

Nomination Format for Natural Property
El Pinacate y Gran Desierto de Altar
Biosphere Reserve
For Inscription on The World Heritage List



**GOBIERNO
FEDERAL**

SEMARNAT



CONANP



**Presented by the National Commission for Natural Protected Areas
and the Secretariat of the Environment and Natural Resources
Mexico**

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Acronyms:

CEDES: Comisión de Ecología y Desarrollo Sustentable del Estado de Sonora

CEDO: Centro Intercultural de Estudios de Desiertos y Océanos

CNC: Confederación Nacional Campesina

CONANP: Comisión Nacional de Áreas Naturales Protegidas

IMADES: Instituto del Medio Ambiente del Estado de Sonora

INEGI: Instituto Nacional de Estadística y Geografía

NASA : Administración Nacional de Aeronáutica y del Espacio (National Aeronautics and Space Administration)

NPS: National Park Service

ORPI: Organ Pipe Cactus National Monument

PROFEPA: Procuraduría Federal de Protección al Ambiente

RBPNGDA: Reserva de la Biosfera El Pinacate y Gran Desierto de Altar

SARH: Secretaría de Agricultura y Recursos Hidráulicos

SEDESOL: Secretaría de Desarrollo Social

SEDUE: Secretaria de Desarrollo Urbano y Ecología

SEMARNAT: Secretaría de Medio Ambiente y Recursos Naturales

UNESCO: Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura.

WHC: World Heritage Centre

Executive Summary:

State Party:

México

State, Province or Region:

Sonora

Name of Property:

Reserva de la Biosfera El Pinacate y Gran Desierto de Altar.

Geographical Coordinates to the Nearest Second:

Latitude	Longitud	Extremes
Nominated Property		
32°10'04.73	113°57'15.76	North
32°10'03.89	114°18'51.00	West
31°32'26.93	113°41'14.22	South
31°54'45.69	113°00'01.23	East
Buffer Zone		
32°22'08.30	114°23'56.63	NorthWest
31°44'57.0	114°22'34.12	Southwest
31°27'47.62	113°26'50.81	SouthEast
31°56'02.12	113°00'05.09	EastEast

Textual Description of the boundary(ies) of the nominated property:

El Pinacate and Gran Desierto de Altar Biosphere Reserve, is located in the extreme northwest of the coastal plain of the Gulf of California, in the part more East of the Gran Desierto de Altar, in the vast physiographic province of the Sonoran desert in the Northwest of Mexico, State of Sonora, just below the border of Arizona, United States and North of the city of Puerto Peñasco, Mexico.

It is bordered by three protected areas in the United States and one in Mexico, all within the heart of the Sonora desert; Organ Pipe Cactus National Monument, Cabeza Prieta National Wildlife Refuge, Sonoran Desert National Monument in Arizona and the Upper Gulf of California and Colorado River Delta Biosphere Reserve in Baja California and Sonora.

To the Northwest lies the Barry M. Goldwater Range, which is not a protected area per se, however part of the biological corridor of the Sonora desert, being a controlled area.

The Reserves, as a whole added over 3'041, 410 hectares of the Sonoran Desert, creating the largest desert in America.

A4 size map of the nominated property:

Zoning map

Pinacate and Gran Desierto de Altar Biosphere Reserve

Nomination Format for Inscription on the World Heritage List

Justification of Outstanding Universal Value:

El Pinacate and Gran Desierto de Altar Biosphere Reserve, located in the State of Sonora, has extraordinary geofoms formed by a volcanic shield composed of more than 400 cinders cones; the largest concentration in the world of Maar craters type of spectacular beauty and dimensions, and its almost perfect circular shapes, as well as vast solidified lava flows, which in contrast to the immense field of dunes, make the El Pinacate lava shield a veritable laboratory of geology opencast in the heart of the Sonoran desert. In turn, by the conjunction of these features the landscape is a unique universal value, being one of the few places in the world which presents an impressive aesthetic appeal for its large number of views in relatively small areas. For years the Gran Desierto de Altar and Pinacate biosphere reserve, it has been a site of particular interest by the international scientific community to conduct investigations on its wide range of geofoms with origins and particular evolutionary histories, as well as the diversity and richness of different taxa of flora and fauna, result of adaptive processes that are manifested by physical characteristics and climatic conditions of the Sonoran desert, one of the most biodiverse in the world.

What's left to conclude is the understanding that the incursion of nominated property "El Pinacate and Gran Desierto de Altar Biosphere Reserve" is essential to ensure the preservation of a "set of features" creditors of exceptional value as natural heritage of humanity.

Criteria under which inscription is proposed:

Criterion VII - Contain natural phenomena or areas of exceptional natural beauty and aesthetic importance.

Criterion VIII - Be eminently example and representative of the main stages in the history of the Earth, including the registration of life, important geological processes in the development of the terrestrial forms, or geomorphological importance or physiographic features.

Criterion X - Contain natural habitats important and meaningful for the in situ conservation of biological diversity, including those containing threatened species of outstanding universal value from a aesthetic or scientific point of view.

Name and contact information for the local institution or official body:

Contact name: Maria Pia Gallina Tessaro,

Director in charge of Areas with International Designations, CONANP.

E-mail: mgallina@conanp.gob.mx

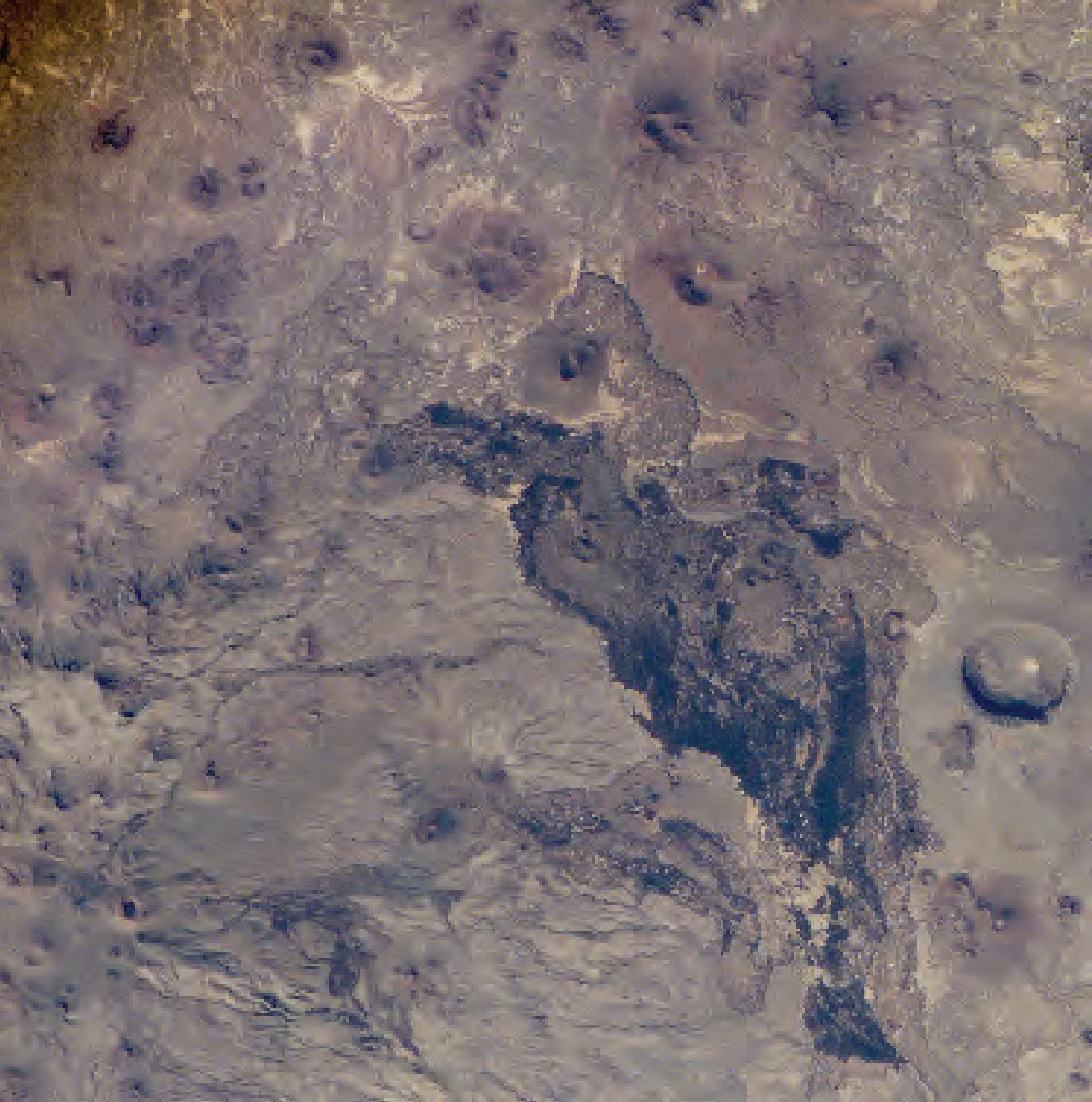
Web page: <http://www.conanp.gob.mx>

Contact name: Federico Godínez Leal

El Pinacate and Gran Desierto de Altar Biosphere Reserve Director, CONANP

Phone number: +01-52 638 105 8030, +01-52 638 383 1433

Email: pinacate@conanp.gob.mx , fgodinez@conanp.gob.mx



01

Identification of the Property



Identification of the Property

1.a Country (and State Party if different):

México

1.b State, Province or Region:

Sonora

1.c Name of Property:

El Pinacate y Gran Desierto de Altar Biosphere Reserve.

1.d Geographical Coordinates to the Nearest Second:

Latitude	Longitud	Extremes
Nominated Property		
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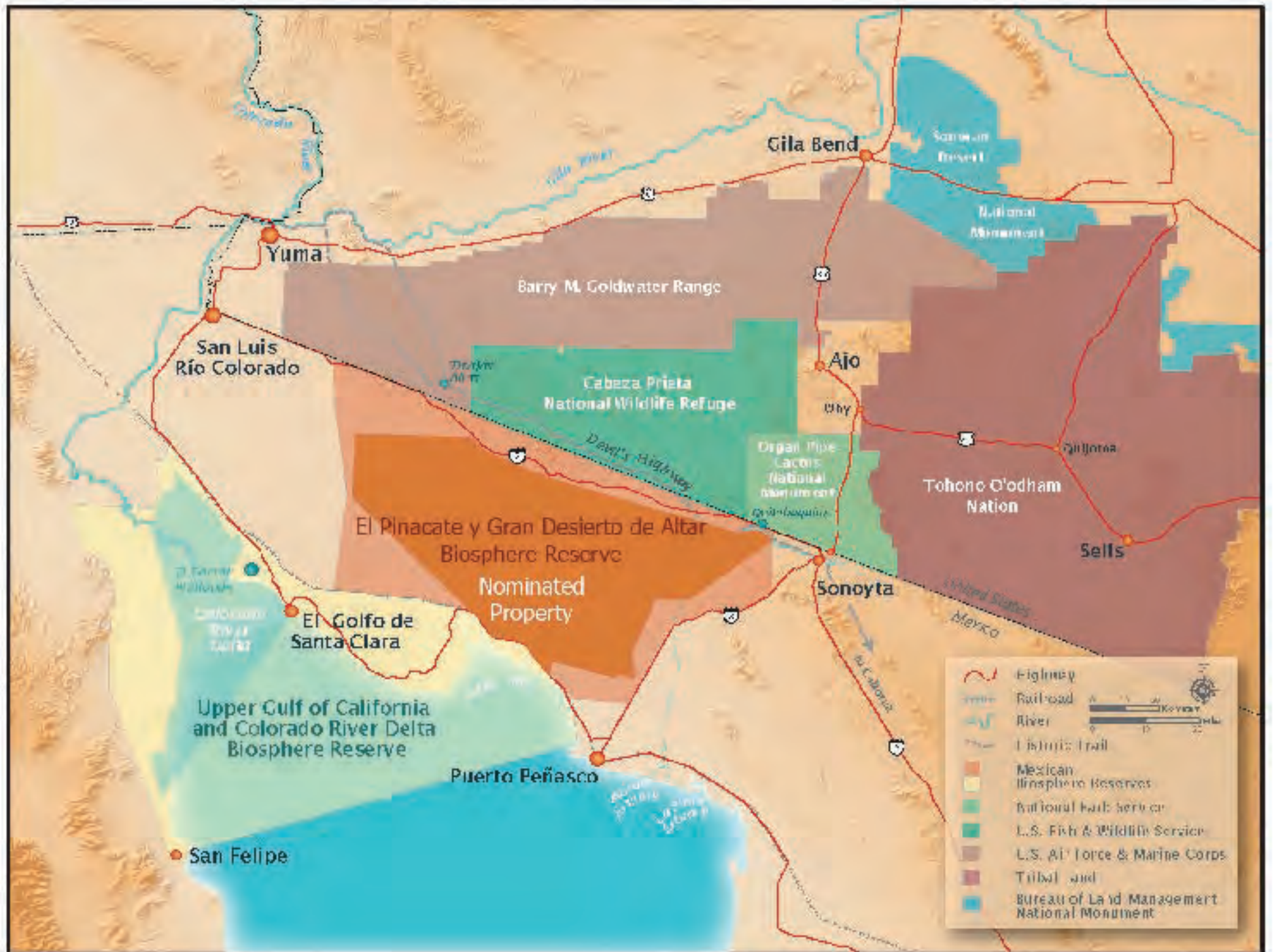
1.e Maps and plans showing the boundaries of the Nominated Property

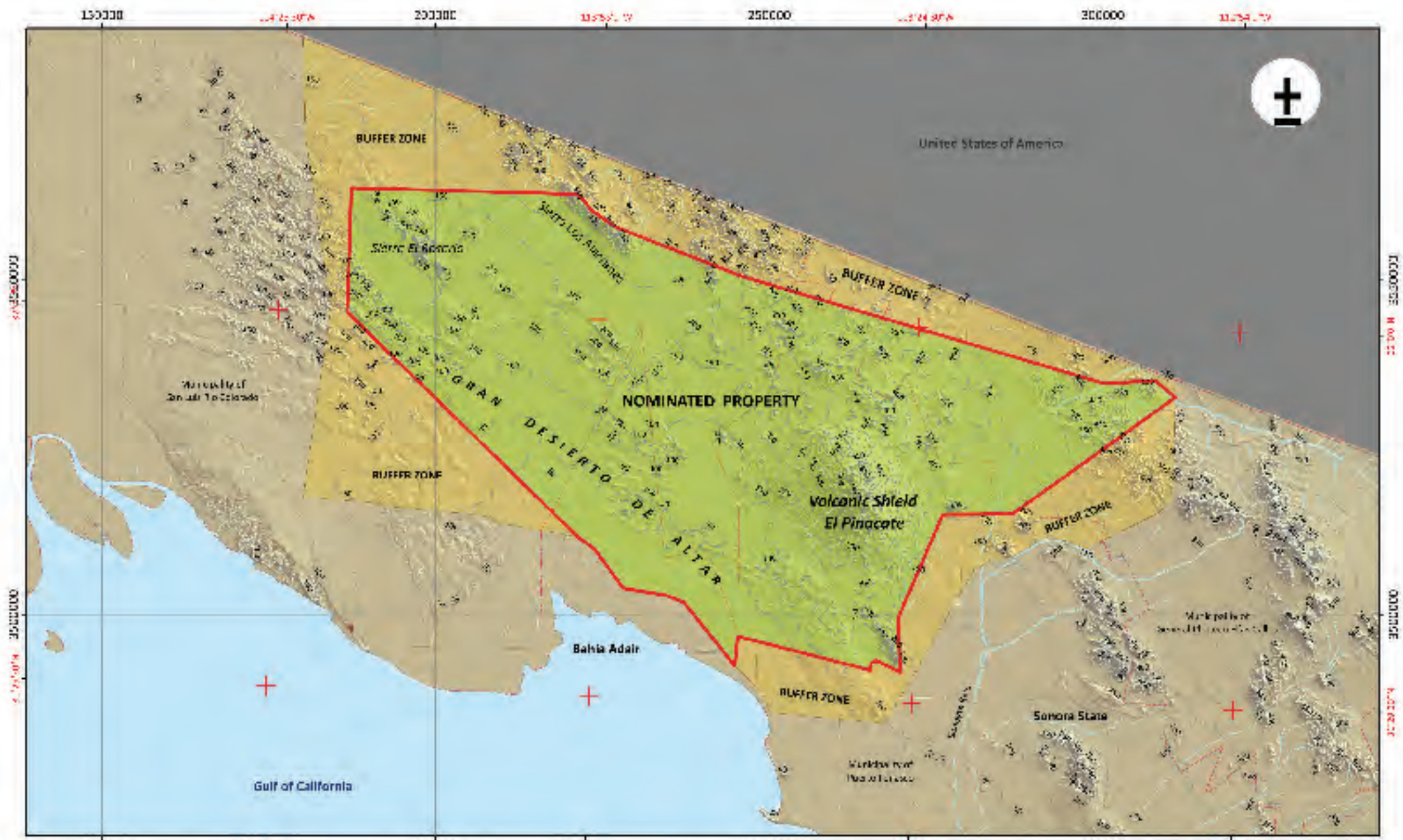
Five maps are presented in A4 size in this document (7 maps in larger format are included as annexes). The first map shows the boundaries of the reserve as well as the boundaries of the nominated property. The second shows the limits of the reserve with the national parks and reserves in the United States. The following, are maps showing the details of topography, geology and the internal route of El Pinacate y Gran Desierto de Altar Biosphere Reserve.

1.f Area of Nominated Property (ha.) & the proposed buffer zone (ha.)

Name	Surface of the Nominated Property (Ha)	Buffer Zone (Ha)	TOTAL (Ha)
El Pinacate y Gran Desierto de Altar Biosphere Reserve	455,207.35	259,349.15	714,556.5







National Commission of Natural Protected Areas (CONANP)

Legend

- Nominated Property
- Boundary of Nominated Property
- Buffer Zone
- District (Municipal) Boundary
- Municipal Boundary
- Stream/River
- Railroad/Highway



Scale: 1:750,000
 The National Commission of Natural Protected Areas
 The National Institute of Statistics and Geography
 INEGI

Cartographic Data
 Projection: UTM
 Datum: WGS 84
 Zone: 15
 Scale: 1:750,000
 Graphic Scale: Meters
Executive Map



02 Description



2.a Description of Property

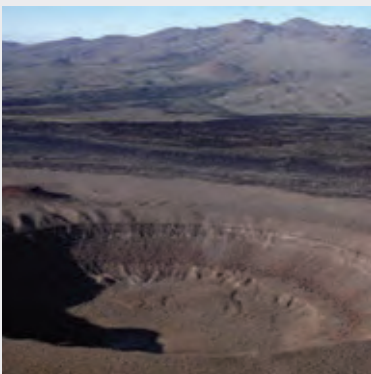
El Pinacate y Gran Desierto de Altar Biosphere Reserve, considered one of the priority regions of Mexico because it is part of the Sonoran desert, a desert with a tropical-subtropical climate origin and a rainfall pattern which allows a great biological wealth (Houk, 2000). The four deserts of North America; the Sonoran desert contains the greatest diver-



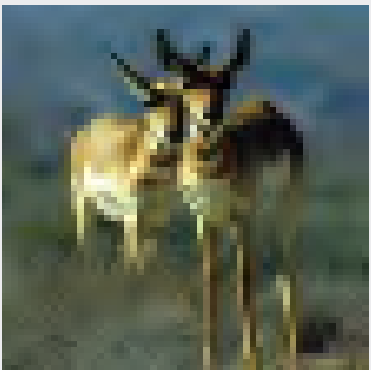
sity. It covers in addition to territory belonging to Sonora, a portion of Baja California and extends into Baja California Mexico, as well as Arizona and California, United States. Due to its climate and environmental variation, it is possible to find more species of plants and animals than in Chihuahua, Great Basin and Mojave deserts. Due to its great biodiversity, is that there are more protected areas in the Sonoran desert than in any other desert in the world (Cornett, 1997).



Desert Sinita



El Elegante Crater

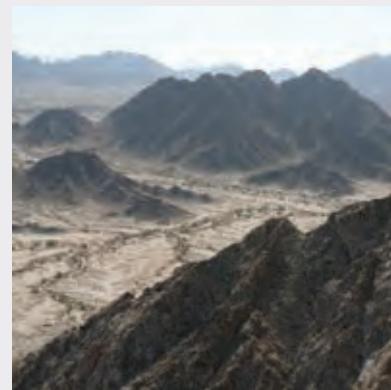


Pronghorn

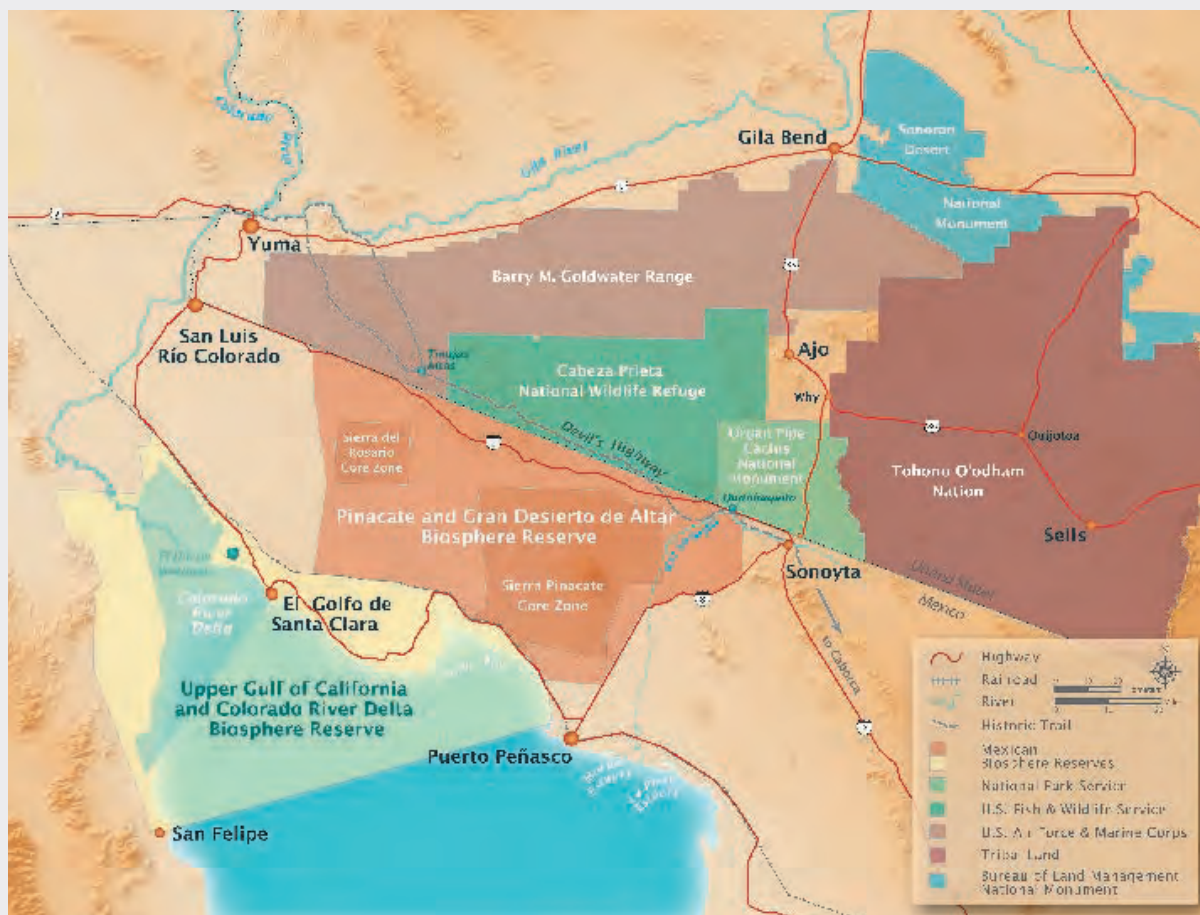
El Pinacate y Gran Desierto de Altar Biosphere Reserve, is a magical place of unusual creatures, notable geological features and unique plants and desolate beauty. It contains the most active dune field in North America where the unusual sand dunes are formed in Star-shaped. The area has a spectacular volcanic shield, where there are lava flows, cinder cones and the impressive giant Maar type craters. On the other hand, the tinajas, rare natural accumulations of water, open in the bedrock strong streams of lava fields, being a source of water for wildlife. Although it is thought that the desert is a place devoid of life, dark lava flows of El Pinacate contrasting with the pale sand dunes of the Gran Desierto de Altar, create a multitude of habitats with a huge biodiversity. More than 540 species of vascular plants, 40 species of mammals, 200 birds, 40 reptiles, as well as amphibians and freshwater fishes can be found in the area. There are endemic, threatened and endangered species. Apparently desolate, El Pinacate y Gran Desierto de Altar contains numerous archaeological remains dating back to more than 20,000 years ago; it is an important cultural site for the indigenous people of the Tohono O'odham, who consider that the origin of its creation occurred in El Pinacate peak and where they still perform sacred ceremonies.

The site operates with a wide regional and international perspective by collaborating with neighboring as protected areas with national non-governmental organizations (NGO's), in United States as Organ Pipe Cactus National Monument, Cabeza Prieta Wildlife Refuge, Arizona Sonoran Desert Museum, Sahuaro National Park, International Sonoran Desert Alliance, Institute of the Sonora desert, the field of Barry Goldwater bombing practice as well as the Upper Gulf of California and Colorado River Delta biosphere reserve in Mexico, in order to protect one area that it serves as a vast biological corridor and so their conservation efforts have one greater scope. In total, all of these protected areas cover an approximate of 3'041, 410 has.

In addition there is a protocol of partner ship with the Los Cardones National Park, located in the province of Salta in the Republic of Argentina.



Sierra Los Alacranes





Superintendent of Cardones National Park Sergio Bikauskas, Federico Godinez Leal Director of El Pinacate Biosphere Reserve and Lee Baiza Superintendent of Organ Pipe National Monument.

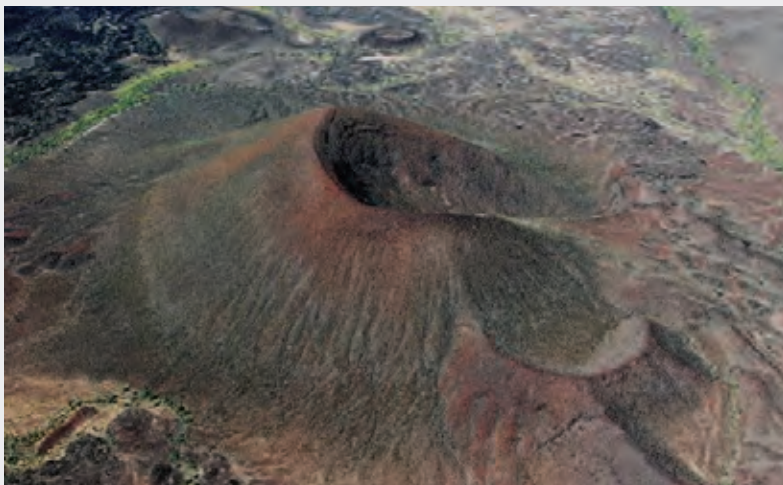


PHYSICAL DESCRIPTION

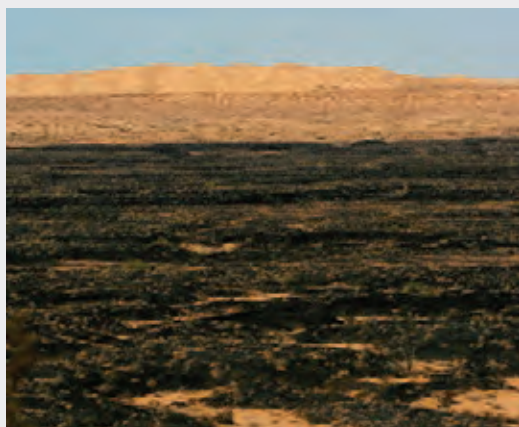
Geology

Without a doubt, the geological aspects of El Pinacate y Gran Desierto de Altar are the main attraction of the area, which have caused an unusual interest in the national and international scientific community because of the geological and natural characteristics so varied and contrasting; so geomorfism, volcanic areas with its craters and lava flows, consolidated and mobile sand dunes, beds of streams, mountainous massifs and alluvial fans of basalt and granite, that can be seen in this region.

The outcrops of rock in the area are of igneous, sedimentary, and metamorphic ages represented from the Precambrian to the recent origin. This broad spectrum in nature and time has resulted in a wide variety of geofoms with origins and evolutionary different stories, making the area a site geologically complex.



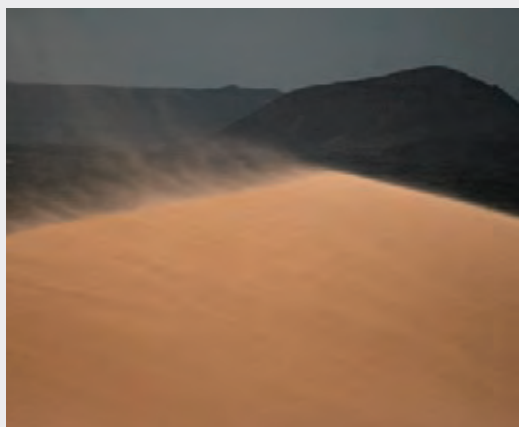
Cinder Cone



Laves Flow



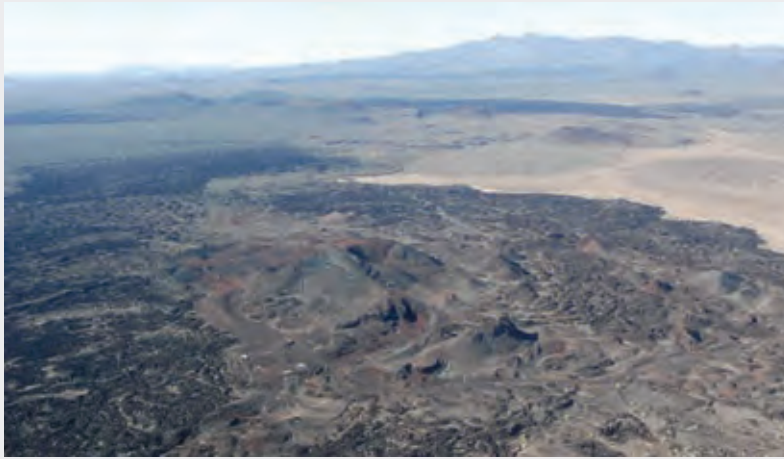
Cave in Tinajas Altas



Mobile Dunes

The area that occupies the volcanic shield of the Sierra Pinacate represents 32%, while the field of mobile and fixed dunes covers most of three quarters of the total surface area of the reserve; the rest of lower surface is occupied by beds of streams, floodplains, coastal plains and crystalline massifs of granitoides. Much of the crystalline massifs which form the base of the area are mountains formed by rocks of endogenous nature with ages of Precambrian to Tertiary, predominance from the Precambrian, mainly composed of granites and metamorphic rocks (schists and gneisses). These formations represent the oldest rocks of the nominated property and are the dominant part of the sierras Blanca, Enterrada, Hornaday, El Choclo Duro and Los Alacranes.

Sierra El Rosario, which is isolated in the Gran Desierto de Altar (an excellent example of inselbergs), is formed by granites from Mesozoic age (INEGI, 1982). All this corresponds to the nominated property, covering an area of 5.8 per cent of the total. The mountainous resort of the Sierra Los Tanques seems to be originated between the Cretaceous and Tertiary (Haxel *et al.*, 1984; Tosdal *et al.*, 1990).



Lava Flow La Laja

The region experienced intense volcanic activity since the end of the Tertiary and is the youngest volcanic activity recognized in Sonora. This volcanism culminated with the formation of El Pinacate lava shield during the Pleistocene and late much of the Holocene. This volcanic shield represents one of the most remarkable geological complex of the Gran Desierto de Altar, occupying a surface area of approximately 2000 km², which presents three main peaks: Pinacate peak, the Pico Carnegie and the Middle peak. The set is called Santa Clara or Sierra Pinacate volcano. These three peaks were the sources of emission of the majority of the region's largest lava spills. Lava flows that delimit the lava shield and materialize the effusive activity in the area extends for more than 20 Km. There are lava flows of basalt composition and alkaline nature, generally very vesicular producing mostly lavas of type aa (approx. 95%) and rarely lavas type pahoe-hoe and lava into blocks. The total volume of issued basaltic lava is estimated at between 150 and 180 km³.

Gran Desierto de altar Sand Dunes



One of the most important geological elements are more than 400 volcanic cones of different shape, size and complexity, they can be grouped into three main types: cinder cones, cones of gaps tobáceas and cones of aggregates (Cortes *et al.*, 1976; Gutmann, 1976; Lynch, 1989). Associated with the cinder cones and lava flows, it is common to find deposits of volcanic ash, lapilli and few bombs. This material is of pyroclastic origin, along with the cinder cones, is the most representative of the explosive activity in the area. It is found on the slopes of the cinder cones product of the free fall,

in other cases has been slightly transported by gravity effect, and in the most extreme cases have been transported and redeposited by the intermittent streams that descend slope below the coat of the volcanic shield. To the whole "tephra": Ash, lapilli, bombs and blocks, found both as constituent essential cinder cones or pyroclastic deposits is called, common and commercially, with the term of Morusa.

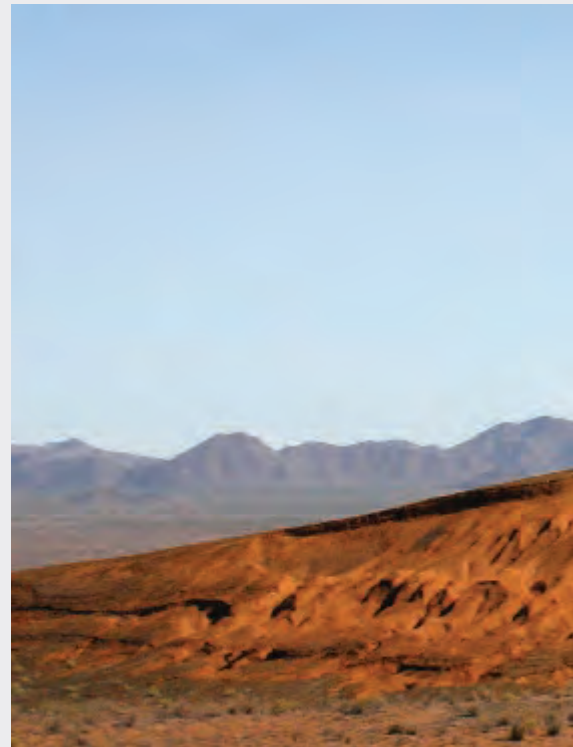
In the western part of the Sierra El Pinacate is the dominant geological component, the dune fields. The fields of sand dunes of the Gran Desierto de Altar form a sea of active



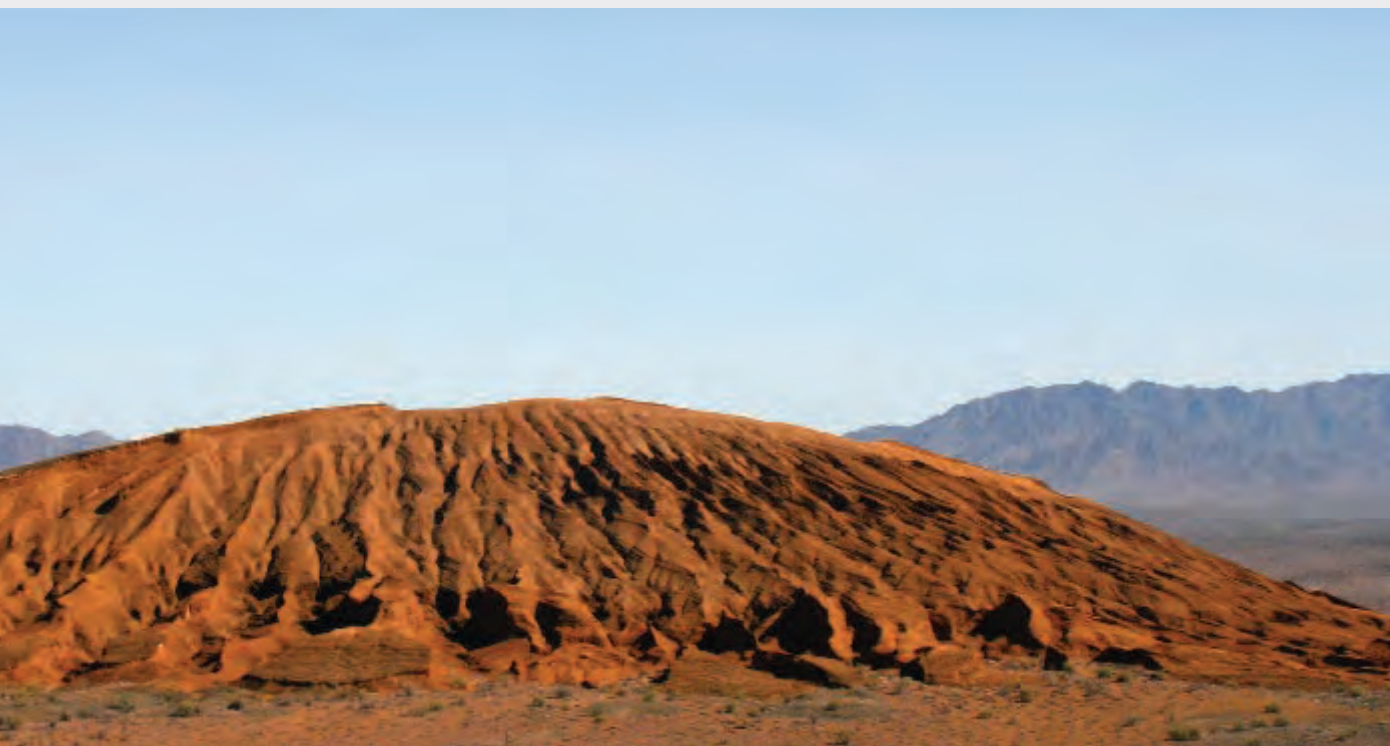
sand, also called Erg of more than 550,000 has. (Lancaster *et al.*, 1989). The sand dunes found in El Pinacate y Gran Desierto de Altar are linear, (transverse) crescentic and star-shaped. All these can be simple, compound and complex (Beveridge *et al.*, 2006; Lancaster *et al.*, 1989). Although the linear dunes dominate (70%), the crescentic complex dunes and star-shaped dunes are of utmost importance that they exist only in a few locations in the world (Breed *et al.*, 1984).



El Verdugo Crater



Cerro Colorado Crater



The most spectacular aspect among all the volcanic features of El Pinacate y Gran Desierto de Altar and the most studied is the ten craters distributed around the lava field. These craters and dune fields are those that give identity to this region. Giant craters of El Pinacate y Gran Desierto de Altar are the result of a phreatomagmatic activity, in other words, that explosive volcanic activity produced by magma contact with shallow groundwater resulting explosions of very powerful steam. These craters are called “Maar” and existed in several of these lava flows and ash cones prior to the explosions of steam so it is possible to observe them in the walls of craters. (Hayden, 1998).



Organismos de la Reserva

Mapa de Referencia

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Description of principal craters

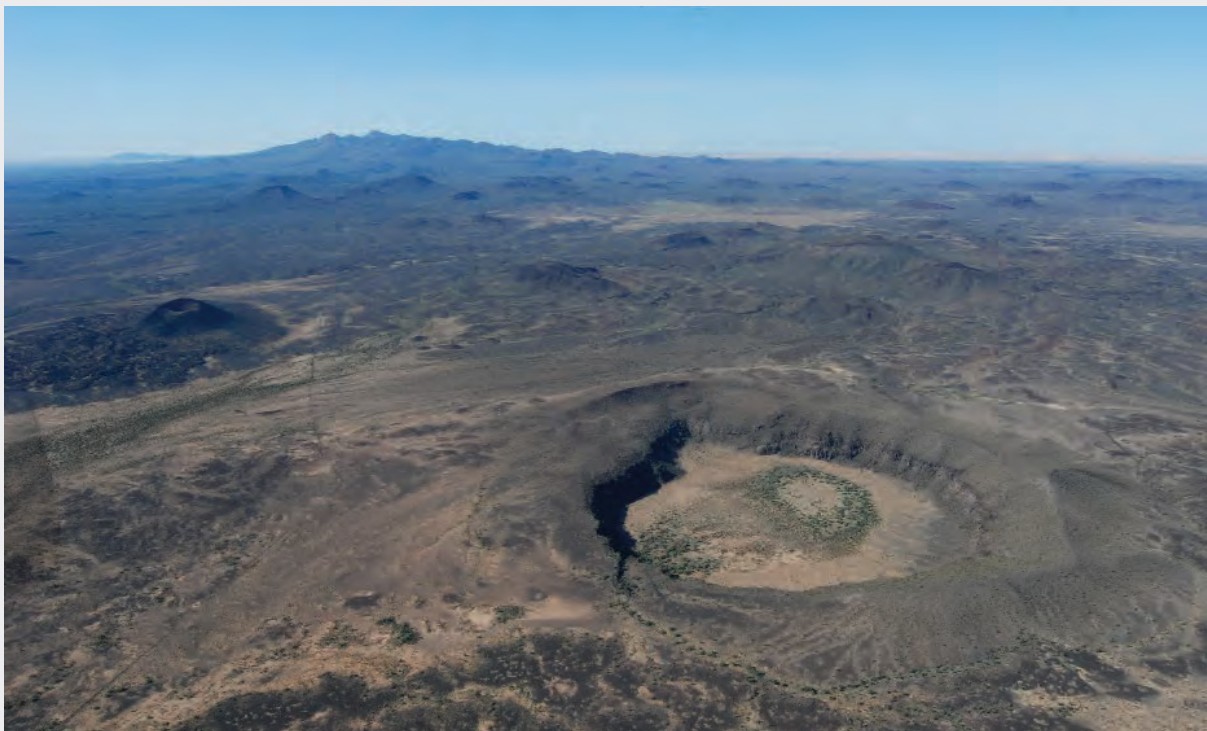
Wood (1972) has classified these craters into four types, according to morphological and lithological characteristics:

- 1 Characterized by powerful layers of toba basalts that form the cliffs that rests on the edge are exemplified by the Elegante crater, El Verdugo, El Grande, Badillo, and Kino. These craters are similar in all forms, at the same time that vary in size and degree of erosion.
- 2 Characterized by a “complex of interlocking craters” with multiple eruptive centers, examples include Molina crater and Celaya crater.
- 3 Exemplified by the Cerro Colorado, composed mostly of toba.
- 4 It has a rib of basalt rocks and some tuffs of the visible edge, and a central cone rising from the center of the crater floor. La Luna crater is a clear example.

The remaining craters: Carvajales and Díaz, represent two additional types of crater found in Pinacate. The Carvajales crater is similar in form to La Luna crater, except that collapse is to a degree much less, there is no visible tuffs on the edge, and the center may be the result cone formed by magma initially developed in decline, or its vesicles due to the reduction of vertical pressures rather than a central cone formed separately. The crater Díaz may be a tuff ring filled with a mound of alluvium of tuff.

Crater	Diameter (mts)	Depth (mts)	Age (years)	Type
El Elegan-	1,609	244	32,000	Maar
El Verdugo	1,896	131	185,000	Maar
Kino	798	20	N/A	Maar
Carvajales	366	30	N/A	Maar
Cerro Colorado	1,116	133	18,000	Tuff Ring/Maar
El Grande	1,004	219	N/A	Maar
Celaya	1,010	79	N/A	Maar
La Luna	450	23	N/A	Maar
Badillo	350	11	N/A	Maar
El Trebol	600	76	N/A	Maar

Major volcanic shield craters of El Pinacate. Based on J. Gutman (1989).



Celaya Crater

El Elegante Crater

The deepest and one of the most visited in the region. It lies 13 kilometres from Cerro Pinacate or volcano of Santa Clara. The rim of the crater Elegante, appearing from a distance as a small hill with gentle slope rises 37 meters above the peripheral lavas that surround it. However, when the crest of this "mountain" is reached, a vacuum almost circular falls to the floor on a beach in the crater that is almost 244 meters below the highest point on the edge. A half crater diameter is of approximately 1,609 meters, as is determined starting from aerial photographs taken in April 1956. Work (1959) reports that the edge of the stratum of the crater Elegante rests in ash cones of reddish brown striped cones which can be resting on the basalt cliffs. Different thicknesses basalt layers alternate with pyroclastic on

the cliff of basalt. The lower units of basalt of the crater has no pyroclastic or visible openings (Gutmann, 1972). Elegante is the only crater known to have contained a large lake evidenced by a "bathtub ring" of water-lain deposits about a quarter of the way up from the crater flow. The section of a cinder cone is visible in the southeastern curve of the wall of the crater, while in the Northwest portion at the bottom, there is a block of material from the edge that fell for a long time. You can observe the tuffs of the edge on basaltic lava. Furthermore, an Indian footpath used by hunters of bighorn sheep that completely surrounds the rim of the crater is also observed.



Cerro Colorado Crater

It lies just northeast of lava flows and takes its name from the red tuffs and land of the edge. The crater is a tuff cone, formed by the explosion of steam through hundreds of feet of the flood of the River Valley. As the material of the edge layer was wet when the volcano erupted, the crater may have formed in a now extinct Lake which the Playa Diaz, Northwest of the crater, may be a remnant which caused that the material thrown during the explosion found damp, which accumulated layers of sediments and volcanic ash rain, forming the tuff cone. The inner wall to the South of the tuff cone was protected from erosion by a layer of wet ash which later cemented. It is located about 24 kilometres from Cerro Pinnacle. It has an approximate depth of 133 m and a diameter of 1 116 m. (Water and Fisher, 1970).



Celaya Crater

The easternmost of the chain of craters of lava flows, is represented by two intertwined, being the Southern craters much smaller than the Northern. The Eastern lip layer is so shallow that a stream divides, feeding its course to a previously lush forest of *Prosopis spp.* and *Parkinsonia spp.* Celaya crater is an irregular depression of approximately 79 metres and 1010 metres in diameter, containing a dense forest of mesquite in his flat. Jahns (1959) believes that the crater represents the collapse and the subsidence of one or two centers of explosive activity, the South is much smaller

than the North. The strata of Celaya crater is rounded and similar to the crater Elegante. Escarpments of the crater reveal a rhythmic sequence of basaltic beds which contain inclusions of granite. A meter of thickness of highly vesicular red slag layer separates the cliffs of basalt of Tuff lining. Most of the blocks of basalt on the edge of the crater are grain thin and not vesicular (Wood, 1972).



Badillo Crater

It is wide and shallow. Nearly 350 m less in diameter, but almost 11 meters deeper than the Kino crater, is located 6.4 kilometers south west of the crater Kino. This shallow crater lies just to the East of one of the main paths to the slopes of the southwestern region of El Pinacate. According to work (1959), the formation of crater Badillo was preceded by a complex sequence of volcanic activity which involved development and alteration of three cones of ash, whose cross section can be seen in its walls.



Carvajales Crater

The smallest craters in the region and the most recently discovered. During the winter of 1963, while a trail system mapped Indians trails, Julian Hayden from Tucson Arizona was the first to find the crater. The stratum of the rim is nearly circular, rising approximately 30 meters above the plain of the environment. The average diameter of the crater is approximately 366 meters. The northeastern part of the crater has a double edge layer. The appearance of the whole of the crater is an inverted crater, a conical cup simulating a cone of paper for drinking, has been slightly flattened by the pressure on the apex of the cone. As the magma chamber was evacuated by the cone, there was a reduction in pressure in the main magma

chamber which is the original cone. The roof of the chamber was then drawn down by reducing the pressure associated with the retreat of magma in the chamber. No exposed basalt cliffs in the crater. Subsidence in the eastern part of the depression is about 4.6 meters is more than 9.2 meters southwest. A subparallel fault passes through the crater from east to west. The fault appears to have occurred after the formation of the crater, because there was no evidence of additional lavas that originated a break in the rim.



