Chapter 18
Using the Ecosystem Services Framework in a Long-Term Socio-Ecological Research (LTSER) Platform: Lessons from the Wadi Araba Desert, Israel and Jordan

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Abstract The establishment of Long-Term Socio-Ecological Research (LTSER) platforms is part of a paradigmatic shift in the way ecosystems are studied and managed: from a narrow species-level focus to a holistic socio-ecological systems approach. The need for this shift is based on increasingly urgent global environmental challenges and the realization that traditional ecological research methods and foci have been insufficient for meeting these challenges. While the theoretical foundation for this shift and guidelines for implementing it are increasingly well defined, there is little actual experience in implementation on the ground. We recount our experiences in establishing an LTSER platform in Wadi Araba, a hyper-arid desert in southern Israel and Jordan, focusing on the challenges in establishing a cooperative agenda between the two countries. We discuss the use of the ecosystem service (ES) conceptual framework for guiding our research program and our efforts to create a dialogue between research scientists and community members, and identify some of the ethical issues inherent in trans-border research and in the application of the ES framework.

Keywords Arava • Ecosystem services • Socio-ecological research • Transboundary

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R. Rozzi et al. (eds.), *Earth Stewardship*, Ecology and Ethics 2,
DOI 10.1007/978-3-319-12133-8_18

18.1 Introduction

Wadi Araba of Israel and Jordan is a hyper-arid desert in the demographic and geographic periphery of the two countries. Although the climate is extreme and characterized by low primary productivity, the region hosts unique biodiversity – including rare hyper-arid species of conservation importance (Dolev and Perevolotsky 2004), one of the earth's northern-most tropical coral reefs, and a major flyway for migratory birds between northern Asia and Europe and central and southern Africa. The area is the first stopover for millions of birds migrating from Africa to Europe in the spring (Frumkin et al. 1995). Concurrently, both countries are interested in distributing their rapidly growing populations away from their geographic core regions and are making great efforts to entice populations to move to these regions. The region is characterized by rapid economic development in the form of transportation, trade (Eilat and Aqaba serve as important port cities for each country) and tourism development. These activities are claiming growing amounts of land, not only for urban development, but for agriculture, solar power generation, and large-scale infrastructures including airports, rail networks, and the proposed Red Sea – Dead Sea conduit.

Into this contentious setting, the Israel Long-term Ecological Research (LTER) Network made a strategic decision to establish a Long-Term Socio-Ecological (LTSER) Platform. The LTSER concept is new to the 17-year old Israel LTER network. Israel was accepted into the International LTER network in 1997 with the recognition of two research sites in the Negev Desert, which had a history of ecological research and monitoring. The Israeli sites were grouped with the (then East) Europe LTER network (Groner and Shachak 2011). Since then, 11 more sites have been added to the Israel network, and more recently, two platforms were added. Until 2009, almost all the research conducted within the Israel LTER network focused on ecology, biology, hydrology, climatology and other natural science disciplines. Accordingly, the data base resulting from LTER monitoring reflected this disciplinary bias (Dick et al. 2014).

In 2009, the Israel LTER management committee decided to expand the disciplinary foundation of the network to include the social sciences and humanities. This decision was based on trends in Europe towards inter- and trans-disciplinary research (Haberl et al. 2006), and because local scientists adopted the view that the incorporation of social science into ecological research was crucial for addressing contemporary conservation challenges. It was decided to establish two LTSER platforms: one based on the five existing LTER sites in the Northern Negev (Orenstein et al. 2012), and a second, completely new, platform in Wadi Araba. Concurrent to the establishment of the Israeli Wadi Araba platform, the new Jordanian LTER network established a Jordanian platform across the international border.

The LTSER concept evolved within the European LTER network as part of a broader trend among scientists responding to the realization that global ecological challenges such as climate change, biodiversity loss and resource depletion were rooted in social and economic dis-function and that the problems must be analyzed

through a multi-disciplinary lens (Haberl et al. 2006; Singh et al. 2013a). LTSER platforms go beyond the LTER site concept in that they link biophysical processes to social processes and governance and include science communication in their mission (Rozzi et al. 2012). The LTSER platform facilitates a place-based, stakeholder-driven, trans-disciplinary[1] research program designed to define the ecological and socio-ecological challenges of a region (from the perspective of both experts and local communities) and research them in order to produce policy-relevant results (Mirtl et al. 2013). As the LTSER concept proliferated throughout Europe and beyond, Israeli LTER scientists realized that the concept was ideal for a country where no areas were devoid of intensive human activity, and the drivers of ecological change (population growth, consumption, political conflict, and land use policy) were (and are) deeply embedded within the values and psyche of the population. Like the LTSER concept, the ecosystem service (ES) approach leads to trans-disciplinary research for society. For this reason and others, many LTSER platforms have adopted the ES framework (Mirtl et al. 2013).

