Linking Knowledge with Action: an approach to philanthropic funding of science for conservation

A report to the Conservation & Science Program, David & Lucile Packard Foundation

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ABSTRACT

Since 2009 the Packard Foundation's Science subprogram has been following a use-inspired research approach to guide its funding. This report describes this approach, Linking Knowledge with Action (LKwA). LKwA is being used at the Conservation and Science program (C&S) to fund scientific research and syntheses that advance strategic objectives. This approach involves innovations in grantmaking that emerged through developmental evaluation, a collaborative process between an independent evaluator and program staff. Using LKwA the Science program develops projects at the request of and in consultation with C&S subprograms focused on conservation action. LKwA then guides the creation of a three-cornered relationship, in which research is jointly produced by a science grantee and the intended user of that research, with funding from the Foundation. These projects are implemented over periods of one to three years, with budgets of $300,000-1.5 million. Each project is in effect a small-scale strategic investment, aimed at informing decisions and decision makers in ways that align with the conservation goals of C&S. In this report we describe LKwA's conceptual framework and its operational implementation at the Packard Foundation.

The authors developed LKwA collaboratively in a process of *developmental* evaluation. This is an unusual use of evaluation skills early program development stages to assist program staff to articulate its theory of change, to define what success looks like, and provide insights during early implementation about options that offer good prospects for success. This report concludes the developmental process with a formative evaluation of the early experience of LKwA. That evaluation has found that

- The Science program has been successful in attracting a pool of researchers.
- These researchers were already familiar with challenges to the use of science research in decision making and brought substantial experience in addressing those challenges.
- The prospects for use of their Science program-supported research is reported to be as good as their most successful research over the previous five years.
- The use-inspired approach is likely to be replicable in other settings with different program officers.
- Developmental evaluation has played an important role in the articulation of LKwA, a practicable and usable theory of change.

These findings describe a grantmaking approach that has been in use for less than four years and involving fewer than 50 grants. Many of those grants are still being implemented. More important, the knowledge produced with this support does not in most cases lead to conservation outcomes that can be measured yet. As a result, the evaluation focuses on process changes such as use of knowledge in decision making. The report should be understood in this context. The findings are clear, but they are based on an experience that is still unfolding and growing.

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This report describes Linking Knowledge with Action (LKwA), an approach to philanthropic support of conservation science. LKwA is being used at the David and Lucile Packard Foundation's Conservation and Science program (C&S) to fund scientific research and syntheses that advance strategic objectives. This approach involves innovations in grantmaking that emerged through developmental evaluation, a collaborative process between an independent evaluator and program staff. Using LKwA the Science program develops projects collaboratively with C&S subprograms focused on conservation action. LKwA then guides the creation of a three-cornered relationship, in which research is jointly produced by a science grantee and the intended user of that research, with funding from the Foundation. These projects are implemented over periods of one to three years, with budgets of $300,000-1.5 million. Each project is in effect a small-scale strategic investment, aimed at informing decisions and decision makers in ways that align with the conservation goals of C&S. In this report we describe LKwA's conceptual framework and its operational implementation at the Packard Foundation; we also discuss the role of evaluation as a structural element of LKwA and the developmental evaluation process that has guided the program innovation process.

The report is coauthored by an evaluator (AR) and the program officer responsible for the grantmaking program being evaluated (KL). While both authors have taken an active part in writing every word, our roles are appropriately distinct. Where those separate roles are important, we have indicated in the headings below which coauthor took the lead in articulating the section that follows.

I. Linking Knowledge with Action in grantmaking (KL)

The uneasy relationship between knowledge and action

The state of the natural world and the pressures put upon it by human activity are both typically obscure. The loss of a species from a marine ecosystem goes unnoticed unless there is careful observation or there are fishers harvesting it. Polluted water is too often found when illness emerges in unwary communities. Whether humans are altering global climate remains contested. Systematic observations and scientific analyses are indispensable to recognizing and responding to changes in the state of natural systems. Usually, though, the responses to problems involve changes in human behavior that affect economic interests and cultural habits. Scientific knowledge is then entangled with social change and advocacy, as one sees in the controversies that erupt when the presence of an

endangered species triggers government intervention in the use of private property. Moreover, scientific knowledge of ecosystems undergoing human-caused change is typically uncertain and incomplete, even when it is clear that there are troubling shifts underway. Science stands in uneasy tension with controversy, because knowledge tends to be used instrumentally—when it aligns with a user's objectives. Science is often ignored in environmental decision making: too frequently, scientific knowledge is inconvenient truth, in which uncertainty provides further room for rationalization and dismissal (see Kahan 2012).

Analysts have observed that this tension complicates both the supply of and demand for science in decision making (McNie 2007). Price (1965) identified a "spectrum from truth to power": science, to be credible, must be independent—guided by the search for truth—while knowledge, to be useful, has to be legitimate—guided by the realities of responsibility and power. It is difficult for a single entity to span this spectrum, although unusual individuals have proved capable of making significant contributions at different points of the spectrum, normally at different points of their careers. Thus, Nobel physicist Stephen Chu has served as secretary of energy in the Obama Administration, while Nobel molecular geneticist Harold Varmus directs the National Cancer Institute. It is much less common for someone to succeed in science after achieving success in politics, however, and Theodore Roosevelt may have been the last president to publish original scientific work after his term of office. Sarewitz and Pielke (2007) have recently clarified the way the tension between truth and power affects both the supply and demand for science by governmental actors, leading to missed opportunities in both science policy and the use of science in decision making.

The emergence in the 1990s of global assessment processes such as the Intergovernmental Panel on Climate Change and the Millennium Ecosystem Assessment demonstrated that environmental science could be influential in decision making on a global scale. In studies of these international assessments, Clark and coworkers (Mitchell et al 2006) called attention to the characteristics of their knowledge production processes that appeared to lead to usable knowledge—knowledge that was *salient* to the decision making process in which it is to be used, *legitimate* in the eyes of decision makers, and *credible* in the eyes of scientists. In these cases, an "authorizing environment" turned out to be crucial: an international coalition, under the aegis of the United Nations, requested the scientific assessments; this provided a legitimate starting point for recruiting scientists and fund raising. In this setting the authorization made it possible to create a "boundary organization" (Guston 2001), a temporary international secretariat that could manage the conflicting demands of science and policy to create the assessments—termed "boundary products" in the academic literature.

Related innovations in regional scale ecosystem-level management were studied by Sabatier and collaborators (see Weible, Pattison & Sabatier 2010) and Graffy (2007), building in part on work in adaptive management by Holling and coworkers (1978), Walters (1986), Walters and Holling (1990), and Lee (1993, 1999). Sabatier has carefully examined the use of science in both adversarial and collaborative settings, concluding that scientific knowledge is more likely to contribute to sustainable resource management in collaborative decision-making situations (Weible, Pattison & Sabatier 2010) and others have pointed to the importance of information in collaborative decision making (Adler,

Barrett, Bean, Birkhoff, Ozawa, & Rudin 2000). This finding is not surprising, but it provides important guidance in philanthropy, which has invested more in advocacy than collaboration.

Environmentalists have repeatedly relied on science as a political resource to argue for social change. From Rachel Carson's warnings about the hazards of pesticides in *Silent Spring* (1962) to the frustrated pleas of climate activists today, scientific knowledge has been invoked, often successfully, as a reason to recognize and to respond to the environmental changes wrought by human activities. Science in the service of advocacy remains an important philanthropic activity, for example in the Lenfest Ocean Program (www.lenfestocean.org).

Environmentalists have won reforms in practices and policies, and major institutions now pursue significant environmental objectives. Environmental science can accordingly make strategic contributions in arenas where stakeholders collaborate. These range from the design of protected areas, to the detection of pollutants at levels far below those at which epidemiological effects can be seen, the development of green technologies, and the governance of community-based natural resource systems. The adoption and use of scientific knowledge in public policy, engineering, community practices, and the marketplace all rely on institutional settings that allow collaboration in important respects. Collaboration, it should be emphasized, does not imply the absence of conflict; under some circumstances, a collaborative approach to the generation of knowledge can help to address impasse by recognizing conflicts and identifying areas of consensus. Negotiation, trust, and the construction of temporary and lasting institutional arrangements to handle disputes are all necessary to linking knowledge with action in conservation.

The historically influential role of environmental science as a political resource has reinforced the belief of scientists that they are in a position to set the agenda of social action. This "science-led" model, in which scientific knowledge prompts responses in policy, engineering, and business practice, corresponds to the initial round of environmental reforms of the 1970s, when the Clean Air Act, Clean Water Act, Endangered Species Act, and Superfund articulated the reaction of Congress to scientific findings, and large public and private resources were redirected to environmental ends. In the ensuing decades, however, the science-led approach has had only fitful successes, together with the notable frustrations of climate and energy policy. The science-led approach remains the default approach of conservation scientists, however, a tendency reinforced by academic norms that define success as the publication of results rather than their translation into use.

Applied research, sponsored by government in agriculture, medicine, and military technologies, and by businesses directly in many commercially important fields, has been the chief alternative model of producing knowledge for utilitarian ends.[1] For instance, toxicology, spurred by widespread public concern and the expansion of chemical and biochemical materials in widespread use, has undergone rapid expansion as a field of environmental science. Applied research has continued to be regarded as

[1] See the discussion of "Applied Research, Use-Inspired Science and Use" below.

of lower status than basic science, however, particularly in the academic world. In part for this reason, the science-led model has persisted despite its uneven record.

As the scope of conservation has expanded, from places and species to large ecosystems like the Great Barrier Reef, and segments of world trade such as the global market for seafood, it has become apparent that a philanthropic funder cannot afford to rely only on a science-led model, even if it were more consistently successful. Yet alternatives to a science-led model of investment have been rare, and the risk of creating a scientific enterprise that is perceived to be mediocre persists. The Science program's Linking Knowledge with Action is an explicit (and to our knowledge unique) attempt to translate the body of learning on use-inspired research into philanthropy.

A recent conceptual summary of the ideas behind the Packard model of LKwA is provided by Clark et al (2010, 2011). This study proposes a simple typology of boundary work—processes and boundary objects "useful in managing the tensions [that] arise at the interface between actors with different views of what constitutes reliable or useful knowledge." (Clark et al 2010, 5) Using illustrations drawn from an international agricultural development program called Alternatives to Slash and Burn (ASB), Clark et al find that

> *boundary work is more likely to be effective in promoting used and useful research to the extent that it exhibits three key attributes: i) meaningful participation in agenda setting and knowledge production by stakeholders from all sides of the boundary; ii) governance arrangements that render the resulting boundary work accountable to relevant stakeholders; and iii) the production of "boundary objects" (collaborative products such as maps or models or reports) that "are both adaptable to different viewpoints and robust enough to maintain identity across them." (Clark et al 2010, 6; reference omitted)*

LKwA aims to support scientific research and syntheses that have these attributes, with the intent of advancing the conservation objectives of C&S. The grantmaking procedures described below are intended to assist producers of knowledge to anticipate what science will be salient for pending decisions about conservation issues, and to strengthen the qualities that make it more likely that the science will be used in decision making.

