Interciencia
ISSN: 0378-1844
interciencia@ivic.ve
Asociación Interciencia
Venezuela

Herrera Ulloa, Àngel F.; Lluch Cota, Salvador; Ramírez Aguirre, Hernán; Hernández Vázquez, Sergio; Ortega Rubio, Alfredo

Sustainable performance of the tourist industry in the state of Baja California Sur, Mexico

Interciencia, vol. 28, núm. 5, mayo, 2003, pp. 268-272
Asociación Interciencia
Caracas, Venezuela

SUSTAINABLE PERFORMANCE OF THE TOURIST INDUSTRY IN THE STATE OF BAJA CALIFORNIA SUR, MEXICO

ÁNGEL F. HERRERA-ULLOA, SALVADOR LLUCH-COTA, HERNÁN RAMÍREZ-AGUIRRE, SERGIO HERNÁNDEZ-VÁZQUEZ and ALFREDO ORTEGA-RUBIO

The term sustainable development (SD) is applied to many disciplines, especially since the 1992 United Nations' Conference on Environment and Development. The highly instrumental political experience that has resulted from the vagueness of the World Commission of Environment and Development definition of sustainable development has led to a diverse spectrum of interpretations (Mebratu, 1998). The concept of SD is essentially an interdisciplinary one (Rao, 2000). In recent years, a plethora of practical scenarios for sustainability have been proposed, some emphasizing social and economic development, others concentrating more on environmental protection (Buchdahl and Raper, 1998; Garrod and Fyall, 1998). Visions of the concept ranges from very weak, with anthropocentric and utilitarian characteristics, to very strong, with bioethical and ecocentric characteristics (Callicott and Mumford, 1997, Hunter, 1997).

Since sustainable use is central to the SD concept, it is unlikely that there will be many major advances until the debate about sustainable development is resolved (Frazier, 1997). Sustainable development can be achieved by conserving biological and cultural diversity, by integrating traditional ecological knowledge of world populations with modern technology, and by adopting a decentralized, bottom-up approach to all policy decisions (Rajeswar, 2001). During the last 15 years, governmental regulation, increasing consumer awareness, implementation of end-of-pipe technologies in industry, and development of "green" products have contributed to sustainability (Dobers and Wolff, 2000).

Measuring SD will contribute to improving performance, especially when externalities are involved; indicators measure the effectiveness of implementing practical policy decisions. Sustainable development indicators (SDI) should start with a clean sheet and not simply be developed in an *ad hoc* fashion (Mitchell, 1996). Although dramatic progress has been made in compiling reliable data and devising useful indicators, it is still too early to draw conclusions about the success of these efforts (Atkinson and Hamilton, 1996). The selection and modelling of SDI's is far from an exact science (Gustavson *et al*., 1999). To avoid information overload, indicators that are strictly necessary should be used. In practice, the most important are the "red light" indicators related to the need for urgent action (Peet and Bossel, 2000). Moffatt *et al*. (2001) indicated that modelling of SD is possible using methods such as dynamic modelling, econometric model, optimization model, input-output and computable general equilibrium models, geographical information systems, and

KEYWORDS / Multivariable Statistics / Sustainability / Sustainability Indicators / Sustainable Tourism / Tourism /

Received: 10/31/2002. Modified: 04/30/2003. Accepted: 05/09/2003

Ángel F. Herrera-Ulloa. **B.S. in Marine Biology, Universidad Nacional, Costa Rica. MBA, INCAE, Costa Rica. Ph.D. in Natural Resources Management, Centro de Investigaciones Biológicas del Noroeste (CIBNOR), La Paz, Baja California Sur, México. Profesor, School of Biological Sciences, Universidad Nacional, Costa Rica. e-mail: fherrera@una.ac.cr**

Salvador E. Lluch-Cota. **B.S. in Marine Biology, Universidad Autónoma de Baja California Sur (UABCS), Mexico. M.Sc. in Marine Sciences. Centro Interdisciplinario de Ciencias Marinas (CICIMAR-IPN), México. Ph.D., CIBNOR. Researcher, Fisheries Ecology Program, CIBNOR. e-mail: slluch@cibnor.mx**