In this chapter, we share some insights from our research on ES of the past 5 years in the Wadi Araba LTSER platform. We hold a mirror to our own research endeavors and interweave history, research results, and anecdotes to highlight the organizational challenges and ethical dilemmas in establishing the platform and applying the ES conceptual framework. Much has been written on the establishment and effective management of LTSER platforms (Singh et al. 2013b); our approach here is admittedly more eclectic, characterized by anecdotes, discussion protocol, and open questions. Such details are seldom presented in the scientific literature (although see Mirtl et al. 2013, which documents the challenges in establishing an LTSER Platform). It is our hope that a candid and honest narrative will resonate with field researchers who might identify with our challenges. We further hope that our experiences will provide inspiration for overcoming those challenges, toward the goal of fostering Earth Stewardship.

18.2 Ecosystem Services (ES) as a Research Framework

Concurrent to the process of establishing the LTSER platform, and similar to established LTSER platforms in Europe (Mirtl et al. 2013) and urban LTER sites in the U.S. (Grimm et al. 2013), the Wadi Araba LTSER team adopted the ES conceptual framework to study socio-ecological interactions between local communities and their environment. The decision to adopt the ES framework was self-evident for socio-ecological research. We began with the assumption that an ecosystem does not a-priori provide services - that is, an ecological survey of an area cannot yield an

[1] Trans-disciplinary research combines traditional research-based knowledge from multiple disciplines with local knowledge derived from local residents and other stakeholders.

ES inventory in the absence of studying the recipients of those services. What would be necessary to develop our understanding of the region was to simultaneously:

(a) survey the local residents with regard to their values, behaviors and opinions regarding their ecosystem,
(b) interview local experts of all disciplines to procure expert knowledge regarding human interaction with the local ecosystem and its services, and
(c) research the status of biodiversity and ecosystem integrity in the region.

We thereby combined social and natural science methods to provide a holistic understanding of the socio-ecological system via the currency of ecosystem services. Our final step will be to turn these data in to policy relevant information. By including policy makers and land use planners in the basic research (as interviewees, for example) and bringing them close to the research in an advisory capacity, we have cultured a conduit for uptake of our research results throughout the process.

The ES framework has been criticized for its over-reliance on economic valuation and its lack of social valuation methods. The act of social-based research is a response to the ethical dilemmas inherent in the ES concept and its over-reliance on monetization (Kosoy and Corbera 2010; Luck et al. 2012). Social-based ES research within the LTSER platform provides a powerful framework for integrating local communities, their values and opinions, into the local research and policy agenda. The social-based approach to ES assessment has proven itself as a catalyst for constructive, community-level engagement in multiple venues (e.g. Bryan et al. 2010; Maynard et al. 2010; Chan et al. 2012).

Through our research in Wadi Araba, including multiple studies employing questionnaire-based surveys and in-depth interviews with local residents, we have established a solid foundation for the claim that the local population is strongly connected to the local landscape (Sagie et al. 2013; Orenstein and Groner 2014) and that despite the perception that deserts are low in ecosystem service provision due to low primary productivity, they are extremely rich in cultural services. The population exhibits high affinity to the desert landscape, its mountains and open spaces. This has led to a persistent debate about whether landscapes devoid of biological life (or whose beauty is attributed primarily to geodiversity rather than biological features) are providing an ecosystem service. The United Kingdom National Ecosystem Assessment (UK-NEA) proposes that both biological and geological features combine to provide ecosystem services. The inclusion of geology as a provider of ES may resolve our conundrum (Gray 2011). Others suggest that cultural value of landscapes is a unique phenomenon that should not be considered within the rubric of ecosystem services, but rather should be considered services unto themselves (Brown 2013). Other research findings include:

1. Ecological knowledge of respondents was generally low; the population lacked a holistic understanding of the ecosystem, the importance of biodiversity, and the implications of their economic activities on ecosystem processes.

2. Cultural value of landscapes, view, open spaces and mountains is very high, and they are considered the most beloved assets of the region. Respondents in Israel were most motivated to political activism when faced with threats to their aesthetic environment (rather than ecological environment).
3. There are both similarities and differences regarding what aspects of the ecosystem are appreciated and used by different populations – along national, urban-rural, and gender lines.
4. Differences along socio-demographic lines may become less significant, however, when core values (derived through factor analysis of survey data) are considered (Diamantopoulos et al. 2003; de Groot and Steg 2008; Orenstein and Katz-Gerro in review). Analyzing core values may liberate us from dividing groups along traditional socio-demographic lines, and allow us to look more at the individual as a product of values rather than as an affiliate of a socio-economic or demographic group.
5. Local residents in both countries express pro-environmental and [selective] pro-development opinions, and reconcile the two through support of "sustainable" economic activities. However, the development trajectories in Israel and Jordan are at very different stages and opinions and behaviors may be affected by economic factors (see below).

