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Biodiversity Offset Strategies for Oil and Gas Exploration and Production

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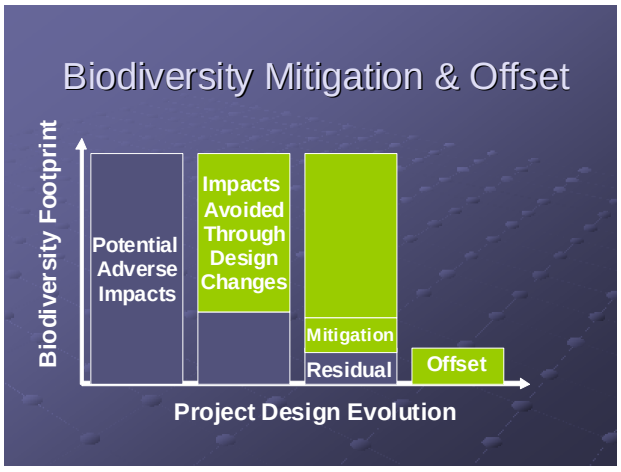
Abstract

This knowledge sharing paper explores the latest in biodiversity offset strategies, means to address residual environmental impacts, beyond normal reclamation and mitigation. Global oil and gas exploration and production companies must now operate in increasingly challenging and sensitive environments. Creation of effective biodiversity offset strategy portfolios for these environments requires a solid understanding of the physical, chemical, biological, social, regulatory, legal, and economic characteristics of the project and its environs. Tropical rain forest, desert, coral reef, riverine, ocean, and estuarine ecosystems present different biodiversity challenges. Oil and gas companies face increasing pressure to reduce biodiversity impacts, and can now use biodiversity offsets to improve conditions in their areas of operation. A special focus discussion on Caspian Sturgeon biodiversity offset potential is included.

Introduction

Biodiversity offsets are defined here as those conservation activities which are engaged by project developers and/or their various stakeholders to counteract residual biodiversity impacts associated with the implementation of project activities following application of detailed engineering, reclamation, and mitigation. The purpose of biodiversity offsets is to create a project scenario where the project will be "biodiversity neutral", or even "biodiversity positive". Biodiversity offsets are not new, dating from the mid 1970's or earlier, when wetland mitigation was instituted on a large scale in the United States. Innovative projects involving biodiversity offsets have been noted for over 40 years involving conservation set asides and land swaps of various types which have preserved various types of habitats valuable for maintaining biodiversity. The historical focus on the preservation of "charismatic megafauna" dominates the biodiversity protection scene (e.g. protection of larger taxa such as whales, salmon, eagles, marine mammals, raptors, etc.). The shift to more comprehensive habitat protection which protects and enhances entire communities comprised of many different species is an important concept in modern biodiversity offset strategy development, as it recognizes the importance of maintaining and enhancing species diversity in project areas. Environmental impact assessments, statements and predictions are rarely comprehensive enough in their scope to identify all of the important interactions between and among different species, so maintenance and/or enhancement of terrestrial, aquatic, and marine habitats is viewed as the means to encompass the broadest range of potential biodiversity protection. More effort is now being expended in the identification of habitat continuity and fragmentation to define opportunities for habitat conservation efforts for biodiversity offsets. Certainly, building portfolios of various integrated offset activities requires knowledge of the physical, chemical, biological, social, regulatory, and economic aspects of the project and its environs.



Organization and Process

Establishing biodiversity offset procedures requires detailed organizational and process oriented planning activities. A detailed assessment of the various stakeholders involved with biodiversity concerns and project activities is extremely useful in establishing the composition of biodiversity related panels and management structure. In most instances the project proponent will benefit from the participation of independent local foundations, natural resource agencies, and other governmental and non-governmental organizations who are knowledgeable and engaged. It is important to know the mission of these outside organizations so they can be identified and factored into the overall biodiversity offset strategy. Considerable interest and concern for achieving a level of independence of the offset strategy has been expressed in many areas of the world. For some NGOs that focus exclusively on charismatic megafauna, discussions must be engaged to explore the depth and breadth of multispecies offset programs and how they relate to the NGO's specific target species. In many instances, a charismatic megafaunal component can be engaged as a type of "keystone species" which can be very useful in focusing public attention, education, and fund raising activities. Biodiversity offset strategies are often included as part of the cumulative impact assessment analysis for the social and environmental impact assessment process, as well as social and environmental management and monitoring.

