# ENVIRONMENTAL IMPACT ASSESSMENT OF ARTIFICIAL FEEDING PLANS: THE HAMMAMI PLAIN IN IRAN

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## Abstract

The research was conducted with the aim of assessing the environmental impacts of artificial feeding plans of Hammami Plain in Fars Province in Iran. In this paper, EIA was undertaken using the ICOLD matrix. In this method, the effect of each project activity on the environmental components in the region was assessed in two stages; project construction and operation based on physical, ecological, socio-economic, and cultural environments. Findings indicate that positive effects will be generally exerted on the environment of the region by establishing and operating artificial feeding plans in Hammami Plain. In other words, the existence of negative impacts on the environment, will mean substantial positive impacts will be seen in the region consequently; the rise in the average level of aquifer, enhancement of agricultural wells, and development of agriculture in the region, to name a few.

**Keywords:** *environmental empact essessment, ertificial feeding basins, agricultural development, Hammami plain, Iran.*

## Introduction

Irrigation, drainage, artificial feeding, and relevant dam projects are implemented in order to benefit and bring welfare to human societies, as food supply is unimaginable without the implementation of these projects. Recently, the idea that a balanced environment can ensure sustainable welfare of human societies as well as project sustainability has received attention; accordingly, for project planning, it is viewed as a holistic approach so as to take into consideration improvement in the whole environment and minimization of inevitable negative environmental impacts of the projects, as well as taking account of production aspects. At the present time, the ultimate environmental protection is to achieve the very important axiom sustainable development in the form of economic and social programs in

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accordance with the principles of environmental protection and prevention of renewable and non-renewable resource's destruction and depletion (Monavari et al., 2012; Ataei et al., 2017). Conduction of the assessment study into environmental, social, and economic effects of water resource development projects is to make sure that policies and determined goals are observed in project programs and activities in line with environmental, social and economic rules, criteria, laws, and regulations. Quite a few examples of damages caused by ignoring environmental impacts of irrigation, drainage and artificial feeding plans in various environments have been reported around the world, in that it not only represents massive environmental destruction caused by the implementation of such projects, but it also posed another problem over time, in some cases, implementing projects in an attempt to alleviate the adverse effects of the activities. The complexity of environmental processes and systems is such that it is not entirely impossible to rightly predict the entire change of a certain activity of a human. Therefore, it is imperative to take serious measures concerning environmental issues and effects so that irrigation activities and torrent control can lead to sustainable development, as well as accounting for the increase of growing needs of the world population (Mondal et al., 2010). Researchers believe, the main cause of weakness in conducting and applying environmental effect assessment and their inefficiency, are associated with political rules (Zhu et al., 2015), encouraging mechanisms, organizational discipline and order, and lack of proper methodology (Ren, 2013).

EIA is believed to be a legal framework that focuses on physical planning and include recognition ability, prediction, and reduction or compensation of positive and negative impacts of various projects (Karlson et al., 2014; Dangi et al., 2015; Ohsawa and Duinker, 2014). EIA functions as a mandatory means of evaluating, environmental management, making decisions, and implementation of various phases of activities (plans, projects, and programs). The assessment measures the effects of natural and human effects on the environment. These effects may affect culture, biodiversity, socio-economic conditions, human health, and ecosystem balance (Robu et al., 2015; Sánchez and Hacking, 2002; Glasson et al., 2012; Arce-Gomez et al., 2015). EIA can play an important role in identifying the potential impacts of development projects on the environment, and can help reduce environmental problems and contribute to sustainable development (Mosaferi et al., 2014; Ozcan and Strauss, 2014; Ahammed and Harvey, 2004). In other words, EIA is a means of decision-making (Zidonienė and Kruopiene, 2015), project feasibility (Morero et al., 2015), and facilitator of huge development projects (Aguilar-Stoen and Hirsch, 2015). Today, the purpose of estimating social and environmental impacts is to make sure the projects under consideration go with maximum efficiency and minimum costs, especially those costs imposed on society (Vanclay, 2006). Almost 20 years after the enactment of a bill by the High Council for Iran Environmental Protection in 1974 as to a mandate for providing a report on environmental assessment, some plans and development projects are undertaken by administrators. During this period, in addition to the stabilization of the legal position of environmental assessment process in Iran, the number of plans and projects requiring environmental evaluation, from 7 to 51 plans and projects, represents a substantial increase (Rahmati and Khodabandeh Dizaj Tekiyeh, 2015). Environmental impacts of development project studies provide an opportunity for decision makers, by which they are able to timely predict the environmental impacts of development projects, whether they be positive or negative, as well as achieving the goals of expected development, and take action to fix destructive aspects and enhance positive effects by offering a right management program (Shariat and Monavari, 1995; Greig and Duinker, 2011). Dangi et al. (2015), hold that environment reports were often issued by incompetent contractors, in that they remained at low levels in terms of quality, they were quite technical and lengthy, as they laid more emphasis on the positive impacts of projects and paid less attention to negative effect (Larsen, 2014). Researchers associated the most important challenges of EIA with basic socio-economic, environmental information, and financial barriers (Chanthy and Grunbuhel, 2015; Yaghoubi Farani et al., 2016; Ataei and Karimghasemi, 2017), shortage of local professionals, weakness in follow-up projects, and lack of long-term land use projects (Badr, 2009).

Iran is located in both an arid and semiarid region where disproportionate distribution of surface currents has put major constraints. In addition, the major part flows out of reach before they come to any use. Since water supply has been always man's basic need for agricultural, industrial, and drinking use in human societies, torrent control and water flow are considered to be the country's major and infrastructural works through establishing artificial feeding plans, which takes on special importance so as to achieve economic self-sufficiency and improvement in social situations (Monavari et al., 2015). The study area is Hammami Plain, in Fars Province, it has a dry and desert climate without any consistent vegetation, artificial feeding plans are already underway in order to fix this problem and prevent rapid decline in the quantity and quality of groundwater. The purpose of the construction projects is the infiltration and storage of floodwater using artificial feeding basins. On the contrary, having the project implemented, some short-term and long-term, positive and negative environmental effects will arise for which it seems necessary to study the effects and offer suitable strategies. Thus, the research was conducted with the aim of studying the EIA of artificial feeding plans in Hammami Plain in Fars Province in Iran.