While our research has shown similarities between Jordanians and Israelis with regard to their perceptions of their natural environment, we also detect a socio-economic fault line that passes down the valley, alongside the geological fault (the Syrian-African Rift). The two populations share virtually the same ecosystem, and yet – by global standards – one community is impoverished and one is relatively wealthy, one Muslim and the other Jewish, one has relatively low formal educational achievement and one high (socio demographic data available in Sagie et al. 2013; Orenstein and Groner 2014).

The degree of collaboration between Jordanian and Israeli researchers in the LTSER platforms varies with time and individuals, as it is strongly affected by social and political currents. However, despite the perennially difficult political climate, trust has been established on a personal level, enabling fairly stable coordination and continuity of research. In August 2010, the ILTER annual meeting was held in the Israel's Negev desert and Jordan sent a delegation. As a step to lessen political pressures, the collaborative research results are sometimes published separately, although one paper was written together within the context of a Pan-European research team (Dick et al. 2014).

The cross-border differences continue in the communities themselves. While both Jordanians and Israelis ranked characteristics of the extreme environment rather low (e.g. heat, aridity, brightness, sand storms), Jordanians expressed lower affinity for these characteristics than Israelis. Some environmental characteristics, such as sand dunes and open space, appealed to Israelis but not to Jordanians. And shrub vegetation, which provides fodder for grazing animals, was the only

environmental characteristic that Jordanians ranked higher than Israelis. Outdoor recreational activities were notably different, with Jordanians more often engaging in campfires and off-road vehicle driving, while Israelis reported swimming in the Gulf of Aqaba/Eilat more often (Orenstein and Groner 2014).

These differences may be due to the host of socio-economic differences between the populations on either side of the border. We suggest that affluence contributes to the relative resilience of Israelis to environmental extremities. Further, with economic resources, Israelis are able to turn these extremities into economic opportunity via specialty crops, algae farming, solar power production, and eco-tourism. In Israel, locals have capitalized on the desert in order to market their products. A senior manager of a local dairy conveyed, "the taste of our chocolate milk is not connected to chocolate, but to the Kibbutz and its pleasant people, with the background of the desert with palm trees… we're not selling chocolate milk, we're selling an idea, an image." Both poverty and economic structure (the agricultural resources in the rural sector of the Jordanian Araba are in private hands) may prevent the Jordanians from perceiving their environment as a potential economic opportunity.

Respondents were also asked for their opinions regarding various environmental and development issues. In general, both Israelis and Jordanians expressed environmental concern, and for many of the questions, results were similar (Table 18.1). However, for each question where economic and environmental issues were presented in conflict with one another, the Jordanians tended towards a development preference, while the Israelis tended more towards environmental protection. The exception was the demographic question. In Israel, the issue of population growth in the demographic peripheries has long been one of national importance. The local population has internalized the belief that their long-term economic sustainability is dependent on local population growth, as reflected in the survey results. The Jordanians, on the other hand, are evenly split on the issue.

The actions of one country have direct impact on the ecosystem services of the other in the narrow landscape of 10 km width. Though separated by a border, the region is linked climatically, hydrologically and ecologically. In Jordan, hunting takes place and the population of large animals is low, while on the Israeli side of the border, hunting has been outlawed since the 1950s, when hunting led to the decline and local extinction of several species. Large herbivores and carnivores sometimes move from Israel to Jordan to feed, before returning to Israel. Land use also differs across the border. In Israel, the percentage of agricultural land cover is much larger, and most of the rare Wadi Araba sand dune ecosystems in the country have been cultivated for agriculture (Yom Tov and Mendelsohn 1988). The sand dunes on the Jordanian side are more prevalent and protected along the border zone, though their proximity to the border also makes them inaccessible to the local population (Sagie et al. 2013). While the geomorphology and abiotic conditions are similar on both sides of the border, the pressures and drivers are different and this results in different densities of large animals and different species assemblages of smaller animals (Shanas et al. 2006, 2011).

