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SCENIC BEAUTY AND HUMAN PERCEPTUAL DIMENSIONS OF
THE PINACATE Y GRAN DESIERTO DE ALTAR BIOSPHERE RESERVE
SONORA, MEXICO
(VISITORS, COMMUNITY AND MANAGERS)

by

Joaquin Murrieta Saldivar

A Dissertation Submitted to the Faculty of the
SCHOOL OF RENEWABLE NATURAL RESOURCES
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For the Degree of
DOCTOR OF PHILOSOPHY
WITH A MAJOR IN RENEWABLE NATURAL RESOURCES STUDIES
In the Graduate College
THE UNIVERSITY OF ARIZONA

2000

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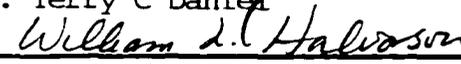
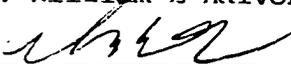
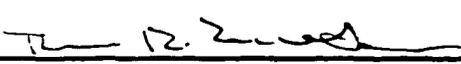
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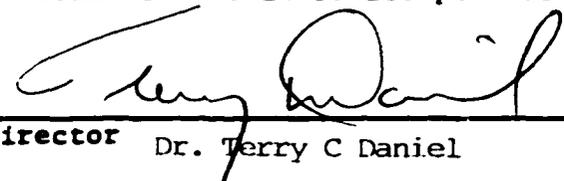
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A handwritten signature in cursive script, appearing to read "Jayi M. B.", is written over a horizontal line.

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DEDICATION

A las cuatro mujeres mas importantes de mi vida:

A mi abuela Eulalia, por su sabiduría del silencio

A miamá Doña Lina, por su firmeza y seguridad

A mi esposa Gillian, por su sonrisa y sencillez

A mi bella dama Leila Sonora, por su felicidad

....con imaginación todo se puede

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ABSTRACT

Two research approaches were combined to study the perceptions, understandings and expectations of visitors, managers and local communities sharing the desert landscape within the recently created Pinacate Biosphere Reserve, Sonora Mexico. The psychophysical approach was applied to measure visitor's perceptions of scenic beauty and quality of outdoor experience in the Reserve. Students at the University of Arizona and tourists at Organ Pipe Cactus National Monument rated views from the road and major attractions presented as color slides arranged in a "virtual trip." Results indicated high internal reliability and consensus in ratings between groups. The highest ratings of scenic beauty were associated with lush vegetation, columnar cacti, rugged geological formations and volcanic features. Travel direction and order of "visitation" for the four major attraction sites were important variables affecting scenic beauty ratings (for road views) and enjoyment of the trip (for attractions), respectively.

Questionnaires, structured and open interviews, and review of public meeting documents were used to assess and contrast the three different population's understandings and expectations regarding the shared desert landscape. The major themes that emerged focused on the trade-offs between environmental conservation goals and development needs of the communities living, or having vested interests in the Pinacate Reserve. Local community (Ejidos) members favored greater emphasis on utilization of natural resources for economic development. Biosphere managers held strongly to their environmental protection mandates, but struggled to find a balance between conservation goals and community needs. Eco-tourism was viewed by both

populations as the most attractive option for achieving such a balance. Visitors agreed that tourism activities should contribute to the welfare of local residents, but in a direct trade-off they much more strongly favored management policies that protect the natural desert environment.

INTRODUCTION

The Pinacate y Gran Desierto De Altar Biosphere Reserve (PBR) was designated in June of 1993 by decree of the president of Mexico. With this declaration, a new human relationship started to develop in the PBR. This resulted from new attitudes towards the land, its uses, regulations and restrictions. New-comers perceptions towards PBR natural resources were based on the objective of environmental conservation. Sharing the same ecosystem are local residents who have been struggling to utilize the natural resources to make a living. In addition there are both local and international visitors who are seeking quality recreational/ touristic experiences. At present, several reactions are occurring due to the declaration of the PBR. Specifically, there are different perceptions of this program depending on the viewpoint of the perceiver. Managers bring new "values" that emphasize local communities adapting their natural resource uses to conservation. Local users are trying to show managers that certain beneficial uses of natural resources could be compatible with the management of the PBR. Every year more and more visitors come to enjoy the special landscape of the reserve. The Pinacate Biosphere Reserve presents a forum for communities and managers to address issues of the environmental and human dimensions of natural resource management balancing the goals of conservation and sustainable uses of the land. See Figure 1 and 2 for location of the PBR and the study area respectively. For a description of the Pinacate Biosphere Reserve see Appendix A.

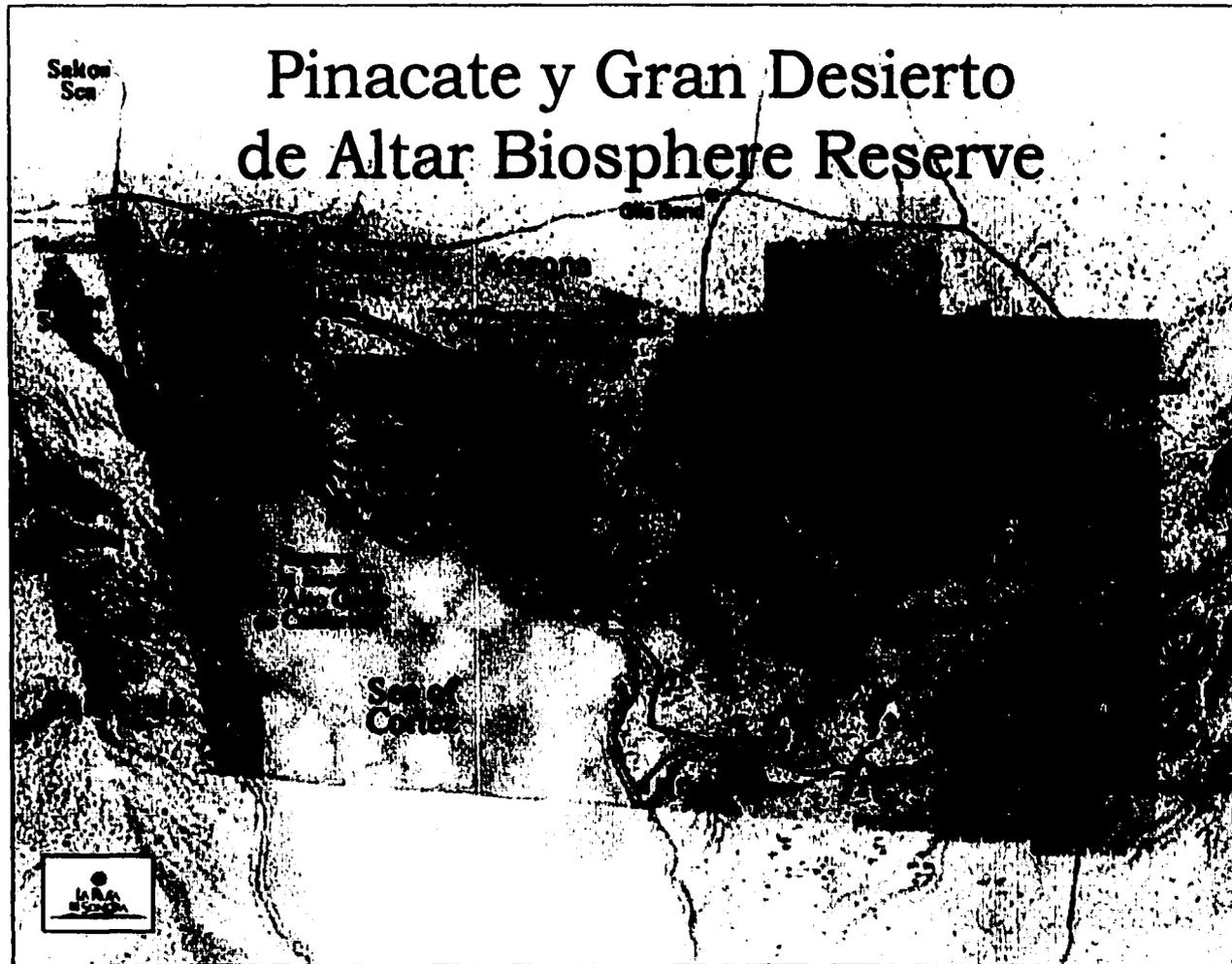


Figure 1. Location of The Pinacate y Gran Desierto de Altar Biosphere Reserve

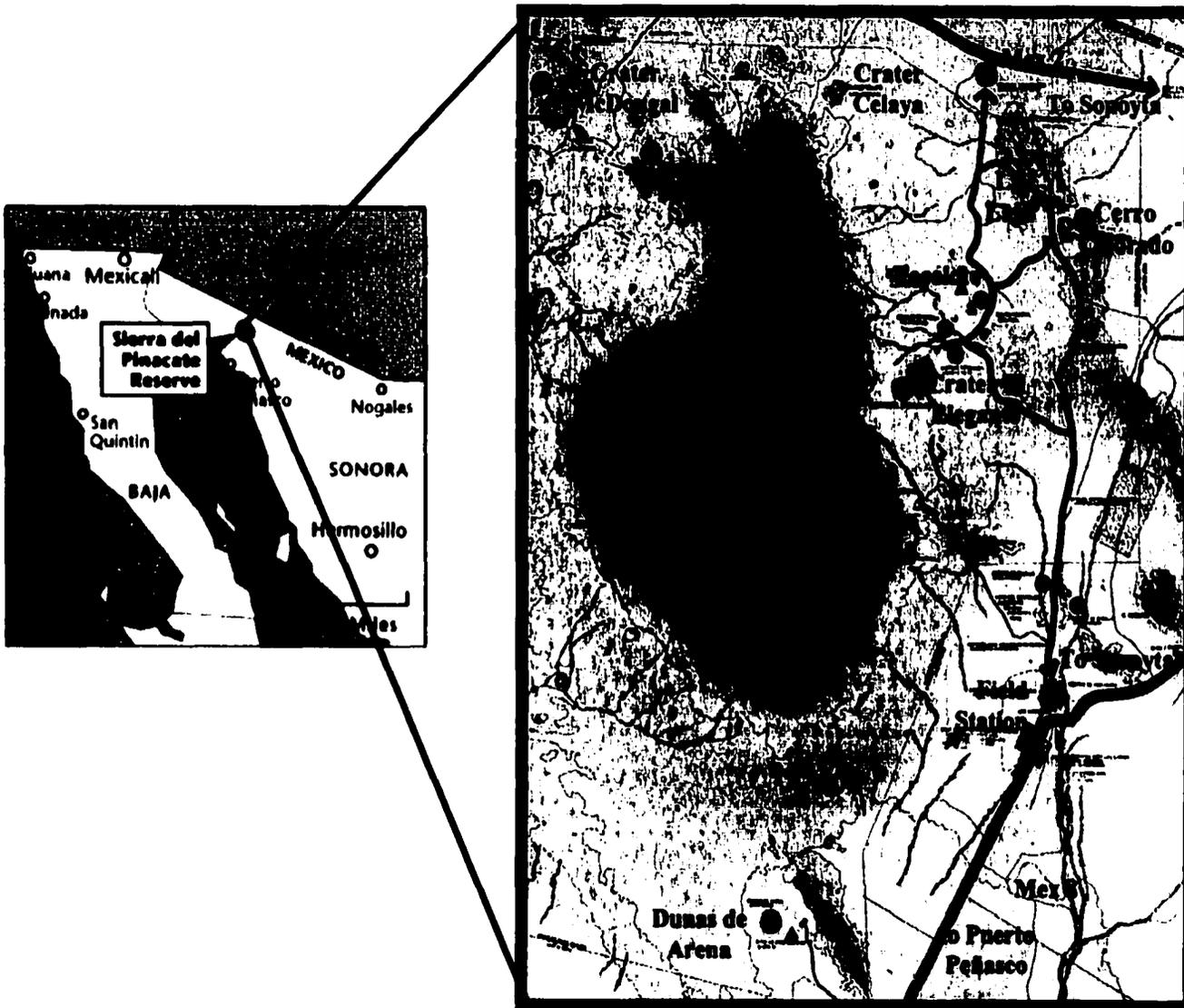


Figure 2. Study Area, Volcanic Shield of the Pinacate Biosphere Reserve

HUMAN PERCEPTION

Several studies have indicated that resource managers and resource users differ in their perception of the landscape (Vining and Ebreo, 1991). Managers tend to view protected areas such as the PBR as nature preserves, park visitors tend to view them as recreational resources, and local residents view them as means for sustenance. In general managers are more concerned about multiple compatible uses than are hikers. Similarly, communities are more concerned about use and harvesting of natural resources than about aesthetic or scientific uses.

Zube and associates (1982) provide a framework in which landscape perception is considered as a function of the interaction between humans and landscapes. The human component encompasses past experience, knowledge, expectations and the socio-cultural context of individuals and groups. The landscape component includes both individual elements and landscapes as entities. The interactions result in outcomes that in turn affect both the human and the landscape components.

The United Nations Education, Science and Culture Organization with the Man and Biosphere Program (UNESCO-MAB) also recognizes different dimensions of land use as well as differing perceptions of the environment between different cultural groups (e.g. managers and local communities). Three dimensions are recognized: 1) the spatial dimension; 2) the perceptual dimension, and 3) the time dimension (UNESCO-MAB, 1985). These dimensions need to be recognized in any activity related to human and natural resource use as management outcomes affect both human and landscape components. These three dimensions together make up human use systems, the socio-

economic and ecological systems through which people manage and benefit from the resources provided by the landscape in which they live.

The spatial dimension -- The human use systems within which people manage their resources often cut across ecosystems and tend to involve interactions of much larger geographical scales than those usually dealt with by natural scientists. Interactions usually occur between a series of human use systems of increasing size from the household or production unit (e.g. herd, farm, factory) to the community, district, region, state and up to country or continent. Defining the spatial dimension for research makes it easier to extrapolate data gleaned from intensive research on a specific site to larger scales for regional and national planning.

The perceptual dimension -- There are different perceptions of land use and resource management from one individual to the next, and from one socio-economic or cultural group to another. Perception can also vary between historical periods and from one geographic region to another. A manager, a tourist and a rancher will each have different ideas about the best use of a given piece of land. A mining company may think very differently about the way to manage a property than a national conservation agency. The aspirations of the local population may not correspond to those of the central government. Local farmers will often have a different perception of land use problems than an outside scientist. Researchers and managers must take into account the perceptions of all individuals involved in a given land use issue. Policies based on these subjective factors, as well as on objective criteria, will be more likely to receive the support of all concerned.

The time dimension -- Within any single geographical unit, people view land use problems from different time perspectives. The hunter-gatherer thinks about survival on a day-to-day basis. The political leader thinks about the next election. Miners think in terms of 30 to 50 years of production; the genetic conservationist thinks in terms of centuries. Research must take into account these different times scales of concerns for land management (adapted from slide program UNESCO-MAB 1985). For a closer appreciation of the different perceptual dimensions through time and cultures of the Pinacate Reserve landscape see Appendix B.

Understanding various landscape perceptions and interactions will contribute to answering questions about why landscapes are perceived as they are, what they mean to different individuals and groups and how the landscape contributes to one's sense of well being or quality of life (Zube et al. 1982).

In the United States of America as well as some other developed countries, landscape quality assessment is an important component of environmental planning and management as well as an important field of study within environmental perception research. The concept of scenic beauty has long been recognized as an important natural resource value in the USA, and its protection has been specifically mandated in key legislative acts that define the goals and procedures for environmental management (Meitner, 1999).

Miller (1994) stated that images are more immediate than polemic and often play a far more important role in changing attitudes. Visual ideas have always been an important tool in landscape management and particularly in architecture. The potential

realities contained within a designer's imagination have been revealed through models, maps, plans, sections, elevations, sketches, perspective drawings, and a wide variety of photographic manipulations. More recently, computer technology has provided the capability to create visual simulations of prospective projects that are almost indistinguishable from images of reality (Watzek and Ellsworth, 1994).

Daniel and Vining (1983) indicated that in the models of landscape-quality assessment, the term landscape focuses upon the visual properties of the environment. Thus biological functions, cultural/historical values, wildlife and endangered species, biodiversity values, and a large array of tastes, smells, and feelings are not directly included. These factors must be assessed and considered separately from landscape quality. The dimension of landscape-quality has been variously labeled as "scenic quality," "visual attractiveness," "visual quality," "aesthetic quality," and "landscape preference." Daniel and Vining (1983) concluded that "scenic beauty" best labeled the relevant landscape-quality dimension.

There are several methods to address public environmental perceptions and preferences (Daniel & Vining 1983; Zube et al. 1982; Meitner 1999). For the present study we are interested in public perceptions of desert landscapes, specifically perception of natural scenic beauty, and a "psychophysical approach" seems the most appropriate.

THE PSYCHOPHYSICAL APPROACH

The psychophysical approach seeks to determine relationships between the physical characteristics of the landscape and the perceptual judgments of human

observers (Daniel & Boster, 1976; Daniel, 1990). These assessments are based on the reactions of persons representative of visitors to and viewers of the landscape. The relationships of interest are those between physical features of the environment (e.g. topography, vegetation, water) and psychological responses (preference, aesthetic value, or scenic beauty). Landscape variables may be defined in photographic terms, such as areas of a picture covered by sky, trees, and water (Shafer & Richards, 1974), or in terms of manageable features such as trees per acre, pounds per acre of grass, and cubic volume of downed wood (Brown & Daniel, 1986). Psychophysical assessments are useful in many management contexts, providing quantitative precision, objectivity, and a basis for determining public perception and judgment. These assessments are not based on expert opinion, but on a measured consensus among observers representative of the public that views the landscapes and are affected by management actions. This model is easily rationalized for public lands and is consistent with the current emphasis on public involvement in land-use planning.

Psychophysical assessments of scenic beauty have been successfully applied in a number of environmental management contexts in which scenic effects have been assessed for harvest treatments, prescribed fire and visual air quality (Daniel, 1990), remote fishing tourism experiences (Daniel and Orland, 1993) and quality of recreation experience (Daniel et al. 1972) among other uses.

This psychophysical method typically relies on the use of photographs or equivalent computer visualizations to represent environmental conditions for determination of public preferences. According to Brown and Daniel (1988), there are

several advantages for this procedure. First, pictures can depict most environmental situations more accurately than mere verbal descriptions. Second, the use of photos as surrogates avoids the costly and time-consuming task of transporting respondents to the scenes. Third, photos can be altered, allowing carefully controlled comparisons among alternative conditions. These advantages have led to the extensive use of photographs in studies of environmental perception.

Shelby and Harris (1985) address some limitations on the use of photographs in landscape perception. First, there may be differences in content because the eye can take in a larger field of view than a photo and can focus greater attention on objects of particular interest. Second, onsite views consist of three-dimensional objects, which occur at varying distances in space, while a photograph is a two-dimensional image that limits depth perception to some extent. To address these limitations they recommend the use of photographs combined with written descriptions to allow respondents to better focus on the characteristics of the landscape.

Collecting environmental perception data from many individuals is expensive, especially when judgments are collected in the field or by individual interviews. Psychophysical methods have the capability to be applied to small groups and still produce satisfactory within-group reliability. This reliability can be achieved with groups of 15 to 25 raters, and can be very cost effective (Schroeder, 1984). Reliability refers to the level of agreement or consistency in measures obtained from one application to another.

The psychophysical methods provide good valuation capabilities. Daniel (1990) mentioned several approaches for establishing values for changes in scenic beauty, including economic trade-off analysis to compute the cost of achieving different levels of scenic beauty in a forest management context and contingent valuation methods to show that higher levels of scenic beauty are associated with greater willingness to pay for forest camping experiences. These dollar values allow comparisons and trade-offs with other important environmental management goals and constraints. The psychophysical approach has provided precise and reliable assessments of perceived scenic beauty and useful mathematical models for predicting the scenic consequences of changes in manageable features for the landscape (Daniel, 1990).

PINACATE BIOSPHERE RESERVE: PSYCHOPHYSICAL APPROACH AND HUMAN PERCEPTION

One of the main motivations for the declaration of the PBR was to protect the aesthetic values of the area. According to the Webster's New World Dictionary, aesthetics refers to the study or theory of beauty and of the psychological responses to it. The General Law for the Ecological Equilibrium of Mexico mentions that scenic beauty and aesthetic values are important for landscape management. However, this law does not present or mention a way to define and measure scenic beauty. In fact, in Mexico, there is no specific legislation that mandates and/or recognizes that scenic beauty is an important resource for conservation and management of protected areas.

There is no history of applying scenic beauty valuation methods in Mexico. The Pinacate Biosphere Reserve provides an excellent opportunity to take initial steps in applying this methodology in the Sonoran Desert setting. In addition to scenic assessment, this study also addresses human perceptions of the management of natural resources from managers and from community points of view.

To address the fundamental conditions for human relations in the PBR, one of the objectives is to examine the relationships between the perceptions of the environment from three relevant populations: 1) visitors and potential visitors to the Sonoran Desert, represented by Organ Pipe Cactus National Monument (ORPI) visitors and by students of the University of Arizona; 2) managers of the PBR, including administrators, researchers and staff of the Reserve and 3) local residents, represented mainly by members of Ejidos (communal land tenure) in the PBR.

Three methods are used, one for each population. For the ORPI visitors, perceptions of scenic beauty for landscape scenes in the PBR were obtained by applying the psychophysical approach for quantifying visitors' quality of experience and perception of scenic beauty while "traveling" in a simulated trip over the main roads of the Pinacates. For the managers, open-ended questionnaires were administered to administrators and staff of the PBR. We used direct observations, review of minutes of community meetings organized by the PBR-managers and informal conversation for assessing perception of the local residents.

Looking at the different perceptions of the environment by these three populations provides the "glue" that ties together different cultures and their interactions with the

Pinacate and Gran Desierto de Altar Biosphere Reserve. The study considers the biosphere reserve as a concept for developing new places where conservation, sustainable uses and an inclusive participatory process are key ingredients for design and management.

GOALS AND OBJECTIVES OF THE RESEARCH

The goal of the dissertation is to assess and compare the perceptions, understandings and intentions of visitors, managers and local communities of the Pinacate Biosphere Reserve. The purpose of the first study of the research is to apply the psychophysical approach to quantify visitors' perceptions of scenic beauty and recreational enjoyment of a Sonoran Desert setting while traveling on a simulated trip. A series of 35 mm color slide photos depicted a "trip" along the main roads of the Pinacate Biosphere Reserve, with stops at the main destination sites. This study tested the applicability of the psychophysical methods to a desert setting, looking at the visual effects of travel direction and order of presentation, and contrasted preferences for natural settings with human impacted features (cinder mining).

In the second study of the research, human perception of the environment was assessed and contrasted between visitors, local communities and managers sharing the same desert-landscape. A direct open-ended questionnaire is used for managers and direct observation and review of meeting minutes is used as research methods for communities. Issues concerning cooperative natural resource management among different populations (visitors, managers and communities) are explored.

STUDY I. PERCEPTUAL ASSESSMENT

Three studies are presented for the scenic beauty valuation analysis. The first phase compares the scenic beauty of the PBR with other representative landscapes of the Sonoran Desert. The purpose of this phase is to explore where the PBR stands in terms of scenic beauty when compared to other neighboring areas and other Sonoran Desert subdivisions, using color slides to administer the survey. The second phase is a photographic (represented by slides) simulation of a trip to the Pinacate and is divided in two sections. Section 1 investigates scenic beauty variations within the landscape of the Pinacate BR, as viewed while “traveling” in a simulated trip along the main roads of the reserve. This line of research investigates the pattern of landscape preference within five segments of the main roads of the Pinacate and compares ORPI-visitors’ and students’ preferences as well as the importance of direction of travel-view (North-South vs. South-North). Section 2 investigates the contribution to the overall enjoyment of a visit to the PBR from four specific destination sites within the reserve that are visited (virtually) during the simulated trip. These destination sites are the most commonly visited in the Pinacate, with the exception of a cinder-mining site known as La Laja. The other three sites include two volcanic craters (Elegante and Cerro Colorado) and a camping site (Ticolote). The third phase of Study I is an actual visit to the PBR to rate on-site the road segments and the destination sites presented in the simulated trip. This line of research, while limited provides some preliminary comparison of the ratings of the simulated trip with the ratings of an actual trip.

Besides the seventy-two slides representing general Sonoran Desert landscapes, fifty-four pairs of landscape photographs were collected at sampled locations (four pictures every kilometer) along the main roads and destination sites of the Pinacate BR. The landscape photographs were presented as a simulated trip with a slide projector to undergraduate students of the University of Arizona and to visitors of Organ Pipe Cactus National Monument who rated the relative scenic beauty of the landscapes represented. It is important to note that color slides are sometimes less than ideal photographically. For example, some are over or under exposed. Therefore, observers were told to use the slides “to get an idea of what the landscape would look like if you were at that place”. The objective was to obtain ratings of the landscape (place), represented by the photograph, not the photograph itself.

To avoid a potential “end-point” problem (Brown & Daniel 1990, Meitner 2000), all participants previewed 12 pairs of slides representing the range of landscape configurations in the PBR. This allowed observers to have an idea of the context of the Pinacate BR and to establish anchors before starting the rating process. The internal reliability of the scenic beauty ratings of each group was assessed, with emphasis on correlation coefficients and comparisons of mean scenic-beauty estimates between groups.

PHASE 1. SCENIC BEAUTY OF SONORAN DESERT LANDSCAPES

The three studies obtained perceptual judgements for several locations of the Sonoran Desert and locations along the main roads and destination sites of the Pinacate BR. This phase compared scenic beauty estimates for 14 different categories/sub-areas of the Sonoran Desert landscape, including among other areas the PBR, Organ Pipe Cactus National Monument, Cabeza Prieta Wildlife Refuge, Saguaro National Park, and Sabino Canyon (Coronado National Forest).

Participants

The participants were sixty-nine undergraduate students from the University of Arizona who received class credit toward a research participation requirement.

Procedure

The experimental stimuli for Phase I consisted of seventy-two individual landscape color slides taken at ground level in several representative Sonoran Desert locations. Human influences were zero or minimal and no people were present in any of the settings. The 14 settings were chosen because of their acknowledged relevance to representing the range of environmental conditions in the Sonoran Desert. The locations of individual photo points within each area were chosen in a semi-random fashion, constrained by the availability of photographs from previous surveys in the Environmental Perception Laboratory of the Department of Psychology of the University of Arizona in Tucson, and the author's own collection. The 72 slides, representing 14

different Sonoran Desert areas (including the PBR) were randomly ordered in a slide projector and shown to the 69 undergraduate students at the University of Arizona. Fifteen sessions of from three to 10 participants were conducted.

Images were arranged and presented in a completely random order, so instances of each of the fourteen desert areas were separated and could appear anywhere in the 72-image presentation. All ratings used a 10-point scale of scenic beauty, where 10 corresponds to very high scenic beauty and 1 corresponds to very low scenic beauty. Viewing time was 10 seconds for each image.

Results and Discussion

With assistance of the RMRATE (Brown, et al. 1990) computer program for analyzing rating data, several estimates were computed. The group-to-group reliability coefficient was quite high at 0.984. This is an indication of the expected correlation between the mean ratings of the respective group in this experiment and ratings by an equivalent sized group sampled from the same population of observers viewing the same settings. The minimum acceptable reliability for basic research suggested by Guilford and Nunnally as mentioned by Herzog and Bosley (1992) is 0.50. Thus, reliability for this study substantially exceeded conventional standards.

