systems and markets, including the creation of institutional structures for the sale and exchange of ecosystem services (Gómez-Baggethun and Ruiz-Pérez 2011).

Critics have raised concerns over each stage of an economic argument for conservation. The economic framing of birds (or of nature in general) implicitly endorses an anthropocentric perspective that prioritizes their instrumental value to human well-being. Some have argued that this may undermine or diminish their intrinsic value (Ludwig 2000; Sagoff 2011; Weidensaul 2013), which may be the most or only enduring justification for their conservation (Rosenzweig 2003; Callicott 2008). Adopting an economic language and metaphor to frame human-nature relationships may also imply substitutability—the notion that components of nature can be replaced by human-derived alternatives. For example, loss of the biological control of pests by birds can be compensated for, economically, by the use of pesticides. The monetary valuation of birds (or nature) is the logical conclusion of economic framing, and this stage has been a volatile source of ethical controversy (McCauley 2006). Indeed, Leopold stated, "The last word in ignorance is the man who says of an animal or plant: What good is it?" (Leopold 1966; p. 190). More recently, Kronenberg (2014) has argued that a narrow anthropocentric focus on identifying useful and harmful birds was the downfall of economic ornithology, which was popular from the late 1800s until the 1920s, and that proponents of ecosystem services must carefully rethink the way they argue for environmental conservation, or it may befall the same fate (chapter 1). Indeed, recent debate over the so-called new conservation science (Karieva and Marvier 2012; Doak et al. 2014) indicates that the conservation community is grappling with how to balance the various approaches to framing values and conservation.

Methods to monetize the value of wildlife raise ethical issues concerning the anthropocentric bias in how value is assigned. For example, charismatic species may attract more attention, and thus higher willingness to pay from the public, than do less well known species (Martín-López et al. 2008; Luck et al. 2012). Others have suggested that while monetization itself may be benign, it paves the way for commodification of nature, which may ultimately undermine conservation (Gómez-Baggethun and Ruiz-Pérez 2011). The commodification stage has received the most ire in the debate. Critiques range from those based on moral grounds (e.g., the idea that some things just ought not be for sale; McCauley 2006) to exposés of undesirable economic consequences (e.g., the argument that substitutability in markets ignores essential ecological realities; Spash 2008), sociocultural impact (e.g., loss of traditional cultural practices: Grieg-Gran et al. 2005), complexity blinding (Gómez-Baggethun and Ruiz-Pérez 2011), or human inequity (conversion of open-access services to commodities that can be accessed only by those with purchasing power, Corbera et al. 2007).

A root critique of the monetary valuation of birds rests on the alleged dependence of intrinsic and instrumental value. For example, Weidensaul (2014, p. 40) stated that valuation of services provided by birds "inevitably cheapens the very thing we're trying to protect." This is a conflation of intrinsic and instrumental value, which need not be at odds (Vucetich et al. 2015). Consider your plumber: recognizing the undeniably useful and valuable service a plumber provides in no way cheapens his or her intrinsic value as a human. Indeed, intrinsic human value and rights remain inviolate regardless of professional skill, as a plumber or otherwise. Meanwhile, failing to value a good plumber's services is foolish. Those of us who have a deep and abiding value for humans consider it ludicrous and immoral to base someone's intrinsic value conditionally on a practical one; those of us who make careful economic decisions consider it imprudent to ignore instrumental value. And so it should be for birds.

Criticism of any proposed commodification of nature must acknowledge that in reality the controversy is over where to draw the line in what should and should not be commodified. In fact, material elements of nature (food, fiber) have been traded and sold as commodities since the birth of markets. Theoreticians acknowledge that all economic products result from the transformation of raw material provided by nature (Farley 2012). Indeed, the ancient philosophers (*ex nihilo nihil fit*) and modern physicists (First Law of Thermodynamics) got it right: you can't make something from nothing.