Theory of change

Although the projects supported by the Science program range widely across the Foundation's strategies for conservation, they share a theory of change that aims at funding use-inspired research (Stokes 1997, chap. 3). Linking Knowledge with Action (LKwA) asserts that knowledge is useful and used when it is *jointly produced* by participants in the decision process and experts with technical and domain knowledge. Knowledge produced in this way is more likely to be salient, credible, and legitimate. These attributes increase the probability that decisions will be effectively informed by science (Fig. 1). This theory contrasts with a more widely held belief, that scientific knowledge produced with little or no participation by decision makers can be influential in informing decisions and reforming decision-making rules and institutions; as noted above, this science-led approach remains the default social model for

conservation. LKwA is a common element of the projects selected for investment in the Science program. With an explicit theory of change the Foundation identifies indicators and hypotheses used to monitor project performance and to evaluate the Science program.

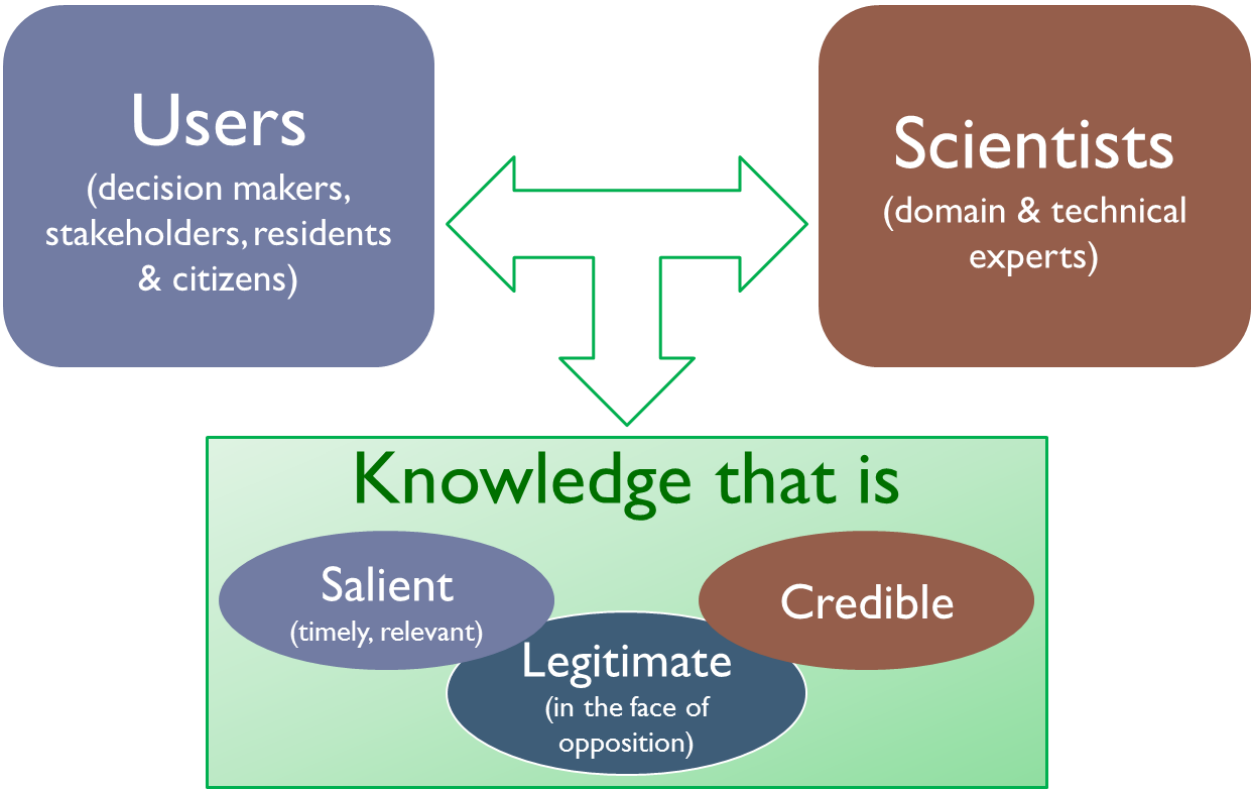

Figure 1. **Goals of Linking Knowledge with Action**

When knowledge links with action, it has three attributes, which often cannot be optimized at the same time. Decision makers need credible information: knowledge that is valid, and that has passed the tests of academic validation where available. In many decision-making situations, however, it is equally or more important that the information be salient—that it be relevant and timely. Decisions also need to withstand challenge, and that means the information on which the decisions are based needs to be legitimate: gathered in ways that assure that the information is correct, complete, and unbiased. Legitimacy can often be strengthened by exposing research to peer review, by involving a wide range of stakeholders as research questions are defined, by relying on syntheses of knowledge carried out by independent scientists who have no political or financial interest in arriving at a preordained result, and by funding such syntheses from similarly independent sources. Credibility, salience, and legitimacy can often reinforce one another, but they are also often pulling in different directions; a central task of LKwA is making knowledge good enough to inform and to improve decision-making (see Box 1). The intent in LKwA is to enlist the participation of users in the knowledge process in ways that contribute to the management of the tensions implicit in creating knowledge that is good enough to be informative and influential.

Box 1: Science that is "good enough" to inform action

Science is the pursuit of *reliable* knowledge. Publication of results in a peer-reviewed journal is the basic guarantor of science good enough for other scientists to rely on it in their own investigations. Gathering reliable knowledge is a meticulous process, with rigorous standards of evidence and disclosure of methods. Often, acceptance of new knowledge takes years of expert debate, replication of observations, refinement of methods, and even the retirement of some scientists reluctant to accept new finds and revised interpretations, as happened with the plate tectonic theory of the earth's crust.

The world of action is strikingly different. Decisions are typically made under deadlines and amid controversy. Although decision makers seek knowledge to justify and to guide their choices, often the knowledge that is usable is the knowledge that is available and relevant—however frail its basis in science. To be useful, knowledge should be scientifically credible, but it must be timely and relevant in the eyes of those in the decision process. The long-persisting public debate over global warming, for example, contrasts with the consensus among scientists about the basic dynamics of the global climate system. Scientists are convinced that changing the concentration of greenhouse gases in the atmosphere will change the climate; that is reliable knowledge. Yet political discussion continues over whether climate change is a legitimate and urgent problem, with arguments about how warnings from scientists should be balanced against economic development or unusually cold weather in a capital city.

Such disconnects reflect deep differences between science and action. Reliable knowledge is essential in a complex and dynamic world. Decisions need to be made responsibly, and that means that decision makers cannot wait but need knowledge that is "good enough." Linking knowledge with action thus requires continuing management of the tensions between science and decision-making, so as to honor both the demands of action and the rigor of science. Knowledge that is "good enough" is a central objective of such management. Usable knowledge requires the application of proper methods to relevant data, and that implies the use of appropriate resources. Useful knowledge is timely and relevant, and it is produced in ways that are transparent and respectful of traditional knowledge or other means of knowing that may not match the canons of field or experimental science. These requirements affect judgments of what counts as knowledge that is good enough to use in decision making. What matters is that these *are* judgments rather than simple metrics. Use-inspired research in conservation is emerging from a social process that connects users, stakeholders, researchers, and donors.

Usable knowledge in conservation is produced by actors acting across conventional boundaries: between researchers and users; between social and biophysical science; between the realms of knowledge and action. Clark et al (2011) propose to organize "boundary work" along two dimensions, by the source of knowledge (single discipline or expertise or multiple) and by the use to which knowledge is put (to enlighten, to support decision making by a single decision maker, or to support negotiation among multiple parties). As suggested in Table 1, LKwA focuses on activities in the shaded cells, where there is a direct contribution to decision making, either by unitary bodies such as government agencies or within a setting where negotiation is required to reach a stable, legitimate outcome. Because LKwA is an unfamiliar way to work, donors also play an instrumental role by

highlighting the use-inspired approach and by helping to bridge the boundaries between knowledge and action.

The Science program invests in opportunities expected to have observable impacts on decision making within one to three years. This demanding screen is intended to speed learning of what works and what does not work to bring about better use of knowledge. Grantees accordingly need to identify decisions, together with research users and scientists who can partner to achieve definable outcomes within this time-limited project approach. The Foundation selects a small portfolio of projects each year. These choices are guided by the strategic priorities of the Conservation and Science program's work in California and the West, the Gulf of California, and the western Pacific, as well as our work in marine fisheries, agriculture, and climate. Early projects have been summarized on the Foundation website (http://www.packard.org/what-we-fund/conservation-and-science/science/).

	Intended use of knowledge		
	Enlightenment	**Decision Support**	**Negotiation Support**
Single domain of expertise	Basic research	Expert advice	Assessment
Multiple domains	Interdisciplinary research	Participatory R&D	Adaptive management

Table 1. Examples of boundary work. Linking knowledge with action is concentrated in the shaded boxes. (Adapted from Clark et al (2011).)

The arrow in Fig. 1 marks social interactions that can address the tension between the needs of decision-makers and stakeholders, on one side, and the scientific community, on the other. By unpacking those interactions, LKwA highlights attributes that can be monitored during the implementation of projects, so that program staff can learn quickly from the experience of its grantees. Some grantees have found this theory of change useful in organizing their own activities, and their reactions to this framework have helped to shape the trajectory of grantmaking.

LKwA is an activity that calls upon donors to undertake a process of spanning boundaries as well. Because a use-inspired approach has not been the norm in scientists' work with decision makers, the donor plays a significant role in facilitating the relationships in the horizontal arrows of Fig. 1. For a philanthropic donor, this is an activity that must be carried out within the limitations of the tax laws that govern philanthropic activity. Since users will often be in government, and since the contribution of science can influence policy making, the direct role of philanthropy is often constrained. For this reason, the Science program has emphasized having grantees secure explicit agreements from decision-making users to consider the knowledge produced.

There are usually additional users, who might be called stakeholders. Some stakeholders are in a position to prevent the use of knowledge, and it is important for grantees and funder to understand

whether that is the case, or if opposition to the science is likely to emerge during the implementation of a grant. When opposition to answering the questions under study is likely, the Science program staff need to make a considered judgment about the probable impact of funding an activity over the opposition of influential stakeholders (see Box 2). That opposition can impair the legitimacy of the knowledge produced, as it would be more readily characterized as knowledge coming from a limited set of voices on a contested subject. In addition, the credibility of the knowledge may be subject to criticism; even when these criticisms are themselves on shaky ground, controversy can erode legitimacy.