The principal component analysis of RMRATE, yielded eigenvalues of the ratings and the percent of the variance accounted for by each component (Appendix C: Eigenvalues). The eigenvalues for the data set varied from 34.11 to 0.6171E-04. The first principal component accounted for 50 percent of the variance in the ratings of the 69

included observers. The eigenvalue of the first factor measures the maximum amount of the variance in the data that may be accounted for by a single weighted sum of observers' ratings, and may be interpreted as a measure of the group consensus (Schroeder 1987). The second factor accounted for only 3.8 percent of variance. This analysis clearly indicates that the participating students had substantial consensus in their ratings of scenic beauty from the images presented, and no factor after factor 2 accounted for more than three percent of variance.

Mean ratings for scenic beauty were obtained from the RMRATE analysis of the 72 slides. Correlations of individual observers with the group ranged from 0.68 to 0.89, confirming the general pattern of consistent preferences noted above. The highest mean value for a desert area was 8.48, for Organ Pipe Cactus National Monument (number of scenes = 10) and the lowest value was 3.43 for Rosemont Basin (three scenes). See Appendix D for more detail. Appendix E, shows the relationship among the mean ratings of the 69 observers and the 72 settings evaluated.

The twenty slides representing the PBR yielded mean scenic beauty ratings ranging from 4.01 to 6.94. To provide a more detailed assessment of the PBR, the 20 slides were divided into high scenic beauty group (11 slides) and a low scenic beauty group (9 slides). Figure 3 presents the mean scenic-beauty ratings over the 14 categories/sub-areas representing the Sonoran desert. Inspection of the figure and the landscape scenes representing each site reveals several trends. First, the very lowest (4.28-4.94) rated settings all included relatively open flat landscapes, dominated by one brush species (*Larrea* and/or *Prosopis* sp), no distinctive geological features and

monotonous contours, sometimes with distant mountains on the horizon and with large areas of bare open dry ground. The lowest rated scenes (4.3 – 5) of the Pinacates also showed a consistent pattern of open range, dominated by one vegetative species (*Larrea*), bare ground with little vegetation cover, volcanic cones only barely visible in the distance or volcanic underground covered with sparse vegetation cover. It is interesting to note that among these lowest rated scenes of the Pinacates, the highest rating was for an extremely sharp-rugged volcanic landscape with little vegetation cover.

As mentioned before, the highest scenic beauty ratings were obtained with images representing ORPI, with the highest score of 8.48 and an average of 7.49. An inspection of these images revealed a trend of higher scenic beauty ratings for scenes containing lush desert vegetation, columnar cacti, prominent geological formations, variation of contour on the landscape, flowers blooming, and vegetative association that included cholla, saguaro, *Prosopis* and ocotillos. In the case of Cabeza Prieta National Wildlife Refuge obtaining the second highest rating, open landscape with spotted vegetation, white granite geology with sharp edges, columnar cacti in association with brush, a background of sharp-mountains, distinctive landscape colors of reddish and white granite were the common trend of these images. Figure 3 places the highest rated scenes (5.71 – 6.94) of the Pinacate BR in the context of the other desert areas. Inspection of the higher-rated PBR scenes revealed a consistent pattern of preference for landscapes containing flowering vegetation in sand with mountains in the near background. Other preferences included columnar cacti in association with desert trees in sandy soils, granite with black-volcanic cones in the near background, lush vegetation in the center of volcano craters,

senita-saguaro-brush association with lava-flow in the background, eroded volcanic features as in the Cerro Colorado eroded face (rating 6.93), flowering *Encelias* with rugged mountains in the background, and columnar cacti on black ash soil with volcanic cones in the background such as in the Tecolote camping grounds (highest 6.94). Table 1 presents a description of each of these locations.

It is important to mention that ORPI, Cabeza Prieta NWR and Pinacate BR are neighboring each other within a Sonoran desert corridor of protected areas in the region. Together they obtained the highest ratings for scenic beauty and also represent one of the highest biodiversity areas of the region, according to TNC, IMADES and Sonoran Institute (Marshall et al. 2000).

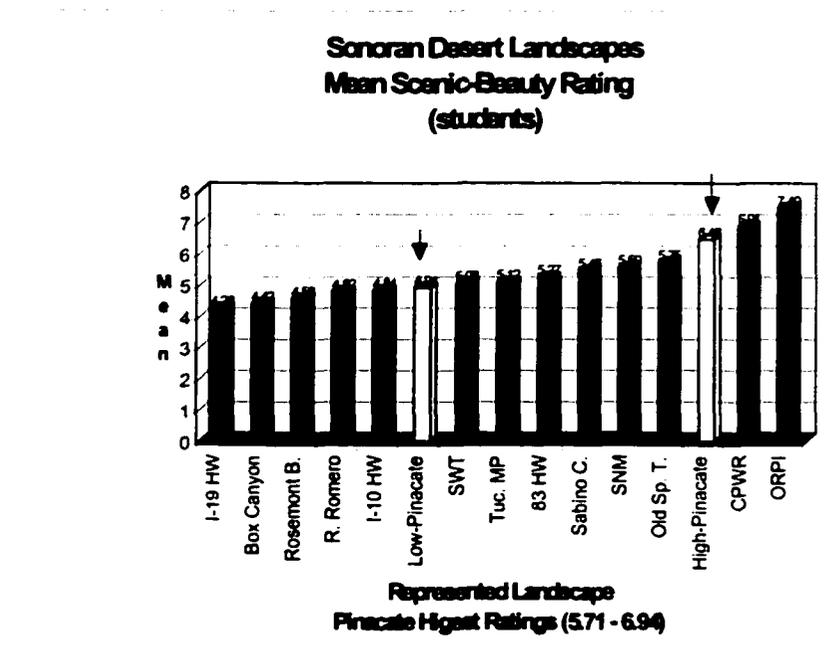


FIGURE 3. MEAN SCENIC-BEAUTY RATINGS. LOWEST AND HIGHEST RATINGS FOR THE PINACATE BR

Table 1. Description of the 14 Areas representing Sonoran Desert Scenic Beauty

Area (mean scenic beauty ratings)	Location	Description	Visual Characteristics
Organ Pipe Cactus National Monument (7.49)	Ajo, Arizona, USA 150 miles West of Tucson, AZ.	Organ Pipe Cactus National Monument. Here, in this desert wilderness of plants and animals and dramatic mountains and plains scenery. The Monument exhibits an extraordinary collection of plants of the Sonoran Desert, including the organ pipe cactus. There are also many creatures that have been able to adapt themselves to extreme temperatures, intense sunlight and little rainfall.	Lush desert vegetation, columnar cacti, prominent geological formations, variation of contour on the landscape, flowers blooming, and vegetative association of cholla, saguaro, Prosopis, ocotillos.
Cabeza Prieta Wildlife Refuge. (6.91)	Ajo, Arizona, USA 130 miles West of Tucson, AZ	The third largest national wildlife refuge in the lower 48 states. Here, seven rugged mountain ranges cast shadows over barren valleys once swept by lava. Saguaros loom in stark profile above the baked earth. A 56-mile, shared border with Sonora, Mexico, might well be the loneliest international boundary on the continent.	Open landscape with spotted vegetation, white granite geology with sharp edges, columnar cacti in association with brush, background of sharp-mountains, distinctive landscape colors of reddish and granite white.
Pinacate and Gran Desierto de Altar Biosphere Reserve. (6.48) – High Ratings	Sonyta, Sonora, Mexico. 200 miles west of Tucson, AZ	Located in the heart of the Sonoran Desert, PBR was declared by the Mexican government in 1993 and received UNESCO's international recognition later that year. The main feature of the PBR is its geology represented by the volcanic landscapes, the Maar type craters (a cone-less volcanic crater formed by a single explosive eruption) and the cinder cones, making this region unique for its landforms worldwide.	Flowering vegetation in sand with mountains in the near background, columnar cacti in association with desert trees in sandy soils and granite with black-volcanic cones in the near background, lush vegetation in the center of volcano craters, senita-saguaro-brush association with lava-flow in the background, eroded volcanic features, flowering Encelias with ragged mountains in the background, columnar cacti on black ash soil with volcanic cones in the background.
Old Spanish Trail. (5.75)	Tucson, Arizona	Gateway to Saguaro National Park district East. Representing a variety of Sonoran Desert plant communities.	Desert grass-mesquite association small hill in the background, prominent saguaro with mountain in the background
Saguaro National Park. (5.59)	Tucson, Arizona. East and West, outside the metropolitan area,	Giant saguaro cacti, unique to the Sonoran Desert, sometimes reach a height of 50 feet in this cactus forest, which covers the valley floor, rising into the Rincon and West Tucson mountains. Since 1933 this extraordinary giant cactus has been protected within Saguaro National Park. Preserved along with it are many other members of the Sonoran Desert community—other cacti, desert trees and shrubs, and animals.	Brush-trees association (mesquite-creosote), cacti and columnar vegetation (cholla-saguaro) with mountains in the background
Sabino Canyon (5.48)	Tucson, Arizona	The nature of Sabino Canyon's topography and climate lead to an unusual diversity in plant life. Its topography features rugged	Prominent saguaro-mesquite association in hillside, cacti-brush-saguaro association with mountain in

		canyon walls narrowing down to a year-round creek bed. It experiences hot desert temperatures during the summer, but still can have snow and frost in the coldest part of winter. Finally, two annual rainy seasons contribute more moisture than many other desert regions.	the background.
Arizona State Highway #83 (5.27)	Southeastern Arizona	Scenic route from Tucson to Patagonia, Arizona, representing rolling hills and grasslands of the Sonoran desert. Based of the Santa Rita Mountains.	Bare reddish ground with spotted mesquite in hillsides, grasslands with mesquite, open grasslands in hillsides with mountains in the background
Tucson Mountain Park. (5.12)	Southwest of Tucson, Arizona	Creosote and brittle bushes as well of other Sonoran desert brush vegetation are well represented in this area. The area is surrounded by black colored hills with 20-30 % vegetation cover.	Mesquite-brush association with bare ground, ocotillo-mesquite association with reddish-black hill in the background
Southwest Tucson Metropolitan Area. (5.08)	Tucson, Arizona	Flat-land with spotted vegetation, monotonous landscape with no prominent features.	Flat open landscape with bare ground and rocky bottoms, presence of sporadic cholla and ocotillo.
Pinacate and Gran Desierto de Altar Biosphere Reserve. (4.94) – Low Ratings	Sonyta, Sonora, Mexico. 200 miles west of Tucson, AZ	Located in the heart of the Sonoran Desert, PBR was declared by the Mexican government in 1993 and received UNESCO's international recognition later that year. The main feature of the PBR is its geology represented by the volcanic landscapes, the Maar type craters (a cone-less volcanic crater formed by a single explosive eruption) and the cinder cones, making this region unique for its landforms worldwide.	Flat open landscape with dominant vegetation cover of creosote bush with Santa Clara peak in the background, black ash-soils with senita and Encelias and sporadic teddy-bear cholla volcanic cones in the background, flat creosote brush over volcanic soil.
Interstate Highway 10. (4.84)	East-West Tucson, Arizona	Open landscape of the Sonoran Desert with presence of grasses and minimum vegetation cover.	Grasslands with sporadic mesquite cover with depressions in the landscape and some hills in the background, bear open ground with presence of creosote bush.
Rancho Romero. (4.82)	State Park North of Tucson, Arizona	West slope of the Catalina Mountains.	Mesquite and grass association and sporadic yucca, minimum vegetation cover with jumping-cholla and prominent mountains in the background
Rosemont Basin. (4.58)	Santa Rita Mountains East of Tucson.	Hillsides and foot hills on the east slope of the mountains, toward the North end of the range.	Mesquite bosque with mountains in the background, rolling hills with grass-brush association.
Box Canyon. (4.43)	Santa Rita Mountains East of Tucson.	This is a site with rolling hills with presence of wash/canyon bottom with good riparian vegetation in some areas.	Rolling hills with mesquite and opuntia with bare rocky ground, hillside (bajada) with brush vegetation.
Interstate Highway 19. (4.28)	South of Tucson, Arizona	Flat lands with association of brush-trees vegetation	Flat land with creosote bush dominating the ground, bare ground with spotted brush cover and saguaros in the distance.

PHASE II. SIMULATED TRIP: SCENIC BEAUTY WITHIN THE PINACATE BIOSPHERE RESERVE

This phase was directed toward assessing the visual quality of the PBR landscape as experienced by visitors, who predominantly travel the main roads of the Reserve.

When traveling along linear features such as roads it is unlikely that people will encounter places in other than the order dictated by the sequential nature of the road (Meitner 1999). This is the case for the Pinacate BR, where accessibility to the area only permits two main entrances to the most visited areas of the reserve, the South entrance from Highway #8 and the North entrance from Highway #2. Managers of the area recommend the South entrance since that is where the visitor center and registration facilities are located. This phase directly addresses whether ratings gathered from individuals in an experimental setting are differentially affected by the direction (traveling North to South vs. South to North) in which the stimuli are presented.

This second phase is divided in two sections: Section 1 was designed to assess the perceived scenic beauty of views from the main roads of the Pinacate BR. Pairs of color slides represented views along 5 road segments, with separate presentations for North-South and South-North travel directions. Section 2 of this phase presented 16 pairs of slides depicting the main destination sites of the PBR. Observers were asked to rate the relative contribution of each depicted site to the overall enjoyment of their (virtual) visit to the PBR. Direction of the trip (South-North vs. North-South) and order of presentation was studied.

Participants

A total of one hundred forty seven observers participated in this phase. Sixty-nine were undergraduate students from the University of Arizona in Tucson and 78 were visitors at Organ Pipe Cactus National Monument (ORPI), who participated in a raffle for a free trip to the Pinacate BR, as an incentive to participate in the study.

Procedure

The settings consisted of a total of 54 pairs of landscape color photographs taken at road (ground) level in the Pinacate Biosphere Reserve. Thirty-eight pairs represented views along the five road segments, and 16 pairs of slides represented the four specific destination sites of the PBR. Photographs were taken every kilometer along the main roads of the reserve starting at the research station in the South entrance and proceeding to Mexican highway #2 at the North entrance. Pictures were taken from the middle of the road at a 45° angle to each side. Each pair of scenes along the road segments represented the landscape view on the left and right, as they would be viewed from a car driving the main roads of the reserve. The road was never prominent in the slides since these are narrow-gravel roads. The slides were organized and presented as a “simulated visit.” Since the PBR has two main entrances (South and North), half of the pairs of scenes were organized to represent the views as they appeared when traveling South to North and half depicted the North to South travel direction (See Figure 2). Only natural landscape features were represented in these pairs of landscape photographs. The images were displayed with two slide projectors on a single screen as seen in Figure 4.

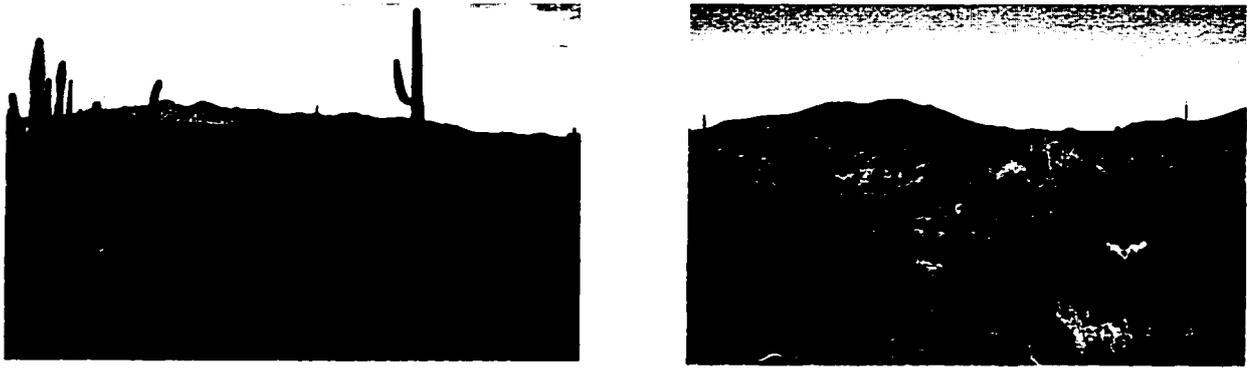


FIGURE 4. DISPLAY OF ROAD SEGMENT LANDSCAPE IMAGES

For the destination sites, 16 pairs of landscape color slides were chosen to represent three of the most visited sites of the reserve and a cinder-mining site that ceased operations in 1993 with the declaration of the reserve. Four pairs of landscape slides represented each of these destination sites where visitors typically get out and explore. The pictures were taken at ground level in different locations as one might encounter them when stopping at the site. Appendix F briefly describes each of the destination sites and shows the type of landscape settings at each site. The four destination sites were observed in the context of the “simulated trip,” provided by the roadside views. Thus each site was “encountered” in the order it would have been in an actual trip (either North-South or South-North) and in the context of the preceding views from the road.

At the University of Arizona, fifteen sessions of from 3 to 10 student participants were conducted. Thirty-five students participated in the North to South representation of the trip and 34 represented the South to North setting. The slides were presented at the Environmental Perception Laboratory of the Department of Psychology. In addition, two sessions were arranged at the outdoor amphitheater of Organ Pipe Cactus National

Monument (ORPI) in order for the visitors to rate the settings. The first session was for the South to North setting and 47 visitors participated. After one week the second session was arranged for the North to South representation and 31 visitors participated. For each session visitors participated in a raffle for a free trip for 9 people to the actual site of the Pinacate BR to see and to rate the real landscapes and destination sites of the reserve. This part is the third phase of Study I explained below.

Rating Scale

Participants were told that their task was to rate a series of places represented by images presented on a slide projector screen. Except for the destination sites, all ratings used a 10-point scale of scenic beauty, where 10 corresponds to very high scenic beauty and 1 corresponds to very low scenic beauty. The four destination sites were rated with different scales, where -5 indicated that stopping at this location would very substantially decrease the overall enjoyment of the visit to the Reserve, and +5 would indicate that the stop would very substantially increase the overall enjoyment of the trip. Participants presented with the visual representations of each place (in this case by pairs of images) recorded an overt indication (a scalar rating) of the relative position of the place represented along the scenic beauty (or contribution to trip) dimension.

Two series of slides were arranged in the “simulated trip” and sequentially ordered to match the order that one would encounter while traveling on the main roads of the Pinacate to get to each destination site. One series represented South to North travel and the other series represented North to South travel. Each observer rated 38 pairs of

road images and 16 pairs of site images, 4 for each particular destination. The numbers of image-pairs representing each of the 5 road segments and the 4 destination sites are presented in Table 2.

Table 2. Images Representing Each Road Segment and Destination Sites of the Pinacates

Segment	Number of Pair-Images	Destination Site	Number of Pair-Images
Field Station to Crater El Elegante	12	Crater El Elegante	4
Crater El Elegante to Cerro Colorado	6	Cerro Colorado	4
Cerro Colorado to Tecolote	10	Tecolote	4
Tecolote to La Laja	7	La Laja	4
La Laja to Mexican Highway #2	3		
Total	38		16

For the students, the ratings were collected in sessions with three to ten participants in each session. Separate groups rated the North-South and the South-North ordered scenes. For the ORPI-visitors, two separate sessions were conducted, the first one represented the South to North travel and the second one represented North to South travel. These two sessions were arranged as special evening presentations in the outdoor amphitheater of ORPI. As a preliminary assessment of the representational validity of the slide-based “trip” with the ORPI-visitors, two-field trips were arranged to the Pinacate BR, one before and the other after rating the slides-images. Nine participants went to each of the field trips where they had an opportunity to rate the studied road segments as well as the destination areas on site (see Phase III).

Results and Discussion

The group to group internal reliability coefficients for the road segments as well as the destination sites were quite high within students and ORPI-visitors (Table 3). These figures support the conclusion that there is substantial consensus in ratings within students and ORPI-Visitors ratings.

Table 3: Group to Group Internal Reliabilities – Phase II

Participants	Number Observers S - N	South-North Group Internal Reliabilities		Number Observers N - S	North-South Group Internal Reliabilities	
		Destination Sites	Road Segments		Destination Sites	Road Segments
Students	34	0.95	0.89	35	0.96	0.92
ORPI-Visitor	47	0.94	0.93	31	0.92	0.87

Road Segments ANOVA Interpretation

An ANOVA was performed on the resulting data for the road views to see the effects of the between subjects variables (group and direction) when crossed with the within subjects variable of location (38 levels). The results show a significant three-way interaction between location by direction by group, $F(37, 4292) = 1.594, p < .013$ as well as a significant two-way interaction for both location by group $F(37, 4292) = 2.279, p < .000$ and location by direction $F(37, 4292) = 14.930, p < .000$, and a significant main effect of location $F(37, 4292) = 22.006, p < .000$. See Appendix G for more detail.

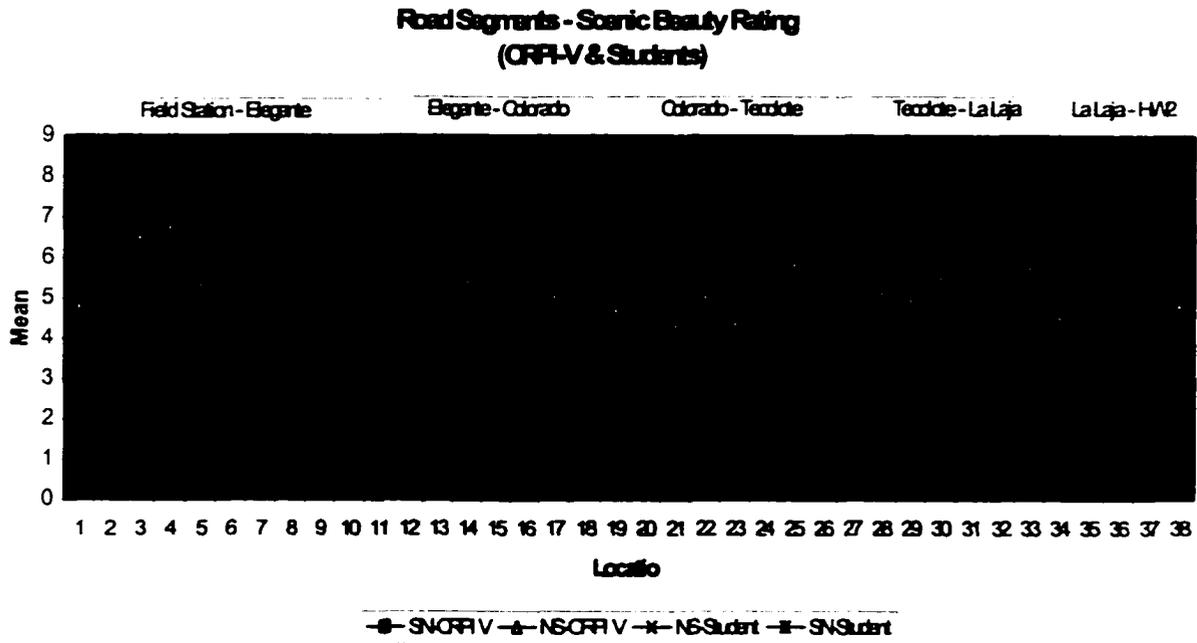


FIGURE 5. LOCATION BY DIRECTION BY GROUP INTERACTION, ROAD VIEWS¹

This result indicates that the difference in mean scenic beauty ratings for the road segments depended upon the conditions of the study from which these ratings were gathered. This indicates that the South-North and North-South presentation methods do not yield the same relative ratings for the 38 road locations.

Inspection of Figure 5 reveals that in general the South to North traveling direction produced higher ratings than the North to South direction independent of whether the observer is a student or a visitor to ORPI. Also it is noticeable that the overall ORPI-visitor ratings are higher than the students. However, comparison of

¹ SN-ORPI V. South-North travel direction for ORPI-Visitors
 NS-ORPI V. North-South travel Direction for ORPI-Visitors
 NS-Student. North-South travel direction for students
 SN-Students. South-North travel direction for students

relative ratings between the two groups indicated a high level of agreement; the obtained correlation coefficient was 0.90 for South-North direction and 0.80 for the North-South direction. Students and ORPI-Visitors largely agree in their relative ratings (See Table 4. Road Segments - correlation coefficients). The absolute difference in mean ratings (ORPI-Visitors > Students) offers at least two interpretations. Because the rating scale provides only an interval scale measure, it is possible that ORPI-visitors and students differed in the arbitrary origin of the scale. In this case, ORPI-visitors may have used a more lax criterion for their ratings (Daniel & Boster, 1976; Brown & Daniel, 1990). Alternatively ORPI-visitors could be interpreted as more "in contact" with the desert-landscape, as they came to the desert to enjoy it and explore it. The students rated the images in the perception lab, which is indoors, and with no reference to the "real" desert-landscape.

Table 4. Road Segment Correlation Coefficients

	N-S Student	SN-ORPI Visitor	S-N Student
NS-ORPI Visitor	0.8954 (38) P= .000	0.2093 (38) P= .207	0.1986 (38) P= .232
N-S Student		0.1594 (38) P= .339	0.1614 (38) P= .333
SN-ORPI Visitor			0.7957 (38) P= .000

(Coefficient / (Cases) / 2-tailed Significance)

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In relation with the direction effect, the South to North order of presentation was rated significantly higher. These differences can have at least three relevant interpretations:

- 1) **The Santa Clara Peak Effect:** The South – North travel direction always has as a focal point this highest peak of the Pinacate BR. From the distance it looks appealing to the eye and builds expectations for the volcanic shield of the reserve. The North – South travel direction does not provide the opportunity to build such expectations, as it puts the visitor at the core of the volcanic shield without much chance to see the changes of the landscape while traveling along the main roads of the reserve. Also, the North-South direction does not have the focal point of Santa Clara Peak.
- 2) **The Elagante Crater Effect:** In the South-North travel direction, the first destination site is El Elagante Crater, one of the most magnificent craters of the region and one of the most visited sites in the PBR. The image that this site presents is breath-taking due to its spectacular dimensions, [820 feet (250m) deep and 3,946 feet (1,200m) in diameter] and the almost perfect circumference of the crater. The Elagante is the seal that represents the PBR, and for a great majority of visitors, this is one of the most preferred sites of the reserve. Visiting this site at the beginning of the excursion may influence in a positive way the quality of the rest of the experience. On the contrary, for the North-South direction, this is the last site visited, so the effect on the ratings may not reflect the Elagante factor, as explained below. These two

effects may put the South-North visitor in the right “mood” to visit the place and it may boost the overall scenic ratings and the quality of experience or enjoyment of the trip.

- 3) **La Laja Effect:** La Laja is a privately owned abandoned cinder mine inside the core area of the Pinacate biosphere reserve. Mining operations stopped in 1993 with the declaration of the PBR. To come to a biosphere reserve or protected area and visit a recently abandoned industrial (mining) site, where you can still observe the old abandoned trucks, old tires and scattered debris may not create a good first impression. This effect may place the observers in a “dislike” mood for the place and may explain why the ratings from North-South are in general lower than the South-North travel direction.

