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PRACTITIONER'S PERSPECTIVE

A partnership approach to addressing applied ecological research needs of an oil and gas business

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Introduction

With ever-increasing demands for energy, oil and gas companies are continually searching for new resources. As a result, companies are looking in ever more remote terrestrial and challenging marine areas. These also tend to be areas with higher biodiversity and ecosystem service (BES) resources (IPIECA-OGP-API 2010; IPIECA-OGP 2011; Palliggiano *et al.* 2013). Accordingly, oil and gas companies recognise the importance of understanding potential impacts and managing their BES interactions. To do this requires applied research; this is a basic part of the business case.

Demonstrably good BES performance helps ensure business continuity under increasingly stringent regulations, access to new resources (Grigg, Harper & Verbunt 2011; IPIECA-OGP 2011), reputational benefits and meeting the requirements of the finance sector (IFC 2012). These require that oil and gas companies are able to identify, assess and mitigate their potential impacts on BES by accessing good quality applied ecological science. Once potential operational impacts are understood and assessed, then targeted actions can prevent and minimise negative effects. Research should be designed so that lessons are transferable within individual companies and the oil and gas sector, so that future activities apply good BES practices and avoid negative effects wherever possible.

In 2000, the Energy and Biodiversity Initiative (EBI 2003) brought together leading oil and gas companies and international conservation nongovernmental organisations (NGOs) to work together to understand each others' perspectives, and to establish a common ground as a basis for improving sectoral BES performance. The result was a series of guidance documents, taken up and further developed by the global oil and gas association for environmental and social issues (IPIECA) and the international Oil and Gas Producers Association (OGP). Since 2003, the oil and gas sector has developed an increasingly stringent set of best practices and tools which sectoral leaders follow and apply (IPIECA-OGP 2012) when considering future operations and have begun to apply to their existing activities.

The EBI found that few oil and gas companies had suitable internal capacity to fully address BES issues, and that peer-review-level research into BESs baselines and impact assessments was also at a premium (EBI 2003). In addition, most of the basic and applied research that was being undertaken by energy companies (internal or externally contracted) was not published, but kept as internal 'grey literature', only partially filtering out into sectoral guidelines (ICMM 2006; IPIECA-OGP 2012). This was reflected in the findings of Armsworth *et al.* (2010) who noted the apparent paucity of applied ecological research carried out by business in partnership with academia.

The subsequent rise of the mitigation hierarchy (avoid, reduce, restore and, if needed, offset residual impacts) as a reference framework in helping companies make decisions on how and where to operate in a BESs–responsible way has reinforced the need for clear BES baselines, ecosystem-wide impacts assessments and science-based restoration programmes (Rio Tinto 2008; Palliggiano *et al.* 2013). This needs the input of applied ecological research. Given the sectoral capacity gap identified by the EBI, one of the outcomes has been the development of partnerships between oil and gas companies, research institutes and international conservation NGOs to remedy this.

Partnerships between oil and gas companies, and conservation NGOs

The EBI opened a door between conservation NGOs and the oil and gas sector. It demonstrated that they could effectively work together with mutual benefits. The sector found

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that their NGO counterparts were science based, had networksof research projects in many of the environments where the sector operated or was going to operate, and offered the potential to improve their BES performance on the ground, based on the results of applied research. In addition, there was the expectation that partnership research should be carried out with a presumption of being peer-reviewable for later publication, allowing companies to substantiate their BESs performance statements. As importantly, the conservation NGOs understood the business rationales and the risk-based processes used by the companies, and how the application of ecological science could inform these, without compromising their conservation mission. That the NGOs were also working with other industrial sectors was a reassurance to oil and gas companies.

For the NGOs, it was important that sectoral companies were prepared to take the lead in addressing BES issues directly, especially as they were often operating in areas little known to ecological science (Finer *et al.* 2009; Bass *et al.* 2010) and had possibly important primary and secondary impacts. Getting a company to fully integrate BES evaluations in its management processes and operational practices, and then deliver these on the ground and through its supply chain, has potentially far-reaching effects on BES retention and environmental and social sustainability in a wide range of natural environments.

