Environmental Impact Assessment Review 48 (2014) 1–9

Contents lists available at ScienceDirect

Environmental Impact Assessment Review

journal homepage: www.elsevier.com/locate/eiar

Evaluating impacts of development and conservation projects using sustainability indicators: Opportunities and challenges

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ARTICLE INFO

Article history:
Received 19 December 2013
Received in revised form 10 April 2014
Accepted 10 April 2014
Available online xxxx

Keywords:
Sustainable development
Sustainability indicators
Project impact evaluation
Lessons learnt
Developing countries

ABSTRACT

There has been an increased interest in using sustainability indicators for evaluating the impacts of development and conservation projects. Past and recent experiences have shown that sustainability indicators can be powerful tools for measuring the outcomes of various interventions, when used appropriately and adequately. Currently, there is a range of methods for applying sustainability indicators for project impact evaluation at the environment–development interface. At the same time, a number of challenges persist which have implication for impact evaluation processes especially in developing countries. We highlight some key and recurrent challenges, using three cases from Kenya, Indonesia and Brazil.

In this study, we have conducted a comparative analysis across multiple projects from the three countries, which aimed to conserve biodiversity and improve livelihoods. The assessments of these projects were designed to evaluate their positive, negative, short-term, long term, direct and indirect impacts. We have identified a set of commonly used sustainability indicators to evaluate the projects and have discussed opportunities and challenges associated with their application. Our analysis shows that impact evaluation processes present good opportunities for applying sustainability indicators. On the other hand, we find that project proponents (e.g. managers, evaluators, donors/funders) face challenges with establishing full impacts of interventions and that these are rooted in monitoring and evaluation processes, lack of evidence-based impacts, difficulties of measuring certain outcomes and concerns over scale of a range of impacts.

We outline key lessons learnt from the multiple cases and propose ways to overcome common problems. Results from our analysis demonstrate practical experiences of applying sustainability indicators in developing countries context where there are different prevailing socio-economic, cultural and environmental conditions. The knowledge derived from this study may therefore be useful to a wider range of audience who are concerned with sustainable integration of development and environmental conservation.

Introduction and background

Among the notable commitments made following the Rio Earth Summit of June 1992 was the formulation of a set of indicators to measure sustainable development (Agenda 21; UNCED, 1992). Since the Rio Summit, a range of sustainability indicators were formulated as a key approach to provide sustainability-related decision-making processes and have been widespread in the international development arena (Dahl, 2012; Mascarenhas et al., 2010; Moldan et al., 2012). They have become popularized among governments, non-governmental organizations, private sectors and the wider public where they are increasingly being used to explain how and why certain trends occur in specified contexts (Bell and Moorse, 2008). Since the Rio Summit, various definitions of what is sustainable and a range of approaches on how to measure sustainability have been published by different authors and promoted by various actors (Belanger et al., 2012; Bell and Moorse, 2008; Havlicek, 2012; McMahon et al., 2012; Moldan et al., 2012; Wang et al., 2012). There is no single universally accepted definition of sustainability and of its indicators and today, its concept remains elusive (e.g. Bell and Moorse, 2008; Moldan et al., 2012). This is because sustainability is context-dependent embracing different temporal and spatial scales and requiring clarity for specific "destinations" (e.g. sustainable for what?) or factual and scientific orientations (Bell and Moorse, 2008). With respect to sustainability indicators, in general, it is agreed that they should quantify characteristics or

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http://dx.doi.org/10.1016/j.eiar.2014.04.001
0195-9255/

processes of the human–environmental systems in a simplified way in order to ensure their future continuity and functionality (Hak et al., 2007). This, in essence, means that sustainability intrinsically involves the maintenance or continuity of outcomes over time. For example, if a proposed sustainability indicator relates to a short-term gain (such as yield increase due to massive fertilizer input), it is bound to become redundant when the project exits and the treatment ceases. Despite their flaws, when carefully defined and applied appropriately, sustainability indicators can be powerful tools for evaluating and communicating complex phenomena (e.g. Bell and Moorse, 2008). Consequently, they can foster sustainable development through improved governance and decision-making (Bell and Moorse, 2008; Gilbert, 1996; Moreno-Pires and Fidélis, 2012; Rametsteiner et al., 2011).

Although the concept of sustainability has increasingly become popular among governmental, non-governmental organizations and the private sector (Bauler, 2012; Boyd and Charles, 2006; Dale et al., 2013; Fernández-Sánchez and Rodríguez-López, 2010; Gilbert, 1996; Milman and Short, 2008; Ragas et al., 1995; Rennings and Wiggering, 1997; Shaheen et al., 2011), it is in some cases misrepresented (Rametsteiner et al., 2011; Valentin and Spangenberg, 2000). Valentin and Spangenberg (2000) argue that sustainability is an ambitious policy target since it gives environmental, economic, social, and institutional dimension an equal importance. Such complexity poses challenges in the design of its indicators, for example, in the appraisal of research and development projects (e.g. Rametsteiner et al., 2011). Thus in practice, there are challenges in the use of sustainability indicators in research and development processes (Azar et al., 1996; Blancas et al., 2011; Dahl, 2012; Rapport and Hildén, 2013).

Sustainability indicators attempt to encapsulate complex and diverse processes in relatively few simple measures, while at the same time maximizing unique and relevant information. Subsequently, their selection is often subjective (Fricker, 1998) and there is no silver bullet solution that depicts the best choice of a given sustainability indicator (Bell and Moorse, 2008). The choice of a sustainability indicator therefore depends on multiple factors including scale, availability of resources, feasibility of measurement, time constraints and data availability (Azar et al., 1996; Bauler, 2012; Blancas et al., 2011; Boyd and Charles, 2006). Some crucial aspects to be assumed are temporal and spatial scales of assessment, for example, sustainable 'where' and for 'how long'. Besides, the choice of a sustainability indicator is context-dependent and it is often the project managers' decision to identify which ones best suit a given situation or setting based on defined selection criteria (Dale et al., 2013).