Hernán Octavio Ramírez-Aguirre. **B.S. in Agricultural Economy and Ph.D. in Economy, Higher Institute of Economy, Sofia, Bulgaria. Professor Researcher, Department of Economics, UABCS. e-mail: hora@uabcs.mx**

Sergio Hernández Vázquez. **Biologist, Instituto Politécnico Nacional (IPN), Mexico. Master in Fisheries Sciences, CICIMAR-IPN. Doctor in Marine Ecology, CICESE, Mexico. Researcher, CIBNOR. e-mail: shernan@cibnor.mx**

Alfredo Ortega-Rubio. **B.S. in Biology, M.Sc. and Ph. D. in Ecology, IPN. Researcher, CIBNOR. Address: Apartado Postal # 128, La Paz 23000, Baja California Sur, México. e-mail: aortega@cibnor.mx**

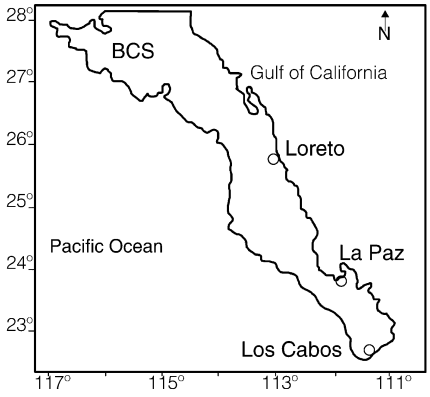

Figure 1. Location of three main tourist destinations in Baja California Sur, Mexico.

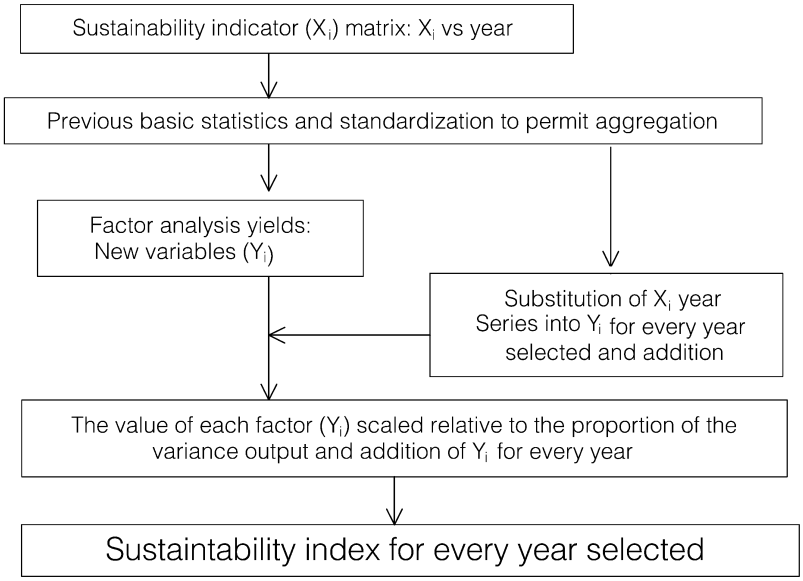

Figure 2. Summary of BCS sustainability index methodology.

decision-support systems. All of these methods have variations, for example the Flag Model (Nijkamp and Ouwersloot, 1997) in case of decision-support systems.

Tourism, like many other industries, is an important source of income for many groups, but poses potentially serious environmental threats. It exerts pressures comparable to most other industrial activities (Welford *et al.*, 2000). The relationships between tourism development, socio-economic development and the environment are circular and cumulative. Most tourism activities, comprising present and future interests of tourist and host populations, as well as of tourism organizations, place pressure on the use of natural resources (Cater, 1995). The urgency of the situation has led the Mexican tourism industry to address the sustainability issue through the implementation of sustainability guidelines and codes of practice (Garrod and Fyall, 1998). Hunter (1995) criticizes the sustainable tourism development paradigm as too tourism-centric, parochial, and therefore inherently flawed, claiming that it effectively condones planning, management, and policy decisions that are not consistent with the general aims and requirements of sustainable development.