Box 2. Wind, Wings & Wilderness

In 2010 the Conservation Biology Institute (CBI) approached the Foundation about funding for a study of wildlife impacts from wind power development in the Tehachapi Mountains of southern California. Staff of the Western conservation program affirmed the ecological importance of the Tehachapis and of wind power as an important but difficult opportunity for renewable energy development. Wind power development is carried out site-by-site, but the impact of wind machines on migrating bats and birds may escalate rapidly as more and more sites are built on a heavily used migration route. The federal and state agencies responsible for permitting development did not have adequate information to evaluate the cumulative impacts along corridors where winds made development attractive. Strengthening this information base was the task that CBI sought to undertake. (See logic model, Fig. 2.)

As program staff worked with CBI on a grant proposal, it became clear that wind power developers working on private lands needed permission from local government, as well as the state and federal agencies supervising development on public lands. CBI created an authorizing environment in the form of agreements that its analyses would be useful in permitting decisions by the federal Bureau of Land Management, the Fish and Wildlife Service, and several state agencies. CBI also approached the local government of Kern County, and the county declined the offer of information. Would the county's decision not to participate impair the legitimacy of CBI's work? Foundation staff judged that the analyses would be of sufficient value and scientific credibility to justify proceeding with the project, even if controversies over wind power development were to become more intense in the future.

Although the CBI project organized the available information well, the data were not sufficient to construct a scientifically credible model of bird and bat migration paths. Some permitting agencies are using the CBI data for background purposes and planning, but site permits have not been affected by CBI's research.

Table 2 identifies seven characteristic elements of Linking Knowledge with Action, including alignment with the strategic goals of C&S. We hypothesize that these together play an instrumental role in creating a knowledge process that key stakeholders and decision makers regard as legitimate, credible and salient. Table 2 articulates questions to ask about progress in achieving each of the seven elements. Logic models written for each project (see Fig. 2) show how these elements take shape in concrete situations. Some elements may already be present at the beginning of a project, such as a ripe situation, while others are strengthened or built in the course of the project, such as joint production of knowledge.

Grantees and users of knowledge are asked to provide grant monitoring information during and at the conclusion of the project for two purposes: to report on their progress in implementing the grant, and to aid in monitoring the performance of the Science program in implementing LKwA. For the latter purpose, monitoring is designed to facilitate comparisons among projects. Since the Science program continues to evolve, the objective is not uniformity of reporting but enough consistency to enable comparison among projects that vary in their goals, approaches, and context.

LINKING KNOWLEDGE WITH ACTION **GOAL: Decision makers, key stakeholders, and scientific experts are aware of the tensions facing effective use of science in decision making, and take steps to manage those tensions, with the aim of producing knowledge that is used because it is salient, credible, and legitimate. The use of knowledge significantly advances the conservation goals of the Packard Foundation.**	
Elements	***Questions to guide monitoring***
Strategic alignment with Conservation & Science	✓ What uses of knowledge are intended as a direct result? Which decisions and decision-makers are engaged? ✓ If the aim is support of negotiations, is the range of outcomes compatible with the Foundation's strategies? ✓ If the aim is decision support, how do users and their institutional agendas align with Foundation strategies? ✓ How will use be recognized? ✓ How would use affect the strategic aims of one or more conservation initiatives of the Packard Foundation?
Ripe situation	✓ Are there openings for rethinking where decision makers are seeking new information? Has commitment to existing options and understandings weakened? ✓ Can new information be provided in time for the decision-making window? ✓ Are there good prospects that new information will be influential—for example does the balance between power and knowledge in decision making favor knowledge?
Spanning the boundary between action and knowledge	✓ Does a boundary organization (Guston 2001) exist or can it be readily created as part of an initial convening by grantee? A boundary organization is accountable to both decision-making and scientific worlds (in different ways); it can organize the creation of an assessment or other "boundary object" that combines science and decision-making information in a useful form; and it can provide incentives for constructive contributions from both decision-making and scientific participants. If there is no explicit boundary organization, are these functions effectively realized? ✓ Are scientific experts trusted by decision makers? by stakeholders? by other scientists with relevant expertise? ✓ Are actors who can influence success (including those who can say "no" to use) engaged by scientists or those working at the boundary?

	✓ Do stakeholders agree that the questions to be investigated are important, even when they disagree on desirable answers?
Capacity of actors	✓ Do researchers have the capacity to conduct the inquiry? If the questions to be answered require an interdisciplinary approach, is the research team capable of integrating knowledge across disciplines, and integrating academic and experiential knowledge? ✓ Do those conducting the research have the interest and capacity to work with decision makers and stakeholders? ✓ Are participants aware of the challenges of salience, credibility, and legitimacy? Are they willing to work with the boundary organization to address those challenges? ✓ Are decision makers and key stakeholders willing and able to inform communication strategies needed for effective use of the knowledge produced? ✓ Are early adopters of the knowledge identified? Are they able to use it and communicate their experiences to other decision makers and stakeholders?
Joint production of knowledge	✓ Does knowledge process secure effective collaboration from decision makers, stakeholders, and researchers? How are researchers accountable to users and stakeholders? ✓ Do potential users believe that the information process took account of concerns and insights of relevant stakeholders and was procedurally fair (Legitimate)? ✓ Do potential users believe that the scientific knowledge is relevant to their decision making and timely in its availability (Salient)? ✓ Do potential users believe that the information has taken into account issues of data reliability, appropriate methods and validity of inferential claims, consideration of alternative hypotheses, and other issues of scientific credibility (Credible)? ✓ Do legitimate potential early adopters participate in the knowledge-production process?
Behavior of decision makers and key stakeholders changes	✓ Are there changes in issue framings, discourse, and agendas related to the issue? ✓ Are there changes in behavior and policies of relevant actors? ✓ Are there changes in actor goals, interests, beliefs, strategies and resources? ✓ Is there increased willingness and capacity to learn? ✓ Are there changes in institutions that enable and constrain interactions among actors? ✓ Did grantee and partners plan and execute a strategic communications plan effectively?
Knowledge process and products **positively influence the situation**	✓ Does the scale of knowledge gained match issue domains in likely use settings? ✓ Does the knowledge spread through likely use settings? ✓ Have the participants gained capacity to contribute to knowledge and to understand information? ✓ Did the process build a relationship between users (decision makers), those who can influence the decision (stakeholders) and those who conduct the inquiry? ✓ Does implementation reflect learning?

Table 2. Questions used to guide grantmaking under Linking Knowledge with Action.

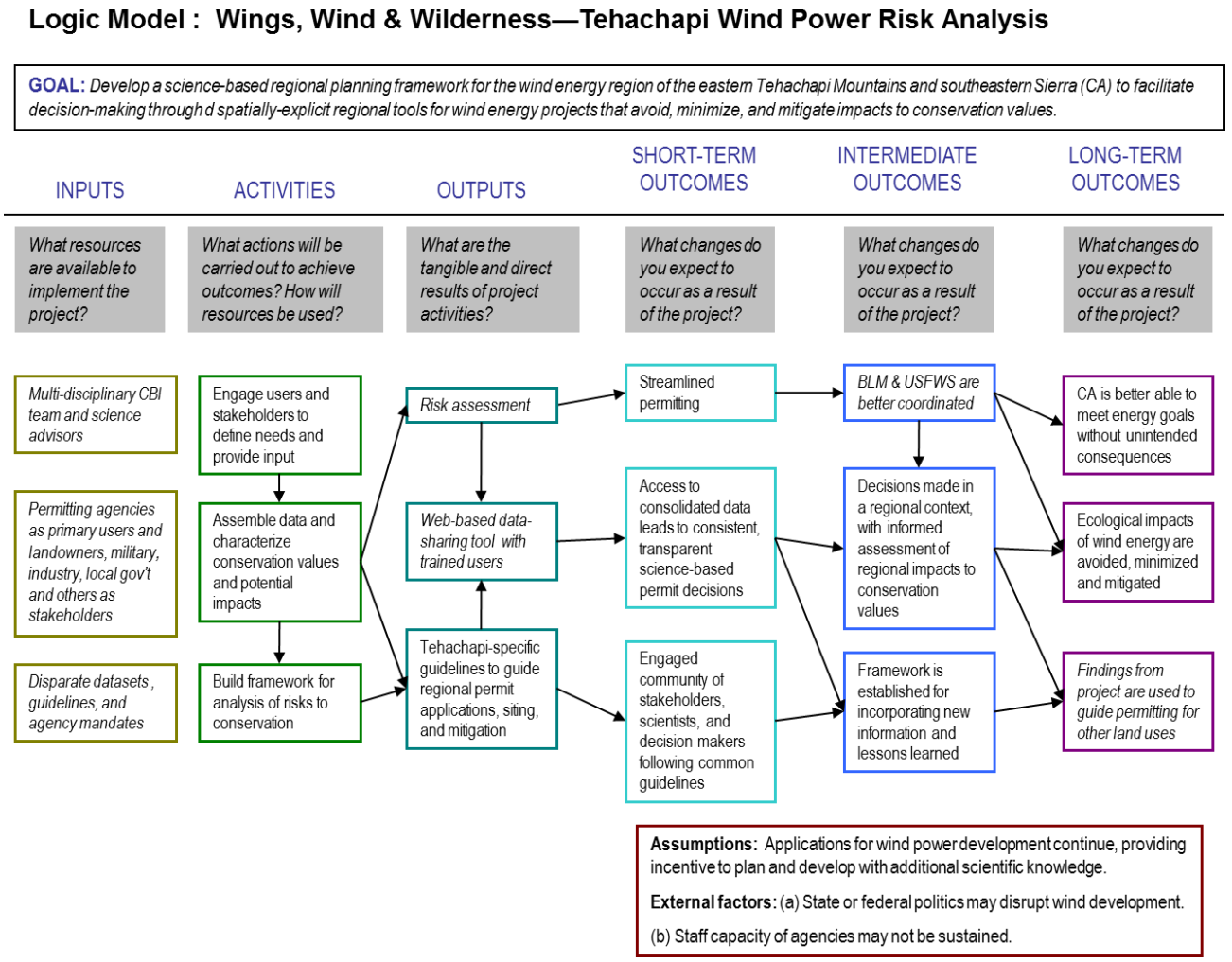

***Figure 2*. Logic model for a project.** (See Box 2.) By the end of the project, the web-based tool was deployed. Because the data available on bird and bat migration was limited, the other outputs could not be achieved

Applied Research, Use-Inspired Science and Use

Applied research utilizes the methods of science to address specific problems that are of interest to those undertaking and supporting the research. Applied research pursues specific ends such as improvements in social, medical, or ecological conditions, profits, or ideological and political ends. Communication of applied research varies: some applied research is internal to the supporting interests and the results rarely see the light of day (e.g. product design in competitive markets); in other settings applied research is part of a public discussion over policies and may be published in academic and popular venues (e.g. changing abundance of forage fish stocks).

In general the relevant performance measure for applied research is making a useful contribution to solving a specific problem. Applied research is instrumental to the supporting interests and so applied researchers have less autonomy in comparison to pure research. And the effects of applied research are much more immediate to the problem and interests that gave rise to the research. Because success is a practical technical matter, applied researchers must have a high level of science competency in the area of the problem that is being addressed (Roll-Hansen 2009).