The BES partnership between a major oil and gas multinational, and Fauna and Flora International

An Italian oil and gas multinational called eni operates globally through its Exploration and Production Division (eni e&p) in the exploration and production of oil and gas. Fauna and Flora International (FFI) is the world's longest-established international conservation NGO. With over 140 projects in more than 40 countries, it works on science-based, sustainable solutions: both with local communities and research institutes and with companies.

Fauna and Flora International led the biodiversity monitoring component of the EBI (2003). It was approached by eni e&p in 2003 after the publication of the EBI, with a view to forming an initial limited period partnership to help it address biodiversity issues in its business. The partnership has since been extended, based on the success of eni e&p's incorporation of BES evaluations into the core of its environmental management practices.

For eni e&p, the benefits of the partnership are multiple and include (i) working with an organisation that understands businesses and business systems in a range of industrial sectors and has working relationships with other NGOs, Governmental and global financial bodies such as the World Bank and the International Finance Corporation (IFC), (ii) FFI's applied ecological research experience in most of the natural environments where e&p operates, (iii) FFI's academic links around the world, (iv) the chance for eni e&p to engage with local academic institutions in practical BESs research for operational, environmental and social benefit, (v) the chance to increase its practical implementation of BES management for demonstrable company benefit as part of improved business performance, through field-testing BES assessments and action plans in onshore and offshore areas of high biodiversity importance, with validation and improvement based on testable data sets and (vi) use of FFI's horizon-scanning capability at local, regional and global levels.

A clear outcome for eni e&p was its rating in 2011 as one of the top three leading sectoral companies for the quality and maturity of its BES management model (Grigg, Harper & Verbunt 2011).

For FFI, partnership benefits include (i) working with a company determined to become a sectoral leader on BESs, and with a world-wide portfolio of holdings in ecologically important areas, (ii) the opportunity to help eni e&p to develop BES awareness from the updating of its internal management systems through to on-the-ground changes from improved operational BES practice and conservation outcomes, (iii) the chance to help the company demonstrably improve its business performance in managing BES using a science-based model, and to see this implemented at all sites or projects and (iv) contributing to FFI's remit of developing in-country conservation and ecological science capacity for the long term.

Working together, based on the EBI's precepts, FFI and eni e&p have developed a company best-practice approach for the effective management of BES issues. This has been tested in a range of sensitive natural environments.

The partnership best practice to manage BES

The best practice developed by the partnership is based on the recognition, assessment and effective mitigation of dependencies and potential impacts on BES at a series of geographical and temporal scales over the full life cycle of an oil and gas operation. Besides minimising BES–related risks, it also maximises opportunities to conserve or enhance them at a local level.

Starting at an ecosystem scale, including patterns of landscape change, protected areas and other globally important areas for biodiversity conservation, threatened species and ecosystem service features, the best-practice methodology then focuses down to the site level. Biodiversity and ecosystem service issues flagged at the ecosystem scale are examined in detail, and at higher resolution, to identify those that need to be addressed in a testable way as part of an operation's BES action plan.

The approach uses the mitigation hierarchy from the earliest consideration of working in an area, through to a targeted action plan on the ground. This means that there is potential for considerable positive conservation outcomes.

The essence of best practice is to tease apart the many initial BES issues and to identify those of particular relevance to the operation. These can be examined applying

ecological science in a question-led way, so that the role of individual players in an area (company, local communities, other stakeholders) affecting change in an area can be evaluated and understood. Potential impacts are identified and tested using comparisons and control areas, with suitable sample sizes for statistical evaluation, and indicators to detect and quantify changes. For eni e&p, this means clearly understanding and evaluating its impacts (and this may include showing that it is not involved in a process of change, contrary to common perception) in a demonstrable way. Where there are effects that the company needs to manage, these are incorporated into a BES action plan that is part of the site environmental management plan; results feed back into adaptive management as appropriate. Best practice also helps identify BES-related opportunities.

Applying best practice in the Ecuadorian Amazon

The Ecuadorian Amazon is one of the most diverse terrestrial ecosystems on earth (Bass *et al*. 2010). It is also under increasing pressures from settlement, legal and illegal logging (Finer *et al*. 2008) and agricultural clearance. Substantial oil resources are known to occur (Finer *et al*. 2009). The history of oil exploitation in the forests of the Andean foothills is mixed, with primary impacts such as fragmentation and secondary impacts, such as illegal logging, bush meat harvesting and others, associated with some oil exploitation (Greenberg *et al*. 2005; Finer *et al*. 2008).