La Luna Crater

It lies to the South of the other craters, on the Southwestern edge of the lavas of the mountains and the desert dunes. Its isolation, approximately 29 km from Verdugo crater, suggests that it may not be related to other craters. Its rim is formed by edges with a few basaltic tuff cone visible and high central cinder rises from the bottom. The crater floor is on the plain to the North and East. The crater rim is little conspicuous and is difficult to distinguish when one travels through the Plains. This crater is 450 m in diameter. Therefore, it has been shown that the El Pinacate volcano is currently active and its origin is related to active tectonic processes that are leading to the separation of the peninsula of Baja California in the American continent (González-León,



El Verdugo Crater

It is the widest of all the craters, it lies to the West of Badillo. It is oval-shaped, with a diameter of 1,896 meters and the maximum depth is about 131 meters with the crater surrounded by the remnants of cinder cones (Ives, 1964). The bottom of the crater is the accumulation of sediment eroded from the walls of the depression and windblown sand. A small beach has been formed and retains water for only a short time after periods of heavy rain. As well as El Elegante, the tuffs of basaltic flows overlie the edge formed by the vertical cliffs of the crater walls. The crater floor has vegetation mainly covered by sahuaros (*Carnegia gigantea*), governors (*Larrea tridentata*) and ocotillo (*Fouquieria splendens*).



El Trebol Crater

It lies just to the South of the crater Verdugo. As its name implies, its silhouette resembles a club formed by the intersection of three small craters, the Northern being the smallest of them. There seems to be few tufts of the edge layers, which contain many basaltic blocks. It has a depth of 76 m and a diameter of 600 m.



El Grande Crater

It has 1004 meters in diameter with a maximum depth of 219 meters. It has a tuff ring higher than any of the craters. The tuff beds are steep edge, ranging from the plains to the top of the two cones that flank it. On the solid lava, tuffaceous layers beneath the Northwest edge of the crater wall, are the remaining sections of a cinder cone associated with lava flows that lie beyond the crater and are partially covered by tuffs. A unique feature is that in comparison with all other craters of El Pinacate, with the exception of the Caravajales crater, a much larger portion of the pre-existing cone was left intact after the formation of the caldera.



Kino Crater

Towards the West, in a straight line is, similar to the Celaya, but smaller in size and depth than the crater El Elegante. As well as in Celaya crater, a creek feeds a large wood of mesquite at the bottom of the crater. The Southwest rim shows a cone of morusa. Its depth is 20 m and diameter of 798 m.







Sierra Blanca

Physiography and Geomorphology

El Pinacate y Gran Desierto de Altar is located at the Northwest end of the coastal plain of the Gulf of California in the physiographic province of the Sonoran Desert.

The elevation ranges from 200 m to 1206 meters above sea level atop El Pinacate peak. The geofoms are very varied and contrasting, which has resulted in a wide variety of habitats with consistent biological and scenic wealth.

There are 10 granitic mountains separated by sandy plains of alluvial origin, coluvial and up wind. The altitudes of these ranges vary from 300 m to the 810 meters above sea level. The mountain ranges with elevations

below 500 m are: Sierra Blanca (or Bambarria), Extraña, Enterrada and Hornaday. The upper 500 m are: Choclo Duro (810 m), Los Alacranes (790 m), Tinajas Altas (630 m), El Águila (620 m), Los Tanques (590 m) and El Rosario (520 m).

From the summit of El Pinacate peak, it's southern boundary of The Gulf of California can be seen. In the region known as Adair Bay, to the Southwest, where are located two of the most important tectonic plates at the global level; the Pacific Tectonic plate and the North America tectonic plate, a similar example to what happens in Iceland. However, the volcanic origin of El Pinacate



cerrocoloradocrater

is somewhat different from the volcanic origin of Iceland and the Gulf of California.

In geology, that has marked this site as a unique place to combine scenes never before seen, this place transforms anyone to explore the area as if it were a laboratory under the open sky. To the North, the region of the Organ Pipe Cactus National Monument in Arizona, United States, which lies a few kilometers of distance, only divided by the border edge, has rocks of volcanic origin, some of them formed by basalt, and who probably were expelled by the El Pinacate volcano explosions years ago. It is noteworthy that the basalt, is the same type of lava that forms the islands of Hawaii, Iceland and some Oceanic soils.

With a view to the Northwest, from Cerro Colorado, just marked contrasts of sand, rocks and vegetation comprising Playa Diaz. At first glance, it seems to be a sand field, however, in times of rain, this area is covered with water, and therefore the vegetation flourishes to its surroundings, creating a space full of resources for the animals that inhabit the region. Playa Diaz owes its origins to the formation of the Cerro Colorado, because it is the result of the eruption of the same, which at the time of the explosion, one of the drainage was blocked, causing water to be stagnant, after heavy rains. Even after heavy rainfall, evaporation levels are very high, thus collected water, soon disappears, part of it is evaporated and another part is absorbed by the soil. The rest of the playas, as well as Playa Diaz, make up one of the most complex in the Sonoran desert ecosystems, since they create optimal conditions and extremely necessary to maintain the ecological balance of the same. The beaches or playas are very shallow, closed basins into which collects temporarily, bringing with it silt and nutrients from surrounding areas. Windblown dust also collects and a fine-grained soil quickly devel-

ops. The bottoms of many craters and the summit depressions of some cinder cones are mini-playas, where the fine-grained soil retains rainwater and support short-lived ponds. Plants are seasonally abundant on crater floors, and the playas host some of the most spectacular wildflower displays in the Sonoran Desert. The soils also attracts burrowing animals, which can forage in the surrounding vegetation.

The most outstanding geoform of the site, is the lava shield or Sierra Pinacate, which occupies approximately a quarter of the total area of the protected area. It has a very rugged topography but its slopes are not pronounced. Characterized by plateaus, lava flows, volcanic projections deposits, craters type "Maar" and cinder cones. At the volcano shield, there are some volcanic devices and major cones, among them: the Sierra Batamote, Sierra Suvuk, Cerro Lava and volcano La Jarapena. The crowning structure of the site is precisely El Pinacate Peak that reaches an altitude of 1206 m.

In the proposed property, geoforms that dominate accounting for more than 70% of the total surface of the area are the mobile dunes fields, with little reaching heights over



El Trebol Crater

100 m. At the East end, occupying an area of alluvial plains with dunes, ancient stream beds and small endorheic basins, they are among the 100 and 200 meters. These geoforms are very fragile and easily vulnerable due to its high natural dynamism by effect of the wind and because these are areas with gentle topography and low elevation that can allow access to vehicles off-road and areas.

El Pinacate lava shield, represents approximately one-third (200,000 has) of the proposed property. Within it, as well as other geological formations, most relevant representations are without a doubt, the largest collection of spectacular giant craters type Maar.

Edaphology

In El Pinacate y Gran Desierto de Altar, there are no real floors, since they are derived from the disintegration and decomposition of rocks, while in El Pinacate basalts resist this disintegration. All soils in this region are called "loess" because they were caused by winds from the sand dunes of the Grand Desert of Altar and the Sea of Cortez. Most soils are poorly developed, with no diagnostic horizons. According to the FAO-UNESCO classification modified by INEGI, the most representative units are:



Gran Desierto de Altar Sand Dunes

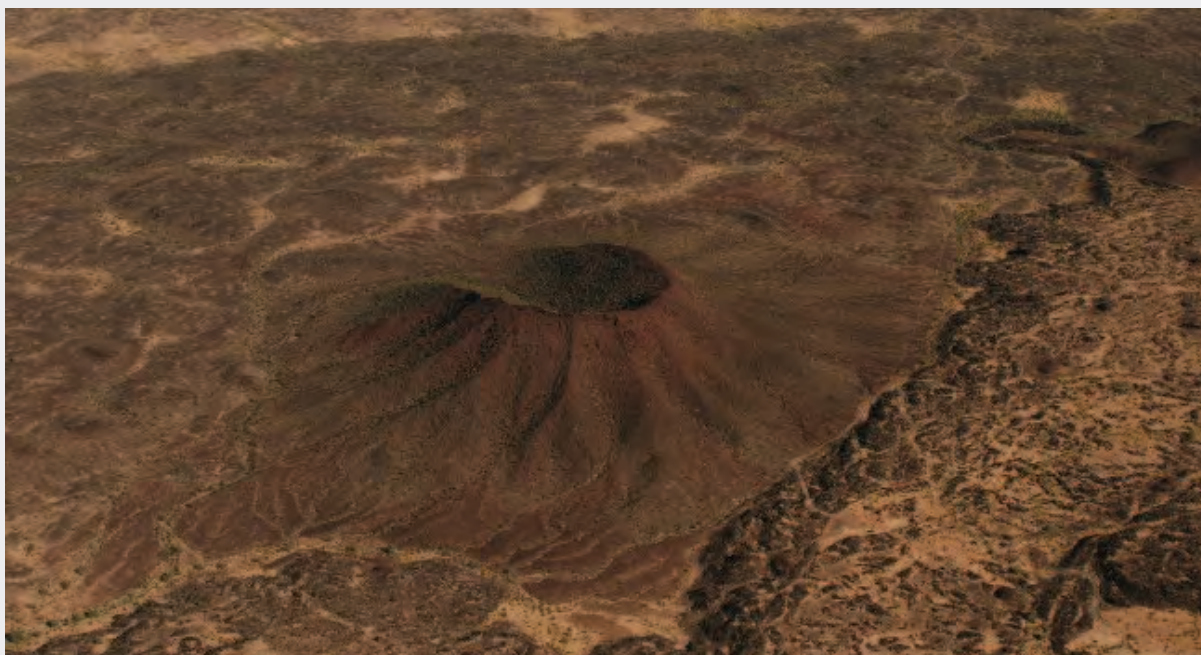
- Litosols:** They are located on steep slopes in the granite hills and volcano shield.
- Regosols:** They are located in alluvial fans, granite hills of the downs and the large fields of dunes of the western portion.
- Fluvisols:** Located in the beds of streams and the Sonoyta River.
- Yrmosoles:** Located in the north and east portion of the field as a small volcanic islands and between Regosols litosols or in areas that have not been covered by sand dunes.
- Vertisols:** Located in Playa Diaz and Los Vidrios Beach.



Lava Flow and Cinder Cone

Throughout this vast region that includes El Pinacate y Gran Desierto de Altar, we can find a huge amount of rocks including shale, gneiss, granite, several sedimentary and volcanic rocks. The metamorphic rocks of the Gran Desierto include schists and gneisses of sedimentary and igneous origin. The Pre-Cambrian schists are the oldest rocks in the region and these come mostly from the highlands (Daly, 1907). Regionally and locally, the schist as well as the gneiss show minor variations in composition and texture, these are predominantly gray to black with interspersed aggregates of fine to medium grain of quartz, feldspar, hornblende and biotite. Quartzite is also very common in the mountains of the region (Bryan, 1925). Generally, the metamorphic schists represent

bows (feldspatic sandstone), sandstone and other sedimentary rocks, as well as occasional igneous masses that have been subjected to metamorphism moderate. The gneiss is small outcrops in several mountainous areas. The typical gneiss is apparently younger than the Pre-Cambrian schists and consists of dark, white stripes with gray, and added sliced thick medium to coarse grains of quartz, orthoclase, plagioclase, biotite and muscovite (Bryan, 1925). Some gneiss formations are probably metamorphosed granitic rocks. Igneous rocks, on the other hand, are more than two-thirds of the rocky surface of the great desert are of igneous origin (Bryan, 1925). The granites are integrated aggregate of medium-to coarse grains of quartz, ortoclasas, microcline, pla-



lava flow and ciner cone

gioclastes, biotite, hornblende, and inherent magnetite throughout the region. The plagioclase, ranging in composition from albite to labradorite, generally represents about half of the feldspars in the region (Bryan, 1925). Some surfaces of granitic formation contain deposits of copper intrusive (Butler, 1935). The igneous dikes of diorite porphyry, monzonite, lampropita, and basalt porphyry, pegmatite, aplita also occur in the Gran Desierto. A series of basalt and tuffs of even a mile of thick are represented in many mountains as well. Since the eruption of these rocks, most of the mountains have been subjected to dissections of deep erosion, perhaps at the end of the Tertiary or Quaternary early (Ives, 1964).

Within the lava shield known as El Pinacate lava flows of basalt from several inches to more than 30 meters thick resting on Ter-

tiary and Quaternary sediments that form the plains and intermountain valleys. There is no Palaeozoic rocks in the Gran Desierto. However, agglomerate of discontinuous, red in color and of an unknown age, is present on a slope at the bottom to the Northwest of the Sierra Pinacate (May, 1973). Downhill from the mountains of the region are more or less consolidated mantle, stratification of masses of gravels and rocks from the erosion of the adjacent mountains, underlying the alluvium and marine loam of the Tertiary and Quaternary. Butler (1935) considers that these gravels may contain gold; however there is no evidence on this.

As well as the fields of sand dunes and the large and almost perfect craters, are lava flows that have been produced by the first eruptions. The largest lava flow is exposed in a canyon to the West of the Red Cone and



Sierra Alacranes

dates from one million seven hundred thousand years. Since then, a series of eruptions of smaller volcanoes have been the source main flows and bubbles of lava that today can be observed in the environment. It should be noted that by the age of the most recent lava flow, some scientists have suggested the possibility of prehistoric cultures have witnessed volcanic events that gave rise (Gutmann, 2008). The lava flows extend radially from the main peaks by many miles. This peripheral lava forms an erosion-resistant barrier and also makes a difficult access to the main peaks. The channels of the deeply eroded canyons exposes the stratification of flows which alternates between layers of thin and thick volcanic tuffs and ash that has been covered by lava. The total thickness of this mantle typically does not exceed the 122 meters. Where the under-



Gran Desierto Sand Landscape

lying material is visible, this seems to be a sequence of compact basalt porphyry (Ives, 1964). The basalt and sometimes the volcanic tuffs of these streams support growth of lichen which contributes to the detachment and the chemical weathering on surfaces of protected flows. According to Ives (1964) the colonization of this lichen is also an indication that the relative recent appearance of these flows is not historical and geological. The basalts are generally vesicular, but include sequences of rock flow gap. Both are dense slag along the upper surfaces of irregular flow and along the margins of irregular flow (Jahns, 1959). Many flows are interspersed with stratified remains of material sections of cindery debris, in which the pellets and ejections of volcanic bombs are common. Both pyroclastic flows and sections of El Pinacate region are cut by vol-

Weather

The region is characterized by low rainfall, high temperatures in summer, intense solar radiation, low humidity and high evaporation. The modifications to the Köppen system proposed by Enriqueta Garcia (1981), defined as extreme climate, very dry or desert, dry, semi-dominant and with rain in winter. Temperatures are among the highest in the



Sand Landscape

northern hemisphere. The records for June and July indicate maximum temperatures average 49 ° C (120°F) and maximum 56.7 ° C (134.06°F) extreme in June. In the winter, night temperatures can fall to -8.3 ° C (17.06°F), although sub-zero temperatures are very rare. The average annual temperature is 18 ° C (64.4°F) to 22 ° C (71.6°F) and average annual precipitation is less than 200 mm.

Rainfall is varied largely in a gradient from northeast to southwest. The greatest amount of rainfall occurs in Sonoyta, recording 164 mm per year, while it is 61 mm in Puerto Peñasco and 52 mm in San Luis Rio Colorado. The frequency and amount of rainfall decreases towards the west - in the Sierra El Rosario there has been a period of 34 months without significant rainfall, which places the Grand Desert of Altar as one of the driest environments in the world. The pattern of rainfall in part explains the variation in floristic composition, which probably originates from the different strategies of the species for efficient water use. While there is a bimodal rainfall pattern, the winter rains are most important to the veg-

etation.

Because there were no weather monitoring stations until 2002, there is no reliable data on precipitation and temperature in the highlands of El Pinacate; possibly due to the altitudinal gradient effect, this small area has more moisture and lower temperature than the surrounding areas. Evidence of this can be seen on the north slopes of the Sierra El Pinacate, where vegetation is similar to the chaparral, which is developed in more-or-less extremes than vegetation typical of the Sonoran Desert (Felger, 1992).



Hidrography

The site is located in two watershed regions, Number 8 and the North Sonora 7 Colorado River (INEGI, 1980). The area includes the lower basin of the Sonoyta River, which has many channels of ephemeral streams and water reservoirs in the form of natural tanks dug into the rocks called Tinajas and the deep wells.

The most important water source is the Sonoyta River, which originates outside the area of the Reserve. Currently the main channel that runs through the city with the same name is much silted and the flow of his base is very small. After crossing the city, it follows a course parallel to the border in an east-west direction, approximately 22 kilometers. It then moves towards the south on the eastern margin of the volcano shield. At the height of the Northern village it crosses Highway 8 south and later, before reaching the Gulf of California, practically in the dunes. The river loses its Sonoyta base flow at the height of Los Vidrios Viejos town. However, the rainy season can bring water along its entire course.

The upper parts of the Reserve have a radial pattern of drainage. The streams are ephemeral and when carrying materials to drain low areas it is possible to observe volcanic ash beds in these streams.

One of the most important and characteristic features of the site are the tinajas, which are small rocky reservoirs capable of storing large volumes of water, located exclusively in the mountains of basalt and granite. Hayden (1998) men-





Emilia Tinaja



Sonoyta River

tions the existence of 23 tinajas that were used by indigenous people and proof of this is the network of trails leading from pitcher to pitcher in the supply of groceries in the sea and the plains beyond the mountains.

On these trails have been found remains of shells and fragments of stone and ceramics. The tinajas are also important sources of water for wild animals that inhabit the site. Among the tinajas, the most representative of is Tinaja Pápagos (Papago Tanks) I'toi, Tule, Huarache, Cuervo, Emilia and Los Chivos, which are nearly permanent, provided they fulfill their rain catchment. Some tinajas have lost over the years the levees holding the water, while others are filled with sand and gravel. The latter are called sand tanks, which are not as apparent as the tinajas and where the sand cover prevents evaporation allowing water-containment most of the year.

The beaches are small endorheic basins where fine sediments are deposited by evaporation and water that accumulates a certain concentration of salts. The characteristic of being subject to flooding and drying processes causes some to be short-lived. The most important beaches are Playa Diaz and Vidrios Viejos located northeast of Crater Cerro Colorado; others less-known are Bolsa del Batamote, near the northern town of Ejido Nayarit, and the beaches in the largest craters, Elegante and El Verdugo.

Another important aspect is the presence of “wells”. Seemingly out of place, is a resource of fresh water present on the south side of the Great Desert. These small oases are formed in the middle of the flat regions and because of that salt in the surrounding area is not growing any vegetation. In El Pinacate y Gran Desierto de Altar, a region where



Flujo de lava de La Laja





Bahía Adahir

drinking water is very scarce, wells are very important, especially for Indians who inhabited this region. The small dunes that form around the wells are filled with small shells and even small pottery or tools used by the Indians since the beginning of the century. The Tohono O'odham used wells during their pilgrimages to Adair Bay on the coast, looking for shells and salt harvesting (Lumholtz, 1912). To venture a bit further into the volcano of El Pinacate, the wells are increasingly scarce, you might even say that do not exist and it shows how hostile can become the Great Desert (Ives, 1964). Large dune fields on the shores of the volcanic complex, extending to the Bay of Adair, and is due to the low permeability of the volcanic shield, the rain slides down the lava flows ending up in aquifers that lie under the dunes.

BIOLOGICAL DESCRIPTION

Vegetation

The vegetation consists mainly xerophytic bushland, and similar chaparral vegetation restricted to some areas, Mesquite is found on some beaches as trees and shrubs, in addition to small tracts of coastal scrub halophilic.

According to Rzedowski (1978), this vegetation means any



Springblossom

xerophilous scrub vegetation that is found in arid and semi-arid climates. Within the core areas are forests of cholla or chollal which are groupings of plants represented by the gross gender *Opuntia spp.* Having association with the surrounding vegetation, in this case with mesquital, where, as its name indicates, there are many trees of the genus *Prosopis spp.*, better known as a mesquite. It usually develops in areas with some degree of moisture where the water table is not very deep and the soils are generally shallow. As for the halophilic vegetation that somehow grows in the sand dunes as Rzedowski description in 1978, they are set in a progressive manner and the surrounding areas from being gender *Larrea spp.* the most widely distributed, although associations with gender *Atriplex spp.*



Cinder cones covered with flowers



Teddy Bear Choyas

Likewise, studies by Richard Felger (1992) on plants in north-western Sonora note the region has 560 species of vascular plants are divided into 315 genera and 85 families, distributed in 10 main regions:

- 1 Sonoyta region,
- 2 The highlands of El Pinacate
- 3 The lower parts of El Pinacate
- 4 The craters "Maar"
- 5 The granite mountains
- 6 The mountains of El Rosario
- 7 Dunes
- 8 The plains of the desert
- 9 Coastal habitats
- 10 Wetlands



Sahuaro



Desert Yam

The area of Sierra del Rosario covers approximately 78 km². Despite the high degree of isolation and a granite mountain, 111 species and exotic species are reported. According to Felger (2000), Sierra del Rosario, introduced plant species that have not been located anywhere else in the northeast of the Reserve. The species found are: *Cistanthe ambiguous*, *Fagonia densa*, and *Mammillaria tetrancistra* and *Mirabilis tenuiloba*.

The volcano shield El Pinacate has a flora of at least 309 species; one is *Senecio pinacatensis*, significant for being an endemic species.

According to Hayden, perennial plants are specially adapted to arid conditions where rainfall is usually uncertain. Most plants develop small leaves to prevent water loss through evaporation, while others have evolved to the extent that they retain their

energy producing green chlorophyll in its bark, leaves, forming only when conditions are optimal.

The dunes have the lowest number of species (85), partly due to the low diversity of habitats; this becomes significant when considering the high proportion of short-lived (65%), endemic (20%) and in the process of speciation (15%). Some of the endemic species to the dune systems are: *Heterotheca thinnicola*, *Chamaesyce platysperma*, *Croton wigginsii*, *Dimorphocarpa pinnatifida*, *Eriogonum deserticola*, *Lennoa sonora*, *Stephanomeria shottii* (Felger, 1992).

Another important aspect is the presence of at least 76 non-native taxa recorded for the region. Families with more species are composites, grasses, legumes, euphorbiaceae, queno-podiaceae and cacti.



Old man cactus



Barrel Cactus flower



Mormons Tea (ephedra sp.)



Inside the Reserve species are under some category of protection by the Mexican Official Standard NOM-059-SEMARNAT-2010, which protects Mexican native wildlife species. The plant species that are under some form of protection is shown in the following table:

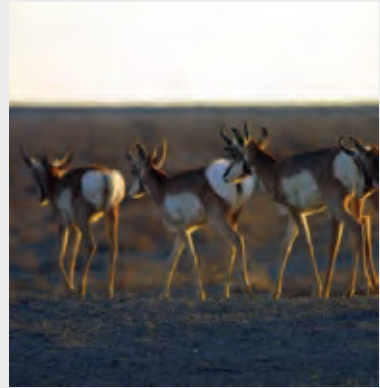
Scientific Name	Common Name	Category
<i>Echinomastus erectocentrus acunensis</i>	Acuña cactus	Endangered
<i>Ferocactus cylindraceus</i>	Barrel cactus	Special protection
<i>Olneya tesota</i>	Desert ironwood	Special protection
<i>Peniocereus greggii</i>	Night blooming cereus	Special protection

List of plants in the Biosphere Reserve El Pinacate y Gran Desierto de Altar with some degree of protection Norma Oficial Mexicana NOM-059-SEMARNAT-2010

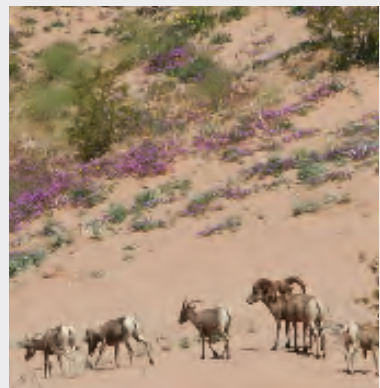
The presence of endemic species of flora or with some degree of differentiation and taxonomic categories of protection, representing one of the biological and ecological values important to El Pinacate y Gran Desierto de Altar.

Fauna

Despite the aridity, low rainfall and high temperatures, all biological groups of higher vertebrates are present on the site.



Pronghorn



Bighorn sheep



Black Tailed Jackrabbit



Big eared bat



Desert Tortoise

Mammals

As for mammals, there are 44 wild species. Of these species the Sonoran pronghorn (*Antilocapra americana sonorensis*), is in danger of extinction as well as being a sub-species of restricted habitat, bighorn sheep (*Ovis canadensis mexicana*) subject to special protection, and Lesser long-nosed bat (*Leptonycteris curasoae yerbabuena*) and Fish-eating bat (*Myotis vivesi*), both endemic, threatened the first and in danger of extinction, the last. It is noteworthy that the former NOM-059, SEDUE 1994, the mule deer (*Odocoileus hemionus*) and gray fox (*Urocyon cinereoargenteus*) were consider as threatened species; thanks to conservation efforts in the country, these species have been removed from actual NOM-059-SEMARNAT-2010.

Scientific Name	Common Name	Category
<i>Ovis canadensis</i>	Bighorn sheep	Special protection
<i>Antilocapra americana sonorensis</i>	Sonoran pronghorn	Endangered
<i>Leptonycteris curasoae yerbabuena</i>	Lesser long-nosed bat	Threatened
<i>Taxidea taxus</i>	Badger	Threatened
<i>Vulpes velox macrotis</i>	Kit fox	Threatened

Birds

This is the best-represented group. There are 225 species of resident, migratory, terrestrial and aquatic. Of these, 19 are under some category of protection, including the red-tailed hawk (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), the Mexican falcon (*Falco mexicanus*) and peregrine falcon (*Falco peregrinus*).



Red Tailed Hawk



Falcon Genus



Logger Head Shrike



Cardinal

Scientific Name	Common Name	Category
<i>Aquila chrysaetos</i>	Golden eagle	Endangered
<i>Micrathene whitneyi</i>	Elf owl	Endangered
<i>Accipiter cooperi</i>	Cooper’s hawk	Endangered
<i>Accipiter striatus</i>	Sharp-shinned Hawk	Endangered
<i>Circus cyaneus</i>	Marsh hawk	Threatened
<i>Parabuteo unicinctus</i>	Harris’ hawk	Special Protection
<i>Buteo jamaicensis</i>	Red-tail hawk	Special Protection
<i>Charadrius montanus</i>	Mountain plover	Threatened
<i>Icterus cucullatus</i>	Hooded oriole	Threatened
<i>Passerculus sandwichensis</i>	Savannah sparrow	Amenazada
<i>Regulus calendula</i>	Ruby-crowned kinglet	Threatened
<i>Athene cunicularia</i>	Burrowing owl	Threatened
<i>Bubo virginianus</i>	Great horned owl	Threatened
<i>Glaucidium brasilianum</i>	Ferruginous pygmy owl	Threatened
<i>Falco mexicanus</i>	Prairie falcon	Threatened



Black Shinned Hummingbird



Gila Woodpecker

Fish

Due to shortage of water on the site, this is the group that is least represented. However, one should consider that the Sonoyta River basin is the only waterway of importance in the area and only a small part of the channel is within the site, being mostly intermittent.

The fish population is composed of two species: the Pup fish (*Cyprinodon macularius*), endangered, and Gila longfin dace (*Agosia chrysogaster*), which is threatened.



Desert Pupfish



Desert Pupfish Shelter

Scientific Name	Common Name	Category
<i>Agosia chrysogaster</i>	Gila longfin dace	Threatened
<i>Cyprinodon macularius</i>	Desert pupfish	Endangered
<i>Gambusia affinis</i>	Mosquitofish	Endangered
<i>Ameiurus melas</i>	Black bullhead	



Horned Lizard



Spiny Lizard



Desert Iguana

Reptiles and Amphibians

These are represented by only five species of toads that restrict their activity period to a few weeks a year or even a few days. Of these, Sonoran green toad (*Bufo retiformis*) is subject to special protection.

Reptiles are well-represented with 44 species recorded, including: the chameleon (*Phrynosoma mcalli*) that is endemic to the Sonoran Desert under the category of threatened, the Sonoran Desert sidewinder (*Crotalus cerastes cercobombus*) is also endemic to the Sonoran Desert and subject to special protection, the Gila monster or scorpion (*Suspectum heloderma*) and the Desert Tortoise (*Gopherus agassizii*), both threatened. Of all the species recorded, 22 are in some category of protection under Mexican norm, NOM-059-SEMARNAT -2010.



Diamondback Rattlesnake

Reptiles & Amphibians

Scientific Name	Common Name	Categoría
<i>Lampropeltis getulus</i>	Eastern kingsnake	Threatened
<i>Masticophis flagellum</i>	Red coachwhip	Threatened
<i>Thamnophis eques</i>	Mexican garter snake	Threatened
<i>Callisaurus draconoides</i>	Gridiron-tailed lizard	Threatened
<i>Crotaphytus draconoides</i>	Zebra-tailed lizard	Threatened
<i>Sauromalus obesus tumidus</i>	Common chuckwalla	Threatened
<i>Gopherus agassizii</i>	Desert tortoise	Threatened
<i>Kinosternon sonoriense longifemorale</i>	Sonoyta mud turtle	Threatened
<i>Heloderma suspectum</i>	Gila monster	Threatened
<i>Micruroides euryxanthus</i>	Western coral snake	Threatened
<i>Uma notata</i>	Fringe-toed lizard	Threatened
<i>Chilomeniscus cinctus</i>	Variable sandsnake	Special Protection
<i>Hypsiglena torquata</i>	Spotted night snake	Special Protection
<i>Phyllorhynchus browni</i>	Saddled leaf-nosed snake	Special Protection
<i>Coleonyx variegatus</i>	Desert banded gecko	Special Protection
<i>Gambelia wislizeni</i>	Long-nosed Leopard lizard	Special Protection
<i>Crotalus cerastes</i>	Horned rattlesnake	Special Protection
<i>Crotalus mitchelli</i>	Speckled rattlesnake	Special Protection
<i>Crotalus scutulatus</i>	Diamondback rattlesnake	Special Protection
<i>Crotalus tigris</i>	Tiger rattlesnake	Special Protection
<i>Crotalus atrox</i>	Diamond-backed rattlesnake	Special Protection
<i>Phrynosoma mcalli</i>	Flat-tailed Horned lizard	Special Protection



Western Coral Snake



Gila Monster



Western Banded Gecko



Blue Dotted Lizard

Cultural Aspects

Historically and culturally, El Pinacate y Gran Desierto de Altar is an area unique among the deserts of North America because all non-perishable remains of human occupation have been retained in direct relation to the shapes of the landscape on which they were deposited and have remained virtually unchanged by erosion. The jars contain a concentration of cultural relics that in other places is scattered and discontinuous. Also, in the desert floor, the stone tools used and left by the Indians during the storm periods are incorporated into the mosaic floor and carry the same patina to them. Therefore, the tools are older than pavements where they lie. There are other tools in subsequent storm periods, the patina thinner, the pavement older. This makes it possible to determine the order in which humans have inhabited the area.

For the Tohono O'odham, the indigenous group that has inhabited the El Pinacate y Gran Desierto de Altar for thousands of years, this is a sacred site because it is the place of its creation, the place where the people live with his older brother: I'itoyi its creator. Among the most significant archaeological remains left by these groups in El Pinacate are: geoglyphs, intaglio, camp clearings, sleeping quarters, trails, mortars and petroglyphs.



Clay Pots



Petroglyph



Sleeping Circle



Tohono O'odhams

2.b History and Development

El Pinacate y Gran Desierto de Altar Biosphere Reserve houses a wealth of information in the fields of geology and history. The geological history is estimated between 3 and 4 million years ago (Gutmann, 2002), while the first human occupation dates back to more than 40,000. (Hayden, 1998).



Geologic events at El Pinacate (Gutmann, 2008)

4'000,000 years. The region was a sea of sand, gravel and playas. The Sonoyta river ran west to the Adair Bay .

4'000,000 years to 2'000,000 years. Volcanism began at this time. The oldest lava flows are buried inside the volcano.

1'700,000 years. Occurred the eruption of lava flow oldest known so far. This flow is exposed in a canyon west of Red Cone.

1'080,000 years. Occurred the last eruption of Santa Clara Volcano.

1'200,000 years to the present time. Erosion of lava erupting volcano and dark (Basalt) in hundreds of small volcanoes or cinder cones throughout the region.

430,000 years. Cinder cone eruption inside the crater Elegante.

38,000 years. Volcano eruptions that formed the Carnegie crater.

32,000 years. Eruptions that formed the crater El Elegante.

27,000 years. Eruptions form the Tecolote cone.

13,000 years. Eruptions form the Ives flow.

12,000 years. Eruptions form the La Laja cone.



Human Occupation

Human occupation in El Pinacate y Grand Desierto de Altar dates back to approximately 40,000 years ago (Hayden, 1976, 1998). In this place, the occupation and abandonment of land, and therefore the use of natural resources, has been linked to periods of drought. The process of human occupation in the sierra of El Pinacate, took place through three classical periods observed in the Northwest of Mexico:

- 1 The Paleoindio, comprising complexes Malpais and San Dieguito.
- 2 The Archaic, which includes the Amargosanos and Hohokam complexes.
- 3 The Late Prehistoric, represented by the Hiaced O'odham, also known as Areneños or Pinacateños, and the Tohono O'odham or Papagos.

The first inhabitants were from what is known as the San Dieguito and the early stages of this complex are called Malpais. They were hunter-gatherers living on the land moving from the mountains to the beach in search of food. Their implements were simple, being made of volcanic stone, thick shell, and probably made of wood, as many of the stone tools were for the same work, because there is no evidence of arrowheads. Malpais slept in the clear surface forming small holes in the floor of the desert, probably behind windbreaks made of branches and stones. Designs were en-

graved on the pavement in the form of animals and humans by rubbing the black tile to expose the yellow sands. Because pavements retain all evidence of alteration, these sleeping prints and designs are still visible. The early stages of occupation of the Malpais seem to have ended at the beginning of the dry glacial period around 20,000 years ago, when drought forced people to leave the mountains (Hayden, 1998).

A second phase of occupation by the San Dieguito people began at the end of the dry glacial period. This group returned to the mountains and lived as their ancestors, but



Ancestral Trail

with better and more varied kinds of stone tools. This phase of occupation is known as the San Dieguito Phase I, which were simply Malpais stages of occupation by the same population. During this period, the last rainfall was between 17,000 and 10,000 years ago; the climate was warmer than the current time, and there were abundant junipers, piñoneros, oaks and grasses. The area was populated not only by many of the mammals that still exist, but also by animals already extinct or no longer present, such as horses, camels, mammoths, bison and others (Hartmann, 1989). Surely,

the jars must have been a source of water during this time that ended with the arrival of another hot and dry period - antitérmico, - about 9,000 years ago. Again, the Indians were forced to leave the area.

The present climate period was initiated 5,000 years ago, which began with periods of heavy rain and flooding. A new population arrived from the north. These newcomers, who migrated south following the change belonged to the Amargosa complex, also called the Early Archaic, and were the ancestors of the Pimas and Pápagos (O'odham). Those who colonized El Pina-



Hia'Ced O'odhams

cate y Gran Desierto de Altar are known as the Areneños Pinacateños, people of sand of the desert, or C'ed O'odham Hia. Like the old town of San Dieguito, the Pinacateños roamed the mountains reaching down to the sea looking for food and concentrating in camps near the jars. For the first time in El Pinacate y Gran Desierto de Altar appeared darts or spears with stone tips and later, arrowheads of jasper, quartz and obsidian used to hunt small prey. In fact, east of the volcanic shield, at a place known as Los Vidrios, there is a source of obsidian with ages up to 30 million years which the first set-



Arrowheads and Metates



tlers used for making tools.

The Amargosanos also introduced tools to grind seeds, the metate, mortar and a hand tool, rotating the mill for processing the pods of the mesquite (Pechito) flour (Hayden, 1969). Pottery used by Pinacateños over the past 1200 years was brought by the Yumanos Indians of the Colorado River valley, who exchanged shells, baskets and skins.

From the earliest hunter-gatherers until recent O'odham, the people of the region have depended on the collection of plants, hunting and harnessing the resources of

the Gulf of California to survive. The native people had to be extremely knowledgeable about their environment to find the location of the animals that they could hunt and plants that could be eaten through all seasons. Also, knowing the location of water sources was critical to survival. Agriculture was practiced in a few locations where



Petroglyphs



Clay Pot



Mortar



Father Kino Illustration

water was available on a permanent basis. The staple crops included beans, corn and squash.

When Europeans arrived, the land and the resources available to C'ed Hia O'odham became limited. In 1698, Father Kino found around 50-200 Pinacateños living in the area of El Pinacate y Gran Desierto de Altar who survived on roots and fish. In 1850 the population was wiped out by yellow fever and the few survivors migrated to the Gila River. The last resident C'ed Hia O'odham who lived in El Pinacate was Juan Carvajal who left the area in 1912. After Juan Carvajal, the O'odham visited the area only for

sacred ceremonies or as a passage route on their trip to the Gulf of California to collect salt and sea shells.

Probably the first white man who saw the mountain now known as Sierra Pinacate was explorer Melchior Díaz in 1540. Subsequently, in 1698 Father Eusebio Kino and his group climbed to the summit of El Pinacate, which he named Hill Santa Clara. He and his group made several trips to the summit in 1701 and discovered in 1706 that Baja California was not an island but a peninsula.

As it has been widely documented, due to the harsh environmental conditions in the

area, the presence of non-indigenous groups was first developed with sporadic exploration motivated by the search for new treasures and territories to implement under the tutelage of the Spanish Crown. Subsequently, this population began a process of settlements through the establishment of small ranches. But, it was not until the 20th century when this region was consolidated and first experienced

- 1 The early explorations (1540 to 1890).
- 2 The explorations and settlements during the first half of the twentieth century (1905 to 1948)
- 3 The exploration and colonization during the second half of the twentieth century to date.



Map by Father Kino circa 1688

Early Explorations

Responsible	Date	Studies
Melchor Díaz	1540	First european explorer to visit the area
Fray Eusebio Francisco Kino	1698	Italian Jesuit who made the first formal studies in the area, his visit resulted in the designation of El Pinacate as "Santa Clara Volcano"
Francisco Garcés	1772	Discovered the Papagos Tinaja
Capitán Juan Bautista de Ansa	1774	Established the Camino del Diablo path that crosses from the town Plutarco Elias Calles to the city of Yuma in California.

Explorations and settlements in the first half of the twentieth century

Responsible	Date	Studies
Daniel T. McDougal William Hornaday Godfrey Sykes	1905	Scientists, anthropologists, hunters and naturalists reported the existence of this place (geology, flora and fauna)
Carl Lumholtz	1909	Study the region east of the mountains, accompanied by the famous guide Alberto Celaya, who study the lava tunnels and their relationship with the inhabitants of the area.
Ignacio Bonillas	1910	He acknowledged that lava flows of El Pinacate are mainly basalts (lavas relatively rich in iron and magnesium) and containing coarse crystals of olivine and labradorite (plagioclase feldspar one)
Ronald L. Ives	1931	Made more accurate studies on the lava, revealing the most recent flow of El Pinacate is located south of the volcanic shield that bears his name (age: 13.000 ± 3.000 years). By 1981, Ives had already published 130 papers on some aspect or another of the region of El Pinacate.



Researchers at Pinacate Peak

Exploration and settlement of second half of the twentieth century to date

Responsible	Date	Studies
Richard H. Jahns	1952	Found that type Maar craters were not meteorite impacts, but collapses from beneath the earth of volcanic origin, that geologists deal with the term "Caldera"
Julian Hayden	1958	The American archaeologist, began his research that led to the collection of archaeological and ethnographic point of this region
NASA	1965	The team in charge began their studies prior to the arrival of man on the moon, because the landscape showing the craters and volcanic ash-covered soils of El Pinacate, resemble the lunar soil
Mike Donnelly	1968	He made the first maps including craters, volcanoes and flows of lacquer, as well as studies of large transparent crystals of labradorite
James Gutmann	1972	He took the job done in the area by earlier scientists and continued with more detailed studies of ages of lava flows, age of the craters and cinder cones and crystals of labradorite
Charles A. Wood	1974	Published an article that introduced the El Pinacate global volcanological community. He discovered that the playa deposits in the Elegante crater, in particular, contain a clear record of flood events and represent a potential store of information on the climate of past centuries
James Gutmann	1977	It assessed the peculiar texture of megacrysts in the lavas of El Pinacate. These include the minerals olivine, augite and magnetite, as labradorite.
SARH	1979	Declares El Pinacate as a protective Forest Area and Wildlife Refuge on March 29th
Exequiel Ezcurra	1980	At the initiative of the State Government, the Institute of Ecology, A. C. conducted an environmental assessment study for the purpose of establishing the scientific basis for the creation of a Biosphere Reserve
Daniel J. Lynch	1981	Certain age and chemical composition of many of the cones and lava flows of El Pinacate, and realized that the volcano Santa Clara yielded the oldest lavas 1.7 million years ago

Exploration and settlement of second half of the twentieth century to date

Responsible	Date	Studies
SEDUE y SARH	1984	A first cooperation agreement between SARH SEDUE was signed to implement a surveillance program and administration of the area
Wadge y Cross	1989	Two statistical methods used to investigate quantitative alignments of cones El Pinacate as seen in Landsat satellite images. They reported a structural trend north and specific alignments of cones in both directions, north and northwest
Davis, Owen K.	1990	Determines the formation and dynamics of dune fields of El Pinacate
Federal Government	1993	On June 10th 1993, the Federal Government recognizes the biotic value of the place and declare this area as a Biosphere Reserve
UNESCO	1993	The "El Pinacate y Gran Desierto de Altar" Biosphere Reserve enters the World Network of Biosphere Reserves "Man and Biosphere" (MAB) by UNESCO, extending this designation in 1995
Julián Hayden	1998	Makes a list of the present Tinajas in the area and a description of each one of them
Jesús Vidal Solano	2001	He noted that the volcanic region had its origin in two major events: Pre-Pinacate dating event to the Miocene, 15 to 12 million years, and the event called the Plio-Quaternary Pinacate, 1.5 to 10 million years
RAMSAR List	2007	Declared RAMSAR site at the premises known as Agua Dulce, located in the riverbed Sonoyta.
James Gutmann	2008	He made a chronology of age type Maar craters, cinder cones, lava flows, among other volcanic structures, which highlights the most recent lava flow, which is located on the Visitor Center with an age of 13.000 thousand years.

Processes of colonization, exploration and conservation of El Pinacate y Gran Desierto de Altar, Biosphere Reserve, nominated property.



03

Justification for Inscription



3.a Criteria under which inscription is proposed (and justification for inscription under these criteria)

El Pinacate y Gran Desierto de Altar Biosphere Reserve satisfies three of the outstanding universal value, criteria described in paragraph 77 of the Operation Guidelines for the inscription in the World Heritage List.

Criterion (vii)

Contains superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.

El Pinacate y Gran Desierto de Altar in Northwest Sonora in Mexico, is unique in the world by combining the extraordinary landscapes of contrasting colors such as the dark lava field, one of the youngest of North America, the white and brown tones of the El Pinacate lava shield along with the clear and extensive fields of mobile dunes with more than 5,000 km² in the dry region of the Sonoran desert where the annual aver-



Barrel Cactus Flower

age of rainfall ranges only from 120 to less than 50 mm. Its location makes the site an exceptional place, even brand big difference in relation to various sites that make up the Sonoran desert. Despite its apparent hostility, the area has been subject to scientific attention due to its wonderful and almost intact natural characteristics.

This complex region of rolling sandy Plains, enormous dunes of sand, steep mountains,



Sand Dunes

ten huge craters, 400 ash cones and lava is also a land of hardy and well-adapted flora and fauna to the summer temperatures that reach 55 degrees centigrade with dry winds that dry the biota of the region and cause to the distant mountains appear gleaming. Except for the upper parts of the Sonoyta River, no perennial river is located along the 25,900 km² of this region. Ephemeral flooding that begins in the canyons of the mountains or streams of the plains of the Valley form networks bifurcated and interlaced drainage, forming a contrasting landscape to dryness, reflecting its long body of water,



Encelia Farinosa in Bloom

Sunset





Ives Lava Flow

the blue of the sky. After the heavy summer storms, these networks are inadequate and rather are cause of flooding. In these landscapes of contrasts, also joined the heavily eroded mountains and gently sloping alluvial plains where the silhouette of the Sierra Pinacate, 1291 m emphasize on the horizon.

The beauty of El Pinacate y Gran Desierto de Altar can be seen even from space, where black lava shield volcano is surrounded by the yellow sands of the Gran Desierto, both contrasting with the blue Sea of Cortez, for its resemblance to lunar landscapes, it was site of training of astronauts in preparation for the first moon landing.

It is precisely for its exotic beauty and composition of the lava shield, which resembles

the lunar landscape that in 1965, for the first time, thirty astronauts of the National Aeronautics and Space Administration (NASA), trained for what would be the first moon landing (Hartmann, 1989) as one of the few places on earth that provides an "alien" landscape. During the training were collected rocks resembling the ones on the Moon, during the Apollo 14 mission, and it wasn't until 1970 that such training ended. Proof of this, is the emblem carved in the veneer of a rock with the legend, APOLLO 14, NASA 2/16/70. The lava field and the volcanic shield is so vast and sharp that it is easily identified in satellite images and photographs taken by astronauts in some of the missions to the space.

The lava shield of El Pinacate, also known as



Sierra Pinacate

Sierra Pinacate or Santa Clara volcano, is the most distinctive feature of the region by its size, height, shape and color. The complex, forms a line drawn on the horizon, in where there are three peaks; Carnegie, Pico Medio and Pinacate, that together, make up the Sierra Pinacate. The highest point, El Pinacate peak reaches a height of 1,190 meters above sea level. The apparent homogeneity of the sierra, of gentle slopes and surmounted by three peaks on the summit, is interrupted by a large number of volcanic cones, large and extensive lava flows, craters of dimensions and spectacular beauty, hills and mountains covered by volcanic ash, extensive plains of lapilli and wonderful desert pavement, product of thousands of years of erosion and redeposition.



Desert Flower

Furthermore, the combination of desert plants in the volcanic shield provides a color contrast with the dark soil of the region. If rainfall is generous during the winter season and in the spring the desert is annually transformed into a vast tapestry of colors of flowers. The stripes of giant saguaros create one of the most beautiful and distinctive landscapes of the desert. For the desert fans, especially on cacti, Pinacate is a site which combines three of the most important species of large cacti; Sahuaro (*Carnegieia gigantea*), the Pitahaya (*Stenocereus thurberi*) and the Sinita (*Lophocereus webberi*). From the cultural point of view, the Sahuaros are the guardians of the desert, as the culture of the Tohono O'odham thinks that each of his ancestors at death reborn in



VolcanicLandscape

each of these columnar plants, place from which they observe and care for the surroundings of the desert. Reaching the rainy season, the landscape changes dramatically, flowers begin to shine and create a contrast with grey, arid soils. The Ocotillo (*Fouquieria splendens*) can even reach bloom more than six times a year, to capture the little rainfall that can fall, it flourishes rapidly and its branches are filled with small green leaves from the base to the apex where its bright red flowers call the attention of the small hummingbirds feed on the nectar. As well as the Ocotillo, many of the plants of the desert are related to animals, as well as be used as food, also play a role in nesting and home to many species of animals, some others act as nurse plants, as the case of the

Palo fierro (Tesota tree) that offers protection as well as nutrients to columnar cactus such as the Sinita, the Sahuaro or Pitahaya during the first years of life unless it is sufficiently large and mature, the roles change, and it is when the cactus absorbed so many nutrients from the roots of the nurse plants, which at one point, they die. Associations such as these, among plants and cacti are quite common in the Sonoran desert.