Dendena and Corsi (2015) argue that focus should not be merely directed to the biological and physical components in the EIA, but social components need to be taken into consideration. Many studies address the environmental impacts of various projects; for instance, Mousavi et al (2012), evaluated the environmental impacts of the reservoir dam Kour using the ICOLD and LEOPOLD matrix, concluding that maximum negative impacts are associated with the physical environment during the building stage, and the maximum positive impacts are seen in a socio-economic environment during the operation stage. Malekhoseini and Mirakzadeh (2014) evaluated the social impacts of the Solymanshah Dam in Songhor (Iran) on the villages covered by it, maintaining that the positive and

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negative social effects of the Solymanshah Dam can be summarized into ten general categories, namely the increase in life expectancy, improvement in the security of the region, tourism development, increased stay in village, increase in employment, decline in poverty, unity and social cohesion, social capital enhancement, uneven development, and violation of public fundamental rights. Using the ICOLD matrix and a checklist, Falahatkar et al. (2010) evaluated the environmental impacts of a highway construction zone, and their results indicated that biological environment incurs the maximum negative impact, as social environment incurs the minimum negative impact by the implementation of the project. Exploring the environmental effects of artificial feeding plans in the Yazd Province (Iran), Monavari et al (2012) concluded that the highest negative impacts are linked with the physical environment during the building stage, as the highest positive impacts occur in the economic-social environment during the operation stage. Moreover, Mohamadi et al. (2009) demonstrated in their study that the positive impacts of the Gabric Dam implementation in Hormozgan (Iran) were greater than negative impacts during its construction and operation. Fataei and Sheikh Jabbary (2005) evaluated the environmental effects of an industrial town using a LEOPOLD matrix, in that the construction of the foregoing project was confirmed in the end. Piri (2012) also in his study evaluated the environmental effects of Chahnime 4 Dam in Zabol (Iran) using a LEOPOLD matrix, concluding that the construction of the dam exerted greater positive effects on the social and economic environment in the region in the face of its negative impacts. Studying the environmental effects of the Sardasht Dam (Iran) during operation stage using a checklist method, Nikbakht and Shahmohammadi (2004) concluded that its environmental effects proved very positive with dam. Hanna et al. (2014) contend that impact assessment should be performed in the early stage of the project planning in cooperation with local people. In studying the social effects of projects relating to water resources in Australia, they conclude that we first need to take account of local and regional activities in order to implement every construction project including projects of water resource management, and they are consistent with the goals of project, and involved local people in decision-making process and implementation so that the highest cooperation and partnership can be seen on the part of them in the course of a project (Franks, 2011). Results of an assessment of environmental impacts of forestry project conducted by Aghnoum et al. (2015) indicated that 100% of the study area requires reconstruction. Assessment of environmental, social, and economic impacts of Green Reservoir Dam in the west of Iran, indicated that in both construction and operation stage the impacts are substantially negative, as the rate of its positive impacts is very little compared to its negative impacts (Farhadiyan and Kiyani, 2014). In India, a project was assessed in order to make wildlife become a tourism region. The results of social and ecologic studies of the project indicated that by doing so, there is an extremely high risk of extinction of scarce animals. However, it results in environmental pollution and ecosystem destruction, yet it leads to the economic and cultural development of the people in the region. Therefore, in order to implement the developmental measure, it is necessary to apply severe laws against hunting, and in favor of sanitation compliance and preservation of ecosystem (Rastogi et al., 2015). The results of the assessment of social impact of local community integration project in Nigeria, indicated that by doing so the region will face many challenges in terms of sustainability because diverse cultures will be merged together which may result in insecurity and instability in the area. Moreover, people will not accept the development measure with respect to culture and make no effort to accomplish and implement it. Therefore, it is most likely the project will not be successfully implemented (Nzeadibe et al., 2015). Fearnside (2016), in assessment of environmental and social impacts of Amazon Dam, found that dam construction would go with some impacts such as population displacement, loss of livelihood, loss of biodiversity, and greenhouse gas emission. Additionally, Pazoki et al. (2015), in the assessment of environmental impact of water transfer projects, concluded that the positive environmental impacts of the projects are by far greater than their negative impacts.

## <u>Research area</u>

The research area is located about 256 km south of Fars Province, at 53°27'49.7" to 53°35'31.0" east longitude, and 27°27'20.5" to 28°07'46.1" north latitude**.** Hammami Plain covers an area of 89.79 km with a minimum height of 779.99 meters and a maximum height of 1540.23 meters from free water (Fig.1).

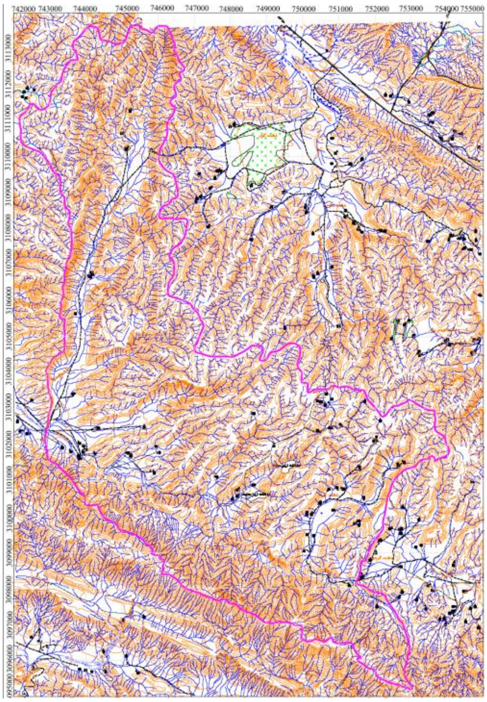

**Figure 1**
*Location of research area (Catchment basin of the Hammami Plain)*

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The two villages of Hammami and Shahrestan are located downstream of the basin outlet, the population of them consists of nomads settled and engage in agriculture and animal husbandry. Increased agriculture and animal husbandry and, in consequence, increased water need which leads to over-abstraction of groundwater resources as the only available water source, as well as flood-prone feature of region which causes financial losses to local residents, serve as reasons for implementing artificial feeding plans and torrent control. In this area, there are 45 wells, of which there are 39 active wells and six are deactivated. Recent droughts and destruction of chemical quality have been the biggest reasons for the deactivation of these wells.

## Materials and methods

In this research, environmental assessment of artificial feeding plans was performed using the ICOLD matrix. The ICOLD matrix is one of the techniques by which we can express the qualitative results of an environmental assessment in a project quantitatively. In this method, the effect of each project activity on the environmental components in the study area during both construction and operation phases, were measured based on physical, ecologic, socio-economic, and cultural environments, and the scores between zero and +5, and zero and -5 were given for the magnitude of effect range. In the columns of the matrix, environmental components are listed and sub-activities of the projects are taken down in their lines (Karimi et al., 2009). As for the advantages of the matrix, we can refer to the expression of the features of each effect on the environment, in that marks numbers used in the matrix represent the status and properties of the effect (Mousavi et al., 2012). As an organized method with a tight framework, the ICOLD matrix has the ability to specify the impacts of projects, also it has the ability and to identify the projects swell. Specially, this matrix examines the impact's type (long-term, med-term and short-term) and can measure construction and operation phases separately. This method carries out the Environmental Impact Assessment based on the impact intensity, project goals, project type, and the covered area. Another reason to choose the ICOLD matrix for EIA, was the need for subject-matter specialists familiar with the study area. In addition, the ICOLD matrix is one of the most common methods used for EIA in Iran. The reason for this is the fact that it calls for subject-matter specialists and in most administrations and consulting engineering companies, consensus is a need for EIA. The Environmental Impact Assessment (EIA) was conducted by a research team comprised of a water structures expert, a geology expert, a water resources expert, and an expert of environment and a socio-economic expert. Finally, regarding all aspects of a project, an analysis was made for the project implementation or otherwise. At the confluence of activity components and environment parameters, if there is an effect in force, the type of effect quality is expressed by using the following descriptions:

**A**. Type of effect: + and – marks stand for desirable and undesirable effects.

**B**. Degree of effect: severity of effects represent level of changes with respect to the status quo, i.e. in this research the changes were considered as very high, high, average, low, and very low, which are shown with the numerical symbols 1, 2, 3, 4, and 5.