Detailed information on the ecology of your specific project area including neighboring and downstream habitats is extremely important. Past research on the composition of the key habitats, communities, and ecological characteristics of your project site and environs must be collected and organized. Some useful handbooks on the process of biodiversity offsets have been organized previously (See Business Biodiversity Offset Program, BBOP, http://bbop.forest-trends.org/guidelines/odh.pdf).

Habitat Protection, Conservation, Management, and Enhancement

Biodiversity offset strategies which focus on habitat protection, management, and enhancement maximize the number of species that can be included in specific programs. The widely recognized impacts of deforestation and habitat fragmentation are a target of biodiversity offsets in many instances. A portfolio approach is needed so that a broad range of species and habitats can be included for protection, conservation, management, and enhancement. Implementation of modern remote sensing and geographic information systems utilizing aerial and satellite imagery analysis are very useful in the assessment of habitat fragmentation, with the expressed goal of identifying areas where projects can effectively link, maintain, and/or enhance habitat connections.

Advanced methods for habitat enhancement are being engaged in many terrestrial, freshwater, and marine environments. The Global Coral Reef Alliance (GCRA, www.globalcoral.org) has installed many electrically stimulated artificial coral reef structures which encourage rapid colonization of BioRocks® artificial reefs (www.biorock-thailand.com) . Reef coral colonization rates can be enhanced up to 5X or more for areas which have seen declines in natural corals. The recolonization of reef structures by native species is monitored carefully to log the natural ecological succession of these important structures, which establish a multispecies community in a short period of time.

Aqua-ponics, the combination of aquaculture and hydroponics, has been proposed for remote sites, to offset the impacts of local fishing and to provide sustainable sources of protein, fruits, and vegetables. Fish aquaculture is set up in circuit with hydroponic production in a system which takes the waste from the fish tanks and uses this as the principal nutrient source for the plant production. The systems are very portable and easily established with a minimal amount of infrastructure and power requirements. Biodiversity offset strategies can implement this type of technology to offset overfishing and to encourage sustainable agriculture.

Watershed-based offset strategies have been proposed to offset habitat disturbance, erosion, and downstream aquatic ecological impacts. Typical fisheries management offsets have included increased stocking of hatchery-based fish in freshwater ecosystems with widely varying success. In remote, developing, and agriculturalized areas with large-scale erosion problems, advanced sediment control strategies can greatly improve local watersheds, delivering much higher quality water to downstream users.

Caspian Sturgeon Biodiversity Offset Potential

Oil and gas activities continue to increase in the Caspian Sea. Some of the world's largest recent oil and gas discoveries have occurred in the North Caspian Region, including the Kashagan, Kalamkas, and Tengiz oil fields. Over 90% of the world's caviar producing sturgeon populations occur in the region. According to many informed sources, the various Caspian sturgeon populations are in great danger of extinction in the not-to-distant future due to irrational fishing pressure and low recruitment of new stocks. Poor breeding success in the Volga and Ural Rivers accounts for a major impact. Science News reports that most sturgeon species are endangered, having been overfished nearly to extinction in pursuit of their caviar. Caviar is a prized delicacy that can fetch more than $100 an ounce, and the Caspian Sea is home to beluga sturgeon (*Huso huso*) and Kaluga sturgeon (*Huso dauricus*), whose eggs are considered to be among the finest in the world. Despite evidence that beluga sturgeon stocks have declined by a staggering 90 percent in the past 20 years, the Convention on International Trade in Endangered Species (CITES) 2009 export quotas again permit the fish and their eggs to be harvested. The sturgeon quota system was established to ensure that trade in sturgeon products would only be permitted from sustainable fisheries, but much evidence indicates the quotas do not reflect the urgent need for protection and the rampant illegal harvest and trade. The abundance of Kaluga and other sturgeons in the Amur River are at critically low levels due to severe overfishing by legal fisheries and illegal poaching, as well as poor water quality, according to the Pew Institute. Considerable time, effort, and money have been expended in an effort to create sturgeon hatcheries and recovery programs, but the over arching problems of overfishing, poaching, illegal taking, and water pollution continue to exist.