Another great attraction is the number of highly contrasting views: the mountains of gray granite, white and pink, sawn profiles and steep slopes, alternating with drops of gentle slope and sparse vegetation, huge sand dunes of bright colors and dry streams with abundant vegetation. El Pinacate y Gran Desierto de Altar is a place of



Ocotillo Flower



Encelia Farinosa



Desert globe mallow



Desert Bervena

great beauty and that due to the characteristics of the inhospitable desert, natural shelters are still majestic, pristine landscapes. Thus, by far, El Pinacate y Gran Desierto de Altar Biosphere Reserve, is the soul and heart of the Sonoran desert. (Hartmann, 2009 Marshall, 1989). The magic and the wonderful scenery of the landscape, is due to its historical, dynamic and violent geological past, which has left a vast and huge landscape, apparently desolated that contrasts with the grey and white mountains of sands dunes. It is a land with layers of volcanic ash, lava and various types of desert sand, stretching along to meet with the surface of the salty waters of the Gulf of California and the Colorado River. Majestic and isolated, impressive and quiet, this is a scenario which inspires, astonish and invites reflection to anyone who visits.

Obviously the deserts are the most inhospitable places on Earth. The apparent absence of life, extreme temperatures, lack of water and the large tracts of land that make up the desert, make the existence in it apparently very difficult, if not almost impossible. However, know them, cross them and watch them is one of the most rewarding experiences that can take humans. The vastness of the landscape, the different shades of color and changing shadows throughout the day, the impressive silence, the strange feeling of solitude or in some cases of liberty, the spectacle of their nights with some incredibly starry skies, all this together makes anyone who has visited it once, to return to admire it again.

Criterion (viii)

outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features

El Pinacate y Gran Desierto de Altar possess a wide variety of geological forms with different origins and evolutionary histories that make a site geologically complex. It is estimated that the geological history of the place began between 3 and 4 million years, although the oldest age dated for lava is approximately 1.2 million years ago (Gutman, 2002). This was due to two major events: the so-called Pre-Pinacate event occurred during the late Miocene (12 to 15 million years ago), and the so-called Pinacate event occurred during the Pliocuaternarium (1.5 to 10 million years ago) (Vidal, 2001). As a result of these events, much of the area became a sea of sand surrounding a volcanic shield, with granitic mountains and flats of igneous rock, a coastal plain, beds of streams and floodplains.

Due to its characteristics, it has been considered constantly as one of the key sites to see, learn and explore its geology.

Although there is no consensus among geologists about the start of volcanic activity



Aa Lava Flow

in El Pinacate y Gran Desierto de Altar, probably the first eruption began 3 million years ago (Cornette, 2000), and they were continuous but episodic. Although at the moment there is no volcanic activity, El Pinacate is far from being inactive. It is currently dormant but in a future eruption is possible (Kresan, 2007). Because volcanic activity has occurred in different periods, the old lava flows and a further volcanic activity can be seen.



Granitic Highlines

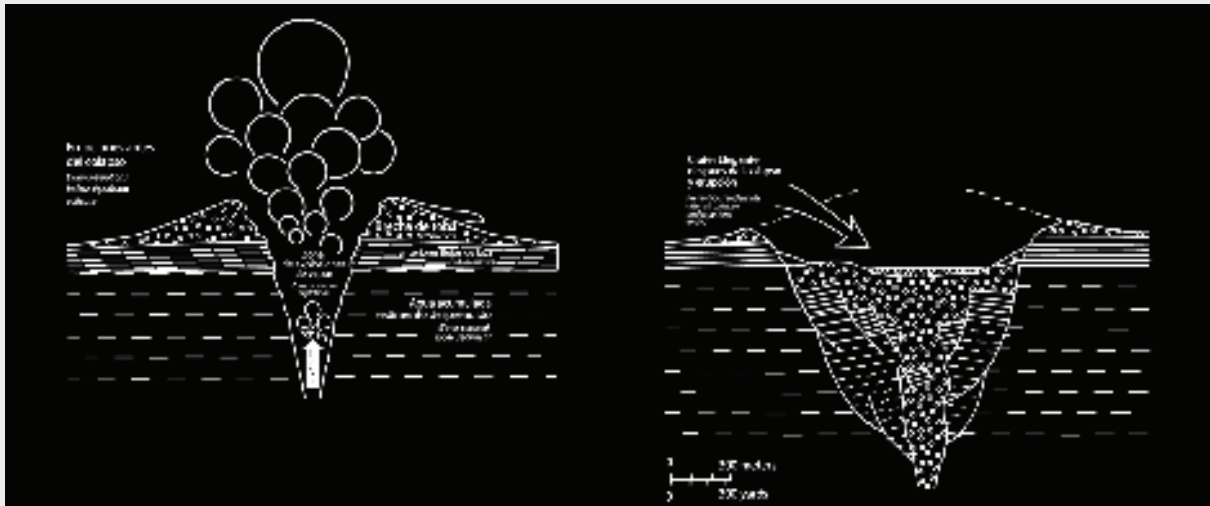
Many of these spills present as streams meandering on lava and this is one of the most outstanding aspects of the Sierra Pinacate. Some of these flows seem to have cooled after flowing the previous day.

No doubt both geologic area values as the impressive giant craters, more than 400 cinder cones, lava flows, lava tubes and the huge volcanic shield, to name a few, are characteristics that are found nowhere else gathered and El Pinacate y Gran Desierto de Altar. Also, numerous lava flows that are now cold hot basalt, we can assume that after the start of the formation of the Gulf of California to the Pacific tectonic plates separated and American, was an area structural-

ly “weak” where lava flowed late Pleistocene (1.2 million years ago), which covered the ground on successive occasions and that together with the manifestations of cinder volcanoes, forming the region, continued until 17.000 years, with no major geological changes since then. The most recent volcanic event occurred in 1936 with lava emission of six meters. The excellent conditions of preservation are these elements make



Tinajas Altas



Maar type crater formation

these some of the most important values of the site.

Geochemical evidence tells us that the volcano of Santa Clara, was originated by amounts of magma that periodically erupted, to form what now is the volcanic complex.

In contrast, grey and dark lava flows, as well as the cinder cones covering the slopes of the volcano, was believed to be product of magma erupted in periods shorter than time, so that the chemical composition of flows of lava in this area has not changed. Some of the lava flows, when cooled, formed big bubbles that have remained static in the landscape, some have survived for millions of years its large and almost perfect circular,

servng as shelter for several animal species forms.

Large amounts of magma that ran during eruptions, in what is now known as lava flows can be observed, the most important by its extension is the Ives flow, which covers more than 75 km² to the South of the volcano Santa Clara. An essential part of the lava shield, is the formation of the striking ten craters of various features, which together form a scenario that seems extra-terrestrial causing a great admiration for all those who have visited the area.

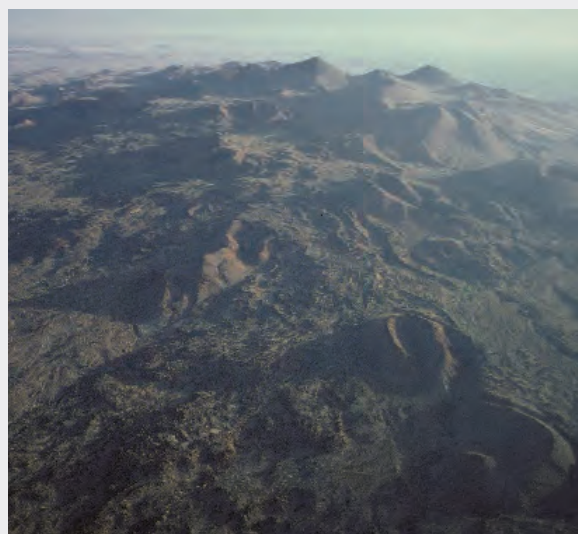
For geologists, the majority of these craters are a hybrid between a crater type Maar and a crater. A crater formed by a large collapse

type Maar is known as a Caldera, on the other hand, a crater, is the one that lacks a cone (coneless) and has been the product of a single eruption, in addition, this type of crater caused when the magma interact with any source of water, can be either a lake or stream for example, so is loading large amounts of water vapor, resulting in a huge explosion.

Surprisingly, in this region of the Sonoran Desert, the craters are nearly perfect, for example, their shapes are circular, quite large and deep, while hesitate to say that they are the product of a single eruption. Interestingly, the region of El Pinacate y Gran Desierto de Altar, is the region so far drier throughout the Sonoran Desert, so the



Mc Dougal



Sierra Pinacate

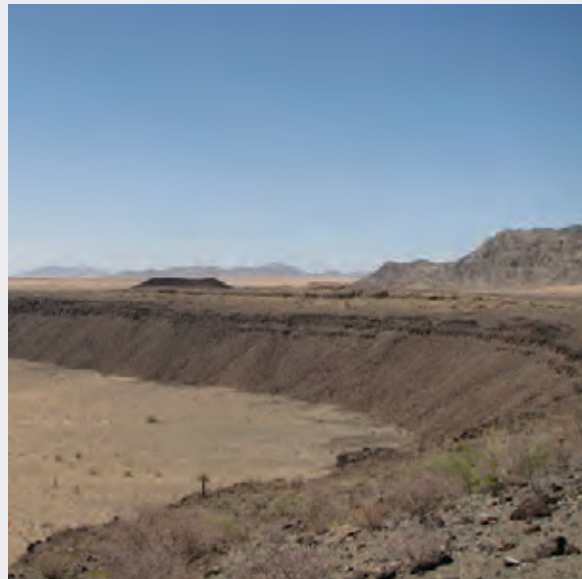
streams, lakes and any water is quite low if not zero and is therefore even more surprising almost perfect formation of these craters, because the magma could hardly have made contact with the water and cause an explosion of such magnitude that would cause such Maar craters, however, the formation of more than ten craters in a relatively small, compared with the magnitude of the explosions is really amazing and great admiration, something definitely not found anywhere else in the world, so far known. Perhaps answers to these questions we find are secrets that keep the same desert and only leaves the option of watching and admiring beautiful landscapes, a product of



SandDunes

nature.

The vast sea of sand dunes that now surrounds the volcano shield is considered the largest in North America, found in the star-shaped dunes that are over 200 m high, found in few places on the planet. The area covered by the gleaming sands of the desert reaches an approximate area of 5,700 km² (Blount and Lancaster, 1990) the largest active sand dunes in North America. The sand dunes that form these come from river and deltaic sediments of the Colorado River, the nearby beaches in the Gulf of California and the river and streams fans formed in the volcanic and granitic mountain ranges, and are transported by the wind systems that affect the region. In the dune field we can identify three different forms of dunes: a half moon (rising), located east of the Re-



Mc Dougla Edg

serve, with an elevation of 10-80 meters; a star-shaped, located west of the reserve, with elevation of 80-150 meters and high reversion located around the old system, with an elevation of 10-20 meters.

The large dunes in star-shaped, are a primary feature of the Gran Desierto de Altar, creating a unique combination which is hardly found elsewhere on the planet. These may be either simple, complex, or even made altogether forming chains which can measure up to 48 km in length. Seasonal changes and directions of the wind play an important role in the formation of the dunes. Variations in winds stack the sand forming the enormous mountains with a light and subtle lateral movement. Star shaped dunes, possibly evolved from crescentic dunes, migrating toward opposite areas where



litoy Cave

runs wind, becoming reversing dunes. Multiple arms of star-shaped dune are caused by side winds (Lancaster 1989) in fact, the dunes (complex crescentic and reversing dunes), they are common and characteristic of the Gran Desierto de Altar, giving a unique combination which is hardly found anywhere else on the planet.

Large rocks, mainly granitic suddenly emerge within the complex sea of dunes, forming a mountain, as it is the case of the Sierra del Rosario, which is the 610 m. Other outcrops called inselbergs, are partially covered by the fine sand of the desert. Located south of the San Andreas Fault, the great desert is active, and because of that region,

earthquakes are common in the area. Obviously the deserts are the most inhospitable places on Earth. The apparent absence of life, extreme temperatures, lack of water and the large tracts of land that make up the desert, make the existence in it apparently very difficult, if not almost impossible. However, know them, cross them and watch them is one of the most rewarding experiences that can take humans.

Criterion (X)

Contains the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

El Pinacate y Gran Desierto de Altar Biosphere Reserve is the residence of many species of animals and plants, which have evolved to adapt to the extreme conditions of this desert. Birds, reptiles, amphibians, mammals, invertebrates, and even some species of fish are represented, including some of the species present in the area are considered rare, threatened or in danger of extinction, and is one of the most important biological corridors of the Sonoran Desert. An extraordinary phenomenon of nature, within the Reserve, is presented annually to the interior of a collapsed lava tube gather thousands of female long-nosed bat *Leptonycteris curasoae*, in what is the largest maternity colony known, constitutes between 170,000 to 300,000 individuals. This bat is considered as threatened in Mexico and in danger of extinction in the United States. The species feeds on nectar and pol-



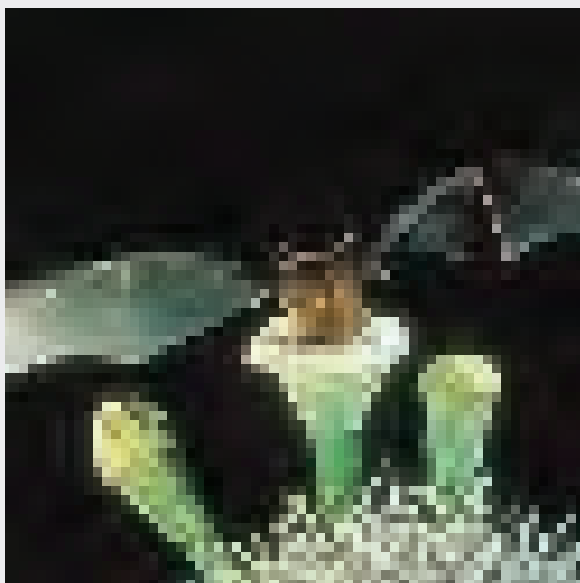
Chuckwalla

len from flowers and juicy fruits, soft and sweet, it is migratory, moving every year since the central-western Mexico's Pacific tropical deciduous forest to the north, Desierto de Altar and southwestern Arizona in the United States. The species carries out a major pulse of reproduction in the summer (late April to July) in this area.

These bats represent ecological importance for many species of plants in the So-



Pronghorn



Lesser Long-nosed Bat

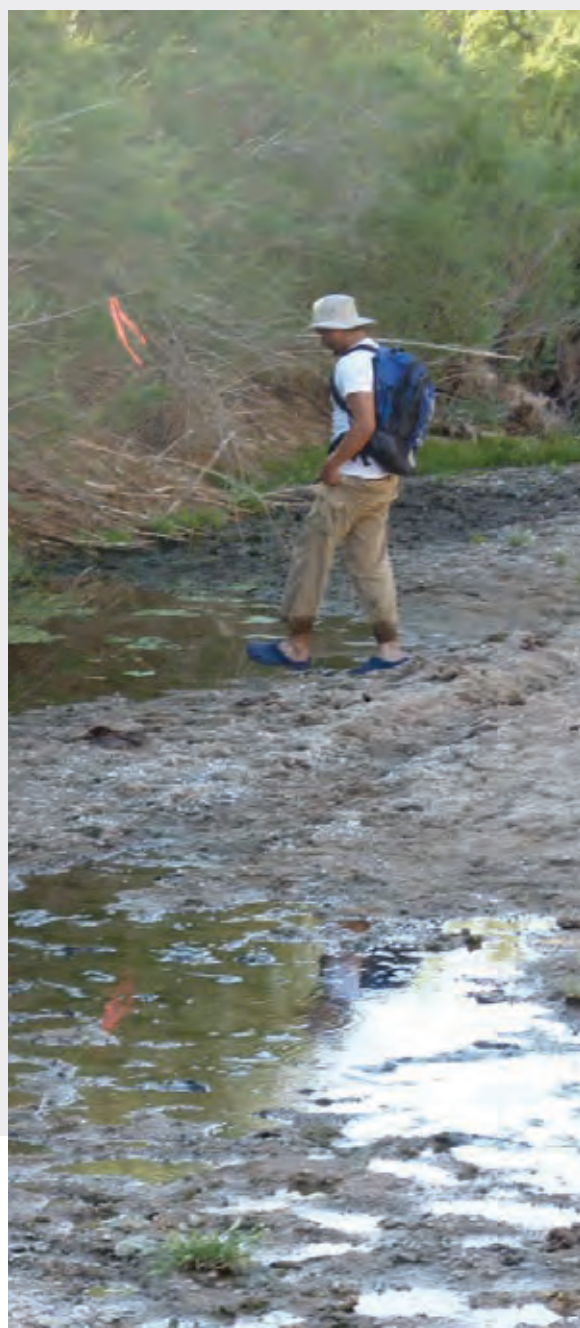
noran Desert. Columnar cacti species such as Cardon (*Pachycereus pringlei*), the Saguaro (*Carnegiea gigantea*), and the Pitaya (*Stenocereus thurberi*), and several species of Agave depend on for pollination and seed dispersal in good measure of this kind of bat. In addition, many species of agave are also depend on for effective pollination of this species.

The cave is formed by cooling lava tunnel, with an internal topography that allows it to accumulate hot air inside, condition which is critical for the survival of the offspring of bats, since they do not possess the adults thermoregulatory ability to survive.

As part of the runoff of the Sonoyta River, is

Sonoyta River

the site called "Agua Dulce", the most prominent portion of the river that extends over 3 kilometres and covers a total of 39 has. Besides being a source of water for the species that inhabit or move around this reserve, the outcrops of permanent surface water throughout the year, originated the so-called "pools" or "pozas", same that provide habitat for endemic species, two fish, the Pup fish (*Cyprinodon macularius*) the Gila Longfin Dace (*Agosia chrysogaster*), and the Sonoran mud turtle (*Sonoran kinosternon*). Extreme weather conditions and physical





Sand Vegetation

characteristics typical of dune systems make these complex habitats highly specific, approximately 20% of plant species endemism in these systems manifest, in addition, 15% of the taxa present taxonomic differentiation processes (Felger, 2000). Among the endemic species are present are:

- *Croton wigginsii*
- *Dimorphocarpa pinnatifida*
- *Eriogonum deserticola*
- *Euphorbia platysperma*
- *Heterotheca thiniicola*
- *Pholisma sonora*
- *Stephanomeria schottii*

El Pinacate y Gran Desierto de Altar Bio-

sphere Reserve is characterized by a mosaic of unique environmental and microenvironmental conditions. For centuries populations of Bighorn sheep (*Ovis canadensis mexicana*) and Pronghorn sheep (*Antilocapra americana*) have coexisted in the vast landscapes of its lava shield and its desert areas.

Pronghorn sheep (*Antilocapra americana*) is considered the only "antelope" of the new world, belongs to the order Artiodactyla and is the only living representative of the family Antilocapridae on the planet. Besides being the fastest land mammal in America and the second worldwide, it is an endemic



Sand Vegetation

species of North America.

In México, the pronghorn sheep is one species that is critically endangered according to the NOM-059-SEMARNAT-2010. Their populations have declined significantly, for reasons such as anthropogenic modification of their habitat and natural adverse conditions, such is the case of prolonged drought that reflect situations of stress due to lack of food during breeding season.

Mexico is the country which possesses the greatest wealth of cacti in the world, of the 1,500 existing species of cacti, 70% are in Mexican territory. About 84 per cent are endemic, as such is credited with origins of



Bobcat



fresh paw print



Desert Iguana

this group of cylindrical plants. The endemic species present in Mexico, at least twenty-one species are found only in the State of Sonora, it is considered therefore the most representative vegetation of the Sonoran desert.

Within the El Pinacate y Gran Desierto de Altar Biosphere Reserve, the vegetation is mainly composed of xerophytic shrubs, but rather restricted in some areas can be found vegetation similar to the chaparral, mesquite associated with the playas and arborescent shrubs (Búrquez and Castillo, 1993; see vegetation map). Ezcurra, *et al.* (1987) in his study of the vegetation of El Pinacate, he

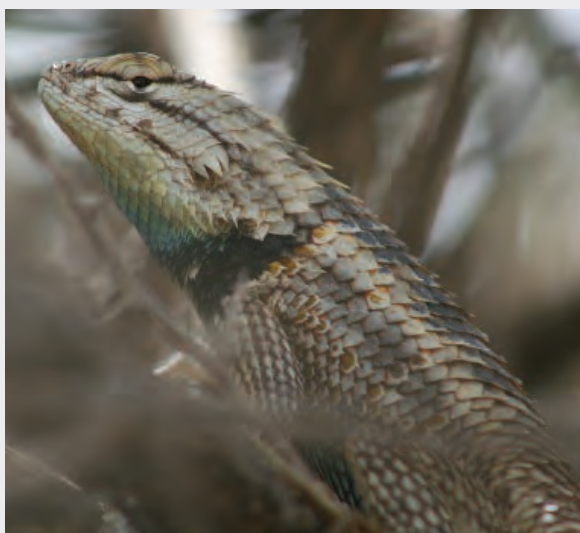
classified into nine general groups, whose main division is given by the presence or absence of ocotillo (*Fouquieria splendens*) as a result of substrate type (rocky or not), that also explains, in much of the variation in changes in diversity, presenting the rockier sites, nearly twice as many species less rocky sites. In this analysis, the authors classify the types of vegetation based on plant associations and their relationship to topography, soil and topography. Felger (1992) however, divides the area into ten regions: the region of Sonoyta, the highlands of El Pinacate, the lower parts of the Pinacate Maar craters, granite sierras, the Sierra de El Rosario, the dunes, the desert plains, coastal habitats and wetlands. Of these, the one with greatest wealth is Sonoyta region with 314 species. Granite Sierras come second sustaining a total of 173 species, some of which are not found in the volcanic shield. The Sierra de El Rosario, despite being a granite mountain, Felger (1992) considered as independent, because of its high degree of isolation, lack of exotic species reported and particular number of species (111 species).

El Pinacate y Gran Desierto de Altar support a flora of at least 309 species among

which stands out an endemic specie such as *Senecio pinacatensis*. The dunes have less wealth in terms of species, partly explained by the low diversity of habitats, however, this relatively poor (85 species) takes on real significance when considering the large proportion of short-lived (65%).

Regarding the importance of wildlife, the reserve is habitat and provides protection to endangered species like the Sonoran pronghorn, bighorn sheep, cougar, foxes, birds and reptiles. Several reptiles also have their home in El Pinacate y Gran Desierto de Altar, some endemic and several with some category of protection, such as the desert tortoise (*Gopherus agassizii*), the Gila monster (*Heloderma suspectum*), and the horns rattlesnake (*Crotalus cerastes*).

The protection that receive these species in El Pinacate y Gran Desierto de Altar is a measure to ensure its survival and that they may be known to future generations.



Spiny Lizard



Red Tailed Hawk



Granitic Sierra, Mc Dougal Crater, Sierra Pinacate

3.b Proposed Statement of Outstanding Universal Value

El Pinacate y Gran Desierto de Altar is natural. Here we combine the lava fields of North America and most active dunes in the Grand Desert of Altar, the driest region of the Sonoran Desert.

The field of lava, so vast and distinctive, is easily identified from space. The landscapes are unique in the world, and seem to be from another planet. The dune fields are a sea of yellow sand which contrast with the black color of the lava, creating landscapes of exceptional beauty. The beauty of these sites coincides with the fact that ecosystems are best preserved in the Sonoran Desert.

The volcanic activity began just 1.7 million years, one of the most recent developments in North America, and left an imprint that for years has attracted the interest of national and international scientific community. Frequent volcanic eruptions of El Pinacate were unique and complex: the volcano Santa Clara and Sierra Pinacate lava flows with aa and pahoehoe type, the more-than- 400 cinerita cones, impressive Maar craters and volcanic shield with all the variety of geological formations of their own home, are some of the most outstanding and unique features of the site. The Grand Desert of Al-



Vegetation Sunset

tar with its large fields of linear dunes forming Crescent and Star is another of the elements that characterize El Pinacate y Gran Desierto de Altar.

The site, despite its extreme weather conditions, has a rich flora, which, coupled with the presence of endemic species, some in the process of speciation and with some protection, make it a priority conservation site in Mexico. Similarly, all vertebrate groups are represented in the area, many of whom found refuge in El Pinacate when pressures elsewhere reduced and degraded habitat. Such is the case of the Sonoran



Rainbow over Choya Cactus

pronghor (*Antilocapra americana sonorensis*), the chameleon (*Phrynosoma mcalli*) and Pupfish (*Cyprinodon macularis*), native freshwater fish that is in danger of extinction, to name a few.

El Pinacate y Gran Desierto de Altar is an area of great biological importance in the Sonoran Desert, contributing to the maintenance of essential ecological processes and supporting vital ecosystems, as well as allowing continuity with other protected natural areas in the United States.

El Pinacate y Gran Desierto de Altar has enormous potential for development of re-

search in fields as diverse as archaeology, climatology, ecology, mastozoology, ornithology and geology, among others. It also has great potential for the development of ecotourism and other productive activities that can bring economic benefit to local populations.

El Pinacate y Gran Desierto of Altar holds an exceptional testimony of the presence of O’odham and their ancestors. They left traces and important cultural values such as trails, pottery, stone tools, petroglyphs, and sleeping circle, geoglyphs, among others. In addition to this archaeological treasure, El Pinacate y Gran Desierto de Altar is a site considered sacred to the O’odham, as this is the place where they were created by I’itoi, the “big brother”.

El Pinacate y Gran Desierto de Altar is a natural laboratory for the development of scientific research, which also combines beautiful scenery, natural and cultural values.



Pinacate Beetle



Ocotillo and volcanic landscape

3.c Comparative analysis (including state of conservation of similar properties)

The nomination is based on the El Pinacate volcanic shield, the field of desert dunes of the Great Altar Desert and biodiversity are of outstanding universal value, and the arguments to justify the OUV are:

- 1 Shield volcanoes with giant craters result of phreatomagmatic activity accompanied by lava flows, cinder cones of different shape, size and complexity.
- 2 Extensive dune fields with different geomorphic shapes: linear, cross and star.
- 3 Subtropical desert ecosystems with high biodiversity.

Were analyzed over 1500 places in the world looking for those that share some characteristics with El Pinacate y Gran Desierto de Altar in this analysis found that there really outstanding sites with elements either by their volcanic formations, extensive sand dunes and deserts or the scenic beauty of the confluence of some of these characteristics and in some cases the biological richness that host these majestic natural sites, among them the follow-

Volcanic Features

Auckland Volcanic Field, New Zealand: consists of cones and other geological features of volcanic origin in urban and rural areas of South Auckland

West eifel Volcanic field, Germany: Is dominated by a group of 240 cinder cones, craters and small stratovolcanoes Maar which cover an area of about 600 km.

Eleganteduringspring



Deserts Features

Tassili n'Ajjer , Algeria: Hyper Arid desert With Scenic and geological interest; prehistoric cave art; floristic and faunal island of Sahelian life

Air and tenere, Niger: a Volcanic massif surrounded by dunes canyons and plateaus with 40 mammals, 165 birds , 18 reptiles.

Las parinas, Argentina: A Volcanic morphology; rainfall <200mm; wetlands; long cultural history

Great Desert Landscapes, Egypt: is one of the largest unbroken mass of sand dune areas of the world, and home to not one living soul

Lut Desert, Iran: Longest system of yardangs; tallest sand pyramid; hottest point; biggest nebkas in the world

Wadi Rum, Jordan: Sand Dunes and Acacia-rocky Sudanian vegetation; mountains, wadis, sand dunes, springs

Great Gobi Desert, Mongolia: Southern Altai and Dzungarian Gobi; 410 plants, 49 mammals, 15 reptiles and amphibians and >150 bird species

Souther Namib Erg, Namib: Southern Namib Sand Sea in Western Namibia, from Sesriem to Saddle Hill along the coast to Sandwich Harbour, inland to the Kuiseb River Canyon

Wadi Howar National Park, Sudan: Volcanic and crater landscape of Meidob Hills, Jebel Rahib complex; palaeo lakes and large active barchan dune fields



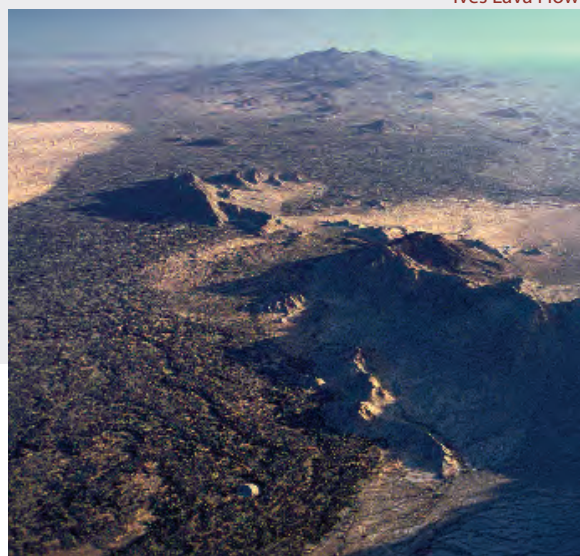
Del Rosario Mountain

Cerro Colorado Crater



SandDunes

Ives Lava Flow



Tassili n'Ajjer , Algery

The Tassili N'Ajjer is one of the more famous landscapes of Algeria, being a vast plateau, to the north of the Hoggar Mountains. Few areas of Algeria has wilder landscape than Tassili N'Ajjer, characterized by deep chasms and dramatic cliffs located in a strange lunar landscape of great geological interest, this site has one of the most important groupings of prehistoric cave art in the world. More than 15,000 drawings and engravings record the climatic changes, the animal migrations and the evolution of human life on the edge of the Sahara from 6000 BC to the first centuries of the present era. The geological formations are of outstanding scenic interest, with eroded sandstones forming 'forests of rock'.



Air and tenere, Niger

This is the largest protected area in Africa, covering some 7.7 million ha, though the area considered a protected sanctuary constitutes only one-sixth of the total area. It includes the volcanic rock mass of the Aïr, a small Sahelian pocket, isolated as regards its climate and flora and fauna, and situated in the Saharan desert of Ténéré. The reserves boast an outstanding variety of landscapes, plant species and wild animals. (Unesco , WHC)





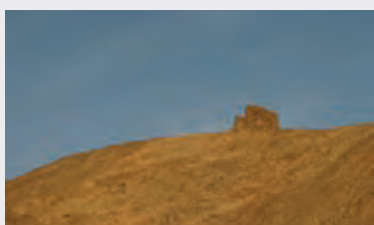
Great Desert Landscapes, Egypt

Inscribed on the tentative list as World Heritage since 2003 under the criteria vii, viii and ix proposes 3 regions among which the region of The Great Sand Sea is one of the largest uninterrupted sand mass in the world where parallel dune ridges run north to south hundreds of miles away, where there is no single point of water.



Wadi Rum Sudanian, Jordan

The Wadi Rum area of southern Jordan has many similarities to Petra and has a spectacular series of sandstone mountains and valleys with remarkable natural arches, the world's most spectacular networks of honeycomb weathering features, and very large landslide features caused by undercutting of slopes by groundwater sapping and salt weathering. This site is currently noted on the Tentative List in relation to both natural and cultural values. The site was inscribed in 2010 as it mixed



Wadi Howar National Park, Sudan

This is a major former tributary of the Nile, and is one of the best examples of a river system that has ceased to flow through its length because of climate change. It has been the subject of important palaeoclimatic research.

Auckland Volcanic Field, New Zealand

Site located on the tentative list for World Heritage inscription from 2007 The proposed site consists of cones and other geological features of volcanic origin in urban and rural areas of South Auckland site is proposed under criteria ii , iv, v, vi and viii as a mixed site (cultural and natural) the Isthmus of Auckland and the region have witnessed a series of basaltic volcanic eruptions in the last 250 000 years resulting in a field that encompasses approximately 100 km², of which about 50 centers eruption scoria cones and maar craters and 8000 acres of lava fields. All the eruptions were of short duration, each volcano was the product of a single eruptive episode. The last eruption of Rangitoto occurred about 600 years. The volcanic cones dominate the views of the wider landscape of Auckland.



West Eifel Volcanic field, Germany

Is dominated by a group of 240 cinder cones, craters and small Maar stratovolcanoes which cover an area of about 600 km², about half of the devices here are volcanic cinder cones are generated which flows washed and approximately 30% are volcanic lakes (Maar) or tuff rings.

The following table lists the sites that share characteristics with landforms of El Pinacate y Gran Desierto de Altar:

	Volcanic Features			Desert Features			
	Volcanic Field	Maar Craters	Lava Flows	Linear Dunes	Star Dunes	Dome Dunes	Desert Ecosystem
El Pinacate y Gran Desierto de Altar, Mexico	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Auckland Volcanic Field, New Zeland	Yes	Yes	Yes	No	No	No	No
West Eifel Volcanic Field, Germany	Yes	Yes	Yes	No	No	No	No
The Great Desert Landscapes, Egypt	No	No	No	Yes	Yes	Yes	Yes
Air and Tenere, Niger	Yes	No	No	Yes	Yes	Yes	Yes
Great Sandy Desert, Australia	No	No	No	Yes	No	Yes	Yes
Mega Basalt Field, Ethiopie	Yes	Yes	Yes	No	No	No	No
Valle de Santiago Volcanic Field Mexico	Yes	Yes	Yes	No	No	No	No

As seen on the description of the nominal criteria it becomes even more evident in the justification of outstanding universal value, El Pinacate y Gran Desierto de Altar Biosphere Reserve as a site which represents a exceptional place that need to be preserve of world heritage.



Star shaped Dunes

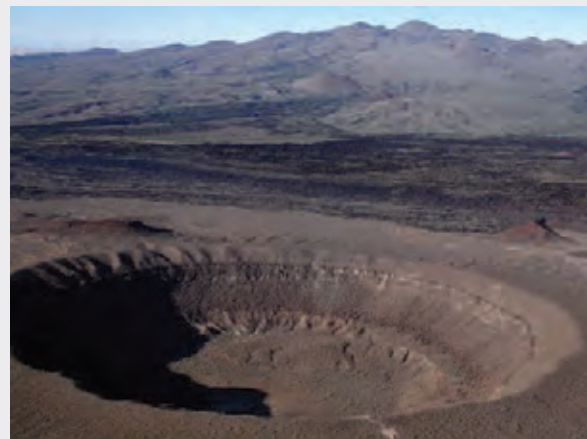
Each of the sites feature comparison is really outstanding creditor, either by their volcanic formations,extensivedunefieldsanddeserts, the scenic beauty of the confluence of some ofthesecharacteristicsandinsomecases,the biological richness that host these majestic natural sites.

However, after carefully analyzing each of the similar properties, it is noteworthy that none of them share all the criteria considered in the comparison: an outstanding volcanic unit with particular morphological features, covered by the dune fields of the Great Altar Desert, belonging to the Sonoran Desert, which is habitat of great diversity of species of flora and fauna.

Another aspect to consider in this regard is the presence of interesting features in small areas. The Biosphere Reserve, El Pinacate y Gran Desierto de Altar, in just a little more

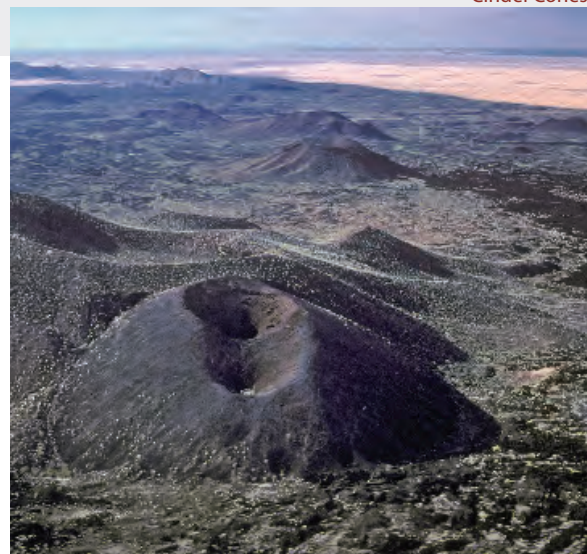
than 700,000 hectares. It houses an outstanding biological diversity factor, in addition to the presence of four dune landforms, a characteristic that is represented only in the extensive dune fields of the Great Sahara Desert and the dune fields of the Middle East with territorial extensions considerably beyond the boundaries of the reserv.

Most deserts comparable to the proposed site are found mainly in Africa and Asia, being El Pinacate y Gran Desierto de Altar the site that best represents its kind in America. What's left to conclude is the understanding that the incursion of nominated property "El Pinacate y Gran Desierto de Altar Biosphere Reserve" is essential to ensure the preservation of a "set of features" creditors of exceptional value as natural heritage of humanity.



Elegante Crater

Cinder Cones





Tarantula

3.d Integrity

The Sonoran Desert is considered a region of biological uniqueness and whose physical features (climate, topography, soils and hydrography) determine its distribution (Shreve and Wiggins, 1964). This desert covers much of the state of Sonora, which owes its name, as well as part of the States of Baja California and Baja California Sur Mexico, Arizona and California in the United States of North America.

At the regional level, a history of conservation are represented by a good number of studies, proposals and suggestions over the past three decades have been made

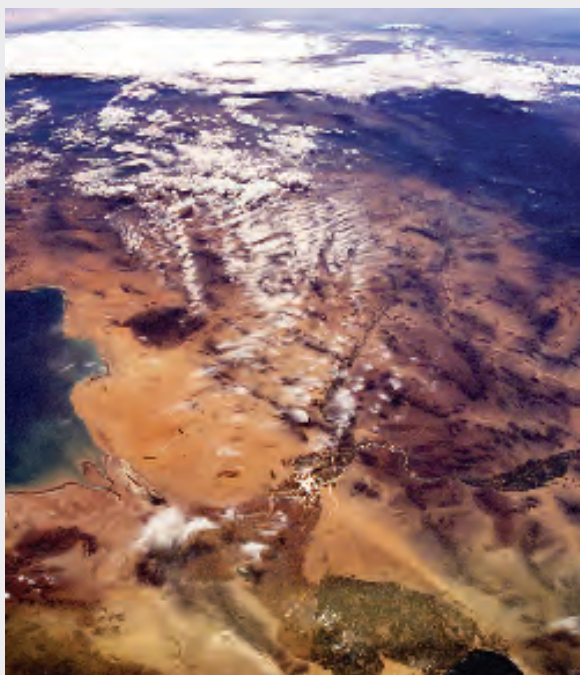
by various institutions of research, federal and state agencies, schools, conservation groups and civilian associations, among others. Efforts for the protection and conservation of the El Pinacate y Gran Desierto de Altar Biosphere Reserve, are very recent and coincide with the increase of the population in the area, there is even the registration of the first attempt at protection, which was the establishment of a protective zone forest and fauna during the year of 1979.

For the beauty of its geological formations, the incredible biological richness and scenic, and as a valuable witness to human oc-

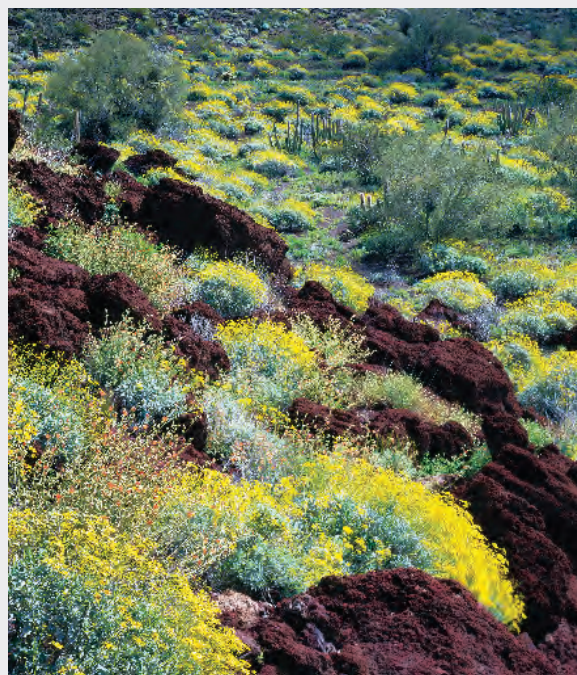
cupation for over 20,000 years, as being the sacred site and center of the universe in the O'odham cosmogony, because of its fragile nature in terms of patterns and as an archaeological site with a great historical and cultural value, the Mexican government at the request of many environmental groups, scientists and people in general, decreed the El Pinacate y Gran Desierto de Altar Biosphere Reserve, on June 10, 1993, under a presidential decree which is currently administered by the National Commission of Natural Protected Areas (CONANP), decentralized body belonging to the Ministry of Environment and Natural Resources

(SEMARNAT), in other words, the Federal Government protects legally this portion of the Sonoran desert, better known as Desierto de Altar, also the State Government and local governments of the municipalities neighboring the reserve which have supported the establishment and formalization of the it.

Pinacate is part of the network Reserve Programme Man and the Biosphere (MAB) of UNESCO, since 1993, expanded to include the reserve of the biosphere Upper Gulf of California and Colorado River Delta and constitute the Upper Gulf of California biosphere reserve as well.



Satelite Image of the Gran Desierto de Altar



Encelias Farinosa on Lava Flow



Teddy Bear Choya

It is one of the elements of the network of reserves also named Sisters Park of the Sonoran Desert covering an extensive and well preserved border between Sonora (Mexico) and Arizona (United States). It is also part of the Binational Project of Ecoregional planning of The Nature Conservancy, and unique desert represented in the portfolio of the Parks in Danger of such organization program.

El Pinacate y Gran Desierto de Altar Biosphere Reserve is one of the largest reserves of Mexico, along with others in the United States protects a large portion of the



White Vegetation

Sonoran Desert and the boundaries which delimit the area, are well defined: The West and Southwest of the Reserve is a protected area, the Upper Gulf of California Biosphere Reserve and Colorado River Delta. Along the international border Mexico-United States, are the northeast portion of the reserve of El Pinacate, is the Organ Pipe Cactus National Monument, administered by the National Park Service of the Department of Interior of the United States; North of El Pinacate is Cabeza Prieta National Wildlife Refuge, which is administered by the Fish and Wildlife Service Department of the Interior of the Unit-



Lonely Saguaro

ed States; the Northern part of this retreat, as well as part of the northern boundary of the reserve of El Pinacate, neighboring the field military of training of the Department of Defense of the U.S. called the Barry M. Goldwater Bombing Range. Together, these reserves cover a surface of the 2,400,000 hectares, a large protected area.

On the other hand, both traditional ethnic authorities Tohono O’odham in Mexico and the authorities of the Tohono O’odham nation in the United States are committed to protect and preserve the area, because here are sacred sites which their ancestors used to live. O’odham community members,

both on the American and Mexican side, are part of the Advisory Council of the Reserve, sharing mechanism to support the management of the protected area.

El Pinacate y Gran Desierto de Altar Biosphere Reserve is and area large enough to ensure the integrity of natural processes that occur there and all of its components. And as already quoted above, the position with five reserves, ensuring their preservation and integrity in the long term due to the cooperation between neighboring reserves, which is a point to emphasize, the similarity of the environments, the problems, as well as the species of flora and fauna, have made

conservation interests of each of the activities converge and go beyond its boundaries and international borders consolidating a vast network of regional conservation.

Given the topographic and climatic characteristics of the reserve, occupation and exploitation by humans has been low or very low scale, which has allowed that much of the area still retains the original features. Only small areas have been altered significantly, productive activities that have been developed by the inhabitants and users of the area and largely contributed to its deterioration are: livestock, agriculture and the extraction of mineral resources. Besides these, the extraction of species of both flora and fauna, the introduction of non-native species, illegal hunting, looting of archaeological sites, and the indiscriminate opening of roads, constitute the main threats in the area.

El Pinacate y Gran Desierto de Altar meets all the conditions of integrity as it contains all the essential areas for the maintenance of its beauty, from the entire shield volcano, the spectacular lava fields, the ten giant craters and more than 400 ash cones, and much of the desert dunes of North



Aa Lava Flow

America's largest active dunes. In the other hand, sand granite mountains are fed by sand, through erosion caused by wind, the dunes of the Gran Desierto, this is an important geological process that, although imperceptible, continues to evolve. El Pinacate y Gran Desierto de Altar is composed of two subdivisions of the Sonoran Desert: the Plateau of Arizona and the Lower Colorado River Valley. Here is a diverse range of xeric ecosystems that contrast dramatically with topography, which ranges from sandy plains to rocky mountains, and contains the necessary elements to ensure their conservation in the long term, as well as its biodi-



Choya Garden

iversity. El Pinacate y Gran Desierto de Altar is also home to several endemic species, migratory and / or endangered. Because of its relative isolation in some species there is a differentiation process. It also covers the extension and the corridor with other protected areas in Mexico and the United States, and is an essential habitat for the survival of several populations of wildlife, including the Sonoran pronghorn.

Extreme weather conditions and inaccessibility in some parts of the territory have been the best way to ensure the conservation of the property. Extreme heat, isolation and lack of fresh water in many cases

have prevented the exploitation of resources. One activity that might have adverse consequences for the conservation of the area is tourism, especially in the adjacent area to the reserve. In the past decade was tourism boom in the area, with the development of tourist infrastructure in the municipality of Puerto Peñasco, located about 50 km from the reserve. As a result, this has brought greater numbers of visitors to the nominated area, but without being a significant problem to maintain the integrity of the site yet. However it is known that tourism will be an increasingly important activity in the area, and will have to analyze this situation, so that it fits the infrastructure for such activity in relation to the characteristics of the environment and in addition to the analysis of the profile of the visitor in the reserve, thereby ensuring the integrity of the site conditions.

According to the Management Program of the reserve, the whole area is considered a banned area, therefore all use and extraction the fauna in the reserve is illegal. The staff working in the reserve, running awareness-raising programmes aimed at persons living within and in the surrounding areas



Horned Lizard

to the same, aimed at understanding of the importance, in relation to the conservation of wildlife for future generations, and focusing especially on the species found under some category of special protection. All this coupled with monitoring programs. Without a doubt, the development of the neighboring municipalities to the reserve is increase and this coupled with the tourist boom. Fortunately with the Decree of this protected area, activities are somehow restricted to avoid the impact of the tourist developments and urbanization along the external limits of de area. This gives us the confidence that the integrity, both the land-



Ocotillo Sunset



04 State of conservation & factors affecting the property





Bighorned Sheep

4.a Present state of conservation

In general, El Pinacate y Gran Desierto de Altar is relatively preserved in his abiotic factors, physical as well as the abundance of native species, biological communities and ecological processes that are relatively intact. There are some factor that theterming thy over that helb estatus of the erea, such as vegetation structure, topography, viable plant populations, viable populations of pollinators and dispersers, and connectivity. In El Pinacate y Gran Desierto de Altar these factors are in good condition. Furthermore, as mentioned above, given the topography and climate of the region, El Pinacate has a

very low human occupation that for centuries has enabled the area to not be over-exploited and still retain the original characteristics of the different ecosystems in the region. However, as in most protected areas in Mexico, people depend on natural resources for subsistence, resulting in several threats to this fragile ecosystem.

In such a way that the state of conservation of the site is very good and the nominate area is in perfect functional condition, its a doleishion a established roads and hardly accessed with a extrim claimed. Economic activities within the reserve have not com-



Birds Nest

promised their natural values, because of the restrictions that have for the operation of economic activities on a large scale outcome of conservation policies set forth in the Management Plant of the reserve, coupled with extreme environmental conditions.