Sustainability indicators may be confused with traditional indicators which can be limited in scope and vision since they often fall short of covering sustainability issues (e.g. Adger and Florian, 1994; Dahl, 2012). Traditional socio-economic and environmental indicators, such as income per capita and amount of generated wastes are so generic that they at times fail to address important sustainability issues such as wealth distribution, equitable access to resources, living costs and behavioral dynamics of a given population (Adger and Florian, 1994). For example, rather than only quantifying solid wastes recycled by a company under traditional indicators, sustainability indicators would show the links between the amount of recycled product and its level of acceptance and subsequent use (e.g. the percentage of the recycled product that is actually being utilized by a given population). Similarly, a traditional economic indicator such as 'number of jobs created' offers little understanding of the resilience and flexibility of a job market, if subjected to economic change. In contrast, a sustainability indicator would focus on parameters such as income distribution, cost of operations, job diversity and required skills.

Sustainability indicators echo the reality of interconnections between economy, society and the environment and their influence on a given change that is to be measured (e.g. Azar et al., 1996; Bowen and Riley, 2003; Dahl, 2012; Fricker, 1998; Rametsteiner et al., 2011). For this reason, interest in the use of sustainability indicators for evaluating impacts of development interventions has increased due to their potential to improve project management (Fernández-Sánchez and Rodríguez-López, 2010). Indeed, impact evaluation is a powerful tool for assessing appropriateness and effectiveness of development interventions (Baker, 2000) and is a vital stage in any project cycle (e.g. Evans et al., 2009; Fernández-Sánchez and Rodríguez-López, 2010). In most cases, impact evaluation focuses on measuring actual effects of interventions and thus may put less emphasis on delivery and management processes (IFRCRCS, 2011). Since impact evaluation exercises involve the assessment of both positive and negative outcomes (e.g. Stem et al., 2005), sustainability indicators are necessary for this process. This is because sustainability indicators reflect the reality that development interventions can produce both intentional and unintentional outcomes. For instance, introducing a new crop/animal breed could lead to cultural erosion in a community and/or social exclusion for non-project beneficiaries.

Today, sustainability indicators are a key aspect of project management and are widely used to monitor and evaluate development interventions (Fernández-Sánchez and Rodríguez-López, 2010). They can help to assess project performance and provide important knowledge base and critical inputs for design of future programs (e.g. Grainger, 2012; Hezri, 2004; Rapport and Hildén, 2013; Ugwu and Haupt, 2007). On the other hand, applying sustainability indicators is technically complex, requiring robust methods which can fully embrace socio-economic, cultural, political and environmental determinants of changes brought by a particular intervention (Dale et al., 2013; Reed et al., 2006; Shen et al., 2011). No empirical work has been done to compare experiences of evaluating development and conservation projects using sustainability indicators, between Kenya, Indonesia and Brazil. This paper fills this gap and uses multiple cases drawn from these countries where different projects have been implemented to conserve biodiversity as well as improve socio-economic human well-being. Our core intention is to present experiences and lessons learnt from these projects by highlighting opportunities and challenges associated with application of sustainability indicators. We first present brief contexts of the three cases, followed by the methods used for the analysis. We then present key sustainability indicators that were used in the cases, their practical benefits and associated problems. Finally, we outline key lessons learnt, opportunities, challenges and key strategies for improving impact evaluation using sustainability indicators. We believe that our analysis will benefit a wide range of audience from academic readership, project managers, private sector, the public and others working at the development–environment interface.

Study context

Case study 1: Mara River Basin (MRB), Kenya

A conservation and development project was convened in the Mara River by an international NGO in the early 2000. With funding from multiple donors, the project set out to promote sustainable management of the trans-boundary Mara River (size: approximately 13,750 km^2; length: 395 km) which originates from Kenya (35%) and enters into Lake Victoria in Tanzania (65%). The Mara River Basin (MRB) ecosystem has a rich biodiversity which are of local, national and global importance. It supports valuable economic activities such as tourism, agriculture and mining in both Kenya and Tanzania (Lake Victoria Basin Commission and WWF ESARPO, 2010). Up to 80% of the population in the MRB is engaged with agricultural activities, yet poverty, hunger and malnutrition are prevalence affecting the majority of its inhabitants. Problems such as over-exploitation of natural resources, water scarcity, pollution, soil erosion, sedimentation and climate change have serious negative environmental and socio-economic impacts on the MRB.

The Mara River Basin Project (MRBP) was convened in response to these critical issues. With three phases running on a 3-year interval, the Project set out to promote good water quality, adequate water supplies and improved biodiversity across the MRB, using an integrated

water resources management (IWRM) framework. IWRM promotes a coordinated planning and management of land and water to meet socio-economic and environmental objectives (Global Water Partnership, 2000). The MRBP ran for nine years and several interventions were initiated to promote a healthy ecosystem of the river basin as well as improve socio-economic well-being of its human population of nearly one million people. Activities that were undertaken were cross cutting and diverse and ranged from land and water management interventions (e.g. soil and water conservation), promotion of income generating activities (IGAs), establishment of multi-level stakeholder platforms (e.g. community based organizations), supporting and promoting strong legal, policy and institutional frameworks (e.g. water reform policies) and ecological monitoring of water quality, quantity and biodiversity.

Much of the efforts made by the MRBP focused strongly on sustainability issues and a strategic approach was taken in implementing activities that would ensure continuity and replicability of the Project's impacts and outcomes. These activities include river bank/riparian land and spring protection, conservation agriculture, livelihood diversification, capacity building, establishment and activation of multi-level institutions, lobbying and advocacy, communication and information dissemination.

Several sustainability indicators were used to assess the Project's outcome and include number of tree seedlings planted and rate of their survival and species diversity; number of income generating activities (IGAs) formed; household income; number of multi-level institutions established/activated and proportion of men and women leaders in these institutions; number of sub-catchment management plans formulated, number of Memorandum of Understandings (MoUs), policies and laws reformed and/or developed.