The Mexican Tourist Promotion Fund (FONATUR, 1987) designed and developed five integrated tourist projects in the 1970s: Cancun (on the Caribbean coast, state of Quintana Roo), Huatulco (on the Pacific Coast, state of Oaxaca); the late 1980s: Ixtapa-Zihuatanejo (on the Pacific Coast, state of Guerrero), and in 1987: Los Cabos and Loreto (both in the state of Baja California Sur; BCS). BCS has an area of 71421km^2 (Figure 1) and adequate levels of health and economic indicators (INE, 2001) like those of other northern Mexican states. BCS is mostly desert, and includes almost 30000km^2 of natural protected areas, a population of less than 500000, and few polluting industries, but has serious problems with insufficient fresh groundwater, dependence on rainfall in recent years in some areas, and a tourism industry that has grown to almost 900000 visitors in 2000, from 100000 by the early 90's. The tourism industry has become the main economic activity in BCS during the last half century. The main tourist centers are the capital city of La Paz, Loreto, and Los Cabos. Los Cabos has been identified as having the most potential (JICA, 1997) and has experienced the second-largest municipal growth rate in Mexico in the 90's (INEGI, 2001). Los Cabos is the rainiest area in the state with approximately 600mm per year, subtropical weather, and important endemic species. León de la Luz *et al.* (1999) found that over 13% of the flora is endemic, and that this region is a rest area for migratory birds.

INE (2001) proposes 113 sustainability indicators for Mexico based on a list of 134 previously created by the United Nations. Data were drawn from yearly statistics of the following sources: National Institute of Statistics, Geography, and Information (INEGI, 1991-2001), Secretary of Public Education (SEP, 2001), Secretary of Health (SS, 2001), Secretary of Economics (SEC, 2001), National Commission of Water (CNA, 2001), Secretary of Tourism (ST, 2001), National Tourism Fund (FONATUR, 1987), Government reports (IG, 1991-2001), and field trips in the state.

Using multivariable statistical methods, a measure for the sustainable performance of the tourism industry in the arid state of BCS during the 1990 to 2000 period is offered.

Materials and Methods

An analysis of environmental, social, economic, institutional, and tourist activities in the state of Baja California BCS was based on a data set constructed from 27 indicators, covering the period 1990-2000 (Table I). Seven additional tourism indicators were also included. Criteria for the selection of indicators were: 1) Time series availability. 2) Avoidance of interrelations among the indicators; for example, the two indicators population growth rate and urban growth rate were rejected because of their high correlation with the core indicator of population growth in coastal areas. 3) Rejection of indicators not applicable to the situation in BCS; for example, air pollution is largely absent in BCS cities.

Data was incomplete for 25 indicators, mainly from 1990 to 1992, and based on the data available for each indicator values were interpolated. Sensitivity analyses indicated no significant differences for the databases used. Economic variables were corrected for inflation and expressed in US dollars using annual average currency exchange rates. Figure 2 summarizes the methodology.