**C**. Continuity of effect: effects that occur at a certain point and cannot persist for long are transient effects and represented by a T symbol. Effects that exist in a long term, either periodically or permanently, are permanent effect, and they are represented by a P symbol.

**D**. Time of occurrence: in the ICOLD matrix, the three symbols I, M, and L stand for immediate, medium-term, and long-term occurrence respectively.

**Table 1.** *Prediction matrix of physical (A) and ecological (B)impacts of artificial feeding basins in construction phase*

| Environmental parameters | Actions | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Worker employment | Staff transportation | Construction of access roads | Construction and tooling work house | Excavation and embankment | Solide sawage | Concreting | Providing saving resources | Materials transportation | Supplying and transmitting power | Green spaces creation | Structures constructions |
| **(A) PHYSICAL IMPACTS** | | | | | | | | | | | | |
| Air quality | | -3TM | -3TM | | -5TM | | | -4TM | -3TL | | +4PL | |
| Environment sound | | -3TI | -3PI | | -5TI | | -4TI | -3TI | -4TI | | | -1TI |
| Dehydration regime | | | | | | | | | | | | +2 PL |
| Flood regime | | | | | | | | | | | | +2PM |
| Surface water quality | | | | | -1TI | | | | | | | |
| Groundwater quality | | | | | | | | | | | | |
| Soil salinity | | | | | | | | | | | | +1 PL |
| Surface water consumption | | | | | | | | | | | -2 PM | +3PL |
| Groundwater consumption | | | | | | | | | | -2 PM | -2PL | +3PL |
| Land form | | | | | -4PI | | -3PI | -5PI | | | | |
| Soil erosion | | | -3PM | | -5PI | | -1PM | -4PM | -4PL | | +4PL | |
| Water table | | | | | | | | | | | | +3PL |
| **Total** | **0** | **-6** | **-9** | **0** | **-20** | **0** | **-8** | **-16** | **-11** | **-2** | **+4** | **+13** |
| **(B) ECOLOGICAL IMPACTS** | | | | | | | | | | | | |
| Aquatic ecosystem | | | | | | -2PL | | | | | +1PL | +2PL |
| Terrestrial ecosystems | | -2PL | -3PL | | -5PI | -4PM | -3PI | -5PI | -3PL | | +3PL | |
| Animal emigration | | | | | -5PM | -2PL | -3PM | -4PM | | | +3PM | |
| Animal habitat | | | -2PM | -2PM | -4PI | -2PM | -4PI | -4PI | -1PL | | +3PM | |
| Plants habitat | | | -4PM | -2PI | -5 | -2TL | -3PI | -3PM | -2TL | | +5PL | |
| Herbal scarce species | | | -2PM | -1PM | -5PM | -3PM | -3PM | -4PL | | | +4 PM | |
| Animal scarce species | | | | -1PL | -3PM | | -3PM | -4PM | | | +1 PL | |
| Animal population | | | | | -2TI | | -2TI | -3TM | | | +1 PL | |
| Disease vectors | | | | | -4PM | -3PL | | -3PL | -2PL | | | |
| **Total** | **0** | **-2** | **-11** | **-6** | **-33** | **-18** | **-21** | **-30** | **-8** | **0** | **+21** | **+2** |

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## Results

As explained earlier, the ICOLD matrix was used to summarize and analyze environmental components. To this end, the algebraic sum of current values was first calculated for each column, then it was divided by the number of available values, and the mean of rating was calculated for each activity. In order to calculate the mean rating of each of four-fold environment, the algebraic sum of available values was divided by the number of effect for each column. In the end, the mean of overall rating for both construction and operation stages was obtained from the algebraic sum of the mean rating of all environments divided by the number of environments.

**Table 2.** *Recognition matrix of socio-economic (A) and cultural (B) impacts of artificial feeding basins in building phase*

| Environmental parameters | Actions | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Worker employment | Staff transportation | Construction of access roads | Construction and tooling work house | Excavation and embankment | Solide sawage | Concreting | Providing saving resources | Materials transportation | Supplying and transmitting power | Green spaces creation | Structures constructions |
| **(A) SOCIO-ECONOMIC IMPACTS** | | | | | | | | | | | | |
| Population | | | | | | | | | | +1PL | +2TL | |
| Migration | | | +2PL | | | | | | | | | +3PL |
| Income and expense | + 12TI | | +2PM | | | | | | | | | |
| Employment and unemployment | +4TI | | | +1TI | | | | | | | | |
| Real estate price | | | -2TM | | | | | | | | | |
| Agriculture | | | | | | | | | | +2PM | | +5PM |
| Industry and mine | | | +3PL | | | | | | | +1PL | | |
| Services | | | +3PL | | | | | | | +1PL | | |
| Transportation | | | +2PI | | | | | | | | | |
| Participation of users | | | | | | -2TM | | | | | | +3PM |
| Welfare | | | +1PL | | | | | | | | | |
| Leisure times | | | | | | | | | | | +2PI | |
| Land use | | | | | | | | | | | | +3PL |
| Future development projects | | | +4PL | | | -3TL | | | | +2PL | | |
| Social acceptance | | | | | | -3TM | | | | | | +3PM |
| **Total** | **+6** | **0** | **+15** | **+1** | **0** | **-8** | **0** | **0** | **0** | **+9** | **+4** | **+17** |
| **(B) CULTURAL IMPACTS** | | | | | | | | | | | | |
| Hygienic indicators | | | | | -4TI | -4PI | -1TI | -4TI | -3TM | | | |
| Educational indicators | | | +1PM | | | | | | | +1PM | | |
| Diseases and illnesses | | | | | -5PM | -4PL | | -4PM | -3PL | | | |
| Water drinking and water supply quality | | | | | | | | | | | | |
| Tourism | | | +2PM | | -3TI | -3PL | | | | | +1PM | |
| Educational services | | | +1PI | | | | | | | +1PM | | |
| Religious and historical building | | | | | -4PI | -2PL | | -2PM | -2PL | | | |
| Landscape and sights | | | | | -4TI | -4PM | | | | | +4PM | |
| **Total** | **0** | **0** | **+4** | **0** | **-20** | **-17** | **-1** | **-10** | **-7** | **+2** | **+5** | **0** |