Use-inspired research may be considered a form of applied research because it shares the performance objectives of applied research: use-inspired research pursues use and influence. Like other applied research use-inspired research targets specific actions—natural resource management decisions in the case of the Science program. Often, the target of use-inspired research is a matter of considerable public interest and controversy. This makes it more important for the research to be seen to be independent of the contending voices in the public debate, and use-inspired research is generally more autonomous from specific user interests than is the case for most applied research. As a consequence, in addition to high levels of technical competency, researchers must also have the capacity to engage in public dialogues with natural resource management decision makers and key stakeholders (see *Capacity of actors* in Table 2 above).

The Science program explicitly pursues use or influence in natural resource management decisions within three years and aligns with the broader conservation priorities of the Packard Foundation. Use and influence can be direct, when the research findings are used directly in the decision, or indirect when they contribute to one or more resource management decisions and decision processes over time. Use can also be intended or unintended but use-inspired research explicitly identifies an intended use. Use-inspired research in other settings such as agenda-setting or policy-forming could require different approaches from the LKwA theory of change employed by the Science program because use occurs over longer time frames and the intent is to target different types of use and influence and different decision settings and processes.

LKwA is applied research that can be appropriate for conflicted settings of the kind studied in the work of Clark and coworkers (e.g. climate change or agricultural practices in tropical forest). The usual applied research approach is for the researchers to address a problem that a commissioning interest wants to know about. In conflicted settings this can mean that different interests sponsor their own applied research and dueling science is the likely result; or alternatively some interests engage in the

discussion without benefit of applied science knowledge, or do not know that they should be engaged in the discussion. In decisions involving endangered species, for example, users of scientific knowledge include property owners, environmental NGOs, and government. Often, each underwrites applied science as part of their position-forming and position-taking.

LKwA as a use-inspired approach to applied research seeks in contrast to span the interests active in a contested terrain by designing research with the involvement of actors from across the spectrum. The aim is to focus research on questions these different interests agree are important, even though they may differ on what they think the answers to those questions will turn out to be. The intended use of the knowledge being produced shapes the research process.

Sometimes use is specific and instrumental, as it is when there is an established regulatory framework for which knowledge is needed to inform regulatory limits and procedures. Grants to the Southern California Coastal Water Research Project (SCCWRP) in 2009 and 2010 led to the formulation of a risk-management approach for monitoring "emerging contaminants" in California's waterways and water supply. None of these contaminants in treated wastewater is currently regulated, and they are found in such low concentrations that there has been little evidence of harm to humans or natural systems; there are more than 100,000 such contaminants that can be detected regularly, many more than can be monitored in practice. By organizing an expert panel of toxicologists and ecologists, SCCWRP facilitated a scientific consensus—to focus on the small subset of contaminants known or likely to be harmful—that is now being considered by the California State Water Resources Control Board in a rulemaking on monitoring of wastewater. Here, LKwA leads to applied research in a conventional sense: knowledge used to solve a problem (how to set priorities in monitoring, within an established regulatory structure).

In other circumstances, the arena of use is taking shape and can be influenced as well as informed by knowledge. Working with the Foundation's Fisheries program, Science provided funding in 2009 for socioeconomic studies along the Oregon coast, to inform the state legislature's deliberations on marine reserves and the land conservation agency's planning process for use of the state's coastal waters. Although both issues were politically sensitive, the socioeconomic knowledge—developed collaboratively with fishing groups—provided new perspectives that led to the successful designation of marine reserves in 2011. By supporting use-inspired research that engaged both users in state government and stakeholders, these grants contributed to problem-solving in a fashion that was quite different from conventional applied research.

This interest-spanning approach and the relatively greater researcher autonomy that is required to span interest are distinguishing characteristics of use-inspired as a form of knowledge production for problem-solving; in this way, use-inspired and applied research are overlapping undertakings, similar but not identical.

Grantmaking

As an operational theory of change LKwA provides one of two primary criteria for selecting projects that the Science program should invest in. The other criterion is advancing the strategic objectives of the Conservation & Science program.

The Packard Foundation website includes this language:

> *The Foundation's Science program focuses on the application of science to critical conservation challenges. We identify opportunities where better use or application of science could dramatically accelerate progress toward the Foundation's conservation goals. We then fund projects over periods of one to three years, with specific, measurable outcomes that pursue those opportunities through support of targeted research projects or projects that increase the impact of relevant research on decision makers. These projects are usually directly linked to the Foundation's other grantmaking strategies.*

Projects are implemented in stages:

- Identification of an opportunity. Usually, other program officers in C&S suggest projects and potential grantees. Prospective grantees can also self-nominate, following guidance on the Foundation's website (http://www.packard.org/what-we-fund/conservation-and-science/science/how-to-get-support/).

- Working with the prospective grantee, a project concept is sketched out. It is often useful to develop a draft project description and logic model (see Fig. 2). If a project is funded, an edited form of the project description and logic model are posted on the Foundation website's summary of projects in Science.

- Science staff then invites a proposal, with supporting documents as required by the Foundation's grantmaking procedures. As part of the due diligence review, Science staff may talk with prospective users to determine their interest in and commitment to using the results of the research. Some grantees are able to provide written statements of interest from decision makers, describing the decisions they expect to face and the way that knowledge developed by the project would help to inform those choices.

- Based on the proposal and due diligence review, Science staff then prepares two related documents. The first is an appraisal of the way that LKwA is expected to work, following Table 2; the six sets of questions describing LKwA are discussed, though it is normally the case that some of those questions cannot yet be answered. The second document is the grant summary, a document prepared following standard Foundation procedures; the summary includes a statement of pros and cons by the program officer, which draws upon the LKwA appraisal. The grant summary becomes part of the file sent forward to the Foundation's trustees for approval.

- As the board considers the recommendation, a third document is prepared, a list of questions for reporting by the grantee, in interim and final reports. This is a tailored form of Table 2. The list of questions is then sent to the grantee for comment.

- If the grant is awarded by the board, the reporting questions are sent with the grant agreement letter, and they become part of the grant file. The questions serve to articulate expectations, in a form useful to both grantee and Foundation staff; among those expectations is the prospect of surprise. The staff appraisal of LKwA is also entered into the grant file, so that staff views of the project can be used as a baseline for learning. A summary of the project, which may include more than one grant, is added to the document posted online.

- As part of the award, the Foundation schedules payments and payment contingencies. These are used to organize an initial phase of implementation if needed. Often the grantee does not have an established working relationship with decision makers who are expected to use the knowledge produced. Initial statements of interest may accordingly be pro forma. In these cases, the grant begins with a period of partnership-building, so that joint production of knowledge can occur. Funding for this partnership construction phase is timed so that a formal acknowledgement of decisions and decision makers engaged in the joint production process can be obtained. Further payments are contingent on meeting this initial deliverable.

- Joint production normally requires adaptation of plans of work and schedules of implementation. These are reviewed by Science staff, with the presumption that grantees know best how to work with users.

- Interim and final reports are used as occasions to record learning, and Science staff add comments to the grant file. These are shared with collaborating program officers and in most cases with grantees and, as appropriate, with users.

Program officers from C&S participate in the development of Science projects, identifying situations in which knowledge is needed to inform decision making. The involvement of the conservation subprograms is essential for two reasons. First, the strategic aims of the subprograms provide a working definition of a worthwhile conservation opportunity to pursue through investment by Science. Second, the program officers provide guidance to the context in which a grantee operates.

For example, one Science project supports baseline monitoring in the northern Gulf of California, contributing knowledge used by the Mexican fisheries management authority CONAPESCA in formulating species-specific management plans. Grantee PANGAS, a multi-institution collaboration, spans boundaries between science and government, between fishing communities, and between academic disciplines. The Science project relies on the understanding of Gulf of California program officer Richard Cudney in framing support for PANGAS and in monitoring the progress of the project.

There is a symbiotic relationship between Science and the conservation subprograms: Science provides funding to advance conservation strategies, while the conservation program staff provide essential

context and guidance to Science. This means that opportunities identified by conservation staff are assumed at the outset to be salient to the Foundation, and due diligence focuses on the identification of users, decisions, and ways to work with decision makers. Opportunities nominated by sources outside the Foundation also undergo due diligence review, but they must also find alignment with the Foundation's conservation strategies.

Prospective grantees have usually found LKwA an unusual approach. A noted analyst, a member of the National Academy of Sciences, expressed astonishment that the Science program wanted his organization to design its research in collaboration with users. "You mean you don't want us to describe the work we will do in the proposal?" he asked. "How will you know if it is any good?" The scientific credibility of his work was assured by his track record and longstanding interest in the topic; what needed strengthening was the legitimacy and salience of the knowledge being produced. This was not the conventional approach to funding research..

II. How evaluation contributed to the design and implementation of LKwA (AR)

Evaluation findings in brief:

- The Science program has been successful in attracting a pool of researchers.
- These researchers were already familiar with challenges to the use of science research in decision making and brought substantial experience in addressing those challenges.
- The prospects for use of their Science program-supported research is reported to be as good as their most successful research over the previous five years.
- The use-inspired approach is likely to be replicable in other settings with different program officers.
- Developmental evaluation has played an important role in the articulation of LKwA, a practicable and usable theory of change.

- These findings describe a grantmaking approach that has been in use for less than four years and involving fewer than 50 grants. Many of those grants are still being implemented. More important, the knowledge produced with this support does not in most cases lead to conservation outcomes that can be measured yet. As a result, the evaluation focuses on process changes such as use of knowledge in decision making. The discussion below should be understood in this context. The findings are clear, but they are based on an experience that is still unfolding and growing.

Three broad evaluation approaches are used to assist programs at different stages in their development:

- Developmental evaluation is used during the initial and early program development stages to assist the program to articulate its theory of change, to define what success looks like, and provide

insights during early implementation about options that offer good prospects for success (Patton, 2010).

- Formative evaluation is the systematic examination of the ongoing success of the intervention and processes, providing information, insights and advice about how these can be improved (Rossi et al. 2004; Scriven 1991). Formative evaluation is generally conducted at different points during an intervention, to assure improvements in efficacy, relevance, logic and efficiency, and to facilitate ongoing adjustments as the initiative matures.
- Summative evaluation judges the merit (changes in outcomes of importance attributable to the intervention) and worth (what they are worth to those affected) of an intervention (Scriven, 1996). Summative evaluation addresses high stakes questions about whether to continue, discontinue, or expand the intervention. An evaluability assessment (Wholey, 2004) is used to judge the readiness of the program for these decisions and whether it is worth the high costs and intrusiveness of summative evaluation; if there are identifiable decision makers and stakeholders interested in using the evaluation results; if the program is a good representation of the approach; and if the program has sufficient clarity about the changes it is pursuing and information useful in determining how it is faring.

The evaluation vision is for programs to utilize all three approaches during their voyage from inception to when they are ready for the high stakes questions: developmental evaluation helping the program find appropriate direction early on by identifying the more promising approaches to address the goals of the program; formative evaluation contributing to developing a successful high performing effort; and, when the program represents a mature approach towards the goals, summative evaluation to judge the difference that the program is making. The Science program use of evaluation is attempting to realize this evaluation vision.