Case study 2: Bintuni Bay, Papua, Indonesia

The development Project located in Bintuni Bay, Papua, Indonesia, was initiated to extract subsurface natural gas for global shipment. Initially two processing plants (Liquefied Natural Gas — LNG Trains) were constructed, an LNG tanker loading terminal, offices and personnel accommodation facilities. The Bintuni Bay Project (BBP) is located in a complex social and environmentally sensitive area with a predominantly indigenous population, poor physical infrastructure, long distances between communities, vast uninhabitable areas and extensive mangrove swamps. Ahead of construction, it was crucial to assess potential positive and negative impacts, identify mitigating measures and highlight activities that could improve local livelihoods.

A thorough Environmental and Social Impact Assessment (ESIA) exercise was undertaken over a two-year period with the establishment of baseline information, identification of the Project's potential direct and indirect impacts and development of environmental management and monitoring frameworks and associated indicators. The Project developed a system for assessing the impacts (and magnitude) of its proposed activities on local populations and the type of assistance that would be expected from those directly and indirectly affected. As a result, a suite of 14 'Integrated Social Programmes' were developed with diverse themes ranging from full-time education and vocational training, community health, water, hygiene and sanitation (WASH), HIV/AIDS awareness to enterprise development and business empowerment. For instance, in recognizing that the construction of the processing plants would cause significant changes on the local and regional environments, the operating company and its partners strategized to improve and support local livelihoods diversification, through activities such as setting up savings schemes, new businesses and capacity building on financial management. These projects aimed at progressing toward a community-led development paradigm, with their designs based on an integrated approach which embraces the principles of sustainable development, cultural preservation and biodiversity conservation. For example, Community Action Plans (CAPs) were formulated involving local people who participated in identifying, prioritizing, planning and implementing the proposed activities in partnership with local governmental and non-governmental organizations. Tailored key performance sustainability indicators were developed and are reviewed regularly as integral to the CAP process. In addition, a Biodiversity Action Plan (BAP) was developed and incorporated in partnership with various international biodiversity conservation organizations. Since September 2011 (Phase 2), these projects have been streamlined and best practices have been identified and highlighted for up-scaling into the wider sectoral development.

Sustainability indicators such as welfare index, household income and the presence of community-based groups (e.g. Farmer Cooperatives, Women's groups and self-help groups) have been useful in monitoring the projects' impacts and outcomes. Attention has also been paid to monitor and assess the level of accessibility and quality of primary health service provision with use of sustainability indicators such as level of communal and personal hygiene, incidences of diseases, percentage of treatment seeking behavior and ratio of midwives/villager. Sustainability indicators related to education have included student/teacher ratios, teacher competency, participation, graduation and literacy rates. In addition, the integrity and validity of national school tests was also assessed. Quality of waste-water discharge testing has been combined with analysis of fish, shrimp and crab stocks on the bay as well as fishing habits.

Case study 3: Brazil

Brazilian case study is a project with the overall goal to conserve biodiversity in agricultural landscapes. The project focused on prevention of deforestation, species extinction and facilitation of compliance with environmental laws by landowners. It supported farmers to transform their practices toward a more sustainable production, ecological restoration and water resources conservation in Atlantic Rainforest region (Mata Atlantica in Portuguese) and Brazilian savanna (Cerrado). Atlantic Rainforest region is characterized by small-scale conservative famers who are cautious and may be unfamiliar with farming innovations, while Cerrado is characterized by large-scale, often more innovation-prone farmers who often practice agricultural intensification (that requires relevant 'know-how'). These two biomes were selected because they are among the world's richest biodiversity 'hotspots' and endangered due to anthropogenic drivers. In Atlantic Rainforest region, the project aimed to establish biodiversity corridors within the remnants of Atlantic Rainforest (so called 'the hottest of the hotspots'; Laurance, 2009) that stretches from the northeast to the southern Brazil. The project closely collaborated with farmers to establish protected areas within farmlands. It involved a multitude of actions performed by a range of stakeholders including various universities, governmental institutions and NGOs. For example, firewood-saving low-emission stoves were donated to a community, trees were planted to increase connectivity within the Atlantic Rainforest and a range of capacity building initiatives were undertaken, such as courses for planning payments for ecosystem services (PES), creation of a network of managers for restoration of Atlantic Rainforest, education centers for conservation or photo exhibition and symbol species of Atlantic Rainforest contest to engage the wider community.

In Cerrado region, the project encouraged local farmers to protect biodiversity and to monitor and manage degraded areas in their farmlands. For example, a forest was replanted in the 'legal protection' areas and in agricultural lands designed for restoration and seeds festival was organized to engage with the wider community. In addition a range of other capacity building actions were performed including organizing courses for the restoration of degraded areas as well as the contests for symbol species in the region and photo exhibition. Cerrado, located in the central-east of Brazil, is an important agriculture frontier for soybean and cotton. According to the Brazilian Institute of Geography and Statistics (IBGE), East of Bahia, which is in Cerrado,

accounts for 92% of the grain production of the entire country. According to the Brazilian Ministry of Agriculture (BMA, 2010), agricultural production is expected to rise due to availability of land and favorable soil and climatic conditions (BMA, 2010). If the current rate of degradation continues, the Cerrado may disappear by 2030 and there is a high risk of biodiversity loss and extinction, especially because animal species such as the Armadillo, *Cingulata* spp. and the Maned Wolf, *Chrysocyon brachyurus* spp. are already threatened.

In order to estimate and measure the project's impacts (medium- to long-term over a 10-year period), a set of sustainability indicators were identified using a participatory approach. Initially, a two-day consultative and participatory workshop was held with a range of stakeholder groups from project management teams, beneficiaries, policy-makers and communicators to the wider community. The participants provided observations and in-depth insights into the project and also suggested actions needed for future improvement. Communication channels were established and follow-up correspondence was put in place to share the data. Further consultations were performed with field coordinators, external consultants, scientists and experts. The design of the evaluation methodology took into consideration the multiplicity of project's activities, their spatial distribution within different communities and the limited time available for assessment. Subsequently, it was concluded that it would not be feasible to evaluate socio-economic and environmental impacts of all interventions (e.g. impacts of reforestation on welfare, economy, soil, water and the atmosphere).