The results indicate that in the construction phase the measures excavation and embankment, providing saving resources and transporting construction materials exert the highest negative impacts on the physical environment, respectively (Table 1A). In the ecological environment, excavation and embankment activities, providing saving resources and concreting have the most negative effects, as providing green space has the most positive effect (Table 1B).In the construction phase, most measures have a positive effect on socio-economic environment, in that installing structures, building access ways, and supplying and transmitting power have the greatest positive effect (Table 2A). In regard to cultural environment, excavation and embankment, producing solid drainage, and providing saving resources have the highest negative effects, respectively (Table 2B). Mirsanjari et al. (2013) found the environmental impacts of expansion pro-

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**Table 3.** *Prediction matrix of physical(A) and ecological (B) impacts of artificial feeding basins in operation phase*

| Enviromental parameters | Actions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Water supply** | **Torrent control** | **Recreational activities development** | **Poisons consumption** | **Fertilizers consumption** | **Distribution and use of water** | **Maintenance of green spaces** | **Maintenance of access routes** | **Repair and maintenance of structures** |
| **(A) PHYSICAL IMPACTS** | | | | | | | | | |
| **Air quality** | | | | | | | +4PM | | |
| **Environment sound** | | | | | | | | -4PM | |
| **Dehydration regime** | +4PL | +4PM | | | | -2PL | -1TL | | +4PL |
| **Flood regime** | +3PL | +4PM | | | | | | | +3PL |
| **Surface water quality** | | +3PM | | -3PL | -3PL | | | | +2PL |
| **Groundwater quality** | +2PL | +4PM | | -4PL | -4PL | | | | +2PL |
| **Soil salinity** | +2PL | | | | -4PM | | +1PL | | +4PL |
| **Surface water consumption** | -3PM | | | | -3PI | -2TI | -1PI | | +2PM |
| **Groundwater consumption** | -3PM | | | | -3PM | -2TL | -1TL | | +2PM |
| **Landform** | | +4PM | | | | | | | |
| **Soil erosion** | | +5PM | | | | | +4PL | | |
| **Water table** | +4PL | +4PL | | | | | | | +4PL |
| **Total** | **+9** | **+28** | **0** | **-7** | **-17** | **-6** | **+6** | **-4** | **+23** |
| **(B) ECOLOGICAL IMPACTS** | | | | | | | | | |
| **Aquatic ecosystem** | +4PM | +4PM | | -4PL | -4PL | | | | +2PL |
| **Terrestrial ecosystems** | +4PL | +4PM | | -4PL | -4PL | | +4PL | -2PL | |
| **Animal emigration** | +3PM | +2PM | -2PL | | | | +2PL | | |
| **Animal habitat** | +3PL | +4PL | -2PL | | | | +2PL | -2PL | |
| **Plants settlement** | +4PM | +4PM | -2PL | | | | +4PM | -3PL | |
| **Herbal scarce species** | +4PM | +3PM | -2PL | | | | +2PL | -1PL | +2PL |
| **Animal scarce species** | +3PL | +3PM | -2PL | | | | | -1PL | |
| **Animal population** | +3PL | +3PL | -1TL | | | | +1PL | | |
| **Disease vectors** | | +3PM | | -3PL | -3PL | | | | |
| **Total** | **+28** | **+30** | **-11** | **-11** | **-11** | **0** | **+15** | **-9** | **+4** |

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jects under construction to be damages such as soil erosion, destruction of the habitats of plants and animals, air and water pollution, natural view of region. Moreover, according to Jigah et al. (2013) the most important negative environmental impacts during construction process include environmental pollution, resource depletion and ecosystem destruction

In the operation phase, torrent control and structure maintenance have the greatest positive impact and use of fertilizers and poisons exert negative impact on physical environment (Table 3A). At the same time, the two activities, torrent control and

**Table 4.** *Prediction matrix of socio-economic (A) and cultural (B) impacts of artificial feeding basins in operation phase*

| Enviromental parameters | Actions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Water supply | Torrent control | Recreational activities development | Poisons consumption | Fertilizers consumption | Distribution and use of water | Maintenance of green spaces | Maintenance of access routes | Repair and maintenance of structures |
| **(A) SOCIO-ECONOMIC IMPACTS** | | | | | | | | | |
| Population | +1PL | +1PL | | -1PL | -1PL | | | | |
| Migration | +4PM | +3PM | +2PL | | | | | | +1TL |
| Income and expense | +2PM | +2TM | | | | | | +!PL | +1TL |
| Employment and unemployment | +3PL | +2PM | | | | | | +3PM | |
| Real estate price | -3PL | -1TL | | | | | | -1PL | -2TL |
| Agriculture | +5PI | +5PI | | +3TI | +3TI | | | +1PM | +4PL |
| Industry and mine | +4PL | +2PL | | | | | | +2PL | |
| Services | +3PM | +3PM | | | | | | +2PM | |
| Transportation | | +2PM | | | | | | +4PI | |
| Participation of users | +3PM | +3PM | +3PL | | | | | | +4PM |
| Welfare | +4PL | +3PL | +1PL | | | +2TL | | | +1TL |
| Leisure times | | | +5PI | | | | +2PM | | |
| Land use | +4PM | +4PM | | | | +3PM | | | +4PM |
| Future development projects | +4PL | +4PL | | | | | | +3PL | |
| Social acceptance | +4PM | +3PM | +3PM | | | | | +2PL | +4PM |
| **Total** | **+38** | **+36** | **+14** | **+2** | **+2** | **+5** | **+2** | **+17** | **+17** |
| **(B) CULTURAL IMPACTS** | | | | | | | | | |
| Hygienic indicators | | +4PL | | -4PL | -4PL | | | | |
| Educational indicators | | +1PL | | | | | | | |
| Diseases and illnesses | +1PL | +3PL | | -5PL | -5PL | | | | |
| Water drinking and water supply quality | +3PL | +3PM | | -2PL | -2PL | | | | +1PL |
| Tourism | | +3PM | +4PL | | | | +2PL | | |
| Educational services | | | | | | | | +1PI | |
| Religious and historical building | | +4PM | | | | | | | |
| Landscape and sights | +4PL | +3PL | | | | | +4PL | | |
| **Total** | **+8** | **+20** | **+4** | **-11** | **-11** | **0** | **+6** | **+2** | **+1** |

water supply, have the greatest positive impacts on ecological environment, and development of recreational activities, use of fertilizers and poisons have the most negative impacts (Table 3B). Jalili Kenari and Salehi (2014) associated the socio-environmental impacts of using chemical substances in agriculture with negative effects on water resource, health, and employmentIn the operation phase of artificial feeding basins, all measures have a positive impact on socio-economic environment, in that water supply, torrent control, preservation of access ways, and maintenance of structures have the most positive impact (Table 4A). Falahatkar et al. (2010) in their study came to the conclusion that social environment incurs the least negative effect. Moreover, in this stage, torrent control, water supply, and maintenance of green space exert the most positive impact on the cultural environment of the project (Table 4B).
In their study, Mousavi et al. (2012) concluded that the highest negative impacts are associated with physical environment during the construction process, as the highest positive impacts are seen in socio-economic environment during operation process. Huang et al. (2015) and Monavari et al. (2012) also in their study pointed out that the negative environmental impacts during construction are greater than those in the operation phase.
The positive and negative impacts on the physical environment in a nutshell indicate that negative transient impacts are greater than the positive impacts. Positive permanent impacts are greater than permanent negative impacts, and generally positive and negative permanent impacts are greater than positive and negative transient impacts.