In the past decades there were serious attempts to develop irrigated agriculture in areas of rough plains, but the effort was unsuccessful, due to the extreme desert conditions and high temperatures present; abandoning the project and remaining only small isolated patches in the North-

east of the reserve, which do not represent a threat to the functionality of the ecological processes. Regarding livestock (mainly cattle), it is known that in certain limited places of the reserve this activity is present, although at low level and temporarily, due to high temperatures that occur during the summer, which decimated the herds and the owners were forced to withdraw from their grazing during the long season of drought and food shortages.

The biodiversity of the area has been grouped into several objects of conservation to have better planning in conservation efforts. These objects are:

System of dunes

Xerophilous system

Sonoran pronghorn

Ephemeral aquatic systems (Tinajas)

Riparian ecosystem

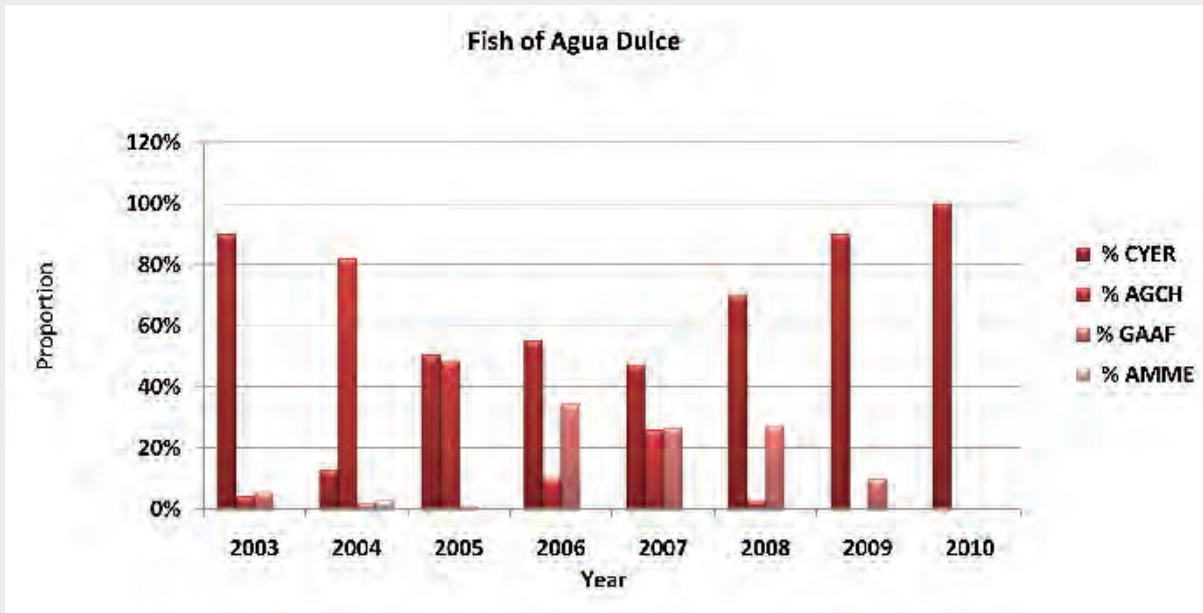
of the Sonoyta River

Mountain ranges and valleys

Guild of native bats and fish

These last four objects of conservation are distributed among the core areas.

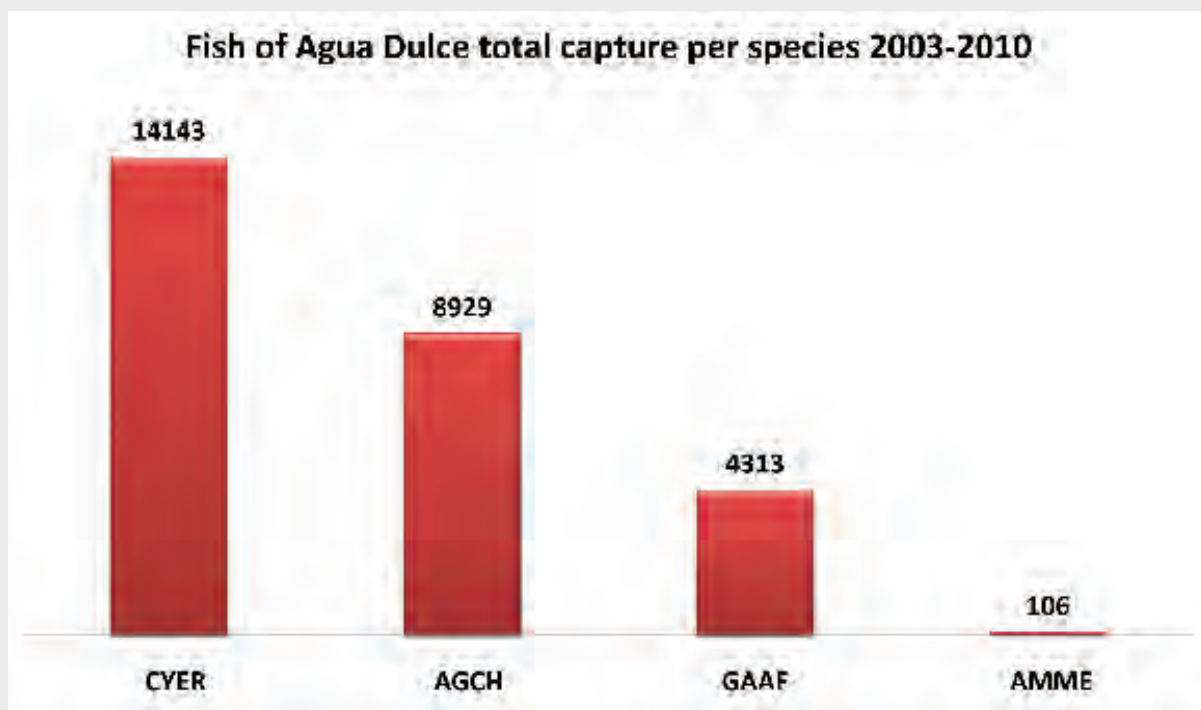
Some places have undergone changes that are not obvious to non-knowledgeable, which is the presence of exotic species.



Graph shows relative abundance of fish in Agua Dulce range, four species exist in the area, two of them are native and two more are exotic, also we can see the relation that native fish: CYER, (*Cyprinodon eremus*) AGCH, (*Agosia chrysogaster*) have in regard to exotic species GAAF, (*Gambusia affinis*), AMME, (*Ameiurus melas*).

Fish Species: CYER, (*Cyprinodon eremus*) AGCH, (*Agosia chrysogaster*), GAAF, (*Gambusia affinis*), AMME, (*Ameiurus melas*). Source: Internal Monitoring program, database of RBPGDA.

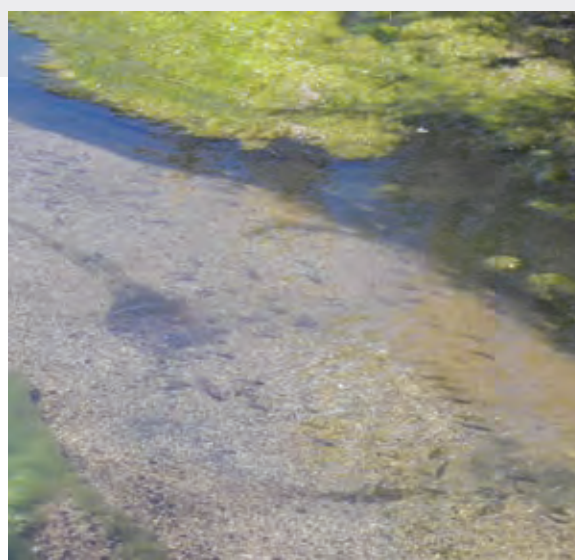
Despite seeing the seemingly intact area, some changes have occurred in the landscape of El Pinacate, and all of this is due to the introduction of exotic species in the area. There is no accurate record of when and how were these species introduced into the area, however, today they are fully adapted to the extreme conditions of the habitat. The case in particular focuses of three species of plants: *Tamarix ramosissima*, *Pennisetum ciliare* and the Sahara mustard (*Brassica tourneforti*) and two species of fish *Gambusia affinis* and catfish (*Ameiurus melas*) which are relevant today.



Total number of captures using minnow traps. We can see very low number of the exotic species individual caught specially compared to native species *Cyprinodon eremus* and *Agosia chrysogaster*.



Agua Dulce stream





Swamp Root

Compared to the rest of invasive species, they are only known to affect very specific areas in the reserve; such is the case of the *Tamarix ramosissima* and Buffel grass (*Pennisetum ciliare*). In the case of the first kind, it occupies only certain areas of the Sonoyta River, forming part of cover for different species of birds in the workplace, while the second species has invaded nearby the road no.2 to the North of the reserve and some portions of internal rough dirt track.

The Sahara mustard (*Brassica tournefortii*) is the only species of exotic plant with large capacity of invasion and displacement in comparison with other plants in the region. This plant is native to the Old World and is a threat to the biodiversity of the area. It was

collected for the first time in 1930, in the United States and currently it has invaded large areas of the desert plain. The Sahara mustard, has biological characteristics that make a plant very adaptable, such as accelerated growth, the ability to absorb moisture, high production of tiny seeds and above all, this plant is not food for wildlife, which helps keep their populations increase, without greater limits than those weather conditions. During the winter season, you can significantly displace native plants, notably the short-lived species, which form the major part of the diversity of plants in the reserve.

With regard to infrastructure within the reserve, this is fairly sparse, with very few human settlements and small waterworks, which has not meant which as were not sources of degradation of the ecological processes. The area has a Biological Station that occupies no more than one hectare (including offices and residential area). In addition to the new building visitor centre's in the southern part of the reserve. The main accesses have controlled systems and most of existem roads have been close to avoide free acces to diferents areas are de nominat-

ed property. The expansion and construction of new roads has not been a source of serious disturbances to the functionality of corridors and conservation of landscape values. Such is the case of the expansion of road no. 2, which has formed part of the landscape for more than four decades and that so far is delimiting the perimeter North of the area. Same thing happened with the highway number 8, which defines the southern perimeter, as well as new coastal road that bears the name Puerto Peñasco-Golfo de Santa Clara towards the west, where it have been strong protection measures following the guidelines provided by the Management Program, and regulation of SEMARNAT, for that matter.

The extraction of volcanic ash or morusa, in the reserve has been historically decommissioned in the north from low to medium scale, developed by the owners of the land. The extraction of these materials with the same soil characteristics was used for the construction and adornment of gardens. This led to small and localized point of impact, functionally speaking, are insignificant, although it is worth mentioning that



Coyote Trails

these impacts are still visible. This activity was abandoned shortly after the decree which gave rise to the Reserve.

Scientific activity in the area has developed with minimum of involvement over the years, despite being quite attractive to scientists, therefore, the area has a rich history involving many characters, as well as national agencies and foreign who focus their knowledge and efforts to learn more about the area and its components while preserving it. As mentioned in the above criteria, the area had interest for the Space Agency of the United States (NASA) in the decade of the 60's where the crater El Verdugo was used for testing vehicles and equipment prior to the arrival on the moon. The Man-



Saguaro



NASA astronauts during research

agement Program, allows this activity while detailed regulations exist for certain activities, noting that it is not destructive to the biotic and abiotic environment, there are also guidelines applied by the SEMARNAT through the issuance of temporary permits. The reserve has an internal monitoring programme of some species that are considered to be priority, i.e. have some category of protection by law, such is the case of the Sonoran pronghorn (*Antilocapra americana sonorensis*). This species has been monitored over 10 years by a working group consisting of several American and Mexican, institutions including the reserve personnel.

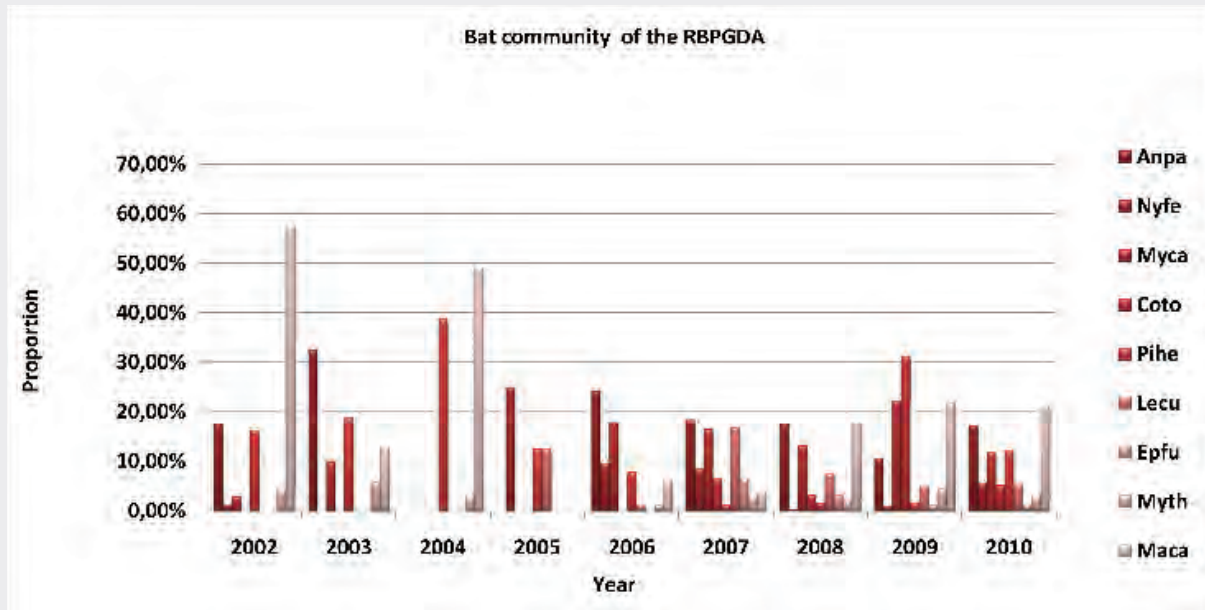
The following table shows some data in relation to the Sonoran Pronghorn sheep monitoring:

Pinacate	Individuals seen	Groups	Average individuals per group	Estimated population
2009	53	15	3.5	101 (57 – 321)
2007	35	6	5.8	50 (36 – 162)
2006	53	9	5.9	67 (54 – 195)
2004	30	11	2.7	59 (32 – 171)
2002	19	4	4.7	25 (21 – 33)
2000	17	5	3.4	34 (27 – 48)
1993	51	21	2.4	124 (91 – 211)



Pronghorns

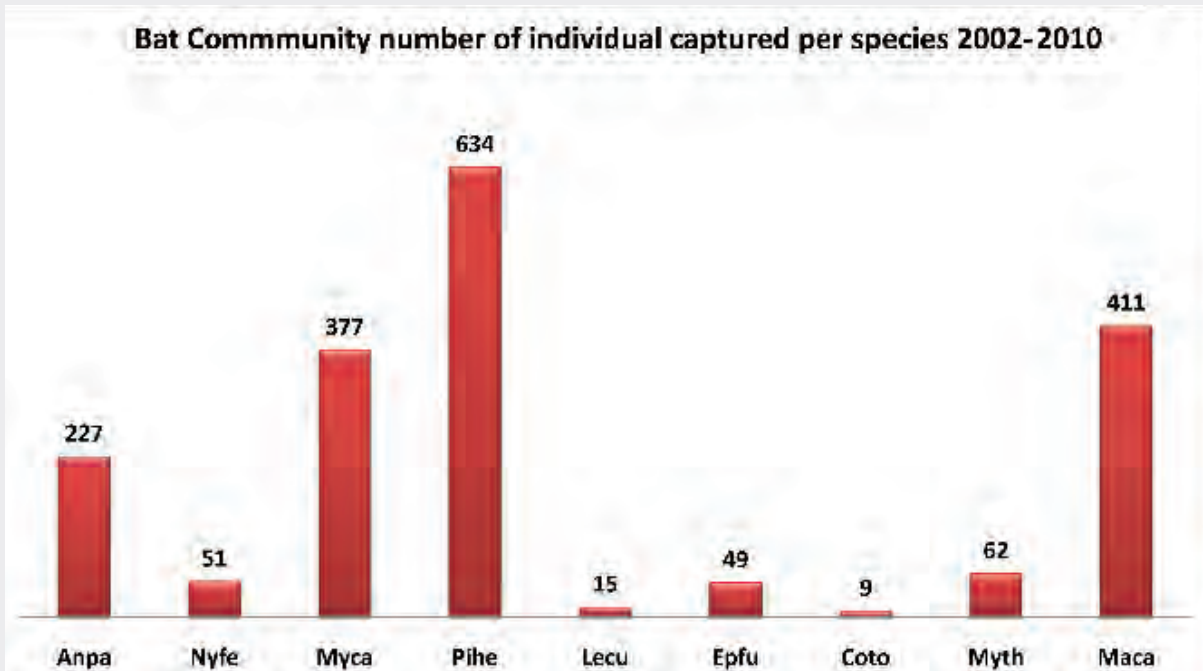
The Monitoring Program also includes groups of species subject to study, for example bats, which are of high importance in this region, there were establish the study of trends in population of the diferent species that distribuity in de reserve and in otrer reserv in de region, these organisms, as well as reserves nearby, because these animals function as good indicators of functional ecosystem status.



Bat mist netting captures shows abundance of nine species in the reserve eight of them are residents in the area all year round, only one species is migratory. Three species Maca, Pihe and Myca are the most abundant species through the years.

Bat Species: Anpa (*Antrozous palidus*), Nyfe (*Nyctinomops femorusaccus*), Myca (*Myotis californicus*), Coto (*Corynorhinus townsendii*), Pihe (*Pipistrelus hesperus*), Lecu (*Leptonycteris curasoae*), Epfu (*Eptesicus fuscus*), Myth (*Myotis thysanodes*), Maca (*Macrotus californicus*). Source: Internal Monitoring program, database of RBPGDA.





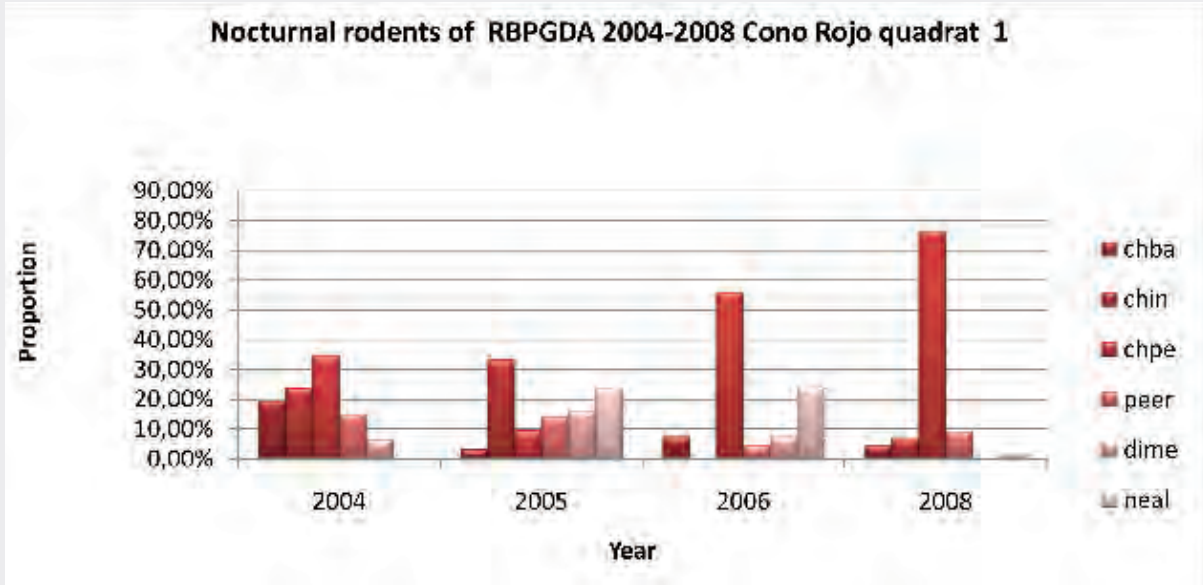
Graph shows bat mist netting total individual captures per species . Pihe (*Pipistrelus hesperus*) has been clearly the most abundant in the last 10 years in the reserve while Coto (*Corynorhinus townsendii*) is a very rare species .

Bat Species: Anpa (*Antrozous palidus*), Nyfe (*Nyctinomops femorusaccus*), Myca (*Myotis californicus*), Coto (*Corynorhinus townsendii*), Pihe (*Pipistrelus hesperus*), Lecu (*Leptonycteris curasoae*), Epfu (*Eptesicus fuscus*), Myth (*Myotis thysanodes*), Maca (*Macrotus californicus*). Source: Internal Monitoring program, database of RBPGDA.



Bat Monitoring





By analyzing the size, condition, and landscape context of each of the above mentioned objects, it was determined that the overall rating of the health of the biodiversity of the site is good.

The reserve Management Program lays down different actions for the short, medium and long term trying to mitigate the effect of the threats, these actions include: enhanced surveillance, education, construction and maintenance of artificial reservoirs of native fish that guarantee the permanence of endemic species, alternative productive to locals and permanent programs of eradication of exotic species by hand, among others.

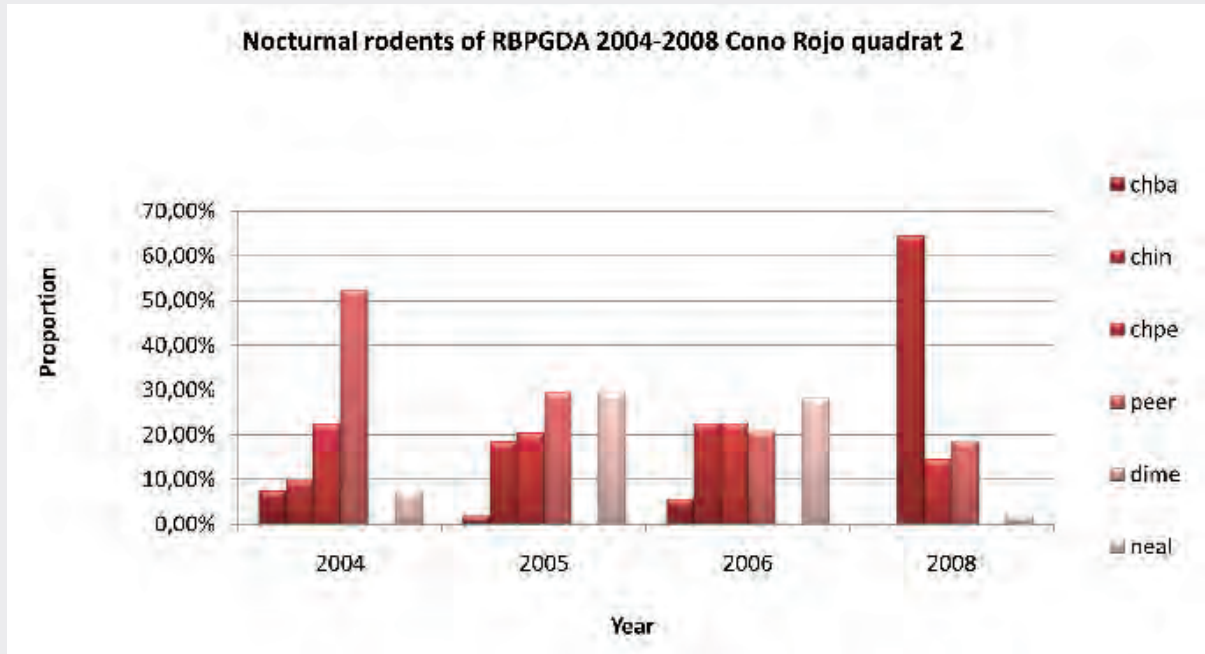
Rodent Species: Chba (*Chaetodipus baileyi*) Chin (*Chaetodipus intermedius*) Chpe (*Chaetodipus penicillatus*) Peer (*Peromyscus eremicus*) Dime (*Dipodomys merriami*) Neal (*Neotoma albigula*).



Rodent Monitoring



According to the graphs, we have caught six nocturnal rodent species in Cono Rojo area, all of them are native species and we can see a consistent relative abundance in chaetodipus genus. Cono Rojo area represents a typical and rich habitat for rodent in the reserve, cinder and lava flows give



Rodent Species: Chba (*Chaetodipus baileyi*) Chin (*Chaetodipus intermedius*) Chpe (*Chaetodipus penicillatus*) Peer (*Peromyscus eremicus*) Dime (*Dipodomys merriami*) Neal (*Neotoma albigula*).





Sandy Beach Resorts

4.b Factors affecting the property

(i) Development Pressures

One of the pressures currently identified is the rapid development of Puerto Peñasco, a growing tourist town located on the boundaries of the Reserve. Many hotels and condominiums are being built and although currently none are sufficiently close to the protected area, it is worth mentioning that if Puerto Peñasco continues to grow at its current pace, in a few years El Pinacate could be surrounded by buildings on its south and southwest sides. New development is causing an increased use of water, thereby reducing the water table, which in a desert area causes the serious problem of deserti-

fication.

Currently, two roads cross the area of El Pinacate y Gran Desierto de Altar. This has resulted in a concentration of litter along with the loss of connectivity (although the roads are narrow) and impact on the fauna. The increase in the number of tourists in Puerto Peñasco may aggravate this situation. In addition, a new road to the southwest of El Pinacate from Puerto Peñasco to the Gulf of Santa Clara is being built, which will undoubtedly increase pressure on the area and represents one of the biggest threats to the future of this region.



Tamarisk or Salt Cedar

(ii) Environmental pressures

(e.g., pollution, climate change, desertification)

Undoubtedly one of the pressures over El Pinacate y Gran Desierto de Altar Biosphere Reserve is the high temperature occurring during the summer and prolonged droughts, which may cause loss of vegetation cover and possibly increase desertification. These are natural processes that have happened previously in the history of El Pinacate, but the effects of climate change are felt in the area, since these phenomena have increased and there are now hotter seasons and longer droughts.

Poaching is low or almost zero within the reserve; however, in the adjacent areas

that are not under any category of protection, some species as Pronghorn sheep and Bighorn sheep, are illegally hunted outside the norm. This activity also damage others species populations. In addition, creating new paths, there is pollution and the risk of introduction of exotic species and disruption of other populations of wild flora and fauna.

Extraction and illegal loggings for fuelwood production is another problem that arises in the area. This activity is mainly performed by locals peoples who appreciate these timbers for its hardness and for handcrafts.

This causes the decrease of important and protected species such as the ironwood (*Oleña tesota*) and mesquite (*Prosopis spp.*). Another threat is the huge impact in the introduction of exotic species, mainly plants. The introduction of salted pine (*Tamarix ramosissima*) in the few riparian habitats that exist in the area, not only within the Reserve, have affected these fragile ecosystems. Unfortunately, the problem of alien species is not unique to El Pinacate; much of the Sonoran Desert is affected by this problem. Two, non-native species of fish are particularly threatening endemic species. Introduced species like cats, dogs, wild donkeys, goats and cows, and these last three have major impact because they compete for food with other native species. Contamination within the site is mainly along the two roads that cross it. Drivers that pass often toss waste through the windows and this garbage is on the banks of the roads. Although there has been no study that demonstrates such, organic waste could be consumed by animals and transmit diseases.





(iii) Natural disasters and risk preparedness

The territory of the El Pinacate y Gran Desierto de Altar Biosphere Reserve is exposed to the disasters determined by climatic conditions, such as droughts, as the current season, in which in the past twelve months of September 2010 through August 2011 has been registered a rainfall 13 mm at the Biological Station. In the Biosphere Reserve there are very few chances of fire because of small cover of scattered vegetation that presents the wilderness.

About seismic activity is low frequently even is also an area with little seismic activity, the latest earthquake registered in April 2010 had have an intensity of 5 degrees

R with its epicenter at a distance of 250 km in Cerro Prieto, Baja California, without any local consequences. By de year 2010 with modern seismograph with cutting edge technology that has been installed in the visitors center in the reserve, considered as a strategic site for the monitoring in real time as part of the seismic network of North Mexico.

No volcanic activity was reported in at least 3000 years, however, according to different researchers the volcanic activity could re-start at any time.



(iv) Visitor/Tourism pressures

Due to the great diversity of values present at El Pinacate y Gran Desierto de Altar Biosphere Reserve this has now become one of the sites of interest to tourists and students, not only for geological values you can observe during the ecotours that takes place in the area, but also the by attractive biological, cultural and historical landscape present in the reserve.

El Pinacate y Gran Desierto de Altar is adjacent to the federal highway to Puerto Peñasco and to the border, causing that thousands tourists go to spend their weekends in the Mexican coast, in de Golf of California.

The geology in this region and the Desert environment are a major attraction however is not an accessible area. To visit the main

attractions (Crater Elegante, Crater Cerro Colorado and Cerro Tecolote) requires a minimum of three hours, which also causes the reception of small number of visitors. Tourists and students who visit the reserve are, in general, people committed to the conservation of nature and a great desire to know the place despite the inhospitable weather and on paved roads.

The impacts that the tourists access to the area may cause are determined by their number and behavior . The number of visitors has increased every year due to greater diffusion of the place as well as the growth of Puerto Peñasco as a tourist destination. Some do not recognize the fragility of the ecosystem and often cause damage to it.

Among the most obvious impacts may include natural landscape modification caused when tourists pass off the roads, leaving foot prints on the desert floor, moving rocks and / or volcanic ash to wread names and figures; establishing camps outside the places designated, erosion and soil compaction, removal of plants and rocks, collecting wood for fires and litter. It exist an official entry and an Information Center where visitors are registered and explained the importance of the area and the activities allowed, restricted, and prohibited,

delivered brochures and maps, register and sign that the person knows the rules and take responsibility for and also comply with the security mesures. The roads are clearly signed and there are stops to interpret and explain various topics of interest.

The increased number of visitors in the internal vehicular circuit was the element considered in order to build a Visitors Center in a specific place, more accessible and safe.



School bus arriving at the visitor center



Children at the visitor center

The following table shows some data in relation to the Sonoran Pronghorn sheep monitoring:

Year	No. of total visitors	Internal Circuit	Visitor Center
1997	3,177	3177	
2000	5,628	5628	
2003	6,495	6495	
2006	8,214	8214	
2008	9,037	9037	
2009	12,283	7533	4750
2010	17,504	7897	9607

By the year 2010 the average vehicle in the internal circuit was 5 vehicles per day in a distance of 69 km of roads, with 20 people, while in the Visitor Center the average per day is 9 vehicles with 27 people. As seen, these numbers are still very manageable and low impact effects.



(v) Number of inhabitants within the property and the buffer zone

Information from the National Institute of Statistics and Geography (INEGI), indicated according to the 1990 population census, around 200 people living permanently in the biosphere reserve, 30 of them within the nominated area. Currently in the year 2011, the number of inhabitants decreased and not exceed the 60 people, most of which are settled in the small businesses out of federal highways No. 2 and 8.

Estimated population located within:

Area of nominated property:	There are no human settlements, there are no persons residing permanently.
Buffer Zone:	55 people including staff from the headquarters and from the Visitor Center of the reserve and people who care for seven small cafes which operate at the side of federal highway 2, to the North and out of the nominated area.
Total:	55 people in buffer zone 0 in the nominated area
Year:	2011



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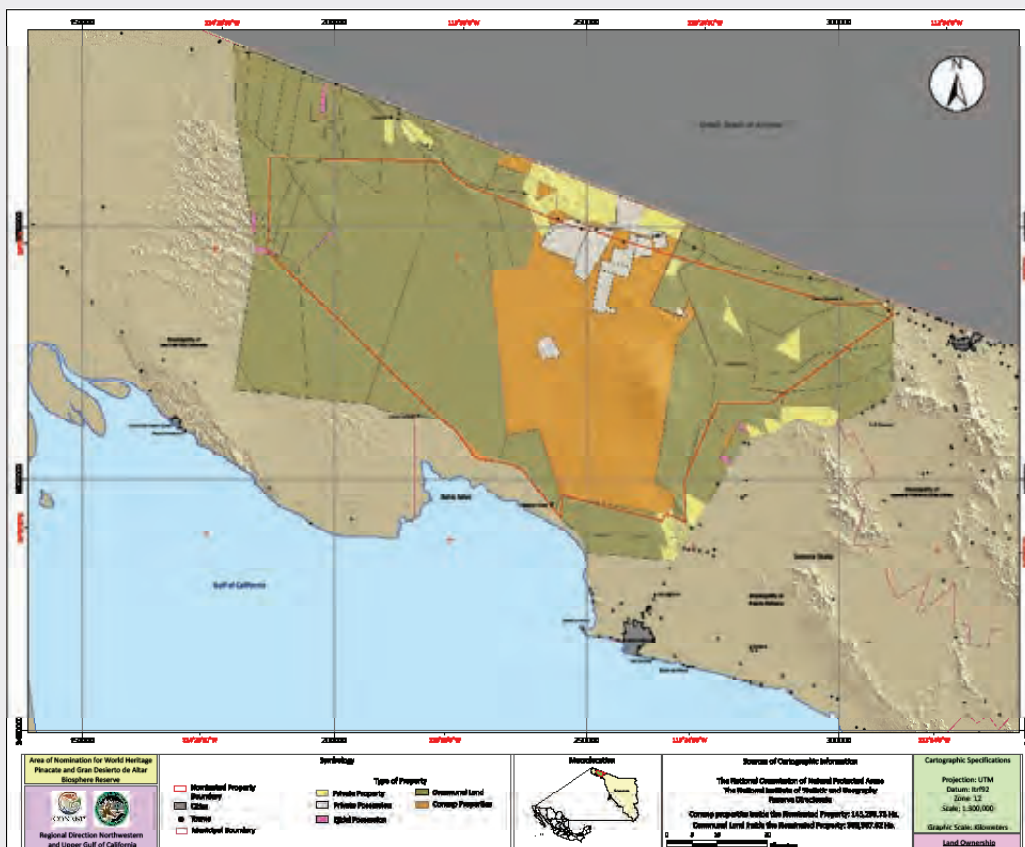
Protection and Management
Of The Property



5.a Ownership

Clasificación	Total	Federal CONANP Property	Communal/Private Property
Nominated Property			
Area (Ha.)	455,207.3	145,300.7	309,907.6
%	100	32	68
Buffer Zone			
Area	259,349.2	13,955	245,394.2
%	100	6	94
Total of the Protected Natural Area			
Area	714,556.5	159,255.7	555,300.8
%	100	22	78

From the previous table can be highlighted that 32% of the surface of the nominated property is owned by the National Commission of Natural Protected Areas (CONANP), and integrity is guaranteed, 68% is communal (social) and private ownership but is protected by a Federal Decree and a Management Program.



Land Tenure



5.b Protective designation

The National Commission for Protected Natural Areas (CONANP) is a decentralized agency of the Mexican Secretariat of the Environment and Natural Resources (SEMARNAT). Its Mission is: "To conserve Mexico's natural heritage through Protected Natural Areas and other conservation modalities, encouraging a conservation culture and sustainable development of communities settled in their surroundings."

As part of its responsibilities and duties, the CONANP dictates measures related to the protection and conservation of the elements of the El Pinacate y Gran Desierto de Altar Biosphere Reserve that are included in this nomination, and for which different strategies have been established. By law, a summarized version of the Management Program including its Administrative Rules

The Presidential Decree in 1993



Upper Gulf of California



and Zoning is published in the Federal Journal Gazette.

According to stipulations included in Articles 65 and 66 of the General Law on Ecological Balance and Environmental Protection, in the term of one year after the official publication of their decree, protected natural areas should have a management program, including the participation of different sectors of society involved in the area. Management programs should contain a description of the physical-biological, social, and cultural features of the area, in relation to a national, regional, and local context: in short, medium, and long-term management actions; the management of protected natural areas and their participatory mechanisms; the specific objectives of protected natural areas; references to applicable norms; flora and fauna inventories; and zoning and administrative rules.

In protected natural areas, all actions are established by means of Annual Operational Programs prepared by each Regional Divi-

sion Director's Office; they are part of the Strategic Planning Matrix which was developed with the participation of the different actors involved in the management of these areas.

These actions are related to the following projects:

- Protection: including surveillance and monitoring of introduced species.
- Management: includes ecological restoration, users' databases, and projects for the sustainable use of natural resources by local communities, permits, and regulations.
- Knowledge and information: includes flora and fauna monitoring, censuses on key species, and biological and socioeconomic databases.
- Culture: environmental education, publication of materials concerning the protected natural area, and participation in events with disseminating activities.
- Administration: includes financing and institutional synergy.

Also, Article 48 of the General Law on Eco-



Mc Dougal

logical Balance and Environmental Protection establishes that in the case of Biosphere Reserves, the surface or surfaces for protection must be designated as core zones and be protected from exterior impacts; that buffer zones must be defined in which productive activities are only to be carried out by those communities that were established in the area prior to the issuing of the declaratory (decree) or with their participation. Those activities should be strictly compatible with the objectives, criteria and programs of sustainable use, in terms of the area's decree and Management Program. The establishment of new human settlements will not be authorized.

El Pinacate y Gran Desierto de Altar Biosphere Reserve was created by Presidential Decree as a Natural Protected Area, and the Decree was published in the Official Gazette of the Federation on June 10, 1993.

The decree establishes, among others the following considerations: that in the region known as "El Pinacate y Gran Desierto de

Altar", fragile ecosystems are representative of desert areas, as well as vegetation and stabilized mobile dunes, home to a vast wealth of wildlife; in this region it live species in danger of extinction such as the Sonoran pronghorn, Bighorn sheep, the Gila monster, the Mug turtle and the Chameleon; there is also a large number of endemic plant species and this region presents a great geological interest, so it is needed to establish the nature of biosphere reserve, protected natural area, called "El Pinacate y Gran Desierto de Altar" in order to preserve the natural habitats of the region and the most fragile ecosystems; ensure balance and continuity of its ecological evolutionary processes, make rational and sustained their natural resources; safeguarding a diversity genetic of existing species, particularly the endemic, threatened and endangered; and provide areas for scientific research and the study of the ecosystems.



Sonora Arizona Convention

5.c Means of implementing protective measures

Until 1997, a total of 27 out of the 107 protected natural areas in Mexico had a basic staff integrated by a Director, Assistant Director, two Chiefs of Project, and an Administrative Assistant. Although this staff was limited, the efforts made, the support they managed to gain, as well as the trust of authorities, people and communities, enabled them to obtain positive results during their administration.

At present, this staff is the most valuable asset of the projects on protected natural areas. During the 1995-2000 Federal Administration, it was possible to obtain fiscal resources in order to endow 36 protected natural areas with this basic staff, for the purposes of preparing, publishing, and applying management programs, developing infrastructure, and promoting the participation of all

local actors in the analysis of conservation problems and in the search for solutions.

By 2011, a total of 132 protected natural areas are currently operating.

The bases for managing protected natural areas are established in the General Law on Ecological Balance and Environmental Protection (LGEEPA) and its Regulations under the topic of protected natural areas. The articles that define the participation of communities in different processes such as declarations of new areas, and their role in management and administration activities are:

Article 65 of the above-mentioned law, which states: "The Secretariat of the Environment shall formulate, in a term of one year after the publication of the respective declaration in the Diario Oficial de la Fed-



ChoyaSunset

eración (Federal Journal Gazette), the management program for the protected natural area, notifying the inhabitants, owners, and possessors of land included in it, other competent agencies, state, municipal, and Federal District governments, as applicable, as well as social, public or private organizations and other interested parties.”

“Once a protected natural area under federal jurisdiction has been established, the Secretary shall designate a director for the area, who shall be responsible for coordinating the formulation, execution, and evaluation of the corresponding management program, in accordance with what is stipulated by this law and its by-laws.”

One of the elements of the structures through which the National Commission for Protected Natural Areas (CONANP) ex-

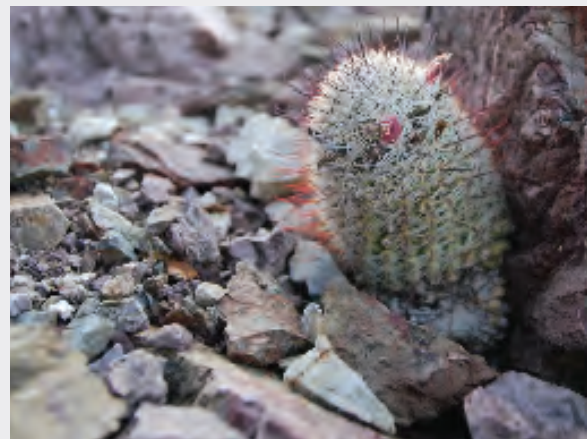
ercises its responsibilities is the Director of Protected Areas or Regional Divisions. Article 150 of the Internal regulations of that Commission stipulates that the director of Protected Natural Areas will have the following functions:

I. To administer, manage, and carry out conservation actions in accordance with the objectives and guidelines established in the management program and the decree declaring the respective area.

II. To supervise that the actions taken within the protected natural area are consistent with the purposes of applicable legal ordinances.

III. To coordinate the implementation of the corresponding management program, in accordance with applicable legal ordinances.

IV. To take part in the delimitation and regis-



mammillaria cactus

tration of national lands included within the protected natural area, as well as to manage them and supervise that the buildings located on them are designated for uses that are compatible with its objectives.

- V. To promote the signing of applicable legal instruments with the public, social, and private sectors, in order to achieve the successful administration, conservation, and improvement of ecosystems in the protected natural area as well as research on them.
- VI. To establish an information system with biological, social, economic, and cartographic data on the protected natural area.
- VII. To exercise, within the corresponding territorial area, the responsibilities specifically delegated to them.



Environmentaleducation

VIII. To assist competent officials in the inspection and surveillance of the protected natural area.

IX. To promote programs and projects for the sustainable development of the protected natural area.

X. To serve as Technical Secretary of the Advisory Board of the protected natural area.

XII. To provide technical information for decisions made at the General Direction for Conservation Management (Dirección General de Manejo para la Conservación) regarding the granting, modification, extension, recovery, suspension, extinction, revocation, or annulment of concessions, permits, licenses or authorizations in the areas of research, the use and wise utilization of ecosystems and their biodiversity, environmental impact assessment, service provision, and of the carrying out of works and activities conducted in the protected natural area, as well as of the corresponding ecological land-use planning.

XIII. To establish and carry out the internal civil protection program of the protected natural area.

XIV. To take part in the preparation of the ecological land-use planning in which the

protected natural area is involved.

XV. To grant permits, licenses, authorizations, and their respective modifications, suspensions, cancellations, revocations, or extinctions in the sphere of protected natural areas within federal jurisdiction, when the persons involved are individuals who intend to conduct recreational activities with no profit, economic remuneration, or similar income involved.

XVI. To supervise the works, studies, and services related to the protected natural area, in coordination with the Executive Office for Administration and Institutional Effectiveness (Dirección Ejecutiva de Administración y Efectividad Institucional).

XVII. To design and set up, according to applicable provisions in this matter, conservation and maintenance projects for the buildings they are responsible for.

XVIII. To receive applications and set up files for granting licenses, permits, authoriza-

tions, and concessions, as well as to notify interested parties about the resolutions issued by the competent head offices of the Commission.

XIX. To keep a record of the payments made by users to comply with their obligations.

XX. Whatever other functions are expressly assigned to them by the National Commissioner of the CONANP.

In the case that a controversy arises regarding a decision made by the Director of the Reserve, Article 151 of the Internal regulations of the National Commission for Protected Natural Areas specifies that the General Directors of CONANP may, in the sphere of their respective jurisdictions, revise, confirm, modify, revoke, or annul, as the case may be, the resolutions issued by the Directors of protected natural areas.

Management strategies for these areas necessarily require the support of state and municipal governments in the region, as well as

Surveillance



the presence and joint efforts of numerous academic institutions, NGO's, owners, users, and local communities.

Each protected natural area has an Advisory Board comprised of representatives of federal and local governments, research and academic institutions, NGO's, and communities located within or near the protected natural area, and member of the ingenious group Tohono O'odham. These Boards serve as forums for public and social participation.

The Management Program of El Pinacate y Gran Desierto de Altar Biosphere Reserve was published in 1995. Now is in the updating process.

CONANP is a decentralized body of the Min-



Inspection taking place at highway antenna

istry of Environment and Natural Resources, whose mission is to "Conserve the natural heritage of Mexico through the protected areas and other forms of conservation by fostering a culture of conservation and the sustainable development of the communities settled in their environment". CONANP belongs to the National Programme of Natural Protected Areas Agency 2007-2012, the best instrument for the conservation of biodiversity.

As part of the obligations and responsibilities of CONANP, is issuing the measures related to the protection and conservation of protected areas applying different strategies. Thus, regulations for the management of these areas are established in the General Law of Ecological Balance and Protection to the Environment (LGEEPA) and its regulations in the topic of natural protected areas.

El Pinacate y Gran Desierto de Altar Biosphere Reserve is managed locally by the reserve's Director and his staff, whose offices are located within the reserve. The these protected area corresponds to the Northwest and Upper Gulf of California Regional Direction, with offices in Hermosillo,

Sonora, which comprises other natural protected areas from the states of Sonora and Sinaloa.

In El Pinacate y Gran Desierto de Altar Biosphere Reserve as well as in the rest of the natural protected areas in the country, all actions carried out are established in the Annual Operating Programme (POA) prepared by the reserve's staff, which include actions, cost of the action, duration, funding if they are not fiscal resources and persons or organization involved in the action. The POA are derived from the management program and are aligned with Strategic Guidelines of the National Programme of Natural Protected Areas 2007-2012.

CONANP does not have the legal authority to apply sanctions when they violated regulations laid down by the laws and by causing damage directly or indirectly to the biodiversity of the area. Thus, CONANP denounces environmental offences registered in the reserve and surrounding areas to the Federal Attorney for Protection to the Environment (PROFEPA) who is responsible for applying the fines corresponding and verify that the damage is restored.

The management and the protection of El Pinacate y Gran Desierto de Altar necessarily requires the support of the State and Municipal Governments, as well as the joint efforts of numerous academic institutions,





Gran Desierto Sand Dunes

5.d Existing plans related to municipality and region in which the proposed property is located

(e.g., regional or local plan, conservation plan, tourism development plan)

Currently, State and Municipal landed use planing are being developed; there is the Management Plan of the El Pinacate y Gran Desierto de Altar Biosphere Reserve. It is also a work done by researchers from the Universidad Autónoma de Baja California (UABC) called "Sub program for the management of tourists" which describes the most attractive natural and cultural elements of the site; possible camp sites, recreational activities that could develop, as well as a possible infrastructure within the area and the most appropriate for the same location.

There is also a diagnosis and master plan of tourism for the biosphere reserve produced jointly with the Government of Sonora and the Sonoran Institute.



Desert Sinita



Sidewindersnake



Pitahaya and cinder cone

5.e Property management plan or other management system

The Management Program of El Pinacate y Gran Desierto de Altar Biosphere Reserve was published in 1995 and is currently under review. A Base Group integrated by researchers from the Centro Ecológico de Sonora, Intercultural Center for the Study of Deserts and Oceans, Universidad Autónoma de Baja California, Universidad de Sonora and the National Institute of Anthropology and History. This group had the support of PROFEPA and State Social Development Secretariat (SEDESOL), members of the Tohono O'odham Nation and representatives of the National Peasant Confederation (CNC) in Puerto Peñasco, Plutarco Elías Calles, and San Luis Rio Colorado. As part

of the integration process of the management program were numerous consultation meetings and working sessions of the Base Group and collaborators.

The Management Program is the guiding rule for the use of natural resources in the area by ensuring the continuity of biological processes, geomorphological and geological events, as well as historical, cultural and scenic aspects. Moreover, it establishes guidelines for the development of productive activities that are feasible from the perspective of sustainable development.