Together with the “La Laja” cinder mine, there were some other points along the roads that reflected the effects of scattered cinder mining activity within the PBR, where the top layer of cinder has been removed, changing the natural condition of the landscape (Figure 5). It is important to mention that even though these places no longer have their natural “look”, neither the students nor the ORPI-visitors seemed to mind this visual change. The ratings that they gave to these sites did not disagree from the general ratings of the rest of the roads. In fact, from the ORPI-visitors, the highest rating (7.8 in Figure 5) recorded from both directions (S-N and N-S) of the road segments was for one of these sites (Figure 6). The sites that reflected cinder mining activity along the road were recorded in Figure 5 as location 9,10, 11, 29 and 31. Therefore, in terms of scenic beauty

for these groups, the scattered cinder mining activity along the roads did not change the perception of the place. In fact observers probably did not recognize the visual difference between a site with prior cinder mining activity and a natural setting.



FIGURE 6. SURFACE CINDER MINING ALONG THE ROADS

Destination Sites ANOVA Interpretation

An ANOVA was also performed for the destination sites to illustrate the effects of the between subjects variables (direction and group) when crossed with the within subjects variable of destination sites (16 levels). The results disclosed a not statistically significant three-way interaction between site (slide-pairs) by direction by group, $F(15,1800) = 1.175, p < .284$ and a significant two-way interaction for both site by group $F(15, 1800) = 2.128, p < .007$ and site by direction $F(15, 1800) = 5.280, p < .000$, and a significant main effect of destination site $F(15, 1800) = 58.588, p < .000$, as seen in Figure 7. See Appendix H (Destination Sites ANOVAS) for more detail.

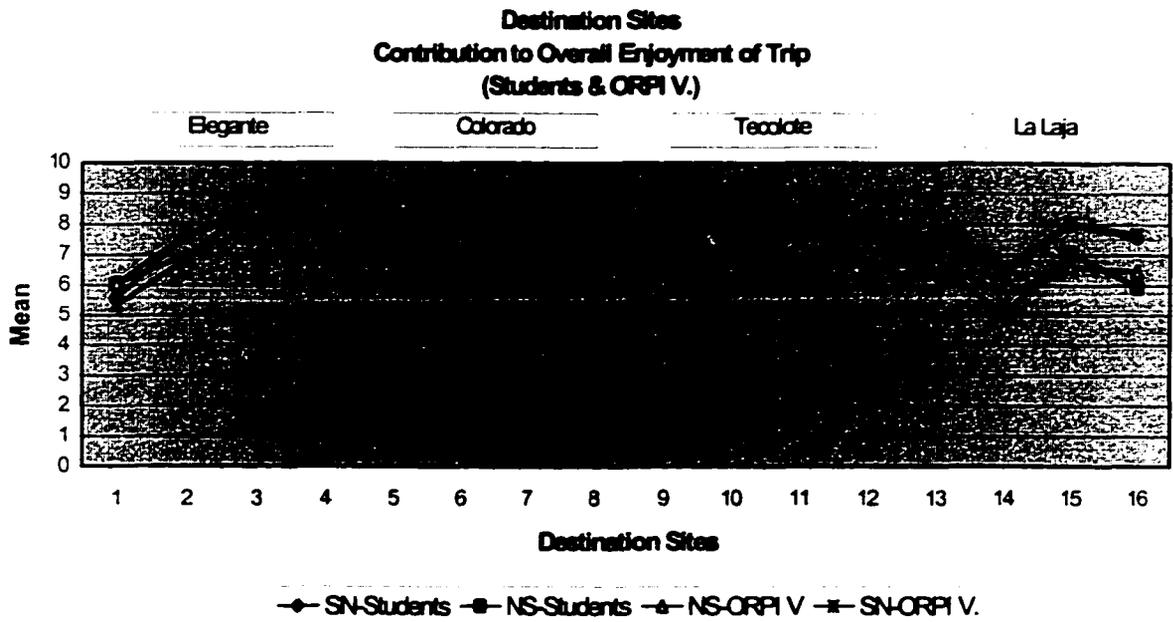


FIGURE 7. DIRECTION BY GROUP BY SITE INTERACTION. DESTINATION SITES

These results indicate that the difference in mean ratings for the contribution to the overall enjoyment of the trip from the destination sites depended upon the conditions of the study from which these ratings were obtained. Therefore the South-North and North-South travel directions do not yield the same ratings for the 16 pairs of slides representing the four destination sites, indicating that they are different depending on which travel direction is taken. However, this statistically significant difference may be minimal since the level of agreement between the two groups and the two travel directions is also high; the obtained correlation coefficients are presented in Table 5.

Table 5. Destination Site Correlation Coefficients

	N-S Student	S-N ORPI Visitor	S-N Student
N-S ORPI Visitor	.9446 (16) P=.000	.8109 (16) P=.000	.8202 (16) P=.000
N-S Student		.7116 (16) P=.002	.8072 (16) P=.000
S-N ORPI Visitor			.8881 (16) P=.000

(Coefficient / (Cases) / 2-tailed Significance)

" . " is printed if a coefficient cannot be computed

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A closer inspection of Figure 7, together with the correlation table, reveals a certain pattern in the level of agreement among the observers with a minimum level of "crossover" indicating that all the observers consistently rated the overall enjoyment of each destination site. Even though there is minimum crossover among the observers' ratings this is sufficient to be statistically significant. These ratings agree with the road segments ratings in terms of travel direction/ order of presentation. As was mentioned in the road segments discussion, travel direction plays an important role in the expectation of the place and the different landscape changes that are encountered in the S-N direction. This puts the visitor in the right mood for the place. On top of this, there is also the first destination site El Elegante crater, which offers one of the most spectacular views of the Pinacate BR. Opposing this is the N-S travel direction, placing the visitor right at the heart of the Pinacate without much chance to develop a feel for the place. Also, the first

destination site in this direction is La Laja. This may influence the responses for the rest of the trip and the other destination sites. It is noted in Figure 7 that in general, the lower ratings are given to the N-S travel direction, the reason may be La Laja effect and travel direction.

Without consideration of travel direction and order effect, there is also the issue of image (slide) within each destination site. The lower ratings of contribution of enjoyment of the trip from each destination site were given to the scenes showing evidence of human activity, such as parking areas in El Elegante and Cerro Colorado, camping sites in Tecolote, and mining activity in La Laja. See Appendix I, Panel A, presenting the images with the lowest ratings. The opposite was also true for the higher ratings, the images depicting no evidence of human interaction with the landscape and showing spectacular viewsheds that characterize each destination site received the highest rated contribution to enjoyment, as we can see in Appendix I, Panel B.

PHASE III. ON-SITE EVALUATION OF ROAD SEGMENTS AND DESTINATION SITES

The third phase was conducted to investigate how adequately the slides (virtual trip) represented the PBR (desert) natural landscapes. According to Daniel and Boster (1976) and others, there is strong evidence that slides and color photos can represent natural landscapes for scenic beauty judgements. This phase is a limited on-site validation of the method, as only a small number of on-site visitors could be tested. This phase compares rating results from the slide-simulated trip with on-site ratings for the 5 road segments and 4 destination sites on the PBR.

Participants

A total of 18 observers participated in this phase. All of them were visitors at ORPI and participated in the slide-simulated trip and they were also the winners of the raffle for a free trip to the Pinacate BR. This raffle was structured as an incentive for the participants to be part of the simulated trip of Phase II, but also to have participants for the on-site evaluation. Half of these participants rated the South-North traveling direction on-site after rating the slide-simulated trip and the other nine rated the North-South direction on-site before rating the slide-simulated trip. The field trips were one week apart.

Procedure

After the South – North slide-simulated trip presentation (Phase II) at the outdoor amphitheater of ORPI, a raffle was conducted to select 9 participants to go on the first of

the two field trips organized to the Pinacate BR. The next morning, the field trip was conducted with a local tour operator from Ajo, Arizona and the author as a host. At the field station and visitor center of the Pinacate a very brief presentation from a park ranger of the reserve was given to the group. At the entrance of the reserve the rating sheet for the expedition was distributed to the nine participants. Each of the 5 road segments was rated as a whole (1 lowest – 10 highest ratings for scenic beauty), and the destination sites were also rated as a whole from –5 to +5 (-5 lowest contribution to the overall enjoyment of trip; +5 highest contribution). The participants then rated the whole road segment from beginning to end, as opposed to rating each 1-km photo-sample point as with the slide presentation (Phase II). The same strategy was used for the four destination sites. Participants rated the whole destination site instead of each sample point within the destination. The road segments and destination sites are presented in Table 2 of Phase II.

For the North-South field trip, ORPI staff as well as a volunteer group stationed at ORPI for the winter months assisted the author in organizing the field trip the morning before the slide presentation. Nine volunteers showed up for the field trip, on this occasion the author was the host as well as the driver for the expedition. The entrance to the Pinacate for this group was from the North end, where a brief explanation of the reserve (similar to the presentation at the visitor center for the South-North group) was given to the group. The same rating scale for road segments and destination sites as for the South-North direction was used. The order of the road segments as well as destination sites was the opposite of the South-North expedition.

Road Segments and Destination Sites from the North entrance of the Pinacates

Road Segments	Destination Sites
High Way #2 – La Laja	La Laja Mining Site
La Laja – Tecolote	Tecolote Camping Site
Tecolote – Cerro Colorado	Cerro Colorado Crater
Cerro Colorado – Crater Elegante	Crater Elegante
Crater Elegante – Field Station	

The North – South participants rated the road segments and destination sites before they saw the slide- simulated trip at the amphitheater of ORPI. After the field trip, the nine participants rested and later that night we met again with the rest of the participants for the slide-simulated trip of the Pinacate BR.

Results and Discussion

The group-to-group internal reliability coefficients for the road segments as well as for the destination sites are presented on Table 6.

Table 6. Group to Group Internal Reliability – Phase III

Participants	Number Observers S - N	South-North Group Internal Reliabilities		Number Observers N - S	North-South Group Internal Reliabilities	
		Destination Sites	Road Segments		Destination Sites	Road Segments
Pinacate-Visitor (on-site ratings)	9	0.86 ^a	0.62 ^a	9	0.86 ^b	0.60 ^b

^aRatings on actual site after seeing the slides

^bRatings on actual site before seeing the slides

Even though the group to group reliability for the Pinacate-Visitor is higher than 0.50, it is lower than for the slide-based judgements (see Table 3 Phase II) due mostly to the low number of observers that took the field trips. Also the on-site observers made only one rating for each road segment between destination sites, not at each 1-km photo-sample site, as was the case for slide based judgements. These figures none-the-less support the conclusion that there is substantial consensus in ratings within each of the groups. The reliability numbers indicate a higher level of agreement for the destination sites (all above 0.80) and a lower level of agreement for the road segments (all below 0.65).

It is important to mention that only 9 participants rated the road segments and the destination sites for each travel direction, therefore the data presented here is not sufficient to endorse the slide-based results. None-the-less these data do provide a preliminary comparison between on-site and slide-based judgements.

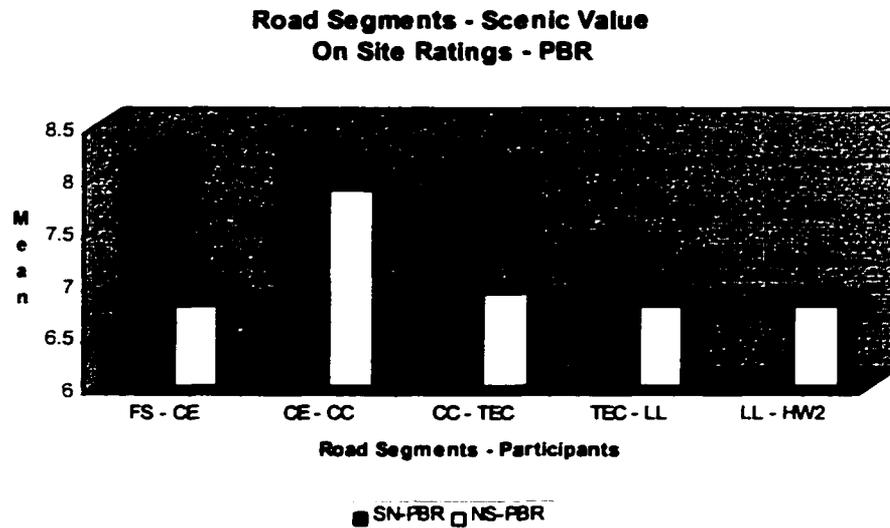


Figure 8. Pinacate BR Visitors, On Site Scenic Value Ratings*

On Site Ratings for the Road Segments

Figure 8, represents the on-site value ratings given by the nine Pinacate visitors. The South-North direction effect of the field ratings is clearly dominant and consistent with the slide-based ratings, where the “Santa Clara Peak” and/ or the “Elegante Crater” effects may play an important role as discussed in Phase II. Another important element of the field trip experience is the fact that the visitors assigned to the South-North direction had an opportunity to stop at the visitor center of the reserve and meet briefly

* FS-CE Field Station – Crater Elegante road segment
 CE-CC Crater Elegante – Cerro Colorado road segment
 CC-TEC Cerro Colorado – Tecolote Camp-Site road segment
 TEC-LL Tecolote – La Laja road segment
 LL-HW2 La Laja – Highway #2 road segment
 NS-OPBR North-South travel direction slide ratings after visiting the Pinacate
 SN-PBR South-North travel direction on site ratings
 NS-PBR North-South travel direction on site ratings

with some of the reserve staff. A short presentation of the reserve was given to the visitors, which may also have influenced the ratings or the “feel” for the place.

The opposite can also be said for the North-South field trip. In this direction, scenic value ratings are among the lowest for the road segments, and the Santa Clara Peak cannot be seen as magnificent as in the South-North direction. As it was already mentioned in Phase II , the “La Laja” effect may put the visitor in a “dislike mood” for the place, reflecting lower values for the overall ratings of the road segments of the PBR.

Figure 9 presents the rating patterns for ORPI and Pinacate visitors. To make this comparison, the means of all photo-points within each of the 5 road segments for the slide-based judgements of the ORPI-visitors was calculated. This was done to be able to compare the slide-based ratings with the on-site ratings. The same conclusion can be drawn from this figure where the South-North travel direction produced overall higher ratings for both the slide-based and the field trip judgments. The differences are with the scale used, the people that experienced the field trip, tended to assign higher ratings than those who did not experience the field trip.

From all the participants (slide-based/ ORPI-visitor and on-site ratings/ Pinacate-visitor), the road segments that obtain the highest scenic value were Crater Elegante to Cerro Colorado and the Field Station to Crater Elegante respectively. This is consistent with the lush vegetation, interesting geology, volcanic ash, vegetation association of desert trees (palo verde, ironwood) on lava flows-volcanic ash, consistent with the observations presented in the findings of Phase I.

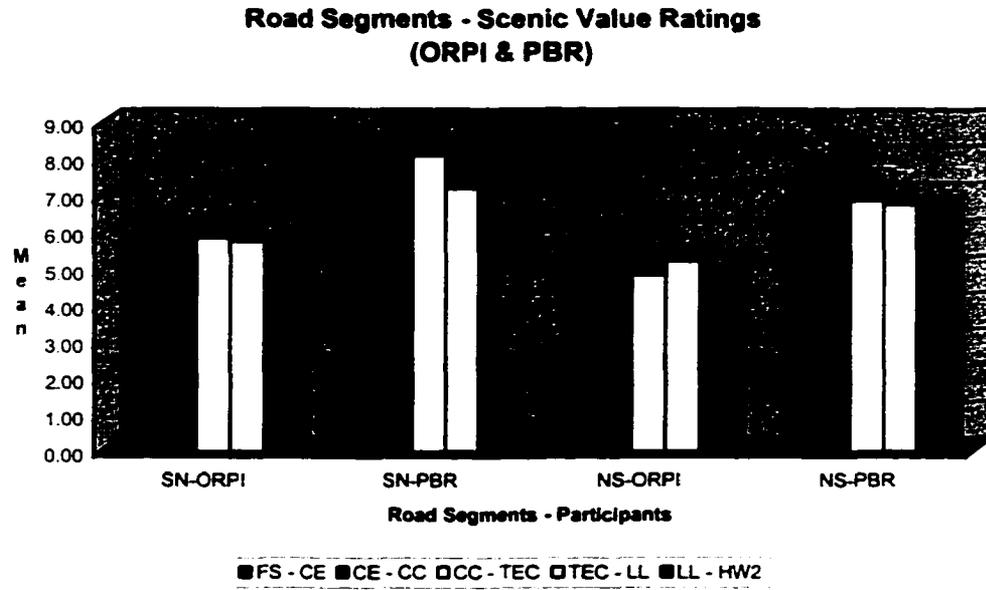


FIGURE 9. SCENIC VALUE RATINGS OF ROAD SEGMENTS FROM ORPI-VISITOR AND PINACATE-VISITOR

Where:

- SN-ORPI Slide-based rating, South-North simulated trip ORPI-visitor
- NS-ORPI Slide-based rating, North-South simulated trip ORPI-visitor
- SN-PBR On-Site rating South-North field trip PBR-Visitor
- NS-PBR On-Site rating North-South field trip PBR-Visitor

On-site Destination Ratings

Among the four destination sites visited in this phase, Elagante Crater is the one that consistently obtained the highest ratings for overall enjoyment of the trip followed by Cerro Colorado Crater. The South-North field trip visit, puts the Tecolote camping site in third place followed by La Laja mining site, while the North-South travel direction puts La Laja in third place and the camping site was placed at the fourth preference level. This could be explained by the order of visitation, since the mining site La Laja was the first stop for the North-South travel direction. Figure 10 shows this tendency.

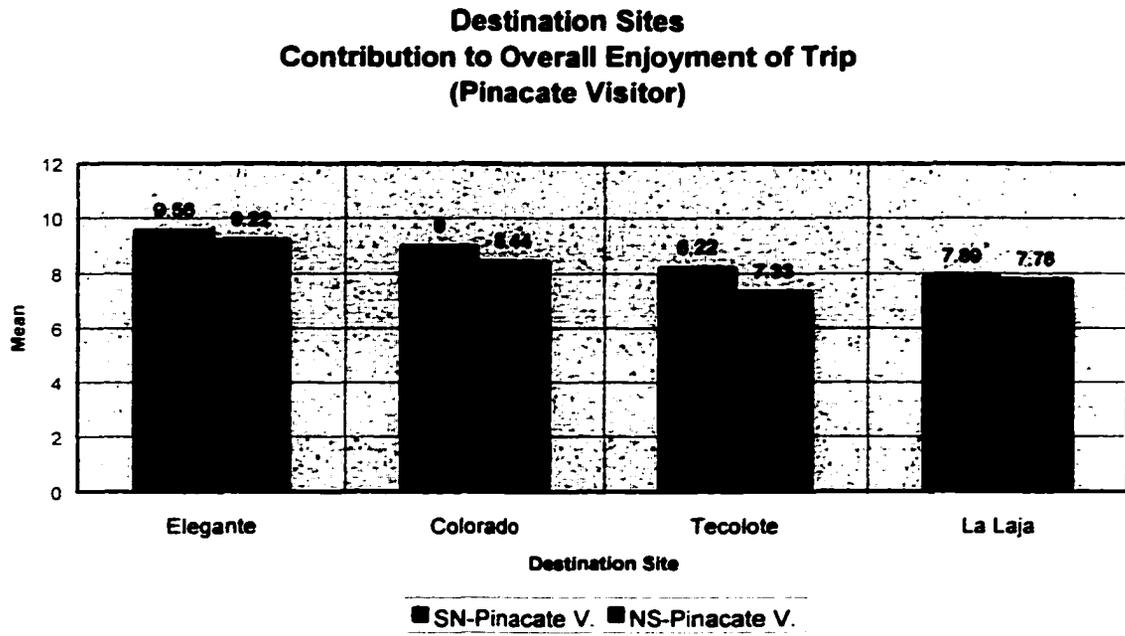


FIGURE 10. ON-SITE DESTINATION JUDGEMENTS
 Note: The numbers in the column represent the order of visitation.

The means of the four pairs of images representing each destination site in the slide-based judgments also shows evidence that Crater Elegante has the highest ratings for the overall enjoyment of the trip. Furthermore in some cases, even La Laja presents a higher level of preference than the Elegante and Tecolote sites as is shown in Figure 11 for the ORPI-Visitor traveling in the South-North direction.

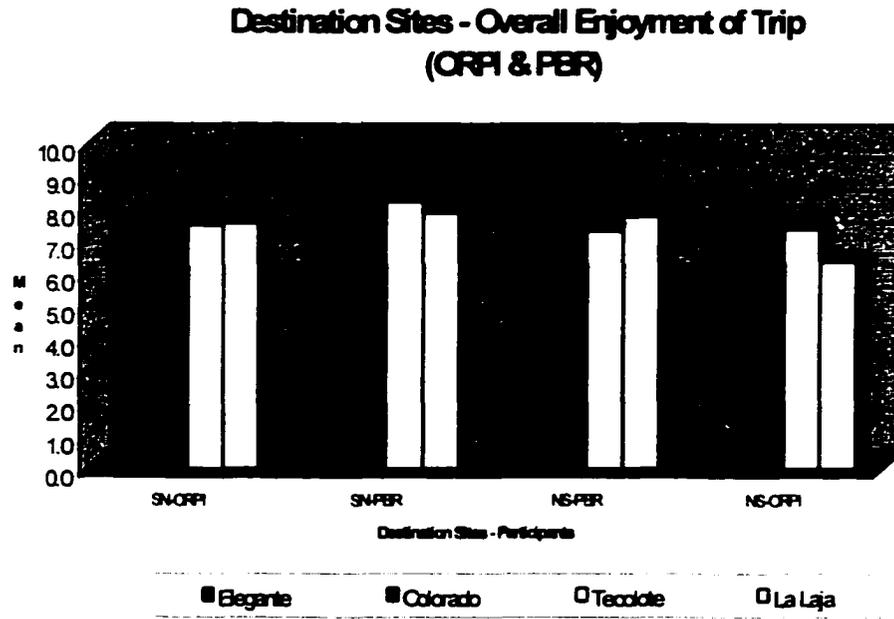


FIGURE 11. CONTRIBUTION TO THE OVERALL ENJOYMENT OF THE TRIP

The problem with Figure 11 is that it is difficult to compare the same ratings with the actual on-site valuation. This graph takes into account the four pairs of images presented in the slide-based valuation and compares the means of those images. A more “realistic” representation of the results could be the one presented by Figure 12. This graph represents only the ratings for the main feature of Elegante Crater and Cerro Colorado Crater. That is showing the two pairs of images representing the actual crater of these two sites, and leaving out the other two pairs of slides representing the trail to the site from the parking area and a panoramic view of the landscape surrounding the destination site. By doing this we can see a more consistent pattern of valuation from the slide-based and the on-site ratings. Apparently the on-site participants’ ratings of the

destinations were more influenced by the main characteristics of the sites (e.g. the volcanic craters) and not the surrounding areas or development features.

Site Within Destination - Overall Enjoyment of Trip (ORPI & PBR)

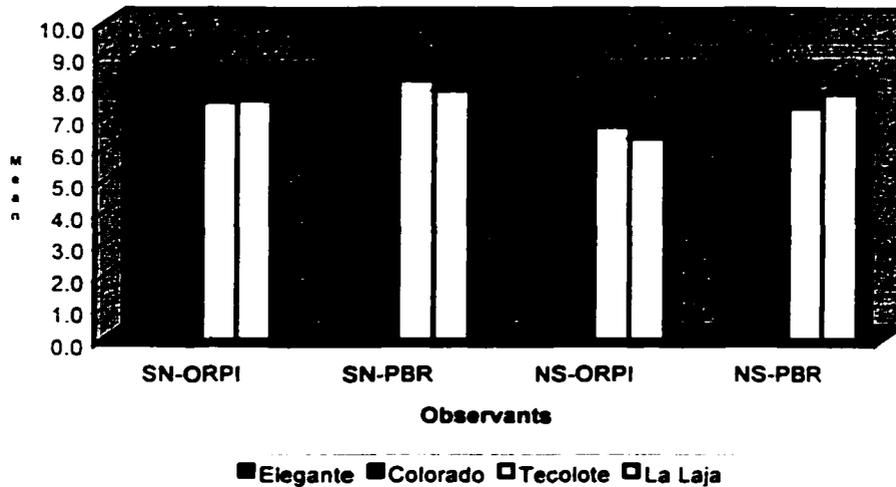


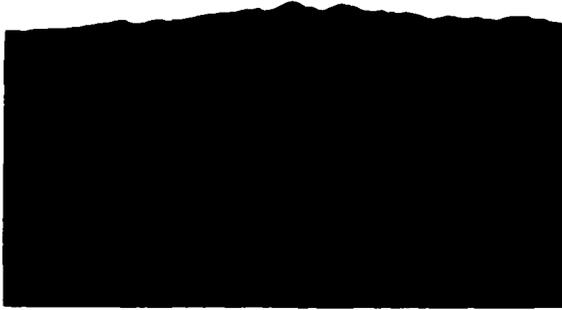
FIGURE 12. SITE WITHIN DESTINATION FOR ELEGANTE AND CERRO COLORADO

Figure 12 presents a higher level of agreement in the valuation of the participants: ORPI-Visitors and on PBR-Visitors. It is evident that Elegante Crater and Cerro Colorado Crater are most preferred for all groups. The Tecolote camping site and La Laja mine site present a different pattern. Fifty percent of the participants (SN-ORPI and NS-PBR) gave La Laja a higher level of enjoyment than the camping site. The other fifty percent (NS-ORPI and SN-PBR), preferred the Tecolote, but the numbers are not far apart, indicating that the differences are minimal.

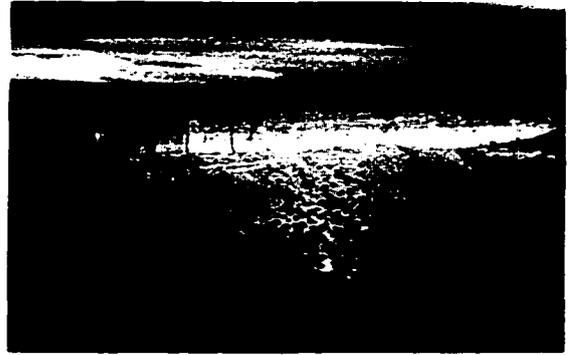
Even though the field trip participants were few in number (nine for each direction), it is important to mention that the level of agreement between the individual observers and the group was quite high, as it is indicated by the correlations of ratings of individual observers with the group: 0.98 for the Pinacate visitor traveling South – North and 0.87 for the North - South travel direction. The results indicate a higher level of correlation but not as high as it is within the slide-based simulated trip. Again this could be interpreted as the need for better representation of the on-site field trip judgments. None-the-less, these results were generally consistent with the slide-based data and support the utility and applicability of the virtual trip method.

At the end of the simulated-trip as well as the field trip, participants were asked to rank in order of importance the contribution to the overall enjoyment of the visit to the PBR by the four destination sites “visited.” The images ranked are presented in Figure 13. Their rankings can be seen in Figure 14.

It is evident that Elegante Crater is the most preferred destination site according to this graph with the exception of the PBR-visitor traveling in the North-South direction placing the Cerro Colorado Crater as the most preferred destination. This is consistent with the ratings of the overall enjoyment of trip (Figure 12). If we combine the overall rankings of all the participants, the pattern is clearer solidifying what the slide-based judgments and the on-site ratings showed. This puts Elegante Crater as the most preferred site followed by the Cerro Colorado Crater. Surprisingly enough La Laja mining site is more preferred as a destination than the camping site of Tecolote, as shown in Figure 15.