A Brief Primer on the Environment in Economics

In classical economics, which dominated from the late 1600s to the late 1800s, natural capital maintained a core position in economic analysis. For example, land was considered a nonsubstitutable production input, which partly explains the emphasis on physical constraints to growth offered by some classical economists, including Malthus's famous essay on population growth (Gómez-Baggethun et al. 2010). However, the industrial revolution, technological advancements, and the rapid accumulation of capital triggered a series of changes in economic thought that diminished the distinct analytical treatment of nature. Economists gradually restricted their analysis to the sphere of exchange values. Hence, nonmonetized inputs and consequences became externalities,[2] and economists' interest in natural resources languished (Crocker 1999). This evolution gave rise to neoclassical economics, which together with Keynesian economics dominates mainstream economics today. Neoclassical economic theory began to elaborate how technological innovation could substitute for production inputs such as land and capital, eventually pushing concerns over resource scarcity to near oblivion (Georgescu-Roegen 1975). This notion is perhaps best summarized by the American economist Robert Solow, who stated, "If it is very easy to substitute other factors for natural resources, then there is in principle no 'problem.' The world can, in effect, get along without natural resources, so exhaustion is just an event, not a catastrophe" (Solow 1974, p. 11).

The environmental movements of the 1960s and afterward gave rise to new schools of thought in economics with alternative treatments of the environment. The field of environmental economics expanded the scope of neoclassical economics by developing methods to value and internalize economic impacts on the environment into decision-making—for example, through extended cost-benefit analyses (Turner et al. 1994; Hackett 2011). Environmental economists assert that pure neoclassical economics neglects the contributions and impacts of nature by restricting its scope to those goods and services that bear a price. Therefore, it is argued, the chronic underappreciation of nature is rooted in the fact that its value is not expressed in terms comparable with economic services and manufactured capital (Costanza et al. 1997). To better capture a comprehensive treatment of ecological inputs and consequences, economic value is often divided into use and nonuse values, each subsequently disaggregated in different value components that are added up to the so-called total economic value (Gómez-Baggethun et al. 2010; Hackett 2011). To quantify these different values, a range of valuation techniques has been developed (e.g., revealed preferences, and travel cost methods; see below).

Environmental economics operates mainly within the axiomatic framework of neoclassical economics; it merely expands it to internalize what are more conventionally considered externalities of nature. Beginning in the 1980s, the new field called ecological economics emerged, and it challenged former assumptions by conceptualizing the economic system as part of the ecosphere that coevolves with social and ecological systems, with which it exchanges energy, materials, and waste (Daly 1977; Norgaard 1994). While environmental economics and ecological economics differ in their qualitative framework, the two schools of thought overlap considerably in the use of techniques to measure sustainability, evaluate policies, and assist in decision making. However, some ecological economists remain critical of valuing ecosystem services because of "incommensurability"—the idea that different types of value cannot be meaningfully expressed in common units (i.e., money). Some advocate for deliberative and multicriteria-based decision processes (e.g., Munda 2004; Spash 1998). The distinction between environmental economics and ecological economics remains controversial, and readers may want to consult Turner (1999) for additional information.

Over the last 20 years, the rise of these new schools of economic thought, combined with a growing recognition of the inadequacy of traditional conservation, has thrust ecosystem services into the mainstream (Marvier and Kareiva 2014). Although the state of the environment would undoubtedly be worse without traditional conservation, it has so far failed to reverse or stabilize biodiversity and habitat loss (Armsworth et al. 2007; Gómez-Baggethun et al. 2011). Many believe that conservationists have been reluctant to mix economics and conservation, thereby failing to act on the economic and sociopolitical roots of environmental problems (Child 2009; Steffen et al. 2004; Gómez-Baggethun et al. 2011). The ecosystem service approach offers an alternative to move away from the logic of "conservation versus people" and toward a logic of "conservation for people" (Kareiva and Marvier 2007).