The overall objective of the Management Program is "to establish the working lines to ensure the permanence of the values of



Santa CLara peak

the biotic and abiotic resources and drive and control the socio-economic activities that take place in the area to be compatible with the conservation of natural resources in the Reserve, the uses of the area and the development of the resources required for surveillance activities." The specific objectives are to "conserve, protect and recover if the case, the biological, ecological and physical elements, ensuring the continuity of its processes for future generations" and "preserve, protect and recover if the case, historical values and archaeological sites in the Reserve and to rescue the cultural traditions of the O'odham Nation."

The Management Program includes the history of the area in a general context, state, national, regional and local levels. It presents the description of describing its physical aspects such as geology, geomorphology and physiography, soils, climate and hydrography, biological aspects such as



Ocotillo after the rain

vegetation, flora and fauna, scenic values as the fields of dunes, volcanic shield and granite mountains, between other elements.

It also describes the socio-economic and demographics, land tenure, infrastructure in the area and the economic basis of the reserve such as agriculture, mining, extraction of flora and forest resources, hunting and tourism. Historical and cultural aspects are also described, explaining the chronology of human occupation in the area and the archaeological remains found.

There is also a summary of impacts on the reserve, which identifies four major landscapes (volcanic shield, sandy plains and riparian habitat, active dunes, granite saws), its ecological and cultural values, socio-economic activities that take place in each of them and the impacts they generate. The analysis indicates that impacts of these threats on natural resources and cultural elements are caused primarily by the



Palo Verde Mirage

development of six major activities. On this basis, developed strategies and actions to be taken to control such activities. Management strategies are presented from two perspectives: 1) monitoring activities of residents and 2) control of public use. Because human activities are the main threats to the resources, promotion of community participation in conservation efforts and wise use of resources is a fairly mentioned in the Management Program. It also sets out education programs to give residents and users of the Reserve an intimate knowledge of their environment and encourage respect for the values and processes it. With regard to activities arising from public use, control of all access is one of the most urgent measures to reduce many of the impacts (strategy to date has not been implemented). It is also noted the improvement in the marking of roads, which has been implemented successfully.



Choya Landscape

In the section “Rules for Using the Book” sets out activities that can be developed within the core zone and buffer zone, addressing the uses of four groups: residents with socio-economic use, visitors to public use, researchers and members of the O’odham Nation. Also, the constraints to implementation of the strategies are also mentioned. The program has four components of management:

Research component which aims to “develop research programs and monitoring the short, medium and long term to deepen their knowledge and learn the elements that provide the basis for establishing the new policies of natural resource management, cultural and historical elements and socioeconomic factors within the Reserve.” It has three sub-components: investigation of natural resources, research and cultural heritage and socio-economic research. These sub-components consider develop-



Pitahaya

ing inventories, studies and monitoring programs. For each set as far as possible the likely institutions or persons with whom they must coordinate the site and arrange the execution.

Education and public use component, your goal is to “encourage and support active participation in the management, protection and rational use of natural and cultural resources through a deep knowledge and appreciation of natural and cultural history of the area of El Pinacate y Gran Desierto de Altar.” The sub-components of public participation within the site, regional outreach and training. The implementation of this component is aimed at residents and direct users of resources, national and for-



Gran Desierto de Altar

eign visitors, the Tohono O’odham people and surrounding communities. The implementation of this component is the direct responsibility of the Directorate of Reserve, which should be coordinated with other governmental and nongovernmental institutions with experience in education in the region and / or interest to financially support the implementation of sub-components. Community development component which aims to “implement programs of technical and economic advice to the residents of the site that uses natural resources, with the aim of harmonizing the conservation objectives of the reserve to the sustained use of the same.” Its sub-components are conversion, development and sustainable tour-



Aerial view

ism development. For the implementation of this component is necessary community consultation, particularly with residents of the Reserve and the direct users of natural resources, to establish, by agreement, the projects of economic, tourism development and sustainable development.

Operation and management component, its objective is "to implement measures for the conservation, protection, recovery and restoration of natural resources, geological features, historical and cultural control of the public entrance to the protected area to prevent damage and contribute to their recovery. Also, develop infrastructure and services necessary for the operation of the protected area and provide security for resi-



Ocotillo and Saguaro

dents and visitors. "The sub-components of management, development and maintenance of infrastructure control and safety. The implementation of this component is basically to management activities for the area; however, coordination with other components is vital because the management strategies are developed primarily on the results generated by them, particularly in the Components Research & Education. The organizational structure, financing strategies and mechanisms for monitoring and evaluation of management are the last paragraphs of the same. Therefore, the protection and management activities could also be modified.



Saguarosunset



SandStorm



SandLandscape

5.f Sources and levels of finance

El Pinacate y Gran Desierto de Altar has a fiscal budget of the federal government assigned through the CONANP for operation expenses and management. The Temporary Employment Program (PET) and the Conservation Programs for Sustainable Development (PROCOCODES) are subsidis that constites another sources of funds from the Federal Government for the implementation of productive projects and hiring local people in activities that benefit the protected area. According to the Federal Law of Rights, to enter the area the visitor must pay a fee which was establish at the beginning of 2007. For residents of the municipalities where the site is located, Puerto Peñasco, San Luis Rio Colorado and Plutarco Elías Calles the fee is 25 pesos and the rest of the visitors the fee is 50 pesos. The resources generated by fees gets back to be use for

the conservation or the protectec area. There are other sources of financial resources from the Global Environmental Facility (GEF) channeled through the Mexican Fund for Conservation of Nature (FMCN-FANP). Another resource is the external support of the councils of the municipalites of Plutarco Elías Calles and Puerto Peñasco to pay salaries of staff seconded to the protected area. During 2010-2012 a project is being funded by the United States National Park Service (NPS) as coperation with the reserve, to provide field equipment for monitoring. El Pinacate y Gran Desierto de Altar is gaining an ever greater visibility due to, among other reasons, the strategic location of the site with respect to the states of Arizona and California, and the importance and expansion of Puerto Peñasco as a tourist destination. This has positively influenced the



WarmSunset

financial resources for the area; many gaps are beginning to be covered, mainly in infrastructure. Thus, the Commission for the Promotion of Tourism of Sonora (COFETUR) and the Federal Secretariat of Tourism (SECTUR) have provided budget for the promotion, infrastructure and maintenance of the Visitor Center.

Agreements with the Federal Secretariat of Communications and Transport (SCT) have provided resources for the construction of infrastructure such as field states and interpretive station stops on federal highway 2 at North from the reserve, to intensify the surveillance programmes, management, environmental education, etc. and to promote the integrity of the nominated property as well as the Biosphere Reserve.



Barrel Cactus

Authorized budget and other financial resources, year 2011

(amount are presented in USD taken that 12 pesos per dollar):

CONANP - Federal Government Budget	\$ 350,000
Temporary Employment Program	\$ 55,000
Conservation programs for Sustainable Development	\$ 92,000
Fee Income	\$ 30,000
Global Environmental Facility	\$ 100,000
NPS Project	\$ 20,000
COFETUR (State Government)	\$ 230,000
SECTUR (Federal Government)	\$ 230,000
MISCELLANEOUS (agreements with SCT, NGOs and others)	\$750,000
TOTAL	\$1,857,000



SECTUR contributing with environmental education through the SchukTouk visitor center



Horned Lizard

5.g Sources of expertise and training in conservation and management techniques

All authorities and organizations involved in the protection and management of the nominated property are highly trained to meet the goals a Management Program. Key government institutions are the Ministry of Environment and Natural Resources (SEMARNAT) is responsible for the protection, restoration and conservation of ecosystems and natural resources, as well as environmental services to promote their sustainable use. These actions are conducted through the National Commission of Natural Protected Areas (CONANP), which also is responsible for the management of the protected areas. The National Institute of Ecology (INE) is in charge of environmental policies and the generation of scientific and technological information on environmen-

tal issues and the capacity building of human resources. The Federal Environmental Protection Agency (PROFEPA) is responsible for the environmental law enforcement, and the application of appropriate sanctions. The National Institute of Anthropology and History is responsible for the conservation of our cultural heritage and is conducting research in anthropology, archeology, history and paleontology.

Academic institutions and non-governmental organizations that collaborate are: Universidad Autonoma de Baja California (UABC), Universidad Autonoma de Sonora (UNISON), Universidad Nacional Autonoma de México (UNAM), Centro intercultural para estudios de Desiertos y Oceanos (CEDO), Instituto de Medio Ambiente y Dessarrollo



Mojave Shovelnose snake

Sustentable del Estado de Sonora (IMADES), Tohono O'odham Nation, University of Arizona, National Park Service through Organ Pipe Cactus National Monument (ORPI) and the International Sonoran Desert Alliance (ISDA).

For the proper functioning of the Reserve, the staff has been trained in various topics, that are considered to be fundamental for the implementation of the several strategic lines of the Management Program, for example, the office of Environmental Education, is in charge of the distribution of pamphlets, visitors attention and the implementation of interpretive trails, among others.

As part of the tri-national work done throughout 2010, the office of Coordination of International Projects, aims to make the exchange programs with institutions,

NGOs, universities and individuals in U.S. to develop projects inside and outside the Reserve. On the other hand, there are several research topics, one of them to develop a project about toponymic of Tohono O'odham tribe, returning the original names of places within the reserve.

Another office is the department of Research and Monitoring, in charge of coordinating and develop research programs and follow up of ecological studies.

The office of the Public Use, is responsible for providing information and attention to every visitor to the reserv, as well as update the information materials.

All of the staff of the reserve are trained personnel and with profound knowledge of El Pinacate y Gran Desierto de Altar Biosphere Reserve, all which facilitates the monitoring.



Biological Station

5.h Visitor facilities and statistics

El Pinacate y Gran Desierto de Altar has services in accordance with the general area. Since it is a remote area where you can enjoy an isolated, pristine, quiet and beautiful, intimate with nature, the infrastructure that has been built, has also been design in a manner harmonious with the environment. The tour consists of approximately 69 kilometers of dirt roads in a good condition over which you can visit the following sites of interest: El Elegante Crater, El Tecolote and Cone Cerro Colorado Crater. There are two different trails, one to El Elegante Crater, and the other to Mayo Cone; a third trail

is being built to the Santa Clara volcano cone. There are two camping areas, one in the cone and the other in El Tecolote Red Cone. There are four parking spaces located in El Elegante Crater, Cerro Colorado Crater and in the camping areas. In addition, there are stops along the tour to observe the landscape. There is currently an interpretive trail where vehicular informational signs are located these stops, that allows the visitor to remain in his vehicle, while he reads the information. At the camp site El Tecolote there are tables and picnic areas.



Vehicle Route Interpretive Stops

At kilometer 52 of the road 8 we find the Information Center, where the visitors register and receive information and orientation about the area. This Information Center provides public services as an exhibition area, a library, store, auditorium, toilets, and interpretative trail; and spaces for administrative offices and research laboratory.

Visitors can find brochures in Spanish and English with information about El Pinacate y Gran Desierto de Altar Biosphere Reserve, its fauna and flora, and the geological and cultural values also there is information of policies and regulations that has to be observed inside the protected area. In the Biological Station facilities exist for staff personnel can perform there duties and work.





Schuk Toak visitor center



Schuk Toak Visitors Center is located at kilometer 73 of Highway 8, on the road towards the dunes, it was opened in 2009. It is an innovative centre built in harmony with the landscape and using environmental friendly technologies. This Centre, called “Schuk Toak”, which means “Holy mountain” in native language pápago has room for temporary and permanent exhibitions, auditorium and audiovisual room with 85 seats and a Botanical Garden. Its purpose is to inform about the values of the reserve and the Sonoran desert in general. It also has two interpretative trails to admire some of the most important geological features.

In addition, special activities are provided: the observation of constellations from the terrace at night, totally free of light pollution and scheduled events like projections of environmental and historical films of the region. The national and foreign visitors, have been until now the best promoters and multipliers of information there provided and the extraordinary beauty of the landscapes of the nominated property.

The relation of the number of visitors in recent years is as follows:

Year	Number of total visitors
1997	3,177
1998	6,000
1999	5,784
2000	5,628
2001	6,389
2002	6,536
2003	6,495
2004	6,816
2005	8,141
2006	8,214
2007	11,000
2008	9,037
2009	12,646
2010	17,504

Due to the great diversity of values, which owns El Pinacate y Gran Desierto de Altar Biosphere Reserve this has become today one of the places of greatest interest for tourists not only for geological values that can be seen during the ecotourism tour that takes place in the area, but by the amount of biological values, historical and cultural values as well as scenic valued present in it.

Thanks to the opening of the new Visitors Center, at the end of the year 2009 it has been able to offer to the public in general different activities that have as objective to strengthen the conservation culture and at the same time allow the stay of tourists in the area to be of much less impact, and





Information Center

as a result achieve a tremendous response not only from the local population but to national and international levels and this is reflected in the present in the same visitation statistics.

It is so that for 2010 according to these statistics you can see a sharp increase in the visitation and consequently an increase in the money raised by the concept of fee payment, which represents an opportunity for the area, and that thanks to these resources we may continue ongoing projects and programs in favor of conservation.

Following, in 2009 actions were taken to improve the visitors' attention and different options for recreational activities without causing impacts to biodiversity and the landscape.

As a result two registration points for visitors were established, one at the Informa-

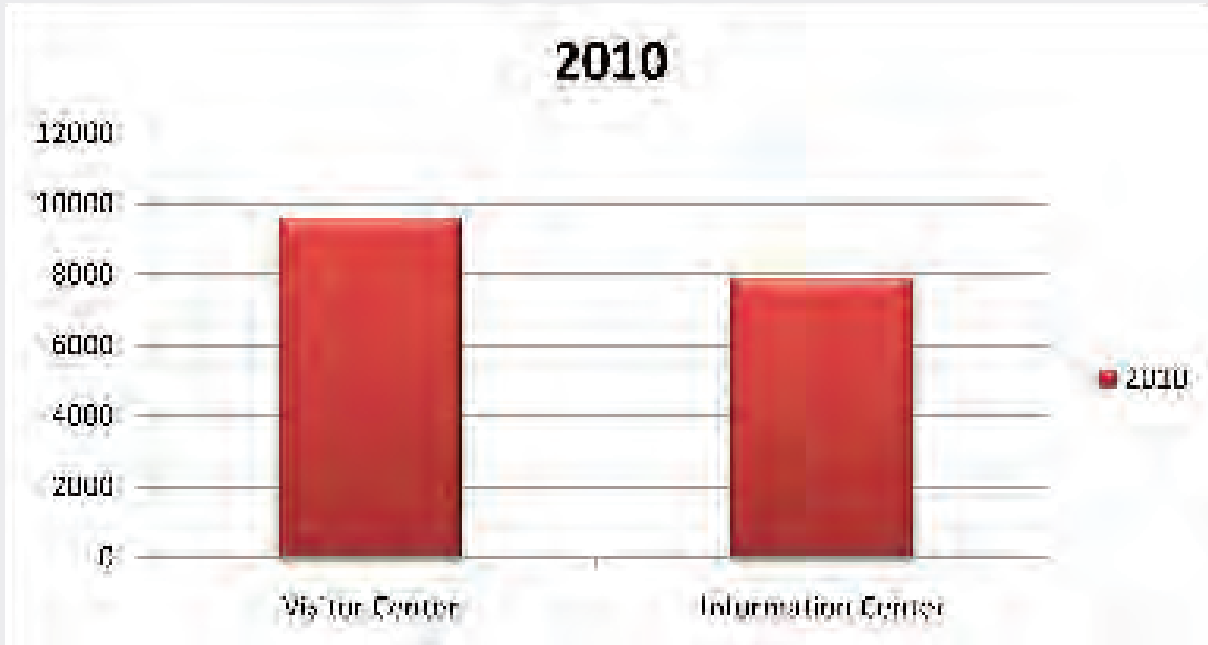
tion Center located at the Biological Station (headquarters) and the second in the new Visitor Center with different attention and reporting mechanisms, as well as increased presence by the staff at the different sites of visitation in order to provide better care and the improvement and strengthening diffusion and information about the area.

As a result of these actions we observed:

The total number of visitation in the reserve for the year 2010 was 17, 504 visitors. This number was recorded in the two control sites:

Information Center: Located at kilometer 51 of highway 8 Puerto Penasco-Sonoita. (Access to Ecotourism Circuit to get to the Craters with 69 km away).

Visitor Center: Located at kilometer 73 of highway 8, Puerto Peñasco-Sonoita Sonora.



Graph: A comparison of visitation

As shown in the figure above visitors registered in the Information Center in 2010 and toured the ecotourism circuit were 7, 897people.



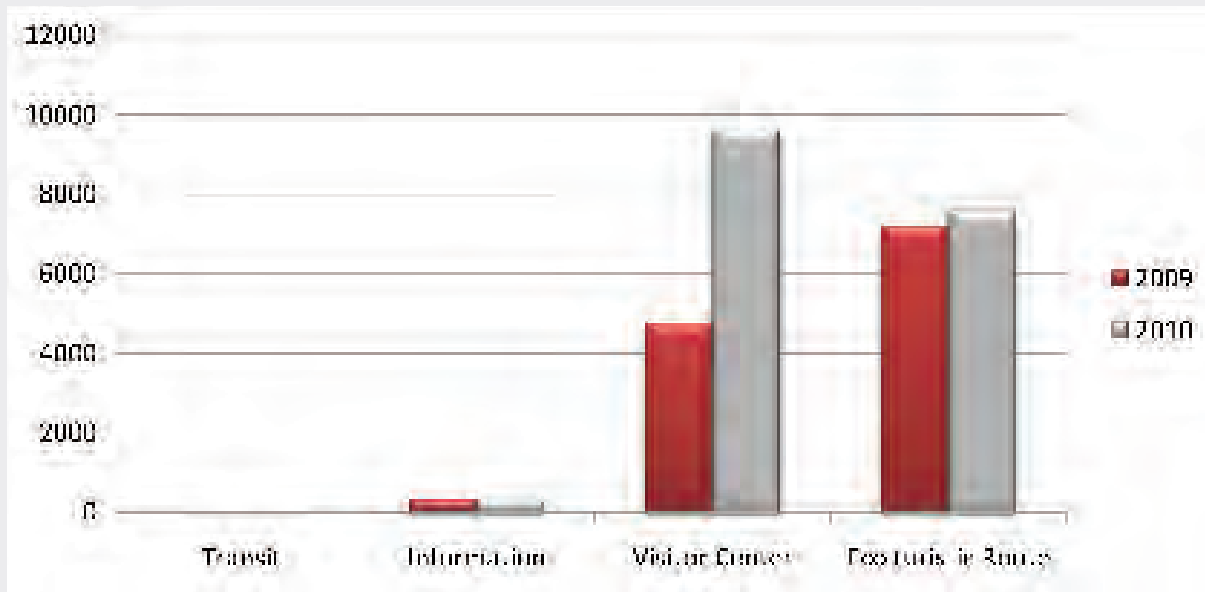
Audiovisualauditorium

What corresponds to people who were registered in the Visitor Center we obtained approximately a total of 9,607 rather than 1,710 visitors ecotourism circuit.

This figure consists of the following data:

Based on the results obtained, the total number of visitors register throughout the reserve was 17,504.

To analyze in more detail these numbers, the following comparative figure 2009-2010 shows the increased visitation.



Graph: comparative visitation between 2009-2010

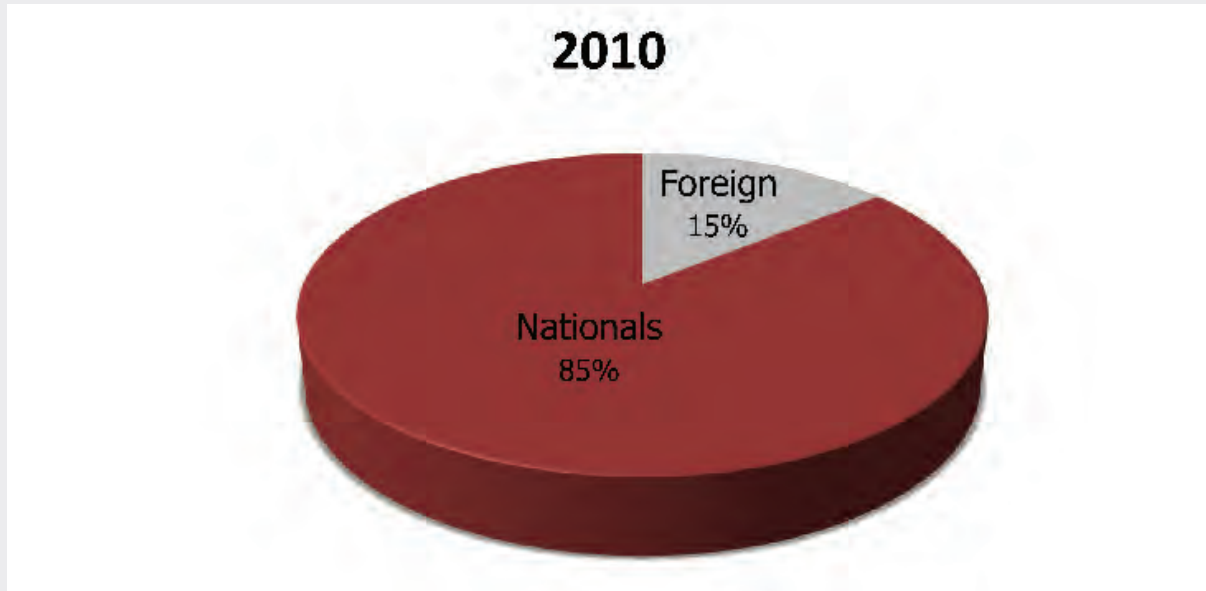
As can be observed, by 2010 the visitation in the reserve increased considerably in regard to 2009 that has recorded 12,283 visitors while that for 2010 was 17,504 registered visitors, which means that this year there was an increase of 5,221 visitors, representing a 43% more. However it is very important to note that all visitors have access to the extraordinary views of the landscapes in adequate sites with specific facilities provided through the Ecotouristic Circuit; the visitors were 7,897 during in 2010.



Children at visitor center

Regarding to visitors, only those for the ecotourism circuit, the increase was not as high as for 2009 were registered 7,208 people, while for 2010 recorded a total of 7,589, approximately 381 visitors more, representing only 5%. In regards to the visitor centre in the year 2009 have registered 4,750 tourists and students while for 2010 recorded a total of 9,607 people, or a 102% increase.

Continuing with the analysis of data obtained in the 2010 the following shows the behavior of the visitation in the reserve a breakdown of the total in national and foreign visitors.



Graph: Visitation composition in 2011

In the graphic, the visitation in the reserve is composed mostly of national visitors from different States specifically of Sonora (Puerto Peñasco, Sonoyta, San Luís Rio Colorado, Caborca and Hermosillo), Baja California (Mexicali, Tijuana and Ensenada), Sinaloa (Mazatlan, Guasave and Los Mochis), Jalisco (Guadalajara) and D.F, among many others.

It can be concluded then that approximately 85% of the visitors are national and only 14% come from foreign cities, mainly from the neighboring States of Arizona (Tucson, Phoenix) and California (Los Angeles and San Diego) in the United States.





Sykes Crater and Pinacate Sierra

5.i Policies and programs related to the presentation and promotion of the property

El Pinacate y Gran Desierto de Altar, is now one of the places with great relevance to national and international levels. It was recently named as one of the 13 wonders of Mexico, showing the rich cultural and environmental site available to the public. Several television shows were broadcast nationally and many tourists have come to the area motivated by them. Without a doubt, the possibility that El Pinacate y Gran Desierto de Altar Biosphere Reserve is inscribed on the World Heritage List as a Natural Property, will bring economic benefits to the area that will result in improvement of conservation, protection and good management of the Property.

CONANP has a programme of strategic communication whose objective is to disseminate the importance of protected areas in different sectors of society. In addition to updating the management program, an ed-

ucational version of the same is being developed; it will be delivered to visitors and inhabitants of the surrounding area so that they know not only the values of the area but the same regulations.

One of the programmes that are considered fundamental for the conservation of the nominated property is the Environmental Education Programme which has the purpose of strengthening interactive activities with different levels of education, establishing a link with teachers and parents in order to create environmental awareness at home and providing the necessary tools to promote the interest of the natural areas. Important part of environmental education program, are the outdoors activities, where the main objective is the to the reserve as well as the different actions carried out on a daily basis in the same for its conservation.

In relation to the State, regional and national promotion, the State Government through the Ministry of Ecology and in coordination with the National Commission of Natural Protected Areas, the National Institute of Anthropology and History, the Secretariat of Tourism and Civil Organized Society, various activities have arisen:

1. - In case of favorable decision of the Committee to inscribe El Pinacate y Gran Desierto de Altar Biosphere Reserve in the World Heritage List, as Natural Property, different media will be invited to visit the area.
2. - It will be broadcast through television and radio, inviting at the same time that people are interested more for the site and to participate as volunteers in the various activities.
3. - As it has been made month by month, a broadcast will be made through the written press, sending notes and articles with relevant information and related topics, depending on the case. At the same time the development of the newsletter that is displayed in the mural newspaper of the reserve.
4. - The designation will be included in the cycles of conferences as well as workshops



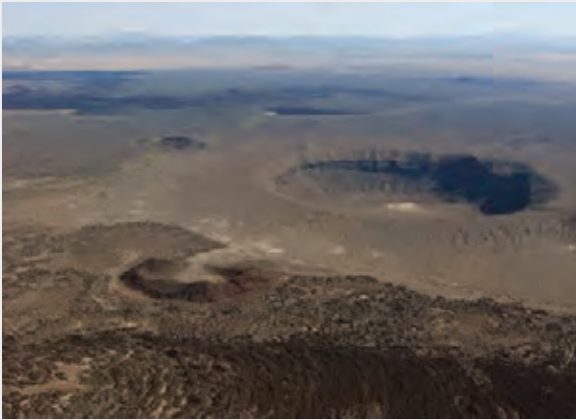
Lava formation



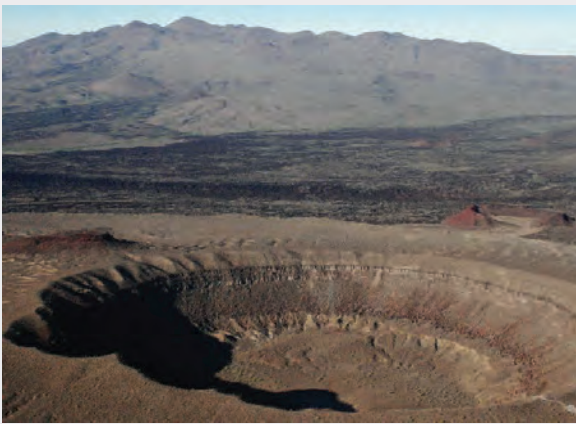
Cerro Colorado crater



Cindercone



Elegante Crater



Elegante Crater



Badillo Crater

for the exchange of experiences with other areas of the country, in order to expose the activities and achievements. In addition to this, it will participate in congresses and symposia at the international level.

5. - Elaboration of dissemination materials such as videos, documentaries, leaflets, posters, postcards, t-shirts, guides of flora and fauna, calendars, among others.

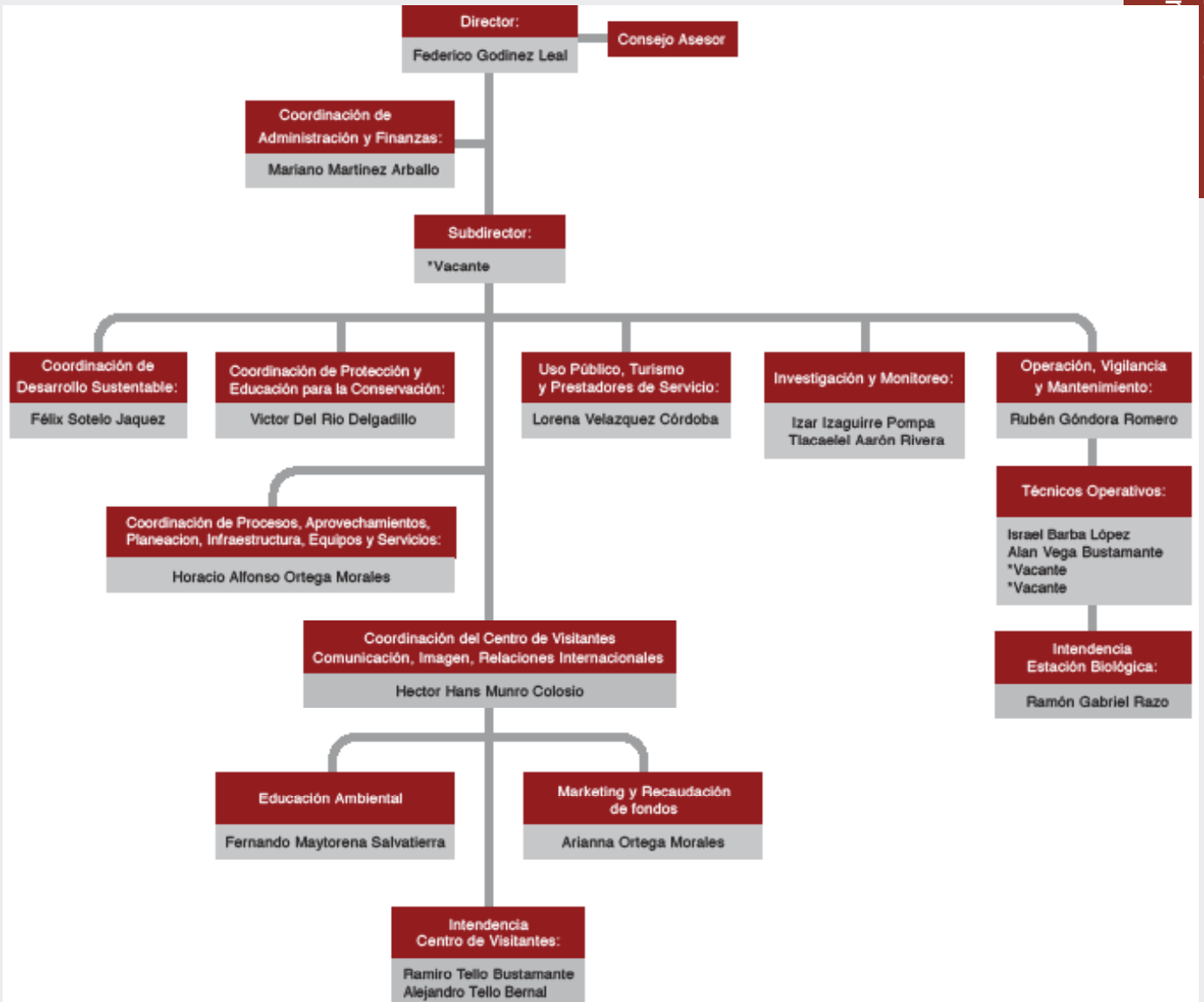


5.j Staffing levels (professional, technical, maintenance)

Personnel assigned to the Reserve has the experience and necessary training for carrying out the activities of management, research, education, monitoring, protection and management of the site. Most of the staff lives in the Biological Station located in the area.

It should be noted that the number of people working in the Reserve could be small if we consider the size of the area and the increasing number of visitors. Actually (2011), 18 people are employed as staff for the management of the nominated property, organized as showed in the following diagram:

Organization Chart:





06 Monitoring



6.a Key indicators for measuring state of conservation

Indicator	Periodicity	Location of records
Extension of the dune field	Every three years	RBP y GDA
Changes in the landscape	Annual	RBP y GDA
Coverage of exotic species	Annual	RBP y GDA
Patterns in the livestock	Annual	RBP y GDA
Extent and location of roads	Monthly	RBP y GDA
Number of illicit caused by tourists	Continuous	RBP y GDA
Total number and size of tinajas	Rain season	RBP y GDA
Water Quality	Rain season	RBP y GDA
Extent of riparian community	Every three years	RBP y GDA
Area invaded by salt cedar and exotic grasses	Annual	RBP y GDA
Volume of water extraction	Annual	RBP y GDA
Number of wells	Continuous	RBP y GDA
Number of people who adopt sustainable practices	Annual	RBP y GDA
Presence of water discharge in Río Sonoyta	Continuous	RBP y GDA
Population size of bats	Annual	RBP y GDA
Population structure of bats	Annual	RBP y GDA
Health status of breeding colonies	Annual	RBP y GDA
Pronghorn population size	Every two years	RBP y GDA
Structure in pronghorn population	Every two years	RBP y GDA
Pronghorn habitat fragmentation	Every two years	RBP y GDA
Inadequate fencing Extention	Continuous	RBP y GDA
Extraction volume of scoria	Every two years	RBP y GDA
Population size of native fish	Annual	RBP y GDA
Presence of exotic fish	Annual	RBP y GDA
Land use and water in basin of Sonoyta River	Annual	RBP y GDA

(*RBP y GDA, El Pinacate y Gran Desierto de Altar Biosphere Reserve)

6.b Administrative arrangements for monitoring property

The National Commission of Natural Protected Areas through the protected area management is responsible for carrying out various monitoring performed in the area. However, there are various academic institutions and foreign government agencies that conduct studies in the area. Below is a list with information from these institutions.

Institution	Researcher in Charge	Contact Information
Arizona-Sonora Desert Museum California University	Dr. Gary Paul Nabhan	2021 N Kinney road Tucson, Arizona 85743 USA
Centro de Investigación en Alimentación y Desarrollo (CIAD A.C.)	Dr. Paul Dayton	San Diego, California, USA
Centro de Investigación en Alimentación y Desarrollo (CIAD A.C.)	Dr. Martín Esqueda Valles	Km. 6 Carretera a La Victoria s/n, Hermosillo, Son.
Arizona-Sonora Desert Museum	Dr. Gary Paul Nabhan	2021 N Kinney road Tucson, Arizona 85743 USA
Centro de Investigaciones Biológicas del Noroeste	M.C. Patricia Cortéz Calva	Apartado Postal 128 km. 0.5 a la telefónica, terrenos del Conchalito, 23000 La Paz, BCS.
Centro de Investigaciones Biológicas del Noroeste	Dr. Sergio Ticul Álvarez Castañeda	Apartado Postal 128 km. 0.5 a la telefónica, terrenos del Conchalito, 23000 La Paz, BCS.
Comisión de Ecología y Desarrollo Sustentable del Estado de Sonora CEDES	Cristina Meléndez	Reyes y Aguascalientes Col. Centro, Hermosillo, Son. Tel. (662) 210 36 61
Comisión de Ecología y Desarrollo Sustentable del Estado de Sonora CEDES	Ing. Norma Núñez	Reyes y Aguascalientes Col. Centro, Hermosillo, Son. Tel. (662) 210 36 61
Comisión de Ecología y Desarrollo Sustentable del Estado de Sonora CEDES	Biol. Eduardo López Saavedra	Reyes y Aguascalientes Col. Centro, Hermosillo, Son. Tel. (662) 210 36 61
Comisión de Ecología y Desarrollo Sustentable del Estado de Sonora CEDES	Biol. Rafaela Paredes Aguilar	Reyes y Aguascalientes Col. Centro, Hermosillo, Son. Tel. (662) 210 36 61
Consejo de Recursos Minerales Subdirección de Cartografía Geológico-Minera	Ing. Rodolfo Saéz Reyes	Bldv. Felipe Ángeles S/N Carretera México-Pachuca km 93.5, Col. Venta Prieta, 42080 Pachuca, Hgo. (771) 13063
Dirección General de Vida Silvestre	C. Juan Manuel Segundo Galán	Av. Revolución No. 1425, col. Tlacopac, 01040, México D.F.
El Colegio de la Frontera Norte	Dr. Noé Aarón Fuentes	Tijuana BC.

Institución	Researcher in Charge	Contact Information
Instituto de Ecología de la UNAM	Dr. Rodrigo Medellín Legorreta	Apartado Postal 70-725, Ciudad Universitaria, UNAM 04510, México D. F.
Instituto de Geofísica de la UNAM	Dra. Beatriz Ortega Guerrero	Apartado Postal 1039, C.P. 83000 Hermosillo, Sonora.
Organ Pipe Cactus National Monument	Charles Conner	10 Organ Pipe Drive, Ajo, AZ 85321 Tel. 520-387-6849
Organ Pipe Cactus National Monument	Amy Pate	10 Organ Pipe Drive, Ajo, AZ 85321 Tel. 520-387-6849
Organ Pipe Cactus National Monument	Peter Rowlands	10 Organ Pipe Drive, Ajo, AZ 85321 Tel. 520-387-6849
R.B. El Pinacate y Gran Desierto de Altar	Ecol. Izar Izaguirre	Carretera 8 Km. 52 Ejido Los Norteños, Puerto Peñasco, Sonora, México Tel. 638 384 90 07
U. S. Fish and Wildlife Service	Biol. James Brady	P.O. Box 1461, No. 3 Fawn road, Cedar Crest, NM 87008-1461
U.S. Fish and Wildlife Service	Dr. Chuck Minkley	P.O. Box 1461, No. 3 Fawn road, Cedar Crest, NM 87008-1461
Universidad Autónoma de Aguascalientes	Biol. Jesús Sigala Rodríguez	Ave. Universidad 940, C.P. 20100, Aguascalientes, Ags.
Universidad Autónoma de Baja California	Dr. Francisco Paz Moreno	Rosales y Luis Encinas Col. Centro Hermosillo, Sonora Tel. (662)259.2110/259.2111
Universidad de Sonora	Dra. Reyna A. Castillo	Apartado Postal 1819, Hermosillo, Sonora.
University of Arizona	Dr. William Calder	Tucson, Az. 85721 EUA
University of Arizona	Phd. Phillip Rosen	Tucson, Az. 85721 EUA
University of Arizona	Christian D'Orgieaux	Tucson, Az. 85721 EUA
Virginia State University	Melanie Culver	Hayden Dr. Petersburg, VA 23806
Wesleyan University	Dr. James T. Gutmann	Connecticut, CT USA

6.c Results of previous reporting exercises

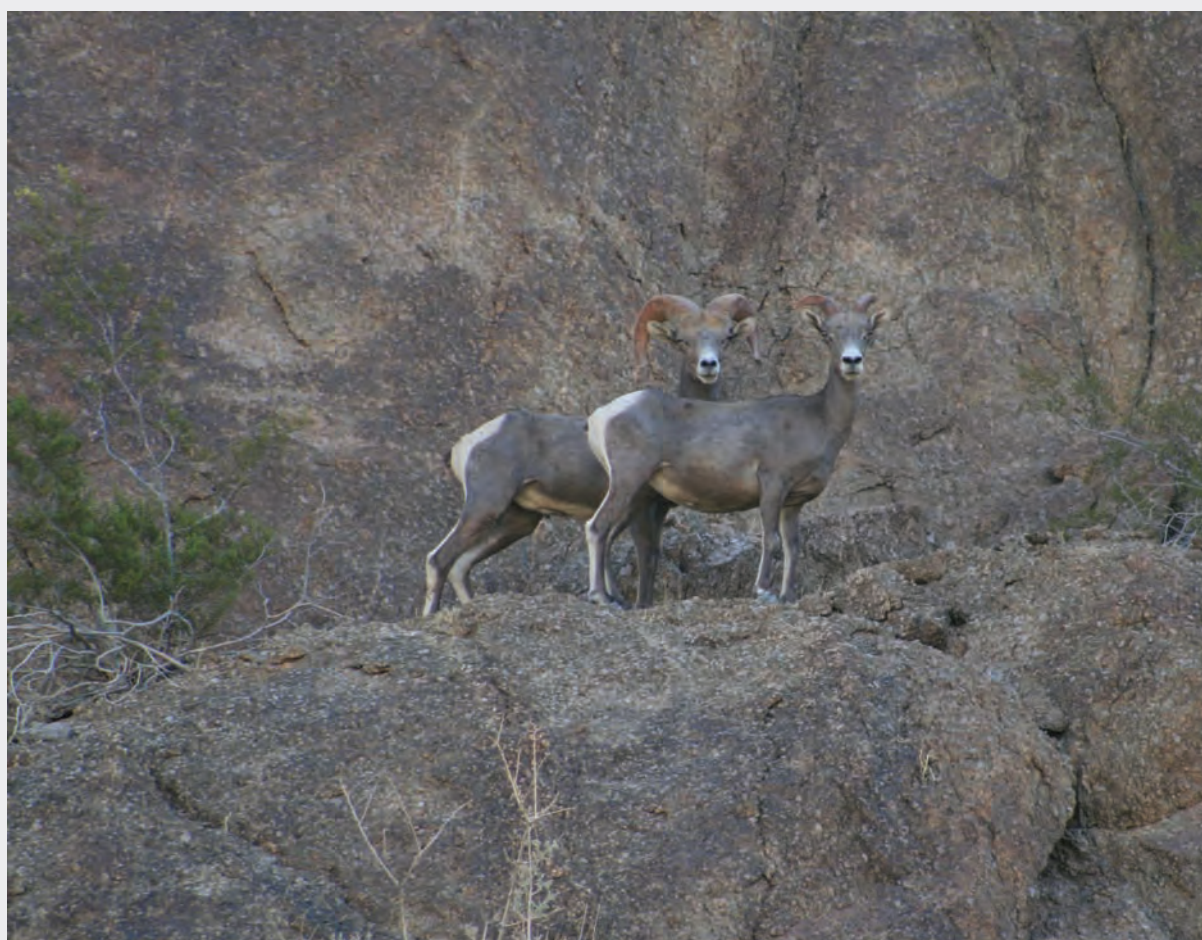
El Pinacate y Gran Desierto de Altar is recognized, in addition to its natural beauty, for being an area with unique features, considered an open laboratory for geological, and ecological studies, of national and international interest for researches.