Given this background and the practical and reputational risk of operating in little-altered 25-m-tall premontane and lowland evergreen forests (Sierra 1999), eni e&p and its Ecuadorian subsidiary Agip Oil Ecuador (AOE) were committed to avoiding and minimising any potential operational impact on the surrounding forest. Agip Oil Ecuador applied the best-practice approach, relying on ecological science to evaluate its effects, in comparison with those associated with settlements, a newly constructed road and the advancing agricultural frontier to the west of its holding.

In line with EBI guidelines, and FFI's own approach, the detailed scientific work was developed and undertaken by a local University, the Pontificia Universidad Católica del Ecuador (PUCE). The participation of PUCE was central in the design and in the implementation of the BES assessment and subsequent action plan, providing the science needed to inform AOE's operations on the ground.

The first step was to identify the main BES concerns at an ecosystem scale to be addressed in the short, medium and long term. The main BES sensitivities (at differing geographical and temporal scales) were identified, and stakeholder consultations with regional and community groups were undertaken to confirm and amend these assessments. These were then put into a series of discrete ecological research activities.

Each activity turned into research questions (Table 1). For each, PUCE developed a sampling strategy, appropriate monitoring protocols and parameters to detect and measure changes in the field. The objective was to provide good, statistically reliable data sets that would allow the company to assess whether its operational practices were effective in avoiding or minimising impacts and whether the effects differed in any way when compared with changes in the forest ecosystem (changes in forest structure, floral and faunal composition and species abundance) associated with (i) a control site, (ii) presence of settlements and of the community-sponsored road and (iii) selective or total forest clearance in areas outside of company's area of influence (Agip Oil Ecuador, eni e&p Division, Fauna & Flora International & Pontificia Universidad Catolica del Ecuador 2011). One of the results would then be sets of BES forest condition indicators suitable for use in the wider area in case of future expansion of the company activities.

Table 1. The three applied research activities undertaken and the questions asked

Activity	Question
Landscape change over time	How has the pattern and extent of forest area in which the company operates changed over time? How do the rates and form of change compare between areas where the company operations are located with areas where settlements are found, and with control areas?
Biodiversity effects from oil operations and other human activities	How do forest structure, faunal and floral compositions vary between different agents of change, and how far are these felt away from that source, and in comparison to an undisturbed control area?
Restoration of land take areas	For areas where direct land take has occurred, what restoration practices could help to accelerate recovery and the return back towards native forest?

In developing the oil field, and to stop uncontrolled access, AOE chose specifically not to open roads, which had led to significant direct and secondary impacts on Yasuni to the north (Finer *et al*. 2009), but instead made its two well pad areas (10 ha) accessible only by helicopter. In an innovative approach (Williams 1999), AOE's 47-km oil flowline to its processing facility in an area of altered agricultural landscape was built <4 m wide, and above the ground, but without disturbing the forest canopy, in order to minimise ecological disturbance. In addition, at an unused area on one of the two well pads, PUCE designed and undertook trials to determine factors that encouraged or limited recovery of forest on disturbed areas, in anticipation of returning the site to its natural status at operation end. Applied ecological research was used to test whether AOE's approach in operating with what was assumed to be least impact had made any significant difference, compared with the form and rate of change in the immediate and wider forest area.

Using GIS imagery to assess the forest area, and the settled area around its processing facility for the period

between 1986 (before AOE arrived) and 2007, it was clear that human settlements, clearing and roads had contributed to significant forest loss (7·38%), while only 0·04% had been used by oil operations (Agip Oil Ecuador, eni e&p Division, Fauna & Flora International & Pontificia Universidad Catolica del Ecuador 2011). By 2007, the scale of these oil operations either had remained constant (well pads and operating helipads) or had become almost invisible from the air (flowline and nonoperating helipads). Importantly, detailed sampling of flora and fauna and forest structure along sets of transect lines away from the ecotones associated with flowline, well pad edges, community road and settlements, and in an undisturbed control area, indicated significant differences between the limited oil and large non-oil-related disturbance in the forest composition. For each disturbance type, and for distances away from the edge, a series of individual indicators was identified.

