

Mino Island Land Use Planning in Order to Sustainable Land Use Management

Zohreh Hossein Mirzaei Beni, Mandana Yavari, Ebrahim Panahpour,
and Masood Hossein Mirzaei Beni

Abstract—Establishment of conservation zone or protected areas in small islands is an effort to sustainable management of these areas. To do so, using systematic analysis, the capability of Mino Island with an area about 27 square kilometers is south west of Iran for Conservation and ecotourism purposes were demonstrated. Evaluation of island was conducted using Salm and Clark method in 4 environmental homogenous units which recognized via systematic analysis. Therefore 5 criteria including social, economic, regional, pragmatic and ecological and 34 sub criteria were applied. The result indicated that from 4 studied zones, 2 zones had higher capability for both conservation and ecotourism. With regard to limited resources of Mino Island, an integrated management was suggested in which both sustainable protection and development could be achieved in the long term.

Keywords— Conservation zone; Ecotourism; Small Island; land capability; Mino Island; systematic analysis; Salm and Clark Method.

I. INTRODUCTION

ISLAND ecosystems are area which affected by both aquatic and terrestrial ecosystems, where, the balance of population and resources is critical for survive for future. These areas provide habitat, breeding and feeding site for various kind of species. Yet island environment in the most part of world are under great pressure of development (UNEP, 1998; UN, 2005). The increasingly devastating effects of natural disasters on islands are largely result of population growth (Whitehead and Jones, 1969; Mimura and Nurse, 2007) and counterproductive development polices (UNEP, 1998; UN, 2005; Briguglio, 1995). Since land and resource are limited in the islands, conservation and protection of this limited resources is critical issue (UNEP, 1998; Briguglio, 1995; White, 1989; Mimura and Nurse, 2007). The isolated environment of islands however leads to high and unique diversity but at the same time more vulnerability to

population (UNEP, 1998; UN, 2005; Bijlsma, 1996; Whitehead and Jones, 1969). Protection programs cannot be isolated from policies and programs that protect the environment. For this reason, conserving island's resources are of crucial importance to help sustainable management and prevent to lose in capabilities of these areas (Salm and Price, 1995).

In small islands, generally application of integrated sustainable management is the best way to protect natural environment as well as benefits to locals (Bertram, 1993). One of the practical approaches to conservation of Small Island's environment has been the establishment of protected areas (UNEP, 1998). These areas can be designed to support multiple uses and aid sustainable utilization (Baldacchino and Milne, 2000), whereby resources are used but not degrade (Gobby, 1995). Properly selected and designed protected areas provide for a variety of uses and controls in an integrated resource management scheme (Salam, and Clark, 1984).

Approximately large number of studies on different aspects of small Islands is available. Ward and Butler 2010, studied the approach of sustainable tourism development in Samoa. Briguglio, 1995 on small island developing states discussed the major economic vulnerabilities faced by SIDS and tried to construct a composite index of vulnerability. Pelling and Uitto (2001) in their study assessed the effect of natural disaster amongst small island developing states (SIDS), and presented a framework for assessing the interaction of global pressures and local dynamics in the production of human vulnerability. Bertram (2004) discussed the concept of sustainability in very small islands in Pacific with regards the economic sustainability of these islands. Most of the studies on sustainable development of Island ecosystems and their evaluation in Iran have used Salm and Clark (1984) method. Jamei (2002) studied the Qeshm Island evaluation and sustainable management using Salm and Clark (1984) Method. Albodorejy (2001) in his study used Salm and Clark (1984) method to evaluate coastal zone of Khuzestan province.

Based on available information, the main source of environmental degradation in Iran is because land use decision making through the years was only based on socioeconomic conditions (Reyahi Khoram, 2005).

Zohreh Hossein Mirzaei Beni Young Researchers and Elite Club, Khorasgan (Isfahan) Branch, Islamic Azad University, Isfahan, Iran (corresponding author's phone: +989168025546; e-mail: zohreh.mirzaee@ymail.com).