The expansion of economics to recognize ecosystem services has followed two main approaches. The first involves public intervention to correct the market failure of externalizing environmental costs by imposing state taxes and subsidies. Implementing this approach involves markets for ecosystem services that invoke the so-called polluter pays principle (Gómez-Baggethun et al. 2011). The second approach relies on private transactions to correct market failures, often in markets where ecosystem services can be bought and sold. Implementing this approach involves payments for ecosystem services that invoke the so-called steward earns principle (Gómez-Baggethun et al. 2011).

The polluter pays principle that underlies markets for ecosystem services (MES) reflects an alleged ethic of responsibility. Usually, taxes or other penalties ensure that the agent causing the environmental harm bears the economic cost that would otherwise be externalized and thus shouldered by society. For example, the US Clean Air Act of 1990 promoted cap and trade mechanisms for atmospheric pollutants such as sulphur dioxides (Stavins 1998; Hackett 2011). The US Clean Water Act also offers a market for ecosystem service, in this case more directly related to the conservation of birds and other wildlife. Mandatory mitigation of wetland losses has prompted the development of "wetland banking," a market-based system designed to incentivize the consolidation of many small wetland mitigation projects into larger, potentially more ecologically valuable sites. This innovative idea has since been expanded to other habitats, and is now more generally referred to as habitat banking or simply conservation banking. This federally regulated system allows a "conservation bank," usually a private entity, to restore resources (e.g., a wetland) to compensate for authorized impacts to similar resources at development sites. Conservation banks operate similarly to other financial institutions that describe transactions in terms of credits and debits. Credits represent the composite of ecological function at a habitat bank, while debits represent the loss of ecological function at a development site. Bank sponsors can sell mitigation credits to permittees who are required to compensate for jurisdictional impacts incurred at their development sites. We are not aware of a review of the effect of conservation banks on bird conservation per se, but in a review of 35 conservation banks in the United States, Fox and Nino-Murcia (2005) found they cumulatively covered almost 16,000 ha and housed more than 22 species listed under the US Endangered Species Act. However, there are serious ecological and implementation issues in using conservation banks for wildlife species, including the suitability of banking sites and the establishment of endowments necessary to properly maintain them over time (Bonnie and Wilcove 2008). Nonetheless, conservation banking is arguably an effective means to conserve habitat for species such as birds (and, collaterally, other co-occurring species), by providing a market mechanism for the funding, strategic selection, and perpetual maintenance of habitats for wildlife and other biodiversity.

While negative externalities are addressed by the polluter pays approach of markets for ecosystem services, positive externalities can be dealt with through the "steward earns principle" with payments for ecosystem services. Payments for ecosystem services (PES) are offered to landowners in exchange for managing lands to provide some ecological service. Payments are voluntary and conditioned transactions between at least one provider and one beneficiary of the service (Tacconi 2012). PES may at first seem like a radically new approach, but rudimentary forms have been in place for many decades. After the Dust Bowl, for example, the US government provided payments to farmers who adopted measures to guard against soil erosion. This notion was expanded in the 1950s to offer payments to protect farmlands from urban expansion (Jacobs 2008), and is now firmly rooted in the United States via the inclusion of the conservation title in the passage of the 1985 Food Security Act (aka the "Farm Bill") and its successors.[3] By many accounts, the conservation programs in the Farm Bill have had demonstrably positive effects on wildlife conservation (see review by Heard et al. 2000). For instance, the Farm Bill's Conservation Reserve Program (CRP) alone includes more than 7 million ha and has had a huge influence on grassland bird populations (Johnson 2000); research suggests that CRP lands in the Prairie Pothole Region contributed to a 30% improvement in waterfowl production (Reynolds 2000).