All indicators were examined for outliers and normality. For all

TABLE I
SUSTAINABILITY AND TOURISM INDICATOR MEASUREMENTS FOR BAJA CALIFORNIA SUR, MEXICO

Sustainability Indicator	Key	Source	Units	Value for 1990
Social Dimension				
GDP spent on education	S1	SEP (2001)	%	4.00
Life expectancy at birth	S2	SS (2001)	-	74.7
Infant mortality rate	S3	SS (2001)	-	2.02
Maternal mortality rate	S4	SS (2001)	-	0.02
Contraceptive prevalence	S5	SS (2001)	%	77.2
Immunization against infectious childhood diseases	S6	SEP (2001)	%	84.1
Rate of change of school-age population	S7	SEP (2001)	%	1.02
Gross primary school enrollment ratio	S8	SEP (2001)	%	65.82
Net primary school enrollment ratio	S9	SEP (2001)	%	59.28
Gross secondary school enrollment ratio	S10	SEP (2001)	%	49.29
Total fertility rate	S11	SEP (2001)	%	0.50
Male and female student enrollment	S12	SEP (2001)	%	5.76
Adult literacy rate	S13	SEP (2001)	%	4.01
National health expenditure devoted to local health care	S14	IG (1991-2001)	%	0.03
State health expenditure related to GDP	S15	IG (1991-2001)	%	0.93
Environmental Dimension				
Annual extraction of subterranean and superficial water	E1	CNA (2001)	%	9.64
Domestic consumption of water per inhabitant	E2	CNA (2001)	m^3 $capita^{-1}$	154
Population growth in coastal areas	E3	INEGI (1991-2001)	%	4
National index of monthly rainfall	E4	INEGI (1991-2001)	mm^3	201
Protected surface area as percentage of total surface area	E5	INEGI (1991-2001)	%	37
Economic Dimension				
GDP per inhabitant	$1	SEC (2001)	US$	4282
Environmental protection as percentage of GDP	$2	SEC (2001)	%	0.065
Debt/GDP	$3	IG (1991-2001)	%	4.22
Direct foreign investment	$4	SEC (2001)	US$	8123000
Institutional Dimension				
Mandated environmental impact assessment	I1	INEGI (1991-2001)	-	Started 1993
National Councils for Sustainable Development (NCSD)	I2	INEGI (1991-2001)	-	Started 1999
Representation of major groups in NCSD	I3	INEGI (1991-2001)	-	Started 1998
Tourism Indicator				
Bank of Mexico funding to tourism industry	T1	INEGI (1991-2001)	US$	14765
Hotel rooms offer	T2	ST (1991-2001)	-	4414
Percentage occupancy	T3	ST (1991-2001)	%	47.83
Rate of annual change of visitor	T4	ST (1991-2001)	%	0.098
Tourism density	T5	ST (1991-2001)	tourist/room	1.94
Night average per tourist	T6	INEGI (1991-2001)	-	3
Service tourism offer	T7	INEGI (1991-2001)	-	167

sustainability indicator variables, no univariable outliers were found. The database was standardized by calculating the sustainability indicator minus the mean divided by the standard deviation, in order to equalize variances across the variables.

Factor analysis was used to explain the relationships among these variables in terms of their common variability factors (Tabachnik and Fidell, 1996). It provides a way of condensing the information into a smaller set of principal components with minimum loss of information (Johnson and Wicheru, 1988). The general formula for this approach is

$$Y_i = e'_i = e_{1i}X_1 + e_{2i}X_2 + \ldots + e_{ni}X_n,\ \text{i} = 1,2\ldots,\text{n}$$

where Y_i: principal component or eigenvector, e'_i: eigenvector, and X_n: original variable (indicator).

An SPSS factor analysis program with principal component (PC) extraction and varimax structure was used. Standardized annual indicators X_n were entered into the principal components Y_i and yield equations, and computed. Using eigenvalue scores and variance % from the factor analysis output, linear weighting was applied to each Y_i, and the sum of results of the equations was the resulting sustainability index.

Results

Baja California Sur tourist activity

In the 1990's, tourism became the main industry in BCS, promoted by the Federal Government by developing two centres: Loreto and Los Cabos. After becoming an important employment region and attracting immigrants from other states, mostly Sinaloa and Guerrero, the state population grew from less than 350000 inhabitants in 1990 to 423516 in 2000. By 1995, the population growth rate reached 9.2%, the second fastest in Mexico, with most

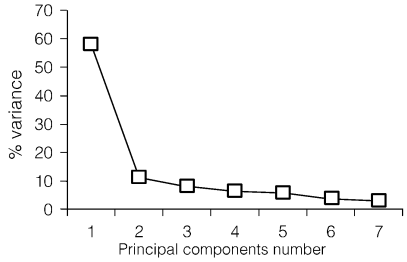

Figure 3. First seven principal components (PC) resulting from factor analysis.