Mandana Yavari, Department of Environmental Management, College of Agriculture, Ahvaz Branch, Islamic Azad University, ahvaz, Iran.

Ebrahim Panahpour, Department of Soil Science, College of Agriculture, Ahvaz Branch, Islamic Azad University, ahvaz, Iran. (e-mail: e.panahpour@gmail.com)

Masood Hossein Mirzaei Beni, Young Researchers and Elite Club, Khorasgan (Isfahan) Branch, Islamic Azad University, Isfahan, Iran

II. METHODOLOGY

Minoo Island with an area about 23 square kilometers is located in south west of Iran. This Island is located at 48° 12' to 48° 15' east longitude and 30 ° 19' to 30° 22' north latitude. Minoo Island is the only fresh water Island of Iran. This Island is surrounded by Arvand River and borders Iran-Iraq boundaries and Persian Gulf from west and south. The typical landscape of the Island is flat plain with average 2 meters above sea level. The slope of Island is in average 2.5% toward south (Persian Gulf). The climate of the Island is arid and semiarid, with long hot summers and short mild winters. The average monthly temperature during June-July the months with highest temperature is 37-39.1°C and during January- February the coldest months of year the average temperature reaches to 6-11.3 °C. The average annual precipitation of Island is 163 mm of which the main rainfall (around 2/3), precipitates in winter and fall. The minimum and maximum amount of the rainfall in the area ranges between 1.7mm to 8.39mm respectively. Humidity of the area ranges from 91.6% in winter to 8.4% in summer.

Based on 2004 census the total number of population and families living in Minoo Island were 5748 and 1060 respectively. The census data of 2004 indicates that only 44.13% of active population has an occupation. Harsh physical condition and destructions which occurred during Iraq-Iran war are the main reasons for high rate of unemployment in the Island. Date palm plantation and production, agriculture activities in small irrigated farms and fishing are the most important sectors in which occupied people are working. Handicrafts (mats, baskets which are made from reeds and mainly date palm tree leaf) and carpet weaving are other source of income for locals. Despite the very interesting opportunities the Island offers such as natural scenery, fishing sports, bird watching, hunting and recreation, the tourism industry in the area is still nonexistent.

With regard to guiding policies, the overall goal of planning exercise in Minoo Island was defined to identify capability of Island firstly for conservation and secondly to develop ecotourism facilities. Collection, analysis and synthesis of data followed by application of criteria to select different parts of Island for different purpose were essential steps of this study. To do so, at first stage the collected data from different resources changed from vector to raster format and resources maps performed in Arc GIS software. Systematic method known as Makhdom model was applied to determine the different classes of ecological resources of study area (Makhdom, 1985). The overlay method was applied to prepare the basic map in 17000 scales. The individual data elements (e.g. nesting or resting habitats, depression of ecologically important species, human settlements and vegetation cover) was mapped and overlaid on basic map to reach environmental homogenous units. Then the capability of area was determined for conservation and ecotourism purposes (Table1).

At the next stage the area with concentration of resources, human activities and threats to resources were identified

(Salm and Price, 1995). For data analysis, each area was graded to high, medium and low levels of human activities and threats to natural resources (Salm and Price, 1995). However, Minoo Island is a Fresh Water Island; the lack of national planning and indicators to protect environmental quality in particular and multiple uses of Island in general were important reasons to apply Salm and Clark Method to evaluate the study area. Therefore, the final stage was application of selection criteria. The selected criteria were based on Salm and Clark (1984) with minor modification. These criteria aimed to ensure objectivity in the choice of site for different activities. Based on overall goal of this study 5 main criteria and 34 sub criteria including social, economic, ecological, and pragmatic were applied to evaluate Minoo Island for protection and ecotourism purpose (Salm and Price, 1995). The sub criteria's then quantified and scored in each zone. Primarily scales of 1-4 were applied for lowest to highest value. Then, view point that different sub criteria had different value based on overall goal and nature of Island resources, different indices or scales used to weighting each sub criteria. Table 2 shows the criteria and sub criteria used in this study.