Though rudimentary forms have been in place for decades, the widespread expansion of PES as an integrated development and conservation scheme has advanced mainly since the mid 1990s (Gómez-Baggethun et al. 2011). Costa Rica was the first country to establish PES schemes at the national scale, by offering landowners US$45 per ha for following ecological protection requirements (Pagiola 2008). These large scale PESs paved the way for global implementation, now emerging from the Conference of the Parties of the Kyoto Protocol, and from the United Nations' Reducing Emissions from Deforestation and Forest Degradation programs (REDD and REDD+). These programs create a financial value for the carbon stored in forests, offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development, and they may yield financial flows that reach up to US$30 billion a year. This significant north-south flow of funds could reward a meaningful reduction of carbon emissions, and could also support pro-poor development, help conserve biodiversity, and secure vital ecosystem services (UN REDD 2013). More recently, Dinerstein et al. (2013) have offered a modification of REDD+ in the form of a "wildlife premium" to more directly ensure that REDD+ projects benefit wildlife. However, critiques of REDD+ note that the program ignores some costs and thereby exaggerates its cost-effectiveness (Fosci 2013), and several NGOs and indigenous organizations have raised concerns of equity (e.g., security of tenure and benefit sharing for local stakeholders) and environmental integrity (e.g., leakage, permanence, and inflated reference levels; Bohm and Dabhi 2009).

Birds and Economics

Some birds and bird products have conventional exchange values and are directly tradable in markets, such as in the legal trade of domestic birds and the poultry and down industries. We do not elaborate on the economics or conservation implications of these markets. Instead, we concern ourselves with the nonuse value of ecosystem services provided by birds, including supporting services (e.g., seed dispersal), regulating services (e.g., pest control), and cultural services (e.g., recreational experiences). The nonuse value of these services is much more difficult to measure, and the development of valuation techniques has captured the attention of environmental economists for the past couple of decades (Kopp and Smith 1993). The underlying concepts for monetizing nonuse values rely on measuring what a society would be willing to pay (WTP) for a service, or what it will be willing to accept (WTA) to forego that service (Farber et al. 2002; Hackett 2011).

For example, let us first consider the ecosystem service provided by an entire ecosystem, such as flood control provided by a wetland (this example follows one offered by Farber et al. 2002). This type of case is far more common in the literature than the type involving ecosystem services provisioned by specific organisms, such as birds. If damages from a future flood event are estimated at $1 million, and the wetland reduces the probability of flooding by 20%, then society receives $200,000 in services from the wetland. In principle, the owner of the wetland could capture this amount from society because it corresponds to society's WTP for the service. This assumes a mechanism to capture the value (and it also assumes that society is risk-neutral). Markets for ecosystem services, such as those developed for conservation banking (reviewed above) are one type of capture mechanism. These markets work well for private services (where landowners can deliver services to those making payments) and properly regulated public services (as is the case for conservation banking).

However, many services provided by nature, such as flood control, are inappropriate for market trading because they offer a public good available to many people. For these cases, economists have developed six major ecosystem service valuation techniques to infer the WTP or WTA (see supplemental table 2.1).

The value of an ecosystem service can be measured as the cost that would have been incurred in the absence of the service; this type of measurement is called the avoided cost method. For example, Markandya et al. (2008) valued the ecosystem services provided by vultures in Northern India. They found that a healthy vulture population avoided costs of elevated human disease and death because vultures remove carcasses, resulting in fewer dogs and fewer bites to humans from rabid dogs. Using link functions to associate vulture numbers to dogs, dog bites, and disease prevalence, and drawing from the literature to provide values for the loss of wages and loss of human life in India, the authors estimated that healthy vulture populations avoid human health costs of up to US$2.4 billion per year. Other applications of the avoided cost method may draw from the concept of substitutability, such as cases for which the value of bird-provided pest control or pollination could be estimated by calculating the costs of chemical and manual labor substitutes. As noted by McCauley (2006), using this approach to promote bird conservation may be tenuous, as advancing technology may render the substitutes more economically efficient than the cost of conservation. Indeed, agricultural technology, such as pesticides, accelerated the demise of the field of economic ornithology, which was widely practiced in the late 1800s and early 1900s (chapter 1; Evenden 1995; Whelan et al. 2008).