Evaluation came to the Science program in 2008, fairly early in the effort to develop a strategy, but until the strategy began to develop a theme and vision the role of evaluation was appropriately limited. Once the vision for the Science program began to coalesce, evaluation became more active in assisting with the conversion of the vision to a programmatic undertaking and initially assessing the capacity of grantees to pursue use-inspired research. In 2010-11 a limited formative evaluation was undertaken with the intent of taking an early snapshot of progress and identifying some options for improving; this evaluation is reported below.

Contributions of developmental evaluation

The Science program began to actively engage evaluation during the early program formation efforts to understand how a donor could usefully support use-inspired research, for which the intended use is in resource management decisions within a relatively short time period. As candidate approaches emerged, sometimes in the form of a grant that seemed to offer more general insights for a possible approach, the evaluator worked with the Science staff to test whether it represented a plausible systematic approach. One of the results of this effort was that some key evaluation concepts entered into the conversation between the program and evaluator including a results focus, outcomes, theory of

change, diffusion of innovation, thinking in terms of projects rather than grants, and mechanisms of change. Of course these concepts had many origins prior to the developmental evaluation work; however during this work they became the language of the program. During this early period Michael Patton provided periodic contributions by observing and commenting; Patton noted that this was one of the first instances in which developmental evaluation was formally identified as an approach to developing a program strategy (personal communication 2011). The Science program also took on the three evaluation questions that were originally introduced during an evaluation of the Science program's EBM Initiative (Rowe, Hershner, & Trum, 2009) and whose origins lie in the planning documents for the US Government Performance Results Act (GPRA) (Koskinen, February 12, 1997):

1. What is my organization or unit responsible for achieving?
2. How will we recognize it?
3. How are we doing now?

Developing the theory of change

To be successful programs need to be clear about what they seek to achieve and the likely mechanisms for this. In evaluation terms this is referred to as a theory of change (Weiss, 1998). A theory of change is essential for both evaluation and the intervention; it addresses the first evaluation question about what the program is responsible for achieving.

Developing a theory of change was an iterative process with the Science program, and LKwA was the third effort to do so: the first was associated with what became an assessment of sustainability certification (Steering Committee of the State-of-Knowledge Assessment of Standards and Certification 2012) early in the program; the second, when an additional round of grants were in their proposal stage. The first two efforts did not bear fruit because the programmatic vision had not yet formed. Both of these early efforts did achieve gains, including the extending the targets of change beyond conservation decision makers (e.g. to include fish buyers as key decision makers in certification) and consideration of the indirect effects that are also attributable to the intervention. In these developmental stages the evaluator sought to ensure that the program embraced the inevitable complexity and ambiguity of their undertakings so the programmatic vision that would actually emerge would be realistic and able to address the many factors likely to affect success.

The LKwA theory of change was precipitated by the program officer offering for consideration recent work assessing the use and influence of global environmental assessments as a possible knowledge base for a use-inspired donor program (Clark, Mitchell, & Cash, 2006). This work resonated with ideas about evaluation use and influence, collaborative decision making, and other related literatures. The evaluator used Clark's work as the base for an initial theory of change (Fig. 3) that provided direction for the Science program. The program officer then used the proposed theory of change to develop a set of outcome-focused questions to guide implementation of the theory (see Fig. 1 and discussion of grantmaking above). The development of a theory of change was itself a process of joint knowledge production resembling LKwA, in which the evaluator's three guiding questions were translated into a

useful protocol for grantmaking. Implementation of the LKwA approach then proceeded for twelve months at which time the current formative evaluation phase was initiated in June 2011.

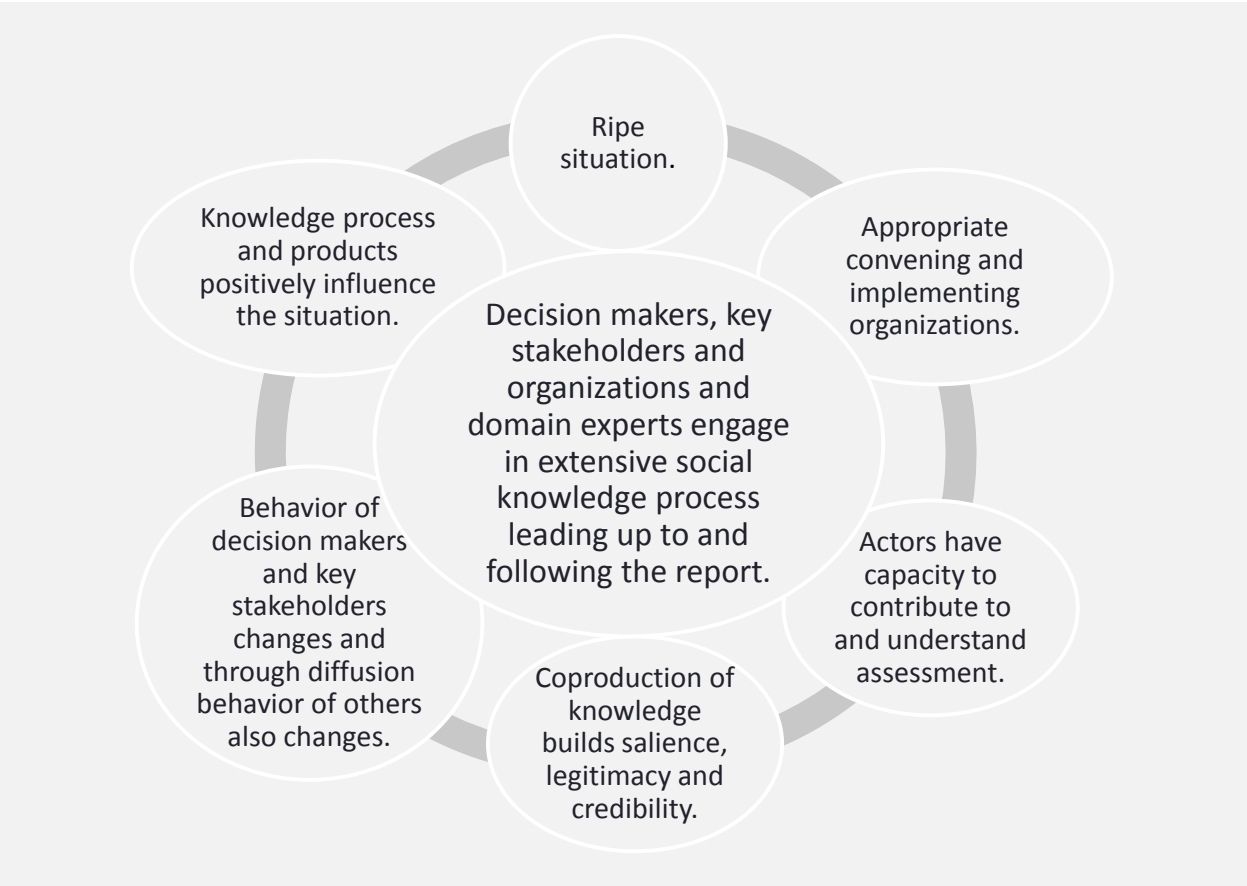

Figure 3. Outcomes map for use of science in decision making.

Developmental Evaluation with Projects

As the theory of change was emerging, the developmental evaluation approach included work with a sample of four of the early grantees, selected to assess how projects pursue use or influence in natural resource decisions. The underlying premise was that actually implementing use-inspired research approaches was very likely to prove challenging, even for these selected grantees who had a track record of focusing on use of science knowledge and who were undertaking projects formally structured on use and addressing clearly identified applied questions. That premise was based on long experience and informed by discussions with Michael Patton. The evaluator suspected that LKwA grantees could be working in contested as well as ambiguous and uncertain territory. And given these challenges, monitoring by the grantees themselves, framed around the three evaluation questions, could provide valuable and timely inputs as they learned by trial and error. Four projects and grantees were included in this developmental review:

- California Nitrogen Assessment, Agricultural Sustainability Institute, UC Davis (ASI)

- Vaquita Reserve Monitoring in the Northern Gulf of Mexico, Pesca Artesanal del Norte del Golfo de California: Ambiente y Sociedad (PANGAS)
- State of California Constituents of Emerging Concern Coastal and Marine Ecosystems Science, Southern California Coastal Water Research Project Authority (SCCWRP)
- Defining Verification Practices that Strengthen Certification's Contribution to Sustainability, ISEAL Alliance (ISEAL)

From the first meeting, three of these projects, ASI, ISEAL and PANGAS, appeared to be operating in potentially contested as well as ambiguous and uncertain territory. Because SCCWRP worked within a well-established regulatory frame and were using approaches that had previously proven successful, it appeared that they were taking a tested route to use and that their approaches would effectively engage decision makers and key stakeholders. This was not the case with the other three: ASI would have to deal with academic institutional and career incentives that were not well aligned with use-inspired science and with California agricultural interests that tend to resist change; ISEAL would likely face challenges in getting its members to implement the new procedures and then taking the approach to wider audiences; and PANGAS was targeting changes in politically charged and rapidly evolving national fisheries policies and enforcement.

The final column in Table 3 provides an assessment of each project's mechanisms for LKwA and illustrating how different settings and capacity can offer good prospects for successful use-inspired research using the LKwA approach.

As a result of this assessment the evaluator asked ASI, PANGAS and ISEAL if they would participate actively in the developmental process of the Science program by focusing on M&E and their vision of how LKwA applied to their work. All agreed and through these discussions the original assessments were refined (see Table 3). It was difficult for the evaluation to be accepted as a resource to the projects and not be seen as representing the donor. In any event, C&S decided to discontinue the developmental evaluation work with grantees, seemingly because the extra expenditure did not seem warranted given the small scale of the Science program, because it seemed to be work that the program officer should be doing, and because the culture of the Packard Foundation was to select good grantees and then stand back from the actual work. From an evaluation perspective this decision meant that evaluation experience and techniques were not as available to projects; while the evaluator had already decided that further engagement with ASI would be ill-advised other than arms-length technical advice for their monitoring and evaluation staff, continuing interaction with ISEAL and PANGAS might have proved helpful.

