

## STRATEGIC PLANNING IN TANG-SAYYAD BIOSPHERE RESERVE

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**Abstract:** *In Iran the Biosphere Reserve concept has proved its value beyond Protected Areas and is increasingly embraced by scientists, planners, policy makers and local communities to bring a variety of knowledge, scientific investigations and experiences to link biodiversity conservation and socio-economic development for human well-being. Thus in Tang-Sayyad the focus is on developing models for local, national and global sustainability and also to serve as learning site for policy makers, scientists, managers and stakeholders to work together to implement global principles of sustainable development into locally relevant practical actions. The methodology include: ecosystem-based management and natural resource governance approaches, through sustainable management of the natural resources with an efficient, sustainable, multi-sectoral and participatory planning method. It was realized, for having effective management, beside government authorities; the plan should include: local and private associations in institutions.*

**Key words:** Tang-Sayyad, Biosphere Reserve, Biodiversity, Sustainable Development

### Introduction

The Protected areas are considered the key global strategy for the conservation of species' populations and habitats (Geldmann et al., 2013; UNEP-WCMC & IUCN, 2016). The protected areas number has been continuously rising, and is currently estimated at 217,155 in 244 countries (excluding UNESCO BRs) covering 14.7 percent of terrestrial regions and 10.1 percent of marine areas within national jurisdiction (UNEP-WCMC & IUCN, 2016). The most widely adopted definition of PA is the one updated in 2008 by the IUCN: "a clearly defined geographical space recognized, dedicated and managed, through legal or other effective means to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley, 2008, P.8). This definition revised the IUCN (1994) version by introducing the aspect of ecosystem services, and highlighting objective-based management. Another popular definition of a PA was developed by the Convention on Biological Diversity (CBD), hence recognized by all 196 parties of the Convention: "a geographically defined area which is designed or regulated and managed to achieve specific conservation objectives" (CBD, 2016). In parallel, BR model of site protection under international programs with a conservation focus and component to contribute to the global sustainability agenda has been flourished (Schaaf and Clamote Rodrigues, 2016). UNESCO BRs organized into a network of 669 in 120 countries (UNESCO, 2016a). UNESCO's early definition of BRs is: "Protected areas of representative terrestrial and coastal environments which have been internationally recognized for the value in conservation and in providing the scientific knowledge, skill and human values to support sustainable development" (UNESCO, 1984). In light of the complex evolution of the MAB program, BRs have now reached a more sophisticated definition: "Biosphere reserves are science for sustainability support sites - special places for testing interdisciplinary approaches to understanding and managing changes and interactions between social and ecological systems, including conflict prevention and management of biodiversity" (UNESCO, 2016a). Ideally fully functioning Biosphere Reserves perform 3 main roles:

1. Conservation in situ of natural and semi-natural ecosystems and landscapes, as well as the diversity there within;
2. Establishment of the demonstration sites for ecological and socio-cultural sustainable land use and resources conservation; and,
3. Provision of the logistics support for research, monitoring, education, training and information exchange related to conservation and sustainable development issues

In Biosphere Reserves the Zonation system comprises of 3 distinct zones (Ishwaran et al., 2008; Price et al., 2010). These zones from the inner most part to the outer most part is called as; Core zone, Buffer zone and Transition zone (UNESCO, 2016a). The core area functions with minimum human activities, except research and monitoring, aimed at protecting the landscapes, ecosystems and species it contains. Then the core zone is a pristine land which is protected strictly under the national legislative law. In Tang-Sayyad Biosphere Reserve this zone from southern altitude of Siravelle in south-eastern of protected area begins and stretches till Ghral mountain altitude in north-western site of protected area and includes 2500 meters in the balance line. In this zone the most valuable genetic and wildlife resources exist and the natural development of habitats happens without human interferences. This area has been named as national park. Regarding to the existence of national park in this area and presence of plants and animals uniqueness values and also presence of vulnerable and extinctive species the area of 4,372 ha is assigned for the core zone at the central part of Tang-Sayyad region. This zone is protected from all human interferences and it is used as an investigation sites for monitoring the characteristics of pristine environment and habitats. Also this area will be used as an array for monitoring the changes that may occur in due time in Biosphere Reserve as the whole. There is a possibility of at least one monitoring center to monitor environmental changes in habitats of the Tang-Sayyad Biosphere Reserve. Under controlled conditions core zone has the feasibility for conducting scientific investigations. Moreover, these activities should not exceed from observation and recording of natural phenomena. This zone is used as a center for continuous monitoring programs on human impacts to natural environment. In 1970 the site Tang-Sayyad has been prohibited from hunting & shooting activities by high council of gamekeeper & hunting security. In 1973 the high council of environmental conservation and protection declared Tang-Sayyad as Protected Area and in 1995 almost 5400 ha of its central part converted to National Park. Therefore, the core zone of Tang-Sayyad considers National Park which is surrounded by buffer and transition zones. Conservation and protection programs based on these developments include:

- Establishment of new check point stations;
- Establishment of observer towers to control the areas activity;
- Fencing some critical parts of the area;
- Installation of electronically control systems;
- Establishment of regional seed and sapling generation station;
- Rehabilitation and restoration of land vegetation covers;
- Rehabilitation and restoration of wildlife habitats; and,
- Establishment of water reservoirs and ponds

The area contain: 124 animal species including; mammals, birds, reptiles and amphibians. From these groups, 3 mammals being categorized as endangered according to IUCN and 3 species are in category I & II of IUCN division and 4 species are protected at a national level. From 70 distinguished birds, 2 species are in category II and 12 species are protected at the national level and one reptile species categorized in IUCN VU category which is protected at the national level. Furthermore, there are 252 plant species which out of this 30

species exist in Iran exclusively, 2 species are endangered and 70 species have genetic value. 52 springs, high hills, parapets, snow summit, shrubby and grassy land cover in valleys and mountain slopes with flock of goats, ram, ewe and wild goats, are all beautiful natural features of Tang-Sayyad area. To ensure environmental, economic and social sustainability in Tang-Sayyad the following programs are considered for development:

- Maintaining and developing ecological and cultural diversity, and securing ecosystem services for human well-being;
- Developing and integrating knowledge, including science for advancing our understanding of interactions between people and the rest of the nature; and,
- Building capacity for the management of complex socio-ecological systems particularly through encouraging greater dialogue between environment and policy interface, social education and multi-media outreach to the wider community.

A commitment to innovative time-bound socio-ecological and policy actions integrating the three Biosphere Reserve functions and the willingness to share data, information, exposure and knowledge are seen as vital to Tang-Sayyad. While education, research, monitoring and capacity enhancement are seen as components of the logistic or knowledge generation function, they are also integral to the conservation and development functions in Tang-Sayyad. Since the role of Biosphere Reserves is to strengthen the functioning of the world network monitoring system, Tang-Sayyad sustainable management model is policy relevant, which can conduct to results useful for improving sustainability and are consistent with current or planned major international research endeavors. The major value of Biosphere Reserves lies to its effort towards improving interactions between humans and the environment. Promoting sustainable development and associated cultural values in the area is a primary means for building the local constituency for conserving biological diversity in the landscape (UNESCO, 2015). Tang-Sayyad should therefore serve as laboratories for research and demonstration of ways in progressing towards sustainability of human-environment interactions, including wise use and viable economic development. The planned policy in Tang-Sayyad should:

- Be associated with research and conservation of natural resources and land use planning at the national level;
- Be consulted on participation of the provinces as appropriate in other national programs in the field of ecology;
- Be composed of representatives of the main scientific research centers and of the universities, institutions and ministries concerned; and,
- Encourage appropriate participation of women and young activists

### **Site Characteristics**

Tang-Sayyad region is located in Chahar-Mahal Bakhtiari province. The area is completely mountainous. There are two types of habitats in Tang-Sayyad region, namely:

- Mountainous type and plain,
- Hills and high grounds

The result of studies on resource assessment and land carrying capability show that mountains and hills almost cover 65 percent of the total area. Also Colluvial type consists of 22.8 percent of total area, which occupy a large portion of the region. The highest elevation above sea level is located in south-west of Sefid-Dasht with almost 3,141 m height. The lowest elevation above sea level is located in Dastgerd plain with 2,010 m height. Average temperature of the warmest month is 31°C. Average temperature of the coldest month is -5°C. According to data from observatory measurements, the average of long-term annual rain in the region is 424

mm and, the minimum and maximum annual rain observed in close by stations accordingly is 170 mm and 625mm.