**Table 5.** *Summary of physical impacts of artificial feeding basins in Hamami plain*

| Impacts | Environmental parameters | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Air quality | Environment sound | Dehydration regime | Flood regime | Surface water quality | Groundwater quality | Soil salinity | Surface water consumption | Groundwater consumption | Landform | Soil erosion | Water table | Total |
| Number of positive impacts of P | 2 | 0 | 4 | 4 | 2 | 3 | 4 | 2 | 2 | 1 | 3 | 4 | 31 |
| Number of negative impacts of P | 0 | 2 | 1 | 0 | 2 | 2 | 1 | 4 | 4 | 3 | 5 | 0 | 24 |
| Total of positive values of P | 8 | 0 | 14 | 12 | 5 | 8 | 8 | 5 | 5 | 4 | 13 | 15 | 97 |
| Total of negative values of P | 0 | 7 | 2 | 0 | 6 | 8 | 4 | 9 | 10 | 12 | 17 | 0 | 75 |
| Number of positive impacts of T | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Number of negative impacts of T | 5 | 6 | 1 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 16 |
| Total of positive values of T | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total of negative values of T | 18 | 20 | 1 | 0 | 1 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 45 |
| Total numberof positive impacts | 2 | 0 | 4 | 4 | 2 | 3 | 4 | 2 | 2 | 1 | 3 | 4 | 31 |
| Total number of negative impacts | 5 | 8 | 2 | 0 | 3 | 2 | 1 | 5 | 6 | 3 | 5 | 0 | 40 |
| Total of positive values | 8 | 0 | 14 | 12 | 5 | 8 | 8 | 5 | 5 | 4 | 13 | 15 | 97 |
| Total of negative values | 18 | 27 | 3 | 0 | 7 | 8 | 4 | 11 | 13 | 12 | 17 | 0 | 120 |

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However, by comparing the sum of positive and negative impacts on the physical environment, it became evident that negative impacts exerted on the physical environment are more than positive impacts with construction and operation of artificial feeding basins (Table 5).
The findings of impacts conclusion in the ecological environment indicated negative permanent impacts were more than positive permanent impacts. Negative transient impacts were also more than positive transient impacts. Generally speaking, by comparing positive and negative impacts in the ecologic environment, it became evident that the negative impacts of the construction and operation of artificial feeding basins are more than positive impacts (Table 6).

**Table 6.** *Summary of ecological impacts of artificial feeding basins in Hamami plain*

| Impacts | Environmental parameters | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Aquatic cosystem | Terrestrial ecosystems | Animal emigration | Animal settlement | Plants settlement | Herbal scarce species | Animal scarce species | Animal population | Disease vectors | Total |
| Number of positive impacts of P | 5 | 4 | 4 | 4 | 4 | 5 | 3 | 4 | 1 | 34 |
| Number of negative impacts of P | 3 | 10 | 5 | 9 | 7 | 8 | 6 | 0 | 6 | 54 |
| Total of positive values of P | 13 | 15 | 10 | 12 | 17 | 15 | 7 | 8 | 3 | 100 |
| Total of negative values of P | 10 | 35 | 16 | 23 | 22 | 21 | 14 | 0 | 18 | 159 |
| Number of positive impacts of T | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Number of negative impacts of T | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 4 | 0 | 6 |
| Total of positive values of T | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total of negative values of T | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 8 | 0 | 12 |
| Total number of positive impacts | 5 | 4 | 4 | 4 | 4 | 5 | 3 | 4 | 1 | 34 |
| Total number of negative impacts | 3 | 10 | 5 | 9 | 9 | 8 | 6 | 4 | 6 | 60 |
| Total of positive values | 13 | 15 | 10 | 12 | 17 | 15 | 7 | 8 | 3 | 100 |
| Total of negative values | 10 | 35 | 16 | 23 | 26 | 21 | 14 | 8 | 18 | 171 |

As a conclusion of impacts on socio-economic environment, it was made evident that positive permanent impacts are greater than negative permanent impacts. Moreover, positive transient effects are more than negative transient effects. Generally speaking, by comparing the sum of positive and negative impacts on socio-economic environment, it was made evident that the negative impacts of construction and operation of artificial feeding basins are very lower than positive impacts (Table 7).
The findings of the impact conclusion in the cultural environment indicated that negative permanent impacts are greater than positive permanent impacts. Negative transient impacts are greater than positive transient impacts.
Broadly speaking, by comparing positive and negative impact in the cultural environment, it became evident that the negative impacts of construction and operation of artificial feeding basins are more than positive impacts (Table 8).

**Table 7.** *Summary of socio-economic impacts of artificial feeding basins in Hamami plain*

| Impacts | Environmental parameters | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Population | Migration | Income and expense | Employment and unemployment | Real estate price | Agriculture | Industry and mine | Services | Transportation | Participation of users | Welfare | Leisure times | Land use | Future deve-lopment projects | Social acceptance | Total |
| Number of positive impacts of P | 3 | 5 | 3 | 3 | 0 | 6 | 5 | 5 | 3 | 5 | 4 | 3 | 5 | 5 | 6 | 61 |
| Number of negative impacts of P | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| Total of positive values of P | 3 | 14 | 5 | 8 | 0 | 22 | 14 | 12 | 8 | 16 | 9 | 9 | 18 | 17 | 19 | 174 |
| Total of negative values of P | 2 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| Number of positive impacts of T | 1 | 1 | 3 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 11 |
| Number of negative impacts of T | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 6 |
| Total of positive values of T | 2 | 1 | 5 | 5 | 0 | 6 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 22 |
| Total of negative values of T | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 3 | 3 | 13 |
| Total number of positive impacts | 4 | 6 | 6 | 5 | 0 | 8 | 5 | 5 | 3 | 5 | 6 | 3 | 5 | 5 | 6 | 72 |
| Total number of negative impacts | 2 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 10 |
| Total of positive values | 5 | 15 | 10 | 13 | 0 | 28 | 14 | 12 | 8 | 16 | 12 | 9 | 18 | 17 | 19 | 196 |
| Total of negative values | 2 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 3 | 3 | 19 |