Table 18.1 Results from an opinion survey of residents in the southern Wadi Araba of Jordan and Israel. Results are based on 407 respondents in an opportunity sample (details in Orenstein and Groner 2014). 38 % of the respondents were from urban localities (Eilat and Aqaba) and 62 % from the rural areas; 37 % were Jordanian and 63 % Israeli; 43 % were female and 57 % male. Educational achievement, income levels, religion and occupation were assessed to be representative of the general population of the region

		Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)	Don't know/no opinion (%)	Average response (1 = strongly disagree; 5 = strongly agree)
There are not enough people living in the southern Arava/Eilat	Jordan	5	**25**	15	**36**	13	7	3.29
	Israel	9	19	**20**	**30**	**20**	2	3.35
Most tourists come to the region because of the natural environment (geology, ecology, aesthetics)	Jordan	5	**25**	15	**36**	13	7	3.29
	Israel	5	**24**	13	**29**	23	6	3.44
The economic benefits of building a hotel outweigh the environmental costs[a]	Jordan	7	16	**19**	**25**	18	15	3.35
	Israel	**33**	**19**	16	9	11	11	2.39
It is important to construct an international airport in the Arava (in Israel)	Jordan	11	**19**	17	**22**	17	13	3.18
	Israel	**21**	19	15	20	**22**	2	3.04
"Environmentalists" are too extreme in their desire to prevent development in the Arava	Jordan	2	17	**33**	17	12	19	3.26
	Israel	15	19	**30**	20	13	4	2.97
I am very environmental in my behaviors	Jordan	2	5	14	**45**	**33**	1	4.04
	Israel	1	8	**33**	**37**	20	2	3.69
My community is very environmental in its behaviors	Jordan	5	22	**23**	**31**	13	5	3.27
	Israel	4	18	**29**	**33**	12	4	3.33
Economic development should always take precedent over environmental protection	Jordan	11	**25**	**23**	**23**	14	4	3.03
	Israel	**25**	**44**	17	7	6	2	2.24
Economic development and environmental protection can occur together	Jordan	2	2	6	**48**	**39**	3	4.24
	Israel	1	8	8	**47**	**35**	2	4.08
Developing tourism infrastructure in the Arava is important for the future of the region	Jordan	1	2	9	**41**	**45**	3	4.29
	Israel	2	5	9	**44**	**39**	1	4.15

(continued)

Table 18.1 (continued)

		Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)	Don't know/no opinion (%)	Average response (1 = strongly disagree; 5 = strongly agree)
My economic wellbeing depends on a clean, healthy environment	Jordan	1	3	14	**41**	**38**	3	4.15
	Israel	2	9	20	**34**	**33**	2	3.88
It is important to protect Arava sand dunes from development[b]	Jordan	1	6	**25**	**42**	21	5	3.80
	Israel	1	6	13	**31**	**46**	3	4.19
It is important to protect biodiversity in the southern Arava and the Gulf of Eilat, even if it means foregoing economic opportunities	Jordan	7	20	**25**	**25**	20	3	3.32
	Israel	0	6	19	**32**	**39**	4	4.07
I enjoy spending time in nature	Jordan	3	2	11	**47**	**35**	1	4.11
	Israel	2	2	8	**37**	**50**	0	4.31

[a]Israeli question was place-specific, referring to the Sasgon Valley example described in the text
[b]Israeli question was place-specific, referring to the Samar Dunes example described in the text

18.3 Where Has the Ecosystem Services Conceptual Framework Led Us?

The objective driving our ES-centered research agenda is the desire to produce policy-relevant research and, like most ES researchers, to protect biodiversity and ecosystem integrity (Cowling et al. 2008). The next stage in our research program is to present our research findings to policy makers and facilitate a community dialogue regarding future regional development. Our assumption was that the ES framework would facilitate a three-way dialogue among local communities, ecologists, and land use managers / policy makers, but a more implicit assumption was that this process would lead to better ecological outcomes than would occur in the absence of the process. Current paradigms in planning and resource management all point to the essential need for collaborative planning with local communities and suggest that top-down conservation planning has not proven successful in many cases (Fraser et al. 2006; Adams and Hutton 2007; Cowling et al. 2008; Clark 2011).

These lofty goals are rife with challenges. Below we draw upon quotes and anecdotes from our various research venues to highlight some of the recurring dilemmas we face.

18.3.1 Ecosystem Services or Biodiversity?

"If I go to a community and tell them that their development is going to cause a species extinction and they respond that they don't "value" that species or that the species doesn't provide them with a service, how does that help me in my job to protect biodiversity?"

— Ecologist, Israel Nature and Parks Authority

"This is a tree and that is a tree – what does it matter which tree, so long as it's nice to look at."

— Local Israeli government planner in response to seeing several landscape options based on different species assemblages

While ES literature is explicit regarding the dependence of ES on biodiversity, we often face decisions that pit ES against biodiversity, or a particular set of ES (e.g. cultural or provisioning) against another (regulating or supporting). Environmental NGO officials and Nature and Parks Authority representatives express great skepticism regarding the ES path, suggesting that it leaves little room for preserving biodiversity on the basis of its intrinsic value and always places the burden of proof on conservation agencies to prove the utility of a given species. Other critics of the ecosystem services concept have foreseen such scenarios (Turnhout et al. 2013). Our response, based on international experience and modern conservation planning theory (Dietz et al. 2003; Clark 2011), is that community-integration is crucial and that top-down policies to preserve biodiversity also carry multiple risks to biodiversity (Adams and Hutton 2007). Unfortunately, this claim is difficult to prove on a case-by-case basis because once policy is implemented it is impossible to do a counterfactual study of what would have happened in the absence of the policy. Nature advocates therefore often dismiss the ES framework as hopelessly anthropocentric.