To prioritize objectives of the evaluation over limited time, the following criteria were used to choose sustainability indicators: i) indicators should be re-applied over time within and outside the project's interventions; ii) no special training required to apply the indicators; iii) capacity building was an important objective and although difficult to measure (Hailey and James, 2003; Templeton, 2009), it was necessary to design methods that would best evaluate its impacts; iv) different methods were designed to evaluate interventions initiated in different contexts; iv) the use of quantitative and qualitative approaches such as direct measurement, interviews and modeling was critical; v) where possible, it was necessary to take large samples in order to reach out the highest number of project beneficiaries within limited time; vii) selection of indicators that would show whether impacts would be sustained after the project exits; and vii) selection of indicators subject to data quality and availability.

Capacity building, socio-economic and environmental objectives were the focus of the project. Subsequently, a modified 'amoeba' method was developed to conceptualize the approach used for the project impact evaluation (Fig. 1). To simplify the assessment and overcome complex discussion on numerical values of sustainability, it was assumed that sustainability increases with a certain action. For example, if the forest was planted in degraded areas or if energy-saving stoves were implemented it was considered a step toward sustainability. This approach however does not use measurable units, but indices (to avoid complex discussion regarding at which score we enter sustainability). For Fig. 1 numbers were adjusted for presentation purposes and normalization method was used to arrive at a common unit when applying this approach in evaluating the impacts of the project. With this approach it is also possible to capture negative effects. This approach also captures projected values for the future, taking into account that certain impacts would only be fully realized some time after the project exits. For example, it is possible to model (given biomass and forest area) how much CO_2 could be sequestered. This thus represents sustained effect of the project over longer time (provided that the forest is not cleared). Analogically, biodiversity restoration can be anticipated based on species–area curve modeling.

Methodology

This paper is based on a comparative assessment and analysis across three cases drawn from different projects. The criteria used to select the cases studies were based on the projects' goals and objectives as well as the types of sustainability indicators used. All the projects were implemented to promote sustainable development, better environmental management and livelihoods improvement. Throughout their cycles, all the projects underwent monitoring and evaluation exercises which assessed their impacts (positive/negative, short-term/long term, direct/indirect). Similarly, selected sustainability indicators were developed to evaluate the projects' impacts (see Table 1), and this presented a good methodological opportunity to do a cross-comparison on all the three cases.

Our assessment was based on a literature review of relevant documents. We reviewed a selection of project's technical proposals, progress reports, mid-term reviews and final evaluation documents. We also followed up with key stakeholders involved in the projects to further improve the comparison between cases. We reviewed academic articles which provided background information on the subject matter. The literature review was complemented with insights drawn from our own experiences gained from previous participation in the monitoring and evaluation of these projects. During such exercises, we already used both qualitative and quantitative methods (e.g. biodiversity assessments, key informant interviews and focus group discussions) to assess the projects' impacts. It is

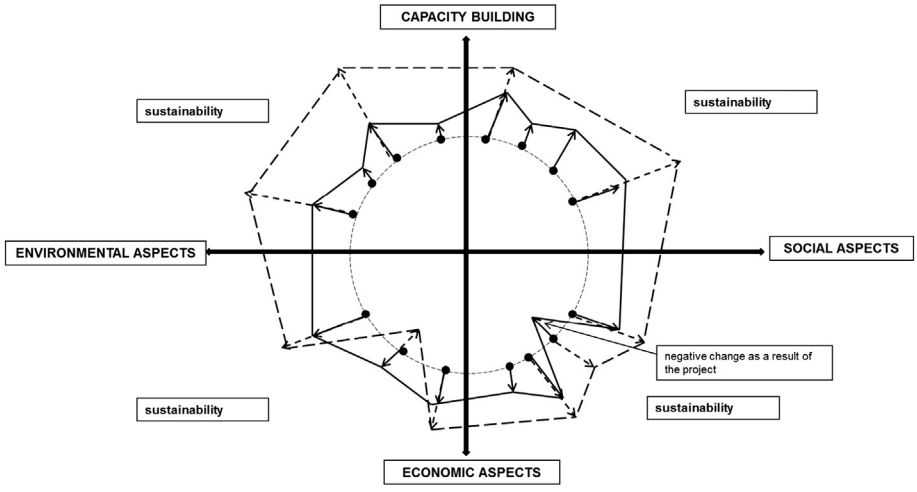

Fig. 1. Visualization of project impact evaluation using sustainability indicators for Brazilian case study. Black dots represent sustainability indicators used (for example, area in hectares of forest restored). Dashed-line circle represent a baseline data (e.g. area of forest before the project), black lines represent value observed during evaluation (area restored). Black dashed lines represent projected values for the future, taking into account that some of the impacts of the project would show some time after it ends.

Table 1
Selected activities from the case studies and associated sustainability indicators. The activities were evaluated with respect to a specific objective of a given project.

Objective	Activity	Sustainability Indicator
Improved forest ecosystem services and CO_2 emission control	Tree nursery establishment and afforestation or reforestation	Number of trees planted, their survival rates and diversity, level of avoided CO_2 emissions, number of jobs created and their diversity
Improved stakeholder participation in conservation	Establishment of multi-level institutions	Number of institutions created and number of active members, and the level of their engagement
Reduced use of firewood and in-house emissions	Implementation of energy saving stoves	Levels of firewood use, emission measures (including CO_2 emissions)
Capacity building in legal frameworks	Training workshops in laws and policies	Number of policies and laws formulated, and level of enforcement and compliance
Increased awareness in conservation	Organizing symbol species, contest, photo exhibition and seed festivals	Number of people participating in educational centers and their levels of understandings
Habitat restoration	Tree planting, river bank protection	Area (e.g. in hectares) restored, vegetation structure (basal area in m^2/ha and abundance in n/ha)
Capacity building in environmental education	Establishment of educational centers and networks	Number of people participating and level of media coverage
Promotion of local products	Development of local products and improved quality	Number of trainings in production and quality improvement
Improved local income	Diversifying livelihoods and creation of economic activities	Number of economic activities, income distribution and asset levels.

not an objective of this paper to present a detailed analysis of these three case studies but to identify and highlight the most common lessons learnt from impact evaluation of the projects and to propose ways forward.