### **Geology, Geomorphology and soils**

Geological structure of the region is mostly cretaceous lime. The results of calculations with PSIAC model shows that the total sediment volume which is produced by land erosion in Tang-Sayyad region is almost 87,525,000 m<sup>3</sup> per year. Considering the mountain type area of the region, more than 64 percent of the sediments will be produced in this land type. Colluvial lands with 24.5 percent of total area are located after mountain type. The amount of total sediment and suspended sediments in waterways with more than 8 sq.km. area are 8,309 and 6,391 tone accordingly. 43 percent of this amount belongs to the largest waterway called Tang- Sayyad waterway. More than 72 percent of total area is categorized in class III of erosion category system; therefore erosion intensity is in the middle to relatively high class. Almost 640 ha of total area which consist 2 percent of Tang-Sayyad region categorized in class I (slight erosion), and the rest, which is 19 percent in class II and 7 percent in class IV.

### **Biological Characteristics**

Temperate broadleaf forest, which broadly there are 20 prominent plant species types distinguished in this region. This bio-geographic region contain varieties of habitats like; rocky habitat, rocky wildlife habitat, broad plain habitat, etc. The main species in the high mountainous region are: *Astragalus susianus*, *Astragalus myriacanthus*, *Astragalus rhodosemius*, *Astragalus gossypinus*, *Astragalus campylanthus*, *Melica persica*, *Daphne mucronata*, *Cousinia tenuiramula*, *Psathyrostachys fragilis* and *stipa hohenackeriana*. In general there are varieties of plant species which usually coniferous in nature or species with needle projection and non-insectivorous species suitable for ranching. The main species in altitude gradient are: *Agropyrum intermedium*, *Bromus tomentellus*, *Stipa hohenackeriana*, *Hertia angustifolia*, *Astragalus myriacanthus* and *Artemisia aucheri*. They mostly cover rocky slopes or colluvial soils and some area with gypsum-marn soils. The concentration of this type is between 25-50 percent and the kind of plantation in this type includes: *Pimpinella deverroides*, *Helichrysum artemisioides*, *Varthemia persica*, *Diantus orientalis*, *Astragalus adscendens*, *Acanthophyllum microcephalum*, *Ferula haussknechti*, *Hertia angustifolia*, and *Capparis spinosa*. Also needle like bushes, deciduous and annual plants are found. The main species cover hills are: *Astragalus myriacanthus*, *Astragalus gossypinus*, *Astragalus cephalantus*, *Astragalus rhodosemius*, *Astragalus albinpinus*, *Camphorosma monspeliacum*, and *Cousinia tenuiramula*. These species are usually prominent in southern plain area of Bar-Aftab-Haji mountainous region and eastern hills of Farokh-Shahr. Insectivorous plants are not there and annual plants with 10 percent density are seen.

### **Method**

For comparability purposes, it is important to develop a standardized and harmonized method. In the case of Biosphere Reserve Integrated Monitoring (BRIM) program in Tang-Sayyad, monitoring covers observations made over time, comparisons of the findings obtained and measurement of the changes versus to given baseline. Integration implies the linking of the abiotic, biotic and socio-economic factors, the understanding of cause and effect, and the need for relevant foundation in adaptive management. Moreover, the development of public participation and support for residents of the surrounding areas and also Tang-Sayyad is one of the main political clues in conserving the bioregion. Undoubtedly, raising public awareness is necessary for their effective participation and attendance in conservation programs. Based on this information they will be convinced that conservation of the natural resources is primarily to their advantage and benefits. So the following activities are for achieving this goal:

- Implementing the adoption of ecosystem approach by the Convention on Biological Diversity to fully recognize the relevance of Biosphere Reserve towards this objective and its potential as a new way to combine conservation with development;
- Dissemination of information about sustainable development should launch comparative studies of different types of development activities in Tang-Sayyad and disseminate them to other Biosphere Reserves in the world network, making in particular full use of regional or sub-regional seminars and meetings;
- Improving communication and understanding among all those engaged in conservation;
- Sustainability programs should encourage adaptation which include aspects as recycling, wise water use, renewable energies, indigenous plantation, environment friendly sewage treatment, sustainable and environmentally friendly agricultural practices;
- Conducting research activities should encourage the development of research facilities and provide guidance, and facilitate access to cooperative research efforts through regular consultations with key relevant international programs and appropriate scientific advice;
- Encouraging government and other stakeholders to develop management system with a range of management objectives tailored to national and local circumstances;
- Enhancing tourism and ecotourism active programs in preparatory of regional workshops and seminars;
- Operating under the guidance of a management plan, and a monitoring and evaluation program that support adaptive management;
- Providing basis for legislation; and,
- Setting budgets

## **Results and Discussion**

The main objective of the core zones is to preserve ecosystem and species in a state as undisturbed by human activities (Dudley, 2008, 2013). Approximately 98 percent of area's land in the core zone is being of rangeland and the remaining comprising of rocks and stepping stones. About 38 percent of buffer zone is also considered as rangeland that with supervision of provincial DoE's official is being used as pasturing and it is a mixture of rangeland with small trees or bushes. A small portion in buffer zone is local communities' agricultural land practices along with traditional ranching, apicultural and farming activities. In transition zone, the major local communities' activities are traditional ranching along with agricultural, apicultural and farming practices. In this zone a small area allocated for rural residential purposes. The conservation, sustainable development and logistic support can be implemented in all zones but with varying degrees, depending on the functional focus of each zone (Matar, 2015; UNESCO, 1996). In general, the climatic condition of the region is semi-arid cold type. Microclimate conditions appears in some parts which is caused by existing of high hills, big height differences between lowlands and highlands and also steep slopes in different geographical directions and narrow mountainous valleys. This condition affects land plantation covering and animal habitats. In this region 124 animal species including mammals, birds, reptiles and amphibians and 252 plant species is distinguished. From animal species 3 species are situated in VU category, 10 species has economic value and 15 species has economical and commercial values. Also there are 2 rare species, 30 species exclusively exists in Iran and 70 species with genetic value have been distinguished. The area focuses on a number of thematic topics for regional collaboration, such as traditional knowledge, biodiversity conservation, sustainable use and equal natural benefit, ecosystem approach and waste management. It will promote scientific studies on common interests, such as:

- Socio-cultural interactions;
- Conflict resolution in land use and management;
- Relations of BR managers with government decision-making;
- Labeling of BR products;

- Cooperation for the sustainable use of renewable natural resources; and,
- Integrated biodiversity conservation

Also intend to show a tendency for the participants to create tools directly related to the particular situation and problems. It should encourage the development of such bottom-up initiatives and give both the intellectual and financial help to succeed. However the BR networks differ one from each other in terms of functions, planning and programs. The area based on political, geographical, linguistic and ecological potential serves as a pilot site for promoting sustainable development of its eco-region. In this respect the Tang-Sayyad offer unique field opportunities for a variety of possible local or regional projects on integrated ecosystem management, environmental education, sustainable resource use and renewable energy. Other opportunities in Tang-Sayyad for promoting sustainable development include:

- Recognition of different management arrangement and governance types;
- Provision of a framework for the collection, handling and dissemination of data on natural reserves;
- Provision of regulatory ecosystem services, including buffering against the impacts of climate change;
- Securing natural environment for scientific studies, environmental monitoring and education;
- Enabling indigenous communities to maintain their traditional lifestyles and use available resources in ways compatible with nature;
- Maintaining viable populations and native species at densities sufficient to conserve ecosystem integrity and resilience in the long-term;
- Contributing to conservation of wide-ranging species, regional ecological processes and migration routes;
- Contributing to local economies through ecotourism activities; and,
- Acting as models of sustainability so that lessons can be learnt for wider application.

Special attention must be given to buffer zone. The role of buffer zone is to minimize the negative impact of external pressures from human-induced activities to the core zone. In addition to the buffering functions related to the core zone, buffer zone can have own intrinsic, "standalone" functions for maintaining biological, social and cultural diversity. Buffer zone can also have an important connectivity function in a larger spatial content as they connect biodiversity components within core areas with those in transition areas or areas of cooperation.