18.3.2 Do the Benefits Arising from Cultural Services for the Many Outweigh the Benefits for the Few?

"Right now this place [a secluded natural spring] is precious to us – a little heavenly corner that we can enjoy; if you open it up, [expletive] will come with their loud music and garbage and destroy it. Why would I want to open the site up for more people?"

— Local resident in the southern Dead Sea Basin in Israel

In a comparison of ecosystem services provided at five LTER sites in Israel's northern Negev, it was found that some management authorities purposely develop sites based on ecological features to attract tourists (Orenstein et al. 2012). Thus, when compared to other sites, sites developed for tourists receive higher values for cultural services. We defined "potential ecosystem services," as ES that are currently not exploited for human use, but have potential to be used depending on changes in cultural, ecological or other circumstances. Some agencies, prioritizing cultural services, realize these potential services by preparing infrastructure and access to natural settings. Survey and interview respondents in Wadi Araba seemed to support such management strategies, by expressing enthusiasm for developing eco-tourism based on cultural ES of the region. This led us to suggest to a group of local residents in the southern Dead Sea that they develop an infrastructure to allow access to several fresh water springs in the region. Aside from capitalizing on potential cultural services, we reasoned that a greater number of visitors would translate into a greater amount of public support should the springs face threats from development. Our suggestion led to the response quoted above. This leads us to a number of open questions: What are we maximizing? How do we use the framework to balance the relative value of cultural services provided by a site? Do more users necessarily translate into a higher value of cultural service benefits?

18.3.3 Biodiversity or Cultural Landscapes?

"I had to think hard for an ecological [biodiversity-related] reason why building the hotel would be bad"

— Local Israeli activist in Wadi Araba protesting the planned construction of a new hotel

During the period of our research, there were two prominent environmental campaigns taking place in the Israeli Wadi Araba. The first was a proposed hotel to be built in the Sasgon Valley at the entrance to the Timna Valley tourist site. Local residents expressed, both in our research and in public protest, that the hotel was a threat to the pristine nature of the valley. The second campaign occurred across the road from the Sasgon Valley, in a small sand dune that was a relic of the once larger Samar Dunes (Fig. 18.1). A tender had been issued by national governmental agencies to mine the remaining sand. While both sites share cultural and landscape importance,

Fig. 18.1 Ecological research conducted at the remaining Samar Sand Dunes in Israel, which have high biodiversity value as well as high value for cultural ecosystem services (Photograph by Elli Groner)

there was a crucial difference between the sites regarding their ecological value. The Samar Dune, once 11 km^2, is home (habitat) for a unique assemblage of species. In the Samar example, ES and biodiversity were both provided as reasons for avoiding mining. The Sasgon Valley is not unique in biodiversity (Nissim 2012). As the quote above exemplifies, the motivation to stop construction had little to do with ecological consequences, but was due to its landscape and wilderness value. In the Sasgon example, opponents to development were limited in their approach when arguing biodiversity, but could harness the terminology of ES to argue against the project (even though, in this case, ES provision was not based on biodiversity). This is an example that biodiversity and ecosystem services may provide contrary conclusions regarding management of a habitat.

Another example arose regarding the ES-biodiversity tradeoff in a debate regarding constructing high tension electric wires through the center of the otherwise open Ramon Crater nature reserve. A public campaign attempted to convince the electricity company to bury the wires instead of erecting lines above ground. Ecologists assessed that this option (burying) would cause extensive damage to biodiversity. Managers were left deciding between biodiversity (underlying all ES) and landscape beauty (a cultural ES). The public was vocally in favor of landscape.

Further north, in the northern Negev Desert, land management agencies and environmental NGOs have been disputing the relative impact of dryland forestry. The managers argue that foresting the area provides crucial ES including carbon sequestration, recreational areas, and prevention of runoff and soil erosion. Others argue that forestry threatens local biodiversity. The public discourse is framed (mistakenly) as a conflict between managing for ecosystem services or for biodiversity. Different land management agencies with different development priorities exacerbate this conflict by choosing one conceptual framework over the other.

Another side to the ES-biodiversity dilemma is that biodiversity and ES can reflect culture. Culture may not always value diversity, as witnessed in the planner's quote above. However, as this chapter shows, cultural diversity can have a direct impact on biodiversity. Acacia trees in the Israeli Wadi Araba depend on large wild herbivores for seed dispersal because local shepherds do not exist anymore on that side of the border. On the Jordanian side, however, large herbivores are hunted and seed dispersal depends on the local domestic herbivores. So not only is herbivore diversity dependent on cultural diversity, ecosystem functions also depend on cultural diversity (e.g. seed dispersal). Cultural diversity can prevent the homogenization of biodiversity or biocultural diversity (*sensu* Rozzi 2013).