III. RESULTS AND DISCUSSION

A. Systematic Analysis

The basic map of the study area was obtained in Arc GIS software from topography map. The elevation and direction maps were overlaid then on basic map to form land unit maps. In the study area soils are generally heavy textured in the surface, layered in the profile with alternate silt, clay and fine sand layers. Poor internal drainage and locally with gypsum and lime accumulation in the profile are the main characteristics of soils in Minoo Island. The soils are very deep, saline, very dark, and with massive structure. Gypsum in the shape of mycelia and crystals is visible in soil profile descending downwards. The main vegetation cover of Island is *Phragmites* sp. and *Phoenix dactylophera*. While along river dense cover of *Phragmites* and *Tamarix* is dominant, in the other parts of Island other forms of flora including different type of trees, shrubs and grass could be found. Overall 32 species of flora were identified in Minoo Island. In present study 20 species of Fishes, 10 mammals species, 42 species of birds, 3 species of Amphibians and 3 sp. of Reptile were recognized. From these species some of them like francolin (*Farancolinus farancolinus*), buzzard (*Buteo buteo*), marsh harrier (*Circus aeruginosus*), and grey heron (*Ardea cinerea*), are conserved species. Francolin and marsh harrier in the IUCN red book list are mentioned as threaten species. The recognized resources maps and land capability map for conservation can be seen in figures 3to8.

B. Result of Evaluation of Study Area

In the four homogenous identified zones, data analysis as Tables 3 and 4 shows, the concentration of values and threats was scored with high, medium and low level of each of them. Salm and Clark method then was applied for evaluating each

zone. In this stage, each sub criteria, received different values, based on real value that they have in each zone. Since, the value of sub criteria based on overall goal of this study was different; therefore, ecological criteria multiplied in index 3, socio economic criteria in index 2 and finally pragmatic in index 1. The weighting sub criteria were an effort and which aimed to more realistic evaluation.

i. Social Criteria

The social acceptance and other attributes related to social characteristics of small islands residents are discussed in this section (Table 5). It is believed that if the residents of small islands want a satisfactory environment for future, they must take effort to reverse the present problem in their resources and try to stabilize their population within carrying capacity of island (Bertram, 1993; Butler, 1993). Since local people has key role (Butler, 1993) in support of each kind of programs, this criteria discusses such this capability. The most care must be attended to decrease the conflicts between conservation and local residents' activities (Salm and Price, 1995).

ii. Economic Criteria

As Table 5 indicates, under this criteria, the number of commercially important species depends on the area was recognized (Salm and Price, 1995). The number of fishermen, the size of fishing yield and the threats of their activities was identified (Salm and Price, 1995). The effect of these threats to overall population was also mentioned in this stage. Possible potentials of area for tourism and/or ecotourism development also discussed. The most important care should be attend that short-term benefits do not overlook the long term cost associated with it (UNEP,1998; UN, 2005). Therefore, the long term cost of economic activities should not get more value than short term benefits. Otherwise, resource reduction and degradation would be happen (Momsen, 1985). Environmentally friendly benefits are those that could be produced indefinitely for people (Bijlsma,1996; Cole, 1993).

iii. Regional Criteria

The significance of an area for conservation is depend on the different process and characteristics (e.g. ecological process, natural resources) of that area in a regional or sub regional network of protected areas (Salm and Price, 1995).

iv. Pragmatic Criteria

Some areas are under serious threats which need urgent actions (Salm and Price, 1995;Momsen, 1985). If whole or some parts of islands are mentioned as protected area, then size is important factor to function as an ecological unit. The degrees of satisfactory management and restorability of that area to natural,former condition were discussed and scored under this criterion(Table 5).

v. Ecological Criteria

Some natural areas of islands with rich diversity of ecosystem, habitat and communities are important parameters for conservation of area (Salm and Price, 1995; Bijlsma, 1996). Lack of disturbance or degradation is necessary since

high degree of naturalness scores highly. Under this criteria habitat of endangered species, sites of rare, endemic or endangered species, sites with historical or natural importance for tourism, areas with critical importance to the productivity of resources and the degree on which, ecologically important species depends on a site received more attention.