We conducted a content analysis (e.g. Bryman, 2008) on the sustainability indicators used to assess the projects' impacts on biodiversity (e.g. ecosystem services, climate sequestration), governance and socio-economic human well-being. The process of content analysis involved studying carefully through project documents, identifying and recording all the sustainability indicators that were proposed. The most common sustainability indicators were selected (Table 1) and were examined in the ways in which they had been used to evaluate the impacts of the project. We then performed a cross-comparison and identified opportunities and key methodological and operational challenges associated with each sustainability indicator. This allowed us to document key lessons learnt from evaluating the impacts of these environmental and development projects using the sustainability indicators.

Results and discussion: assessing project impact using sustainability indicators

In this section, we outline the most common sustainability indicators that were identified from the case studies (Table 1) and discuss key opportunities and challenges of selecting and using them for evaluating the impacts of the projects within the case studies.

Although the projects were initiated and evaluated under different circumstances, they provide common opportunities and share methodological and operational challenges in attempts to evaluate their impacts using sustainability indicators. Here we have identified four common themes that best exemplify the opportunities and challenges and we discuss them below.

Monitoring and evaluation (M&E)

Sustainability indicators should be accompanied with actions that monitor the state, trends and pressures of a given socio-ecological system (Boyd and Charles, 2006; Fraser et al., 2006; Grainger, 2012; Rapport and Hildén, 2013). This provides a basis for actions and the appraisal of policy responses (Rapport and Hildén, 2013).

The importance of expert opinion in environmental analyses has been widely demonstrated (e.g. Krueger et al., 2012). This is supported by our analysis which showed that independent experts were useful in providing advice on the projects and monitoring and evaluation (M&E) processes. In the Indonesian case, impact evaluation exercises were guided by international standards set out by the Equator Principles (EP), the International Finance Corporation (IFC) and the Asian Development Bank (ADB). Independent Advisory Panel (IAP) was established which comprised of prominent global experts who provided advice on critical issues such as security, human rights, revenue management and governance.

Sustainability indicators require systematic monitoring and evaluation (M&E) for building evidence-based impacts. Within the projects, specific M&E targets were developed to form the basis from which progress was monitored systematically. But systematic monitoring activities were not done for some interventions, especially within the Mara River Basin Project (MRBP) where evaluation exercises required the assessment of the Project's impact on water quality and biodiversity levels. In some cases, the MRBP Project relied significantly on the services of a third party such as government authorities for monitoring water quality and quantity in the Mara River. However, due to limited resources, the authorities did not carry out their roles effectively so that by the time the Project exited, its specific contributions to water quality and biodiversity improvement was difficult to quantify. Besides, some activities were implemented as collaborative initiatives between multiple partners (e.g. afforestation activities). Without systematic monitoring and collection of reliable data/information, it was difficult to discriminate water quality impacts which the MRBP attributed to, since several other organizations had initiated afforestation activities.

Monitoring and evaluating long-term impacts of post-interventions using sustainability indicators also requires the assessment of whether an exit strategy has been put in place. An exit strategy outlines measures that will be (or has been) taken to ensure continuity of certain activities after the final phase of the projects. In the Mara River for example, the project implementers facilitated the formation of locally-based institutions, such as, the water resources users associations (WRUAs) and community forest associations (CFAs). These are legal institutions which are fully recognized within the Water Act (2002) and the Forest Act (2005). Successful formalization of these local institutions fostered community participation in catchment protection and livelihoods improvement after the project exited. Subsequently, activities such as tree planting and livelihood diversification are still on-going in some areas in the Mara River Basin even though the project officially ended about three years ago. Sustainability indicators such as number of community-based institutions formed, that took full account of exit strategies helped in the monitoring and evaluating both long-term and indirect impacts of the various interventions in the Mara River Basin.

It was noted that to some extent, much efforts that NGOs or the private sectors make at the conservation–development interface can bring laxity within the realm of government authorities. For example, some government institutions in the Mara River Basin made no or little efforts in carrying out their legal mandate in facilitating local communities in catchment protection and conservation (e.g. financial support).

Upon seeing the willingness of other organizations (such as the NGO which implemented the Mara River Project) to provide technical and financial support to local communities, some government authorities became passive spectators rather than active implementers.

Measurability

The majority of the projects discussed here aimed to increase biodiversity, improve climate (e.g. through carbon sequestration) and the overall ecosystem services within the areas of interventions. In Mata Atlantica and Cerrado, Brazil and the Mara River, Kenya, many of the biodiversity related sustainability indicators were measured using ecological surveys which yielded data on species numbers, diversity, composition, and survival rates. At the beginning of the projects, many grassroots communities were strongly supported to plant trees to restore degraded land and enhance biodiversity (e.g. increase forest cover in legally protected areas). Within the Mara River, hundreds of seedlings of fodder and shrubs were given to local communities who planted them in farmlands and along the River bank.

It was noted that much attention was paid to immediate effects and outputs of activities implemented such as survival rates of seedlings, number of mature trees, proportion of increased forest cover and the mere local job opportunities created (e.g. paid labor in tree nurseries). Many of these sustainability indicators could easily be measured. However little or no consideration was given to long-term desirable future impacts of some of these activities such as pollution abatement (soil, water and air quality), carbon sequestration, meeting future fuel wood and water demands and increased gender equality. Our analysis has shown that the most common challenges encountered were; strict financial reporting to funders, insufficient funds and lack of technical knowledge and skills required for measuring sustainability indicators. For example, since, project implementers were obliged to justify resource expenditure to funders, they could not deviate away from the budget to carry extra-activities that were not originally planned. In Brazil, the application of modeling tools that would predict long-term multiple impacts of tree planting on hydrology or soil erosion prevention in Mata Atlantica and Cerrado could have provided a robust method for impact evaluation. However, they were feared too costly and time-demanding, and could in the future require additional personnel trained to perform modeling. Instead, focus group discussions were proposed to capture project's impacts on some ecosystem services. In addition long-term impacts were designed to be measured from simple CO_2 modeling (from average biomass measurements of a similar forest cover).