**Table 8.** *Summary of cultural impacts of artificial feeding basins in Hamami plain*

| Impacts | Environmental parameters | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Hygienic indicators | Educational indicators | Diseases and illnesses | Water drinking and water supply quality | Tourism | Educational services | Religious and hi-storical building | Landscape and sights | Total |
| Number of positive impacts of P | 1 | 3 | 2 | 3 | 5 | 3 | 1 | 4 | 24 |
| Number of negative impacts of P | 3 | 0 | 6 | 2 | 1 | 0 | 4 | 1 | 17 |
| Total of positive values of P | 4 | 3 | 4 | 7 | 12 | 3 | 4 | 15 | 52 |
| Total of negative values of P | 12 | 0 | 26 | 4 | 3 | 0 | 9 | 4 | 58 |
| Number of positive impacts of T | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Number of negative impacts of T | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 6 |
| Total of positive values of T | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total of negative values of T | 12 | 0 | 0 | 0 | 3 | 0 | 0 | 4 | 19 |
| Total number of positive impacts | 1 | 3 | 2 | 3 | 5 | 3 | 1 | 4 | 22 |
| Total number of negative impacts | 7 | 0 | 6 | 2 | 2 | 0 | 4 | 2 | 23 |
| Total of positive values | 4 | 3 | 4 | 7 | 12 | 3 | 4 | 15 | 52 |
| Total of negative values | 24 | 0 | 26 | 4 | 6 | 0 | 9 | 8 | 77 |

## Discussion and Conclusion

The implementation of every project undoubtedly has positive and negative effects. Thus, prior to its implementation, it needs study and exploration of potential effects from different aspects. As a result, EIA can function as a suitable means of environment management, and is used widely in accordance with legal frameworks

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in most countries (Morgan, 2012). The research was conducted with the aim of assessing the environmental impacts of artificial feeding plans in Hammami Plain in Fars Province. The results indicate that implementation and operation of artificial feeding plans exert positive effects as a whole, in that the most positive effects are exerted on the socio-economic environment. However, apart from this, we cannot disregard the negative impacts exerted on physical, ecological, and cultural environments, for which the effects have to be alleviated by using planned and regular measures. In spite of adverse effects of the project, especially in construction stage, namely soil erosion, and the destruction of plant and animal habitant, the possibility of the spread of some diseases, and unwanted noises, and comparing the effects with positive effects, it can be concluded that implementation of project and leaving the region to be as it is, would involve more serious negative effects resulting from the failure to control floods in downstream agricultural lands and destruction of rural houses, and the failure to effectively utilize water resources, especially for agriculture in the area. In addition to this, positive economic effects obtained from torrent control and enhancement of regional wells will be missed. However, with project implementation, positive impacts may exist in the region and environment as a whole (Table 9), in the sense that the average level of aquifer water will significantly increase with the construction of artificial feeding basins (Cobos, 2014). The finding is in agreement with the results of Mohamadi et al. (2009), Monavari et al. (2012), Piri (2012), and Nikbakht and Shahmohammadi (2004), considering the greater share of positive impacts than negative impacts in this project.

**Table 9** *Overall situation of environmental impacts of artificial feeding basins construction*

| **Impacts** | **Environment** | | | | |
|---|---|---|---|---|---|
| | **Physical environment** | **Ecological environment** | **Socio-economic environment** | **Cultural environment** | **All of environment** |
| Total number of positive impacts | 31 | 34 | 72 | 22 | 159 |
| Total number of negative impacts | 40 | 60 | 10 | 23 | 133 |
| Total of positive values | 97 | 100 | 196 | 52 | 445 |
| Total of negative values | 120 | 171 | 19 | 77 | 387 |
| Algebraic sum of values | -23 | -71 | +177 | -25 | +58 |

Any negative environmental impacts of a project can be rarely deleted. Nevertheless, by some actions it can be decreased. The actions are called reconstructing measures or impact reduction. Reconstructing measures can be taken through managerial and engineering activities and are considered as an important principle. However, in order to lessen negative effects, we can offer the following suggestions:

The use of heavy machinery will cause, to some extent, soil erosion, as well as air pollution and noise pollution. Based on research of Hayes and Morrison-Saunders (2007), environmental compensations are decided in order to lessen environmental

effects such as conservation and protection measures as well as managerial measures. Thus, in lieu of using old machineries, we can utilize machinery that generates less air pollution and noise as much as possible.
With operation of structures, there is the possibility of greater use of poisons and fertilizers by farmers, which has negative impacts on the quality of surface water and groundwater, and aquatic ecosystem. As a result, we can train farmers to reduce the use of poisons and chemical fertilizers while motivating them to use plant residues, animal manure, and biologically to battle with pests instead of the overuse of pesticide. Because environmental education plays a very crucial role in the society and make environmental behavior (Meyer, 2015) exhibited, as well as increasing environmental awareness and preventing adverse ecological effects (Rangel et al., 2015).
Additionally, the use of local public participation and collaboration can be very helpful in the EIA. Local public participation should be in a way that the cooperation remains active from the beginning of planning through the end of assessment, because local public participation in assessment will provide better recognition and better surveillance (Mani-Peres et al., 2016).
Finally, with the help of related institutions, it is necessary to restore the regions that sustained destruction to its former situation, (through reconstruction and seeding in degraded pastures), by means of regular and planned measures.
There are no accurate and reliable rules and regulations to carry out impact assessment in Iran, not only that, existing laws are not fully implemented. There is thus a need for developing precise rules and for practicing good performance supervision. Since no adequate attention is paid to the accuracy of projects impact assessment in Iran, it is recommended that a realistic and impartial assessment be carried out prior to project implementation.
Unfortunately, in Iran short-term impacts are given greater attention and environmental impact assessments for long-term effects are less studied in Iran, whereas the aim of project implementation is focusing on long-term impacts. Accordingly, it is suggested to examine short-term, med-term and especially long-term environmental assessment types on the various aspects.
In Iran, environmental impact assessments are mostly carried out for major projects, such as, the construction of dams and small projects are not adequately evaluated. Regarding the importance of assessments in preventing resources wastes and environmental degradation, it is recommended to pay more attention to the environmental assessments in the medium and small projects. Also, most environmental assessments in Iran cover a wide area and not deep in nature. However, due to the importance of the issue, in-depth environmental assessment seems inevitable.

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**References**

AGHNOUM M., FEGHHI J., MAKHDOUM M.F., JABBARIAN AMIRI B. (2015) Environmental impact issessment of the forest management plan, using degradation model (Case study: Patom district of Kheyroud Forest). Environmental Researches, 5(10):91-98.

AGUILAR-STOEN M., HIRSCH C. (2015) Environmental impact assessments, local power and self-determination: the case of mining and hydropower development in Guatemala. The Extractive Industries and Society, 2(3):472-479. Doi:10.1016/j.exis.2015. 03.001.

AHAMMED R., HARVEY N. (2004) Evaluation of environmental impact assessment procedures and practice in Bangladesh. Impact Assess Project Appraisal, 22(1):63–78. Doi:10.3152/147154604781766102

AJIGAH E.A., JIMOH R.A., ARULEBA B.O., BILAU ADE A. (2013) An assessment of environmental impacts of building construction projects. Civil and Environmental Research, 3(1):93-104.

ARCE-GOMEZ A, DONOVAN JD, BEDGGOOD RE. 2015. Social impact assessments: Developing a consolidated conceptual framework. Environmental Impact Assessment Review, 50:85-94. Doi:10.1016/j.eiar.2014.08.006.8

ATAEI P., KARIMGHASEMI S. (2017). Environmental impact assessment of Lavar plain artificial recharge plans in Bousher province. Journal of Environmental Science and Technology, 19(4):531-544.