Project	Initial Assessment		Subsequent Assessment	LKwA Mechanism
	Strength of Challenge	**Monitoring & Evaluation Capacity**		
ASI	Career incentives of key post docs and junior faculty did not favor use-inspired science. Uncertain how agriculture interests could be engaged.	Project director had a key role in the research underlying LKwA, and the project budget had an allocation for M&E.	Weak M&E capacity to assist with addressing evaluation questions. Project director fully aware of, addressing challenges.	Director
SCCWRP	Joint production addressed with institutionalized and tested procedures within a structured and known regulatory environment.	Existing procedures provided managers with needed feedback and stock taking information from stakeholders.	Research and review processes reflected LKwA and likely to generate necessary information.	Established Processes
ISEAL	Unknown but suspected to be potentially problematic given the different capacities and priorities of members.	Absence of a theory of change for diffusion of innovation was of concern, but impending significant investment in M&E capacity provided comfort.	M&E capacity not a problem, but suspected that diffusion beyond a few early adopters could be problematic (confirmed in 2011 grant).	Staff
PANGAS	PANGAS culture developed at the U. of A. School of Natural Resources over generations of grad students; strongly collaborative with local decision makers and key stakeholders. But current work was on new territory where collaboration potentially more difficult.	PANGAS did not systematically monitor or document progress and challenges in working with decision makers and key stakeholders and did not appear to have the capacity to do so.	PANGAS included PIs whose base in conservation NGOs and non-tenure track academic positions made commitment to monitoring plausible. Capacity included strength working with federal government.	Culture of organization

Table 3. **Assessments of Sample Projects.**

There is understandable ambiguity about where developmental evaluation ends and formative evaluation begins. To the program officer the developmental evaluation phase concluded with the implementation of the theory of change through LKwA, and while he would include the project-level work as part of the developmental effort, there was no strong value associated with this effort. Most developmental evaluators would suggest that since the success of the Science program is heavily contingent on the success of grant-funded projects then the developmental phase should include more

intensive project-level work, either directly with projects or indirectly through closer monitoring of projects through the program officer. The difference is moot, it is at least unknown in this instance and since developmental evaluation is a relatively new coalescence of evaluation practice it is also unknown more generally.

III. Highlights from the formative evaluation (AR)

LKwA is still a very young initiative; the intent is that research supported by LKwA is used in or influences natural resource decisions within three years. The formative evaluation provided information and insights about LKwA intended to be useful to adaptation of the LKwA approach in the Science program. It was undertaken approximately two years into the program life, when even the first round of grantees were not yet at the target three year point. Once LKwA reaches a stage where experimentation is less frequent and strong, it will be appropriate to undertake systematic comparisons to true alternatives such as science-led research or possibly other applied research; at this stage our interest lies in adapting the LKwA approach to address identified improvement options. This was a focus of the formative evaluation reported below, including interim prospects for LKwA-supported research.

The formative evaluation is an important and systematic source of information and insights for improving LKwA. The primary concerns of the evaluation are to:

- Obtain a snapshot of progress towards the goal of realizing science knowledge that is used and influential in natural resource decisions,
- Identify the characteristics necessary for a successful use-inspired grant program, and assess the extent to which they can be replicated in other settings,
- Assess whether LKwA creates additional burdens for grantees and the Foundation, and if this is an issue.

LKwA success depends on the program and grantees; at an elementary level the program needs to recruit and support use-inspired science researchers to the program and they must address science issues of importance to natural resource management decisions in a fairly expeditious manner. Working with program staff, potential grantees should craft projects that will address the program's focus on use. Projects need to be undertaken in a manner providing good prospects for use, either following the LKwA approach or another plausible evidence-based model. These are addressed below as recruitment and prospects for successful use. Of course *use* is potentially a very ambiguous concept and this is also explored below; what are the places of use and influence and how closely do grantee visions match those of the program? The formative evaluation also considered grantmaking practices from the perspective of replicability and efficiency. The two key questions framing the formative evaluation were:

1. What is the contribution of LKwA to grantees undertaking use-inspired research?
2. Can the LKwA approach be used by other Conservation and Science programs or by other donors?

The formative evaluation effort also considered the burden on grantees because if the approach imposed heavy burdens it would be unlikely to have merit for replication elsewhere without first improving efficiency.

Information was obtained from a survey of grantees[2], a review of the documentation for each grant, a one and half day discussion with Kai Lee, interviews with six grantees, seven C&S program officers and the C&S Director and three program officers from other donors and who also pursue use of science knowledge. This work was undertaken during July – October 2011. The findings have been reviewed with the program officer; highlights are presented in the following section and were part of a December 2011 convening of selected grantees and other funders.

Recruiting use-inspired grantees

Grantees in the Science program should have some degree of success, measured by use or influence of their research in targeted resource management decisions. In a diffusion of innovation approach (Rogers, 1983) these grantees are regarded as early adopters of LKwA, respected by their peers and known to be successful in trying new approaches. At this early stage the Science program is not explicitly recruiting scientists to use-inspired research from curiosity-inspired research, but engaging scientists already inclined toward a use-inspired approach, to test and demonstrate LKwA. The expectation is that a focused use-inspired grant program will improve prospects for and accelerate use and influence of the work of these scientists.

This is confirmed by the record of LKwA grantees who were already use-focused:

- Over 80% of grantees responding to the survey reported at least one grant targeting use since 2006 in addition to the LKwA grant; the median was 4 use-inspired grants from donors other than the Science program since 2006.
- These use-inspired grants constituted about 45% of all grants received by LKwA grantees since 2006.

In addition the mechanisms to communicate knowledge by LKwA grantees from their other use-inspired research was consistent with joint production, and most importantly did not strongly utilize the mechanisms associated with curiosity-inspired research:

- The leading mechanism to promote use for the knowledge from the use-inspired grants was specific dissemination efforts targeting stakeholders and decision makers, used for over 40% of all use-inspired grants since 2006. Other options included peer reviewed publications or communications such as lectures and seminars or media (about 20% each), or other vehicles (about 15%).

It seems fairly clear that the Science program is recruiting grantees who are currently engaged in what they regard as use-inspired research.

[2] The response rates were 88% of grantees surveyed, representing 100% of projects studied.

What is the contribution of LKwA to grantees undertaking use-inspired research?

Bear in mind that LKwA grantees have not yet reached the three year deadline by which LKwA aims at use or influence in natural resource decisions; so the observations reported here are of prospects for use.

The LKwA supported research is expected to generate levels of influence very similar to the levels grantees achieved with their most successful use-inspired research since 2006.

- LKwA grantees were asked to select one of the use-inspired grants that they regarded as the most successful from those funded by a donor other than the Packard Foundation. A series of questions combine into the metric provided in Fig. 4[3] assessing prospects for use in resource management decisions compared between these "most successful" and their LKwA grant; the LKwA grants are judged as equally likely to be used or have influence in a resource management decision as their most successful recent research. This is a necessarily crude estimate of influence and depends on factors including different concepts of use, the unfolding of events affecting potential use over the period of the still incomplete research supported by LKwA and the simplicity of the measure itself. However, in follow-up interviews grantees confirmed their judgments and were able to explain the rationale for these. The measure provides a rough but useful take on expected influence from the research supported by LKwA.

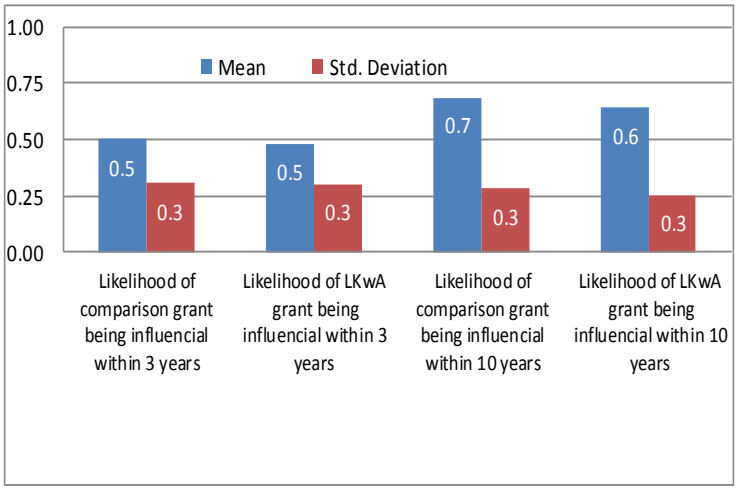

Figure 4. Comparison in likelihood of use, between grants from non-Packard sources and from the Science program, as estimated by grantees.

- During the interviews one grantee highlighted use and the three year ambition of the Science program: *Need to set deadlines; forces grantees to produce something which may have bigger impacts down the road.* This echoes what a number of interview respondents said, essentially that

[3] The score is the product of the likelihood that the research will be influential and the level of influence divided by the maximum possible score to convert the product to an index. The approach was adapted from a proven method used to evaluate complex environmental decisions.

to achieve use it is not necessary to have science exact before it is useful: *scientists get hung up on perfection* said one, another emphasized the importance of *producing something early on* and using it to engage some key stakeholders. These and other comments from the interviews are consistent with the LKwA knowledge process emphasizing the joint production process over knowledge and balancing credibility with salience and legitimacy.

The LKwA program appears likely to achieve a comparable standard of success matching grantees' most successful work over the past five years. Grantees expect to achieve most gains within the three year period, additional benefits between three and ten years are expected to be marginal.

Where does use and influence occur?

The places where natural resource decisions occur can be thought of in terms of decision forums, involving convening organizations and those with the authorities to make and implement the decisions; also (as discussed above) the decision process has the potential to affect openings for science in the decision. The LKwA theory of change and the Science program direct use-inspired researchers toward joint production with actors who have the authority to make and implement decisions. The decision forum varies. Graffy (Graffy, 2008) identified five stages in policy where science knowledge can be used or influential; these were used in the LKwA grantee survey.

- Emergence – identifying need for action
- Framing and legitimatizing perspectives and actions
- Setting priorities
- Forming policy, rules or program response
- Implementation

Respondents selected a first and second choice of decision forums where science knowledge can make the most useful contributions (first two data columns in Table 4 below). These decision forums were also used to code open ended responses to survey questions about the decisions respondents anticipated to be affected by their LKwA and other use-inspired research over the past five years (two right columns in Table 4). Responses from grantees are at the project level (last two data columns); often a project will have been supported by multiple grants.

- Grantees judge the potential influence of science knowledge to be greatest at the emergence and priority-setting stages of policy; actual policy formation is also judged to be the forum where science knowledge can be most influential (green shaded columns 2 and 3 below).

However grantees report that both their LKwA projects and their other use-inspired research conducted since 2006 were used at the priority setting stages, with LKwA projects also used at the framing and legitimizing stage.

- Priority setting forums are where both the LKwA grants and other use-inspired are used (columns 4 and 5 green shading).

- Framing is also an important forum for use of LKwA grant research (column 4).

	Stage where science knowledge can make most useful contributions		Actual stages where research used or influential (coded from responses)	
	First choice	First and second choice	First choice	First and second choice
Emergence – identify need for action	6	11	0	2
Framing and legitimizing perspectives and actions	6	10	5	1
Setting priorities	4	6	6	5
Forming policy, rules or program response	2	9	2	2
Implementation	1	3	0	3

Table 4. Grantees' estimates of policy stages science can be useful, and where their own research is used.