Capacity building initiatives were popular and commonly initiated within the projects with the aim to improve local knowledge and skills and subsequent public participation in development and conservation activities. Within the Brazilian projects, a range of capacity building activities were initiated, such as; setting up educational centers, stimulating public awareness through contest for the best symbolic species, establishing network of conservation managers and active involvement of local media. In rural Indonesia community needs assessment were conducted to support more effective fishing activities in the project area. In the Mara River, over 70 multi-level water resources management (WRM) institutions were established and/or activated and practical training in soil and water conservation, energy-saving stoves, information and technology were facilitated and demonstration farms established. In evaluating the impacts of these interventions, the most commonly used sustainability indicators were; number of participants and their levels of participation and understanding, number of educational/demonstration centers and number and frequency of training sessions.

Our analysis revealed that measuring capacities explicitly using these indicators can be a complex process. This is due to resources constraints required to carry out robust systematic methods, difficulties of demonstrating attribution and measuring intangible impacts such as implicit knowledge. We found that measuring the actual impacts of capacity building initiatives beyond mere numbers was ignored in some cases. Little efforts were put into demonstrating how the knowledge and skills acquired through capacity building processes were being put into practice and to what extent. Thus, although capacity building is universally accepted as a means to foster active participation in development and environmental conservation (e.g. Brown et al., 2001; Hailey and James, 2003), the term bears different interpretations which can cause conflicts and confusion.

Most projects within our case studies promoted livelihoods diversification by providing alternative economic opportunities for the local populations through income generation activities (IGAs). Community groups were provided with technical and financial support to start the IGAs which can bear double dividend of improved living standards (through income) and biodiversity conservation. Tree nursery establishment, energy-saving stoves, dairy goat farming, bee-keeping and baking cakes, were among the IGAs which the projects supported. The most commonly used indicator used for evaluating the impacts of IGAs was income (e.g. cash accrued from selling tree seedlings, honey, energy-saving stoves), which is not necessarily a good sustainability indicator. In the case of the Mara River, many IGAs were managed by community groups so that financial benefits were shared between members. However, measurements of income distribution among individuals or households were lacking. In addition, gathering information on group income was subjective because the main data sources were key-informant interviews (mainly committee members) and sometimes personal testimonials from focus group discussions. For example, during evaluation exercises, some individuals claimed that significant amount of financial benefits were accrued (without any proof) while others from the same group disagreed.

It was also observed that although sustainability indicators rather than traditional indicators were in some cases proposed to evaluate long-term project impacts they were sometimes rejected to meet funders' requirements. For example, some funders are still resistant to adopt more robust methods to evaluate real project impacts because either they have no experience with the evaluation methods and/or because these methods can sometimes be expensive. It was thus sometimes difficult to perform better project impact evaluation using sustainability indicators and traditional indicators were used instead. We also observed that in theory although many groups (including funders and project managers) are interested in performing better evaluation to claim that a project leads to sustainability, in practice, however, easier and cheaper methods of evaluation are often pursued. This sometimes excludes sustainability indicators in favor of traditional ones (e.g. planted seedlings instead of successful restoration). Ultimately, because of the pressure that practitioners face to meet funders' requirements, a change in funders' position to incentivize the use of sustainability indicators for project impact evaluation is paramount.

In conclusion, we maintain that a focus on tangible, physical and objective aspects of sustainability indicators (e.g. use of numbers) creates significant methodological challenges of evaluating the impacts of many projects. This argument is supported by Fricker (1998) who has observed that the internal manifestations of sustainability such as subjectivity and non-material aspects tend to be ignored because they are chaotic, interpretive and time-consuming.

Evidence-based impacts

The identification and collection of evidence-base can provide valuable information for decision-making processes (Hezri, 2004). Experiences from our case studies suggest that it is important to have strong baseline information in order to demonstrate proven and solid evidence of outcomes. As Dahl asserts “indicators are only as good as the data behind them” (Dahl, 2012; pp. 3). Most of these projects in our case studies focused on implementation of practical activities for bringing positive environmental and socio-economic changes. Qualitative and quantitative methods were used to collect data ranging

from focus groups, interview, and direct measurements to surveys. In the Mara River Basin, visual observations and photography were important sources of baseline information such as the magnitude of deforested areas in the upper catchment; proportions of eroded farmlands; extent of gullies along the river bank and physical water quality. By collecting baseline information, it was feasible to evaluate impacts such as increased forest cover and reduction in soil erosion events in farmlands.

The use of mixed methods to triangulate data sources minimized biasness to a certain extent, especially when collecting evidence of impacts at various project stages (e.g. Phases 1, 2, 3). For example, rather than relying only on direct measurements, surveys and/or observations, personal experiences and testimonials gathered from informal and formal interactions with key actors (e.g. beneficiaries) were used to complement key outcomes. Our analysis however showed that it was difficult to ensure that data triangulated were completely free from bias. Sometimes, the perspectives of project beneficiaries were influenced by their past and/or current experiences. For instance, some beneficiaries who had positive experiences with the projects (or similar interventions) exaggerated their benefits while those who may have had negative encounters were resentful and even disapproved of positive impacts of a given intervention. We conclude that subjectivity can influence the authenticity of evidence of impacts even if collected from multiple sources. Hence it is vital to consider this when applying sustainability indicators.

Where baseline data were not collected, it was difficult to confirm impacts especially those linked to water quality improvement in the Mara River. For example, there were claims that incidences of waterborne diseases (mainly diarrhea and cholera) were reduced within local communities due to impacts of water springs protection. Since no data were collected on rates of incidences of the diseases prior to the springs being protected, evaluation processes largely relied on personal testimonials from the local people. We suggest that working closely with local health centers/clinics and facilitating simple community health monitoring (e.g. reporting incidences of diseases) can yield important information for evaluating impacts.