ATAEI P., YAGHOUBI FARANI A., IZADI N. (2017) Environmental components assessment of Feyzabad irrigation and drainage network in order to rural development (Case of study: Feyzabad irrigation and drainage network of Fars province). Journal of Natural Environment, 70(1):113-137.

BADR E.A. (2009) Evaluation of the environmental impact assessment system in Egypt. Impact Assess Project Appraisal, 27(3):193–203. Doi:10.3152/146155109X465959

CHANTHY S., GRÜNBÜHEL C.M. (2015) Critical challenges to consultants in pursuing quality of Environmental and Social Impact Assessments (ESIA) in Cambodia. Impact Assess Project Appraisal, 33(3):226-232. Doi:10.1080/14615517.2015.1049488

COBOS G.D. (2015) A historical overview of Geneva’s artificial recharge system and its crisis management plans for future usage. Environmental Earth Sciences, 73(12):7825-7831. Doi:10.1007/s12665-014-3575-0

DENDENA B., CORSI S. (2015) The Environmental and Social Impact Assessment (ESIA): a further step towards an integrated assessment process. Journal of Cleaner Production, 108(A):965-977. Doi:10.1016/j.jclepro.2015.07.110

DANGI M.B., FERNANDEZ D., BOM U.B., BELBASE S., KAPHLE R. (2015) Evaluation of environmental impact assessment report preparation and public participation in landfill projects in Nepal. Habitat International, 46:72-81. Doi:10.1016/j.habitatint. 2014. 10.021

FALAHATKAR S., SADEGHI A., SOFYANIAN A. (2010) Environmental Impact Assessment of Ghameshloo highway using ICOLD matrix and Checklist. Town and Country Plannning, 2(2):111-132.

FARHADIYAN M., KIYANI V. (2014) Environmental, social and economic impact assessment using Rapid Impact Assessment Matrix with emphasis on water resource management: a case study of Garin dam in Nahavand, western Iran. International Bulletin of Water Resources and Development, 2(1):109-109.

FATAEI A., SHEIKH JABBARY H. (2005) Study of Environmental Impact Assessment of the 2nd Industrial TownShip of Ardabil. Environmental Sciences, 2(3):29-44.
FEARNSIDE P.M. (2016) Environmental and Social Impacts of Hydroelectric Dams in Brazilian Amazonia: Implications for the Aluminum Industry. World Development, 77(3531):48-65. Doi:10.1016/j.worlddev.2015.08.015
FRANKS D. (2011) Social impact assessment of resource projects. Report of International Mining for Development Centre Mining for Development.
GLASSON J., THERIVEL R., CHADWICK A. (2012) Introduction to Environmental Impact Assessment. (4th ed.) Routledge, p. 416.
GREIG L.A., DUINKER P.N. (2011) A proposal for further strengthening science in environmental impact assessment in Canada. Impact Assessment and Project Appraisal. 29(2):159–165. Doi:10.3152/146155111X12913679730557
HANNA P., VANCLAY F., LANGDON E.J., ARTS J. (2014) Improving the effectiveness of impact assessment pertaining to Indigenous peoples in the Brazilian environmental licensing procedure. Environ Impact Assessment Review, 46:58-67. Doi:10.1016/j.eiar. 2014.01.005
HAYES N., MORRISON-SAUNDERS A. (2007) Effectiveness of environmental offsets in environmental impact assessment: practitioner perspectives from Western Australia. Impact Assessment and Project Appraisal, 25(3):209–218. Doi:10.3152/146155107X227126
HUANG L., ANDRÉ BOHNE R., BRULAND A., JAKOBSEN P.D., LOHNE J. (2015) Environmental impact of drill and blast tunneling: life cycle assessment. Journal of Cleaner Production, 86:110-117. Doi:10.1016/j.jclepro.2014.08.083.
JALILI KENARI M., SALEHI S. (2014) Assessing the Socio-environmental Consequences of Using Chemical Materials in Agriculture. Socio-cultural strategy, 10:141-160.
JIGAH E.A., JIMOH R.A., ARULEBA B.O., ADE A.B. (2013) An assessment of environmental impacts of building construction projects. Civil and Environmental Research, 3(1):93-104.
KARIMI S., SALEHI MOAYED M., JAFARI H.R. (2009) A new method of utilizing water resources in dry land watersheds (Case study: Marvast dam-Iran). Journal of Environmental Studies, 34(47):87-98.
KARLSON M., MÖRTBERG U., BALFORS B. (2014) Road ecology in environmental impact assessment. Environ Impact Assessment Review. 48: 10-19. Doi:10.1016/j.eiar. 2014.04.002
LARSEN S.V. (2014) Is environmental impact assessment fulfilling its potential? The case of climate change in renewable energy projects. Impact Assessment Project Appraisal, 32(3): 234-240. Doi:10.1080/14615517.2014.898386
MALEKHOSEINI A., MIRAKZADEH A.A. (2014) Assessment of social impacts of Sonqure's Soleimanshah dam on the regions that are under influence of irrigation and drainage network of dam. Journal of Rural Research,. 3(19):589-610.
MANI-PERES S., XAVIER L.Y., SANTOS C.R., TURRA A. (2016) Stakeholders perceptions of local environmental changes as a tool for impact assessment in coastal zones. Ocean & Coastal Management, 119:135-145. Doi:10.1016/j.ocecoaman.2015. 10.005.
MEYER A. (2015) Does education increase pro-environmental behavior? Evidence from Europe. Ecoloical Economics, 116:108-121. Doi:10.1016/j.ecolecon.2015.04.018.
MIRSANJARI M.M., ASHEGH MOALLA M., ZAREKARE A., GHORBANI S. (2013) Environmental Impact Assessment of Ecotourism site's Values. Advances in Environmental Biology, 7(2):248-252.