The result of systematic analysis indicated that Minoo Island has capability for both conservation and ecotourism. The results of evaluation of Island using Salm and Clark (1988) method confirmed the findings of systematic analysis. The evaluation results showed that from overall 268 scores, zone 112 with 190 and zone 48 with 157 was scored highly compare to zone 148 with 148 and zone 95 with 84 scores. This implies the high value of zone 112 and 48 and their capability for conservation and protection.

IV. CONCLUSION

Considering that land is important property (Reyahi Khoram, 2005), will needed to promote environmentally, economically and socially sustainable development. If development becomes sustainable, human behavior along with corporation and public agencies should be switched away from activities that degrade the environment and contribute in activities that conserve ecosystem for futures. In recent study delineation, listing and evaluation of Minoo Island's natural resources was conducted to qualify and recognize sensitive sites of this island for conservation purpose. To do so, the area with highest level of value for protection (e.g. critical habitats, endangered species) was selected as area with high capability and suitability for conservation.

Determining the appropriate land capability for conservation in Minoo Island is an effective way in preventing further destruction of natural resources. In small islands like Minoo, resources limitations encourage the efficient use of them to meet the needs of present and future generation. In this aim, efficient Management skills are important tools to help sustainable use of resources. Most of small islands face with problems such as waste disposal, diminishing the number of natural habitats and species, soil erosion and fresh water shortage. However since Minoo Island is surrounded by fresh water rivers the latest problem is minor, but the most degradation and destruction roots in Iraq-Iran war in a way that coming back to natural condition take long time. Nevertheless, this island still is unique habitat for huge number of residents and migratory birds between them some are recorded as endangered. Establishment a conservation zone or protected area is a part of sustainable development of this island. If development becomes sustainable then the aim of both conservation and development would be to maximize welfare a long with resource conservation.

TABLE I
MAKHDOUM ECOLOGICAL MODELS FOR ECOTOURISM AND OUTDOOR RECREATION OF IRAN

Ecological parameters	Symbol	Class 11	Class2 2	Incapable
Slope (%)	S	0-10	0-15	Over15
Aspect	A	Plain, N, E	N ,E	any
Soil texture	pte	loam, loamy clay	loam, loamy clay, sand, sandy loam, loamy sand, sandy loamy clay	massive clay, hydromorphic
Soil depth (cm)	pd	Over120	Over60	any
Land form	L	ridge, mid-slope	ridge, mid-slope and foothill	any
Precipitation (mm)	cp	Over200	Over50	Less than 50
Relative humidity (%)	ch	Over40	any	Less than 40
Temperature (°C)	ct	18-25	18-30	any
Wind velocity (km/h)	cw	Less than 60	Less than 60	More tahn60

TABLE II
CRITERIA AND SUB CRITERIA APPLIED IN THIS STUDY

Criteria	Sub criteria
Social Criteria	Social acceptance, Public health, Recreation, Culture , Aesthetics Conflicts of interests, Accessibility, Research and education Public awareness, Conflict and computability, Benchmark
Economic Criteria	Importance to species, Importance to fisheries, Nature of threats Economic benefits, Tourism
Ecological Criteria	Diversity, Naturalness, Dependency, Representativeness, Uniqueness Integrity, Productivity, Vulnerability
Regional Criteria	Regional significance, Sub regional significance
Pragmatic Criteria	Urgency, Size, Degree of threat, Effectiveness, Opportunism, Availability, Restorability

TABLE III
CONCENTRATION OF THREATS

Zone Threat	1	2	3	4
Population density	high	low	medium	low
Agriculture activities	high	medium	high	low
Pollution	medium	low	low	low
Traditional fishing	medium	low	medium	low
Traditional hunting	-	-	medium	low
Boating	low	low	low	low
Collecting (e.g. fish or shell)	medium	medium	low	medium