Socio-economic baseline data, such as population densities, education and poverty levels, gender parity and household income levels can also enhance the outcomes of impact evaluation exercises. Where such baseline information was available and used effectively, it was possible to verify impacts of specific interventions. Some project managers made efforts to collect data on cultural practices through participatory approaches which engaged local community members. To appreciate the value of participation in conservation and development projects (e.g. Fraser et al., 2006), some project managers identified past, present and future interventions in the target areas and developed close partnerships with their proponents and key stakeholders.

Some useful information was gathered including on-going, and/or planned projects in the area as well as challenges within previous interventions. We noted however that where multiple projects were running in an area simultaneously (or where other projects were already completed in the same area), verifying which impacts were attributed to which interventions was challenging. For example, within some projects, more than ten organizations (including government-based) facilitated conservation and livelihoods interventions. The interventions engaged multiple actors (e.g. implementers, community beneficiaries, local politicians) with different socio-economic strengths and backgrounds and political influence. At times, such diversity and heterogeneity caused methodological difficulties of evaluating impacts. For example, although sustainability indicators such as number of beneficiaries and their level of satisfaction/dissatisfaction were used to evaluate impacts, it was still difficult to discriminate which activities of which projects (or organizations) were most/least beneficial to the local communities. Project managers should establish close relationships with those working in the intervened area as well as beneficiaries and should keep and update records on their different perspectives so as to build-evidence base and minimize the problem of measuring attribution.

In addition, we suggest that the establishment of control groups could have enhanced impact evaluation processes for some projects. For instance, where activities were piloted within a small number of people (or a target zone), it was possible to set up a control group/area with similar characteristics of the intervened areas (or closely similar) so as to compare impacts on project recipients with non-recipients. However, control groups may not always yield desired results. Firstly local communities are seldom static, rather they are dynamic and can go through rapid and sometimes major changes, which can affect outcomes of comparisons. Secondly, it may difficult to find control groups/with many similar characteristics of the recipients/areas intervened. Lastly, identifying and establishing control groups may require more resources such as personnel, money and time which may not be readily available.

Scale of impacts (spatial and temporal)

Our analysis showed that many of the projects within our case studies were diverse, piecemeal and dispersed over different localities and communities. With little time and resources, it was neither feasible nor rational to assess the impacts of all projects' activities on biodiversity, soil, water, atmosphere and livelihoods. For example, in the case of Brazil, it was not possible to confirm impacts of reforestation on multiple stakeholders over different temporal and spatial scales. It was therefore suggested to assess reforestation impacts through surveys (focus groups and interviews in Mata Atlantica and Cerrado, respectively) that would include participants and different stakeholders in the community with the highest number of project participants (to increase sample size). Surveys are efficient tools in covering large sample sizes and enable respondents to be asked about different aspects of the projects in order to get a bigger picture of impacts that occurred throughout their lifespan. Such extensive information would later be used to build future modeling and scenario tools to extrapolate future impacts.

In the Mara River, several activities were implemented at multiple-scales ranging from the village, sub-catchment, catchment and transboundary levels. For example, more than 50 catchment management groups (CMGs) were established on the Kenyan side of River Mara Basin to raise awareness and promote good land and water management practices at the local level. CMGs are grassroots level organizations which provide excellent opportunities to tackle land and water management issues at the smallest scales possible. For example, the groups engaged in various activities ranging from tree planting, bee-keeping, dairy goat farming, river bank and spring protection. But the scale of these activities was so small that the impacts were almost negligible when considering a basin wide approach. In some cases, it was impractical to use indicators such as the number of tree planted, amount of honey harvested and area of the river bank protected to justify the Project' impacts across the whole river basin. We argue that social, economic and institutional indicators which are used at the local scales may be unsuitable to apply at larger scales. Conversely, indicators suitable at larger geographic scales may be inappropriate for use at the local levels (e.g. Boyd and Charles, 2006). For extensive discussion on the role of scale for sustainability indicators see, for instance, Mascarenhas et al. (2010).

Key lessons learnt

In Table 2 we highlight the most recurrent lessons learnt from our case studies. We also filtered these key lessons taking into consideration reviewed literature and included issues that are depicted by other authors elsewhere.

Table 2
Lessons learnt and recommendations.