Project	Institution	Species
Protocol for monitoring bats in the Biosphere Reserve El Pinacate y Gran Desierto de Altar	Reserva de la Biosfera El Pinacate y Gran Desierto de Altar	Bats
Protocol for monitoring Fish in the Biosphere Reserve El Pinacate y Gran Desierto de Altar	Reserva de la Biosfera El Pinacate y Gran Desierto de Altar	Exotic and Natives Species
Protocol for monitoring Pronghorn (<i>Anitlocapra sonorensis</i>) in the Biosphere Reserve El Pinacate y Gran Desierto de Altar	Reserva de la Biosfera El Pinacate y Gran Desierto de Altar	Pronghorn
Protocol for monitoring public use in the Biosphere Reserve El Pinacate y Gran Desierto de Altar	Reserva de la Biosfera El Pinacate y Gran Desierto de Altar	Bighorn Sheep
Research and Collect of Tortuga Casquito in the Sonoyta River	Arizona Game and Fish / Reserva de la Biosfera el Pinacate y Gran Desierto de Altar	Mud Turtle
Research and collect of diverse species of chamaleon in the Biosphere Reserve El Pinacate y Gran Desierto de Altar	Universidad Autonoma de Mexico y Universidad de Sonora	Horned lizard
Research and collect of Desert Turtle in the Biosphere Reserve El Pinacate y Gran Desierto de Altar	Comision de Ecologia y Desarrollo Sustentable (CEDES)	Desert Tortoise
Arrays of sensors for acoustic monitoring of diversity and behavior of birds	ITESM - Campus Estado de México	Birds
Mexican Biodiversity of arachnids	Departamento de Zoología Instituto de Biología UNAM	Arachnids
Collection of birds listed in NOM-059-SEMARNAT-2001	Facultad de Ciencias, UNAM	Birds

Project	Institution	Species
Collection of forage grasses and cool-season legume germplasm in Northern Mexico	Noble Foundation Inc.	Flora
Collection of living plants, herbarium specimens and seeds for the Ethnobotanical Garden of Oaxaca / Scientific Collector License	Jardín Etnobotánico de Oaxaca	Flora
Collections of mammals	CIBNOR, S.C.	mammals
Genetic comparison of <i>Phrynosoma mcallii</i> in Arizona, California and Mexico	Virginia State University	Reptiles
Conservation genetics of a threatened salamander (<i>Ensatina eschscholtzii klauberi</i>)	Instituto de Biología, UNAM	Reptiles
Development of drugs from medicinal plants (DEMEPLAN) in the Mexican Social Security Institute	Instituto Mexicano del Seguro Social	Flora
Ecology of tree squirrels <i>Tamiasciurus mearnsi</i>	Universidad de Arizona	Squirrel <i>Tamiasciurus mearnsi</i>
Ecology of the jaguar and puma in Western Mexico	Fundación Ecológica de Cuixmala A.C.	Capture, immobilization and placing radio collars on 6 jaguars and 6 cougars
Ecology and biogeochemistry of microbial mats	NASA	microbes
Ecology and systematics of phytophagous insects and saprophagous	Instituto de Ecología, A.C., Veracruz	Insects
Monitoring of population of the migratory specie "Murcielago Magueyero" in El Pinacate y Gran Desierto de Altar	Dr. R. Medellin / UNAM / University of Arizona	Bats
Nonlethal effect of predation on habitat selection of prey. Validation of a theoretical model in a mammal predator-prey	Instituto de Ecología, A.C.	Flora

Project	Institution	Species
Status nesting brown pelicans in California, the hocks and Hallet on the coast of Baja California, Sonora and Sinaloa, Mexico.	Servicio Geológico de los Estados Unidos	Bird
Studies of mesquite mice along the Rio Sonoita, Son.	RB El Pinacate y Gran Desierto de Altar	<i>Peromyscus merriami</i>
Biogeographic studies of birds and mammals in mountainous areas of Mexico	Museo de Zoología, Facultad de Ciencias, UNAM	Bird Birds, Mammals
Population studies of the burrowing owl (<i>Athene cunicularia</i>) in Northern Mexico	Escuela de Recursos Naturales, Universidad de Arizona	Tecolote llanero (<i>Athene cunicularia</i>)
Phylogeny of scorpion Family Vaejovidae	Instituto de Biología, UNAM	Scorpions de la Familia Vaejovidae
Inventory of vascular plants	Centro de Investigaciones en Ecosistemas, UNAM	Flora
The tail of the rattlesnake: Evolution and loss of a complex trait	Instituto de Biología, UNAM	<i>Crotalus catalinensis</i> , <i>C. lorenzoensis</i> , <i>C. estebanensis</i> , <i>C. angelinensis</i> .
Scientific Collector License	Departamento de Zoología Instituto de Biología, UNAM	Herpetology
License Collector to capture bats Scientific	Escuela Nacional Preparatoria, UNAM	Bats
License Collector for collection of plants Scientist	Instituto de Ciencias Biomédicas, Universidad Autónoma de Ciudad Juárez	Flora
License Collector for wildlife	SERBO, S.C.	Fauna y flora
License Collector for wildlife	FES-ZARAGOZA, UNAM	Flora
License Collector for wildlife	Facultad de Ciencias, UNAM	Flora
License Collector for wildlife	Instituto de Biología, UNAM	Flora
License Collector for wildlife	Universidad Autónoma del Estado de Morelos	Wildlife
Biological Monitoring in Protected Areas	Instituto de Historia Natural y Ecología, Dirección de Áreas Naturales Protegidas	Wildlife
Monitoring Sonoyta River, Biosphere Reserve El Pinacate y Gran Desierto de Altar, Sonora	Reserva de la Biosfera El Pinacate y Gran Desierto de Altar	Fish

Project	Institution	Species
Morphology of Endemic Rodents in Mexico	Investigador y Curador de la Colección Nacional de Mamíferos, Instituto de Biología, UNAM	Mamíferos <i>Xenomys nelsoni</i> "Rata de Magdalena"
Collector Renewal Scientific	Instituto de Biología, UNAM	arcnids
Zero prevalence and geographical distribution of Hantavirus in Northeast Mexico	Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León	Rodents and bats
Scientific collector	Instituto de Biotecnología, UNAM	arachnids
Collector to work with squirrels	Universidad de Guadalajara	<i>Spermophilus aedocetus</i> , <i>S. annulatus</i> , <i>S. variegatus</i> , <i>S. atricapillus</i>
Scientific collector	Universidad de Miami	Birds



Bighornsheep





07

Documentation



7.a Photographs, slides, image inventory and authorization table and other audiovisual materials

ID No.	Format	Caption	Date of Photo	Photographer/ Director of the video	Copyright owner	Contact Details	Non exclusive cession
1	Digital	AA lava flow	2010	staff	Pinacate	Pinacate	yes
2	Digital	AA lava flow	2009	staff	Pinacate	Pinacate	yes
3	Digital	agua dulce string	2008	staff	Pinacate	Pinacate	yes
4	Digital	agua dulce string	2008	staff	Pinacate	Pinacate	yes
5	Digital	agua dulce string	2008	staff	Pinacate	Pinacate	yes
6	Digital	Animal pawprint	2009	staff	Pinacate	Pinacate	yes
7	Digital	ancestral trail	1989	staff	Pinacate	Pinacate	yes
8	Digital	arrowheads	2007	staff	Pinacate	Pinacate	yes
9	Digital	Bahia Adahlr / ojo de agua	2010	staff	Pinacate	Pinacate	yes
10	Digital	banded gecko	2010	staff	Pinacate	Pinacate	yes
11	Digital	bats monitoring	2008	staff	Pinacate	Pinacate	yes
12	Digital	bats monitoring	2008	staff	Pinacate	Pinacate	yes
13	Digital	bats monitoring	2008	staff	Pinacate	Pinacate	yes
14	Digital	bats monitoring	2008	staff	Pinacate	Pinacate	yes
15	Digital	Big eared bat	2008	staff	Pinacate	Pinacate	yes
16	Digital	Big Horn Sheep	2010	staff	Pinacate	Pinacate	yes
17	Digital	Big Horn Sheep	2009	staff	Pinacate	Pinacate	yes
18	Digital	Black-chinned Hummingbi	2010	staff	Pinacate	Pinacate	yes
19	Digital	bluedotted lizard	2010	staff	Pinacate	Pinacate	yes
20	Digital	Camote del desierto	2009	staff	Pinacate	Pinacate	yes
21	Digital	Campo volcanico peste sa	2007	Nasa	Nasa	Nasa	yes
22	Digital	Cardinal	2009	staff	Pinacate	Pinacate	yes
23	Digital	Cave in tinajas altas	2010	staff	Pinacate	Pinacate	yes

ID No.	Format	Caption	Date of Photo	Photographer/ Director of the video	Copyright owner	Contact Details	Non exclusive session
24	Digital	Cerro colorado	2009	staff	Pinacate	Pinacate	yes
25	Digital	Cerro colorado	2009	staff	Pinacate	Pinacate	yes
26	Digital	chollas mojadas	2010	staff	Pinacate	Pinacate	yes
27	Digital	choya	2009	staff	Pinacate	Pinacate	yes
28	Digital	choyal	2010	staff	Pinacate	Pinacate	yes
29	Digital	choyas	2009	staff	Pinacate	Pinacate	yes
30	Digital	chukwala	2010	staff	Pinacate	Pinacate	yes
31	Digital	chukwala	2011	staff	Pinacate	Pinacate	yes
32	Digital	Cinder cone la mancha	2010	staff	Pinacate	Pinacate	yes
33	Digital	Cinifas	2010	staff	Pinacate	Pinacate	Yes
34	Digital	clay pots	2005	desert museum	desert museum	desert museum	yes
35	Digital	clobis	2007	staff	Pinacate	Pinacate	yes
36	Digital	Cono cinético	2010	staff	Pinacate	Pinacate	yes
37	Digital	Cono volcanico. Flujo de l	2009	staff	Pinacate	Pinacate	yes
38	Digital	Conos y flujos de lava	2010	staff	Pinacate	Pinacate	yes
39	Digital	Conos y flujos de lava	2010	staff	Pinacate	Pinacate	yes
40	Digital	coyote trail	2008	staff	Pinacate	Pinacate	yes
41	Digital	crater badillo.satelitai	2007	nasa	Nasa	Nasa	yes
42	Digital	crater carvajales . Nasa	2007	Nasa	nasa	Nasa	yes
43	Digital	crater celsya	2008	staff	Pinacate	Pinacate	yes
44	Digital	crater celsya	2010	staff	Pinacate	Pinacate	yes
45	Digital	Cráter cerro colorado	2009	staff	Pinacate	Pinacate	yes
46	Digital	crater el colorado	2011	staff	Pinacate	Pinacate	yes

ID No.	Format	Caption	Date of Photo	Photographer/ Director of the video	Copyright owner	Contact Details	Non exclusive cession
47	Digital	Crater Kino	2007	Nasa	Nasa	Nasa	yes
48	Digital	crater la luna	2010	staff	Pinacate	Pinacate	yes
49	Digital	Crater macdougai	2008	staff	Pinacate	Pinacate	yes
50	Digital	Crater macdougai	2011	staff	Pinacate	Pinacate	yes
51	Digital	Crater Molina	2010	staff	Pinacate	Pinacate	yes
52	Digital	Crater Bykes	2011	staff	Pinacate	Pinacate	yes
53	Digital	Crater trebolmolina	2010	staff	Pinacate	Pinacate	yes
54	Digital	Desert puppy fish	2010	staff	Pinacate	Pinacate	yes
55	Digital	desert flower	2008	peter kraesen	P.O. BOX 439 (T. TUCSON, ARIZONA 85733) *KRESANG.COX.NET (520) 321-3200		yes
56	Digital	Desert Iguana	2011	staff	Pinacate	Pinacate	yes
57	Digital	Desert Iguana	2010	staff	Pinacate	Pinacate	yes
58	Digital	Desert tortoise	2010	staff	Pinacate	Pinacate	yes
59	Digital	desert verbena	2010	staff	Pinacate	Pinacate	yes
60	Digital	Desierto de Altar	2011	staff	Pinacate	Pinacate	yes
61	Digital	Diamond back rattlesnake	2009	staff	Pinacate	Pinacate	yes
62	Digital	Dunes del desierto de altar	2010	staff	Pinacate	Pinacate	yes
63	Digital	Eligante -Santacruz	2009	staff	Pinacate	Pinacate	Yes
64	Digital	Eligante -Santacruz	2009	staff	Pinacate	Pinacate	Yes
65	Digital	Eligante -Santacruz	2009	staff	Pinacate	Pinacate	yes
66	Digital	encelia farinosa	2010	staff	Pinacate	Pinacate	yes
67	Digital	encelia farinosa	2008	peter kraesen	P.O. BOX 439 (T. TUCSON, ARIZONA 85733) *KRESANG.COX.NET (520) 321-3200		yes
68	Digital	falcon genus	2010	staff	Pinacate	Pinacate	yes
69	Digital	Father Kino illustration	1874	?	?	?	yes

ID No.	Format	Caption	Date of Photo	Photographer/ Director of the video	Copyright owner	Contact Details	Non exclusive cession
70	Digital	Father Kino map	1688	staff	Instituto sonora Instituto sonora		yes
71	Digital	flower utznata	2008	peter kraesen		P.O. BOX 43117 TUCSON, ARIZONA 85733 PKRESANGCOX.NET (520) 321.3295	yes
72	Digital	Flujo Ives	2011	staff	Pinacate	Pinacate	yes
73	Digital	flujo Ives	2008	peter kraesen		P.O. BOX 43117 TUCSON, ARIZONA 85733 PKRESANGCOX.NET (520) 321.3295	yes
74	Digital	flujo la laja	2011	staff	Pinacate	Pinacate	yes
75	Digital	flujo lava la laja	2011	staff	Pinacate	Pinacate	yes
76	Digital	gila woodpecker	2011	staff	Pinacate	Pinacate	yes
77	Digital	gillmonster	2008	nps	nps	nps	yes
78	Digital	Granite highlands, macedoug	2008	peter kraesen		P.O. BOX 43117 TUCSON, ARIZONA 85733 PKRESANGCOX.NET (520) 321.3295	yes
79	Digital	granitic highlines	2010	staff	Pinacate	Pinacate	yes
80	Digital	Green Ocotillo	2009	staff	Pinacate	Pinacate	yes
81	Digital	Hie'ced'odhana	?	staff	Pinacate	Pinacate	yes
82	Digital	Horned Lizard	2010	staff	Pinacate	Pinacate	yes
83	Digital	Horned Lizard	2009	staff	Pinacate	Pinacate	yes
84	Digital	incienso encelia farinosa	2008	peter kraesen		P.O. BOX 43117 TUCSON, ARIZONA 85733 PKRESANGCOX.NET (520) 321.3295	yes
85	Digital	Itoy caettle	2009	staff	Pinacate	Pinacate	yes
86	Digital	Itoy Cave	2010	staff	Pinacate	Pinacate	yes
87	Digital	ives lava flow	2008	peter kraesen		P.O. BOX 43117 TUCSON, ARIZONA 85733 PKRESANGCOX.NET (520) 321.3295	yes
88	Digital	Jack Rabbit	2009	staff	Pinacate	Pinacate	yes
89	Digital	logger head shrike	2010	staff	Pinacate	Pinacate	yes
90	Digital	macedoug	2008	peter kraesen		P.O. BOX 43117 TUCSON, ARIZONA 85733 PKRESANGCOX.NET (520) 321.3295	yes
91	Digital	maguey bats	2010	?	?	?	yes
92	Digital	maguey bats	2010	?	?	?	yes

ID No.	Format	Caption	Date of Photo	Photographer/ Director of the video	Copyright owner	Contact Details	Non exclusive cession
93	Digital	mal de ojo	2010	staff	Pinacate	Pinacate	yes
94	Digital	Matates	2010	staff	Pinacate	Pinacate	yes
95	Digital	mormon tea /ephedra ssp.	2005	staff	Pinacate	Pinacate	yes
96	Digital	mortar	2009	staff	Pinacate	Pinacate	yes
97	Digital	mobile sand dunes	2010	staff	Pinacate	Pinacate	yes
98	Digital	Nasa research	1963	Nasa	Nasa	Nasa	yes
99	Digital	nest	2010	staff	Pinacate	Pinacate	yes
100	Digital	ocotillo flower	2010	staff	Pinacate	Pinacate	yes
101	Digital	ocotillo suncel	2010	staff	Pinacate	Pinacate	yes
102	Digital	Odham pot.	2007	staff	Pinacate	Pinacate	yes
103	Digital	petroglyph	2005	desert museum	desert museum	desert museum	yes
104	Digital	petroglyph	2008	staff	Pinacate	Pinacate	yes
105	Digital	Pinacate	2009	peter kraehn	P.O. BOX 43317 TUCSON, AZ 85734 PKRESANG.COX.NET (520) 321.3297		yes
106	Digital	pinacate beetle	2008	peter kraehn	P.O. BOX 43317 TUCSON, AZ 85734 PKRESANG.COX.NET (520) 321.3297		yes
107	Digital	Pinacate springline	2008	peter kraehn	P.O. BOX 43317 TUCSON, AZ 85734 PKRESANG.COX.NET (520) 321.3297		yes
108	Digital	Police/taue	2008	staff	Pinacate	Pinacate	yes
109	Digital	Pronhom	2008	staff	conanp	conanp	yes
110	Digital	Pronhom	2009	staff	Pinacate	Pinacate	yes
111	Digital	Pronhom	2010	staff	Pinacate	Pinacate	yes
112	Digital	Pronhom	2008	staff	conanp	conanp	yes
113	Digital	rainbow over choys	2010	staff	Pinacate	Pinacate	yes
114	Digital	red tail hawk	2009	staff	Pinacate	Pinacate	yes
115	Digital	red tail hawk	2011	staff	Pinacate	Pinacate	yes

ID No.	Format	Caption	Date of Photo	Photographer/ Director of the video	Copyright owner	Contact Details	Non exclusive session
116	Digital	Researchers in mactougal	1905 ?		Pinacate	Pinacate	yes
117	Digital	Rioa Sonoyta	2010	staff	Pinacate	Pinacate	yes
118	Digital	rodents monitoring	2009	staff	Pinacate	Pinacate	yes
119	Digital	rodents monitoring	2009	staff	Pinacate	Pinacate	yes
120	Digital	rodents monitoring	2009	staff	Pinacate	Pinacate	yes
121	Digital	rodents monitoring	2009	staff	Pinacate	Pinacate	yes
122	Digital	sahuaro	2008	staff	Pinacate	Pinacate	yes
123	Digital	sahuaro	2010	staff	Pinacate	Pinacate	yes
124	Digital	Sahuaro	2010	staff	Pinacate	Pinacate	yes
125	Digital	Sahuaro's landscape/ lava	2011	staff	Pinacate	Pinacate	yes
126	Digital	Sahuaro- Itoy	2007	staff	Pinacate	Pinacate	yes
127	Digital	Sand dunes	2009	staff	Pinacate	Pinacate	Yes
128	Digital	sand dunes	2008	peter kraehn	Pinacate	Pinacate	yes
129	Digital	Sand landscape	2010	staff	Pinacate	Pinacate	yes
130	Digital	Sand landscape	2010	staff	Pinacate	Pinacate	yes
131	Digital	Sand vegetation	2008	staff	Pinacate	Pinacate	yes
132	Digital	Sand vegetation	2010	staff	Pinacate	Pinacate	yes
133	Digital	Santaclara campo volcanic	2009	staff	Pinacate	Pinacate	Yes
134	Digital	satelite gran desierto de el	2007	Nasa	Nasa	Nasa	yes
135	Digital	Shelter puppy fish	2009	staff	Pinacate	Pinacate	yes
136	Digital	Sierra Alacranes	2010	staff	Pinacate	Pinacate	yes
137	Digital	Sierra Alacranes	2009	staff	Pinacate	Pinacate	yes
138	Digital	Sierra Blanca	2009	staff	Pinacate	Pinacate	yes

ID No.	Format	Caption	Date of Photo	Photographer/ Director of the video	Copyright owner	Contact Details	Non exclusive cession
139	Digital	Sierra del rosario	2008	peter kraesen	P.O. BOX 49917 TUCSON, ARIZONA 85733 PKRESANG.COX.NET (520) 321.3295		yes
140	Digital	sierra el pinacate	2008	peter kraesen	P.O. BOX 49917 TUCSON, ARIZONA 85733 PKRESANG.COX.NET (520) 321.3295		yes
141	Digital	sierra pinacate	2008	peter kraesen	P.O. BOX 49917 TUCSON, ARIZONA 85733 PKRESANG.COX.NET (520) 321.3295		yes
142	Digital	Sonoyta River research	2009	staff	Pinacate	Pinacate	yes
143	Digital	spiny lizard	2009	staff	Pinacate	Pinacate	yes
144	Digital	spiny lizard	2011	staff	Pinacate	Pinacate	yes
145	Digital	Spring blossom	2009	staff	Pinacate	Pinacate	yes
146	Digital	Star shape dunes	2008	peter kraesen	P.O. BOX 49917 TUCSON, ARIZONA 85733 PKRESANG.COX.NET (520) 321.3295		yes
147	Digital	sunset vegetation	2008	peter kraesen	P.O. BOX 49917 TUCSON, ARIZONA 85733 PKRESANG.COX.NET (520) 321.3295		yes
148	Digital	swamp root	2010	staff	Pinacate	Pinacate	yes
149	Digital	tarantula	2008	peter kraesen	P.O. BOX 49917 TUCSON, ARIZONA 85733 PKRESANG.COX.NET (520) 321.3295		yes
150	Digital	teddy bear choyas	2010	staff	Pinacate	Pinacate	yes
151	Digital	Tinaja de emilla	2009	staff	Pinacate	Pinacate	yes
152	Digital	tinajas altas	2009	staff	Pinacate	Pinacate	yes
153	Digital	Tobono Oodhem	2005	staff	Pinacate	Pinacate	yes
154	Digital	Viznaga flower	2009	staff	Pinacate	Pinacate	yes
155	Digital	volcanic landscape	2008	peter kraesen	P.O. BOX 49917 TUCSON, ARIZONA 85733 PKRESANG.COX.NET (520) 321.3295		yes
156	Digital	Volcano illustration	2010	?	?	?	yes
157	Digital	western coralsnake	2010	nps	nps	nps	yes
158	Digital	white vegetation	2011	staff	Pinacate	Pinacate	yes
159	Digital	Zona volcanica	2010	staff	Pinacate	Pinacate	yes
160	Digital	Puerto Penasco turistic ar	2010	staff	Pinacate	Pinacate	yes
161	Digital	Ternaris or salt cedar	2008	staff	Pinacate	Pinacate	yes

ID No.	Format	Caption	Date of Photo	Photographer/ Director of the video	Copyrigh t owner	Contact Details	Non exclusive cession
162	Digital	Highway 2	2010	staff	Pinacate	Pinacate	yes
163	Digital	dry season	2008	staff	Pinacate	Pinacate	yes
164	Digital	biological trail	2010	staff	Pinacate	Pinacate	yes
165	Digital	school bus	2010	staff	Pinacate	Pinacate	yes
166	Digital	children in the visitor cenl	2010	staff	Pinacate	Pinacate	yes
167	Digital	sunset visitor center	2010	staff	Pinacate	Pinacate	yes
168	Digital	condo rojo	2010	staff	Pinacate	Pinacate	yes
169	Digital	Decorat	1993	staff	Pinacate	Pinacate	yes
170	Digital	upper gulf of california	2007	Nasa	Nasa	Nasa	yes
171	Digital	inascdougal	2009	staff	Pinacate	Pinacate	yes
172	Digital	Sonora -Arizona conventio	2009	staff	Pinacate	Pinacate	yes
173	Digital	Chrys sunset	2009	staff	Pinacate	Pinacate	yes
174	Digital	Mammillaria	2010	staff	Pinacate	Pinacate	yes
175	Digital	Enviroment education	2010	staff	Pinacate	Pinacate	yes
176	Digital	surveillance	2009	staff	Pinacate	Pinacate	yes
177	Digital	inepaction	2009	staff	Pinacate	Pinacate	yes
178	Digital	surveillance	2010	staff	Pinacate	Pinacate	yes
179	Digital	sand dunes	2010	staff	Pinacate	Pinacate	yes
180	Digital	Cinifas	2008	staff	Pinacate	Pinacate	yes
181	Digital	side winder rattlesnake	2011	staff	Pinacate	Pinacate	yes
182	Digital	pitahaya and binder cones	2008	staff	Pinacate	Pinacate	yes
183	Digital	Santa clar peak	2010	staff	Pinacate	Pinacate	yes
184	Digital	ocotillo	2009	staff	Pinacate	Pinacate	yes

ID No.	Format	Caption	Date of Photo	Photographer/ Director of the video	Copyright owner	Contact Details	Non exclusive cession
185	Digital	paloverde mirage	2008	staff	Pinacate	Pinacate	yes
186	Digital	cheya landscape	2011	staff	Pinacate	Pinacate	yes
187	Digital	platahaya	2010	staff	Pinacate	Pinacate	yes
188	Digital	Great Desert	2009	staff	Pinacate	Pinacate	yes
189	Digital	Aerial view	2011	staff	Pinacate	Pinacate	yes
190	Digital	ocotillo Ye sahuaro	2011	staff	Pinacate	Pinacate	yes
191	Digital	Sahuaro Sunset	2009	staff	Pinacate	Pinacate	yes
192	Digital	sand storm	2010	staff	Pinacate	Pinacate	yes
193	Digital	Sand landscape	2010	staff	Pinacate	Pinacate	yes
194	Digital	Warm sunset	2008	staff	Pinacate	Pinacate	yes
195	Digital	barrel cactus	2010	staff	Pinacate	Pinacate	yes
196	Digital	Government contribution	2008	staff	Pinacate	Pinacate	yes
197	Digital	Horned Lizard	2011	staff	Pinacate	Pinacate	yes
198	Digital	Mojave shovel nose snake	2011	staff	Pinacate	Pinacate	yes
199	Digital	Biological station	2009	staff	Pinacate	Pinacate	yes
200	Digital	Vehicle routes , interp etc	2010	staff	Pinacate	Pinacate	yes
201	Digital	Vehicle routes , interp etc	2010	staff	Pinacate	Pinacate	yes
202	Digital	shucktoak visitor center	2010	staff	Pinacate	Pinacate	yes
203	Digital	shucktoak visitor center	2010	staff	Pinacate	Pinacate	yes
204	Digital	shucktoak visitor center	2010	staff	Pinacate	Pinacate	yes
205	Digital	information center	2008	staff	Pinacate	Pinacate	yes
206	Digital	Audiovisual room	2009	staff	Pinacate	Pinacate	yes
207	Digital	children at visitor center	2011	staff	Pinacate	Pinacate	yes

7.b Texts relating to protective designation, copies of property management plans or documented management systems and extracts of other plan relevant to the property

Decree of El Pinacate y Gran Desierto de Altar Biosphere Reserve by the Federal Government

Official Journal: Thursday June 10th , 1993

MINISTRY OF SOCIAL

DEVELOPMENT

The decree declare as a Natural Protected Area with the character of Biosphere Reserve, the region known as El Pinacate y Gran Desierto de Altar, located in the municipalities of Plutarco Elias Calles, Puerto Peñasco and San Luis Rio Colorado, Son.

The margin a seal with the national emblem, which reads: United Mexican States .- President of the Republic CARLOS SALINAS de Gortari, Constitutional President of United Mexico States, in exercise of my powers under Article 89, Section I of the Constitution of the United Mexican States, based on the provisions of Articles 27 third paragraph of their own Constitution; 1, Sections IV to VI, 2nd Section III, 5 th fractions II, IV, XI to XIII and XVII, 8, sections I to IV, 38, 44, 45, 46 fraction I, 47, 48, 57 to 61, 63 70, 73, 75 to 78, 160, 161 and 171 of the General Law of Ecological Equilibrium and Environmental Protection, 1 st and 2 nd Section IV of the Federal Law of Tourism, 1, 2, 6 ° fractions I and II, 16 , 38

CONSIDERING

The National Development Plan 1989-1994 states that the planning and execution of government action should be done under the premise that natural resources consti-

tute a fundamental strategic reserve for national sovereignty and the development of the country, so posed consolidating the National System of Protected Natural Areas, and the implementation, management and administration of these areas.

The region known as "El Pinacate y Gran Desierto de Altar", located in the municipalities of Plutarco Elias Calles, Puerto Peñasco and San Luis Rio Colorado, Sonora, fragile ecosystems are representative of desert areas and vegetation and stabilized dunes, home to a wealth of wildlife.

They live in the region endangered species like the Sonoran pronghorn, bighorn sheep, Gila monster, desert tortoise and the chameleon, there is also a large number of endemic plant species.

In El Pinacate y Gran Desierto de Altar are irrationally exploit resources such as volcanic rock or "crumbs" illegally hunted bighorn sheep and pronghorn, and aquifers in the region have been significantly reduced by water extraction subsoil.

That this region has a great geological interest, to include a newly formed volcanic shield, with the presence of cones and craters knows as "maar", unique in the world for its size and beauty.

That the Ministry of Social Development, Agriculture and Water Resources, Agrarian Reform and Tourism, in coordination with the State Government of Sonora, and in collaboration with the Ecology Centre, Na-

tional Autonomous University of Mexico and the Ecology Center of Sonora, technical studies conducted in the geographical area comprising the region of "El Pinacate y Gran Desierto de Altar."

That these technical studies shows the need for the protected area as a matter of Biosphere Reserve, called "El Pinacate y Gran Desierto de Altar" in order to preserve the natural habitats of the region's most fragile ecosystems, securing balance and continuity of its natural resources, to safeguard the genetic diversity of existing species, particularly endemic, threatened and endangered species, to provide a fertile ground for scientific research and study the ecosystem and balance.

That the area enclosed in the official plan that works in the National Ecology Institute of the Ministry of Social Development, where he will establish the Biosphere Reserve "El Pinacate y Gran Desierto de Altar" is made up of federal lands, tortoise and privately owned.

That after consultation and agreement with the communities that inhabit the area, the Ministry of Social Development has proposed to the Executive under my responsibility to incorporate this region into the National System of Natural Protected Areas, with the character of biosphere reserve, so I have to issue the following

DECREE

FIRST ARTICLE .- As public interest is declared a natural protected area with the character of biosphere reserve, the region known as "El Pinacate y Gran Desierto de Al-

tar" located in the municipalities of Plutarco Elias Calles, Puerto Peñasco and San Luis Rio Colorado, Sonora, with a total area of 714-556-50-00 Has. Composed of the core area I called "Sierra El Pinacate and Bahia Adair" You 228,112-75-00 surfaced. The core zone II called "Sierra El Rosario" surfaced 41,392-50-00 has a buffer zone with you 445,051-25-00 surface. Analytic topographic whose description is as follows:

GENERAL POLYGON BORDERING DESCRIPTION

The polygon starts at the vertex 1 of coordinates $Y = 3'584, 100$; $X = 744.800$, from this point with a RAC of $S 04^{\circ} 26'42'' E$ a distance of 14,192.69 meters. Vertex 2 is reached coordinate $Y = 3'569, 950$ $X = 745.900$, from this point with a RAC of $S 11^{\circ} 31'10'' E$ a distance of 26,789.64 meters. 3 reached the apex coordinate $Y = 3'543, 700$; $X = 751.250$, from this point with a RAC of $S 05^{\circ} 21'32'' W$ a distance of 28,374.01 meters. Arrive at vertex 4 of coordinates $Y = 3'515, 450$; $X = 748.600$, from this point with a RAC of $88^{\circ} 38'56'' S$ "E a distance of 10,602.94 meters. Reached the apex 5 of coordinates $Y = 3'515, 200$; $X = 759.200$, from this point with a RAC of $S 74^{\circ} 03'16'' E$ a distance of 1456.02 meters. Arrive at corner 6 of coordinates $Y = 3'514, 800$ $X = 760.600$, from this point with a RAC of $S 87^{\circ} 45'15'' E$ a distance of 15,311.76 meters. Reached the apex 7 of coordinates $Y = 3'514, 200$; $X = 775.900$, from this point with a RAC of $S 64^{\circ} 32'11'' E$ a distance of 2325.94 meters. Reached the apex 8 of coordinates $Y = 3'513, 200$; $X = 778.000$, from this point with a RAC of $S 83^{\circ} 20'44'' E$ a distance of

12,081.39 meters. Reached the apex 9 of coordinates $Y = 3'511, 800$ $X = 790.000$, from this point with a RAC of $S 56^\circ 18'35'' E$ a distance of 3244.99 meters. Reached the apex 10 of coordinates $Y = 3'510, 000$; $X = 792.700$, from this point with a RAC of $S 39^\circ 24'02'' E$ a distance of 7247.06 meters. Reached the apex 11 of coordinates $Y = 3'504, 400$; $X = 797.300$, from this point with a RAC of $S 83^\circ 56'44'' E$ a distance of 6637.01 meters. Reached the apex 12 of coordinates $Y = 3'503, 700$; $X = 803.900$, from this point with a RAC of $70^\circ 33'35'' S E$ a distance of 2704.16 meters. Reached the apex 13 of coordinates $Y = 3'502, 800$ $X = 806.450$, from this point with a RAC of $S 42^\circ 09'45'' E$ a distance of 12,141.76 meters. Reached the apex 14 of coordinates $Y = 3'493, 800$ $X = 814.600$, from this point with a RAC of $S 47^\circ 39'46'' E$ a distance of 6087.69 meters. Reached the apex 15 of coordinates $Y = 3'489, 700$; $X = 819.100$, from this point with a RAC of $S 22^\circ 55'55'' E$ a distance of 2823.11 meters. Reached the apex 16 of coordinates $Y = 3'487, 100$; $X = 820.200$, from this point with a RAC of $S 87^\circ 41'46'' E$ a distance of 17,414.07 meters. Reached the apex 17 of coordinates $Y = 3'486, 400$; $X = 837.600$, from this point with a RAC of $N 46^\circ 56'33'' E$ a distance of 27,146.45 meters. Reached the apex 18 of coordinates $Y = 3'510, 600$ $X = 849.900$, from this point with a RAC of $S 81^\circ 52'11'' E$ a distance of 707.10 meters. Reached the apex 19 of coordinates $Y = 3'510, 500$; $X = 850.600$, from this point with a RAC of $N 42^\circ 30'37'' E$ a distance of 1627.88 meters. Reached the apex 20 of coordinates $Y = 3'511, 700$;

$X = 851.700$, from this point with a RAC of $N 77^\circ 00'19'' E$ a distance of 4002.49 meters. Reached the apex 21 of coordinates $Y = 3'512, 600$ $X = 855.600$, from this point with a RAC of $N 54^\circ 46'56'' E$ a distance of 4161.73 meters. Reached the apex 22 of coordinates $Y = 3'515, 000$; $X = 859.000$, from this point with a RAC of $N 59^\circ 02'10'' E$ a distance of 1166.19 meters. Reached the apex 23 of coordinates $Y = 3'515, 600$ $X = 860.000$, from this point with a RAC of $82^\circ 52'29'' S E$ a distance of 3244.90 meters. Reached the apex 24 of coordinates $Y = 3'515, 200$; $X = 863.200$, from this point with a RAC of $S 71^\circ 33'54'' E$ a distance of 3162.27 meters. Reached the apex 25 of coordinates $Y = 3'514, 200$; $X = 866.200$, from this point with a RAC of $N 60^\circ 29'18'' E$ a distance of 12,180.31 meters. Reached the apex 26 of coordinates $Y = 3'520, 200$; $X = 876.800$, from this point with a RAC of $N 39^\circ 48'20'' E$ a distance of 3124.09 meters. Reached the apex 27 of coordinates $Y = 3'522, 600$ $X = 878.800$, from this point with a RAC of $N 01^\circ 41'04'' W$ a distance of 17,007.35 meters. Reached the apex 28 of coordinates $Y = 3'539, 600$ $X = 878.300$, from this point with a RAC of $N 71^\circ 33'54'' W$ a distance of 140,721.35 meters. Vertex 1 is reached where the polygon is closed with an area of 714,556-50-00 has.

CORE ZONE I

BORDERING DESCRIPTION

"Sierra El Pinacate and Adair Bay"

The polygon starts at the vertex 1 of coordinates $Y = 3'544, 600$ $X = 797.300$, from this point with a RAC of $S 07^\circ 38'11'' E$ a distance of 36,1290.35 mts. vertex 2 is reached coor-

dinate $Y = 3'508, 00$ $X = 802.100$, from this point with a RAC of $S 47^\circ 29'22''W$ a distance of 6511.52 meters. 3 reached the apex coordinate $Y = 3'504, 400$; $X = 797.300$, from this point with a RAC of $S 83^\circ 56'44''E$ a distance of 6637.01 meters. Arrive at vertex 4 of coordinates $Y = 3'503, 700$; $X = 803.900$, from this point with a RAC of $70^\circ 33'35''S E$ and a distance of 2704.16 meters. Reached the apex 5 of coordinates $Y = 3'502, 800$ $X = 806.405$, from this point with a RAC of $S 42^\circ 09'45''E$ a distance of 12,141.76 meters. Arrive at corner 6 of coordinates $Y = 3'493, 800$ $X = 814.600$, from this point with a RAC of $N 02^\circ 36'09''E$ a distance of 4404.54 meters. Reached the apex 7 of coordinates $Y = 3'498, 200$; $X = 814.800$, from this point with a RAC of $S 78^\circ 44'41''E$ a distance of 20,494.14 meters. Reached the apex 8 of coordinates $Y = 3'494, 200$; $X = 834.900$, from this point with a RAC of $N 05^\circ 42'38''E$ a distance of 1004.98 meters. Reached the apex 9 of coordinates $Y = 3'495, 200$; $X = 835.000$, from this point with a RAC of $N 54^\circ 27'44''E$ a distance of 860.23 meters. Reached the apex 10 of coordinates $Y = 3'495, 700$; $X = 835.700$, from this point with a RAC of $S 67^\circ 55'55''E$ a distance of 3992.49 meters. 11 reached the apex coordinate $Y = 3'494, 200$; $X = 839.400$, from this point with a RAC of $N 04^\circ 56'21''W$ a distance of 8130.19 meters. Reached the apex 12 of coordinates $Y = 3'502, 300$ $X = 838.700$, from this point with a RAC of $N 20^\circ 09'27''E$ a distance of 16,830.92 meters. Reached the apex 13 of coordinates $Y = 3'518, 100$; $X = 844.500$, from this point with a RAC of $N 86^\circ 41'53''E$

a distance of 10,417.29 meters. Reached the apex 14 of coordinates $Y = 3'518, 700$; $X = 854.900$, from this point with a RAC of $N 02^\circ 13'17''W$ a distance of 23,217.45 meters. Reached the apex 15 of coordinates $Y = 3'514, 900$ $X = 854.000$, from this point with a RAC of $N 88^\circ 10'19''W$ a distance of 9404.78 meters. Reached the apex 16 of coordinates $Y = 3'542, 200$; $X = 844.600$, from this point with a RAC of $N 59^\circ 44'36''W$ a distance of 6946.22 meters. Reached the apex 17 of coordinates $Y = 3'545, 700$; $X = 838.600$, from this point with a RAC of $88^\circ 28'27''S W$ and a distance of 41,314.64 meters. Vertex 1 is reached where the polygon is closed with an area of 228,112-75-00 Has.

CORE ZONE II

BORDERING DESCRIPTION

"Sierra el Rosario"

The polygon starts at the vertex 1 of coordinates $Y = 3'562, 000$; $X = 753.300$, from this point with a RAC of $S 01^\circ 13'55''E$ a distance of 18,604.30 meters. Vertex 2 is reached coordinate $Y = 3'543, 400$; $X = 753.700$, from this point with a RAC of $N 8^\circ 12'07''E$ a distance of 22,310.98 meters. 3 reached the apex coordinate $Y = 3'544, 100$; $X = 776.000$, from this point with a RAC of $N 01^\circ 14'19''$ and a distance of 18,504.32 meters. Arrive at vertex 4 of coordinates $Y = 3'562, 600$ $X = 775.600$, from this point with a RAC of $88^\circ 27'31''S$ and a distance of 22,308.07 meters. Vertex 1 is reached where the polygon is closed with an area of 41,392-50-00 Has.

ARTICLE SECOND .- The conservation, management, development and monitoring of

the Biosphere Reserve “El Pinacate y Gran Desierto de Altar” is in charge of the Ministry of Social Development with the participation corresponding to other units of the Public Administration Federal.

ARTICLE THIRD .- The Ministry of Social Development with the participation corresponding to other agencies of the Federal propose the conclusion of coordination with the state government of Sonora, with the participation of the Municipalities of Plutarco Elias Calles, Puerto Peñasco and San Luis Rio Colorado, in matters deemed necessary, including:

- I.-The manner in which the state government and the municipalities involved will participate in the administration of the Reserve;
- II. - The coordination of federal policies applicable in the protected area, with the state and participating municipalities;
- III. - The development of the program management of the reserve with the formulation of commitments for its implementation;
- IV. - The origin and destination of financial resources for the management of the Reserve;
- V. - The types and shapes as conducted research and experimentation in the Reserve;
- VI. - The actions of inspection and monitoring to verify compliance with this decree and other applicable provisions, and
- VII. - The forms and patterns of consultation with the community, social groups and scientific and academic groups.

ARTICLE FOURTH .- For the administration and development of the Biosphere Reserve “El Pinacate y Gran Desierto de Altar”, the

Social Development Secretariat will propose the signing of agreements of cooperation with private and social sectors and the inhabitants of the area, to:

- I. - Ensuring the protection of ecosystems in the region;
- II. - To promote the sustainable development of the community, and
- III. - Provide advice to its inhabitants for the rational and sustainable utilization of natural resources in the region.

ARTICLE FIFTH .- The Ministry of Social Development program management of the Biosphere Reserve “El Pinacate y Gran Desierto de Altar”, with the participation corresponding to other agencies of the Federal, State and the Municipalities of Sonora Plutarco Elias Calles, Puerto Peñasco and San Luis Rio Colorado, do pursuant to coordination agreements to be concluded.

ARTICLE SIXTH. - The program management of the Biosphere Reserve “El Pinacate y Gran Desierto de Altar,” must contain at least the following:

- I. - The description of the physical, biological, social and cultural reserve, the national, regional and local levels;
- II. - The actions to be taken long-short, medium and long term, establishing its relationship with the Democratic National Planning System. These actions include research, resource use, conservation, environmental education, dissemination, operation, monitoring, coordination, monitoring and control;
- III. - The specific objectives of the Reserve and

IV.- The rules for the use of flora and fauna, for research and experimentation, protection of ecosystems, as well as those designed to prevent contamination of soil and water.

ARTICLE SEVENTH. - The construction of buildings or facilities in the Reserve, subject to the provisions of this decree, the management program and other applicable legal provisions.

ARTICLE EIGHTH. - The productive activities that make communities living in buffer zone of the Biosphere Reserve “El Pinacate y Gran Desierto de Altar”; the use of wildlife for research and experimentation, so the activities of conservation of ecosystems and their components, scientific research and environmental education will be subject to the restrictions in the management program and applicable Mexican Official Standards.

ARTICLE NINTH.- The Ministry of Social Development will promote the establishment of closed forests in the Biosphere Reserve “El Pinacate y Gran Desierto de Altar”; considering the socio-economic and technical studies carried out in coordination with the Ministry of Agriculture and Water Resources

ARTICLE TENTH. - The Biosphere Reserve “El Pinacate y Gran Desierto de Altar” is declared and indefinite total ban hunting and trapping of the following species:

- I. - Pronghorn (*Antilocapra americana*);
- II. - bighorn sheep (*Ovis canadensis*);
- III. - Gila Monster (*Heloderma suspectum*);
- IV. - Desert Tortoise (*Gopherus agassizi*);
- V. - Chameleon (*Phrynosoma mcalli*) and

VI. - All those endemic, rare, threatened and endangered species.

ARTICLE ELEVENTH. - The use, exploitation and utilization of national waters located in the Reserve, are governed by the applicable legal matter and is subject to:

- I. - The official Mexican standards for the conservation and utilization of wildlife and its habitat, as well as for avoiding water pollution;
- II. - The policies and restrictions for the protection of flora and fauna, established in the management program, and
- III. - The agreements for concerted action to protect the ecosystems to be concluded with the productive sectors and communities in the region.

ARTICLE TWELFTH.- The owners and possessors of land located in the Biosphere Reserve “El Pinacate y Gran Desierto de Altar” are required to conserve the area under this decree, program management and other applicable legal provisions.

ARTICLE THIRTEENTH.- The notaries and public federatarios involved in the acts, agreements, contracts and any other on the ownership, possession or other rights related to real estate located in the Biosphere Reserve “El Pinacate y Gran Desierto Altar, “will refer to this declaration and its registration information in the public records of property as appropriate.

ARTICLE FOURTEENTH.- Violations of the provisions of this decree shall be punished by the competent authorities, in terms of the General Law of Ecological Equilibrium and

Environmental Protection, the Forest Law, Federal Hunting Law, Law National Water and other applicable legal provisions.

ARTICLE FIFTEENTH. - The Ministry of Social Development, Agriculture and Water Resources, Agrarian Reform and Tourism, will watch in their respective areas of competence, strict compliance with this decree.

TRANSIENT

FIRST. - This Decree shall enter into force on the day following its publication in the Official Journal of the Federation.

SECOND. - Report the present decree the owners or occupants of the land within the Biosphere Reserve "El Pinacate y Gran Desierto de Altar." If ignored their names and addresses, there will be a second publication of this decree in the Official Journal of the Federation, which shall take effect personal service on such owners or possessors, from which they will within 90 calendar days to express to the Secretariat of Social Development which in his interests.

THIRD. - The Ministry of Social Development will develop the program management of the Biosphere Reserve "El Pinacate y Gran Desierto de Altar," a term of 365 calendar days from the date of entry into force of this decree.

FOURTH. - The Ministry of Social Development shall examine the registration hereof in the public records of property as appropriate and in the National System of Protected Natural Areas, within 90 calendar days after its publication in the Official officer of the Federation.

FIFTH. - abrogates the decree declaring Forest Protected Area and Wildlife Refuge, the area known as Sierra del Pinacate, published in the Official Journal of the Federation on March 29TH, 1979.

SIXTH. - The administrative abrogate contravene this decree.

MANAGEMENT PROGRAM

El Pinacate y Gran Desierto de Altar (Nominated Property)

Summary

I. INTRODUCTION.

El Pinacate y Gran Desierto de Altar Biosphere Reserve, was declared on June 10th 1993 by the then President Carlos Salinas de Gortari. Located on the northwest corner of State of Sonora, Mexico, between 113 ° 00'-114 ° 30'W and 31 ° 30'-32 ° 30'N, comprises a total area of 714,556.5 ha. And covers the municipalities of Plutarco Elias Calles, Puerto Peñasco and San Luis Rio Colorado.

The importance of the declaration of the El Pinacate y Gran Desierto de Altar Biosphere Reserve is supported by the need to preserve unique scenic and aesthetic values in the world. These values are represented by approximately 200,000 hectares covering a spectacular volcanic shield with all that variety of geological formations of their own origin are amazing lava flows, the highest concentration in the world of giant Maar craters, about 400 cinder cones and nearly 500,000 hectares covered by vast plains of sand and areas with active dunes.

Another need that supports its declaration is to preserve prehistoric values, history and culture of great importance for understanding the early occupation of America, and that it is also a place of great spiritual and cultural significance for Tohono O'odham (commonly known as Pápagos).

There is the need to maintain a high biodiversity evident in the approximately 560

species of vascular plants are distributed in the region and most of which are located within the Reserve also the presence of at least 41 species of mammals, 184 species of birds, 43 species of reptiles, amphibians and 42 native species of freshwater fish (Búrquez and Castillo, 1993).

According to this decree, the reserve is divided into two areas with specific objectives Conservation. The Core and Buffer Zone. The core zone comprises two different areas:

A) The Sierra El Rosario in the extreme northwest of the Reserve, an area of 41,392.5 ha. Its importance lies in the fact that an isolated mountain surrounded by fields of active dunes.

B) The Sierra El Pinacate in Central and Eastern part of the Reserve with an area of 228,112.75 ha. It is important because it contains most of the volcanic shield that gives identity to the area.

The buffer zone includes the remaining area of the Reserve with an surface of 445,051.25 ha. This area contains important elements for conserving and its primary function is to reduce the negative impacts on core areas.

II. BACKGROUND

There is now a continuing trend toward globalization, which includes our perception of ecological and environmental problems. This globalizing attitude is evident especially in the tendency to define problems on ecological research from a global perspective (Von Droste, 1987).

This successful approach was the globalization trend that framed the 2nd Earth Summit in Rio de Janeiro, Brazil in June 1992.

This summit was based in the principle that all countries of the world must participate in solving environmental problems. The current tragic dimensions it has assumed a global ecological catastrophe is a problem that concerns all countries and the solution to them must be from a global perspective. The Man and Biosphere Program (MAB) by UNESCO, attempts to revisit and analyze environmental problems from a global perspective while seeking solutions applicable to these problems at different levels: National, regional and international levels.

The concept of "Biosphere Reserve" was developed in 1974 by a study group assembled by UNESCO. Biosphere Reserves are areas; ecologically representative established with the objective of conserving genetic resources and promotes international cooperation through ecological research and monitoring of environmental parameters.

The overall objectives for the entire biosphere reserve are:

- Conserving biodiversity and integrity of biotic communities within natural ecosystems and semi-natural, and protect the genetic diversity of species that live there.
- To provide areas for ecological and environmental research, including studies of basic research and control and monitoring in and around the reserves.
- Provide opportunities for environmental education and training.
- Work with communities within and outside the reserve to develop ways of rational use of resources and thus support conservation goals.

Within this general framework, and considering that environmental problems that can not considered apart from poverty, have come to occupy the highest rank of priority for all governments in the world, when the then president of México Carlos Salinas de Gortari declared in June 1993, the El Pinacate y Gran Desierto de Altar Biosphere Reserve.

III. RESERVE DIAGNOSTIC.

This section describes the relevant items from the standpoint of environmental, socio-economic, cultural and historic within the area:

Physical Aspects.

- Geology
- Physiography and Geomorphology
- Soils
- Weather
- Hydrology

Biological Aspects:

- Vegetation and Flora
- Fauna

Scenic Values:

- Key Elements
- Dune Fields
- Sierra Pinacate
- Streambeds
- Floodplains

Socioeconomics Aspects:

- Demography
- Land
- Infrastructure
- Economic base of the Reserve

Historical and Cultural Aspects:

Problematic:

IV. OBJECTIVES.

A. DECLARATION OF EL PINACATE Y GRAN DESIERTO DE ALTAR BIOSPHERE RESERVE.

General Objective:

The decree of the El Pinacate y Gran Desierto de Altar Biosphere Reserve proposed for the future generations to maintain the continuity of the biological processes of arid ecosystem from the Sonoran Desert, and protect geological and geomorphological events, the historical, cultural and scenic. Treating these conservation activities are intimately linked to the productive activities of the region and that they are feasible under sustainable development perspective.

B. MANAGEMENT PROGRAM FOR THE BIOSPHERE RESERVE EL PINACATE Y GRAN DESIERTO DE ALTAR.

General Objective:

Establish lines of work to ensure the permanence of biotic and abiotic values of the reserve and control the socioeconomic activities that take place in the area, to be compatible with the conservation of natural resources in the reserve, area uses and the development of the resources required for monitoring activities.

Particular Objectives:

1. To preserve, protect and restore where appropriate, the biological, ecological and physical Reserve's values, ensuring continuity of processes for the future generations.
2. To preserve, protect and restore where appropriate, historical and archaeological values in the reserve and to rescue the cultural traditions of the Tohono O'odham Nation.

V. GUIDELINES MANAGEMENT.

Strategies Management:

Based on the impacts caused by socioeconomic activities and public key defined for the reservation landscape, it raises a number of management strategies. It is clear that solving the specific problems of this reserve requires the control of the activities taking place within it, from two perspectives:

1. Use of the area from the residents.
2. Public use.

To achieve the objectives of the management program is necessary not only to community involvement, also a process of coordination and cooperation at the governmental and non governmental agency, as well as community participation and civil society in general.

1. Interagency coordination:

El Pinacate y Gran Desierto de Altar Biosphere Reserve generated from the development of its proposal an agreement with five institutions of the core group responsible for the development of this management program. Plus a wide participation of other institutions as partners. Particular emphasis on the relation between SEMARNAT and the State Government to initiate emerging management actions.

2. Community consultation.

Considered an essential synergy, consultation with residents and users of the reserve in terms of cooperation for the management and operation of the area in this sense the formulation of the management program are conducted informational meetings with

residents of the reservation (private landholders and owners), representatives of the farmers, representatives of municipal authorities, members of the Tohono O'odham Nation, productive sectors and environmental groups.

3. Scientific consensus:

Indispensable to define conservation and management of natural resources within the Reserve, according to a technical support for researches from various institutions. At the same time it is important to the continued participation of these academic institutions to submit research and develop projects that enrich the knowledge and understanding of the processes taking place in the area.

4. Consultation with NGO's:

Consultation with NGO's is essential, since these organizations represent a potential source of logistical, technical and financial support for the development of component and subcomponents within the program.

APPLICABLE LAWS AND REGULATIONS FOR THE ADMINISTRATION AND OPERATION OF THE RESERVE.

The use and rational exploitations of the resources in a reserve are regulated by existing legislation for each particular resource; however there is a legal general The General Law of Ecological Equilibrium and Environmental Protection LEGEEPA.

This law specifies restrictions that should be subject to the use and enjoyment of water, land, flora, fauna and mineral resources in the reserve.