TABLE IV
ECOLOGICAL VALUES

Zone Value	1	2	3	4
Biodiversity	medium	medium	high	high
Habitat diversity	medium	medium	high	high
Natural scenery	low	high	medium	high
Ecotourism potentials	medium	medium	high	high
Education value	high	high	high	high
Cultural value	high	low	medium	high
Biodiversity	medium	medium	high	high

TABLE V
RESULTS OF EVALUATING STUDY AREA BASED ON CRITERIA AND SUB CRITERIA

ZONER	Social Criteria										Economic Criteria					Regional Criteria		Pragmatic Criteria					Ecological Criteria																								
	Social acceptance	Public health	Recreation	Culture	Aesthetics	Conflict of interests	Safety	Accessibility	Conflict of interests	Conflict and compatibility	Public awareness	Bench mark	Final score	Score*2	Importance to species	Importance to fisheries	Nature of threats	Economic benefits	Tourism	Score	Score*2	Regional significance	Sub regional significance	Score	Score*1	Urgency	Size	Degree of threat	Effectiveness	Opportunism	Availability	Restorability	Score	Score*1	Diameter	Manarabuse	Dependency	Representativeness	Uniqueness	Integrity	Productivity	Vulnerability	score	Score*3			
148	2	3	4	2	4	4	4	1	2	3	3	2	34	68	3	4	4	3	2	1	3	2	2	3	5	5	2	2	2	3	3	1	3	1	6	1	6	2	2	2	-	1	-	-	2	9	27
95	1	1	1	1	1	2	1	3	2	2	2	1	18	36	1	2	-	-	2	5	1	0	1	1	2	2	-	2	-	1	1	1	1	6	6	1	3	2	-	1	-	-	3	1	3	0	
112	2	3	4	4	4	4	4	1	4	3	3	2	38	76	3	4	4	3	3	1	3	4	7	7	3	3	2	3	4	1	3	1	9	1	9	4	2	4	4	2	-	-	2	1	5	8	4
48	3	2	2	1	1	2	1	3	4	3	3	3	28	56	2	2	2	2	2	1	2	0	3	3	6	6	2	2	1	3	1	1	3	1	2	4	3	4	4	4	-	-	2	2	6	1	3