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MOHAMADI E., KHALIGHI SIGAROUDH S.H., EBRAHIMI S.H. (2009) Environmental assessment of Gabric dam on regional sustainable development. The 13th World Lake Conference, Wuhan, China.
MONAVARI S.M., FARSHCHI A., HASANI A.H., MOROVATI M. (2012) Investigation of environmental impacts of artificial injection aquifer plan in Yazd province (Case study: Yazd – Ardekan plain sub watershed). Journal of Environmental Science and Technology, 14(2):27-36.
MONDAL M.K., RASHMI B., DASGUPTA V. (2010) EIA of municipal solid waste disposal site in Varanasi using RIAM analysis. Resources, Conservation and Recycling, 54(9):541-546. Doi:10.1016/j.resconrec.2009.10.011.
MORERO B., RODRIGUEZ M.B., CAMPANELLA E.A. (2015) Environmental impact assessment as a complement of life cycle assessment. Case study: Upgrading of biogas. Bioresource Technology, 190:402-407. Doi: 10.1016/j.biortech.2015.04.091
MORGAN R.K. (2012) Environmental impact assessment: the state of the art. Impact Assessment and Project Appraisal, 30: 5–14. Doi:10.1080/14615517.2012.661557
MOSAFERI M., GOLAMPOUR A., NOROUZ P., ROSHAN R. (2014) Environmental impact assessment of Hadishahr industrial Town (a case study). Journal of Civil and Environmental Engineering, 42(2):95-103.
MOUSAVI S.H., SHEIKH GOUDARZI M., KAVIANI A. (2012) A comparison of modified Leopold Matrix and ICOLD Matrix in the Environmental Impact Assessment of Koor (Nahang) dam in the Sistan and Baluchistan province. Journal of Environmental Management and Planning, 6:15-24.
NIKBAKHT M., SHAHMOHAMMADI Z. (2004) Environmental impacts of the Sardasht dam during operational phase. Journal of Water & Wastewater, 15(52):87-99.
NZEADIBE T.C., AJAERO C.K., OKONKWO E., OKPOKO P.U., AKUKWE T., FEECHI NJOKU-TONY R. (2015) Integrating community perceptions and cultural diversity in social impact assessment in Nigeria. Environmental Impact Assessment Review, 55:74–83. Doi:10.016/j.eiar.2015.07.005
OHSAWA T., DUINKER P. (2014) Climate-change mitigation in Canadian environmental impact assessments. Impact Assessment and Project Appraisal, 32(3):222-233. Doi:10. 1080/14615517.2014.913761
OZCAN A., STRAUSS E.J. (2014) Environmental Impact Assessment (EIA) in Protected Areas of Turkey and Sustainability Dilemma: The Case of National Parks. 2nd International Conference on Sustainable Environment and Agriculture, Singapore.
PAZOKI M., AHMADI PARI M., DALAEI P., GHASEMZADEH R. (2015) Environmental impact assessment of a water transfer project. Jundishapur Journal of Health Sciences, 7(3):e27238.
PIRI H. (2012) Environmental Impact Assessment of Chah Nimeh Four Construction in Zabol. Town and Country Planning, 3(5):145-163.
RAHMATI A.R., KHODABANDEH DIZAJ TEKIYEH H. (2015) Vulnerability assessment of environmental impact assessment process. Environmental Research, 5(10): 63-72.
RANGEL M.O., PITA C.B., GONÇALVES J.M.S., OLIVEIRA F., COSTA C., ERZINI K. (2015) Eco-touristic snorkelling routes at Marinha beach (Algarve): environmental education and human impacts. Marine Policy, 60:62-69. Doi:10.1016/ j.marpol. 2015. 05. 017.
RASTOGI A., HICKEY G.M., ANAND A., BADOLA R., HUSSAIN S.A. (2015) Wild life-tourism, local communities and tiger conservation: a village-level study in Corbett Tiger Reserve, India. Forest Policy and Economics, 61:11-19. Doi:10.1016/j.forpol.2015. 04.007

REN X. (2013) Implementation of environmental impact assessment in China. Journal of Environmental Assessment Policy and Management, 15(3): 34-47. Doi:10.1142/S1464333 213500099
ROBU B., JITAR O., TEODOSIU C., STRUNGARU S.A., NICOARA M., PLAVAN G., CASCAVAL D. (2015) Environmental impact and risk assessment of the main pollution sources from the Romanian Black Sea coast. Environmental Engineering and Management Journal, 14(2):331-340.
SÁNCHEZ L., HACKING T. (2002) An approach to linking environmental impact assessment and environmental management systems. Impact Assessment and Project Appraisal, 20(1):25–38. Doi:10.3152/147154602781766843
SHARIAT M., MONAVARI M. (1995) Introduction to Environmental Impact Assessment. Environmental Protection Agency Press.
VANCLAY F. (2006) Principles for Social Impact Assessment: a critical comparison between the International and US documents. Environmental Impact Assessment Review, 26(1):3-14. Doi:10.1016/j.eiar.2005.05.002.
YAGHOUBI FARANI A., IZADI N., ATAEI P. (2016) Assessment of Ecological and Social impact of Fadami Dam Construction on Agricultural Development of the Area. Geography and Development Iranian Journal, 14(43):91-112.
ZHU X., ZHANG L., RAN R., MOL A.P.J. (2015) Regional restrictions on environmental impact assessment approval in China: the legitimacy of environmental authoritarianism. Journal of Cleaner Production, 92:100-108. Doi:10.1016/j.jclepro.2015.01.003
ZIDONIENE S., KRUOPIENE J. (2015) Life Cycle Assessment in environmental impact assessments of industrial projects: towards the improvement. Journal of Cleaner Production, 106:533-540. Doi:10.1016/j.jchepro.2014.07.081.

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## VALUTAZIONE DELL'IMPATTO AMBIENTALE DEI PIANI DI ALIMENTAZIONE ARTIFICIALE: LA PIANURA HAMMAMI IN IRAN

**Riassunto**

La ricerca è stata condotta allo scopo di valutare gli impatti ambientali dei piani nutrizionali artificiali di Hammami Plain nella provincia di Fars in Iran. In questo documento, l'EIA è stata intrapresa utilizzando la matrice ICOLD. In questo metodo, l'effetto di ciascuna attività di progetto sulle componenti ambientali della regione è stato valutato in due fasi; la costruzione e l'esecuzione di progetti basati su ambienti fisici, ecologici, socio-economici e culturali. I risultati indicano che gli effetti positivi saranno generalmente esercitati sull'ambiente della regione istituendo e operando piani di alimentazione artificiale in Hammami Plain. In altre parole, l'esistenza di impatti negativi sull'ambiente significherà conseguenze sostanziali positivi nella regione in conseguenza; l'aumento del livello medio dell'acquifero, la valorizzazione dei pozzi agricoli e lo sviluppo dell'agricoltura nella regione, per citarne alcuni.

**Parole chiave:** *valutazione di impatto ambientale, bacinelle per alimentazione artificiale,sviluppo agricolo, pianura Hammami, Iran.*

## EVALUACIÓN DEL IMPACTO AMBIENTAL DE LOS PLANES DE ALIMENTACIÓN ARTIFICIAL: LA LLANURA DE HAMMAMI EN IRÁN

**Abstracto**

La investigación se realizó con el objetivo de evaluar los impactos ambientales de los planes de alimentación artificial de Hammami Plain en la provincia de Fars en Irán. En este documento, EIA se llevó a cabo utilizando la matriz ICOLD. En este método, el efecto de cada actividad de proyecto en los componentes ambientales en la región se evaluó en dos etapas; construcción y operación de proyectos basados en ambientes físicos, ecológicos, socioeconómicos y culturales. Los resultados indican que generalmente se ejercerán efectos positivos sobre el medio ambiente de la región estableciendo y operando planes de alimentación artificial en Hammami Plain. En otras palabras, la existencia de impactos negativos en el medio ambiente significará que se verán impactos positivos sustanciales en la región en consecuencia; el aumento en el nivel promedio del acuífero, la mejora de los pozos agrícolas y el desarrollo de la agricultura en la región, por nombrar algunos.

**Palabras clave:** *evaluación de impacto ambiental, cuencas de alimentación artificial, desarrollo agrícola, Hammami llano, Irán.*