The General Law of Ecological Equilibrium

and Environmental Protection, Title Two, Chapter I, Section 1, Article 45, paragraph II, III, IV, V and VII indicates that you must make rational use of existing resources, generate scientific and technological research that will allow the rational use and protection of natural and historic environment for the sake of culture and national identity.

Article 48 states that may not be authorized new settlements. The Article 69 states that the measures the Federal Government may impose for the protection of the reserve will be set out by the respective subjects of this law, as well as those listed in the Forestry Law, the new National Water Act, the Hunting Act and other laws that may apply which may restrict or prohibit activities that disturb ecosystems and to impose rules on private Property and regulate the exploitation of natural resources susceptible of ownership, such measures being included in closures whether temporary or permanent total or partial.

Section 70 of the same Act states that in the core area is prohibited: dumping or discharge of contaminants in soil, subsoil and any kind of power or water tank and perform any Pollutant.

Fraction II of the same article states not to interrupt or divert water flows in Section III, says hunting is prohibited activities or exploitation and utilization of species of flora and fauna.

In Article 87 refers not to allow the use of natural populations of endemic, threatened or endangered, except in cases of scientific research. Regarding to land in the reserve

land occupied these are to be regulated by the new Farm Bill because of the changes experienced by the Article 27 of the Constitution. In general, the modifications made to this article shortly change or alter the three modes of land in the reserve as they are, ejido land ownership and national small.

It should be clear that the declaration of the Biosphere Reserve at any time mention the expropriation of ejido land or small property, so the ejido and the owner of small property, no matter where locate their premises, shall retain the rights conferred by the new Land Law, as the ejidatarios have the right to sell, lease or partnership under the new arrangements gives the changes in Article 27 of the Constitution.

Reserve's Regulations:

With the declaration of the Biosphere Reserve, there were established two management zones (Core zone and Buffer zone) with specific objectives and general activities allowed to develop within them. Based on this specific proposed legislation for each, directing it to particular uses four distinct groups:

- Resident's socioeconomics use.
- Visitor's to public use.
- Researchers.
- Tohono O'odham Nation members.

A) CORE ZONE

1. Socioeconomic Use:

- a) Agriculture is prohibited within the core area.
- b) Should be restricted to eliminate the live-

stock within the core area, those engaged in extensive cattle ranchers in this area should seek ways to prevent the passage of livestock to the core area. Immediately limit the introduction of more won in the general area of the reserve until they have been determined coefficients pasture for each of the land dedicated to this activity.

c) It is prohibited the extraction of mineral resources of any kind within the core area. Those who do not have current permits should suspend all activity extraction immediately.

d) Prohibited the removal or destruction of any flora and fauna resources within the core area.

e) Prohibited the hunting for sport or for commercial purposes within the area nucleus.

f) Do not allow the growth or new investments on existing productive activities or the development of new productive activities in the core area.

2. Public Use:

a) It shall be restricted establishment of camps inside the core zone.

b) Is restricted to the bare minimum, the development of infrastructure within the core Zone.

c) Allow for public input to the core zone under strict rules to be issued by SEMARNAT and depending on the tourism carrying capacity, only the following areas:

- 1) The Elegante - Cerro Colorado.
- 2) Red Cone.
- 3) Hick to the Pico Pinacate.

- 4) Route to McDougal Crater
 - 5) Dunes by the access road on Federal Highway Number 8 Puerto Peñasco-Sonoyta up to the Sierra Blanca.
 - 6) Sierra Del Rosario.
 - d) The production of fires is prohibited within the core zone, except those ceremonial fires made by members of the O'odham Nation.
 - e) It is forbidden to drive off established roads and places beyond suitable for vehicular access of any kind, and the performance of any event.
 - f) It is prohibited to litter within the core area, people entering this place should carry out all the waste.
 - g) The introduction or carry any firearms.
 - h) The introduction of alcohol and drugs is restricted, as well as the passage of intoxicated persons and/or under the influence of drugs.
 - i) It is prohibited to excessive noise pollution.
 - j) For purposes of human fecal droppings should be used holes and cover health properly.
 - k) It is forbidden to hunt.
 - l) The extraction, removal, destruction, alteration or disturbance of any natural resources (flora and fauna and ground water, soil and other physical elements) present in the area, as well as archaeological evidence It is prohibited.
 - m) The introduction of nonnative flora and fauna in the core area.
3. Scientific Use:
- a) Enable the development of any manipula-

tive or destructive investigation prior SEDESOL and authorization record in the Address Book.

- b) Allow only non-destructive research projects or mining.
 - c) In the few cases to justify the collection of specimens should have special permits issued by the Ministry of Social and specimens should be returned after of study, scientific collections registered with it.
 - d) To carry out any research within the reserve must be submitted a project, which be reviewed and approved as appropriate for a "consultative committee" to advise the administration Reserve. This committee will turn it over to the respective opinion, to SEDESOL for approval. A copy of all research results should be delivered, and integrated data Reserve files.
 - e) The investigator must abide by all provisions of the Reserve Rules of Procedure.
 - f) For purposes of archaeological research prohibits the destruction and removal of evidence or archaeological features, and remote if warranted removal of any evidence must be authorized by INAH and with the approval of the representatives of the Historic-Cultural Consultation committee and the representative of that Tohono O'odham committee.
4. Tohono O'odham Culture Use.
- a) Do not restrict entry to the O'odham in the core area.
 - b) Groups over 20 people requires registration.
 - c) Permission is granted When access by car on all roads established by the reserve, but ve-

hicles shall not get off the road.

d) Permission is granted to the traditional use of natural resources and sacred sites that are not of type extractive or destructive. The collection of seed or fruit is allowed as well as the implementation of ceremonial fires with dead wood.

e) The removal, destruction or sale of any evidence archeology is Prohibited.

f) It is forbidden to hunt any animal protected by law, the commitment to revise this standard in five years, depending on the population status of species and considering the possibility of allowing the traditional harvest (without firearms) of some species mule deer, for ceremonial use.

B) BUFFER ZONE

1. Socioeconomic Use:

a) Permission is granted to medium-term follow-up of those productive activities exist in the area represent a source of income for the inhabitants of the reserve, established the review engagement to propose measures for restructuring long term, in the case of those activities in contravention of the conservation objectives of the reserve.

b) Is restricted growth and new investments on existing productive activities and the creation of new productive activities without prior approval from the Reserve and without the timely submission of environmental impact assessment and authorization of SEMARNAT

c) Do not encourage the development of new centers of population.

d) It is prohibited the extraction of natural resources (flora and fauna of aquatic and terrestrial) and mineral resources without permission of SEMARNAT

e) With the permission of SEMARNAT it is allowed the collection of dead wood for household consumption (for residents) and only in the medium term.

f) Must apply the standards and criteria for the design of buildings and architecture landscape.

g) For any lighting project in the reserve area is recommended lamps sodium vapor as a protective mechanism of clarity at night.

2. Public Use:

a) Permission is granted to the establishment of camp only in areas designated by the Reserve and based on the internal rules of the same.

b) Permission is granted to public entry to the reserve for authorized access (Los Norteños, los Vidrios, McDougal, Sierra del Rosario, The duness), under the rules defined above.

c) Requires the registration of visitors at the entrances indicated.

d) The production of fires outside the areas specified by the Reserve is Prohibited. To fire it should bring their own firewood and must be purchased outside the reserve.

e) It is forbidden to drive off established roads and places beyond those that are suitable for vehicular access of any kind, and the performance of any event.

f) It is prohibited to litter and waste within the buffer zone, people entering this place

should carry it off, all their waste.

- g) The introduction of any firearms.
- h) The introduction of alcohol and drugs as well as the passage of intoxicated persons and / or under the influence of drugs is restricted.
- i) It is prohibited to excessive noise pollution.
- j) Hunting is prohibited.
- k) the extraction, removal, destruction, alteration and disturbance of all natural resources (flora and fauna and ground water, soil and other physical elements) present in area, as well as archaeological evidence is prohibited.
- l) The introduction of nonnative flora and fauna of the buffer zone except permission and supervision from the Reservation.

3. Scientific Use:

- a) Enable the development of any manipulative or destructive investigation prior SEDESOL and authorization record in the Address Book.
- b) For any inquiry within the reservation must be submitted a project, which be reviewed and approved as appropriate for a "consultative committee" to advise the administration the reserve. This committee will issue the ruling and being favorable turn it over to SEDESOL for approval. A copy of all research results must be delivered to the Reserve for inclusion in your files.
- c) Research projects will be allowed with prior approval manipulative Committee Consultation and approval of SEMARNAT
- d) The collection of specimens must have special permits issued by SEMARNAT The

specimens collected should be deposited in scientific collections recorded the same SEMARNAT.

- e) The investigator must abide by all provisions of the Rules of Procedure Reserve.
- f) For purposes of archaeological research prohibits the destruction and removal evidence or archaeological features, and remote if warranted removal some evidence must be authorized by INAH and with the approval of the representatives of advisory committee Historic-Cultural O'dham and the representative of that committee. All archaeological researches will SEDESOL for approval and materials shall be deposited in the Reserve or where assigned Reserve in coordination with the INAH in accordance with the laws on the subject.

4. Tohono O'dham culture Use:

- a) The entry of all Tohono O'dham upon registration at the entrance to the reserve.
- b) For groups over 20 people requires registration.
- c) Allow access by car to all the paths set by the Fed, but will prohibited the use of vehicles off the roads.
- d) Permission is granted to the traditional use of natural resources and sacred sites, under agreement with Reserve management.
- e) Prohibited the removal or destruction of any archaeological evidence.
- f) It is forbidden to hunt any animal protected by law, the commitment to revise this standard in 5 years, depending on the population status of species and considering the possibility of allowing the traditional harvest

(without firearms) of species such as mule deer for ceremonial use of the O'odham.

g) Is an open possibility of establishing a residence within the area O'odham of damping for the people of this nation that works for the Reserve.

h) Establish cultural property rights of the O'odham sacred sites on and traditional names described in the draft Place Names of the Reserve.

VI. MANAGEMENT COMPONENTS.

A. RESEARCH COMPONENT.

General Objective develop research and monitoring programs in the short, medium and long term to deepen their knowledge and get the items as a basis to establish new policies for managing natural resources, historical and cultural elements and socioeconomic factors within the reserve.

B. COMPONENT OF EDUCATION AND PUBLIC USE

General Objective

Encourage and support active participation in the management, protection and rational use of natural and cultural resources through a deep understanding and appreciation of natural and cultural history of the El Pinacate y Gran Desierto de Altar biosphere reserve.

C. COMMUNITY DEVELOPMENT COMPONENT

General Objective:

Implement technical assistance programs and economic restructuring of the Reserve residents make use of the natural resources therein, in order to harmonize the conservation objectives of the Reserve with the sus-

tainable use of resources.

D. COMPONENT OF CONSERVATION AND MANAGEMENT

General Objective:

Conservation measures, protection and restoration of natural resources and geological features, historical and cultural, and public control access to the reserve to prevent deterioration and contribute to their recovery. Developing the infrastructure and services necessary for the operation of the Reserve and provides security for residents and visitors.

VII. ADMINISTRATION AND FINANCE.

For the administration and management of the reserve there are three main elements

A. Organizational structure:

According to the decree that created El Pinacate y Gran Desierto de Altar Biosphere Reserve conservation, management, development and monitoring are the responsibility of the Secretariat of Environment and Natural Resources (SEMARNAT) with the participation corresponding to other federal government departments.

Based on this decree, SEMARNAT requires propose the conclusion of agreements with the State government and the municipalities involved, to establish among other things, the way they participate in the management of the Reserve.

The management program is a planning instrument whose function is to present strategies and projects for the short, medium and long term.

It is essential that is always updated and responsive for changing conditions and needs of socio-economic and natural reserve.

Therefore mechanisms should be designed to detect and incorporate those new elements or situations that affect the reservation. Also in the process of implementing the management program should incorporate concepts that are related to adaptive management and other concepts that lead to efficient management of protected natural area and its natural resources.

B. Administrative structure:

For the administration and operation of the reserve, SEMARNAT is responsible for hiring a director for it, to be a professional with high moral character, experience in the management of protected areas and staff.

Must also be resident in the Reserve. This person in coordination with the responsible(s) institution(s) will search and hire people who work and reside in the Reserve, and to develop annual operational programs.

C. Funding strategy:

There is currently a fiscal budget; the federation provides the same every year in addition to receiving financial support from agencies of the United States government and national and international NGO's.

VIII. MECHANISMS FOR MONITORING AND EVALUATION PROGRAM

For purposes of the implementation management program, the fed must be kept informed institutions responsible for quarterly

on activities. It this suggests periodicity in reporting to give more flexibility to the operation of Reserve and avoid excessive investment of time in reporting.

On the other hand, management program must work through the development and implementation of programs annual operations. These programs should be developed by the Director of the Book coordination with the Consultation Organ and approved by the relevant institutions and Governing board.

The operational program must undergo this review process and approval at the beginning of each fiscal year to give the opportunity to have funding. The Reserve Board, Board Members and heads institutions responsible all have a shared responsibility to seek funding.

Annual Operating Program must consider the short-term actions recommended in management components, and this based on continuous updating of the diagnostic and use of current resources. It is suggested that after three years and after all actions short term and some medium-term thereof, will be making a full review of diagnosis of the Reserve and evaluate it based on the issues and objectives management program and propose new actions for short, medium and long term should be incorporated actively Consultation Organ and once developed the new program must undergo a process of consultation at different levels: institutional, community, scientific and non-governmental organizations.

7.c Form and date of most recent records of inventory of property

The Direction of Evaluation and Follow-up of CONANP requests to the protected area activities report of monitoring biological, environmental and ecosystems that are made in the area.

The last report submitted to this Directorate was in the year 2010 which presents the results of the monitoring: Pronghorn sheep (*Antilocapra americana sonorensis*), Bat magueyero (*Leptonycteris curasoae*), Chameleon (*Phrynosoma mcalli*), Mud turtle (*Kinosternon sonorense longifemorale*), Desert pupfish (*Cyprinodon macularius*), Bighorn sheep (*Ovis canadensis*), as well as populations of bats, rodents and reptiles.

7.d Address where inventory, records and archives are held

Comisión Nacional de Áreas Naturales Protegidas
(CONANP)

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ACTA ZOOLOGICA MEXICANA

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ACTA BOTANICA

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CONVENCION RAMSAR

<http://www.ramsar.org>

IUCN

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<http://www.beta.undp.org/undp/es/home.html>

SISTEMA INTEGRAL DE INFORMACION TAXONOMICA

<http://www.itis.gov/>

SISTEMA DE INFORMATICA PARA LA BIODIVERSIDAD Y EL AMBIENTE

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TRAFFIC

<http://www.traffic.org/>

FUNDACION PARA LA DEFENSA AMBIENTAL

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08

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of Responsible Authorities



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09

Signature on behalf of
the State Party



On behalf of the Mexican Government
I am signing the Nomination Format for
El Pinacate y Gran Desierto de Altar Biosphere Reserve
For inscription on the
World Heritage List as a Natural Property

Mtro. Luís Fueyo Mac Donald
National Commissioner for the
National Commission of Natural Protected Areas
Ministry of the Environment and Natural Resources



**GOBIERNO
FEDERAL**

SEMARNAT



CONANP

Comparative Analysis

Introduction

Until 2011, features 183 sites with exceptional natural and 28 mixed(natural and cultural) have been included in the list of world heritage. Are even more sites that are on the tentative list as potential properties to be included under the category of natural. Based on the above the comparative analysis decide to restrict comparative analysis to those properties and share some of the nominal criteria, present peculiarities and values related really like.

As a result of a careful search identified about 50 sites that share some sort of generic characteristic and resembled value of importance for the preservation of natural heritage. In spite of this are few properties that achieve a majority group of features similar to those manifested Biosphere Reserve Pinacate and Gran Desierto de Altar.

Universal Declaration of Value

The nomination is based on the El Pinacate volcanic shield, the Dune Fields of the Gran Desierto de Altar and the biodiversity that hosts the site are of outstanding universal value, and the arguments to justify the VUE are:

1. Shield volcanoes with giant craters result of phreatomagmatic activity accompanied by lava flows, cinder cones of different shape, size and complexity.

1. Extensive dune fields with different geomorphic: linear, cross and star.
2. Ecosistemas desérticos subtropicales con alto grado de diversidad biológica.
3. Subtropical desert ecosystems with high biodiversity.

Deserts and Dunefields

Taking into consideration the document from the IUCN "World Heritage Desert Landscape" We know that the world's deserts occur on all continents, including Antarctica and parts where there is a severe lack of moisture, especially in places where precipitation levels are low. In some desert aridity is partly the result of high temperatures, which means evaporation rates are high.

The Sonoran Desert is considered a semi-arid desert receiving rainfall of between 100 and 200 mm per year, however the subprovince of the Gran Desierto de Altar, is known to be a Hyperarid desert because it receives only 50 mm of rain per year and may spend up to 15 consecutive months without receiving any precipitation.

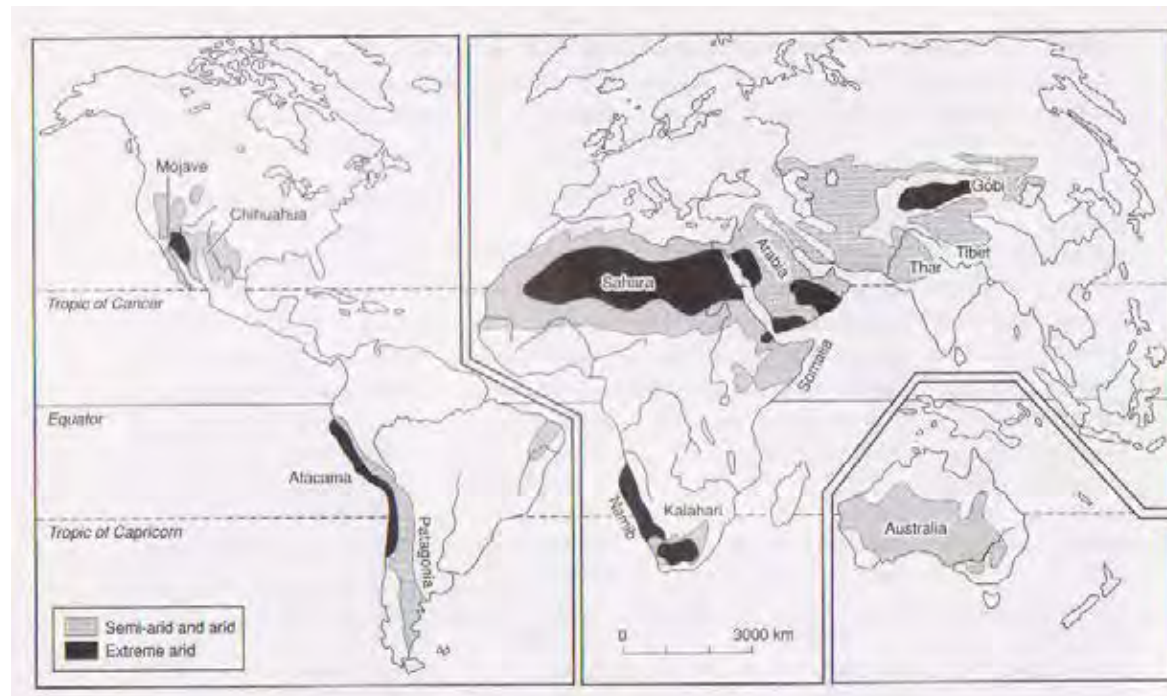


Figure 1 Major non-polar deserts (from Goudie, 2002).

Deserts can be classified according to their proximity to the ocean. coastal deserts Like that of Namibia to the south of West Africa or the Atacama desert, west of South America, temperature regimes have very different characteristics of moisture the deserts are among the continents. These tend to be diurnal and seasonal temperature relatively modest and subject to frequent fogs.

The non-polar deserts are the world into five provinces separated by oceans or equatorial forests. The biggest one by far includes the Sahara and an array of other deserts extending eastwards through Arabia to central Asia. The province of South Africa consists of the coastal desert of Namibia and the interior of the Kalahari and Karoo. The dry zone of South America is limited to two bands - the Atacama Desert and Altiplano along the west coast and Patagonian desert along the southeast coast. In North America the desert province occupies much of Mexico and the southwestern United States, including the Mojave, Chihuahuan, Sonoran Desert and Great Basin. The fifth and final province is located in Australia, the driest of the continents except Antarctica.

Knowing that the desert can be subdivided into those whose relief units are determined by geological factors and then subdivided into those with distinct geomorphological factors. For example, while one can distinguish between desert shield and desert mountain on a finer scale they can be subdivided into deserts of sand, stone deserts, plains and deserts of river clay.

The current tectonic setting of dry have been discussed by Rendell(in Thomas 1997) which identified five types: cratons (shield and platform areas); active continental margins associated with the Cenozoic orogenic belts, the Phanerozoic orogenic belts, basins and inter-orogenic mountain ranges and passive continental margins.

Examples of each of these types are given in Table 1.

Contemporary tectonic setting	Examples	Comments
1. Cratons	Kalahari (Botswana) Great Karoo (South Africa) Simpson Desert (Australia) Rub Al Khali (Saudi Arabia)	Relative stability since the late Tertiary
2. Active continental margins and Cenozoic	Atacama (Peru and Chile) Sahara Sinai-Negev (Israel, Egypt and Palestine) Arabia-Zagros (Saudi Arabia and Iran) Thar (India) Taklimakan (China)	Compressional setting, thrust and transcurrent faulting
3. Older orogenic belts	Sahara Aravallis (India)	Some reactivation of existing fault zones
4. Inter-orogenic, intercratonic	Afar and Danakil (Ethiopia) Mojave Desert (USA) Great Basin (USA) Sonoran Desert (USA and Mexico) Chihuahua Desert (USA and Mexico) Monte Desert (Argentina)	Extensional tectonic setting, 'pull-apart' basins
5. Passive continental margins	Namib Desert (Namibia and South Africa) Patagonian Desert (Argentina and Chile)	

Note: The physical extent of the Sahara is such that it features in several of the categories listed above. Source: adapted from Rendell 1997, Table 2.1.

The covered proportions by dunes of different deserts are varied. In the Sahara, Arabian Peninsula, Australia and South Africa, active sand seas cover between 15 and 30 percent of the area classified as arid. By contrast, in America, the aeolian sand covers less than 1 percent of the arid zone.

Table 2 shows the proportions of four types of relief in desert areas where relevant data are available: The U.S. southwest and northwest Mexico, the Sahara, the Libyan desert (mainly Egypt and Libya) and the Arabian peninsula. The importance of alluvial fans and downs in the southwestern United States called attention such as the importance of rock fields (including hamadas) in the Sahara.

Table 2 Proportions of landform types in selected non-polar deserts

Landform type	South western of USA and Northwest of Mexico	Sahara	Libyan Desert	Arabia
Desert mountains	38.1	43	39	47
Playas (base-level plains)	1.1	1	1	1
Desert flats	20.5	10	18	16
Bedrock fields (including hamadas)	0.7	10	6	1
Regions bordering through-flowing rivers	1.2	1	3	1
Dry washes	3.6	1	1	1
Fans and bajadas	31.4	1	1	4
Dunes	0.6	28	22	26
Badlands and subdued badlands	2.6	2	8	1
Volcanic cones and fields	0.2	3	1	2
	100%	100%	100%	100%

Source: Clements et al. (1957 in Cooke et al. (1993)). Figures are percentages of areas. Note that there is a lack of comparable data for some important desert regions, e.g. Central Asia.

As shown in Table 2 Deserts with volcanic fields in North America are represented by only 2% of the total territory that includes the El Pinacate volcanic field, and the rest of the world although they are represented by the highest percentage remains significantly low.

Deserts have a wide range of processes and landforms on earth, some of which are present in other biomes, but some are unique or very dry particularly well developed (Table 3)

Table 3 Examples of desert landforms in existing natural and cultural World Heritage Sites	
Landform	Examples of presence in World Heritage Property
Aeolian features	
Dunes	Willandra Lakes Region (Australia) (linears and lunettes)
Yardangs	Aïr and Ténéré Natural Reserves (Niger)
Pans	Willandra Lakes Region (Australia), Península Valdés (Argentina)
Dust storms and deflation surfaces	
Coastal sabkhas	Banc d'Arguin (Mauritania)
Weathering forms, processes and surface materials	
Sodium nitrate (caliche) crusts	Humberstone and Santa Laura Saltpeter Works (Chile) (cultural property)
Gypsum crusts (gypcrete)	
Calcium carbonate crusts (calcrete)	
Salts and salt weathering	
Cavernous weathering forms (tafoni and alveoles)	Rock-Art Sites of Tadrart Acacus (Libya), Tassili n'Ajjer (Algeria) (cultural property)
Desert varnishes and rinds	Twyfelfontein or /Ui-//aes (Namibia) (cultural property)
Desert karst and tufa deposition	Purnululu National Park (Australia) (sandstone only)
Fossil lakes and other pluvial evidence	
Relict weathering profiles	
Lake basins with palaeo shorelines, stromatolitic tufas etc.	Lake Turkana National Parks (Kenya)
Ancient river systems	
Fluvial and slope processes and forms	
Ephemeral stream channels (wadis)	Grand Canyon National Park (USA)

Badlands
Pediments
Sheetflood activity
Inselbergs
Pediments
Debris flows
Groundwater zapping

Natural arches

Dinosaur Provincial Park (Canada),
Ischigualasto/Talampaya Natural Parks
(Argentina) (natural sites listed primarily for
fossil values

Uluru-Kata Tjuta National Park (Australia)

Grand Canyon National Park (USA)

Rock-Art Sites of Tadrart Acacus (Libya)
(cultural property)

There are about 150 fields of dunes in the world, mainly found in northern Africa, central Asia and Australia, in America the best representation is in the Gran Desierto de Altar in Mexico



Figure 2 shows the major dune fields in the world.

In order to delimit and comparative analysis to target sites that were rejected that ones not considered "big" dune fields (greater than 5000 km²).

MAIN DUNES FIELDS TABLE 4

CONTINENTE	CAMPO DE DUNAS	PAIS
AMERICA	ATHABASCA	CANADA
	GREAT SAND HILLS	CANADA
	GREENWICH DUNES	CANADA
	MIDDLE SAND HILLS	CANADA
	SPIRIT SAND HILLS	CANADA
	GREAT SAND DUNES	U.S.A
	GUADALUPE DUNES	U.S.A
	KELSO DUNES	U.S.A
	LOS MEDANOS DUNES	U.S.A
	MARINA DUNES PRESERVE	U.S.A
	NORTH ALGODONES	U.S.A
	PANAMINT DUNES	U.S.A
	RICE VALLEY DUNES	U.S.A
	SALINE VALLEY DUNES	U.S.A
	DUNAS DE ACATITA (ZONA DEL SILENCIO)	MEXICO
	BILBAO DUNES	MEXICO
	GUERRERO NEGRO DUNES (VIZCAINO)	MEXICO
	GRAN DESIERTO DE ALTAR	MEXICO
	CUATRO CIENEGAS	MEXICO
	SAMALAYUCA DUNES	MEXICO
	DUNAS DE ARIEA CUMBUCO BRAZIL	BRAZIL
	DUNAS DE RITOQUE CHILE	CHILE
	MEDANOS DUNE DE CORO VENEZUELA	VENEZUELA
	LENCOIS MARANHENSES BRAZIL	BRAZIL
	DUNAS DE GENIPABU BRAZIL	BRAZIL
	DUNAS DE JOAQUINA BRAZIL	BRAZIL
	DUNAS POR DO SOL BRAZIL	BRAZIL

	liha do caju BRAZIL MANGUE SECO DUNES PORTO ALEGRE SAND DUNES PORTO DAS DUNAS CERRO BLANCO PERU HUACAHINA PERU	BRAZIL BRAZIL BRAZIL BRAZIL PERU PERU
AFRICA		
	SWAKOPMUND , NAMIBIA ORANJEMUND DUNES KALAHARI DESERT SOSSUSVLEI DUNES CORRALEJO SAND DUNES DUNAS DE MAS PALOMAS the great sand sea DE LYBIA-EGIPTO SAND DUNES LYBIE SAND DUNES II LYBIA SAND DUNES II LYBIA NTIFERNINE DESERT ALGERIA TUNISIA TENERE	NAMIBIA NAMIBIA NAMIBIA NAMIBIA ISLAS CANARIAS ISLAS CANARIAS EGIPTO-LYBIA LYBIA LYBIA ALGERIA ALGERIA TUNEZ NIGERIA
ASIA		
	TURKMENINSTAN KAZAKSTAN TURKMENINSTAN UZBEKISTAN CHOLISTAN DESERT THAR DESERT PAKISTAN INDIA HAR-NUUR MING-SHA-DUNES	TURKMENINSTAN KAZAKSTAN TURKMENINSTAN UZBEKISTAN PAKISTAN INDIA MONGOLIA CHINA
MIDDLE EAST		
	AN NAFUD DESERT WESTERN NEGEV ASHDOD SAND DUNE MARANJOB DUNES DASH E LUT EMPTY QUARTER EMPTY QUARTER RUB AL KHALI KHOR AL UDEID	ARABIA SAUDI ISRAEL ISRAEL JORDAN IRAN IRAN OMAN YEMEN ARABIA SAUDI QATAR

	MOREB HILL WAHIBA SANDS	EMIRATOS ARAB OMAN
PACIFICO		
	FRASER ISLAND	AUSTRALIA
	HENTY DUNES	TASMANIA
	MORETON ISLAND	AUSTRALIA
	SIMPSON DESERT	AUSTRALIA
	NATTERANIE SAND HILL	AUSTRALIA
	STRETZLESKI DESERT	AUSTRALIA
	GREAT SANDY DESERT	AUSTRALIA
	STURT STONY DESERT	AUSTRALIA
	STOCKTON BIGHT	AUSTRALIA
	THURRA SAND DUNES	AUSTRALIA
	YEAGERUP DUNES	AUSTRALIA
	TE PAKI SAND DUNES	NEW ZELAND
	SIGATOA SAND DUNES	FIJI
	TOTTORI SAND DUNES	JAPAN

Based on the above being detected more than 20 fields of dunes that meet the characteristic of being greater than 5000 km², of which some are part of the same complex.

Table 5 shows the dunes with areas greater than 5000 km²

DUNE FIELD BIGGER THAR 5000 KM2	
Sahara dunes	PAIS
The great sand sea ,	LIBIA-EGYPTO
Dunes fields	LIBIA I ,II,III
N'tifernine ,	ALGERIA
AIR N TENERE	NIGERIA
Medio Oriente	
An nafud	Arabia Saudita
Maranjob dunes ,	Irán
Dasht-e lut	Irán
Dunes field	Oman
Liwa,	Emiratos Arabes
Rub al Khali,	Arabia Saudita

Asia	
Dune field	Uzbekistán
Cholistan desert	Pakistán
Desierto del THAR	Pakistán-India.
Ming Sha dunes	China
Har nuur-	Mongolia
Oceanía	
Simpson desert	Australia
Natteranie sand hills	Australia
Stretzleski desert	Australia
Great Sandy Desert	Australia
Sturt stony desert	Australia
América	
Dunas del Gran desierto de altar	México

TABLE 6 Los campos de dunas que comparten la mayor cantidad de características con el Gran Desierto de Altar son

		Superficie		tipos de dunas					
		de dunas km ²	altura de la duna mas alta	Crescénticas	estrella	Lineares	domo	parabólicas	
Grand erg of Sahara	North África	300,000	180	x	x	X	x	x	
Ming Sha dunes	China	50,000	500	x	x		x		
Great Sandy Desert	Australia	100,000			x			x	
Gran desierto de altar	México	12000	200	x	x	X	x	x	
Khongor	Mongolia	5000	190	x	x		x		

Gran erg of Sahara

Sahara Desert It is the largest hot desert in the world. With more than 9,400,000square kilometers (3.63 million miles square), which covers most of North Africa, some of the sand dunes reach 180 mts. The central region of the hyper-arid Sahara, where rainfall is minimal and sporadic. The vegetation is rare, and this ecoregion consists mainly of sand dunes (erg, chech, Raoui), stone plateaus (hamadas),gravel plains (reg), dry valleys (wadis), and salt flats. It covers 4,639,900 square kilometers (1,791,500 miles square



Figura 3 Dunes of the Gran Desierto de Altar

Biotic characteristics of Deserts:

The desert biome comprises a variety of complex ecosystems with diverse and fragile groupings of sometimes bizarre plants, animals and fungi and little studied members of the Protista and Monera. The biomes may be influenced by their positions in coastal, inland or rain shadow

deserts (Ezcurra 2006). Key characteristics of the biota are their adaptations to aridity, climate variability, scant summer and winter rainfall patterns and, most importantly, unpredictable rainfall pulses. Some elements of the desert biota escape from the desert environment while others tolerate it (Louw and Seely 1982). Some may find their homes only in the very limited, usually isolated wetland habitats of the drylands. The adaptations fostering tolerance may take the form of morphological, physiological or behavioural adaptations but most commonly some combination of the three.

The most important factors that affect life in the desert biomes include radiation, heat and temperature, wind, water and nutrition. The radiant environment to which organisms in the desert environment are exposed is complex including, inter alia, direct solar radiation, diffuse radiation from clouds and the atmosphere, and considerable short wave radiation reflected from the soil's surface and other objects. The heat to which a desert organism is exposed comes not only from solar radiation but includes metabolic heat production, radiant heat transfer, conduction, convection and evaporative heat exchange, all of which are exacerbated in the desert environment. Wind and the role of limited water in the water balance of the organisms are also important influencing factors, together with nutritional stress. That plants and animals survive in the harsh and unpredictable conditions in desert environments at all requires an array of adaptations responding to the complex habitats in which they live. There are 68 deserts around the world, including polar winter cold coastal and subtropical regions. Only 11 of the subtropical deserts in the world covering an area greater than 50,000 km², characteristics that attribute as the most extensive subtropical deserts of the world:

Table 7 Show subtropical desert bigger tan 50000 km 2

Subtropical Desert > 50,000 km ²	Localización
Sahara Desert	9065253 Several countrys in the north of africa
Arabian Desert	1,300,000 Arabian Peninsula
Kalahari Desert	259000 Botswana, and parts of Zimbabwe, Namibia and South Africa
Great Victorian Desert	325000 Australia
Syrian Desert	324000 Siria
Chihuahuan Desert	225000 México
Sonoran Desert	310800 México
Great sandy desert	420,000 Australia
Thar Desert	260,000 India ,Pakistán
Gibson Desert	220,000 Australia
Simpson Desert	130,000 Australia

Table 8 Shows the characteritics of the subtropical deserts

Phisycal Feature				
Subtropical Deserts				
NAME	TIPE OF DESERT	LOCALIZATION	PHISYCAL FEATURES	NATURAL FEATURES
Sahara include The Great Sand Sea	Subtropical	Algeria, Chad, Egypt, Libya, Mali, Niger, Mauritania, Morocco, Sudan and Tunisia	It is the largest hot desert in the world. With more than 9,400,000square kilometers (3.63 million miles square), which covers most of North Africa, some of the sand dunes reach 180 feet. The central region of the hyper-arid Sahara, where rainfall is minimal and sporadic. The vegetation is rare, and this ecoregion consists mainly of sand dunes (erg, chech, Raoui), stone plateaus (hama	In the central region is estimated to be only 500 plant species, which is extremely low considering the enormous extent of the area. Plants such as acacias, palms, succulents, thorny shrubs, and grasses have adapted to arid conditions. fauna of the central Sahara is richer than generally believed. Within the ecoregion there are 70species of

			das), gravel plains (reg), dry valleys (wadis), and salt flats. It covers 4,639,900 square kilometers (1,791,500 miles square)	mammals, of which 20 are large mammals. There are 90 species of resident birds, and about 100 species of reptiles.
Arabian Desert	Subtropical	Saudi Arabia, Jordan, Iraq, Kuwait, Qatar, United Arab Emirates, Oman and Yemen	occupies most of the Arabian Peninsula, an area of 2,330,000 square kilometers, one of the largest continuous bodies of sand in the world. A corridor of sandy desert known as the ad-Dahna desert connects the large one Nafud (40,389 miles or 65,000 square km ²) in northern Saudi Arabia in the Rub-Khali in the south-east. the sand or gravel covered plains and gypsum dunes reach maximum heights of 250 m (820 ft)	The Rub'al-Khali has very limited floristic diversity. There are only 37 species, 20 in the main body of sand and 17 in the outer margins. Among these 37 species, only one or two are endemic. Vegetation is very diffuse but fairly uniform, with some interruptions of near sterile dunes
Kalahari Desert	Subtropical	Angola, Botswana, Namibia and South Africa	It is a great sandy arid to semi-arid southern Africa extending 900,000 square kilometers, is a monotonous, slightly undulating, sandy plain, which everywhere is 3,000 feet (900 meters) above sea level. Bedrock is exposed only in the low hills, but with vertical walls, kopjes, but rarely visible above the general surface.	Despite its aridity, the Kalahari supports a variety of wildlife, are two dominant trees in the sandy savanna: Zambezi teak (<i>Baikiaea plurijuga</i>) and acacia, the former is more abundant north of the ecoregion, and the second, <i>sur.La fauna</i> is rich and diverse with a variety of ungulates and several endangered animals like the white rhinoceros (<i>Ceratotherium simum</i>) and black (<i>Diceros bicornis</i>), the Lycaon (<i>Lycaon pictus</i>) and the elephant (<i>Loxodonta africana</i>).

Great Victoria Desert	Subtropical	Australia	<p>is the largest desert in Australia [1] and consists of many small dunes, plains grassland, areas with a surface area of stone fill covers an area of 424,400 square miles</p> <p>of Great Victoria Desert is the third largest in the world after the Sahara and Arabian deserts</p>	<p>this region have organ pipe cactus and desert flower. Wildlife adapted to these harsh conditions includes few large birds or mammals but the desert does sustain many types of lizard including the vulnerable great desert skink (<i>Egernia kintorei</i>) and a number of small marsupials including the Sandhill Dunnart (<i>Sminthopsis psammophila</i>) and the vulnerable Crest-tailed Mulgara (<i>Dasyurus cristicauda</i>). O</p>
Syrian Desert	Subtropical	Syria, Jordan and Iraq	<p>is a combination of steppe and desert truth found in the north covering the Arabian Peninsula (200,000 square miles).</p>	<p>has comparatively few areas of natural vegetation. Overall, non-arable areas are too dry to support plant life and virtually all arable areas have been stripped of natural cover among the mammals are antelope, deer, bobcat, porcupine, squirrel and rabbit. Birds are most important flamenco, pelican, bustard, ostrich, eagle and hawk. In the desert you can find lizards and chameleons.</p>

Chihuahuan Desert	Subtropical	México and United States	<p>It has an area of approximately 362,000 km² (139,769 miles square). It is the third largest desert in the western hemisphere and is the second largest in North America. The land consists mainly of watersheds by numerous small mountain ranges. The Chihuahuan Desert is higher than the Sonoran Desert to the west, mostly ranging from 600 to 1,675 m (1,969 to 5,495 feet) altitude. Rainfall is a little heavier than most of the southern Great Basin, Sonoran and Mojave deserts, however, is still usually less than 254 mm.</p>	<p>Creosote Bush (<i>Larrea tridentata</i>) is the dominant plant species throughout the Chihuahuan Desert. The other species found there depend on factors such as soil, altitude, and slope gradient. Its fauna is rich in reptiles with 120 species and mammals such as black bear and cougar.</p>
Sonoran Desert	Subtropical	Mexico and United States	<p>One of the largest deserts and warmer in North America, with an area of 311,000 square kilometers (120,000 square miles). The desert contains a variety of unique plants and animals, such as the saguaro cactus. Within the southern Sonoran Desert in Mexico is found the Gran Desierto de Altar, with the Biosphere Reserve El Pinacate and Gran Desierto de Altar ('Pinacate National Park' in Mexico), 2,000 square kilometers (770 sq mi) of desert and mountainous regions. [3] The Pinacate National Park includes the only active erg dune region in North America.</p>	<p>The Sonoran Desert includes 60 mammal species, 350 bird species, 20 amphibian species, over 100 reptile species, 30 native fish species, over 1,000 native bee species, and more than 2,000 native plant species. [4] The Sonoran Desert area southwest of Tucson and near the Mexican border is vital habitat for the only population of jaguars living within the United States. The Sonoran Desert includes such plants from the agave family, palm family, cactus family, legume family, and many others. The Sonoran is the only place in the world where the famous saguaro cactus grows in the wild. [7] Cholla, beavertail, hedgehog, fishhook, prickly pear, night-blooming cereus, and organ pipe are other species of cactus found here.</p>
Great Sandy Desert	Subtropical	Australia	<p>An area of 284,993 square kilometers containing ergs large, often consisting of longitudinal dunes. The Wolfe Creek meteorite impact crater is located in the northeast.</p>	<p>The vegetation of the Great Sandy Desert is dominated by spinifex. Animals occurring in the region include feral camels, dingoes, goannas (including the large Perentie).</p>

				and Numerous species of lizard and birds
Thar Desert	Subtropical	India and Pakistan	<p>is a large region of arid northwestern Indian subcontinent with an area of over 200,000 km², there are three main formations of the desert region - predominantly sand covered Thar, plains, hills, including the central dune country free and semi-arid zones surrounding the entire Aravalli range. On Thar desert slope imperceptibly to have uneven plain "Indo" and the surface is mainly due to the sand dunes. The dunes in the south are higher, sometimes reaching the 152 m, while in the north are lower reaching 16 m above the ground, the soils of the arid zone are generally sand and silt in texture. The consistency and depth vary according to the topographic features. The lower marls are heavier and may have a hard shell, these soils contain a high percentage of soluble salts in the lower horizons that can turn water into poison.</p>	<p>About 23 species of lizards and 25 species of snakes are found here and several of them are endemic to the region. Region a haven for 141 species of migratory and resident birds of the desert, some species of wildlife, are disappearing rapidly other parts of India are in the desert the natural vegetation of this area is classified as dry northern desert thorn forests occur in small scattered groups, more or less openly.</p>
Gibson Desert	Subtropical	Australia	<p>covers about 155,000 km², much of the desert is characterized by gravel-covered terrain of the desert covered with thin grass also contains large areas of rolling plains and fields of red sand dunes, low rocky / gravel ridges and substantial portions of land high with a high degree of formation of laterite, sandy soil of the plains pellet is rich in iron laterite. Several isolated saltwater lakes occur in the center of the southwest region and a system of small lakes follow paleo-</p>	<p>Due to the lack of large-scale agriculture or industry in the area, the environment is relatively unchanged in its natural state. Plants adapted to this dry climate grasses <i>Triodia</i> include with a <i>Cacia</i> and other shrubs that bloom after the occasional rain. Wildlife includes red kangaroo, emu, Gran Bilbao and endangered reptiles</p>

			drainage features	as the devil and thorny perentie ((<i>Varanus giganteus</i>) - the largest monitor lizard, native to Australia Goanna,
Simpson Desert	Subtropical	Australia	is a large area of dry plains, red sand and dunes in central Australia. The Simpson Desert is an erg, which contains the longest parallel sand dunes in the world. These dunes oriented north to south are static, so they have vegetation. They vary in height from 3 meters in the west at about 30 meters on the eastern side.	The flora of the Simpson Desert ecoregion is limited to drought-resistant shrubs and grasses, especially grass that holds together paradoxical Zygochloa the dunes and spinifex grasses and other harsh side slopes and sandy desert floor between dunes. The wildlife must adapt to this environment warm and dry and seasonal flooding include the water-holding frog (<i>Litoria platycephala</i>) and a number of other reptiles that inhabit the desert pasture. Desert endemic mammals include kowari (<i>Dasyurus byrnei</i>) while birds are Grasswren Grey (<i>Amytornis barbatus</i>). Lake Eyre and other seasonal wetlands important habitat for fish and birds, especially in a breeding ground for waterfowl, while rivers are home to birds, bats and frogs.

Undoubtedly the Sonoran desert is by far the most biodiverse in the world, taking as consideration in an area much more limited than the large subtropical deserts like the Sahara or Arabia represents a greater number of species of flora and fauna, is one of the few deserts in its biologically rich houses all taxonomic groups. A clear manifestation of the above mentioned is the fact that only the desert altar contains more species of flora that the whole of the Sahara (9.4 million km²)

PRIORITIES FOR DESERT WORLD HERITAGE SITES

The UICN identified eight desert World Heritage properties with earth science features of Outstanding Universal Value

-Gran Canyon National Park USA.	<i>Mountain Desert/Semi arid</i>
- Dinosaur Provincial Park (Canadá),	<i>Grassland/Semi arid</i>
- Ischigualasto/Talampaya Natural Parks (Argentina)	<i>Temperate/Semi arid</i>
- Purnululu National Park (Australia),	<i>Hot/Sub humid</i>
- Tassili n'Ajjer (Algeria)	<i>Hot/ Hyper arid</i>
- Uluru-Kata Tjuta National Park (Australia)	<i>Hot/Semiarid</i>
- Wadi Al-Hitan (Egypt)	<i>Hot/Hyperarid</i>
-Willandra Lakes Region (Australia)	<i>Hot/Semi arid</i>

Seventeen desert landscape sites were identified which have been included by State Parties on their Tentative Lists. Two are suggested in the Tentative Lists as possible mixed properties, two as cultural properties and the remainder as natural properties. In terms of location, six are in

Asia, eight in Africa and three in South America. The geomorphological characteristics cover a wide variety of forms. Tentative List sites. It should be noted that, due to the ever changing nature of notified Tentative Lists, this range of properties will vary over time, and is likely to have varied at least slightly since the above analysis was completed.

A provisional assessment suggests that two properties can be identified as World Heritage properties with significant earth values, but which are inscribed on the World Heritage List for other reasons (Dingwall et al. 2005). Both properties, Air Ténéré (Niger) and Banc d'Arguin (Mauritania), are on the African continent and both were listed for their biodiversity values. Their geomorphological characteristics include plateaus, canyons, dunes and a volcanic massif as well as a coastal saline, mangrove swamp and salt marsh.

Three inscribed desert properties were not identified in the list of Dingwall et al. (2005). They lie in Africa (Lake Turkana, Kenya), Asia (Uvs Nuur Basin, Russia and Mongolia) and South America (Valdés Peninsula, Argentina) and their geomorphological features include: a rift valley lake, delta and active volcanoes, salt lakes and salt pans.

Five inscribed cultural properties with significant desert geomorphological values have been identified in South America, Asia and Africa: Humberstone and Santa Laura Saltpeter Works (Chile), Petra (Jordan), Rock-Art Sites of Tadrart Acacus (Libya), Tsodilo (Botswana) and Twyfelfontein (Namibia). Their geomorphological features include nitrate (caliche) deposits, weathering sandstone, rock domes and ancient dunes.

REVIEW OF TENTATIVE LISTS FROM STATE PARTIES

The follow sites were identified which have been included by State Parties on their Tentative Lists. Two are suggested in the Tentative Lists as possible mixed properties, two as cultural properties and the remainder as natural properties. In terms of location, six are in Asia, eight in Africa and three in South America. The geomorphological characteristics cover a wide variety of forms

-The Lut Desert, Iran.

-Great Desert Landscapes / Western Desert, Egypt

-Southern Namib Erg / Namib Desert, Namibia.

-Chott el Jerid / The Chotts, Tunisia.

-Thar Desert, India.

-Taklimakan, China

-Band-E-Amir, Afganistán.

-Las Parinas, Argentina.

-Les Lacs d'Ounianga

-Gravures et peintures rupestres de l'Ennedi et du Tibesti, Chad

-San Pedro de Atacama, Chile





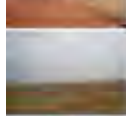

-Wadi Rum, Jordan

-El Pinacate et le Grand désert d'Altar, México

-Great Gobi Desert, Mongolia

-Wadi Howar, Sudan.