18.3.4 Who Should Make the Decisions?

Various experts often suspect that using the ES framework will lead to over-reliance on public opinions to make decisions. Our ecologist colleague quoted above suggests that while the public expresses particular affinities for the outdoors, it has little understanding of the importance of ecosystem integrity or of human reliance on natural systems for their regulating or supporting services. Our results from surveys and interviews indeed confirm a public knowledge gap.

As ecologists, we hold the importance of conservation of biodiversity to be indisputable, and yet, as socio-ecologists, we understand that (1) community participation in natural resource and land-use decision making is crucial, and, (2) accepting community participation means accepting that ecologists themselves become stakeholders, and not the agents of truth and last word in decision making. In assessing our role within the new paradigm of socio-ecology, we must consider the balance between "expert" knowledge and "local" or "stakeholder" knowledge, each providing a unique and complementary knowledge base. This complementarity is represented graphically in Fig. 18.2. In the figure, ecosystem services are assigned high and low value by local stakeholders and experts, respectively (though the two aren't mutually exclusive groups).

High priority ES, as defined by both experts and locals, are considered high-priority, easy targets for management, as both groups agree about their importance (e.g. a rare, charismatic species). Where locals do not consider a given ES important (usually they do not mention it at all), but experts do consider it important (e.g. nitrogen cycling), there is a *knowledge gap*. Where locals give high importance

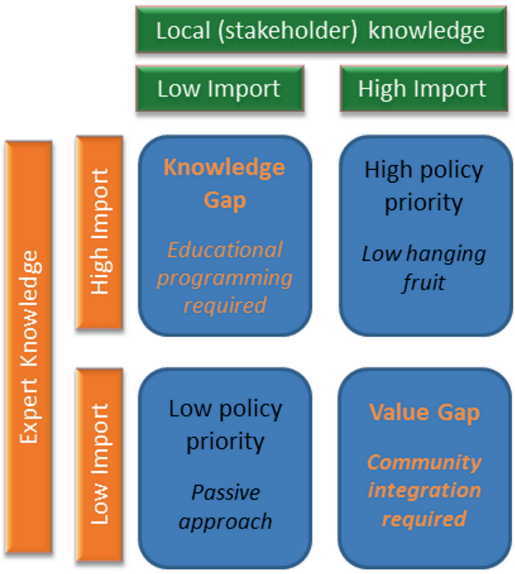

Fig. 18.2 Complementary knowledge sources for policy-relevant ecosystem service research

to ES, but experts do not, then there is a *values gap*. In our region, the knowledge gap exists where the public has little understanding of the broad value of biodiversity and the presence of supporting ES. On the other hand, as in the Sasgon example, ecologists found little ecological importance in the valley, yet the local population emphatically demonstrated that its landscape value was of utmost importance (the values gap).

18.4 Conclusions

ES tradeoffs is a recurring theme in our research and experience. Maximization of one or more services may lead to the degradation of others; maximization of some may yield a decline in biodiversity. This issue has been covered in the literature, both theoretically (Foley et al. 2005; de Groot et al. 2010) and also practically, within the context of community stakeholder engagement (Fraser et al. 2006; Cowling et al. 2008; Chan et al. 2012). We find the model proposed by de Groot and colleagues (2010) useful in explaining this dynamic. Their model suggests that it is possible, like in our case studies, to raise the value of cultural-recreational services through a small amount of development, but this may come at the expense of regulating services, cultural-informational services, and biodiversity. In general, as their model and our experience suggests, land use decisions will often be a function of trade-offs in the composition of a bundle of ES; the optimal bundle of services is a socio-ecological decision that should be made through community discussion.

We are reminded that biodiversity was the predominant concept for conveying the importance of ecological conservation to the public during the past two or more decades. We suggest that the lack of success of that concept, which has been argued to have been largely a paradigm development to strengthen the role of ecologists in development discourse (Takaks 1996), in preventing global species extinctions and habitat destruction gave rise to the new, current concept, of ecosystem services. Like the term biodiversity, we find that the ES concept also is difficult to convey to the general public. The Hebrew translation is particularly difficult, as interview respondents confused the term with a variety of other phenomena, from the private companies that come and haul away garbage and sewage, or those that sell pesticides to farmers. Some mistook the term to mean composting toilets.