Similarly, the value of an ecosystem service can be measured as the costs to replace that service with human-made substitutes, an approach called the replacement cost method (Swinton et al. 2007). For example, Hougner et al. (2006) conducted an economic valuation of a seed dispersal service provided by Eurasian jays (*Garrulus glandarius*) in the Stockholm National Urban Park of Sweden (chapter 7). Based on the cost of replacing this seeding or planting service through human means, they estimated the replacement cost of a pair jays to be between US$4,900 and $22,500. However, this may not be an appropriate measurement of value (Barbier

1998; Bockstael et al. 2000), because people might not be willing to replace a service at the full replacement cost (Freeman 2003).

The value of an ecosystem service can also be measured as the enhancement of income associated with the service; this is called the factor income method. This method is commonly applied in agricultural settings by identifying the effect of birds on yields or costs. When birds enhance yield without altering cost, the increased yield directly translates into increased income (Swinton et al. 2007). For example, Johnson et al. (2010) compared saleable coffee berry production inside and outside bird exclosures to document the increase in yield from bird predation of the insect pest *Hypothenemus hampei* in Jamaica. They found that bird-provisioned pest control contributed about US$310 per hectare per year, a value that is approximately 10% of the per capita gross national income in Jamaica at the time. More generally, when an ecosystem service affects agricultural outputs and the need for various inputs, a production function can be used to value the ecosystem service. A production function relates the quantity of output (e.g., agricultural yields) to various levels and combinations of inputs, including natural (e.g., bird predation of insects) and human-provided (e.g., pesticides or fertilizers; Christiaans et al. 2007) inputs.

Some ecosystem services, especially cultural values such as recreational opportunities, require travel. In these cases, the value of an ecosystem service can be revealed by the cost of travel required to receive the service; this is called the travel cost method. Travel associated with birding, ecotourism, and bird hunting can be assessed with this technique. For example, Gürlük and Rehber (2008) used the travel cost method to quantify the recreational economic value of bird-watching in the Kuşcenneti National Park (KNP) at Lake Manyas—one of the Ramsar sites of Turkey and an important habitat for endangered birds. They found recreational value of the park to exceed US$103 million annually. Using a similar approach, Czajkowski et al. (2014) estimated that each person visiting Zywkowo, the best known "stork village" in Poland, paid a surplus of between US$60 and $120 for the opportunity. Given that Zywkowo receives 2,000 to 5,000 tourists annually, this represents a substantial willingness to pay for bird-based recreation. Observations of the relationship between people's recreation activity and their travel costs are used to estimate recreation demand functions. If the demand can also be related to levels of ecosystem provision, then changes in the ecosystem service will shift the demand functions and can be used to value changes in the value of the service. This approach has been used to estimate values associated with agricultural conservation programs that affect pheasant hunting (Hansen et al. 1999). Although the travel cost method is intuitive and has been used for decades, there are several challenges in applying and analyzing travel cost models, including choosing the dependent variable, choosing model specification, quantifying the value of time, and accounting for substitutes and multipurpose trips (Gürlük and Rehber 2008).

The value of a service can be measured by the change in value of a marketed good associated with the service; this is called the hedonic pricing method. In essence, hedonic approaches can measure values that get capitalized into the asset value of property (Swinton et al. 2007). Application of this method for valuing open space as a characteristic of residential properties is well established (Taylor 2003). A hedonic price function is estimated, often with regression, usually by characterizing the land, structure, neighborhood, and environment. The analysis can reveal the effect of environmental attributes on local real estate pricing after accounting for the other factors. For example, Neumann et al. (2009) conducted an analysis of real estate prices near the Great Meadows National Wildlife Refuge in Massachusetts, a popular place for bird-watching. They found that a property located 100 meters closer to the NWR than a neighboring property had a price premium of $984. This ecosystem service cannot be attributed solely to birds, of course, as open green space in general improves home prices; but the researchers noted that proximity to the refuge was valued more than proximity to agricultural land, cemeteries, and general conservation land. More generally, bird diversity positively influences human perception of natural areas (e.g., Fuller et al. 2007). Thus, an increase in the presence and diversity of birds in urban areas has the potential to provide a service that benefits humans directly.