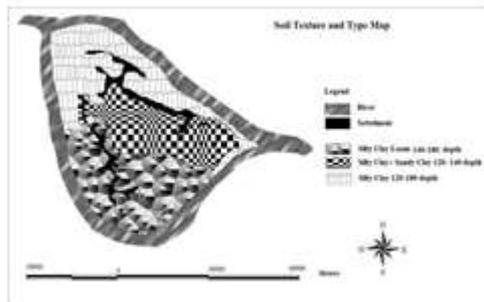


Fig. 1 soil texture and type map

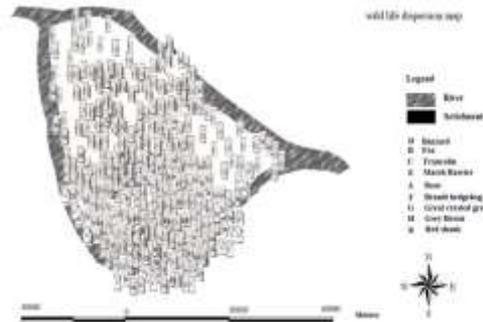


Fig. 4 Fauna Map



Fig. 2 Flora Map

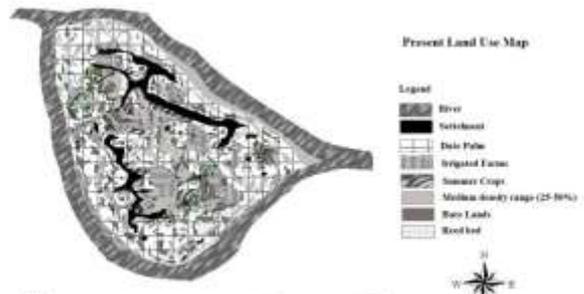


Fig. 5 Present Land use Map

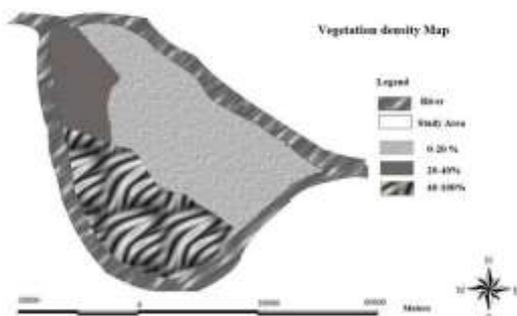


Fig. 3 Flora Density Map

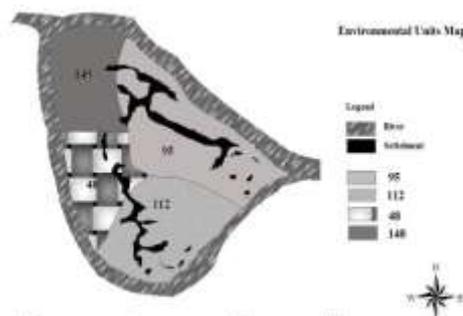


Fig. 6 Environmental Unit Map

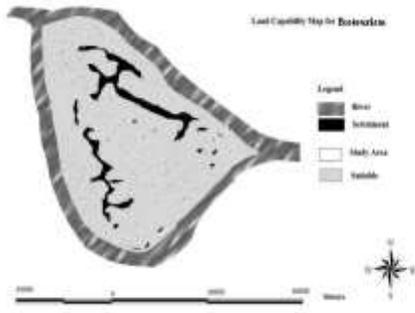


Fig. 7 Land Capability Map for Ecotourism

REFERENCES

- [1] Albodoureyj, H. "Inspection and feasibility study of coastal protected areas of Khuzestan province for sustainable management". Master dissertation, Science and Research University, Ahvaz, Iran. 2001.
- [2] Baldacchino, G and Milne, D. "Lessons from the Political Economy of Small Islands," *The Resource Fullness of Jurisdiction*. Macmillan Press, LTD. 2000.
- [3] Bertram, G. "Sustainability, Aid, and Material Welfare in Small South Pacific Island Economies," 1900-90. *World Development*. 1993.21(2): 247-258.
- [4] Bertram, G. "Sustainability, Aid, and Material Welfare in Small South Pacific Island Economies," 1900-90. *World Development*. 1993. 21(2): 247-258.
[http://dx.doi.org/10.1016/0305-750X\(93\)90020-A](http://dx.doi.org/10.1016/0305-750X(93)90020-A)
- [5] Bertram, G. "On the convergence of small island economies with their metropolitan patrons," *World Development*. 2004. 32(2): 343-364
<http://dx.doi.org/10.1016/j.worlddev.2003.08.004>.
- [6] Bijlsma, L. "Coastal zones and small islands". Cambridge University Press. New York, NY (USA). 1996.pp. 289-324.
- [7] Briguglio, L. "Small Island Developing States and Their Economic Vulnerabilities". *World Development*. 1995. 23 (9): 1615-1632
[http://dx.doi.org/10.1016/0305-750X\(95\)00065-K](http://dx.doi.org/10.1016/0305-750X(95)00065-K).
- [8] Butler, R.W. "Tourism development in small islands: Past influences and future directions". In *The Development Process in Small Island States*, eds, Lockhart DG, Drakakis S D and Schembri J. London: Routledge. 1993. pp. 71-91.
- [9] Cole, V. R. "Economic Development in the South Pacific Promoting the Private Sector". *World Development*. 1993. 21(2): 233-245.
[http://dx.doi.org/10.1016/0305-750X\(93\)90019-6](http://dx.doi.org/10.1016/0305-750X(93)90019-6)
- [10] Whitehead, D.R., and Jones, C. E. "Small Islands and the Equilibrium Theory of Insular Biogeography". *Evolution*. 1969. 23 (1): 171-179
<http://dx.doi.org/10.2307/2406492>.
- [11] Draft strategy for the further implementation of the Programme of Action for the Sustainable Development of Small Island Developing States. International Meeting to Review the Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States. United Nations (UN): Port Louis, Mauritius 10-14 January 2005.
- [12] Gobby, S. "Marine protected Areas: past, present and future. In S. Gobby. *Marine protected Areas*": principles and techniques for management. 1995. (pp. 1-13). Chapman and Hall, UK.