The activities planned for buffer zone in Tang-Sayyad include:

- Amenity planting with noninvasive species;
- Nature and resource conservation;
- Nature and culture-based tourism;
- Small-scale tourism; and,
- Small scale agriculture

Moreover, in Tang-Sayyad Biosphere Reserve this zone has important ecosystems and habitats. In addition to research and educational activities, other activities such as mountain climbing could be planned in this area. The magnitude of this area is 21,199 ha. In buffer zone limited agricultural activity is possible in the form of dry and irrigation farming also there are feasibility of traditional animal husbandry and use of pastureland. Water consumption for agricultural activities is under control of water affairs organization and issuance of pasturing permit is based on the number of livestock and pasture capacity. This region is under management of the Department of Environment (DoE). Therefore, this organization and its provincial representative will control and monitor the use of existing pastures. At present livestock grazing is allowed for limited farmers who have the grazing permit. They will graze their livestock for a period of 3 months, from the mid of June till the mid of September. People live and make living conditions in transition areas, which are characterized by multiple land uses. Transition areas have a central function concerning socio-economic development. In the

past, short-coming in transition areas was that its outer boundary was not regarded to be delineated or spatially defined. But the establishment of cooperation plans and concepts, implementation of multidisciplinary projects and fostering of citizenship commitment brought about clear boundaries to transition areas which are easily accepted and understood. Further, the inclusion of the total area of Biosphere Reserve in the WNBR needs to be clearly specified; hence, while acknowledging the arbitrary nature of transition area boundary, accept the capacity of boundary extension beyond those boundaries, for practical sharing and problem solving approaches with the wider region, thus fulfilling the role of Biosphere Reserves as learning sites for regional cooperation in sustainable development. In Tang-Sayyad more than 60 points have been recorded with GPS from transition area. These points include villages, cities, animal husbandries, farms, industrial complexes, brick kiln, fodder production, car-wash, sand washing, dam, greenhouses, office foundations and different organizations. The magnitude of this area is 20,053 ha. Due to enforcing laws and applying specific rules and regulations in the region, plant coverage exploitation is under control. This control is mainly applied to the national park area appropriately. In national park there is no human exploitation for plant resources, but in buffer and transition zones plant coverage exploitation in the form of grazing land through livestock, under the control of law and existing rules and regulation is taking place. According to the national and provincial convention from the month of May, with the supervision of the environmental department officials farmers who have grazing permit card come into area with restricted number of livestock and pitch their temporary nomadic tent. They will remain there for almost 100 days. Livestock enter the pastureland from morning till evening time. After termination of allotted time of 100 days the farmers will leave the region. In addition to farmers who have authorized permissions, the farmers who live in the surrounding villages enter their livestock unauthorized. This kind of exploitation is not planned and if the environmental guards object and confront with them, they will act immediately against them in mass. So in absence of complete actions, land exploitation will further take place. In this region the conservation activities is considered more important, since birds are under severe conservation. National park and protected area regulations in this region is the reason of the birds continuous generation. For the habitat and species conservation the following 2 aspects are of utmost importance:

- Conservation of existing diversity focusing on in situ strategies; and,
- Reduction of pressure on plant species from grazing and timber collection;

Since this region is special with its temperate broad leaf forest, sustainable management of the natural resources with an efficient, sustainable, multi-sectoral and participatory planning method must be organized. The main threats in Tang-Sayyad are the illegal grazing, over pasturing, construction of new roads passing through area and illegal hunting. The existence of about 30 species of plants, in which 2 species are on the verge of vulnerability and extinction, indicate the importance of this area. Also existence of about 70 plant species with medicinal and pharmaceutical values emphasizes the conservational importance of the region. The most important plants with medicinal and pharmaceutical values identified in the region are:

- *Thymus*
- *Perethum sp.*
- *Achillea wichelmsii*
- *Cichorium intybus*
- *Glycyrrhiza glabra*
- *Famarin*
- *Boraginace*
- *Erygerom sp.*
- *Sophora*
- *Alcea sp.*
- *Anthemis sp.*
- *Mentha longifolia*
- *Colcnicum persicum*
- *Valerianaceae*

- *Solanum daenensis*

The most important plants in the Tang-Sayyad region with ornamental values are:

- *Dianths*
- *Saliva*
- *Liliaceae*
- *Alcea sp.*
- *Glaucium*
- *Rosa sp.*

From sum of 252 identified plant species in the region, almost 37 species could be used for rehabilitation and re-plantation in the damaged and fragmented areas. The following plants will have such capacities:

- *Chenopodiaceae*
- *Compositae*
- *Gramineae*
- *Papalionaceae*
- *Umbelliferae*

The conservation of genetic diversity of existing species, especially the species which are rare or being critically endangered in protected areas and biosphere reserves are very important. From 30 plant species which exclusively exist in Iran, 2 species based on IUCN criteria for Red list species being vulnerable. These species are *Ferula assa-foetida* and *Ferula haussknechit*. If grazing livestock counts as economic value of the region, at present some parts of pasturelands in the protected area is grazed for 100 days by 11,000 livestock under official supervision. It is estimated that about 5,300 tons dried fodder is the total fodder production in Tang-Sayyad region. Also 15 plant species with economical and commercial values are known, which some of them are as follows:

- *Chrozophora*;
- *Hierosolymitana*;
- *Cichorium intybus*;
- *Carthamus oxyacantha*; and,
- *Astragalus effuses*.

### **Recommendation**

In May 2000, the conference of the parties (COP) to the Convention on Biological Diversity (CBD) adopted a set of principles and preliminary operational guidance on the Ecosystem Approach. The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use of these resources and their biodiversity in an equitable way. It is based on the application of appropriate scientific methodologies and recognizes that humans are an integral component of ecosystems. Thus, almost all Biosphere Reserves are involved in problem-oriented research activities in different subject areas. In Tang-Sayyad the whole entire region is managed by the general office of environmental conservation which controls the area via 4 environmental monitoring stations (3 stations in buffer and transition zones and 1 in national park territory). Promoting existing stations with required facilities and establishment of new stations and observer towers in north west of the region and fencing some parts which are in danger of local population invasions, and provision of electronic control system are essential. Some of the most important conservation programs which are defined by provincial office of environment include:

- Information collection and disbursement;
- Tourist center establishment; and,



- Regional monitoring and surveillance program

However other substantive planned activities should include:

- Protecting and sustaining important landscapes and the associated nature conservation created by interactions with humans through traditional management practices;
- Protecting biodiversity and its sustainable use, when biodiversity and its sustainable use can be mutually beneficial;
- Promoting social and economic benefits to local communities;
- Managing inter-generational security for local communities' livelihoods; therefore ensuring that such livelihoods are sustainable;
- Developing and maintaining a more balanced relationship between humans and the rest of nature;
- Facilitating recreation and small-scale tourism activities

### **Conclusion**

The institutional basis for Biosphere Reserve Integrated Management System (BRIMS) includes the following key directions in the implementation of the three basic functions of Biosphere Reserves:

- Reinforce scientific research;
- Monitoring, training and education; and,
- Local communities, private sectors and public authorities involvement and participation

Since no standard model exists for the management structure of Biosphere Reserves and each country must adopt a model best suited to its needs and feasibilities, Biosphere Reserves management program in Iran like the majority of other countries in the world is mostly by government officials. One important point related to "governance" is the fact that some Biosphere Reserves are very large in size and very complex. This means a lot more obligations besides research and conservation, for example resolution of land and water conflicts or negotiations with various partners is needed. In Iran the authorities responsible for entire Biosphere Reserves are mostly National Parks' Authorities, Department of Environment and sometimes Forestry Department. But the plan for having effective management beside government authorities will include; local and private associations in institutions. Moreover, at present municipal and rural councils, local and national environmental NGOs are involved and participate with government officials in designing a model for carrying out the functions of Biosphere Reserve in Tang-Sayyad. Considering the Madrid Actions on the World Network of Biosphere Reserves the following programs are in hand:

- Cooperation, communication and management to climate change;
- Zonation-linking functions to area;
- Science and capacity enhancement;
- Public-private partnerships on regional hydrology;
- Rehabilitation and restoration programs;
- Preventing exploitation of sand, grit and stone; and,
- Preventing of road construction and other development plans which are located within the Tang-Sayyad territory.

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