Sustainability indicators should be flexible and context-dependent. Although many environmental and development projects have similar goals and objectives, their outcomes may vary significantly depending on a given context. For this reason, is important to identify a set of sustainability indicators based on clearly defined selection criteria. The process of developing the criteria should be informed by systematic information gathering that enables practitioners to understand the prevailing socio-economic and environmental conditions and workings of a given system or situation and their interconnectedness. The final list of sustainability indicators should be inter-related and flexible and should recognize that dynamic systems will develop and change. The challenge for practitioners is how best to select a set of sustainability indicators that is fully complete i.e. can be applied exclusively in a context and used effectively in dynamic systems but requires no extra resources.
Key sustainability indicators for evaluating impacts should be agreed upon at the start of each intervention by proponents and potential beneficiaries. For example, if the intervention is to improve the water quality and health of a given community or change agricultural management practices the most appropriate sustainability indicators should clearly be identified. There are plenty of opportunities for identifying sustainability indicators before actual interventions, especially during project inception meetings with all stakeholders. The challenge however is that many project proponents prefer to invest much of the available resources in the actual implementation while paying little attention on pre-project processes.
A baseline should be established at the beginning of the project and where feasible, control group, not dependent on the intended interventions, should be identified in order to verify whether there have been any impacts. We observed that preliminary studies, systematic monitoring and evaluation exercises presented good opportunities for building evidence-based information, but only within certain projects. Where baseline data were available, some were unreliable, incomplete, not scientifically rigorous and/or lacked triangulation. The process of building a good evidence base can benefit from creating a control group which is not affected by the intended interventions. Since interventions were initiated in selected sites within the projects, we propose that control groups be identified in a different area in order to distinguish impacts on the affected groups. We recognize that there are methodological challenges of distinguishing which impacts have been attributed by a specific intervention and not by others. To minimize such challenges, it is vital to identify other projects/events in the areas intervened, interact/work closely with their proponents/beneficiaries and keep records of their different perspectives. This can help verify and where possible quantify the extent and magnitude of claimed impacts and whether outcomes have been influenced, positively or negatively by a third party.
Triangulation of data sources and collection methods is important in cross-checking information and reducing bias to ensure they are valid, reliable and complete. Being eclectic about the data requires a mix of formal (e.g. reports from monitoring) and informal (unstructured interviews), qualitative and quantitative methods. Triangulation can help to overcome challenges such as biasness, provided such processes are time- and cost-efficient.
A robust monitoring system should be put in place at the project's onset to help in impact evaluation so as to compare situations before and after interventions in order to assess if and to what extent the project has influenced the final outcome(s). Importantly, the design of a monitoring system should be realistic and performed in collaboration with local actors. Since third parties may be responsible for monitoring and reporting, regular collaboration between them and the project managers is key to ensuring quality control and to maintain relevant focus. However, some of the projects lacked a robust monitoring system to be used over the project's duration and this led to lack of or limited good quality data that could be useful for modeling and forecasting long-term impacts. This is especially challenging as most of the projects have limited budget allocation for long-term follow up activities, which is crucial in the context of 'sustainability'.
Legacy of previous interventions in the area should be identified and verified taking into account their positive and negative socio-economic and environmental impacts. Historical negative impacts can build a basis of distrust and resentment in the local communities, serving to undermine future activities. Similarly, previous positive impacts may have been exaggerated, raising local community expectations far too high about forthcoming interventions. There have been previous interventions within the project areas which present good opportunities for exploring past experiences. However, it takes time for project implementers to gain some trust from the local community order to gather their opinions and perspectives. Proponents and conveners of new projects should pay attention to these issues, otherwise, their intentions may be misconstrued by stakeholders.
Heterogeneity of project's participants should be taken into account when developing a set of sustainability indicators to evaluate impacts. Certainly, the projects in our cases engaged with multiple stakeholders of different backgrounds and capabilities depicting their heterogeneity in nature. But project's outcomes may differ depending on socio-economic or political backgrounds of these actors (e.g. whether one is educated, economically stable or politically powerful). If such heterogeneity is not taken into account, it may not be possible to verify differential impacts on people. Consideration should be given to why certain individuals might provide certain feedback, based on their motives and interests in the project. The projects within our cases presented opportunities to map out the different actors and stakeholders, their interests and expectations. Although balancing stakeholders' goals can be challenging, is it useful to develop a database of key actors with their interests and expectations and keep records of their feedback (including grievances) as these will form the basis for developing a set of sustainability indicators to be applied in a given context.
Assumptions and limitations of the assessments should be acknowledged. Our case studies have shown that demonstrating evidence of impacts on socio-economic well-being of the local populations can prove to be challenging. In addition, even when long-term effects of the project are predicted, new circumstances may prevail in the future, for example, alternative uses of trees may arise leading to new demands. Most of the projects had a framework of activities (for example, Logical Framework Analysis) containing clear objectives and strategies for achieving them. Such frameworks give opportunity to state risks, assumptions and limitations of the projects which are then taken into consideration when evaluating impacts. Capacity building activities tend to be common in most projects and although they are relatively easy to convene, measuring their impacts and outcomes using sustainability indicators is challenging as shown in our case studies. It is therefore important to design impact evaluation methods which can go beyond attainment of knowledge and skills but clearly shows how enhanced capacities have been put into practice.
Scale is an important determinant for evaluating impacts of most projects. Various stages of projects (temporal) and extent of interventions (spatial) must be taken into account when designing and applying sustainability indicators. For example, evaluating project's impacts on multiple temporal scales (short-term, medium term and long-term) is important as certain outcomes can be immediate, others may take a longer term and may only be realized after the project has exited. In order to tackle the most critical issues effectively and efficiently, most interventions within the projects were set up at appropriate and manageable scales. However, the scale of some activities was so small that their contributions toward the overall goal were not easy to justify.
Post-project sustainability indicators should be identified throughout and robust methods used to forecast future impacts even after the project has exited. It is also crucial to provide a project with sustainability indicators that are collectable, viable and feasible for longer period. An exit strategy should be formulated clearly outlining the ways in which a project' activities and impacts would be sustained in the longer run. As some of our cases have shown, supporting and strengthening the capacities of local governmental institutions to implement certain activities of the project can foster positive impacts in the longer term since such entities are legally mandated to fulfil specific responsibilities.

Conclusions

To foster sustainable development, there is a growing demand to apply sustainability indicators. Sustainability indicators can be powerful tools for evaluating the impacts of development and conservation projects on the environment and society, when selected carefully and used appropriately and adequately. Evidence from this study has shown that putting sustainability indicators into practice for project impact evaluation can be difficult, particularly in the developing countries context, where they tend to be misrepresented, overlooked and sometimes confused with traditional indicators. This is mainly due to a combination of challenges including scale of impacts, context-dependency, limited participation of stakeholders (e.g. beneficiaries); project heterogeneity, lack of triangulation and the difficulties of building evidence base. We propose that those involved in impact evaluation processes should pay much attention to these issues, make efforts to minimize these challenges and seize a range of opportunities identified here to optimize the benefits of sustainability indicators for better project management, e.g. through improved performance.

We are aware of the scope limits of this paper, our main intention, however, was to highlight opportunities and key methodological challenges of applying sustainability indicators to evaluate project impacts with evidence from various geographical locations, under different socio-economic, political, cultural conditions. The lessons learnt from these cases provide key evidence on the complexity of using sustainability indicators in conservation and development projects implemented under different conditions. We believe that this paper adds knowledge and insights into contemporary issues of sustainable development

such as resilience and the green economy and that it has important policy implications at local, national and international levels.

Acknowledgments

We gratefully thank the Norwegian Agency for Development Cooperation (NORAD) for financial support. Conservation International is gratefully acknowledged for excellent collaboration during development of sustainability indicators for Brazil case study. The anonymous reviewer is gratefully acknowledged for a constructive review. Dr. Rachael Garrett is gratefully acknowledged for her useful insights on the manuscript.

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