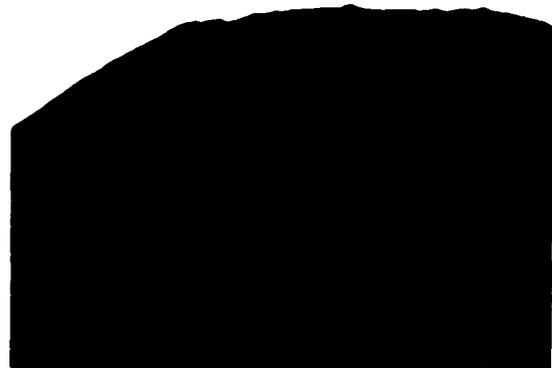
Crater Elegante



Cerro Colorado



Tecolote Camping Site



La Laja Mining Site

FIGURE 13. DESTINATION SITE IMAGES

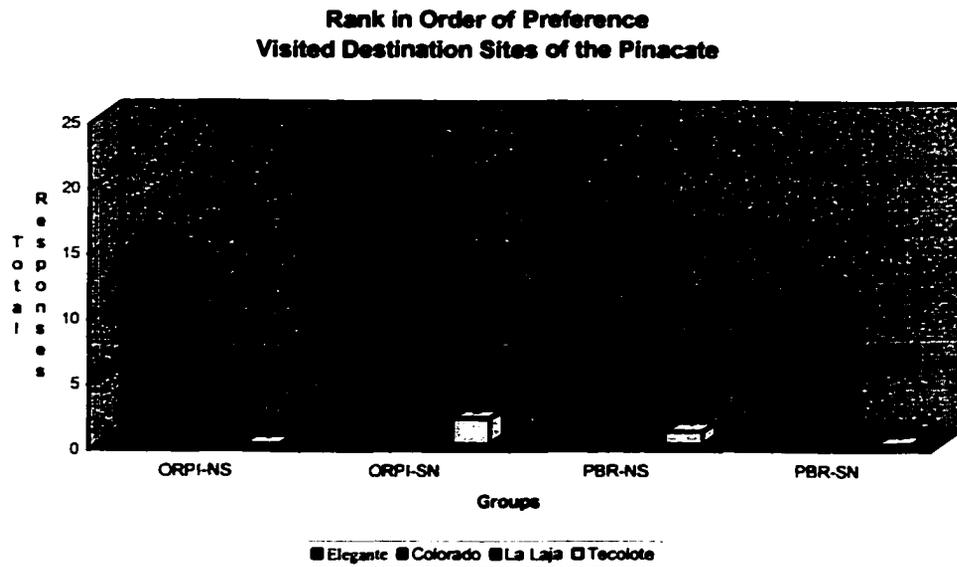


FIGURE 14. ORDER OF PREFERRED DESTINATION SITES

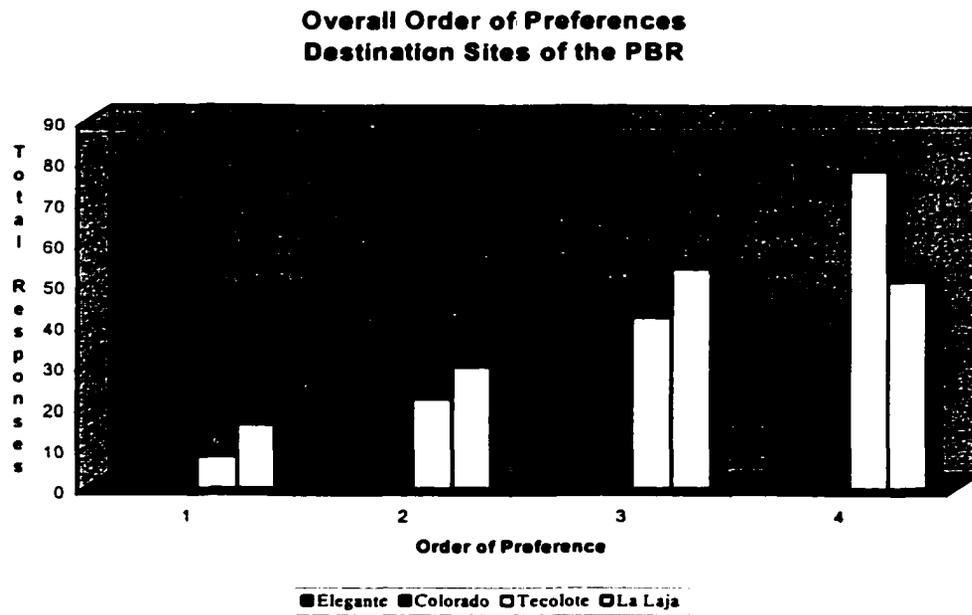


FIGURE 15. OVERALL PREFERENCE OF DESTINATION SITES OF THE PBR

The North - South PBR-Visitor Group

This group took the N-S Pinacate field trip and it was possible to identify them before and after the slide presentation. These 9 participants were able to provide on-site ratings as well as slide-based judgements of the road segments and destination sites. The slide-based ratings present lower group reliability coefficients (0.82 for destination sites and 0.70 for road segments) in comparison to the students and ORPI-Visitor (>0.90) [see Table 3] that did not visit the Pinacate sites. This may be an indication that the 9 participants that visited the sites used a lower scale for the slide-based judgements since they already experienced the sites directly earlier that day and their images were still fresh from the real visit. However, even though with a lower scale the tendency holds where the destination sites have a higher level of reliability than the road segments. It is evident from Figure 16 that the on-site judgements used a higher scale than the slide-based ratings. Even though the scales are different the pattern of preferences still holds for the road segments, where the Crater Elegante – Cerro Colorado segments present the highest scenic beauty independent of whether the judgements are slide-based or on-site (Figure 16, upper panel). This is consistent with the judgements of the ORPI-visitors, indicating that the actual trip did not alter a great deal their judgements. Therefore, the slide-based simulated trip is a good representation of the actual trip. Figure 16, also presents a comparison of the slide-based judgments from the group that visit the PBR (SB-PBR-V) and the rest of the group that did not visited the PBR (SB-ORPI-V). These ratings are consistent with each other and there is little difference among them, indicating a level of agreement between these two groups.

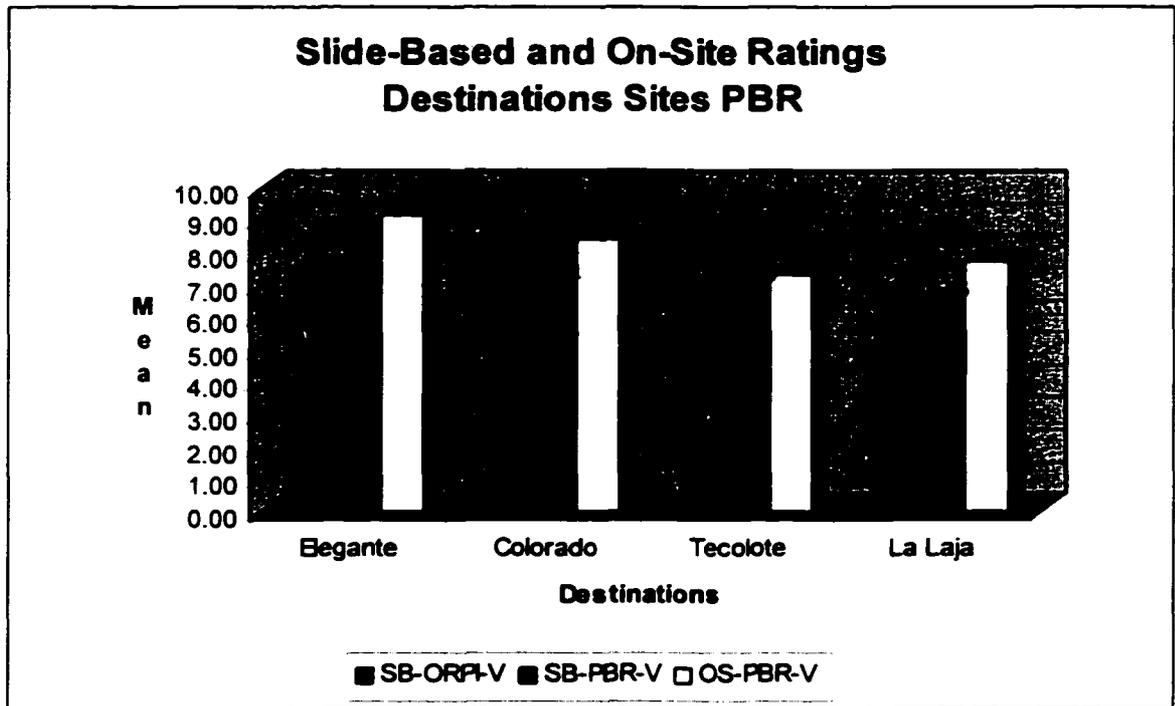
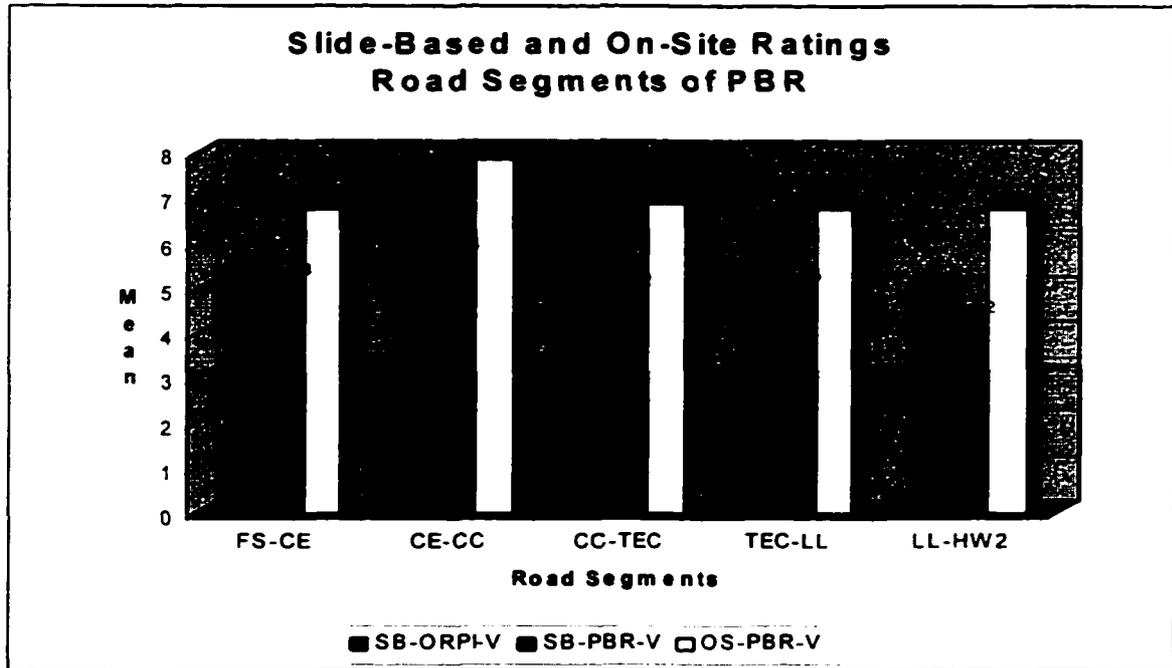


FIGURE 16. SLIDE-BASED AND ON-SITE RATINGS FOR ROAD SEGMENTS AND DESTINATION SITES OF THE PBR. NORTH-SOUTH PBR-VISITOR

STUDY II. THE BATTLE OF PERCEPTIONS

This section interprets the results of several research methods applied to three distinctive populations: International visitors, human communities within the buffer zone of the reserve and managers-staff of the PBR. Each population was studied using a different research method. For visitors I used a direct questionnaire as part of the simulated trip presentations with ORPI-visitors. For the community, I reviewed minutes and notes as well as data from direct observation of community meetings organized by the PBR-staff. For the managers I used an open-ended questionnaire applied to the managers-staff of the PBR.

The intention here is to acknowledge the different perceptions of these populations with regard to the global issue of conservation based on community-development within a Biosphere Reserve. A concept established by UNESCO.

ORPI-VISITORS

At the end of the simulated trip presented at the outdoor amphitheater of ORPI and together with the slide ratings applied to the visitors-campers, there were some general verbal questions regarding “likes and dislikes” of their visiting experience to the Sonoran Desert. Another important question was to assess the importance of conservation and local residents’ benefits while touring the area. Their responses are summarized next.

Participants Characteristics

Participants in the simulated-trip sessions represented a range of outdoor tourism experience, extending from individuals taking one or more outdoor trips per year for the past 10-15 years to those who had only recently taken their first trip. Some individuals had visited ORPI every year for the last 5-10 years. Their origin also varied, most were from the continental USA, and some were from Canada and a few from Germany participated in each study group.

The analysis of written responses of the two groups (S-N and N-S groups) that participated in the study were reviewed abstracted and grouped into similar categories. No important differences were noted in the responses from the two groups. Individual written responses as to *the reason for choosing a desert destination and likes and dislikes* questions regarding the current trip are summarized in Appendix J.

The great majority of the participants strongly endorsed the warm weather in the winter months (November – April) of the Sonoran Desert as an important reason for choosing an outdoor experience in the desert, particularly Southwestern Arizona. Access to incredible scenic landscapes, great opportunities for learning experiences about the desert, quiet and peacefulness, and the opportunity to see wildlife in a very unique landscape, were all factors considered in making a trip to the desert. In conclusion, both the warm weather as well as the scenic beauty of the Sonoran Desert were of vital importance to the two groups of participants. Some characteristic reasons presented by the participants include:

I don't generally enjoy the desert. HOWEVER, I have visited Organ Pipe every year since 1992, the quiet, serene and rugged beauty is the attraction.

Because the Sonoran Desert is something really unique which brings so much spirituality to me.

The weather of the Sonoran Desert is warm enough for spending the days outside and tent-camping at night.

We love the enduring warm and magic that the desert seems to have.

Consistent with the responses to the *reasons* question, the most important *likes* cited, tended to be divided between scenic beauty, qualities of the outdoor experience such as solitude - serenity, night-skies and wilderness characteristics of Sonoran Desert such as cacti, bird watching and flora and fauna of the desert. Examples of *likes* reported include:

Seeing the different and unique environment of the desert while hiking along open landscapes is what I like the most.

The saguaro cactus, the mountain's geology, and the great open and beautiful vistas of the Sonoran Desert.

The birds have been wonderful – so many of them boldly going about their natural activities despite my presence.

The lush growth of this incredible desert and learning how things survive in this unique environment.

Sitting still

Dislikes were generally few and of much less importance to participants.

Negative factors cited included an array ranging from the weather (wind), insects and

poisonous critters to negative setting factors such as washboard roads, campground designs and trash. Some of the complaints of the visitors were:

Some insects are very annoying.

Seeing how people destroyed the beauty by throwing out their trash.

Worrying about rattlesnakes and other harmful critters. I will like to see a rattle in a way, but I do worry some.

No showers and some washboard roads are really bad.

It's sad to see the overgrazing outside the park (ORPI) on ranches. The campsite allows too many "RVs" (Recreational Vehicles).

Finally, the last question was in relation to balancing the importance between minimizing negative impacts on the local environment and the importance for local residents to benefit from the tourism activity, and the management implications of choosing one or the other emphasis. This question was within the context of integrating conservation of natural environments with enhancing the well being of the local human communities. The following statement was read before answering these last questions:

Tourism has several effects on the environment and on the local residents of the areas that are visited. While any human use can have negative impacts on natural environments, tourism can increase the values of special places and provide an important reason to protect the area against other potentially more damaging uses. The philosophy of the Biosphere Reserve concept is to integrate conservation of natural environments with enhancing the well being of the local human residents, creating a platform for experimenting to find human uses that are compatible with conservation of natural resources.

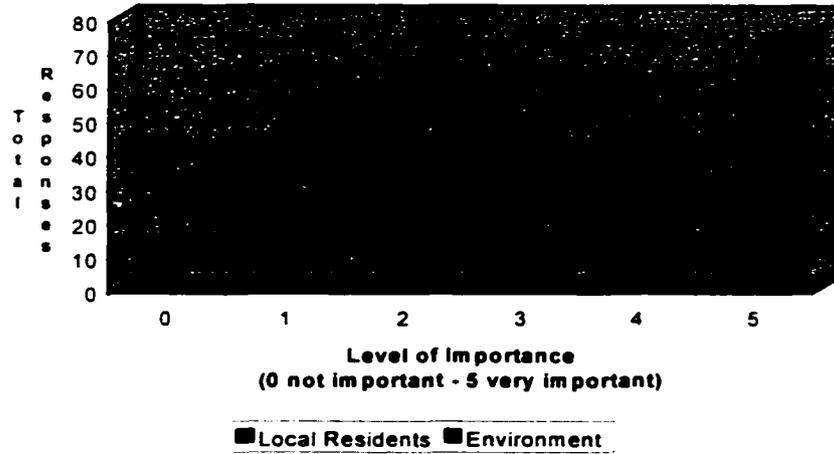
Figure 17 presents a graphic representation of the answers to these questions. The first graph (A) is an interpretation of the two individual questions dealing separately with:

1) how important is it to you that your visit has minimum negative impacts on the local environment? And 2) how important is it to you that local residents benefit from your tourism activity?

The participants were asked to circle a number on a scale from 0 (not important) to 5 (very important). The intention of these two questions was to give an opportunity to the students and the ORPI-Visitors to express the importance of environmental issues in the areas they visit as well as to put a human face (local communities) on their outdoor experience.

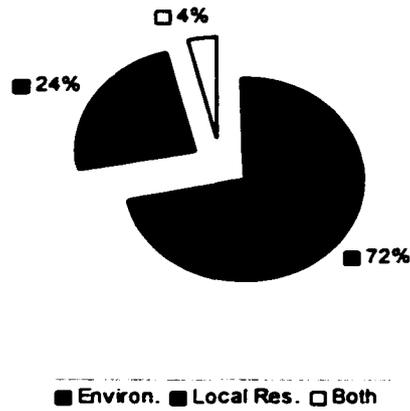
From panel A in Figure 17, it is clear that the great majority of the participants agree on the importance of minimizing their impact on the local environment while visiting the area. The importance of benefits to local residents through tourism activities was placed as a second priority by all of the participants. It is important to notice even though the local residents are not the highest priority, the visitors recognized that benefits to local residents have some level of importance in their tourism experience. It is clear however, that they care more for the protection of the environment. This brings some perspective with respect to community development and conservation of natural resources through tourism activities. In these two questions the participants had the opportunity to rate each value separately on the 0-5 scale, allowing them to rate both the environment and the welfare of local people equally.

Importance of Minimizing Negative Environmental Impacts and Providing Local Residents Benefits



A

Total Percentage in Favor of Environment and Local Residents



B

FIGURE 17. MINIMIZING NEGATIVE IMPACTS TO THE ENVIRONMENT AND PROVIDING BENEFITS TO LOCAL RESIDENTS THROUGH TOURISM

The two separate questions were rephrased to “force” the participants to choose between the environment and local residents. This question was:

In cases where we have to choose between protecting the environment or helping the local residents, how would you advise the managers of the Pinacate Biosphere Reserve?

Panel B of Figure 17, presents the aggregated response presenting 72 percent in favor of the protection of the environment, while favoring assistance to local residents received 24 percent of the responses. Even though favoring both was not given as an option, 4 percent of the participants wrote in that response. Once again the tourists clearly care more for the protection of the environment than for providing benefits to the local community.

LOCAL RESIDENTS OF THE PINACATE BIOSPHERE RESERVE

The population density of the Pinacate Biosphere Reserve is around 0.02 inhabitants/km² which means that around 200 people live permanently in the 714,556.5 hectares of the reserve. Most of these people are concentrated along the main national highways #2 and #8. There is another segment of the population (estimated at 1,288 individuals) with legal rights to use and affect the land of the PBR. There are around 23 Ejidos that influence 44 percent of the 269, 504.5 hectares of the nuclear zone of the PBR and 87 percent of the 445,051 hectares of buffer area (INE 1995). Therefore we could say that this is an “Ejido Biosphere Reserve” (Reserva Ejidataria). Ejido is a form of communal land tenure established after the Mexican Revolution. Normally “Ejidatarios”

(Ejido members) reside on their communal land. But in some situations including the PBR, a segment of population who reside elsewhere maintain the right to use the land and they have the right to know what is happening there. Most of the Ejidatarios live in the urban communities of Puerto Peñasco, San Luis Rio Colorado and Sonoyta, outside of the Pinacate Reserve. Most of these Ejidos were created during the 1970s, bringing a new population to the desert with great hopes that the land was going to give them the prosperity and quality of life promised by the Mexican government. This promise was to be achieved with agricultural technology and ranching operations in the heart of the Sonoran Desert. Through the years and at great cost, they started to realize that the promised land was not going to be the garden that they had in mind. They started to migrate back to the urban centers that promised a better life for their families and themselves. The land was left behind, open to all kinds of unregulated practices such as hunting, cinder mining, wood harvesting, overgrazing, and recreation. Later, much more regulation was imposed by presidential decree with the declaration of the Pinacate Biosphere Reserve in 1993. It has not been easy for this population to deal with two major top-down governmental programs, first the establishment of the Ejido land tenure system and presently the declaration of an internationally recognized biosphere reserve.

These ejidatarios are still looking for their identity in the Sonoran Desert and the Biosphere Reserve Concept may be the new paradigm they seek. This is the “local population” that we concentrate on in this section. Through a review of a series of 1) community meetings organized by the PBR staff during the period of 1996-1999; 2) documents and reports prepared by the PBR- staff and independent consultants regarding

community issues and; 3) direct observation and informal interviews with members of the community. This part of the study sheds some light on the human community component of the PBR. There are many community issues, but we will concentrate on the ones relevant to or affecting community based conservation, as sought in the Biosphere Reserve model.

Community Meetings

Right after the declaration of the PBR, three important events took place: 1) establishing the management personnel of the Reserve; 2) developing the management plan and 3) informing the communities what had just happened through a community outreach program.

The declaration of the PBR promised to bring opportunities for conservation and sustainable uses of natural resources. It also brought the reserve managers to the area. The reserve managers had legal capability to regulate and control uses by Ejidos. The managers began to impose constraints on the activities of Ejido members, local communities, general users and visitors. Different perceptions of the PBR environment from the view point of managers (conservation) and users (utilitarian) began to develop on the same natural resource base, where previous and current activities and attitudes towards the land are reflected in the landscape of the Pinacates. The “voices” of the local communities recorded through a series of community meetings are presented in this section.

The Top-Down Effect

The community meetings were called to inform the participants what was going to happen. These meetings represent a period of adaptation, of starting to get to know each other. Unfortunately most of the time the one leading the dance was the manager and not the community. The managers' sat in front of the room and the local residents sat in the back. The managers tried to make an effort to understand the community and the "community" usually did not come to the meetings even though there were people representing them. Right from the start there was a misconception of who is who and what each is doing here.

At the beginning, two main issues were always present in these meetings: 1) a total lack of knowledge from the communities about the concept of the Biosphere Reserve, its declaration and boundaries and 2) the ever-present conflict of interest between managers and users. Some of the comments recorded were:

Our Ejido needed to pay to see if we were part or not of the Reserve, since we did not know and we thought we were outside the Reserve limits.

First the government gave us the land so we could farm and ranch, what are we going to do if these activities are against the interest of the Reserve?

The declaration of the Reserve prohibits all the activities but it does not resolve my economic problem..., as the owners of the land we want to know what are our alternatives for using our land.

It's all backward! First they create the Reserve and then you guys come asking about the effects of the declaration. We are the owners of the land here and before the decree nobody asked us about our alternatives.

I am very disappointed with this declaration, that we were not invited. You are restricting and prohibiting everything and you do not present any solution to the economic activities, and now you want our cooperation?

Agency Fragmentation

The declaration of the reserve also affected some other agencies involved in the management of the natural resources of the area, creating a conflict of interest and “turfy” attitudes among agencies. As part of the confusion in the early stages of the reserve, communities were wondering about their Ejido rights to the land, as given by presidential resolution 20 years earlier. They were feeling violated in their property rights and in some instances questioning and challenging the legality of the declaration of the reserve. Some of their concerns were expressed as follows:

We also need to take into account that the Ejidos are federal entities, we need to take a step back and understand all these federal declarations. What needs to happen here is respect for our way of life we are poor and you want to take away our sustenance, you are wrong.

The freedom of the Ejidos is at stake here, that's why it is important to have more information to know what and what not to do in the Reserve.

The same agency that declared the Reserve is the one that has given permits for extractive activities and the ones that are trying to do the things right do not benefit with anything. I am here in this meeting while some other people are carrying out the cinders. There has to be some agency coordination among you.

I do not understand: the decree that you guys mentioned has to coincide with the establish laws, therefore what we are doing in the Ejidos is totally legal... so what's going on? ... the Ejido laws were established before the decree!

The decrees and laws are against our own will... what are we going to eat? ... you should have studied the “problematic” before the decree. Now we have to pay for the them conservation... Solution? Solution? solution? Yes But when!?

Government Dependency

The Ejido system through all its history has been a controversial issue in terms of land reform in Mexico. The latest challenge for the Ejido is the constitutional changes of Article 27 of the agrarian reform that took place in 1992. These changes recognized the Ejido members as the owners of the land, and provided them the opportunity and options to sell the property, to use it as collateral and to create partnerships with the private sector to use the land. These changes also brought new opportunities for conservation, such as: 1) conservation easements; 2) establishing units of environmental management (UMAs) to commercialize nature, such as controlled hunting; and 3) creating new partnerships with the private and international sector to “buy” conservation in “The Nature Conservancy style.” These are new times and new potentials for the “modern Ejido” that can be considered as private property. Looking deeper into the Ejido culture we also find a tremendous government dependency that throughout the years of subsidies, soft credit, banking institutions, governmental development programs, housing, control of political power and so on, the Ejidos were trapped in an operational apparatus controlled by the government. This dependency is still present today, the only difference is that all the subsidies and governmental programs that the Ejido had access to were suddenly gone, due to the Article 27 changes. The roots of this dependency are still present in the operational culture of the Ejidos, therefore they are still waiting for somebody to come and fix their problems. This time they have placed their hopes with the Biosphere Reserve, as we can hear:

In our Ejido we have good land for farming desert-adapted plants such as dates and prickly pears. But the government does not help, with good

assistance and subsidies we could bring up this desert. We could do it but the government does not have the good intentions to make us prosper.

We have 3 years waiting in here. We have interest in knowing new alternatives, but we want people to come to us with technical knowledge so they can show us how to do it.

We need people to come to us and present the options so we can know our alternatives.

The government should compensate us for living in a protected area.

There is lots of information, but who is going to help us in applying all these?

Managers to the Test, or Making Their Life Miserable

There is no rule of thumb in working with communities. Several professionals in the field had expressed that at least two to three years had to pass in order for the communities and community outreach people to start believing, understanding, seeing and finally building the necessary trust to really begin to understand each other. But before that bridge of communication and knowledge is established, first you need to suffer the consequences of working with communities that are constantly putting the “outsiders” to the test. The managers of the PBR are no exception to this as we can see:

What is this thing that you are proposing? Conservation?... Conservation of what? Don't you know you are in a desert? So what's going to happen with the land, do you really want us to leave it idle?

...of whatever government office you represent, please next time bring people with better capability to understand us and maybe trained psychologically so we can speak the same language, because right now we do not understand a thing of what you are saying.