For AOE, applied ecological research provided science-based confirmation that its noninvasive operational practices avoided and minimised impacts on the surrounding natural environment. The absolute rates of change associated with roads, as well as the differences in forest biodiversity, were in contrast to the limited and localised effects associated with the flowline and the absence of road building and ready access. In addition, the identification of indicators associated with undisturbed, partially disturbed and recently disturbed forest was put to use by AOE in evaluating potential operational impacts elsewhere in its holding.

Lessons learned from the Ecuadorian experience

If a partnership is to work, it has to have value for all partners. For the company, being able to access and use external scientific resources to help identify BES–related risks and field-test, the assessment methodology developed as best practice was essential. Fauna and Flora International had the opportunity to field-test the EBI guidelines, to apply its experience in stakeholder engagement and ecological risk analysis working with an oil and gas company, in one of the most biodiverse regions of the world.

Developing the research requirements, and then monitoring the research along with PUCE, provided reassurance both to the company and FFI that the research was valid, and suitable indicators could be provided to AOE for them to monitor, as part of their operational practices, along with suitable practical responses. It also helped reinforce the importance of the area for biodiversity to both PUCE and FFI. For PUCE, it provided the chance to undertake fundamental ecological research in an area otherwise inaccessible, gain logistical support, and to make new range and species discoveries (Tirira, Boada & Burneo 2010; Buitrón-Jurado 2011) relevant to biodiversity conservation at local, regional and national level. In addition, PUCE developed regionally relevant monitoring protocols and indicators for use in the future: either by AOE or by other companies.

Applying the partnership elsewhere where ecological research is needed

The eni e&p partnership approach, initially developed in Italy, has now been applied to a range of different geographical, socio-economic and ecological contexts, including the following:

AGRI RIVER VALLEY, ITALY

As one of the largest onshore oil fields in Western Europe, the Val d'Agri field is strategically important for eni e&p. It is a biodiversity-rich area with natural and managed woodlands at higher altitudes, next to a site of European biodiversity importance (SAC). This, and the presence of a National Park in the upper valley, has been the focus of the attention of national NGOs in querying the development of oil in the area. In addition, the largely rural community has a close historical relationship with the land and is sensitive to change. Working with the local university, applied research here has helped understand factors driving ecological change and restore eni e&p's limited impacts.

BARENTS SEA, NORWAY

The Barents Sea is a critically important area for fisheries and bird, cetacean and fish communities. With subtle ecological changes evident from global warming, it is important that oil and gas operators understand the factors driving these changes and their potential role in these. Government regional planning (the periodically revised Barents Sea Management Plan) and licence terms both impose BES monitoring requirements and offer eni e&p the opportunity to contribute to sustainable development in the area. As in other projects, partnered applied science research is critical in understanding potential operational footprint effects across the whole operating life cycle, and the main indicators of BES health and operational needs.

TROPICAL FOREST AND COASTAL HABITATS, CONGO

Working in tropical coastal and terrestrial areas of high ecological and social value, there are clear risks of being perceived as a primary driver of change. Here, eni e&p has been using applied ecological research to understand BES dynamics and to distinguish its role from those of other land users in the same area.

ARID HABITAT, PAKISTAN

Working in a difficult climate, goat-dominated, where many of the BESs are under stress, requires applied research that understands the ecological effects of climatic

cycles, of how the community uses the area and how this may in turn affect the restoration activities of the company.

CONCLUSION

The benefits of a partnership founded on sound ecological science are clear for eni e&p, FFI and local universities like PUCE. Each can help deliver BES conservation on the ground using ecological science as a common language. This is used to develop research questions that guide the BES assessment and help in the collection of field data. Results feed into company's operational practices and adaptive management, ensuring the delivery of BES conservation on the ground. Evidence of the value of the partnership approach comes from the recognition of eni's leadership position in managing BES by the benchmarking of the financial sector such as the Natural Value Initiative (Grigg, Harper & Verbunt 2011) and Dow Jones Sustainability Index (Dow Jones 2012). With the new 2012 IFC Performance Standards 6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources (IFC 2012), being able to effectively address BES issues as part of how a first tier company operates is no longer discretionary. The use of targeted applied ecological research is fundamental.

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