Yet we are cautiously optimistic regarding the application of the ES framework within the burgeoning research program of the Wadi Araba LTSER platform. An important added value of ES research is that applying social research methods to ES assessment has catalyzed direct contact between researchers and communities. This contact allows for two-way learning in which respondents to questionnaires, interviews, and participants in focus group discussions have the opportunity to express their opinions, perceptions, and needs with regard to their natural environment. The researcher, through the act of inquiry, provokes the respondent to think about issues that they may have not considered, particularly about the role of ES in their well-being. Both researcher and subject become more sensitive to social and ecological needs.

We concur with Maass and Equihua (2015, this volume [Chap. 14]) regarding the need to make their suggested paradigm shifts, which corroborate well the transition from LTER to LTSER (Haberl et al. 2006). Our experiences provide insights regarding the on-the-ground challenges for implementing those changes in a small corner of the Middle East. Within Israel, the gap between theory and implementation of LTSER remains wide. Between Israel and Jordan, the collaboration is an excellent first step to bridging the gaps in a common ecosystem. It is clear that without the political motivation to work together in order to build bridges between the two countries, such research would not have been possible due to the many obstacles that exist. In both countries the ecologists work together with social scientists. The combination of transboundary, transdisciplinary research is a complex challenge that brings new insights and angles to the study of the Wadi Araba landscape. If mutual benefits (for Jordanians and Israelis) could be derived from the platform in the form of improved ecosystem management, and local people perceive these benefits, this would be an excellent tool for peace making and, as a result, it would strengthen the collaboration and the two LTSER platforms could flourish.

Acknowledgements We gratefully acknowledge the work of our Jordanian colleagues. We thank the editors of this volume for their improvements to the manuscript and our research assistants, Hila Sagie and Inna Kaplan. Roy Zaidenberg developed the model displayed in Fig. 18.2. Portions of this research were supported by a trans-border cooperation grant from the Israel Ministry of Regional Cooperation to the Dead Sea – Arava Science Center.

References

Adams W, Hutton J (2007) People, parks and poverty: political ecology and biodiversity conservation. Conserv Soc 5:147–183

Brown G (2013) The relationship between social values for ecosystem services and global land cover: an empirical analysis. Ecosyst Serv 5:58–68. 10.1016/j.ecoser.2013.06.004

Bryan BA, Raymond CM, Crossman DM et al (2010) Targeting the management of ecosystem services based on social values: where, what, and how? Landsc Urban Plan 97(2):111–122. 10.1016/j.landurbplan.2010.05.002

Chan KMA, Guerry AD, Balvanera P et al (2012) Where are cultural and social in ecosystem services? A framework for constructive engagement. BioScience 62(8):744–756. doi:10.1525/bio.2012.62.8.7

Clark SG (2011) The policy process: a practical guide for natural resource professionals. Yale University Press, New Haven

Cowling RM, Egoh B, Knight AT et al (2008) An operational model for mainstreaming ecosystem services for implementation. Proc Natl Acad Sci 105(28):9483–9488. doi:10.1073/pnas.0706559105

de Groot JIM, Steg L (2008) Value orientations to explain beliefs related to environmental significant behavior: how to measure egoistic, altruistic, and biospheric value orientations. Environ Behav 40(3):330–354. doi:10.1177/0013916506297831

de Groot RS, Alkemade R, Braat L et al (2010) Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making. Ecol Complex 7(3):260–272. 10.1016/j.ecocom.2009.10.006

Diamantopoulos A, Schlegelmilch BB, Sinkovics RR et al (2003) Can socio-demographics still play a role in profiling green consumers? A review of the evidence and an empirical investigation. J Bus Res 56(6):465–480. 10.1016/S0148-2963(01)00241-7

Dick J, Al-Assaf A, Andrews C et al (2014) Ecosystem services: a rapid assessment method tested at 35 sites of the LTER-Europe network. Ekologia 33(3):217–231. doi:10.2478/eko-2014-0021

Dietz T, Ostrom E, Stern PC (2003) The struggle to govern the commons. Science 302(5652):1907–1912. doi:10.1126/science.1091015

Dolev A, Perevolotsky A (2004) The Red Book: vertebrates in Israel. The Israel Nature and Parks Authority and The Society for the Protection of Nature in Israel, Jerusalem

Foley JA, DeFries R, Asner GP et al (2005) Global consequences of land use. Science 309(5734):570–574. doi:10.1126/science.1111772

Fraser EDG, Dougill AJ, Mabee WE et al (2006) Bottom up and top down: analysis of participatory processes for sustainability indicator identification as a pathway to community empowerment and sustainable environmental management. J Environ Manage 78(2):114–127

Frumkin R, Pinshow B, Kleinhaus S (1995) A review of bird migration over Israel. J Ornithol 136(2):127–147. doi:10.1007/BF01651235

Gray M (2011) Other nature: geodiversity and geosystem services. Environ Conserv 38(03):271–274. doi:10.1017/S0376892911000117