Finally, in cases where none of the above methods is appropriate, it may be possible to monetize a service by surveying people to assess their willingness to pay. In these cases, the value of a service is measured by posing hypothetical scenarios that involve the valuation of alternatives based on preference that is explicitly stated or revealed by comparisons (Hackett 2011). For example, Clucas et al. (2014) used stated preferences to perform a cross-continental economic valuation of native urban songbirds, estimating the lower boundary to be about US$120 million/year in Seattle and US$70 million/year in Berlin. The contingent valuation method allows researchers to specify the exact scenario to be valued (Swinton et al. 2007). Unlike other methods, it is capable of measuring passive use values that people may hold regardless of whether or not they will directly use the ecosystem (Freeman 2003). This method has been applied especially for endangered wildlife species (Richard and Loomis 2009). For example, Reaves et al. (1999) showed that people were willing to pay between US$7.57 and $13.25 per person per year in South Carolina to restore the endangered red-cockaded woodpecker (*Picoides borealis*). Stevens et al. (1991) documented a figure of US$28.25 per person per year for bald eagles (*Haliaeetus leucocephalus*), and Bowker and Stoll (1988) found between US$21 and $42 for whooping cranes (*Grus americana*).

Future Directions

As the above review indicates, efforts to value ecosystem services by birds have been promoted by many in the last 20 years (Sekercioglu 2006b, Wenny et al. 2011). In theory, these efforts should help society and its institutions better recognize the value of birds, and this should increase investment in bird conservation while simultaneously advancing human well-being (Daily et al. 2009). To date, however, there are relatively few practices and policies that deliberately incorporate the ecosystem services delivered by birds into land-use decisions. Doing so will require ornithologists to work collaboratively and in interdisciplinary ways to advance our understanding not only of the ecological science underlying services provided by birds, but also of the social science linking those services to human values and policies. Here, we briefly review key steps and strategies so that ecosystem services can be harnessed for bird conservation and human well-being alike.

The ultimate goal of valuing ecosystem services provided by birds is to make better decisions about the use of land and other natural resources. Those decisions are part of a loop of information that must include acknowledgment of the instrumental values of birds (fig. 2.1). Navigating this loop requires key information and science to link each stage to the next. The ornithological and ecological sciences are essential for predicting how land use decisions affect birds and other elements of the ecosystem, and in turn how those changes affect the delivery of bird-provisioned ecosystem services. In this regard, ornithologists should focus additional future work on unraveling how habitat and landscape modification affects bird communities and populations, and how those changes affect ecologically functional groups (Díaz and Cabido 2001; Sekercioglu et al. 2004). In turn, economics and cultural sciences are necessary to translate those services

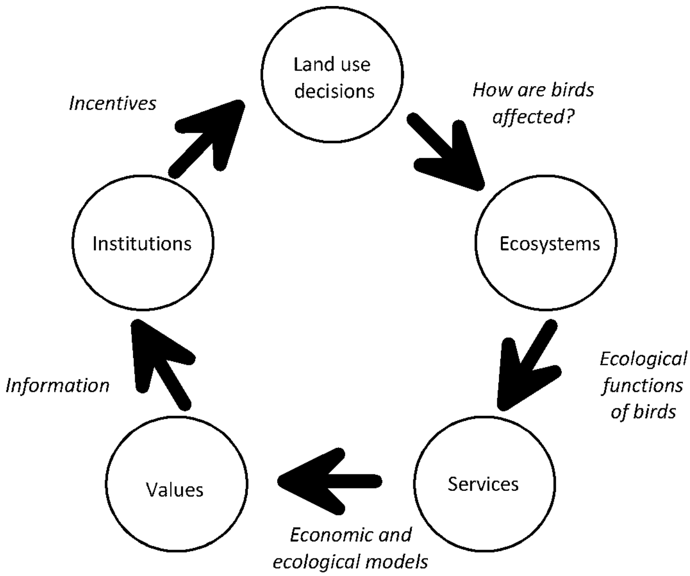

FIGURE 2.1. A framework for how ecosystem services provided by birds or other organisms can be integrated into land use decisions. Redrawn from Daily et al. 2009.