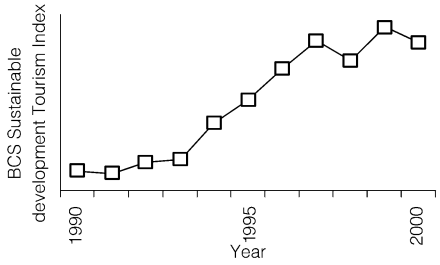

Figure 4. BCS sustainable development tourism index for 1990-2000.

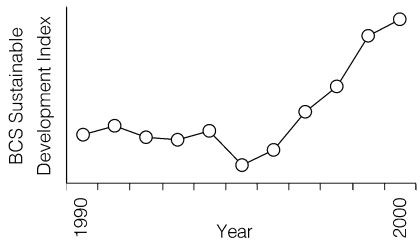

Figure 5. Baja California Sur sustainable development index for 1990-2000.

of the immigration in the 1990's concentrated in Los Cabos County.

Most tourists arrive in BCS to enjoy sun and sand. La Paz, as state capital, also receives business tourism. Los Cabos attracts tourists for golf and sport fishing; sex tourism is also visible. The US and Canada are the largest markets. As the main tourist attraction, Los Cabos had a fast growth in the 90's, reaching 66% of all BCS tourism by 2000. Five star hotels offer more than 50% of the total rooms.

Los Cabos is successful in comparison to other areas in the state because of higher availability of freshwater which is scarce in other regions, traditional sport fishing, a large international airport, and significant private sector investment by domestic and international hotel chains. The main environmental impacts are construction, tourist activity, and ranching, which pose serious threats to endemic plants, especially in coastal areas.

The Baja California Sur sustainable tourism index

After the factor analysis, using the 34 selected SDI's, seven PC's with eigenvalues higher than one were found (Figure 3). PC1 with eigenvalue 1.9735, is a blend of the social, environmental, economic, and institutional dimensions. This PC includes 31 indicators with loading factor larger than 0.6. The eigenvalues of important PC's that do not have indicators with a significant loading factor are PC2 with 3.805 and 2 indicators, PC3 with 2.776 and 3 indicators, PC4 with 2.211, PC5 with 2.002, PC6 with 1.291, and PC7 with 1.045.

To build an index and have a useful idea about sustainable performance of BCS tourism, seven factors that account for 96.7% of variance were used, each factor with proportional weighting: first factor 58.0%, second 11.2, third 8.2, fourth 6.5, fifth 5.9, sixth 3.8 and seventh 3.1. For the data in this time series, the value of each factor was scaled to its proportion of the 96.7% variance. The final result is the Baja California Sur sustainable development tourism index (BCS ST Index, Figure 4). The index shows a positive trend, with sustainability for the tourism industry in 2000 higher than in 1990. The index is a measure of overall sustainability for the BCS region, relative to the indicators used. Because the index shows the trend in the sustainability performance of the tourism industry, it was preferred not to use ordinal values on the Y-axis.

Previous research with the same methodology, using the 27 sustainability indicators selected from social, economic, institutional, and environmental dimensions, permitted to build a sustainability index for the state of Baja California Sur (Figure 5). The difference between the indices is due to the positive tendency of tourism indicators in the 90's. This tourism growth masked national macro-socio-economic effects in the first part of that decade which are clear in the BCS ST index. In contrast to the rest of the country, the population growth is remarkable. Because of migration, at least 20000 new jobs were created, most of them in the Los Cabos tourist area of about 2500km^2.