Why you do not respect our traditions and way of life? You guys are just not at our level. Among us we can create better solutions for us and for your reserve, but you just do not understand us.

I just want to know if all your meetings are going to be like this, since I do not see anything tangible, its you just telling us what we can not do in the Reserve.

Before you talk about conservation, you kids have a lot of work to do. You are young and full of energy but we know better, if you want to work with the Ejidos you need to be flexible with you rules, there are lots of Ejidos to work with... but each of them is different.

Crossing the Bridge to a New Desert Culture

Most of the ejidatarios were also new comers to the Sonoran Desert. They just got there ahead of the managers. They came from more temperate parts of Mexico and as one of them puts it “coming to the Sonoran Desert was a punishment for bad behavior in past existence.” So they started a process of adaptation and understanding of the desert which sometimes was done the hard way. Farming has never succeeded even with the best technology available. There is just not enough water to irrigate, and/or it is too costly to pump. If this is not enough to stop a crop, the evapotranspiration levels of the Sonoran Desert are so high that salinization will be evident in a few seasons. Some Ejidos experienced this and their effort was a total failure. They were producing perhaps the most expensive wheat ever produced in the world. Ranching followed the same pattern, a single head requires 135 hectares to survive, and must walk a distance of at least 5-km to have a drink of water. As a result, the competition from better rangelands in the State will kill any attempted ranching operation. Two studies conducted by IMADES about traditional agriculture and ranching in the Pinacate suggested that these two operations are just not suitable for the area (IMADES 1995). With the arrival of the PBR, local residents are starting to pay attention to what the managers have to say about

new economic alternatives that are more adaptable to the harsh environment of the desert. Slowly, some local residents are crossing the bridge to a new culture in the Sonoran Desert, and together with the managers their voices are starting to echo in the community meetings:

Several years ago we were requesting a National Park, then some Mexico City official came to get information to support this petition so we could live out off tourism, in fact I was taking care of the entrance. You should come to our Ejido meetings so we could have signed agreements with all the Ejido members and you, that way we could work together and support each other in our efforts.

We as Ejido members need to respect the norms, it is your responsibility to inform us, and we have to find the equilibrium between the Ejido needs and the objective of the Reserve.

I am just concerned about the diminishing of the water flow of the Sonoyta River, all of us know that this is the habitat of the desert pupfish. What can we do about it?

We do not have the culture of knowledge of desert plants and their potential. We need to learn more with the managers of the Reserve the different options for uses, management and conservation of the desert plants.

I just want to congratulate the managers of the Reserve for all the information and the work they are doing with us. Let's invite them to our communities.

Arrival of the Experts

Over the years, the community meetings started to show a change. During this “dancing” process between communities and managers, they both started to take the leading steps of the dance and they both adapted to the tune the other was playing. In some instances they danced a whole song together without stepping on each other’s toes. The meetings started to be more productive and targeted towards specific actions, ideas or

concepts. Depending on the topic of the meetings, managers took the responsibility of inviting “experts” specializing on that topic. This also came as a request from the communities that were expressing interest in knowing more about desert plants, ecotourism, sustainable economic alternatives, and specific regulations of the PBR. It was interesting to notice that the behavior of the communities as well as of the managers was a little more respectful whenever some impartial participation was invited to these “targeted” meetings. The flow of communication was more fluid, the tone of voice from the community was more receptive and a lot of them were taking notes. In some instances everybody sat at the same table, feeling like there was only one level of decision making. This was the summit of the community meetings. Information was actually being exchanged instead of there only being accusations. In some cases the experts were community-Ejido leaders from the neighboring Upper Gulf Biosphere Reserve and other communities. Here are some of the comments:

Lets not waste this meeting that has a specific topic of tourism. Lets not waste our time and energy in discussions that are out of this topic. This is the fifth meeting and each of them has different topics and experts. This gentleman (an expert) its been standing there for over an hour without finishing his presentation. It is better that each community agree with their own people and find their own solutions to their specific problems, meanwhile lets give them an opportunity to finish with their interesting presentation.

From an Ejido leader in the Upper Gulf Reserve: ...friends, I been hearing your comments and the Reserve declaration is not going to take away our land. We were exactly how you are right now, we did not want anything to do with the Reserve and we were thinking that they were going to take our sustenance away. Looking at the management plan and talking with the managers we found out that there is a way of using the natural resources. The Reserve does not take anything away, it only asks us to work right. Now we earn our living by farming, fishing and now this thing called ecotourism.

I just want to congratulate the managers of the Reserve for all the good work they are doing in coordination with the communities. Just putting together these meetings has been helpful.

It is not "daddy government" that is going to solve our problems, it is not easy, it takes time, it is painful, but we need to take responsibility for our actions in our communities.

From a Tohono O'odham community meeting: ...it is great to try to know the Reserve and its good that you organized these meetings with the O'odham. We need to know better our history and the places of our community, in fact even though our ancestors came from this Pinacate region, there are O'odham that don't even know the Reserve.

These targeted meetings opened the door to other kinds of community outreach. Managers began to understand what they needed to get out of the community meetings to understand better the communities, actions and attitudes towards the landscape of the PBR. Through the project of "Community Actions" established in 1998, managers developed a whole strategy for community visits with the sole objective of having a better understanding of the community needs and what the community perceptions were with respect to conservation of this protected area. In the first preliminary report they discovered that 72 percent of the Pinacate population (estimated at 1,288 individuals) responded that they did not know the Reserve. The 28 percent that were familiar with the area knew the most visited sites of Elagante and Cerro Colorado craters and the camping sites of Tecolote and Cono Rojo. Also this report had details of the demographic analysis as well as the major concerns of the communities. These community concerns included the high cost of production, lack of community organization, high unemployment and low self-esteem. Communities have also expressed interest in rural development and

have recognized tourism as an important economic opportunity, along with some other traditional activities like farming. The important outcome of this community outreach program was an open channel of communication between the Ejidos and the PBR-Managers, where the dialog, understanding and respect for each other are part of the conservation efforts for the Pinacate Reserve (RBP 2000).

MANAGERS OF THE PINACATE BIOSPHERE RESERVE

In the middle of the 1990s, a group (~ 5) of well intention well-trained biologists with little understanding of the human dimension implications of their conservation paradigms began to arrive at the Pinacate Reserve. Managers arrived at the area with an “image” in mind. They already had a “picture” in their head of what they wanted to see in the PBR, its resources and its communities. They wanted to see conservation and management of natural resources with full cooperation from local residents. The only problem was that the communities were already there being participants in the landscape by default, with a totally different “image” in their heads. They primarily had a utilitarian attitude towards the land, saying that “we are simply trying to make a living out of this place.” This started a long process for the understanding of the social fabric that is tangled with the natural resources of the Sonoran Desert.

The manager’s main tool is the Management Plan for the PBR. This plan was approved by INE-SEMARNAP (Instituto Nacional de Ecologia-Secretaria del Medio Ambiente Recursos Naturales y Pesca) in 1995. The Pinacate BR is one of the three reserves in Mexico with a management plan “approved.” In the second paragraph of this

plan is the statement: “The importance of the PBR declaration is based on the necessity to conserve biodiversity and the scenic and aesthetic values of a landscape unique in the world and that together with the socioeconomic characteristics allows for a better and easier management.” (INE 1995). This did not turn out to be an “easy” task to be accomplished.

The current managers of the PBR are facing several challenges of adaptation of local traditional knowledge from the O’odham people. In 1998, the PBR managers were celebrating the 300th anniversary of Father Kino’s presence in the area of the Pinacate region (October 9, 1698). The managers are still trying to identify and understand the knowledge left by the expeditions of the late 1800s and early 1900s. They are seeking local participation of the Ejidos in order to obtain input for sustainable development. They are dealing with multicultural and multinational issues to adapt to the proper management of the area. They are dealing with the international values imposed by the biosphere model of adaptive-ecosystem management, sustainable development, conflict resolution and local participation. They need to face the multiple issues that local and external non-governmental organizations bring to the area. And on top of it all, they need to police, patrol, research and conserve the area.

For the first time in the history of the Pinacate BR there is a permanent population in charge of the protection and “proper” use of the area. Now there is a need for registration to enter and there is a big list of “NOs” and regulations that need to be followed in order to be a good visitor, scientist or resident of the area. Conservation has arrived, and together with it the science of No –as Halffter (1991) identified the

environmental sciences - has entered the Pinacates. Thanks to the Mexican conservation policies of the 1990s there is also some financial support to meet the challenges of conservation and community participation in the protected areas, or at least to maintain the managers-staff on site.

This is the context in which this research was taking place. Several site visits to the reserve were scheduled. During this time the author was able to talk with all of the personnel based at the field station located at the main entrance of the reserve at Km. 40 of highway #8 towards Puerto Peñasco. An open-ended questionnaire was structured, with some questions answered in direct conversation and others answered the questions at their own leisure. Four components were present in the questionnaire: 1) biography; 2) perceptual questions; 3) management questions and 4) opinions about the future of the PBR. A total of 10 questionnaires were completed. At that time there were 12 staff working in the PBR. Their comments are summarized below:

Environmental perception

Conservation was the number one priority for the most acceptable land use within the PBR, followed by research of natural resources and communities and environmental education. Seventy percent of the responses indicated ecotourism as an acceptable way to use the land within the boundaries of the reserve.

Scenic beauty (value) was an important element, as the majority of the managers agreed when they were asked about the most important resources within the PBR. They identified the volcanic shield, the area of the sand dunes and the granite mountains and

bajadas for their scenic values and for the important interactions between the geology and the endemic flora and fauna.

The land use activities that were not judged compatible with the goals of conservation included: traditional farming and ranching (the activities that have probably impacted the conservation of natural resources the most, and can be continued under some regulations and control). Mining of volcanic cinders, sand and gravel were viewed as changing the native landscape, affecting the scenic beauty of the area and destroying irreversibly the natural vegetation cover. Everybody was strongly against cinder mining within the reserve, particularly in the core zone of the PBR. If this activity was going to continue it had to be in the buffer zone and heavily regulated to minimized the impacts to the natural resources as well as to the aesthetics of the landscape. It also would have to be a benefit to the local communities not just to a few wealthy families of the region.

In terms of human activities compatible with conservation, ecotourism was again identified as the number one activity, followed by alternative farming of native species such as propagation of cacti species, moderate harvest of wild species such as organ pipe cactus fruit (pithaya), and medicinal plants. With respect to ecotourism and visitation to the reserve the PBR-staff agree that is an excellent opportunity for environmental educational activities for visitors and communities. It can also be a good outreach program to gain more “social” support for continuing the conservation and protection of the reserve. The most visited sites are the giant craters of Elegante and Cerro Colorado and the camping sites of Tecolote and Cono Rojo. All the staff comments with respect to human activities within the reserve mention local community participation as a key factor

to be considered. Local benefits need to occur in order for the communities to be interested in supporting any business related to “conservation” initiatives. They place community participation as a high priority for all their activities.

Management and Future of the Reserve

Seventy percent of the managers felt confident that they were bringing local benefits with the establishment of the reserve in terms of technical assistance and better management of natural resources. An interesting comment was that “with the establishment of the reserve the number of economic opportunities increase since conservation is adding value to the land.” Therefore activities like ecotourism, research, and environmental education are added to the more traditional community activities. The other 30 percent mentioned that the reserve so far has not brought any benefits to the local residents.

By the year 2010 managers would like to see a common vision with the communities for conservation and sustainable uses of the natural resources, a secure financial pool for the reserve administration and a better relationship with the human communities within the reserve and in the transition areas. In terms of community participation there has to be a balance between protecting the interest of local communities and the conservation of natural resources. The reserve has to work together with the communities in finding sustainable alternatives for the appropriate use and conservation of the natural and cultural resources. We need to create models of rural development in accord with conservation. This is the great challenge for managers of

this reserve. If the reserve does not succeed in having a good relation with the communities and users of natural resources, the human population of the reserve may disappear or take over the natural resources.

AFTER ALL THESE YEARS

Some of the most relevant studies have identified ecotourism as one of the activities with more potential for community participation and development. In 1996 a series of community workshops were organized in the main population centers influencing the Pinacates. These workshops were structured to allow participants to gain a better understanding of their community's relationship to the Sonoran Desert by exploring how the desert contributes to their livelihood, quality of life, their cultural identity, and community traditions. The goal was that such understanding would allow individuals to participate more effectively in future local management decisions. These workshops were also recognizing that the success of the biosphere reserve model depends on cooperation and action between resource managers and adjacent communities. The objective was to have participants identify projects related to natural resources or environmental issues that the community could take full responsibility for implementing. The outcome was a series of community projects in accord with the conservation strategies of the reserve. The one common project that every single community identified and related to was ecotourism in coordination with the reserve (Murrieta 1996).

Around the same time a study was conducted to identify sustainable development opportunities in the Arizona-Sonora borderlands where the Pinacate is situated. Here

again, ecotourism came to the top of a group of four economic opportunities for the region after screening them on sustainability criteria. These criteria included: 1) businesses must operate in a fashion that they does not diminish the region's biological diversity when the continued viability of the enterprise depends on sustainable management of the region's natural resources; 2) businesses must be sensitive to and enhance the customs and cultures of the region; and 3) businesses will further local understanding of sustainable development principles and stimulate further local action consistent with these principles (Nimkin 1996).

Some other studies directly managed and financed by the PBR are moving in a similar direction, taking into consideration social factors and community indicators to achieve a balance between the conservation of biological and cultural diversity and economic development. One study is directly contemplating the viability of two Ejidos of the PBR developing controlled excursions into the reserve. These excursions will be conducted by Ejido members and target the local market of the maquiladora industry of San Luis Rio Colorado (Murrieta et al 1999). This study was started through a petition to the PBR from these two Ejidos. These are small steps that are moving managers and communities to a shared vision of conservation based in community development.

Another study suggested by the community meetings was to investigate economic alternatives compatible with the conservation program of the PBR came out in mid 2000. Presently the managers are looking at 7 proposed alternatives. Of these, three deal directly with visitation to the reserve and they are on the top of the list, again putting a priority on tourism of the region. An interpretive-visitor center, a trailer-RV park and

greenhouses for propagation, germination and selling of native plants are the alternatives that are being reviewed by the managers (Fuentes and Vázquez 2000). The only caveat here is the role of the communities in these alternatives. Are they going to be simple employees or are they going to actually administer them? Are they willing to take the risk in these types of businesses or must the reserve absorb all the responsibility?

La Ruta De Sonora

All these entrepreneurial ideas are yet to be proven. They are real life experiments deserving the opportunity and support to succeed and be duplicated. Let us hope that these real life experiments won't end up on the bookshelf. A promising program that is actually putting together the elements of conservation and management of natural and cultural resources, community development and participation, and work in full coordination with public land managers and communities, is a young hybrid of a non-profit and business venture established in 1998: La Ruta de Sonora Ecotourism Association (La Ruta). La Ruta, organized through a regional development process is a nonprofit organization established by tour operators, residents, land managers and conservationists to promote an ethical and community based approach to tourism. A board of directors who represent a broad constituency from throughout the region manages it. La Ruta embraces standards that guide responsible tourism, provides educational and enlightening experiences, promotes understanding among the regions many actors, contributes directly to conservation and assures that the benefits accrue locally. Although these are noble goals and principles, La Ruta will continue to be

challenged and must be attentive to maintaining a level of community and ecological integrity.

The origins of La Ruta were based in the community workshops organized in 1996 and in the study of sustainable economic opportunities for the borderlands of the Sonoran Desert. Both of these initiatives were launched from the Sonoran Institute, a non-government organization based in Tucson, Arizona. These two initiatives independently found that the local economies have a historic and cultural dependency and relationship with the land. Traditional industries that are dependent upon the natural resources of the region (fishing, mining, agriculture) are in decline because of global economic forces and unsustainable practices. This region has not benefited from the increase in trade and commerce between the US and Mexico in recent years. Where there has been growth, tourism has not benefited or supported local customs and cultures of the fragile ecosystem. Any wealth created has not generally been retained in the region. In the middle of all these, La Ruta emerges to “create and package specialized tours, theme itineraries, and custom trips for visitors who want to explore this unique region. It is committed to providing guests with authentic adventure experience, while creating ecotourism economies which directly benefit local customs, traditions, and cultures by promoting local values and natural resources conservation ethic” (From La Ruta brochure).

La Ruta is working in full coordination with communities, public land managers and visitors to promote an ethic of responsible tourism for the region that provides opportunities for its residents to generate new sources of income from business ventures

and services. The natural resources, cultures, traditions and customs in this region become valuable as assets that support an emerging industry. La Ruta believes that by providing incentives and opportunities that require preserving and protecting these resources and values, an ethic of community based conservation and development can prevail.

The guiding principles of La Ruta define responsible and compatible tourism.

They are becoming the “standards” for all its members and operators:

1. *Development that does not degrade resources;*
2. *Provision of first-hand, participatory and enlightening experiences;*
3. *Education for all participants;*
4. *Acceptance of local resources on their own terms and with recognition of their limits;*
5. *Promotion of understanding, communication and partnership among its many actors;*
6. *Promotion of moral and ethical responsibilities and behavior towards the natural and cultural environment;*
7. *Provision of long term benefits to the resource, to the local community and the industry (benefits may be conservation, economic, social, cultural and/or scientific).*

This is a totally new enterprise for the region, and it has been getting a lot of support and attention from federal, state and local institutions at the binational (USA-Mexico) level. Local communities have participated in the thinking, design, development and implementation since the start, and there are Ejido representatives on the La Ruta board of directors. The community members benefit directly from being service providers, tour operators, host and nature-culture guides of La Ruta. At the same time they are developing an appreciation for the scenic beauty of the Sonoran Desert and creating a new culture and tradition that makes them feel proud that they belong to this

landscape. Also the managers of the public lands including the Pinacates are party to La Ruta, forming an advisory committee. This committee advises, guides and warns about visitation initiatives in their managed land.

In the inaugural season of La Ruta (1999-2000), 11 tours were conducted providing services for 80 people. The quality of the experience was highly graded and all the participants of La Ruta got good remarks for their performance. In these early stages of La Ruta, the main challenges are:

- Working with three different nations and at least three different cultures (US, Mexico and Tohono O'odham Nation)
- Develop a binational identity for La Ruta de Sonora
- Maintaining a Unique Experience within La Ruta destinations
- Balancing Absorptive Capacity and Visitor Interest
- A Tightening US-Mexico Border
- Pricing and marketing the product that reflects the actual "value" of the experience.

La Ruta de Sonora Ecotourism Association is an exciting and innovative example of responsible and compatible community tourism development. It demonstrates the viability and importance of community based decisions that support development of sustainable businesses that promote conservation and protection of natural resources and cultural values. La Ruta de Sonora is poised to demonstrate these values, confident that its products, its members and its mission is sound and well conceived.

With all this, La Ruta is contributing to bring communities, managers and visitors to the same level of insightful appreciation of the Sonoran Desert. This way these three populations can share their spiritual appreciation of the place in a harmonic and significant inner peace in contact with the energy and peacefulness of the Desert.

AFTER THE DUST HAS SETTLED

Most, if not all of the protected areas in the world have their boundaries drawn physically, leaving the social boundaries to adapt to this physical line. More than just drawing the line for biodiversity protection, we need to pay more attention to the human population and the social-economic structures that accompany this biodiversity. The social tapestry of a reserve can be as varied and as important as the biodiversity present in the area. In the context of this study, three populations have been addressed:

- **The International Visitor:** The human population seeking a quality visitation experience in a remote setting, looking for an opportunity for solitude, closeness to nature, viewing wildlife and experiencing the unspoiled natural scenic beauty of the Sonoran Desert not easily obtained elsewhere. This population is represented by ORPI-Visitors as well as students of the University of Arizona
- **Local Residents:** The human population of the reserve with rights to use the land within the limits of the protected area, even though they are not living in the reserve. Mainly Ejidos represent this population.

- **Managers-Staff:** The human population of the reserve whose mission is to conserve the land, its biodiversity and the scenic beauty of the reserve. This population includes administrators, researchers and staff of the PBR.

In the Pinacates, the last population is the one that carries on their shoulders the responsibility for biodiversity and landscape beauty protection. The local residents can provide strategies for a long-term conservation plan, if they see direct tangible benefits occurring with conservation. In the end, not only will the international visitor have a place to contemplate nature and seek spiritual realization of the “innerscape,” but also the local communities. These local communities are struggling to see the beauty of the landscape, while they are busy making a living. They are looking for their identity in this special place. It may well be that it is up to the managers to provide guidance and walk together with the communities to help them find their own identity in the Sonoran Desert, the identity that they never had as a community before.

For this to happen, an alliance of these three populations has to occur. This implies an integration of their perceptions and responses to the place, including their actions and activities within the PBR. It is necessary to understand what and how they think so actions in the landscape can be of mutual benefit to all of these populations. In the process we learn and better understand the place, we know how to use it and in the end we may be able to create a new place that fully integrates all participants with a balance of conservation and acceptable uses of natural resources. Some of the steps to move in this direction have already been taken. There is a certain level of trust between

communities and managers. Managers are beginning to understand that their actions can actually have potential threats and benefits to the local population in terms of land tenure rights, economic productivity and political power in the Pinacate region. Managers as well as local residents need to understand that they both have to accept responsibilities for change. The managers need to cooperate and participate in the local way of life, and the communities need to cooperate with managers in their conservation efforts. This way the exchange of cooperation and participation is both ways, so the groups involved understand and confront the same challenges.

In short managers need to be part of the community and the community needs to be part of the management. Most of the time, managers of protected areas want the cooperation and participation of local people in their conservation initiatives. This places the responsibility for change on the local people rather than on the proponents of the program, neglecting the reverse viewpoint: the role of the conservationist, administrators, and researchers in the pre-existing social systems to distribute and manage land use rights (Kaus 1992, 380). The responsibility for change is from both ends, so the social relations must be on the same level field. Then the human use system can be in better harmony with the landscape. Figure 18 presents a graphic description of this process inspired and adapted from Canter's (1977) model of place.

According to this model the Pinacate reserve is starting the second phase, with the identification of perceptions and actions taken by the different populations that interact with the Pinacate landscape. At present, managers are investing time and resources in developing partnerships with other institutions to work together toward conservation-

based community development programs. It is interesting to note that sociologist, economist, anthropologist and people oriented in the human dimensions of conservation are the ones conducting these community programs. The management of the reserve is moving from a simple ecological perspective to a more multidisciplinary and multicultural approach to adaptive management.

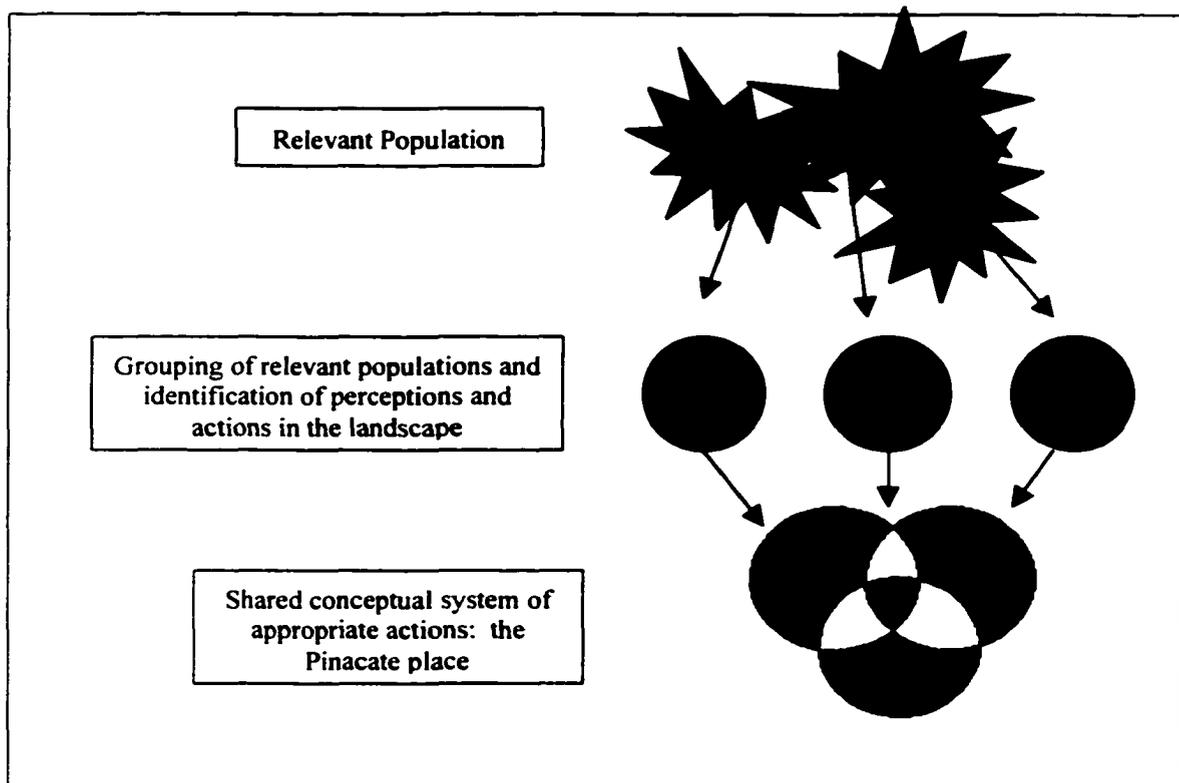


FIGURE 18. DEVELOPMENT OF A CONCEPTUAL "HUMAN USE SYSTEM" FOR THREE RELEVANT POPULATIONS IN THE PINACATE BIOSPHERE RESERVE

From the three distinctive populations, ecotourism has been identified as the common activity to integrate managers, community and visitors of the Pinacate. This activity is already moving managers and communities more into a sense of partnership.

taking into consideration the social factors and community indicators to achieve a balance between conservation of biological and cultural diversity and economic development.

Initiatives like La Ruta de Sonora are already putting to the test partnerships among different groups interacting in the same landscape. These kinds of actions are developing new traditions and are providing an opportunity for local residents to feel part of the Sonoran Desert and to start developing a shared sense of place. The importance of concepts like La Ruta and research like that presented in this dissertation is that we change people's perceptions and attitudes towards the place, without changing the landscape.

CONCLUSIONS

Multidisciplinary approaches to research on the interactions of humans and natural environments are extremely difficult, but the efforts are worth taking. The results can be a better representation of the human dimensions of the natural landscape.

RESEARCH RESULTS

The utility and applicability of the psychophysical approach to measure scenic beauty and quality of outdoor experience in the Sonoran Desert setting has been shown. The three different studies conducted using this approach presented consistent and meaningful results.

Organ Pipe Cactus National Monument, Cabeza Prieta National Wildlife Refuge and Pinacate Biosphere Reserve, in that order, attained the highest ratings for scenic beauty among the Sonoran Desert areas sampled for the first phase of Study I. Lush vegetation, columnar cacti, rugged geological formations and volcanic features were associated with the highest ratings.

Further research is suggested by the correlation between scenic beauty and biodiversity indicators for the Sonoran Desert. This could provide an excellent tool for biodiversity conservation in association with scenic values.

The psychophysical approach proved to be reliable for assessments for both students and Organ Pipe Cactus National Monument visitors ("real" outdoor enthusiasts) in a desert setting. The individual group reliability and between group correlation

coefficients were all quite high, indicating strong consensus in the results provided by the method. For future studies of perceptions of desert settings, students would appear to be an appropriate subject population.