Actual use of LKwA and the other use-inspired research occurs at more advanced stages of policy development than where grantees judge science knowledge can make the most useful contributions. One can speculate that this could be associated with the focus on natural resource decisions within three years. The associated need to identify key decision makers and stakeholders and engage them in joint production moved grantees towards research contributing to priority setting. Satisfying a request to connect with decision makers seems more challenging for emergence and framing, which are more distant from decision tables and often address settings where the convening agency and sometimes the agency with decision authority is not clearly known. This raises the question whether it might be useful in the grant development process to clarify the stage of policy the research will likely address and ensure that the specify decision makers and stakeholders who will be engaged are appropriate for that stage. It also seems entirely possible that science researchers who are successful at emergence and identifying the need for action might be different from those who can usefully contribute at later stages of the policy; and that the research approach suitable for these earlier stages might also differ from approaches more likely to be effective at the latter stages.

Another way of looking at the place of use or influence is the decision processes to which science contributes. In the survey we used the categories of stakeholder engagement in decision processes developed by the US EPA Conflict Prevention and Resolution Centre (CPRC), in turn based on the model developed by the International Association for Public Participation (International Association for Public Participation). CPRC identifies four types of decision processes[4] where convening agencies involve

[4] The stakeholder engagement spectrum actually has five types of decision processes; the fifth process, with the highest level of stakeholder engagement is one in which stakeholders make their own decisions. This was not included because it was considered a variation of agreement and so not a useful distinction for the survey.

outside interests and which also seem to provide an imperfect but expedient framing of the ways that science knowledge can contribute to decisions:

- Outreach – provision of information
- Information exchange - provide & exchange data, opinions and options
- Recommendations - provide useful & influential advice or comments
- Agreements – provide inputs to settlements or agreements

The two middle processes, information exchange and recommendations, are where grantees judge science knowledge to be most useful (green shaded in columns two and three in Table 5). They are also the processes where they report their LKwA research and other use-inspired research contributed (green shaded cells in columns four and five).

	Decision processes where science knowledge can make most useful contributions		**Actual decision processes where research used or influential coded from responses**	
	First choice	**First and second choice**	**First choice**	**First and second choice**
Outreach	3	6	2	1
Information exchange	5	11	7	3
Recommendations	6	11	3	7
Agreements	4	9	2	1

Table 5. Grantees' estimates of decision processes where science can be useful, and where their own research is used.

The LKwA grants target information exchange uses more whereas the other use-inspired grants target recommendations.

Combining policy stages and decision processes (Table 6) illustrates how explicit consideration of the policy stage might benefit the LKwA grant processes. It seems likely that the place of decision clarifies as one moves closer to a policy decision and implementation, and with agreement, and that at earlier stages one might have a general idea of who has the authorities, but who will be involved as decision makers and who the key stakeholders will be is still unclear. This logic suggests that the current practice of requesting potential grantees to identify decision makers and stakeholders is more realistic and of understandable utility for these more advanced policy stages; promoting actual joint production as a grant condition might require a different frame for the ambiguity of earlier stages of decisions.

<table>
<tr><td rowspan="2">Policy Stage</td><td colspan="4">Ways decision processes engage stakeholders</td></tr>
<tr><td>Outreach</td><td>Information Exchange</td><td>Recommendations</td><td>Agreements</td></tr>
<tr><td>Emergence</td><td colspan="2" rowspan="2">Unlikely one can identify decision table or convenors and perhaps also those with authority. A</td><td colspan="2" rowspan="2">Unlikely combinations</td></tr>
<tr><td>Framing</td></tr>
<tr><td>Priorities</td><td colspan="2" rowspan="3">Unlikely combinations</td><td colspan="2" rowspan="3">B
Likely can identify decision table, convenors and those with authority</td></tr>
<tr><td>Forming policy, rules</td></tr>
<tr><td>Implementation</td></tr>
</table>

Table 6. Decision process and policy stage jointly determine the likely contributions of LKwA.

Bear in mind that at the time of the survey the total number of grantees was small and so at this stage the analysis likely has validity issues, especially when combining measures. At this very early stage respondents report that the two decision processes addressed by grantees with their LKwA and other use-inspired grants were information exchange and recommendations, while framing and priorities were the stages in decisions. These are the four cells closest to the axis in the middle of the table; essentially information exchange associated with framing (marked A); and recommendations associated with priorities (marked B). The former is further from the decision table than the latter. This has potential implications for selection of grantees and research problems to be addressed. It also has potential implications for implementing LKwA, for example how decision makers and key stakeholders are identified and engaged and the nature of their engagement could well vary according to the combination of policy stage and decision process. At this stage the formative evaluation can merely point to this as a topic for further consideration, which can be revisited later once more grantees are in place. This approach might also enhance our understanding of different forms of use-inspired research with data from other donors.

Science program staff judge ripeness when a grant is being considered (see Table 2). A ripe situation is usually one where rethinking of existing methods and procedures has begun. This provides openings for new knowledge to be influential. In the interviews several respondents referred to opportunities that emerged during use-inspired research: one spoke of staffing changes, another the unforeseen role of a local boundary organization, a third about the ease of passing control to local decision makers and stakeholders as they responded to disaster. Such ripeness may be difficult to anticipate *a priori but* it can affect success of a grant. Perhaps undertaking use-inspired research in an already ripe setting with participation of decision makers and stakeholders in joint knowledge production processes enabled recognition of and response to the opportunity, and might even have contributed to seeding the

opportunity. This suggests the benefits of an adaptive approach to use-inspired research, creating, observing and utilizing opportunities to further ripen the setting and promote use. More generally, ripe situations are likely to be dynamic; while following a rigid design may foreclose opportunities.

Grantmaking

There are many elements that can influence the effectiveness of a program; however two are always important, the efficiency of the proposal and reporting processes, and the contributions from the donor and the donor/grantee relationship. The formative evaluation seeks to contribute to improving effectiveness with a snapshot of the current level of burden on grantees and the donor, an exploration of donor contributions and ways of that the effectiveness of these can be improved, and consideration of what contributions, if any, are central to the performance of the Science program and LKwA.

Burden and efficiency of grantmaking

Efficient administration is presumed to require fewer resources, leaving more for grantees to do their work and increase the portion of donor endowments available for grants. Because none of the LKwA grantees have yet progressed to final reporting, the results reported here relate only to the proposal and ongoing reporting/accountability requirements associated with the grant.

- Grantees report that the burden of preparing the proposal for LKwA funding was similar to their experience with other programs, including other Packard Foundation programs.
- The mean was 2.71 on a five point scale where a 2 was somewhat less time and a 3 about the same.
    - In comparison to other Packard programs the burden of LKwA was greater (3.5 where a 4 was somewhat more time), compared to other donors the mean was 2.26.

The reported number of hours associated with the various proposal-related undertakings is greater for the Science program than for other Packard Foundation programs surveyed in 2010 by the Center for Effective Philanthropy's (CEP) biennial Grantee Perception Report (Center for Effective Philanthropy, 2010. Grantee Perception Report) In this study, the burdens associated with receiving a grant are somewhat lower than what was reported by CEP. Our grantee survey used the same question as CEP.

- Grantees report that preparing the proposal and completing the other requirements associated with selection required, on average, 54 hours per project[5]. The median was 49 hours per project, while the median from the most recent CEP survey was 65 reported by LKwA grantees and 24 over all Packard Foundation programs.

  The standard deviation for proposal hours from the formative evaluation survey was 55 hours, the values ranged from a minimum of 5 to a maximum of 200 hours. This relatively high variation suggests that respondents are likely interpreting the concept differently and suggests that the reliability of the CEP question might benefit from review.

[5] The means and median were virtually identical for grantees or projects (where weighting was used to balance values for projects with more than one grantee responding).

The few grantees who judged the burden of the LKwA proposal process to be greater than for their comparison grant report that the increased burden improved prospects that their work will be used and also the improved value/quality of their work.

- The mean for improving prospects for use was 1.5 and for improving value/quality was 1.7 where a 1 was *significantly greater* and a 2 *somewhat greater*.

Grantees' comments about the causes of the higher burden suggest that it was associated with the nature of the work being proposed requiring additional work, such as having to demonstrate a connection to potential users:

- *The second proposal was linked to letters from the * federal agencies showing their support for our project. Acquiring these letters took considerable time and effort. Also the scope of work was quite complicated.*
- *It was a larger project overall, with many follow-up questions*
- *The size and scope of the programs are dramatically different. The (other) grant is much more focused. The difference is not a result of the Packard proposal format itself. It is a reflection of the subject matter, nature of the programs, etc.*
- *The nature of the proposal.*

While the level of burden of this use-inspired approach appears similar to what other donors require, further improvements seem to be possible. Grantees were asked to suggest two ways to improve the efficiency of the proposal, reporting and administrative requirements for LKwA. Each bullet represents the response of an individual grantee, with the first and second ways separated by a comma:

- *Clearer expectations regarding scope of reporting,*
- *Instead of over-engineering the award and repeating McNamara's bets-and-brightest mistake, trust the folks you fund a little more based on past accomplishments, take more risks—federal agencies are cautious, foundations should not be (respondent later indicated that this applied far less to the Science program than other donors)*
- *Carry over required proposal background information from one online grant site (created per submission) to the others, e.g. list of Board of Directors*
- *Am only qualified to judge proposal stage—this was very efficient from my perspective*
- *Continue with development of the web-based Grant Site for archiving and managing administrative requirements including reporting schedules, Proposal and reporting guidelines are clear for discrete short-term projects. They are less clear (or somewhat redundant) for multi-year continuing programs with annual renewal requests. Format and content guidelines could help the process for continuing programs, as would annual amendments to existing awards (rather than new award numbers each year, which increases administration to set up new accounts at the grantee's institution).*
- *None. I think that the process has been smooth.*

- *This is tough - as I think it's really efficient. And appreciate that the Foundation makes it efficient. If I had to pick something: on line submissions perhaps?*
- *I think it is very efficient, I don't have a suggestion*
- *Packard support has worked very well for us. I have no ideas for improvement!*
- *Clarity on outputs versus outcomes and risks, to have administrative requirements tailored for * agencies*
- *More time between receipt of proposal format (tables, etc.) and deadline for first draft*
- *I don't have any major suggestions, so far the process has been quite streamlined and straightforward, I did run into a couple of minor glitches with the on-line proposal submission site, but they were easily rectified.*
- *No suggestions. I think that the Packard program is fair and reasonable*
- *More clarity for budget line items and/or flexibility,*
- *I give them kudos for a fairly efficient, simple process, We have not found the logic tree to be particularly useful. They could delete this requirement.*
- *I did not find the logic model to be helpful, Obtaining "commitments" from public agencies is not always very productive.*
- *A key issue is the complexity of multiple funders. Perhaps more can be done to create consistency with regard to the various funders. However, in reality this is not necessarily a Packard issue specifically. In fact Packard is probably the most straightforward/responsive, Allow greater flexibility with regard to projects that don't quite fit the proposal/budget format. This can be done without losing the value of the Packard format, focus on TOC elements, etc.*
- *Use LKwA framework as a reporting framework and learning tool, not as proposal framework and screening tool, to avoid distorted & donor-driven behaviors. Not clear what added value the online grant application, etc., system provides to the grantee. Make clear?*
- *More verbal interaction with the program manager,*
- *Align your expectations with the incentives and constraints that your grantee's operate under (do not take a one size fits all approach), If need be, utilize incentives and potentially provide additional support to address cases where your expectations extend the grantee's usual operations. For example, you might offer certain grantee's additional funds and connections to organizations that can help communicate the results to a broader audience.*
- *I think it is one of the best programs the Packard Foundation currently has, I will just recommend making sure they are funding applied science for conservation*
- *Continue close communication with the program officer - it has been central to all aspects of the grant, Perhaps increase lead time of proposal writing, but I believe this was an exceptional circumstance and other timelines have been adequate*

Contributions of grantmaking

Although use-inspired research is central to the current work of most grantees, they report that their LKwA work still benefited from the inputs provided by the Packard Foundation, especially those from the program officer.