[http://dx.doi.org/10.1016/S1464-2867\(01\)00018-3](http://dx.doi.org/10.1016/S1464-2867(01)00018-3)
- [13] Hess, A.L. "Overview: Sustainable Development and Environmental Management of Small Islands". In W. Beller et al., (eds). *Sustainable Development and Environmental Management of Small Islands*. 1990. pp: 3-11. UNESCO, Paris, France.
- [14] Jamei, N. " Evaluation and classification of Qeshm Island sensitive areas based on IUCN Criterias". Master thesis (In Farsi with English abstract). Science and Research University, Ahvaz, Iran. 2002.
- [15] Makhdoum, M.F. "Land use planning (in Persian)". MSc textbook. Karaj: Faculty of Natural Resources. 1985.
- [16] Mimura, N. and Nurse, L. "Small islands". www.Ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter16/. Accessed on December 2010.
- [17] Momsen, H. J. "Tourism and Development in the Caribbean". *Mainzer Geogr. Studien*. 1985. 26: 25-36.
- [18] Momsen, H.J. "Gender and Environmental Perception in the Eastern Caribbean". In G. D. Lockhart and D. W. Drakakis-Smith (eds.). *The Development Process in Small Island States*, 1993. pp: 127- 143. Routledge. New York.
- [19] Pelling, M. and Uitto, I. J. "Small island developing states": natural disaster vulnerability and global change. *Environmental Hazards*. 2001. 3(2):49-62.
- [20] ReyahiKhoram, M., Shariat, M., Moharamnejad, N., Azar, A., Mahjub, H. "Ecological capability evaluation for aquaculture activities by GIS". *Iran J Environ Health Sci Eng*. 2005. 2(3):183- 188.
- [21] Salm, R., and Price, A. "Selection of Marine Protected Areas. In Susan Gobbay eds *Marine Protected Areas*": Principals and Techniques for Managers. 1995. (pp. 15-31). Chapman and Hall. UK
http://dx.doi.org/10.1007/978-94-011-0527-9_2.
- [22] Small Islands Environmental Management, Unit A, Introduction. 1998. UNEP ISLANDS Web Site. http://smallislands/SIEM_AIntroduction.mht. Accessed on September 2010.
- [23] Salm, R.V., and Clark, J.R. "Marine and Coastal Protected Areas: a Guide for Planners and Managers". Gland, Switzerland: IUCN. 1984.
- [24] Ward, T. L. and Butler, R. "Implementing STD on a Small Island: Development and Use of Sustainable Tourism Development Indicators in Samoa". *Journal of Sustainable Tourism*. 2010.10 (5): 363 - 387.
- [25] Weaver, D. B. "Model of urban tourism for small Caribbean islands". *The Geographical Review*. 1993. 83 (2): 134-140. White, A. T. Two community-based marine reserves: Lessons for coastal management. In T. E. Chua and D. Pauly (eds). *Coastal management in Southeast Asia: Policies, management strategies and case studies*. ICLARM Conference Proceedings 19, Manila, Philippines. 1989. pp. 85-96.
- [26] Whitehead, D.R., Jones, C.E. "Small islands and the equilibrium theory of insular biogeography". 1969 .*Evolution* 23 : 171-179.
<http://dx.doi.org/10.2307/2406492>