Travel direction was an important consideration for the appreciation of scenic beauty when traveling the main roads and visiting the main features of the Pinacate Biosphere Reserve. The South-North travel direction consistently obtained higher ratings than the North-South direction. Traveling in the S-N direction produced a better appreciation of the aesthetic values of the Reserve. This is in agreement with the Reserve managers' recommendation that visitors travel through the reserve in this direction for better control of access. The Santa Clara Peak and the Elegante Crater were major factors influencing the scenic beauty of the Reserve. Encountering these two features early in the "trip" seemed to put the visitor in the "right mood" for appreciating the other scenic elements of the Reserve.

Order of visitation for the main features presented in the study (Elegante, Colorado, Tecolote and La Laja) was also an important factor influencing ratings of scenic beauty and enjoyment of the trip. Visiting first the cinder-mining site of La Laja (N-S) appeared to put the observer in a "dislike mood" for the whole place. This site could be the one to blame for the lower ratings in the North-South travel direction, together with the lack of an important visual feature: the Santa Clara Peak. The opposite results are obtained when making El Elegante the first stop (S-N). Good interpretation and cleaning up the old mining debris at La Laja might boost the quality of the

experience and scenic beauty values. Further research is needed to confirm true potential for restoration and clean up actions at La Laja.

The effect of landscape changes due to surface cinder mining does not always affect the scenic beauty of the Pinacate. In terms of scenic beauty, the scattered cinder mining activity along the roads did not change the perceptions of the place for the studied groups. In fact most participants did not appear to recognize the visual difference between a site with previous cinder mining activity and a natural setting.

Indications of human presence-actions in the destination sites were regarded as negative for the enjoyment of the trip. The quality of the experience increased when there was no indication of human presence in the views of an area.

On-site judgements are difficult and costly to collect. For the travel direction and order of presentation effects there was a general agreement between the on-site ratings and the slide-based judgements. Since they rated real images, field trip participants tended to use a higher scale for rating scenic beauty than the slide-based judgements, but the pattern among the two methods was very similar.

The most preferred road segments in terms of scenic beauty for all the participants were: 1) El Elegante Crater to Cerro Colorado Crater; and 2) the Field Station to Elegante Crater, respectively. This was consistent with the lush vegetation, rugged geological formations and the expectation of getting to the first destination site. Elegante Crater and Cerro Colorado, provided the highest enjoyment of the trip, while La Laja and Tecolote camping site were the lowest rated.

The warm weather in the winter months (November – April) as well as the scenic beauty of the Sonoran Desert are of vital importance for attracting visitors to the desert. Visitors seek solitude-serenity, night skies and wilderness characteristics of the desert. Minimizing the impact on the natural environment was also a high priority for these visitors, with somewhat less concern for the welfare of local residents. Most indicated a desire that their tourist activities should provide some benefits to the local resident economy. This gives an indication of the “quality” of visitors Organ Pipe Cactus receives every year. When it came to a forced choice between protecting the local environment and helping local residents, the great majority (72%) chooses the environment. Still some (24%) opted for assisting the local residents through tourism-visitation activities.

More research is needed to compare on-site valuation and slide-based judgements using the psychophysical approach in a desert setting. Also further research in applying the psychophysical approach to managers and communities of the Pinacate Biosphere Reserve is recommended. This would allow assessment of perceptions of the scenic beauty of the Pinacates from the perspective of managers, communities and visitors providing a base for better management and understanding of the place.

MANAGEMENT IMPLICATIONS

Based on the study results several lines of management implications are indicated: To fully appreciate the scenic beauty of the Pinacate BR, the South – North traveling direction should be highlighted. This will put the visitor in a better position to increase

the quality of experience for visiting the volcanic landscape of the PBR. Also the S-N travel direction will “force” the visitor to make a first stop at the Elegante Crater, developing a “right mood” for the place that will translate in to a better appreciation for the other scenic elements of the Reserve. Managers should encourage (enforce) this route, since the visitor center is located at the South entrance, the quality of experience is higher, and the control of access to the Reserve will be more manageable.

In terms of old cinder mining activity along the road, the impacts of surface removal created by this activity in the past does not affect the scenic beauty of the PBR as experienced by visitors. In terms of aesthetics it is not worth the cost to make restoration efforts for these impacted areas. Good interpretation and information management is important for the visitors to appreciate these landscape changes and better understand the conservation of the place as well as past extractive activities in the area.

La Laja mining site may have promise for visitation in the Pinacate. The ratings for enjoyment of the trip were about the same as for the Tecolote camping site. With proper interpretation and a clean up program, La Laja could serve as another camping site with higher carrying capacity than the Tecolote. There is also less risk of impacting the site since this place is already impacted by the past cinder mining activity. None-the-less in its current condition participants seemed to prefer this site as much or more than Tecolote.

La Laja presents a great opportunity for increasing the overall enjoyment of the visit to the PBR. La Laja can contribute positively to the quality of experience in the Reserve. To get to this stage several things must happen first. It was evident from the

results that visitors to the site and in the simulated trip do not relate to the old debris present in the site. However the rest of the site was considered of considerable visual interest to the visitor. Removal of the old mining debris at La Laja and good interpretation of the site can contribute greatly to the quality of experience in the PBR.

The greatest potential of La Laja could be for development of a camping site and interpretation center for the human activities that occurred in the history of the Pinacates. La Laja potential camping site could bring several important elements:

- The site is already impacted by the past mining activity, therefore additional impact to the landscape by visitation is going to be minimal. There are already some facilities in place that could be used for restroom and for an interpretative center for the mining activities in the Reserve.
- The carrying capacity for the campsite can easily exceed the one established in the Tecolote of 40 visitors. The physical dimensions, the location and access to the site together with a good landscape design could provide for some recreational vehicles (RVs) hookups, tent and primitive camping. The development of this campsite with minimal and appropriate infrastructure (restrooms, RV-sites) could attract some of the thousands of annual visitors that come and stay at the sister reserve of the Pinacates: Organ Pipe Cactus National Monument, only 30 miles away.
- La Laja is strategically located in the middle of two of the main attractions of the Pinacate BR, Cerro Colorado Crater and Tecolote. In addition to the camping site, at least two interpretative trails could be developed departing

from La Laja to these two destinations. These trails could provide an excellent opportunity to appreciate the different formations of lava flows interacting with the Sonoran Desert vegetation and a great view of Cerro Colorado.

- An important aspect of La Laja is that it is on private property within the core area of the PBR, this could be a great opportunity for collaboration between the owners to become involved in a new venture with the managers of the Reserve.

The warm weather of the winter months, the scenic beauty, solitude, serenity and night skies, are important elements for visitors to the Sonoran Desert. Visitors to the area have identified these elements as the main reason for visiting this region. The Pinacate BR has a comparative advantage to offer this quality of experience since it still offers a sense of seclusion. For management of visitation and quality of experience it is important to maintain this sense of isolation. More and more in the traveling world visitors are seeking for the “last great places.” To keep providing this experience in the Pinacates it may be important to consider some “zoning” of the area. Zoning can occur in at least two fashions: One is developing the areas with higher visitation such as the Elegante and Cerro Colorado craters, this means allowing for more visitation in this part of the Reserve. The second aspect could be “restricting” or minimizing access to the rest of the nuclear zone of the Pinacates including Sierra del Rosario. Issuing backcountry permits where the visitor can only get to these special sites hiking could do this. Initiatives like this can keep human presence and activities at a minimum and visitors

who want to experience this solitude and remoteness should pay a premium for this quality of experience.

One of the major challenges in the ecotourism business is to detach money from the visitors to support local initiatives for conservation and community development. For this detachment to occur more efficiently, emphasis should be placed in the conservation and protection of the environment. Visitors in this study showed that they are more interested in supporting or participating in the conservation of the local environment than they are in providing benefits to the local human communities.

The psychophysical approach should be applied to local communities and managers of the PBR, this will provide a better understanding of the human perceptions of the environment so managers, communities and visitors could share their visions of the Pinacate Reserve. These visions will hopefully be closing the gap between community development and conservation of natural resources of this important landscape of the Sonoran Desert.

**APPENDIX A:
THE PINACATE Y GRAN DESIERTO DE
ALTAR BIOSPHERE RESERVE**

The PBR was established by presidential decree on June 10, 1993. It is located in the NW part of Sonora, Mexico. It possesses a total area of 714,556.5 hectares shared by the municipalities of Puerto Peñasco, San Luis Río Colorado and Plutarco Elías Calles. (See Location Map).

The PBR consists of two well-defined zones, the core zone and the buffer zone. The core zone has two discontinuous areas: a) Sierra del Rosario, covering an area of 41,392.5 hectares and b) Sierra de El Pinacate, located in the center of the reserve, with an area of 228,112.75 has. Surrounding these two areas is the buffer zone with an extension of 445,051.25 hectares. (See Map of the PBR)

According to the management plan, the declaration of the PBR is based on the public interest to conserve biodiversity and cultural, aesthetic and natural values, as well as to promote sustainable development at the local and microregional levels.

Natural values of the PBR are represented by approximately 200,000 hectares of volcanic landscape with an extensive variety of geological forms, such as lava flows, and one of the biggest concentrations in the world of giant “Maar” type craters, about 400 cinder cones and almost 500,000 hectares of active sand dunes. Even though this is a desert, there is great biodiversity in the area. There are approximately 560 species of vascular plants, 42 species of mammals, 184 avian species, 43 reptile species, 4 amphibians and two native species of fresh water fish (SEMARNAP 1997; 11).

The PBR is part of a cluster of protected areas along the Arizona (U.S.) Sonora (Mexico) border. These protected areas manage a great portion (around 2,400,000 hectares) of the Sonoran Desert. These areas are adjacent to the PBR: to the West and Southwest is the Alto Golfo de California y Delta del Río Colorado Biosphere Reserve; to the Northeast is Organ Pipe Cactus National Monument Biosphere Reserve; to the North is Cabeza Prieta National Wildlife Refuge and the extreme North of the PBR is adjacent to the Barry M. Goldwater Bombing Range of the Department of Defense of the U.S.

The first attempt to officially protect the area was done with the declaration of March 29, 1979. This decree established 28,600 hectares as a Wildlife Refuge and Forest Reserve under the jurisdiction of the Department of Agriculture and Hydraulic Resources (SARH) (Cano 1989; 48).

Early in the 1980's, with the initiative of the state government of Sonora, the Mexican Institute of Ecology initiated an ecological evaluation of the area to establish the scientific foundation to create a biosphere reserve. This proposal was oriented towards the "Mexican Modality" of biosphere reserves (Búrquez and Castillo 1994; 12). During this decade there were several forums that addressed the need to "protect" the area. It was not until the early 1990s that a group consolidated by the state of Sonora, the National Autonomous University of Mexico (NW Regional Station) and the Centro Ecológico de Sonora, took all the past experience and information in to one single document that culminated in a new proposal for the creation of the biosphere reserve. At the same time several community forums created political and social support that

reinforced the creation of the Pinacate y Gran Desierto de Altar Biosphere Reserve.

Búrquez and Castillo (1994) give a description of the PBR.

Administration of the PBR is under the federal Secretary of the Environment, Natural Resources and Fisheries (SEMARNAP) and is managed directly by the National Institute of Ecology (INE). At the local and regional level the PBR has an Advisory Technical Committee created in 1996, to give advice on several aspects of administration and management with representation of public, private and social sectors.

Pinacate's Landscapes

The best way to experience and understand desert landscapes is to experience them directly. The author has had that privilege on many occasions:

Every time I go to the Pinacates, what captures my attention most are the soundscapes. One time, as I was walking along the volcanic cinder gravel of Cono Rojo late in the spring the sound transported me to the frozen rolling hills of Iowa. The sound of the hot gravel was similar to the sound of walking through the snow covered farmlands of the Midwest U.S.A. As I continued wondering in the lava flows I realized that this lava has been "frozen" for centuries, even though the temperatures in the summer some times exceeds the 50°C. Later I found a passage in one of the journal entries of Hartman (1989) where he contrasted a symphony about Antarctic ice and the Sonoran Desert, reminding him that "both places manifest contrasted masses of fluid "rock" matter, frozen in place".

In another occasion, at the Elegante crater, I caught myself listening to the different variations of sounds that the wind makes as it passes through ocotillos, palo verdes, chollas, and other desert vegetation. The wind sounds different as it passes through these species. It gives a sensation of openness as it pass through the palo verdes in bloom, while the ocotillo presents a clear, sharp and clean sound. There is a great symphony in the Pinacates that harmonizes sound, with color, shadows and the sharpness of the open, rough landscape. I wonder if these sounds were the same for Padre Kino as he was surveying the area in the late 1600s. Some of his partners discovered "a big hole of such depth that it caused terror and fear." How were these soundscapes perceived by the Hohokam trying to capture his next meal?

The Pinacate has been considered the heart of the Sonoran desert by several authors (Cano 1989; Hartman 1989; Felger 1997). The Pinacate Mountains are easily recognized from a satellite picture due to the blackness in the middle of a tan desert. Santa Clara is the highest peak rising to 1,206 meters and surrounded by rugged hillsides, volcanic cones, craters, frozen lava flows and sand dunes swirled by the wind (Cano 1989; 46).

Hartman (1989), presents an excellent description of the “spookiest features” of the Pinacate landscapes which are the craters that “pock the lavas.” The ten major craters are listed in Table below. All of them are circular features several hundred meters to over one kilometer in diameter. They range from El Elegante 250 meters deep to the flat “pancake” of Díaz.

**Major Craters of the Volcanic Shield of the Pinacates
(Hartmann 1989 and SEMARNAP 1997)**

CRATER	DIAMETER (Meters)	Depth (Meters)	Approximate Age (years)
El Elegante	1200	250	149 000
MacDougal	1100	130	185 000
Kino	800	20	-
Díaz	800	0	-
Cerro Colorado	750	4	Youngest?
Sykes (Grande)	700	220	Young?
Celaya	550	80	-
La Luna	450	0	340 000
Badillo	350	10	-
Lynch	300?	20?	-
Molina (El Trébol)	150	30	-

These great craters are of the “maar” type, which is a cone-less volcanic crater formed by a single explosive eruption. Maar volcanoes often occur when magma interacts with a source of water –water table- and becomes supercharged with water vapor, creating explosive eruptions (Kresan 1997, 585; SEMARNAP 1997, 19).

Another part of the Pinacates landscape west of the volcanic shield is the Gran Desierto de Altar, surrounding the Sierra del Rosario. Described by Kresan (1997, 578) as “a landscape of dramatic starkness and beautiful desolation”. The Sand Sea covers 5,698 square kilometers and is the largest area of active dunes in North America. An extensive sand sheet separates discrete areas of large dunes. Towering as high as 180 meters above the desert floor, the dunes around La Sierra del Rosario are some of the highest. The depth of sand is unknown but the principal source for the eolian sediments is most likely the delta of the Colorado River.

Ecological Characteristics

The PBR experiences long, hot and dry summers, with winter and spring rains. Maximum daily temperatures commonly exceed 38-45°C from late April to early October. The highest temperature recorded for the Sonoran Desert is 56.7°C taken in the Sierra Blanca in late June 1971. Winter daytime temperatures often range between 15.5-24°C but temperatures commonly dip several degrees below freezing on a few nights during each of the colder months. (Felger et al 1997, 414; Burques and Castillo 1994, 20; Cano 1989, 50). However, on rare occasions it is possible to see snow-frost on the highest peak (Santa Clara) of the Pinacates, as happened on December 23, 1997.

The PBR survives with less than 200 mm of rainfall a year. There is a great variability gradient from NE to SW. Sonoyta presents the greatest rainfall with 164 mm and Puerto Peñasco and San Luis Río Colorado report 61 and 52 mm respectively (SEMARNAP 1997, 23).

The area of the PBR includes the lower part of the Sonoyta River watershed. It consists of several intermittent arroyos and bodies of water in the form of natural tanks carved in the rock by the force of the water currents. These are named "tinajas." There are some artesian wells and also some deep wells for irrigation and potable use (SEMARNAP 1997, 24; Burques and Castillo 1994, 21).

Vegetation and Flora

In terms of vegetation and flora, Felger et al (1997; 414) reports several regional studies conducted over a period of 40 years. As is expected in every arid region, the

number of species is relatively small in relation to area and ecological complexity. He reports some essential endemic species to the region. Among them are: *Croton wigginsii* (Euphorbiaceae); *Dimorphocarpa pinnatifida* (Brassicaceae); *Euphorbia platysperma* (Euphorbiaceae); *Heterotheca thiniicola* (Asteraceae); *Perityle ajoensis* (Asteraceae); *Senecio pinacatensis* (Asteraceae); *Stephanomeria schottii* (Asteraceae); *Suaeda puertopenascoa* (Chenopodiaceae).

Mesquite (*Prosopis glandulosa*) is the most conspicuous and predictable larger perennial. Other common perennials include slim-leaf ragweed (*Ambrosia confertiflora*), spiny poppy (*Argemone gracilentia*), blue palo verde (*Cercidium floridum*), rattlesnake weed (*Euphorbia albomarginata*), and devil's claw (*Proboscidea altheifolia*) (Felger 1997, 400).

Felger (1997, 401), also reports that in good spring rainfall the crater playas are carpeted orange with annual globe mallow (*Sphacelalcea coulteri*). Other spring annuals are likewise abundant. Summer rains bring 100 percent coverage of ephemerals dominated by amaranth (*Amaranthus palmeri*), *Gaura parviflora*, and perennial ragweed (*Ambrosia cofertiflora*).

Approximately 10 percent of the total flora, or 72 species, consists of non-native plants. The majority of these exotics are agricultural or urban weeds, and many are not established in undisturbed desert habitats. Among the most insidious are red brome (*Bromus rubens*), buffelgrass (*Pennisetum ciliare*), Mediterranean grass (*Shismus spp*), and Sahara Mustard (*Brassica tornefortii*) (Felger et al 1997, 415).

Fauna

Some of the keystone species of the PBR, due to biological and cultural values, are larger the mammalian species, such as the bighorn sheep (*Ovis canadensis mexicana*), pronghorn (*Antilocarpa americana sonorensis*), mule deer (*Odocoileus hemionus*), white tail deer (*Odocoileus virginianus*), javalina (*Tayassu tajacu*) and puma (*Felis concolor*) (Burques and Castillo 1994, 32). SEMARNAP (1997, 28), reports around 100 species of birds on the area of the PBR. Among these, 15 are endangered or threatened. There are some species in danger of extinction, such as the golden eagle (*Aquila chrysaetos*), the stork (*Mycteria americana*) and the Yuma clapper (*Rallus longirostris yumanensis*). Burques and Castillo (1994, 33), report a total of 43 reptile species and 5 amphibians. Among the most important, due to their listed status, are Gila monster (*Heloderma suspectum*), desert tortoise (*Gopherus agassizi*), and the Sonoran green frog (*Bufo retiformis*). Among the threatened species are rosy boa (*Lichanura trivirgata*) and coral snake (*Micruroides euryxanthus*).

Fish

The Sonoyta watershed is the most important within the PBR. The Sonoyta River for the most part is an intermittent stream. There are some perennial streams that sustain some aquatic life. Representing the ichthyofauna of the river are: desert pupfish (*Cyprinodon macularius*) and longfin dace (*Agosia chrysogaster*). There are also two introduced species. yellow catfish (*Ameirus melas*) and mosquito fish (*Gambusia affinis*) (Búrquez and Castillo 1994, 9-63).

APPENDIX B: THE HUMAN TOUCH – CULTURAL LANDSCAPE OF THE PINACATE REGION

Over a period of several centuries human attitudes and perceptions toward the Pinacate region have been changing. While attitudes have changed the desert landscape has remained the same. Human perceptions have changed through time and space according to the different sets of values that each culture brings to the area. These attitudes interact with the environment to create different “places” for each culture.

Over time these attitudes have accumulated and overlapped into each other, creating new attitudes and adapting old values into new. At the beginning of the 21st century we have accumulated a mixture of values towards the landscape representing a continuum of perceptions of what is appropriate land uses for the area. This section is divided in to the different “places” that the Pinacate Biosphere Region has inspired over time.

A Spiritual Place

In October 1988 in Hermosillo, Sonora, a strong statement from the Tohono O’odham Nation was made in front of the audience participating in the First International Pinacate Symposium. They suggested that the “Hia Ced O’odham be recognized as the original inhabitants of the area known as the Pinacates” (Joaquin 1988, 13). If we recognize this statement we are simply cutting 40,000 years of native history in the region. According to Hayden “Indians have lived in and about the Pinacate for perhaps more than 40,000 years”. These Indians, known now as belonging to the Malpais stage

of the San Dieguito Complex, were gatherers, living off the country and moving from place to place in search of food. This culture left a network of trails that connected the several "tinajas" (water tanks), the desert and the sea with each other (Hayden 1988, 53)

According to Hartmann (1989, 129), the San Dieguito people were representatives of the first Americans, who arrived around 10,000 BC. The San Dieguito period lasted from a cool era around 10,000 BC until a hotter, drier period, called the *altithermal*, centered around 5,000 BC.

By around 3,000 BC grinding mortars cut into the lava rocks of the Pinacates appeared together with more specialized tools (smaller projectile points), presenting evidence of more sophisticated travelers. These new comers are called the *Amargosa* people (Hartman 1989, 131). The Amrgosans are the ancestors of the present O'odham culture. Those who settled in the Pinacate are known as Pinacateños, which are related to the Areneros or Sand Papagos (Hia Ced O'odham). Around 1850 the Pinacteños were nearly wiped out by yellow fever and the few survivors joined the Areneros on the Gila River. (Hayden 1988, 54).

Lumholtz (1990, 333), Hartman (1989,141) and Hyden (1988, 54) mentioned that the last Pinacateño living in the area was Juan Carvajales who died around 1912. Hartman states that with Juan, ended 10,000 years of Indian occupation in the Pinacates. After Juan Carvajales died, the Pinacate area was only visited by the Hia 'Ced O'odham and Tohono O'odham for sacred ceremonies or as a stop on the way to the collection of salt. According to SEMARNAP (1997, 47), the description by Lumholtz (1990, 206-209) of the visit of "shaman" Quelele to I'ittoi's cave illustrated the rapid erosion of the

traditional knowledge of the sacred sites that is still happening in this century. Quelele, took advantage of Lumholtz resources to visit the Pinacate and traditions by showing for the first time to some young O'odham a sacred site of the area.

Lumholtz (1990, 201-203) presents two traditional stories for Tjuktóak (black "tjuk" mountain "tóak") and SEMARNAP (1997; 50-52) presents one more ("Schuk Toak" Pinacate mountain). According to the O'odham, the Pinacates is a sacred place because it is the mountain where the creator Í'ittoi or Elder Brother landed after the deluge. It is where the O'odham people originated: "the Pinacate are our roots."

For reference to the volcanic activity of the Pinacate and for personal preference I reproduce the second legend that Lumholtz presents in his book:

Í'ittoi lived in Baboquivary before he came to Pinacate. At that time there where many people in Pinacate. The mountains were very high then, and the sun used to set soon after it had risen, so the days were very short. He saw that this did not suit the people, and he decided to lower the mountains. He built two fires, where the two peaks are found to day, making fire by drilling one stick into another one. The wind blew the ashes about to all parts and made the mountains lower, covering the country so as to look as seen to day. After that the people lived contented, and there was not so much shade form the west.

A Demons Place

After they arrived to the New World, it took over 100 years for the Spanish to start arriving in Sonora. Their attitude towards the desert landscape (*terra incognita*) and towards the inhabitants did not change much in this period. They were still seeing the "mirage" of the golden cities of Cibola. Particularly, if you are traveling during the summer months in the Pinacate region you not only see the mirage of gold, but also you see water and, interesting formations at the edges of the hills surrounding the area. A

brother of mine contrasts this passage of the first Spaniards looking northward for Cibola to the present travelers going North in search of “golden” cities. Some of them believe that Las Vegas is the modern Cibola.

Fray Marcos de Niza has a bad reputation from some historians for not telling the truth and falsifying data. It is important, however, to recognize what Hartman (1988, 28) mentioned about the possibility that Niza was the first European to see the Pinacate mountains from the coast of the Gulf of California, and perhaps the first to step into the northwestern region of the Sonoran Desert. The first white man to step a foot in the Pinacate region according to some authors (Hartman, Ives) was Melchor Díaz, who crossed the Pinacate border country in 1539. Díaz, long before Kino, knew that Baja California was a peninsula and not an island, as it was believed. After crossing the Pinacates, he continued West and crossed the Colorado River near Yuma. The “beds of burning lava” impressed him. *None of the group could cross them, for it would be like going into the sea to drown. The ground resounded like a drum, as if there were lakes underneath. It was amazing to see the cinders boil in some places, for it looked like something infernal*” (Ives 1989, 158). He clearly encountered the geothermal mud pots and sulfur springs South of Mexicali, Baja California, known as Volcano Lake.

There was fifty years of silence after the first Spanish explorers discover no gold, no seven golden cities, and no beautiful Amazons. But they did leave a new frontier of knowledge and the *terra incognita* frontier was expanded further North. The Sonoran Desert and the Pinacates, as well as the mouth of the Colorado River started to show in

maps. Even though this area was now recorded, many Spanish still believed that Baja California was an island (Hartman 1988, 33).

Oñate in search of the Colorado's mouth in 1604, passed through the North portion of the Pinacates (Cano 1988, 47). Upon arrival to the Colorado and after a welcoming speech from an Indian chief, a wide-eyed priest with Oñate recorded "it appears to me doubtful that there should be so many monstrosities ... so near to us" (Hartman 1988, 33).

With Coronado, a second generation of Spanish explorers arrived in the region. In 1687 a 42 year old from Tyrol, Italy representing the Jesuit Order arrived in the Papaguería Alta (northern Sonora, southern Arizona), spending the remaining 24 years of his life Christianizing, exploring, and mapping the "so sadly watered vineyard of the Lord" (Ives, 1989, 18). To the present, many of the towns along the border of the Sonoran Desert keep the names, missions, foods and plants, and beliefs given by father Francisco Eusebio Kino.

Kino was and still is one of the most influential individuals that shaped the cultures of the Sonoran Desert. It was not easy, but he was able to interact with the native cultures and introduce them to new and different values for the desert landscapes. Kino among some other elements, introduced wheat to the region; "wheat became so important to the Pimas along the Gila River that some even began to call the first month of the year Wheat Harvest Moon instead of Saguaro Harvest Moon" (Sheridan 1996, 134).

Hartman (1989) and Ives (1989), described the six trips that Kino organized through the Pinacate in search of a land passage to the Californias. In 1706, from the top of the Pinacate mountains (known as Santa Clara peak), he was successful (as well as Díaz in 1539) in recognizing that Baja California it was not an island. Two of Kino's associates expressed their impressions of the area:

It gave us more horror to discover a great chain of mountains which seem also to be made of cinders, so that I do not know where there is a place in which can be better shown the face of the earth in the general conflagration before judgment day... Juan María Salvatierra, S.J. (Ives 1989, 19).

From the top of the Santa Clara Mountain, we could see a big hole of such depth that it caused terror and fear. Juan Mateo Manje. (Hartman 1989, 50).