- 76% of projects selected inputs from the Science program officer as most useful to the design of their LKwA supported research at the proposal or during implementation.
    - On a 0 to 10 scale where 10 is *essential*, the input of the program officer was rated 7.6; for the other inputs the formative rating was 5.0
    - Also on a 0 to 10 scale where 10 is *complete understanding*, LKwA grantees rated as 9.5 the understanding of program staff of their organization's strategy and plans.
    - Using a four point scale where 0=*essential* and 4=*not very important*, the mean rating for the inputs of the program officer was 0.37; the next best rating was for "connections to others" at 1.5.
- 74% of projects reported that the funding they received for this project from the Packard Foundation and other sources was sufficient for the core of the work, 13% said it was sufficient for all they needed to achieve, 11% said insufficient, constraining the work.

The coded results from a question asking grantees to describe how the LKwA program's focus on use contributed to their approach reflects the compatibility between the LKwA and grantee approaches and suggests that the Foundation's contributions contributed to improving the approach of many grantees (Figure 5.

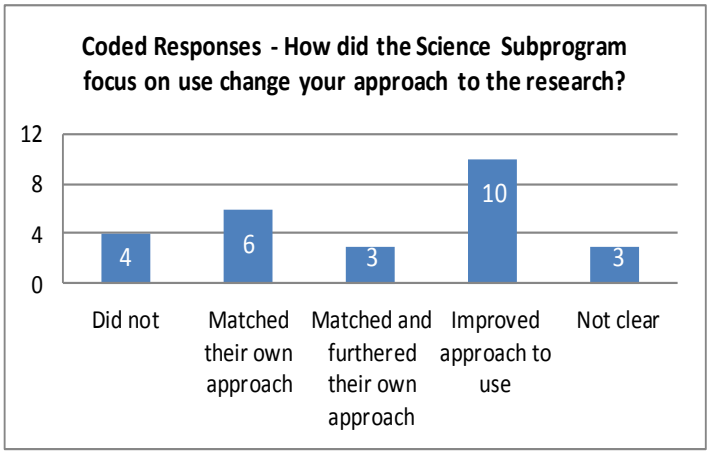

Figure 5. Influence of LKwA on research approach.

Other program officers within the Conservation and Science Program point to a number of important contributions from the Science program such as reducing the risk of other subprograms supporting high quality but unused science. Instances are reported to be increasing where other program officers approach the Science program seeking contributions (approach and budget) to projects to address important questions, and some pointed to the possibility of tensions when the results of Science program supported work does not align with the current funding priorities of other subprograms. They also pointed to important gains from the Science program such as the work on coastal Oregon.

Grantmaking style

Grantees were asked what two adjectives they would use to describe the approach to grantmaking by the Science program; their responses are reported in Table 6. In the list below each pair is a separate grantee with the first and second adjectives separated by a comma. The responses suggest attributes of a high quality and experienced program officer; these attributes can potentially be replicated elsewhere with appropriate staffing and guidance.

clear, supportive	relevance, goal oriented
collaborative, pathbreaking	supportive, communicative
deliberate,	targeted, strategic
encouraging, supportive	thorough, cautious
focused on outcomes, overly confident	thoughtful, relevant
holistic, efficient	thoughtful, intriguing
impact oriented, targeted	visionary, strategic
influence, adaptive	visionary, professional
influential, targeted	proactive, thoughtful
innovative, Thoughtful	relevance, goal oriented
mechanistic,	sharp, ethereal
optimistic, applied	supportive, communicative
pragmatic, creative	targeted, strategic
proactive, thoughtful	thorough, cautious

Table 6. Adjectives used to describe Packard grantmaking approach.

From the comments on the survey and from interviews it is clear that the program officer adds value over and above a typical program officer for many donors. Consistent with our previous evaluation of the EBM Initiative (Rowe, Hershner, & Trum, 2009), some of these characteristics are part of the Packard Foundation culture. The characteristics the interview respondents added to the list above include:

- Broader resume/depth of experience than most program officers,
- Good listener,
- Open to possibility that his initial views might not be correct,
- Helps us generalize concepts, see the larger picture,
- Does his homework, triangulates input in a constructive, not a “gotcha” way,
- Constructive contributor to project design suggesting options such as additional knowledge applicable to the project, networking facilitation
- Talks with both grantee and other parties, and improves communications amongst parties,
- Engages and works with others such as with other subprograms at the Foundation (mentioned in three interviews), embraces getting multiple, different and informed perspectives,
- Embraces errors and disappointments as part of the learning and improvement process,
- Intellectually rigorous.

The characteristics associated with the program officer and the LKwA approach suggest a boundary spanning function addressing some of the disconnects between researchers and users and bringing in additional knowledge and facilitating the connections between the two groups. This seems to be a function that could be successfully undertaken by a mature program officer with sufficient diversity of experience, along with the direction provided by the theory of change and experiences of the Science program and other efforts at use-inspired research.

Summary of formative evaluation

This formative evaluation effort had three concerns:

a. Obtain a snapshot of progress towards the goal of realizing science knowledge used and influential in natural resource decisions,

b. Identify the characteristics necessary for a successful use-inspired grant program and assess the extent to which they can be replicated in other settings,

c. Assess whether LKwA creates additional burden for grantees and the Foundation and if this is an issue.

It appears that there are grounds for rejecting the null hypothesis that the LKwA program is not contributing to use or influence. It is still too early in the life of the projects to be able to observe use, and a fuller evaluation should include comparison to a reasonable alternative. However, at this stage the LKwA program has selected grantees with a track record of use-inspired research and they suggest that their LKwA work will be at least as successful as their most successful recent use-inspired research. Some potential areas for improvement emerged from the formative work: reflection on what use and influence might look like when the decision table is unclear, such as at the emergent and framing phases of policy and resource decisions; reflection on the opportunities for use and influence presented by emergency / disaster settings and how to recognize and capitalize on *door opening* moments during projects.

It also appears that we can reject the null hypothesis associated with replication of LKwA, essentially that the program depends on the unique characteristics of the program officer. The characteristics that grantees associate with their very positive views of the contributions of the program officer to their project are not so unique that they are unlikely to be found elsewhere when set within appropriate operating guidance. It does appear that the program officer and the LKwA program design provide a collegial and helpful boundary function for grantees and potential users which seems to be the necessary core for replication.

Finally grantees report that LKwA does not generate incremental burden at the proposal and mid grant phases; whether subsequent phases will prove more burdensome cannot be observed until a sufficient number of projects is completed. However, the boundary spanning effort of the donor, which seems to be an important part of the LKwA approach, does not seem to be particularly amenable to efforts by some donors to significantly increase the ratio of the value of grants managed to staff resources

required; in this sense it appears useful to consider the costs and benefits of use-inspired grantmaking once the LKwA program has matured further and benefits become more observable.

IV. Conclusion (AR, KL)

The institutional setting of the Conservation and Science program at the Packard Foundation establishes two important contextual conditions for the Science program; the science it supports should contribute to conservation, and the program itself operates within guidelines limiting direct participation in advocacy and policy. The second condition potentially influences implementation of a program that explicitly aims to improve conservation by targeting its investments on the nexus between science and policy decisions.

The theory of change for the program directs investments to knowledge generation process where the researchers, decision makers and key stakeholders jointly generate the science knowledge; and the donor, in addition to selecting investments, serves as a boundary spanner, helping to identify and to bridge barriers to joint knowledge production. The emphasis on joint production, and on the knowledge process rather than knowledge products, is intended to improve prospects that decision makers will find the science to be salient, legitimate and credible—thereby enhancing prospects that the science will be used or influential in resource management decisions. This use-inspired approach to the use of science stands in contrast to the dominant approach of curiosity-inspired research where peer reviewed publication, sometimes accompanied by targeted communication efforts, connects science to resource management decisions. But in comparison to other forms of applied research, use-inspired stands somewhat closer to curiosity-inspired research because of the greater independence of the researchers from funder interests and the way that LKwA incorporates different and potentially opposing interests into the research processes.

The use of evaluation for program development is another notable characteristic of the Science program. Developmental evaluation is a recent understanding of the ways that evaluation contributes to establishing effective interventions; for the Science program developmental evaluation helped frame the Linking Knowledge with Action theory of change for the program including the major outcomes that are the focus of the questions listed in Table 2 above. Evaluation also contributed a snapshot of the program as of summer 2011 with inquiries into projects' progress towards use and whether the LKwA approach could be replicated in other settings. Both of these subjects of the snapshot are linked to key early decisions; if funded projects were not progressing towards use, then the approach should be reviewed and adapted; if important elements of the program could not be replicated in other settings then the value of LKwA as an approach to improving the use and influence of science would be limited. The snapshot also considered the efficiency of the program, focusing on the burden on grantees; if the approach imposed heavy burden, it would be unlikely to have merit for replication elsewhere without first improving efficiency.

Both of the evaluation undertakings have proved beneficial for the program; development of the theory of change enhanced the clarity of the vision of how science could more directly and immediately

contribute to resource management decisions, and also identified the key outcomes that the program should assess in reviewing proposals, and that should be addressed by proposals; these outcomes also frame a shared structure for reporting.

The formative evaluation finds that prospects for use and influence of the science supported by the Science program is on a par with the best grant-funded projects of grantees over the past five years. This represents a good level of achievement for the "beta" application of LKwA. The evaluation also did not identify any essential or important elements in implementing LKwA that were unique to the Packard Science program and difficult to replicate elsewhere.

The formative evaluation identified some aspects of the program where improvements are desirable and possible:

- It is beneficial to differentiate grantmaking opportunities in two settings: first, where the convening and authority for resource management decisions is known and where science contributes to setting priorities and shaping programs and policies; and second, settings where decisions are still distant and the identity of the convening and decision organizations is more ambiguous. In the latter case, the role of science lies more in identifying emerging issues and framing how policy and programs can contribute to these. LKwA has been aimed toward the first of these settings, but there may be conservation value in including some of the second setting in the overall investment portfolio.

- Replication of the LKwA approach elsewhere is not constrained by the characteristics of the program, although continued attentiveness to implementation processes and their documentation will improve replicability, as will improvements in the efficiency of grant processes.

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