Oil and gas exploration and production companies are often targeted as potential sources of impact to sturgeon and other aquatic organisms due to their potential for controlled and uncontrolled discharges to the marine environment, noise, disturbance of breeding and foraging areas, and other potential impacts. Thus, there exists a need for effective biodiversity offset strategies that can focus on sturgeon populations. Aquaculture facilities which can produce commercial quantities of caviar and sturgeon meat in a controlled environment can offset the potential impacts from offshore oil and gas operations in a unique way. This type of biodiversity offset is considered beyond the normal realm of hatchery operations, as it produces products which can be directly substituted for caught sturgeon. Siberian sturgeon (*Acipenser baeri*) culture methodologies have been developed and refined by the Mote Marine Lab in Sarasota, Florida to produce high quality caviar and meat. The process is now being licensed around the world. Detailed environmental, economic, and socio-cultural analyses have been performed that show high potential benefits for offsets, especially when local commercial fishing can be substituted or offset, with direct and indirect employment of local operations in controlled aquaculture facilities. Again, these types of facilities can be located anywhere in the world, and can produce significant amounts of caviar and sturgeon meat which can supplant local supplies in a highly effective sustainability framework.

Legal, Regulatory, and Economic Considerations

The legal, regulatory, and economic considerations of biodiversity offsets are under scrutiny in a rapidly developing arena. These issues are best approached on a project-specific and jurisdictional-specific basis. Regulations are being developed to address the possibility, efficacy, and implementability of biodiversity offsets for many jurisdictions around the world. Definitions and metrics for biodiversity are currently being evaluated widely. What are the best and most appropriate definitions of biodiversity? The approach which has as its basis a broad complement of species, communities, and even ecosystems will encompass the broadest complement of energy, nutrient, and chemical fluxes. Many viewpoints exist as to the best definition of biodiversity itself. For the purposes of this discussion and development of effective offset strategies, the broadest interpretation is considered best, to include the most species over the broadest multidimensional niche space possible.

Legal instruments for insuring programmatic implementation of biodiversity offsets vary widely, as do the economic incentives for such programs. It is important to gain broad community support for biodiversity offsets in much the same way as social and community programs. Implementable biodiversity offset strategies will require well developed legal, regulatory, and economic documentation with buy-in from a number of different entities depending upon the project of interest.

Summary and Conclusions

As oil and gas exploration and production moves into more sensitive environments around the world, biodiversity offsets will likely become more prevalent as a means to achieve project acceptability and approval. Biodiversity offset strategies are already being applied globally in unique and innovative ways using a wide variety of techniques. Coral reef construction and inoculations, watershed improvement programs, reforestation, aquaculture, aqua-ponics, habitat defragmentation (continuity), restocking, habitat reconstructions, biobanking, and other methodologies have found their way into the biodiversity offset tool box. A broader, habitat-based approach is deemed most important in achieving optimal biodiversity protection, conservation, and offsets. Habitat fragmentation has been demonstrated to be a key component of environmental impact in many diverse terrestrial habitats. Much work remains to be done with respect to the legal, regulatory, and economic aspects of biodiversity offsets. Defining biodiversity and the metrics to measure it remain a challenge, especially in areas in remote, diverse ecosystems with little academic investigation. Biodiversity offset strategies require strong interdisciplinary teams that can organize portfolios of innovative program components. With support from the oil and gas industry, local regulators, communities, and other stakeholders, biodiversity offsets can have a significant positive impact on the global environment.

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