TABLE II
POPULATION GROWTH IN BAJA CALIFORNIA SUR COUNTIES (1990-2000)

County	1990	%	2000	%	Growth rate
BCS	317764	100.00	424041	100.00	3
Los Cabos	43920	13.82	105469	24.87	9.2
Comondú	65674	20.67	63864	15.06	-1.5
Loreto	8672	2.73	11812	2.79	0
Mulegé	38528	12.12	45989	10.85	1.8
La Paz	160970	50.66	196907	46.44	2.1

Source: INEGI (2001)

The relationships between the BCS ST index and selected sustainability indicators was tested through correlation analysis. Table III shows all significant relationships found. Because of the positive tendency of the index, 19 indicators with significant correlation were found. The highest correlation of positive population growth is between that in coastal areas, with a value of 0.98, and population growth in Los Cabos County, the second largest in Mexico. The correlation Gross Development Product per inhabitant of -0.911 is the most negative one, since a decremental tendency is due to the base year (1993) used by the government to calculate this indicator, at a moment of large currency devaluation.

Conclusions

Baja California Sur is an important tourist destination, especially in Los Cabos County, which has a high population growth rate. The area has become an important source of jobs, conservatively estimated at 20000 in the 1990's. The bottom line for Mexico is less migration to the US with its attendant positive benefits. Despite the efforts of federal agencies to develop two tourist areas in Los Cabos and Loreto, only Los Cabos achieved international status, because of much larger

TABLE III
STATISTICALLY SIGNIFICANT CORRELATIONS (p<0.01) BETWEEN BCS SUSTAINABLE DEVELOPMENT TOURISM INDEX AND SELECTED SUSTAINABILITY INDICATORS

Sustainable indicator	Correlation value
Population growth in coastal areas	0.977
Immunization against infectious childhood diseases	0.955
Contraceptive prevalence	0.951
Services tourism offered	0.941
Debt/GDP	0.936
Adult literacy rate	0.921
Percentage occupancy	0.875
State health expenditure related to GDP	0.867
Total fertility rate	0.855
Gross secondary school enrollment ratio	0.855
Infant mortality rate	0.849
Life expectancy at birth	0.849
Direct foreign investment	0.832
GDP spent on education	0.779
Hotel rooms offered	0.742
Mandated environmental impact assessment	0.741
Annual extraction of subterranean and superficial water	-0.826
Domestic consumption of water per inhabitant	-0.879
GDP per inhabitant	-0.911

private investments and an international airport.

The positive trend found in the BCS sustainable development tourism index is derived from 27 sustainability indicators and 7 additional strategic tourist indicators. Comparison with a previous analysis, applied to only 27 sustainable indicators, indicated how positive tourist indicators influenced the BCS sustainable development index curve, masking negative tendency in the early 90's. However, in the second half of the decade, both indices show similar values, and much of this similarity is due to increasing tourism indicator values, with indirect effects in higher social indicator values.

This proposed index is a parameter for performance measurement of sustainable tourist activity development not only in Mexico, but also in other countries with adequate sustainability indicator records.

ACKNOWLEDGEMENTS

The authors are grateful for the support of the Secretaría de Relaciones Exteriores of the Government of Mexico, the Universidad Nacional of Costa Rica, the Consejo de Investigaciones Científicas y Tecnológicas (CONICIT) of Costa Rica, the Earth Island Institute in California and Taylor Morey (CIBNOR's Editor) for comments and editing the English text.

REFERENCES

Atkinson G, Hamilton K (1996) Accounting for progress: indicators for sustainable development. *Environment 38*: 16-20.

Buchdahl JM, Raper D (1998) Environmental Ethics and Sustainable Development. *J. Sust. Dev. 6*: 92-98.

Callicott JB, Mumford K (1997) Ecological sustainability as a conservation concept. *Conserv. Biol. 11*. pp. 32-40.

Cater E (1995) Environmental contradictions in sustainable tourism. *The Geographical J. 161*: 21-28.

CNA (2001) Report of Extraction of Subterranean Waters. Comisión Nacional del Agua. Baja California Sur. Mexico. 14 pp.

Dobers P, Wolff R (2000) Competing with "soft" issues - From managing the environment to sustainable business strategies. *Buss. Strat. Environ. 9*: 143-150.