into values. The examples above show how ornithologists have drawn from the field of economics and, in the best cases, collaborated with natural resources economists to use valuation methods to quantify ecosystem services delivered by birds. As we have seen, these values are multidimensional (cultural, economic, intrinsic), so it will be important to characterize them as comprehensively and broadly as possible, and in ways that will be meaningful to many different audiences (Daily et al. 2009). New tools, such as the InVEST model (Nelson et al. 2009), can help land use managers integrate and balance multiple ecosystem services into proposed land use scenarios to, in the end, inform appropriate land use decisions.

The links between values, institutions, and ultimate land use decisions draw more from politics and social change than from science. Nonetheless, the scientists involved in the earlier links must remain engaged to inform the development of institutions and incentives. Influencing existing institutions and building new ones is a profound challenge to conservation science. The view of birds as economically essential can be cultivated by (1) promoting existing and proposing new incentives for bird and habitat conservation (e.g., Farm Bill conservation title) while fostering the recognition of the value of their services (Sekercioglu et al. 2004),

(2) evaluating existing policy and finance mechanisms with recognition of both their environmental and social consequences (Berkes et al. 2003), and (3) ensuring that essential stakeholders participate in the development of these new institutions and mechanisms (Cowling et al. 2008; Daily et al. 2009).

Finally, the link between institutions and decisions rests on human behavior. Societies that deliberatively value nature and resist an overemphasis on short-term economic gain will easily mainstream ecosystem services into decision-making (Diamond 2005; Daily et al. 2009). For this reason, perhaps the greatest benefit of documenting why birds matter economically is in advancing the ontological position that ecosystems and the species they hold not only are a matter of ethics and aesthetics, but are also essential for human subsistence and fulfillment (Gómez-Baggethun and de Groot 2010). There are many devils in the details of even the most basic decisions in setting up markets and payments for ecosystem services; these include contract duration, size and frequency of payments, and monitoring of outcomes (Daily et al. 2009). Indeed, proponents of ecosystem service science must be mindful that the commodification of birds' services may reproduce neoclassical market logic and its underlying ideology and institutional structures (Gómez-Baggethun et al. 2010). Commodification of ecosystem services may in the long term be counterproductive for biodiversity conservation and equity of access to an ecosystem's benefits (Gómez-Baggethun and Ruiz-Pérez 2011; see also "Value and Ethics," above). Working with philosophers can help ecologists free themselves from the misconception that recognizing instrumental value requires monetization and a diminution of intrinsic value, and such collaboration can introduce new decision support tools for conservation that do not demand monetization (Justus et al. 2008).

To advance the conservation of birds, should we appeal to peoples' hearts, minds, or wallets? All three. Our view is that the recognition that birds matter economically is a powerful tool for conservation and for improving human life. But it is just a tool—one that should be used not as a single decision-making criterion, but alongside recognition of the noneconomic value dimensions of nature (Justus et al. 2008; Gavin et al. 2015). So with one breath we should describe how, for example, black-throated blue warblers (*Setophaga caerulescens*) can deliver economically important ecosystem services by controlling insect pests of coffee (Kellermann et al. 2008), and thus advocate for policies that attract birds and improve human livelihood, while with the next breath we expound on the bird's lilting song, its awe-inspiring migration, and its place on this earth as our feathered kin. We can remind ourselves that, in Thoreau's words, a blue bird "carries the sky on his back" (Thoreau 1952).

Notes

1. Ecosystem services are the conditions and processes through which nature sustains and fulfills human life (Daily 1997).

2. In economics, an externality is a cost or benefit that results from an activity or transaction and that flows to members of society other than the buyer, seller, or owner (Hackett 2011).

3. At the time of publication, the current farm bill is the Agricultural Act of 2014.

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