A Frontier Place (Prospectors)

Spaniards were not the only ones looking for gold in the Sonoran Desert region. After the influential and detailed mapping journeys of Kino in the late 1600s, some other Europeans followed. This time it was English from the sea and Yankees from the northlands. Hardy, an unemployed Englishman looking for pearls and corals along the Gulf of California in 1826 followed the Gulf route that Alarcon did in 1540 towards the Colorado mouth. The maps that Kino developed in the late 1600's guided him. He named the Adair Bay (south of the Pinacate) after a friend and also the Hardy Channel of the lower Colorado after his family. While this was happening on the coast, hordes of Americans were coming down from the Gila River, trapping beavers to make hats that were in fashion at that time. Hartman (1989) presents several passages of these adventurers of XIX century. He quotes Hardy's vision of the area:

A traveler sees many things which give rise to a multitude of feelings ... some of them pleasing, some painful, and yet other productive of wonder and surprise. My own sensations were of this latter kind ... [This country] is probably in the same state that it was ages ago ... those who loved the total absence of sound, and of the busy hum of men ... 'would here find a solitude so absolutely melancholy, that they would never willingly again quit the society of their fellow creatures.

El Camino del Diablo that extends from Sonoyta (Sonora) towards Yuma (Arizona) crossing the North flank of the Pinacates, was marked by the dead 49ers (1849) in search of gold first, and later desperately in search of water. About the same time, John W. Audubon, -the son of the famous bird painter- before he lost nearly 200 watercolors and sketches of the region described the Indian settlement East of the Pinacates:

Why it is that these Indians settle in such a country, I cannot conceive, for even the lizards, in most places innumerable are scarce here.

In 1848, with the end of the Mexican-American war, for the first time the Sonoran Desert was subdivided by two nations. North of the Gila River became part of the United States and South of the Gila including Pinacates, El Camino del Diablo, Tucson and the rest of southern Arizona were part of Mexico. Six years latter (1854) with the Gadsen Purchase, this international border was extended southward to were the actual boundary is.

Ives mention by Hartman (1989, 92), capture the kind of “cultural” interactions and mixture of perceptions that where occurring along the Sonoran Desert by the end of the 1800s with this passage:

Three Americans, Tom Childs, Rube Daniels and John Merrill, married three Papago sisters and settled at Quitibaquito. According to local gossip, Childs had married a Papago to learn the secret location of a gold that had supposedly been stolen by Indians from the old Sonoyta mission many years before.

Much of the actual names of the Pinacate region are due to the writers-scientist expeditions of the beginning of the 1900s, even though some of them like MacDougal thought they were the “first” ones to arrive and discover such peculiar volcanic landscape. Hartman (1989) identified this period as the “great expeditions”, describing the adventures and early scientific data collection that started describing the origins and volcanic landscapes of the Pinacates. In his descriptions he mention the work done by MacDougal-Hornaday expedition in 1907 and by that time they were surprise that “no American has set a foot in the area, nor mapped the mysteries of the Pinacates”. This expedition hunted, mapped and photographed the area giving names to some of the craters they “discover”. According to Ives (1989, 45), most of these expeditions were based on local knowledge developed by Ygnacio S. Bonilla a mining engineer of Nogales, Sonora, who made several trips to the Pinacate region, apparently discovering many of the great “calderas” for which the region become famous. Out of this expedition, Hornaday in 1908 make the first English-language description of some of the craters of the area.

Another local based knowledge expedition was conducted by a Norwegian named Carl Lumholtz in the early stages of the Mexican Revolution of 1910. Thanks to the assistance of Alberto Celaya from Sonoyta, Lumholtz was able to explored and

prospected the area of the Pinacates developing the classic book *New Trails in Mexico* (1912) about the people and their interactions with the Pinacate. Comparing with the analytical description of the the MacDougal-Hornaday expedition, Lumholtz was more sensitive to the people issues surrounding the Pinacates and taking the time to understand the traditions and the ancient trails that existed in the area.

Thanks to these expeditions of the early XX century now we can have a better understanding of the geography and natural elements of the region, we can recognized some of the names of the area, and compare early records on temperature, rain, distances. The extensive game hunting that brought them to the area also marked these scientific explorations. Ironically the names that identified some of the features of the PBR are of those great hunting-expeditions like in the case of the MacDougal Crater and the Sierra Hornaday but they also provide great understanding of the natural resources of the area.

During all these processes of change, these different cultures brought different perceptions to the place. The Pinacate was changing from the sacred place representing the home of the “Elder brother” I’ittoi, to the place that caused “terror and fear” for the missionaries and by 1907 Hornaday (1983, 193) was describing the Pinacate place as a “magnificent, grand Vesuvius in the desert”.

By the end of the 1920s, the people without history and the people without “scientific” publications were also conducting expeditions of the Pinacate region. The best seller of *Barrios Matrecitos* (1996) described the early automobile-travelers along the Sonoran Desert between Santana and San Luis Río Colorado, Sonora establishing human settlements along the early routs that the missionaries developed. *Matrecitos*

described the internal landscapes of the people who was firm in conquering the desert to create the human settlements of San Luis Río Colorado and Mexicali developing as important Mecca's for agriculture. Munro in his two publication of the Sonoran Desert also describe how this region was seen from the fisherman that settled in Puerto Peñasco and how they manage to bring water from Sonoyta to Peñasco crossing the Pinacates (Munro, 1994). In *El Camino del Diablo* book (1997), Munro takes us by the hand in a great try-cultural journey along the desert, describing how three different cultures (Mexican, U.S. and O'odham) along the border experience the desert along El Camino del Diablo during the 1930s.

A Utilitarian Place (Ejidos, Users)

With the establishment of the ejidos (communal land tenure system) in the Pinacate region a new utilitarian vision for the desert landscape started to develop. They brought ideas, visions, attitudes and perceptions that in some instances were not compatible with what the desert offers. But they weren't explorers or visitors to the area, they were "send" here by the Mexican government with the promise of land and prosperity to expand the agricultural frontier of the 1960s. They came to settle this isolated landscape and to claim their right to make a living in this "Promised Land". They came from places where extensive commercialized farming and ranching was a feasible economic activity like in Jalisco and Nayarit, and they wanted to do just that in the hart of the Sonoran Desert.

A Conservation Place (PBR)

This is the latest sense of place that is currently occurring in the area of the Pinacate Biosphere Reserve and is certainly one of the most challenging ones due to the overlapping of attitudes and perceptions of the land that accumulated over time and over cultures. The current managers of the PBR are facing challenges of adaptation of local traditional knowledge from the O'odham people. They just currently were celebrating the 300 anniversary when father Kino was recognizing the area in October 9, 1698. They are still identifying and understanding the knowledge left by the expeditions of the late 1800s and early 1900s. They are trying to seek the local participation of the ejidos in order to obtain input for sustainable development. They are dealing with multicultural and multinational issues to adapt in the proper management of the area. They are dealing with the international values imposed by the biosphere model of adaptive management, ecosystem management, sustainable development and local participation. They need to face the multiple issues that local and external non-governmental organizations bring to the area. And on top of all that they need to police, patrol and conserve the area.

For the first time in the history of the Pinacate BR there is a permanent population in charge of the protection and "proper" use of the area. Now there is a need for registration to enter and there is a big list of NOs and regulations that need to be followed in order to be a good visitor, scientist or resident of the area. Conservation has arrived, and together with it the science of No –as Halffter identified the environmental sciences - has entered the Pinacates. Thanks to the Mexican conservation policies of the 1990s there is

also some financial support to meet the challenges of conservation and community participation in the protected areas or at least to maintain the managers-staff on site.

In part, due to the presence of the biosphere concept along the border lands of the Sonoran Desert in 1997, the U.S. Secretary of Department of Interior Bruce Babbitt and Mexican Secretary of the Environment (SEMARNAP) Julia Carabias signed a letter of intent. This letter is pledging to work jointly in protecting and managing natural protected areas along this portion of the Sonoran Desert. This letter, also emphasize the history of cooperation as well as the sovereign rights and responsibilities of both countries to manage and properly use the natural resources (Murrieta 1997, 27). To get to this point of cooperation among this two nations there is a long history of events that needed to developed and also a different mind set from a whole latitude of local, regional, national and international participants. The following table presents a chronology of events leading towards this letter of intent and recent developments regarding cooperation for management along the Sonoran Desert border region including the Pinacate BR.

A Chronology of events of the Conservation Wave of the Sonoran Desert

1937	U.S. Congress declares <i>Organ Pipe Cactus National Monument (ORPI)</i>
1939	<i>Cabeza Prieta</i> set aside as National Game Refuge for conservation of Bighorn sheep and Pronghorn antelope
1941	<i>Luke Air Force Range</i> established for military training, excluding grazing, mining, agriculture, and intensive recreation activities
1955	Mexico Fishery Directorate establishes <i>Zona de Refugio Rio Colorado</i> for freshwater and marine species conservation

- 1965 Initial proposal by US Secretary of Interior Stewart Udall to create a binational protected area along the Sonora Arizona border, that would include *ORPI*, *Cabeza Prieta National Wildlife Refuge (CPNWR)* and the *Tinajas Altas*, then under BLM.
- 1976 NPS proposal of biosphere reserve status for *ORPI* accepted by UNESCO
- 1977 Mexico establishes Biosphere Reserve as a protected area category
- 1979 SARH declares the *Pinacate* region a Zona Protectora Forestal y Refugio Faunístico.
- 1980 State of Sonora initiates feasibility study of *Pinacate* as a biosphere reserve
- 1982 *Luke Air Force Range* Natural Resources Management Cooperative Agreement Cooperative Agreement between USAF, USN/MC, USFWS, BLM, AGFD
- 1982 State natural areas established on LAFR at *Tinajas Altas*, *Mohawk Mountains and Sand Dunes*, and *Crater Range*
- 1983 US and Mexico sign *Agreement for the Protection and Improvement of the Environment in the Border Area (La Paz Agreement)* providing a formal foundation for cooperative environmental efforts.
- 1986 *ORPI* dedicates Sonoran Biosphere Reserve Center and launches sensitive ecosystems research program
- 1986 US Congress consolidates withdrawal of 2.664 million acres of public land for Air Force training purposes for 15 years. USAF prepares Natural Resources Management Plan for renamed *Barry M. Goldwater Air Force Range (BGR)*.
- 1988 First International Research Symposium on the *Pinacate*, sponsored by the Ecology Committee of the Sonora-Arizona Commission and Friends of ProNatura
- 1989 BLM develops amendment to Lower Gila South Resource Management Plan (1987) that provides for cooperative management with USAF of *BGR*.
- 1990 NPS incorporates biosphere reserve into general management planning process for *ORPI*
- 1990 Arizona Wilderness Bill declares special wilderness status for 95% of *ORPI*, 93% of *CP NWR* and 78% of *Kofa NWR*.
- 1991 NPS Management Policies NPS-77 guideline supports concept of interagency and intersectoral collaboration in support of broader ecosystem management
- 1992 *Alto Golfo* identified as high priority marine conservation site in Mexico
- 1992 Sonoran Institute and FPN coordinate a regional forum on regional land-use change and biosphere reserves
- 1992 SI and FPN establish International Sonoran Desert Alliance (ISDA) to coordinate movement towards biosphere reserve program and cross border, interagency collaboration.
- 1992 Federal governments of Mexico and US release Integrated Environmental Plan for the Mexican-US border Area (IBEP).

- 1993 INE declares *Delta del Rio Colorado* as an international reserve of the Western Hemisphere Shorebird Network
- 1993 Based on new proposal by Centro de Ecologia (UNAM) and Centro Ecologico de Sonora (CES), Mexico declares *Pinacate y Gran Desierto de Altar (PDABR)* and *Alto Golfo y Delta del Rio Colorado (AGDC)* as biosphere reserves.
- 1993 Commission for Environmental Cooperation (CEC) created by the N.A. Agreement on Environmental Cooperation (side agreement to NAFTA), to enhance regional cooperation, prevent potential environmental and trade disputes and promote effective enforcement of environmental law.
- 1993 Border XXI Program established to ensure a binational federal commitment to sustainable development through improved social and economic welfare of border communities and conservation of natural areas.
- 1993-96 ISDA, with support from SI, NPS-Office of Mexican Affairs, Sonoran State Office of Normatividad Ecologica, convenes stakeholder parties in a series of meetings to further inform on and build support for a transborder network of protected areas in the Arizona/Sonora borderlands
- 1995 *Pinacate* and *Alto Golfo* are accredited by UNESCO as additions to the global network of Biosphere Reserves.
- 1996 USFWS, SEMARNAP and CWS sign Cooperative Agreement on the Conservation and Management of Wildlife and Ecosystems.
- 1996 Management of natural protected areas to guarantee the conservation of ecosystems and biodiversity; promoting environmentally appropriate productive projects, and furthering education, training, law enforcement, and research capacities in the border region are identified as 5-year objectives by Border XXI Natural Resources Workgroup.
- 1996 Management plans for *Pinacate* and *Alto Golfo* biosphere reserves are approved and implementation initiated by IMADES and SEMARNAP/INE.
- 1996 Governors Fife Symington of Arizona and Manlio Fabio Beltrones of Sonora sign letter of support for cooperative management of natural and cultural resources and promotion of sustainable development in the Sonoran Desert borderlands.
- 1996 Supernatant of *ORPI* and Refuge Manager of CP *NWR* endorse establishment of a transboundary Sonoran Desert Biosphere Reserve Network in letter to MAB Biosphere Reserve Committee.
- 1997 Concept for a multinational Sonoran Desert Ecosystem Partnership to coordinate decisions relating to the management of existing protected areas along the Arizona-Sonora border is agreed to during meeting in Hermosillo, Sonora by representatives of over 20 federal and state management agencies, universities, tribal groups, and non-governmental organizations from Mexico and the U.S. A working group is established to follow up on the structure, mission, and role of such a partnership.
- 1997 Letter of Intent signed between the US Department of Interior and the Mexico Secretariat of Environment, Natural Resources and Fisheries for joint work in natural protected areas on the United States and Mexico border with special priority given to the Sonoran Desert.

1997 USAF, BLM, AGFD, FWS and others initiate discussions regarding the renewal of withdrawal agreement for military use of the *BGAFR*

(Adapted from Cornelius, 1998)

The management plan of the PBR was approved by SEMARNAP in 1996, and implementation initiated in 1996 in coordination with the state office of IMADES. The objective of the management plan is to maintain in perpetuity the biological, geological and geomorphologic processes of the Sonoran Desert Ecosystem, and the historical, cultural and scenic values of the area. These conservation initiatives are strongly linked to economic productivity and supportive of regional and national goals for sustainable development. Cornelius (1998, 20) reports that in order to accomplish the overall objective and to deal effectively with the treat facing the reserve, the management strategies will be utilitarian and to promote use of the resources by residents and the general public. The plan recognizes the willingness to collaborate with the Tohono O'odham people in development of guidelines for traditional access and use of resources on the reserve.

These conservation initiatives are not only reflected in the management plan, they are actually taking place on site. A series of community meetings to bring the communities point of view of the area and also to bring the reserve to the communities are a continuum process from the managers and also from a series of NGOs working on the area. Such is the case of the International Sonoran Desert Alliance (ISDA) established in 1993. ISDA is a regional NGO representing citizens' from the U.S. Mexico and the O'odham people. The alliance is combining the local institutions with the

biosphere concept to create the body of knowledge in the design of policies to accomplish sustainable use of natural resources within and around the PBR (Murrieta 1998, 66).

The biosphere concept is providing a place where residents and resource managers in the Sonoran Desert border region are strengthening and incrementing cooperation, respect and understanding for the common goal that lead to sustainable communities and a healthy environment. With this goal in mind, a series of workshops were organized by ISDA and the Sonoran Institute in 1996, that developed in a series of community projects where conservation and development have a strong link (Murrieta 1996, 19). The Technical Advisory Council (TAC) of the Pinacate BR has reinforced this open process of participation created by the biosphere concept. Its main objective is to formalize and institutionalize the mechanisms for participation from the different sectors of the civil society involved and concerned with the conservation activities of natural resources *in situ*. Even though the TAC was established in May, 1997 is still in the development process and it counts with representation from the local, regional, state and federal institutions.

Also from the environmental and social science perspective, in the summer of 1998 the managers of the PBR organized the first science forum regarding research and management of natural and cultural resources as well as sustainable development issues. This are the firsts steps to know what is the state of the art in human dimensions and natural resources in the Pinacate region so that way, we know where to go from here and what are the gaps of knowledge for a better management and understanding of the area.

The Pinacate BR is young and still in its development stages, as a lot of biosphere reserves in the world the main emphasis is conservation. The managers of the reserve are trained mainly in the field of the natural sciences but their major challenge are social and political and is in here where the understanding needs to be reinforced. At least in the present conservation stages of the Pinacate region we have a forum to discuss the past, present and future of this region and its communities and that is a major step from the resource management perspective.

A Place.... (the future)

October 9, 1998 in Sonoyta, Sonora they just celebrated the 300 anniversary of the presence of Father Kino in the Sonoran Desert. I do not know if Kino was envisioning Sonoyta as the crossroads between two nations, a three cultural landscape that most of them are Christianized, a gateway for the Pinacates BR as well as for Organ Pipe Cactus National Monument in Arizona, and a truck stop. In the center of town there is an obelisk representing the diversity of cultures in the region. I wonder what type of ceremony our Friend Quelele would envisioned for this anniversary, even though the physical connection to the Pinacate's is weak, the present O'odham generation still consider this place as a special and "sacred" one. Some of them are connecting back to this landscape, thanks to the cooperation among Pinacate BR-managers and O'odham people, on that day they explored the internal landscape as well as the volcanic landscape of the Pinacates. In that same date, some eco-tour operators of the region gather in Puerto Peñasco to agree in partnerships of cooperation with La Ruta de Sonora Ecotourism Association and to see the final details to install the board of directors for that

association. La Ruta is a regional effort to link communities and protected areas in the development of the ecotourism industry to bring economic alternatives to local residents and proper management of natural and cultural resources. A German group is making efforts to rebuild the San Marcelo Kino-Mission where Father Rhuen from Germany died.

I hope 300 hundred years from now we can still celebrate Father Kino, Quelele, and maybe the declaration of the Pinacate Biosphere Reserve for bringing prosperity and reconciliation between natural resource uses and human occupation of the Pinacate landscape. One thing is certain, change is always present and we as resource managers, and we need to adapt to these changes. We also need to recognize the history of these changes in order to shape and envision our future. A place is a constant and dynamic change.

APPENDIX C: EIGENVALUES

RMRATE - output

DISPLAY 13. PRINCIPAL COMPONENT ANALYSIS: EIGENVALUES

EIGENVALUES:

34.11	2.683	2.488	2.308	2.011	1.710	1.548	1.349	1.342	1.237
1.164	1.142	1.107	1.002	.8987	.8322	.7868	.7280	.6884	.6431
.6001	.5742	.5508	.5254	.4964	.4748	.4496	.4044	.3825	.3677
.3526	.3421	.3108	.2904	.2691	.2581	.2378	.2150	.2064	.1950
.1772	.1568	.1382	.1275	.1201	.1115	.1086	.9708E-01	.9015E-01	.7958E-01
.7471E-01	.6297E-01	.6147E-01	.5066E-01	.4786E-01	.4323E-01	.3999E-01	.3413E-01	.2574E-01	.1820E-01
.1569E-01	.1060E-01	.9555E-02	.6643E-02	.4592E-02	.3469E-02	.1789E-02	.5521E-03	.6171E-04	

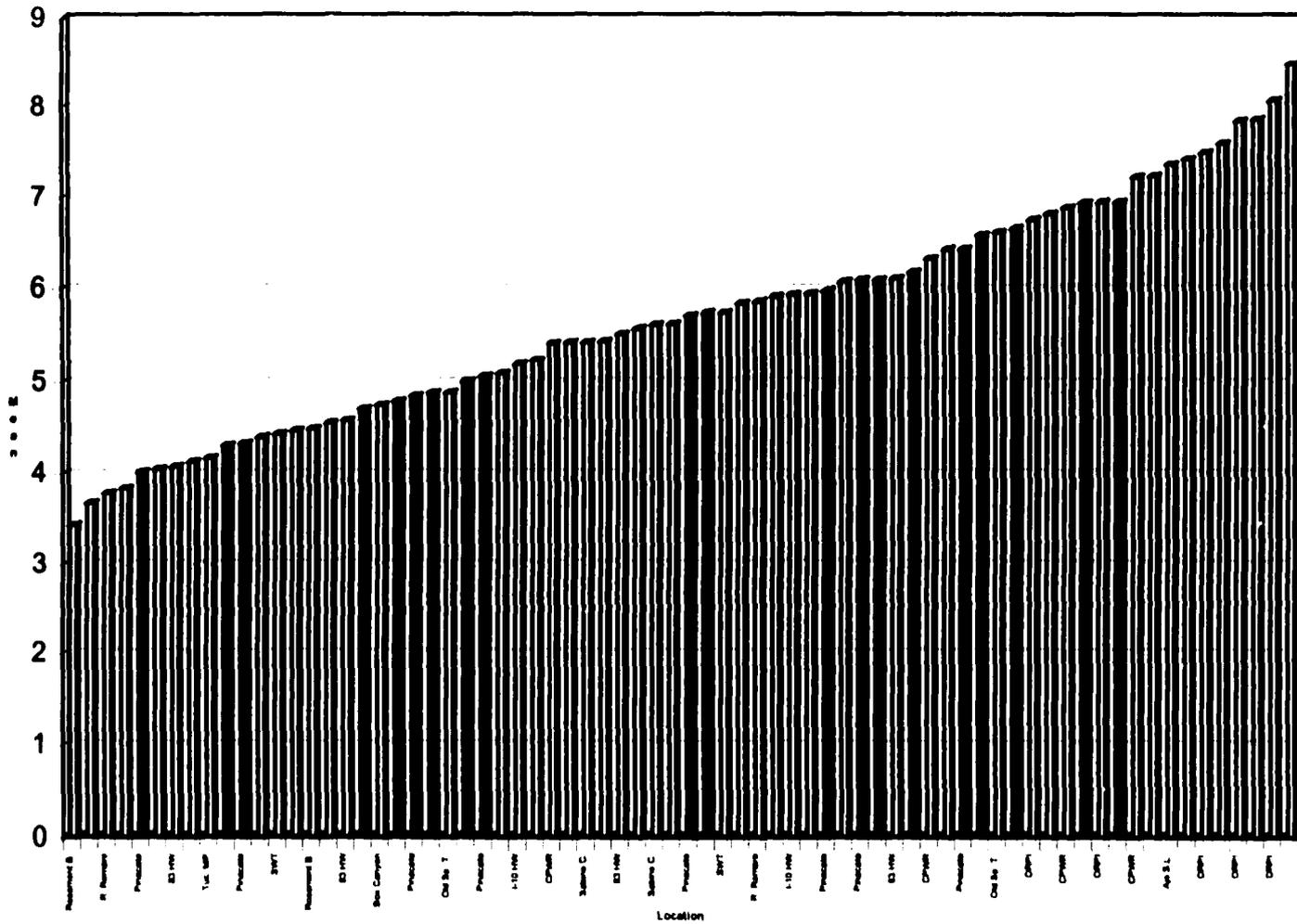
PERCENT OF VARIANCE:

49.43	3.889	3.606	3.346	2.914	2.479	2.244	1.956	1.945	1.792
1.687	1.655	1.605	1.453	1.302	1.206	1.140	1.055	.9977	.9320
.8697	.8321	.7983	.7614	.7194	.6881	.6516	.5860	.5543	.5328
.5111	.4958	.4504	.4208	.3900	.3741	.3447	.3115	.2992	.2826
.2569	.2273	.2003	.1848	.1740	.1615	.1573	.1407	.1307	.1153
.1083	.9126E-01	.8909E-01	.7342E-01	.6936E-01	.6265E-01	.5796E-01	.4946E-01	.3731E-01	.2637E-01
.2274E-01	.1536E-01	.1385E-01	.9627E-02	.6655E-02	.5028E-02	.2592E-02	.8002E-03	.8944E-04	

APPEBDIX D: MEAN VALUES SONORAN DESERT REPRESENTATION									
Mean Values									
		Mean	Median	Std. Dev.				Mean	
	ALL STNM	5.68	5.7	1.8			ALL STNM	5.68	
	baseline	5.68	5.7	1.8	Carousel Position		baseline	5.68	
ORPI	1	7.86	8	1.73	1	Rosemont	70	3.43	Lowest Rating
	2	7.42	8	1.84	7	I-10 HWY	34	3.67	
	3	7.49	8	1.95	13	R. Romer	59	3.78	
	4	6.75	7	2.07	20	I-19 HWY	40	3.83	
	5	7.59	8	1.74	25	Pinacate	29	4.01	
	6	6.42	7	1.99	31	I-10 HWY	37	4.04	
	7	8.48	9	1.51	38	83 HWY	41	4.07	
	8	8.07	8	1.71	47	Box Cary	56	4.12	
	9	6.94	7	2.11	52	Tuc. MP	58	4.18	
	10	7.84	8	1.96	61	Pinacate	23	4.3	
Pinacate	11	4.7	4	2.02	3	Pinacate	24	4.32	
	12	6.65	7	1.98	9	I-10 HWY	35	4.39	
	13	4.88	5	2.07	15	SWT	62	4.42	
	14	5.71	6	2.02	22	I-19 HWY	38	4.46	
	15	6.42	6	1.91	29	Rosemont	69	4.48	
	16	6.09	6	2.07	36	I-19 HWY	39	4.54	
	17	5.74	6	2.01	40	83 HWY	44	4.57	
	18	6.93	7	1.8	42	Pinacate	11	4.7	
	19	4.84	5	2.23	45	Box Cary	55	4.74	
	20	6.17	6	1.71	48	Pinacate	27	4.78	
	21	5.06	5	2.25	50	Pinacate	19	4.84	
	22	6.58	7	1.78	54	Pinacate	13	4.88	
	23	4.3	4	2.1	57	Old Sp. T.	71	4.88	
	24	4.32	4	1.84	59	Pinacate	28	5	
	25	5.97	6	1.83	62	Pinacate	21	5.06	
	26	6.94	7	1.92	63	I-10 HWY	31	5.09	
	27	4.78	4	1.79	65	I-10 HWY	33	5.19	
	28	5	5	2.48	67	SNM	53	5.23	
	29	4.01	4	1.99	71	CPWR	51	5.41	
	30	6.09	6	2.32	72	Sabino C.	65	5.42	
I-10 HWY	31	5.09	5	1.75	2	Sabino C	67	5.42	
	32	5.57	5	1.84	6	83 HWY	45	5.43	
	33	5.19	5	1.87	8	83 HWY	43	5.51	
	34	3.67	3	1.79	12	I-10 HWY	32	5.57	
	35	4.39	4	1.91	14	Sabino C	66	5.61	
	36	5.93	6	2.08	32	SNM	52	5.62	
	37	4.04	4	1.79	35	Pinacate	14	5.71	
I-19 HWY	38	4.48	4	1.68	17	Pinacate	17	5.74	
	39	4.54	4	1.97	68	SWT	61	5.74	
	40	3.83	4	1.92	70	Rosemont	68	5.84	
83 HWY	41	4.07	4	2.18	53	R. Romer	60	5.86	
	42	6.1	6	1.92	56	SNM	54	5.91	
	43	5.51	5	1.86	58	I-10 HWY	36	5.93	
	44	4.57	4	2	60	83 HWY	46	5.94	
	45	5.43	5	1.57	64	Pinacate	25	5.97	
	46	5.94	6	1.79	66	Tuc. MP	57	6.07	
CPWR	47	6.88	7	1.88	5	Pinacate	16	6.09	
	48	7.22	7	2	11	Pinacate	30	6.09	
	49	6.81	7	2.07	18	83 HWY	42	6.1	
	50	6.32	6	2.08	33	Pinacate	20	6.17	
	51	5.41	5	2.22	69	CPWR	50	6.32	
SNM	52	5.62	6	1.77	37	ORPI	6	6.42	
	53	5.23	5	1.74	43	Pinacate	15	6.42	
	54	5.91	6	1.96	55	Pinacate	22	6.58	
Box Cary	55	4.74	5	1.68	16	Old Sp. T.	72	6.61	
	56	4.12	4	1.88	21	Pinacate	12	6.65	
Tuc. MP	57	6.07	6	1.79	19	ORPI	4	6.75	
	58	4.18	4	1.76	23	CPWR	49	6.81	
R. Romer	59	3.78	4	1.7	24	CPWR	47	6.88	
	60	5.86	6	1.99	28	Pinacate	18	6.93	
SWT	61	5.74	6	1.83	26	ORPI	9	6.94	
	62	4.42	4	1.97	30	Pinacate	26	6.94	
Ajo S.L.	63	7.36	8	1.92	27	CPWR	48	7.22	
	64	7.23	8	1.7	44	CPWR	64	7.23	
Sabino C.	65	5.42	6	1.77	34	CPWR	63	7.36	
	66	5.61	6	1.66	39	ORPI	2	7.42	
	67	5.42	6	1.9	41	ORPI	3	7.49	
Rosemont	68	5.84	6	1.92	46	ORPI	5	7.59	
	69	4.48	4	1.97	49	ORPI	10	7.84	
	70	3.43	4	1.91	51	ORPI	1	7.86	
Old Sp. T.	71	4.88	5	1.82	4	ORPI	8	8.07	
	72	6.61	7	1.83	10	ORPI	7	8.48	Highest Rating

APPENDIX E: SONORAN DESERT LANDSCAPE, SCENIC BEAUTY

Sonoran Desert Landscapes Scenic-Beauty
(Pinacate Values)
(Students)



APPENDIX F

Description of the Area and Destination Sites

The Pinacate Biosphere Reserve (PBR) located in the heart of the Sonoran Desert was declared by the Mexican government in 1993 and received UNESCO's international recognition later that year. The main feature of the PBR is its geology represented by the volcanic landscapes, the Maar type craters (a cone-less volcanic crater formed by a single explosive eruption) and the cinder cones, making this region unique for its landforms worldwide. For the study, the four specific sites of interest are:

Crater El Elegante: This is the most visited of all craters in the Reserve, having relatively easy access. It is the largest crater in the region, 820 feet (250m) deep and 3,946 feet (1,200m) in diameter. Its approximate age is around 149,000 years. Elegante is a vast, dark amphitheater located 15.8 miles (25.2km) from the visitor center representing the center of the volcanic landscape of the Pinacate. The section of an earlier cinder cone is visible in the southeast curve of the crater wall. In the tuff beds of the rim are resting layers of basaltic lava flows.