FONATUR (1987) El municipio y el desarrollo turístico. In *Memorias del encuentro de presidentes municipales. San José del Cabo, B.C.S.* Secretaría de Turismo. México. pp. 74-76.

Frazier J (1997) Sustainable development: modern elixir or sack dress? *Environ. Conserv. 24*: 182-193.

Garrod B, Fyall A (1998) Beyond the rhetoric of sustainable tourism? *Tourism Manag. 19*: 199-212.

Gustavson K, Lonergan S, Ruitenbeek H (1999) Selection and modelling of sustainable development indicators: A case study of the Fraser River Basin, British Columbia. *Ecol. Econ. 28*: 117-132.

Hunter C (1995) On the need to re-conceptualize sustainable tourism development. *J. Sust. Tourism 3*: 155-165.

Hunter C (1997) Sustainable tourism as an adaptive paradigm. *Ann. Tourism Res. 2*: 850-867.

IG (1991-2001) *Yearly Reports*. Informes de Gobierno. Baja California Sur. Mexico.

INE (2001) *Well-being levels in Mexico*. Instituto Nacional de Ecología. http://www.inegi.gob.mx/difusion/espanol/niveles/ (in Spanish).

INEGI (1991-2001) *Baja California Sur Yearly Statistics*. Instituto Nacional de Estadística, Geografía e Informática. Aguas Calientes. México.

JICA (1997) *Estudio para la formulación de estrategias de desarrollo y promoción para destinos turísticos seleccionados en México*. Informe final: Estrategias regionales para destinos seleccionados. Japan International Cooperation Agency. Pacific Consultant International System. Science Consultants Inc. Mexico City. 6 pp.

Johnson R, Wicheru D (1988) *Applied multivariate statistical analysis*. 2nd ed. Prentice Hall. Englewood Cliffs. New Jersey, USA.

León de la Luz JL, Pérez-Navarro JJ, Domínguez-León M, Domínguez-Cadena R (1999) *Listados florísticos de México: XVIII Flora de la región del Cabo de Baja California Sur*. Instituto de Biología. Universidad Autónoma de México. Mexico City. 39 pp.

Mebratu D (1998) Sustainability and sustainable development: historical and conceptual review. *Environ. Impact Assess. Rev. 18*: 493-520.

Mitchell G (1996) Problems and fundamentals of sustainable development indicators. *Sust. Dev. 4*: 1-11.

Moffatt I, Hanley N, Wilson M (2001) *Measuring and modelling sustainable development*. Parthenon. New York. USA. 305 pp.

Nijkamp P, Ouwersloot H (1997) *A decision support system for regional sustainable development: the flag model*. Tinbergen Institute Discussion Papers No. 1997-074/3. Tinbergen Institute, Tilburg. Netherlands. 28 pp.

Peet J, Bossel H (2000) An ethics-based system approach to indicators of sustainable development. *Int. J. Sust. Dev. 3*: 221-238.

Rajeswar J (2001) Conservation ethics versus development: how to obviate the dichotomy?. *Sust. Dev. 9*: 16-23.

Rao PK (2000) *Sustainable Development*. Blackwell. Massachusetts. USA. 393 pp.

SEC (2001) *Economic Statistics Report for Baja California Sur*. Secretaria de Economia. Baja California Sur. Mexico. 10 pp.

SEP (2001) *Educational Statistics Report*. Secretaria de Educación Pública. Baja California Sur. México. 7 pp.

SS (2001) *State Health Statistics*. Secretaria de Salud. Baja California Sur. Mexico. 3 pp.

ST (2001) *State Tourist Statistics*. Secretaria de Turismo. Baja California Sur. México. 22 pp.

Tabachnick B, Fidell L (1996) *Using Multivariate Statistics*. Harper-Collins. New York. USA.

Welford R, Ytterhus B, Eligh J (2000) Tourism and sustainable development: An analysis of policy and guideline for managing provision and consumption. *Sust. Dev. 7*: 165-177.