Grimm NB, Redman CL, Boone CG et al (2013) Viewing the urban soc-ecological system through a sustainability lens: lessons and prospects from the Central Arizona-Phoenix LTER Programme. In: Singh SJ, Haberl H, Chertow M et al (eds) Long term socio-ecological research. Springer, Dordrecht

Groner E, Shachak M (2011) The history of establishing the LTER network in Israel and its status. Hebrew, Jerusalem, Ma'arag, Jerusalem

Haberl H, Winiwarter V, Andersson K et al (2006) From LTER to LTSER: conceptualizing the socioeconomic dimension of long-term socioecological research. Ecol Soc. 11(2):13 [online]. http://www.ecologyandsociety.org/vol11/iss2/art13/

Kosoy N, Corbera E (2010) Payments for ecosystem services as commodity fetishism. Ecol Econ 69(6):1228–1236. 10.1016/j.ecolecon.2009.11.002

Luck GW, Chan KMA, Eser U et al (2012) Ethical considerations in on-ground applications of the ecosystem services concept. BioScience 62(12):1020–1029. doi:10.1525/bio.2012.62.12.4

Maass M, Equihua M (2015) Earth stewardship, socioecosystems, the need for a transdisciplinary approach and the role of the International Long Term Ecological Research Network (ILTER). In: Rozzi R, Chapin FS III, Callicott JB et al (eds) Earth stewardship: linking ecology and ethics in theory and practice. Springer, Dordrecht, pp 217–233

Maynard S, James D, Davidson A (2010) The development of an ecosystem services framework for South East Queensland. Environ Manage 45(5):881–895. doi:10.1007/s00267-010-9428-z

Mirtl M, Orenstein DW, Wildenberg M et al (2013) Development of LTSER platforms in LTER-Europe: challenges and experiences in implementing place-based long-term socio-ecological research in selected regions. In: Singh SJ, Haberl H, Chertow M et al (eds) Long term socio-ecological research. Springer, Dordrecht

Nissim H (2012) Landscape units in the Arava. M. Sc. thesis. Blaustein Institute for Desert Research, Ben Gurion University of the Negev, Beer Sheva

Orenstein DE, Groner E (2014) In the eye of the stakeholder: changes in perceptions of ecosystem services across an international border. Ecosyst Serv 8:185–196. 10.1016/j.ecoser.2014.04.004

Orenstein DE, Katz-Gerro T (in review) Environmental tastes, opinions and behaviors: social theory in the service of ecosystem service assessment.

Orenstein DE, Groner E, Argaman E et al (2012) An ecosystem services inventory: lessons from the northern Negev Long-Term Social Ecological Research (LTSER) Platform. Geogr Res Forum 32(2012):96–118

Rozzi R (2013) Biocultural ethics: from biocultural to homogenization toward biocultural conservation. In: Rozzi R, Pickett STA, Palmer C et al (eds) Linking ecology and ethics for a changing world: values, philosophy, and action. Springer, Dordrecht/Heidelberg/New York/London, pp 9–32

Rozzi R, Armesto J, Gutiérrez JR et al (2012) Integrating ecology and environmental ethics: earth stewardship in the southern end of the Americas. BioScience 62(3):226–236. doi:10.1525/bio.2012.62.3.4

Sagie H, Morris A, Rofè Y et al (2013) Cross-cultural perceptions of ecosystem services: a social inquiry on both sides of the Israeli–Jordanian border of the Southern Arava Valley Desert. J Arid Environ 97:38–48. 10.1016/j.jaridenv.2013.05.007

Shanas U, Abu Galyun Y, Alshamlih M et al (2006) Reptile diversity and rodent community structure across a political border. Biol Conserv 132(3):292–299. 10.1016/j.biocon.2006.04.021

Shanas U, Galyun YA, Alshamlih M et al (2011) Landscape and a political border determine desert arthropods distribution. J Arid Environ 75(3):284–289. 10.1016/j.jaridenv.2010.10.008

Singh SJ, Haberl H, Chertow M et al (2013a) Introduction. In: Singh SJ, Haberl H, Chertow H et al (eds) Long term socio-ecological research. Springer, Dordrecht

Singh SJ, Haberl H, Chertow H et al (eds) (2013b) Long term socio-ecological research. Springer, Dordrecht

Takaks D (1996) The idea of biodiversity: philosophies of paradise. The Johns Hopkins University Press, Baltimore

Turnhout E, Waterton C, Neves K et al (2013) Technocratic and Economic ideals in the ecosystem services discourse. Conserv Lett. doi:10.1111/conl.12069

Yom Tov Y, Mendelsohn H (1988) Changes in the distribution and abundance of vertebrates in Israel. In: Yom Tov Y, Tchernov E (eds) The zoogeography of Israel: the distribution and abundance of a zoogeographical crossroad. DRW Junk Publishers, Dordrecht