Cerro Colorado: Lies just Northeast of the lava flows, and take its names from the red color and from the rim beds of tuff and earth. It is considered one of the youngest craters of the Pinacate, with 13 feet (4m) deep and 2,460 feet (750m) in diameter. Located 21.5 miles (34.4km) from the visitor center, it is a tuff ring, formed by steam blasting upward through hundreds of feet of old river valley fill. The south inner wall of the tuff ring has been protected from erosion by a coating of once wet ash.

Tecolote: It's one of two remote (primitive) camping sites with a capacity for 40 persons and/or 10 vehicles. Located 20.6 miles (33km) north of the visitor's center and approximately 5 miles Northeast of El Elegante. The campground is composed by volcanic ash and sand surrounded by interesting formations of "frozen" lava flows. There is one hiking trail that leads to some of the most spectacular views of the Pinacate landscapes.

La Laja: Privately own traditional cinder mining operation inside the core area of the Pinacate biosphere reserve. It's located 25 miles (40km) from the visitor center. This is one of the 9 sites that were operating before the declaration of the PBR in 1993. La Laja was closed with this declaration. At the present there are 2 sites outside the core area that continue operation of cinder mining. The cinder is use for construction material, insulation and landscape decorations. It provided some jobs for local communities.

APPENDIX G: ROAD SEGMENTS ANOVA RESULTS

General Linear Model

Within-Subjects Factors

Measure: MEASURE_1

FACTOR1	Dependent Variable
1	SL1
2	SL2
3	SL3
4	SL4
5	SL5
6	SL6
7	SL7
8	SL8
9	SL9
10	SL10
11	SL11
12	SL12
13	SL13
14	SL14
15	SL15
16	SL16
17	SL17
18	SL18
19	SL19
20	SL20
21	SL21
22	SL22
23	SL23
24	SL24
25	SL25
26	SL26
27	SL27
28	SL28
29	SL29
30	SL30
31	SL31
32	SL32
33	SL33
34	SL34
35	SL35
36	SL36
37	SL37
38	SL38

Between-Subjects Factors

		N
GROUP	1.00	61
	2.00	59
DIRECT	1.00	61
	2.00	59

		Value Label
GROUP	1.00	S-N Travel Direction
	2.00	N-S Travel Direction
DIRECT	1.00	Students
	2.00	ORPI-Visitors

Multivariate Tests^b

Effect		Value	F	Hypothesis df	Error df	Sig.
FACTOR1	Pillai's Trace	.867	14.074 ^a	37.000	80.000	.000
	Wilks' Lambda	.133	14.074 ^a	37.000	80.000	.000
	Hotelling's Trace	6.509	14.074 ^a	37.000	80.000	.000
	Roy's Largest Root	6.509	14.074 ^a	37.000	80.000	.000
FACTOR1 * GROUP	Pillai's Trace	.477	1.973 ^a	37.000	80.000	.006
	Wilks' Lambda	.523	1.973 ^a	37.000	80.000	.006
	Hotelling's Trace	.912	1.973 ^a	37.000	80.000	.006
	Roy's Largest Root	.912	1.973 ^a	37.000	80.000	.006
FACTOR1 * DIRECT	Pillai's Trace	.841	11.409 ^a	37.000	80.000	.000
	Wilks' Lambda	.159	11.409 ^a	37.000	80.000	.000
	Hotelling's Trace	5.277	11.409 ^a	37.000	80.000	.000
	Roy's Largest Root	5.277	11.409 ^a	37.000	80.000	.000
FACTOR1 * GROUP * DIRECT	Pillai's Trace	.348	1.152 ^a	37.000	80.000	.295
	Wilks' Lambda	.652	1.152 ^a	37.000	80.000	.295
	Hotelling's Trace	.533	1.152 ^a	37.000	80.000	.295
	Roy's Largest Root	.533	1.152 ^a	37.000	80.000	.295

a. Exact statistic

b.

Design: Intercept+GROUP+DIRECT+GROUP * DIRECT

Within Subjects Design: FACTOR1

Mauchly's Test of Sphericity^a

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon ^a		
					Greenhous e-Geisser	Huynh-Feldt	Lower-bound
FACTOR1	.000	1678.396	702	.000	.501	.616	2.703E-02

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

b.

Design: Intercept+GROUP+DIRECT+GROUP * DIRECT

Within Subjects Design: FACTOR1

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
FACTOR1	Sphericity Assumed	1211.672	37	32.748	22.006	.000
	Greenhouse-Geisser	1211.672	18.538	65.362	22.006	.000
	Huynh-Feldt	1211.672	22.804	53.134	22.006	.000
	Lower-bound	1211.672	1.000	1211.672	22.006	.000
FACTOR1 * GROUP	Sphericity Assumed	125.481	37	3.391	2.279	.000
	Greenhouse-Geisser	125.481	18.538	6.769	2.279	.001
	Huynh-Feldt	125.481	22.804	5.503	2.279	.001
	Lower-bound	125.481	1.000	125.481	2.279	.134
FACTOR1 * DIRECT	Sphericity Assumed	822.084	37	22.218	14.930	.000
	Greenhouse-Geisser	822.084	18.538	44.347	14.930	.000
	Huynh-Feldt	822.084	22.804	36.050	14.930	.000
	Lower-bound	822.084	1.000	822.084	14.930	.000
FACTOR1 * GROUP * DIRECT	Sphericity Assumed	87.771	37	2.372	1.594	.013
	Greenhouse-Geisser	87.771	18.538	4.735	1.594	.051
	Huynh-Feldt	87.771	22.804	3.849	1.594	.037
	Lower-bound	87.771	1.000	87.771	1.594	.209
Error(FACTOR1)	Sphericity Assumed	6387.129	4292	1.488		
	Greenhouse-Geisser	6387.129	2150.377	2.970		
	Huynh-Feldt	6387.129	2645.262	2.415		
	Lower-bound	6387.129	116.000	55.061		

Tests of Within-Subjects Contrasts

Source	FACTORY	Type III Sum of Squares	df	Mean Square	F	Sig.
Measure MEASURE_1 FACTORY	Linear	18 823	1	18 823	2 320	.000
	Quadratic	2 055	1	2 055	.572	.451
	Cubic	8 388	1	8 388	2 183	.144
	Order 4	80 833	1	80 833	24 878	.000
	Order 5	4 846	1	4 846	2 719	.102
	Order 6	223 864	1	223 864	88 437	.000
	Order 7	27 586	1	27 586	11 884	.001
	Order 8	220 833	1	220 833	140 541	.000
	Order 9	32 588	1	32 588	18 808	.000
	Order 10	6 082E-02	1	6 082E-02	.041	.841
	Order 11	48 572	1	48 572	34 212	.000
	Order 12	41 344	1	41 344	27 881	.000
	Order 13	103 441	1	103 441	58 885	.000
	Order 14	50 324	1	50 324	36 044	.000
	Order 15	102 003	1	102 003	88 440	.000
	Order 16	45 347	1	45 347	55 088	.000
	Order 17	11 108	1	11 108	10 788	.001
	Order 18	2 103	1	2 103	1 837	.167
	Order 19	21 702	1	21 702	22 238	.000
	Order 20	7 960	1	7 960	5 337	.022
	Order 21	432	1	432	523	.471
	Order 22	43 773	1	43 773	37 865	.000
	Order 23	2 458E-02	1	2 458E-02	.021	.888
	Order 24	2 245	1	2 245	2 088	.151
	Order 25	888	1	888	1 204	.275
	Order 26	8 318E-02	1	8 318E-02	.088	.753
	Order 27	1 348	1	1 348	1 084	.300
	Order 28	18 835	1	18 835	18 373	.000
	Order 29	15 841	1	15 841	17 351	.000
	Order 30	28 417	1	28 417	24 477	.000
	Order 31	33 882	1	33 882	33 571	.000
	Order 32	8 285	1	8 285	8 423	.003
	Order 33	1 782	1	1 782	1 874	.163
	Order 34	577	1	577	531	.468
	Order 35	10 183	1	10 183	18 515	.000
	Order 36	17 842	1	17 842	18 850	.000
	Order 37	886	1	886	1 238	.288
FACTORY * GROUP	Linear	8 738	1	8 738	1 527	.218
	Quadratic	30 232	1	30 232	8 418	.004
	Cubic	8 185	1	8 185	2 085	.151
	Order 4	4 157	1	4 157	1 712	.193
	Order 5	4 534	1	4 534	2 483	.117
	Order 6	4 877	1	4 877	2 145	.148
	Order 7	1 828E-02	1	1 828E-02	.007	.833
	Order 8	4 794	1	4 794	3 054	.083
	Order 9	4 384	1	4 384	2 503	.118
	Order 10	3 320	1	3 320	2 220	.138
	Order 11	173	1	173	127	.722
	Order 12	483	1	483	310	.579
	Order 13	2 881	1	2 881	1 718	.193
	Order 14	545	1	545	381	.533
	Order 15	2 882	1	2 882	1 744	.188
	Order 16	1 786	1	1 786	2 178	.143
	Order 17	104	1	104	101	.751
	Order 18	17 813	1	17 813	16 410	.000
	Order 19	288	1	288	303	.583
	Order 20	210	1	210	142	.707
	Order 21	1 181	1	1 181	1 441	.232
	Order 22	808	1	808	528	.470
	Order 23	2 834E-03	1	2 834E-03	.002	.861
	Order 24	6 084E-02	1	6 084E-02	.057	.812
	Order 25	6 410E-02	1	6 410E-02	.088	.770
	Order 26	2 625	1	2 625	2 784	.087
	Order 27	879	1	879	850	.358
	Order 28	13 208	1	13 208	12 235	.001
	Order 29	2 804	1	2 804	3 052	.083
	Order 30	2 814	1	2 814	2 422	.122
	Order 31	4 588E-03	1	4 588E-03	.005	.947
	Order 32	471	1	471	535	.488
	Order 33	482	1	482	561	.458
	Order 34	107	1	107	088	.754
	Order 35	6 448E-02	1	6 448E-02	.104	.747
	Order 36	8 354E-02	1	8 354E-02	.083	.781
	Order 37	1 883	1	1 883	2 487	.118
FACTORY * DIRECT	Linear	23 152	1	23 152	4 071	.048
	Quadratic	48 488	1	48 488	13 779	.000
	Cubic	11 421	1	11 421	3 883	.052
	Order 4	38 855	1	38 855	16 418	.000
	Order 5	17 888	1	17 888	8 888	.002
	Order 6	87 878	1	87 878	38 888	.000
	Order 7	22 823	1	22 823	9 828	.002
	Order 8	3 881	1	3 881	2 522	.115
	Order 9	3 881	1	3 881	2 170	.143
	Order 10	8 144E-02	1	8 144E-02	.064	.818
	Order 11	57 824	1	57 824	42 331	.000
	Order 12	2 625	1	2 625	1 758	.188
	Order 13	173	1	173	100	.752
	Order 14	10 038	1	10 038	7 188	.008
	Order 15	22 403	1	22 403	15 251	.000
	Order 16	881	1	881	628	.385
	Order 17	7 848E-02	1	7 848E-02	.074	.788
	Order 18	13 812	1	13 812	12 816	.001
	Order 19	3 182E-02	1	3 182E-02	.033	.857
	Order 20	2 881	1	2 881	1 817	.180
	Order 21	885	1	885	1 082	.300
	Order 22	4 838E-02	1	4 838E-02	.042	.838
	Order 23	6 480	1	6 480	5 470	.021
	Order 24	72 886	1	72 886	87 788	.000
	Order 25	430	1	430	578	.448
	Order 26	1 545	1	1 545	1 844	.282
	Order 27	-----	1	-----	-----	-----
	Order 28	5 872E-03	1	5 872E-03	.005	.942
	Order 29	25 484	1	25 484	27 738	.000
	Order 30	83 411	1	83 411	58 798	.000
	Order 31	38 182	1	38 182	35 882	.000

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	119614.287	1	119614.287	1583.398	.000
GROUP	1765.417	1	1765.417	23.370	.000
DIRECT	620.435	1	620.435	8.213	.005
GROUP * DIRECT	35.478	1	35.478	.470	.495
Error	8762.961	116	75.543		

APPENDIX H: DESTINATION SITES ANOVA RESULTS

General Linear Model

Within-Subjects Factors

Measure: MEASURE_1

FACTOR1	Dependent Variable
1	SL1
2	SL2
3	SL3
4	SL4
5	SL5
6	SL6
7	SL7
8	SL8
9	SL9
10	SL10
11	SL11
12	SL12
13	SL13
14	SL14
15	SL15
16	SL16

Between-Subjects Factors

		N
GROUP	1.00	62
	2.00	62
DIRECTIO	1.00	62
	2.00	62

		Value Label
GROUP	1.00	S-N Travel Direction
	2.00	N-S Travel Direction
DIRECT	1.00	Students
	2.00	ORPI-Visitors

Multivariate Tests ^b

Effect		Value	F	Hypothesis df	Error df	Sig.
FACTOR1	Pillai's Trace	.830	34.545 ^a	15.000	106.000	.000
	Wilks' Lambda	.170	34.545 ^a	15.000	106.000	.000
	Hotelling's Trace	4.888	34.545 ^a	15.000	106.000	.000
	Roy's Largest Root	4.888	34.545 ^a	15.000	106.000	.000
FACTOR1 * GROUP	Pillai's Trace	.287	2.838 ^a	15.000	106.000	.001
	Wilks' Lambda	.713	2.838 ^a	15.000	106.000	.001
	Hotelling's Trace	.402	2.838 ^a	15.000	106.000	.001
	Roy's Largest Root	.402	2.838 ^a	15.000	106.000	.001
FACTOR1 * DIRECTIO	Pillai's Trace	.290	2.882 ^a	15.000	106.000	.001
	Wilks' Lambda	.710	2.882 ^a	15.000	106.000	.001
	Hotelling's Trace	.408	2.882 ^a	15.000	106.000	.001
	Roy's Largest Root	.408	2.882 ^a	15.000	106.000	.001
FACTOR1 * GROUP * DIRECTIO	Pillai's Trace	.140	1.147 ^a	15.000	106.000	.325
	Wilks' Lambda	.860	1.147 ^a	15.000	106.000	.325
	Hotelling's Trace	.162	1.147 ^a	15.000	106.000	.325
	Roy's Largest Root	.162	1.147 ^a	15.000	106.000	.325

a. Exact statistic

b.

Design: Intercept+GROUP+DIRECTIO+GROUP * DIRECTIO

Within Subjects Design: FACTOR1

Mauchly's Test of Sphericity ^b

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon ^a		
					Greenhous e-Geisser	Huynh-Feldt	Lower-bound
FACTOR1	.002	697.370	119	.000	.510	.562	6.667E-02

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

b.

Design: Intercept+GROUP+DIRECTIO+GROUP * DIRECTIO

Within Subjects Design: FACTOR1

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
FACTOR1	Sphericity Assumed	1608.008	15	107.201	58.588	.000
	Greenhouse-Geisser	1608.008	7.648	210.241	58.588	.000
	Huynh-Feldt	1608.008	8.424	190.894	58.588	.000
	Lower-bound	1608.008	1.000	1608.008	58.588	.000
FACTOR1 * GROUP	Sphericity Assumed	58.403	15	3.894	2.128	.007
	Greenhouse-Geisser	58.403	7.648	7.636	2.128	.033
	Huynh-Feldt	58.403	8.424	6.933	2.128	.028
	Lower-bound	58.403	1.000	58.403	2.128	.147
FACTOR1 * DIRECTIO	Sphericity Assumed	144.917	15	9.661	5.280	.000
	Greenhouse-Geisser	144.917	7.648	18.947	5.280	.000
	Huynh-Feldt	144.917	8.424	17.204	5.280	.000
	Lower-bound	144.917	1.000	144.917	5.280	.023
FACTOR1 * GROUP * DIRECTIO	Sphericity Assumed	32.256	15	2.150	1.175	.284
	Greenhouse-Geisser	32.256	7.648	4.217	1.175	.312
	Huynh-Feldt	32.256	8.424	3.829	1.175	.309
	Lower-bound	32.256	1.000	32.256	1.175	.280
Error(FACTOR1)	Sphericity Assumed	3293.540	1800	1.830		
	Greenhouse-Geisser	3293.540	917.809	3.588		
	Huynh-Feldt	3293.540	1010.829	3.258		
	Lower-bound	3293.540	120.000	27.446		

Tests of Within-Subjects Contrasts

Measure MEASURE_1						
Source	FACTOR1	Type III Sum of Squares	df	Mean Square	F	Sig.
FACTOR1	Linear	101.144	1	101.144	21.792	.000
	Quadratic	142.261	1	142.261	45.727	.000
	Cubic	375.854	1	375.854	111.164	.000
	Order 4	103.229	1	103.229	66.333	.000
	Order 5	47.211	1	47.211	16.554	.000
	Order 6	21.987	1	21.987	21.470	.000
	Order 7	4.283	1	4.283	3.754	.055
	Order 8	128	1	128	.080	.778
	Order 9	469.974	1	469.974	270.266	.000
	Order 10	21.689	1	21.689	15.579	.000
	Order 11	37.861	1	37.861	30.921	.000
	Order 12	66.721	1	66.721	72.539	.000
	Order 13	38.483	1	38.483	33.759	.000
	Order 14	84.872	1	84.872	106.367	.000
	Order 15	92.311	1	92.311	100.071	.000
	FACTOR1 * GROUP	Linear	9.981	1	9.981	2.153
Quadratic		6.590E-03	1	6.590E-03	.003	.958
Cubic		3.319	1	3.319	.982	.324
Order 4		.453	1	.453	.291	.591
Order 5		9.359	1	9.359	3.282	.073
Order 6		3.344	1	3.344	3.266	.073
Order 7		7.857	1	7.857	6.711	.011
Order 8		13.803	1	13.803	8.607	.004
Order 9		5.788E-02	1	5.788E-02	.033	.856
Order 10		1.025	1	1.025	.736	.393
Order 11		4.086E-02	1	4.086E-02	.033	.855
Order 12		1.049	1	1.049	1.140	.288
Order 13		3.322	1	3.322	2.914	.090
Order 14		4.938	1	4.938	6.189	.014
Order 15		3.604E-02	1	3.604E-02	.039	.844
FACTOR1 * DIRECTIO		Linear	117.953	1	117.953	25.414
	Quadratic	6.958	1	6.958	2.237	.137
	Cubic	2.510	1	2.510	.742	.391
	Order 4	1.386	1	1.386	.891	.347
	Order 5	.300	1	.300	.105	.745
	Order 6	3.074	1	3.074	3.002	.086
	Order 7	4.614	1	4.614	4.044	.047
	Order 8	908	1	908	.565	.454
	Order 9	2.135	1	2.135	1.228	.270
	Order 10	.177	1	.177	.127	.722
	Order 11	7.125E-04	1	7.125E-04	.001	.981
	Order 12	3.211	1	3.211	3.482	.064
	Order 13	.238	1	.238	.209	.648
	Order 14	.713	1	.713	.894	.346
	Order 15	.741	1	.741	.803	.372
	FACTOR1 * GROUP * DIRECTIO	Linear	4.848	1	4.848	1.044
Quadratic		5.557	1	5.557	1.786	.184
Cubic		.549	1	.549	.162	.688
Order 4		.142	1	.142	.091	.763
Order 5		1.280	1	1.280	.442	.507
Order 6		2.984	1	2.984	2.914	.090
Order 7		4.322	1	4.322	3.788	.054
Order 8		.197	1	.197	.123	.726
Order 9		1.872	1	1.872	1.077	.302
Order 10		2.539	1	2.539	1.823	.179
Order 11		4.493	1	4.493	3.670	.058
Order 12		3.161	1	3.161	3.436	.066
Order 13		.184	1	.184	.161	.689
Order 14		6.140E-03	1	6.140E-03	.008	.930
Order 15		.143	1	.143	.155	.695
Error(FACTOR1)		Linear	358.959	120	4.841	
	Quadratic	373.332	120	3.111		
	Cubic	405.730	120	3.381		
	Order 4	186.747	120	1.556		
	Order 5	342.231	120	2.852		
	Order 6	122.892	120	1.024		
	Order 7	136.923	120	1.141		
	Order 8	192.441	120	1.604		
	Order 9	208.672	120	1.739		
	Order 10	167.067	120	1.392		
	Order 11	146.934	120	1.224		
	Order 12	110.376	120	.920		
	Order 13	136.792	120	1.140		
	Order 14	95.750	120	.798		
	Order 15	110.895	120	.922		

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	106910.331	1	106910.331	6335.503	.000
GROUP	14.226	1	14.226	.843	.360
DIRECTIO	141.583	1	141.583	8.390	.004
GROUP * DIRECTIO	19.760	1	19.760	1.171	.281
Error	2024.976	120	16.875		

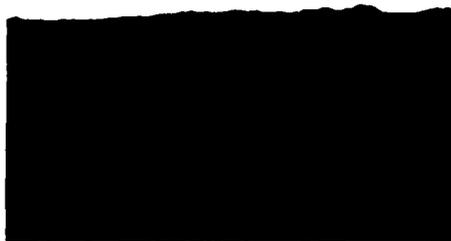
**APPENDIX I:
Lower and Higher Ratings for the Overall Enjoyment of the Trip of
Destination Sites**



La Laja Mining Site (5.72 Mean Rating)



El Elegante Crater (5.89 Mean Rating)

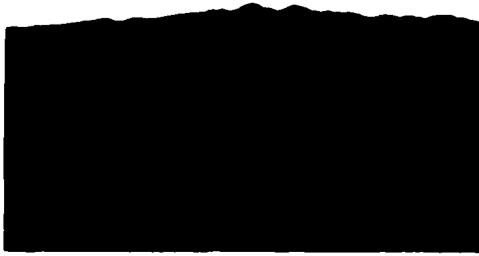


Cerro Colorado Crater (6.82 Mean Rating)

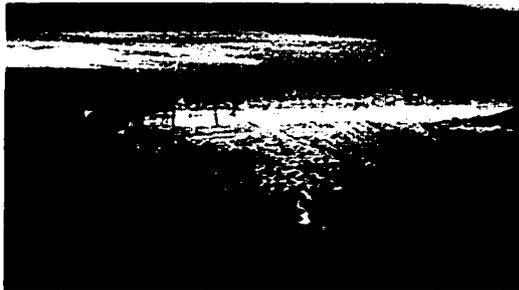


Tecolote Camping Site (6.37 Mean Rating)

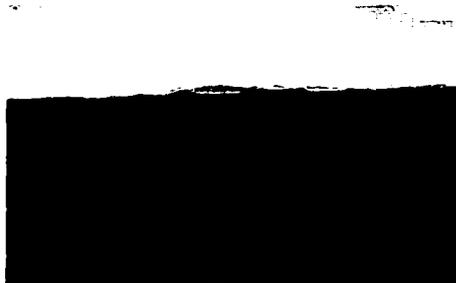
Panel A. Lowest Rating Images for the Destination Sites



El Elegante Crater (8.71 Mean Rating)



Cerro Colorado Crater (8.62 Mean Rating)



Tecolote Camping Site (7.58 Mean Rating)



La Laja Mining Site (7.34 Mean Rating)

Panel B. Highest Ratings Images for the Destination Sites

APPENDIX J

Reason(s) for Choosing a Desert Destination in Current Trip.

Warm weather in winter months	11111111111111111111111111111111
Scenic Landscape	1111111111111111
Learning experience	11111111
Camping	11
Eduard Abby's books	
Cacti	
Birds	
Quiet and peaceful	
Uniqueness	

Outdoor Desert Experience Likes

Scenic Landscape	1111111111111111
Cacti	111111111111
Solitude and serenity	1111111111
Weather	11111111
Night Skies	1111111
Bird watching	11111
Flora/ Fauna	111
Something new to see	
Uniqueness of the desert	1
Hiking	1
Everything!	

Outdoor Desert Experience Dislikes

Wind	111111
Bugs	111
Flat landscape	1
Dirt Roads	1
Scared of hike-crime along the border	
Generators at camping site	
Lack of visitor stops for water/bathroom	
Destroyed desert areas	
Dirty human inhabitats	
Sun goes down to early!	
The lack protected use of the land	
The campground is too packed	
Campsite design	
Lack of water	

Remoteness of automovil services
Other travelers
Least of all border guards!
Water is heavy to carry!
Shoping in the city for supplies
Cactus spines
Cholla in my leg

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