Table 9 Show characteristics of similar sites than the proposal Site

	COUNTRY	Mean annual rainfall mm	Desert type	Desert Climate altit.	Geomorphological features	Reason for listing	Biodiversity significance	Vegetation type	Vegetation richness	Degree of endemism	Fauna richness	Degree of endemism	
	Mexico	100	Hyper-arid	Hol	apirafos volcánicos con sus cráteres y derrames de lava, dunas de arena consolidadas y móviles, lechos de arroyos, ibaricos aluviales y macizos montañosos de basalto y granito	Volcanic fields with giant mesar crater . Dunes/Biodiversity of desert	The Subtropical desert most biodiversity of the world	The vegetation comprises mainly xerophytic scrub, but rather restricted in some areas can be found vegetation similar to the chaparral, mesquite thickets associated with beaches and tree-As well as small areas of coastal scrub halophytes.	569 plants species	Senecio pinacateensis	Antilocapra americana (sonorensis), (Ovis canadensis mexicana), (Lepus arizonae curvicauda), (Myotis vivax)	44 species of mammals 225 birds 44 reptiles	Papo del desierto y charal de aleta larga
World Heritage Site													
	Algeria	25	Hyper-arid	Hol	Sandstone plateau , gravel massif	Scenic and geological interest,prehistoric cave art, floristic and faunal island of saharan life.	Floristic and faunal island of saharan life in the middle of the desert,relict mediterranean cypress	Sheltered Mediterranean and saharian flora,Subsaharan riverine vegetation , endemic Saharan Species	Species no comments	26 plants rarest in algeria	Mediterranean and Saharan Palearctic species: import for nesting migratory	4 fish species , 23 larger mammals, 5 endangered	No comment
	Niger	20-100	Hyper-arid	Hol	Plateaus , canyons, volcanic massif	Sanctuary for addax, other biodiversity	Outstanding variety of Landscapes, plants species and wild animals	Sahelian floristic enclave within the sahara; well wooded oases; relict sudanese and mediterranean species above 1000.m Saharan species	350+ species	No statistic	9 species on IUCN Red List for Niger Air herbivores inspired ungulates	40 mammal species, 165 bird 16 reptiles 1 amphibian	no comments
Tentative List of World Heritage List													
	Argentina	<200	cold	wet lands	Volcanic morphology	A highly representative and extensive example of the Andean volcanic landscape comprising the highest peaks of the American Continent.	habitat restricted during the summer to these wetlands	Fulica Gigantea, Recurvirostra Andina, Podiceps Occipitalis and Lophortyx Specularoides are endemic and nesting in the area	no comments	no comments	endangered species: chinchilla (chinchilla), gato andino (Oreailurus Jacobita), zorro Colorado (Dasyurus Culpeus) and puma (Puma Concolor)	n/d	Endemic species with a high preservation value: phoenicopanus andinus, phoenicopanus jamesi, fulca comata
	Egypt	100	Hyper-arid	Hot	Sand Dunes	is one of the largest unbroken mass of sand dune areas of the world, and home to not one living soul	Outstanding variety of landscapes, plant species	Plants such as acacias, palms, succulents, thorny shrubs, and grasses have adapted to arid conditions	< 300 plants	no comments	Several species of fox live in the Sahara, including the fennec fox, pale fox and Rüppell's fox. The addax, a large white antelope	70 species of mammals, of which 20 are large mammals. There are 90 species of	not comment
	Iran	50-100 mm	Hyper-arid	Hol		Longest system of yardangs (aligned sand pyramid, hottest point, biggest rebbits in the world)	Outstanding variety of landscapes, plant species	Plants such as acacias, palms, succulents, thorny shrubs, and grasses have adapted to arid conditions	>300 plants	n/d	Podoces rubans, alouatta n ganges, Gazelles, Fox , wolf	n/d	
	Jordan	100 mm	Hyper-arid	Hot	desert landscape, sandstone mountains and valleys, natural arches, and the range of narrow gorges, towering cliffs, massive landslides	Petroglyphs and desert landscape (Mixed)	no comments	no comments	no comments	no comments	no comments	no comments	no comments
	Mongolia	200 mm	Semi-Desert	Cold	is a cold desert, and it is not uncommon to see frost and occasionally snow on its dunes.	a largely undisturbed part of the vast Gobi desert, and provides a last refuge for representatives of the ancient terrestrial fauna of Central Asia.	High	saxaul (Haloxylon ammodendron) and Agriophyllum gobicum. The others include prickly convolvulus, field wormwood (Artemisia campestris), acacia, inula ammodia, Sophora flavescens, Convolvulus arvensis, Peganum and	410 plants species		49 species of mammals , 15 of reptiles and amphibius , 150 bird species	Gobi bears (Ursus arctos)	
	Namibia	100-200	Semi-Desert	Cold	This sand sea is one of the greatest unconsolidated sand accumulations of the world, both in area and in height. At some places the eolian dunes may exceed a height of more than 250 meters above their bases, and represent almost all geomorphological dune classes.	Cultural n natural	The Namib desert biota is internationally renowned as primary examples to explain the evolutionary, physiological, behavioral, and ecological processes associated with desert ecosystems world-wide	plant of desert landscapes	600 species of plants (a global biodiversity hotspot)	high	Web Footed or Palmato Gacko , Brown Hyena, Whirling Spider/Sand Dwelling Spide	250 species of invertebrates	80 % of the invertebrates are endemic
	Sudan	40 mm	Hyper-arid	Hot	outstanding geological features, including the volcanic and orange landscape of Meisob Hills. The endless granite plains and the crescent shaped dunes	is one of the most remarkable natural features of the south Eastern Sahara.	13 mammalian orders found in Africa, 12 orders occur in the Sudan	Boscia, Meroia, Cadeba, Acacia and even Colobrops, Celtis and Combretaceae, Acacia rotunda, Acacia tortilis ssp. raddiana, Acacia ehrenbergiana and Capparis			addax, onix, barbary sheep, dorcas and other gazelles	224 species of mammals, 871 bird species	High

Volcanic Shields:

The Smithsonian Institute's Global Volcanism Program lists 1550 volcanic areas in the world that have erupted in the last 10,000 years (Holocene) of these 160 sites are only to "shield volcanoes" of which the geography location is:

Table 10 show the volcanic shield divided by regions

VOLCANIC SHIELDS						
REGIONS						
Seabed	Kamchatka	WHC	África and red sea	North America	Islands or Island systems	center and south america
48		41	26	19	16	10

Of these we selected those containing among its features Maar craters

Table 11 Describe the volcanic sites that included at lest one maar crater

NAME OF THE SITE	LOCALIZATION	GENERAL DESCRIPTION
West Eifel Volcanic Field	Germany	Craters MAARS, 240 cinder cones, stratovolcanoes SMALL covers an area of 600 km ² , ORIGINATING IN HOT SPOT "THE REGION IS MOSTLY URBANIZED
Chaîne des Puys	France	32 KM COVERED INCLUDES 8 CONOS cinder, FROM AND FAILURE AND CONSERVATION IN A STATE, HAS MORE THAN 15 Craters MAAR, the largest with 700 meters in diameter, 8 lava domes,
Karapinar Field	Turquía	Two lava fields, CONE IS HIGHER THAN 300 MTS, craters covered with water, 5 cinder cones, the size of the craters MAYOR IS 1070 X 1400 MTS
Bishoftu Volc Field	Etiopia	MOST MAARS 15 are filled with water, the largest has a diameter of 1.5 KM, STATE OF CONSERVATION IN, cinder cones
Butajiri-Silti Field	Etiopia	13 MAARS, FILLED WITH WATER, THE MAYOR HAS ADIAMETER. 7 KM
Bilate River Field	Etiopia	Have 3 craters, THE GREATEST IS 1.3 X 1.5 KM OF PROF X 50 MTS. 2 TOBAS RINGS
Mega Basalt Field	Etiopia	10 Craters MAAR , 1.8 KM DIAMETER MAAR, 50 CONE, SHIELD 150 m
Segeberua Plateau	África-E	LENGTH OF 50 KM, 6 Craters MAAR, contains water
Kieyo	África-E	Filled wit wáter
Fort Portal	África-C	50 VENTS, SOME ARE LAKES AREA OF 150 KM ²
Katwe-Kikorongo	África-C	80 cones and craters, a crater is 3 km, craters AMORPHOUS AND FULL OF WATER LEVEL IN STORAGE, AREA OF 180 KM ²
Bunyaruguru	África-C	SURFACE 800 km ² , 130 Craters MAAR, 27 contain lakes, the largest crater is 2.5 KM









Tombel Graben	África-W	3 CRATERS MAAR
Todra Volc Field (AIR N TENERE)	África-N	1050 KM 2, WORLD HERITAGE AIR NTENERE, 130 CONES
Tahalra Volc Field	África-N	100 conos, 20 MAARS, THE GREATEST MEASURE 1.05 km, 1800 km 2
Manzaz Volc Field	África-N	AREA OF 5000 KM2 Much like Pinacate, surrounded by dunes,OVER 0.9 KM CRATER DIAMETER
Meidob Volc Field	África-N	700 cinder cones, 9 craters, the MAYOR of the craters measures 1.6 kilometers in diameter
Nosy-Be	Madagascar	Lake craters
Itasy Volc Field	Madagascar	Cinder cones, lava dome, craters MAARLAKE
Auckland Field whc LIST	New Zealand	Fifty cones and craters, area of 140 KM2
Ruapehu	New Zealand	Stratovolcano, PYROPLASTICOS CONES, 1 MAAR CRATER
Dakataua	New Britain-SW Pac	CALDERA , SHIELD VOLCANO , MAAR
Garbuna Group	New Britain-SW Pac	STRATOVOLCANO ,LAVA dome, MAAR
Sulu Range	New Britain-SW Pac	MAAR, LAVA DOMES
Koranga	New Guinea	2 MAAR , LAVA DOMES
Suoh	Sumatra	CALDERAS, MAAR, LAVA DOMES
Ibu	Halmahera-Indonesia	STRATOVOLCANO ,1 CRATER MAAR of 1 KM widht by 400 MTS of proof. , CONO PYROCLASTICOS
Gamalama	Halmahera-Indonesia	STRATOVOLCANO , MAAR, CONO PYROCLASTICOS
San Pablo Volc Field	Luzon-Philippines	STRATOVOLCANO , MAAR, CONO PYROCLASTICOS
Sumiyoshi-ike	Kyushu-Japan	2 MAARS DE 500 Y 1200 MTS of DIA.
Megata	Honshu-Japan	3 MAAR lakes
Kostakan	Kamchatka	1 CRATER MAAR 180 MTS of DIA.
Akademia Nauk	Kamchatka	STRATOVOLCANOES , CALDERAS ,2 CRATERES MAARS CON 500 MTS DE DIAMETRO
Uzon	Kamchatka	Covers an area of 1700 km 2, BOILERS, LAVA DOMES, 1 TRAMCraters of 1.2 km in diameter, covered with water
Kinenin	Kamchatka	MAAR CRATER OF 2.5 km in diameter,contains a lake
Ukinrek Maars	Alaska Península	MAARS
Shishmaref.	Alaska península	Craters contains the group of MAAR GREATEST WORLDBETWEEN 4 AND 8 KM DIAMETER
Nunivak Island	Alaska-W	Shield volcanoes, cinder cones 60, 4 MAARS LARGESTDIAMETER TO 1.6 KM
St. Michael	Alaska-W	shield volcanoes of 3000 km, cinder cones 55 and CraterusMAAR, SHIELD VOLCANO, CINDER CONES, MAARS
Blue Lake Cráter	US-Oregón	MAAR , FISSURE VENT
Clear Lake	US-California	LAVA DOMES, MAARS, CINDER CONES
Ubehebe Craters	US-California	AREA 15 KM 2, 12 Craters MAARS LARGEST DIAMETER OF 800 MTS
Soda Lakes	US-Nevada	2 Craters MAARS WATER COVERED THE GREATER OF 1.3 X 2 km in diameter, cinder cones.
Dotsero	US-Colorado	MAAR CRATER OF 700 1 X 400 MTS,cinder cones.
Pinacate	México	Craters MAAR 10, 1 RING TOBAS, 400 cinder cones, shield volcanoes, 2000 KM2
Durango Volc Field	México	100 cinder cones, 12 Craters MAAR, covers an area of 2100 km 2
Valle de Santiago	México	Craters MAAR 13 LARGEST measures 1.8 km in diameter

San Martín	México	Shield volcanoes, 1 MAAR CRATER DIAMETER OF 1 KM, 250 CONES PYROCLASTICOS
Suchitán	Guatemala	STRATO VOLCANO CONES CINERIGICOS, MAAR
Aramuaca, Laguna	El Salvador	MAAR CRATER OF 1 km in diameter, covered by water
Rota	Nicaragua	LAVA DOMES, STRATO VOLCANO OF 1 KM high, 1 MAAR CRATER DIAMETER OF 1 KM
Pilas, Las	Nicaragua	VOLCANO COMPLEX, stratovolcano, 12 Craters MAARS THE OVER 1 KM DIAMETER
Apoyeque	Nicaragua	Pyroclastic Shield, 1 MAAR CRATER 2.5 km X 3 km in diameter
Nejapa-Miraflores	Nicaragua	FISSURE VENTS, Pyroclastic Cones, Craters 4 MAAR'S LARGEST DIAMETER 1.2 km
Huaynaputina	Perú	STRATO VOLCANO , CONOS CINERIGICOS , MAAR
Tambo Quemado	Bolivia	Pyroclastic Cones, Craters 3 POSITIONS ON THE GREAT TRAM has a diameter of 1.8 km
Jayu Khota, Laguna	Bolivia	2 Craters MAAR WATER INSIDE
Cordón de Puntas Negras	Chile-N	500 KM 2 SURFACE
Azul, Cerro	Chile-C	STRATUM VOLCANO CONES pumice, MAAR CRATER DIAMETER OF 800 MTS
Carrán-Los Venados	Chile-C	STRATUM VOLCANO CONES pumice, MAAR CRATER DIAMETER OF 800 MTS
Antillanca Group	Chile-C	It covers an area of 380 km 2 stratovolcanoes, MAAR, CONES
Cayutué-La Viguera	Chile-S	PYROCLASTICOS Cones, Craters MAARS 20 LARGEST oval-shaped 1 km x 2 km
Palei-Aike Volc Field	Chile-S	PYROCLASTICOS CONES, MAARS
Grímsnes	Iceland-SW	MAAR, CRATER ROW
Penguin Island	Antártica	TUFF CONES BOILERS, MAARS FLOODED IN THE OCEAN
Deception Island	Antártica	MAAR

From the above list were selected sites that share as many characteristics to the proposed site, and which were compared as follows:

Table 11 Shows the volcanic sites with craters maar that share special characteristic with the proposal site.

	NAME SITE	LOCALIZATION	LAST KNOW ERUPTED	HIGH ELEVATION	CINDER CONES	VOLCANIC SHIELD	CRATERS MAAR	DIAMETER OF THE BIGGEST CRATER	TUFF RING
	Pinacate	México	13000	1200	400	2000	10	1609	1
	West Eifel Volcanic Field	Germany	8300 BC ± 300 years	600	240	600	75	1500	0
	Mega Basalt Field	Ethiopia	N/D	1067	50	1750	n/d	1800	0
	Katwe-Kikorongo	Uganda	n/d	1100	80	180	70	2000	1
	Bunyaruguru	Uganda	N/D	1554	N/D	800	120	2500	0
	Todra Volc Field (AIR N TENERE)	Kenya	siglos atras	1780	130	1050	1	1500	0
	Tahalra Volc Field	Algeria	10000	1467	100	1800	20	1050	0
	Manzaz Volc Field	Algeria	N/D	1672	380	1500	20	800	0

	NAME SITE	LOCALIZATION	LAST KNOW ERUPTED	HIGH ELEVATION	CINDER CONES	VOLCANIC SHIELD	CRATERS MAAR	DIAMETER OF THE BIGGEST CRATER	TUFF RING
	Meidob Volc Field	Africa-N	2950 BC ± 500 years	2000	700	5000	9	1050	1
	Shishmaref.	Alaska peninsula	19000 BC	150	N/A	N/A	12	4000	N/A
	Nunivak Island	Alaska-W	300,000 BC	200	60	4300	4	1600	N/A
	St. Michael	Alaska-W	N/D	715	55	3000	10	1900	N/A
	Durango Volc Field	México	N/D	2100	100	2100	12	1200	N/A
	valle de santiago	México	N/D	250	180	N/A	13	1700	1
	Volcanes de Kamchatka	Rusia	Active	4750	400	N/A	6	2500	N/A
	auckland	New zeland	600	260	50	140	50	1000	1

Volcanoes of Kamchatka, Russia is one of the most representative examples of volcanic activity occurring on earth. Within its volcanic formations reveals the presence of maar craters type and about 30 are active volcanic structures. For this and other properties raised in 1996 in the list of world heritage.



Figure 4 volcanoes of Kamchatka

Auckland Volcanic Field, is a series of volcanic cones originating in the urban and rural areas of the city of Auckland, is on the tentative list of WHC to be considered as a property of cultural and natural value. Within regions for its outstanding natural features include volcanic Rangitoto shield that covers about 100 km² and includes 50 cones, lava flows, craters, caves and maars.



Figure 5 Auckland Volcanic field

The volcanic field, West Eifel, is a group of 240 cones of scoria, craters maar and stratovolcanoes which covers an area of approximately 600 km², half of the cone produced lava flows, forming two-thirds of its volcanic field which about 30% are type maar craters and tuff rings, forming most lakes. About 230 eruptions have occurred in the last 730.000 years, the last event maar craters formed "pulvermaar, and Strohn Ulmenes" at the end of the Pleistocene and early Holocene.

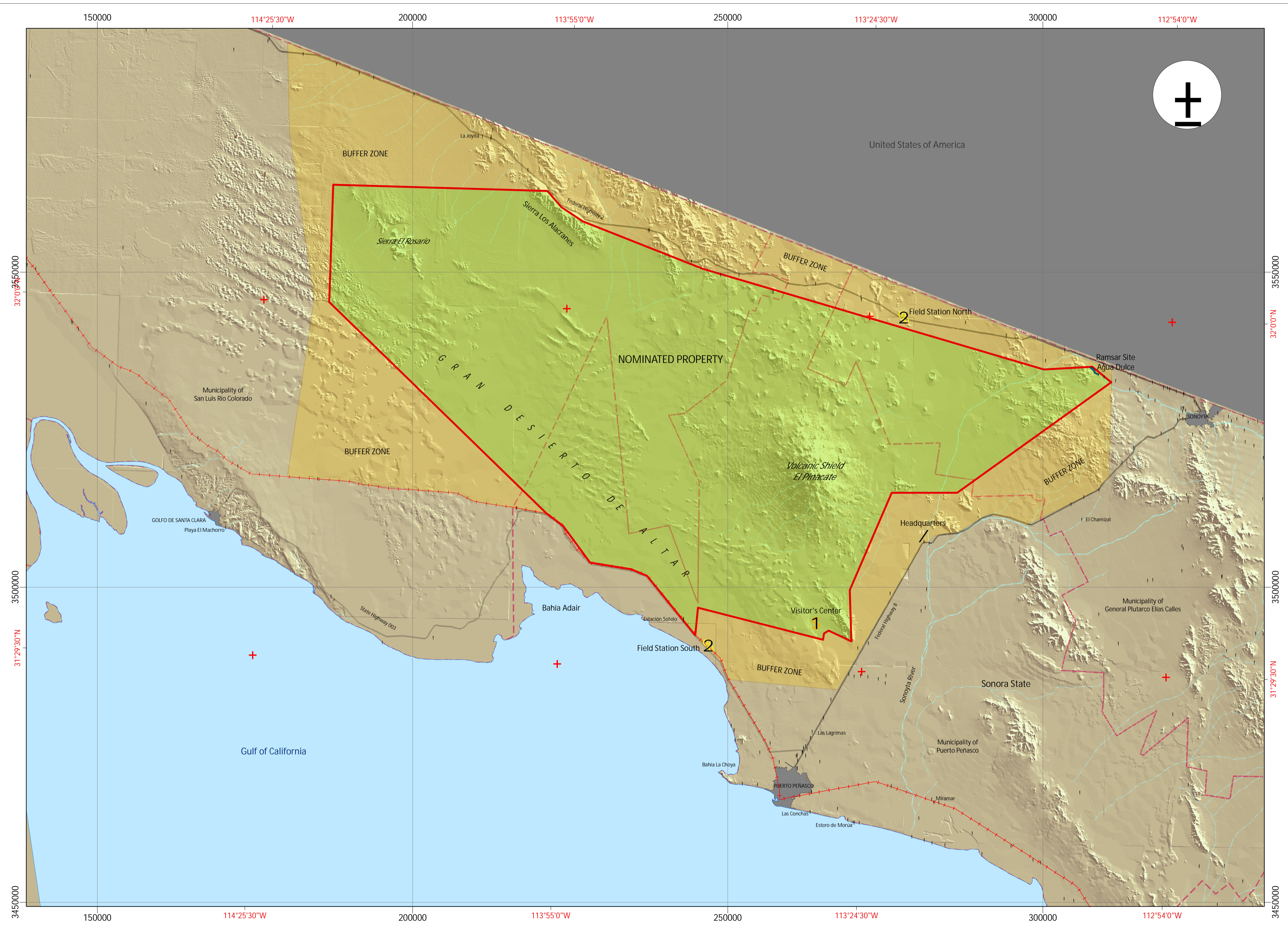


Figure 6 West eifel Volcanic field , Germany

Within the central table called the Mexican plateau, crosses three mountain ranges, the most important is known as "Valle de Santiago" formed by a group of 14 volcanic craters inactive. The region is in the midst of the urban area of Michoacán-Guanajuato volcanic complex that is associated with a structurally weak area that is part of what is known as the Trans-Mexican volcanic belt(TMVB), this zone includes maar craters, rings tuff and cinder cones.



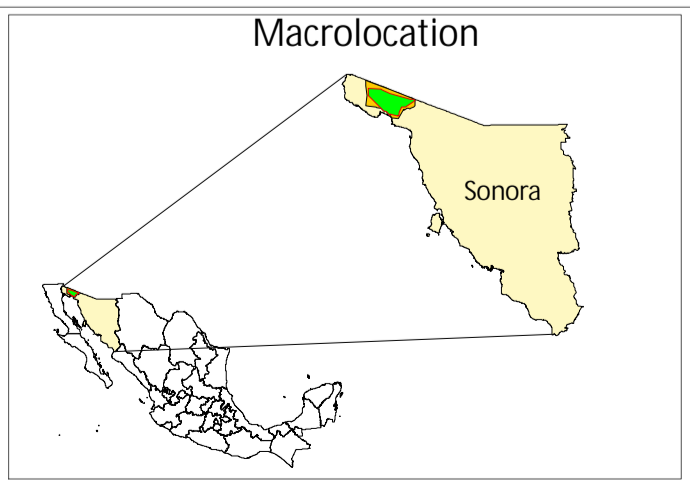
Figure 7 Show the Volcanic field of the valle de Santiago, MExico



Area of Nomination for World Heritage
Pinacate and Gran Desierto de Altar
Biosphere Reserve

CONANP
Regional Direction Northwestern
and Upper Gulf of California

Symbology	
Nominated Property	Headquarters
Nominated Property Boundary	Visitor's Center
Buffer Zone	Field Station
Ramsar Site Agua Dulce	Municipal Boundary
Cities	Train Railway
Towns	Roads
Sonoyta River	Affluent Water



Sources of Cartographic Information

The National Commission of Natural Protected Areas
The National Institute of Statistic and Geography
Reserve Directorate

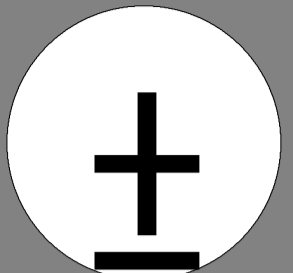
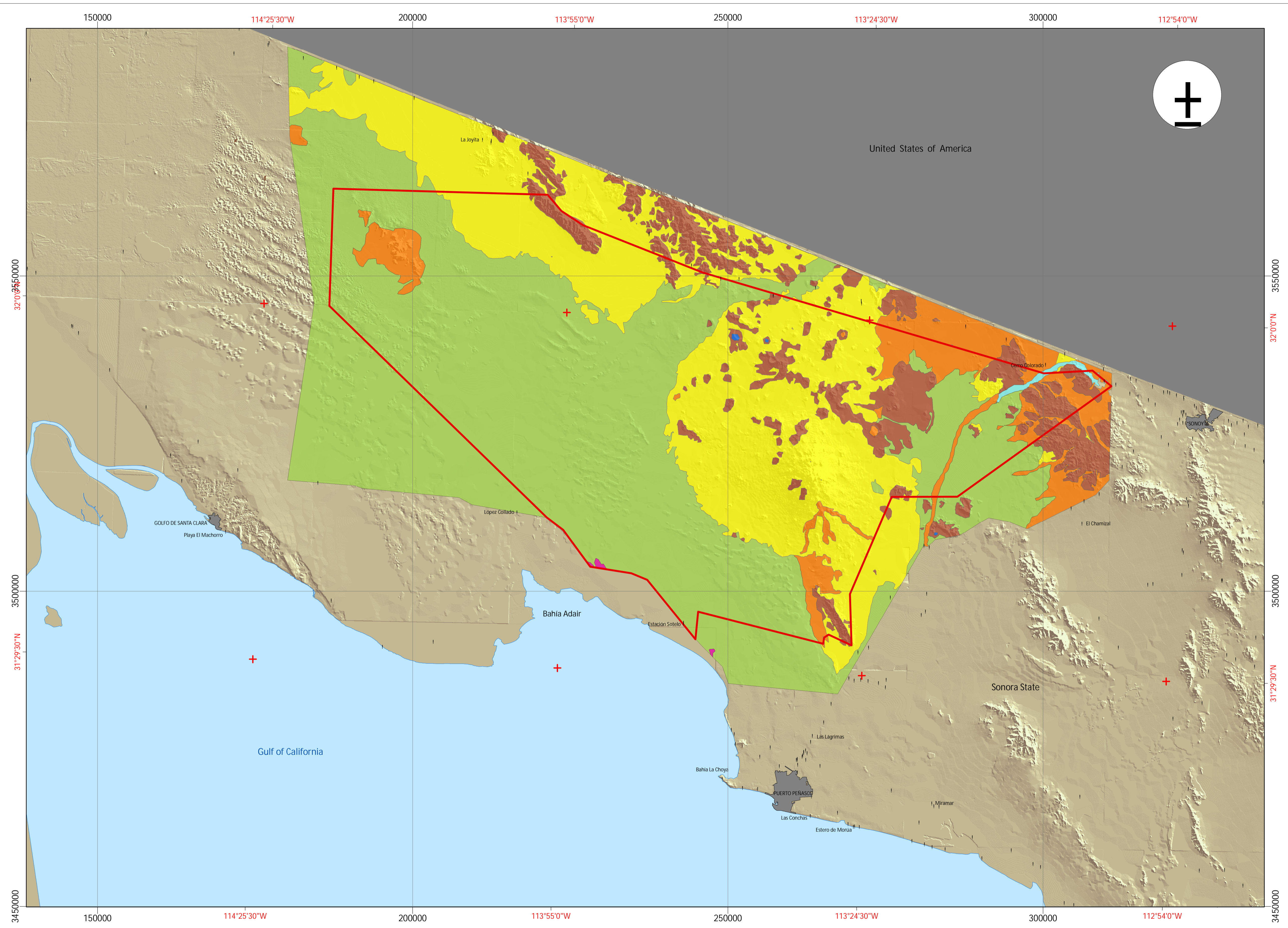
Surface Nominated Property: 455,207.35 Ha.
Surface Buffer Zone: 259,349.15 Ha.

Cartographic Specifications

Projection: UTM
Datum: Itrf92
Zone: 12
Scale: 1:300,000

Graphic Scale: Kilometers

Zoning Map



Area of Nomination for World Heritage
Pinacate and Gran Desierto de Altar
Biosphere Reserve

CONANP
Regional Direction Northwestern
and Upper Gulf of California

Symbology

- Nominated Property Boundary
- Cities
- Towns

Types of Vegetation

- Coastal/Interior Dunes and Plains
- Creosote Bush-Bursage Desert Scrub
- Salt Bush/Salt Marsh
- Semi-Desert Grassland/Chaparral
- Mesquite Woodland
- Tourchwood-Limberbush Desert Scrub
- Palo Verde-Mixed Cacti Desert Scrub

Macrolocation

Sources of Cartographic Information

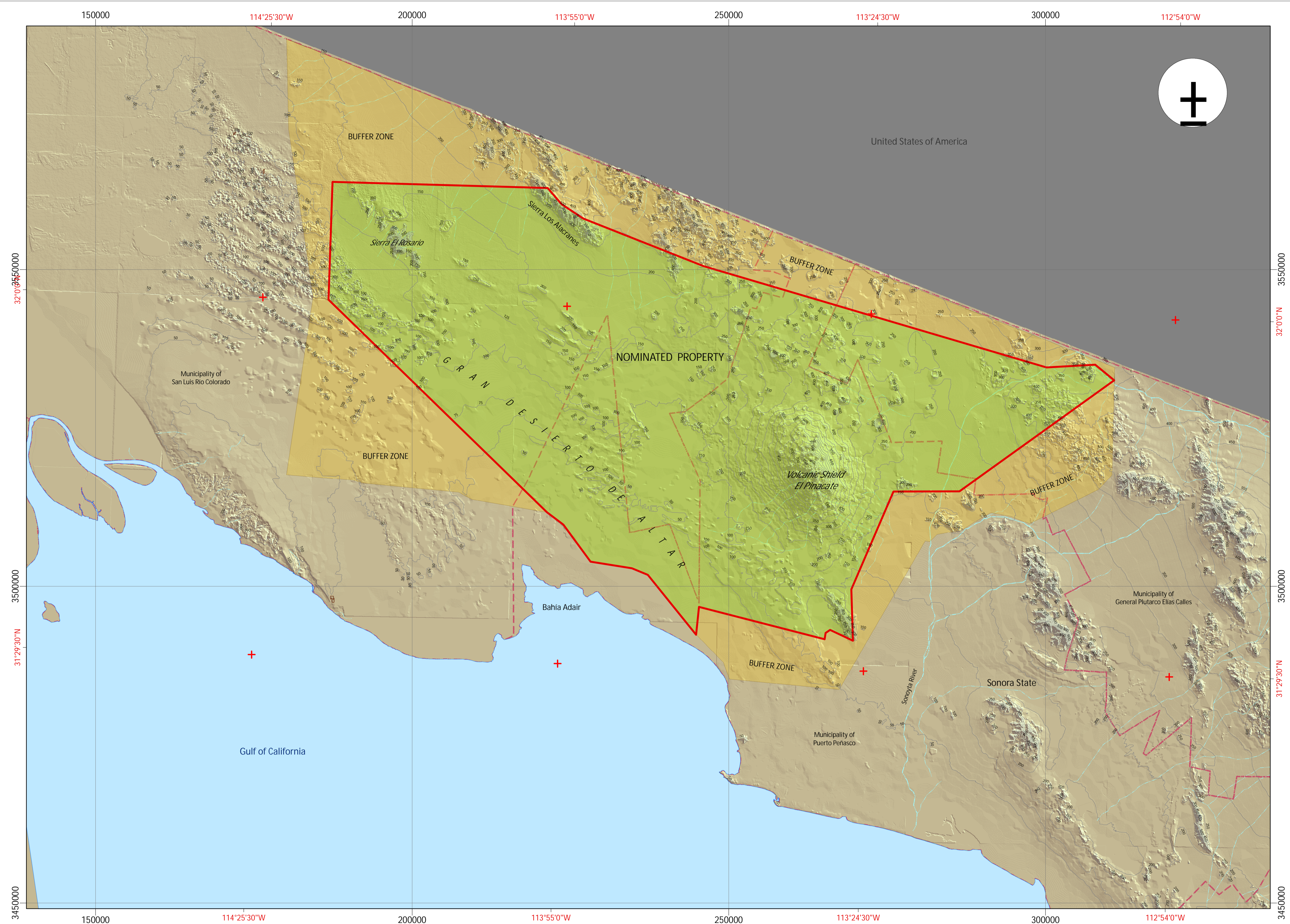
The National Commission of Natural Protected Areas
The National Institute of Statistic and Geography
Reserve Directorate

Cartographic Specifications

Projection: UTM
Datum: Itrf92
Zone: 12
Scale: 1:300,000

Graphic Scale: Kilometers

Vegetation Map



Area of Nomination for World Heritage
Pinacate and Gran Desierto de Altar
Biosphere Reserve

CONANP
Regional Direction Northwestern
and Upper Gulf of California

Symbology

Nominated Property	Contour Topographic (m.a.s.l.)	Sonoyta River
Nominated Property Boundary	Municipal Boundary	Affluent Water
Buffer Zone		

Macrolocation

Sources of Cartographic Information

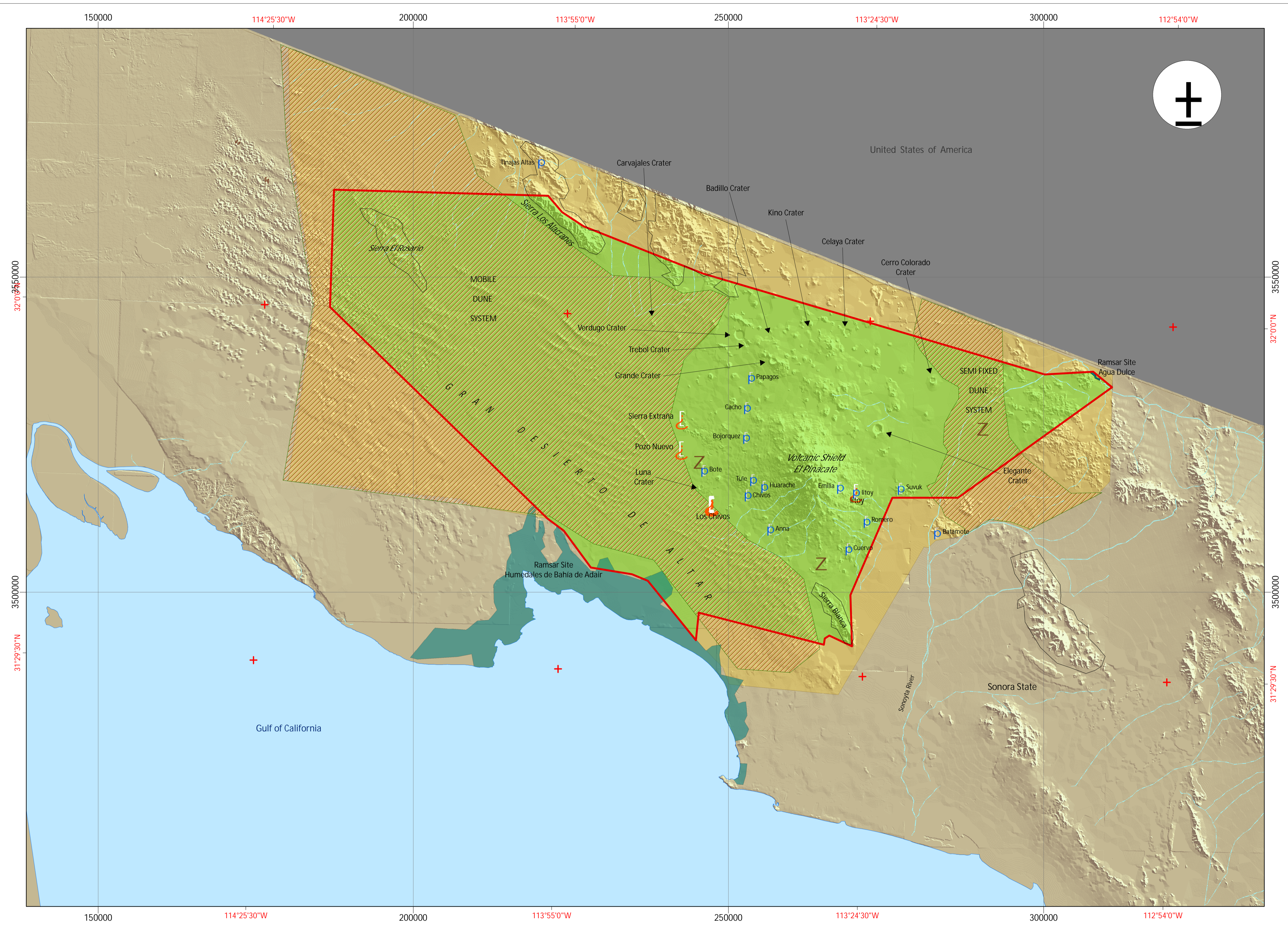
The National Commission of Natural Protected Areas
The National Institute of Statistic and Geography
Reserve Directorate

Cartographic Specifications

Projection: UTM
Datum: Itrf92
Zone: 12
Scale: 1:300,000

Graphic Scale: Kilometers

Topographic Map



Area of Nomination for World Heritage
Pinacate and Gran Desierto de Altar
Biosphere Reserve



- Nominated Property
- Nominated Property Boundary
- Buffer Zone
- Dune System

Symbology

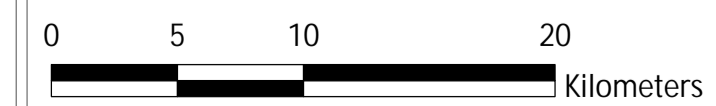
- p Tinajas
- Archaeological Sites
- Bat Cave
- Ramsar Sites
- Granitic Mountain
- ~~~~~ Sonoyta River
- ~~~~~ Affluent Water

Macrolocation



Sources of Cartographic Information

The National Commission of Natural Protected Areas
The National Institute of Statistic and Geography
Reserve Directorate

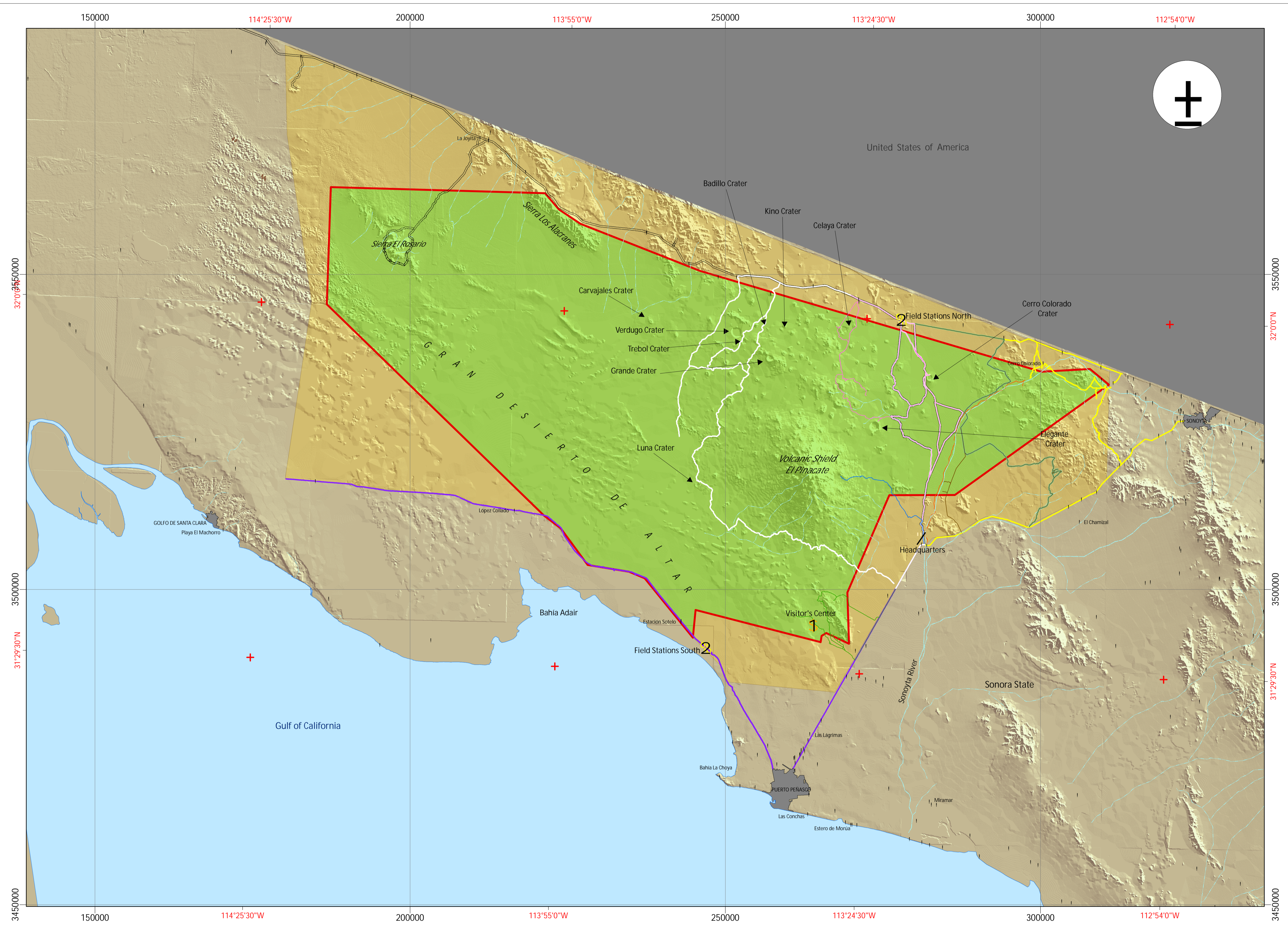


Cartographic Specifications

Projection: UTM
Datum: Itrf92
Zone: 12
Scale: 1:300,000

Graphic Scale: Kilometers

Geomorphologic Map



Area of Nomination for World Heritage
Pinacate and Gran Desierto de Altar
Biosphere Reserve

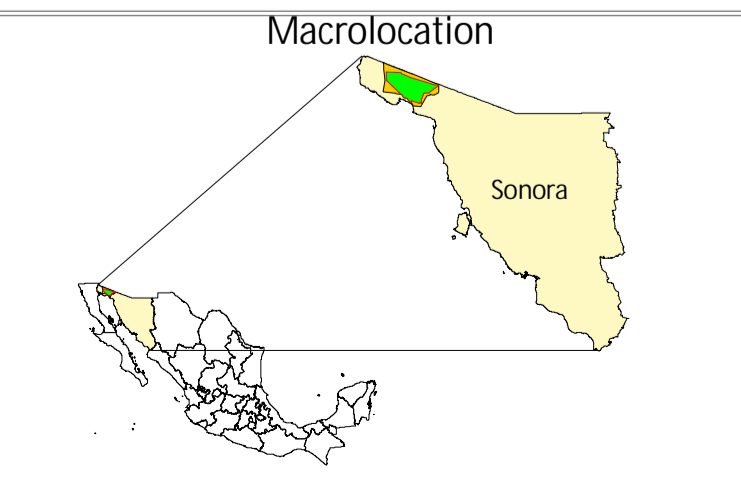


Symbology

Nominated Property	Headquarters
Nominated Property Boundary	Visitor's Center
Buffer Zone	Field Stations
Cities	Sonoyta River
Towns	Affluent Water

Monitoring Route

Route 1	Route 5b
Route 2	Route 6
Route 3	Route 7
Route 4	Route 8
Route 5a	Route 9



Sources of Cartographic Information

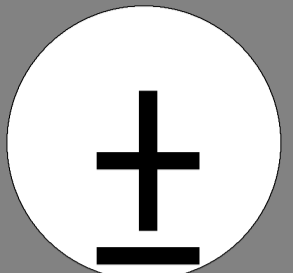
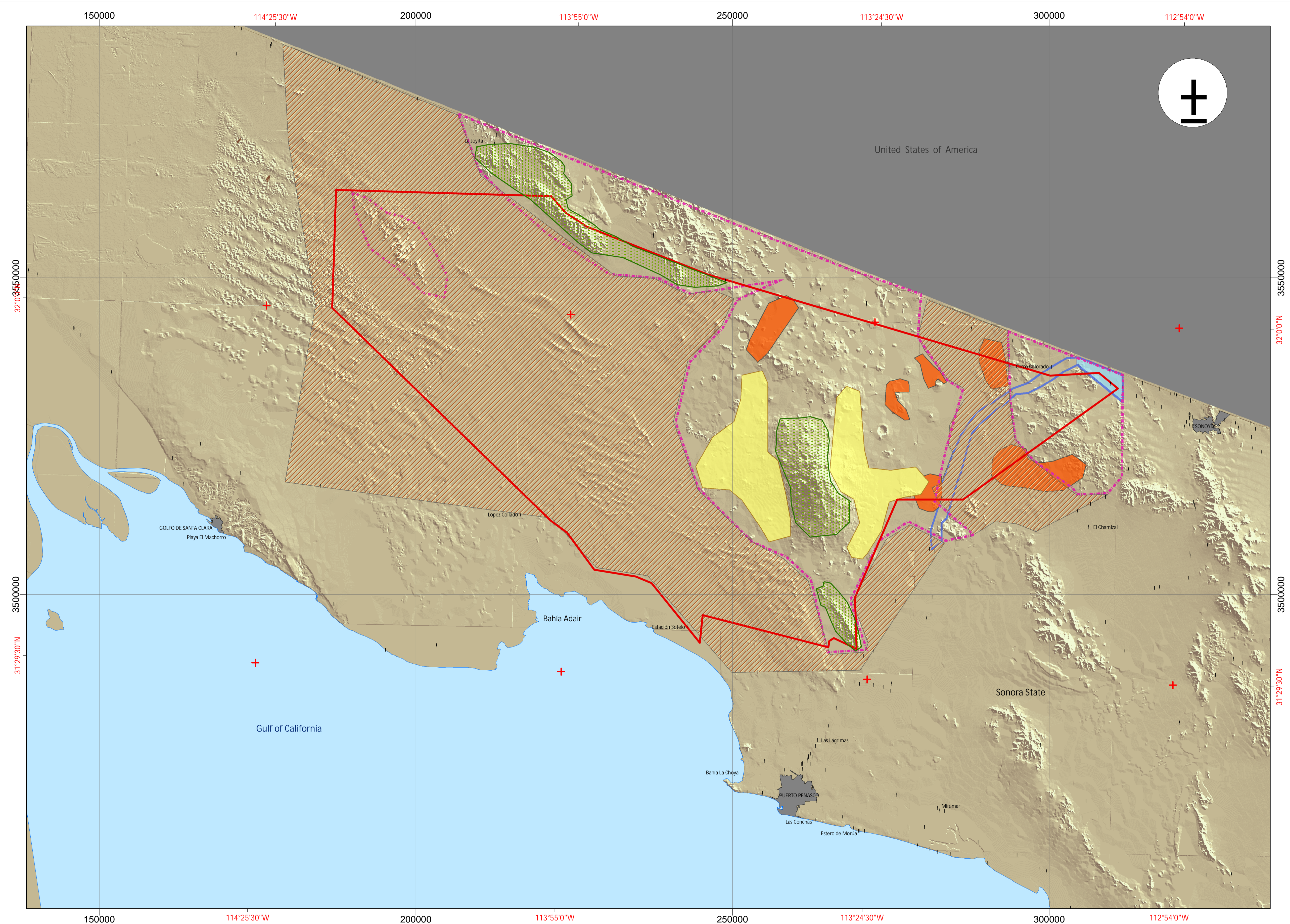
The National Commission of Natural Protected Areas
The National Institute of Statistic and Geography
Reserve Directorate

Cartographic Specifications

Projection: UTM
Datum: Itrf92
Zone: 12
Scale: 1:300,000

Graphic Scale: Kilometers

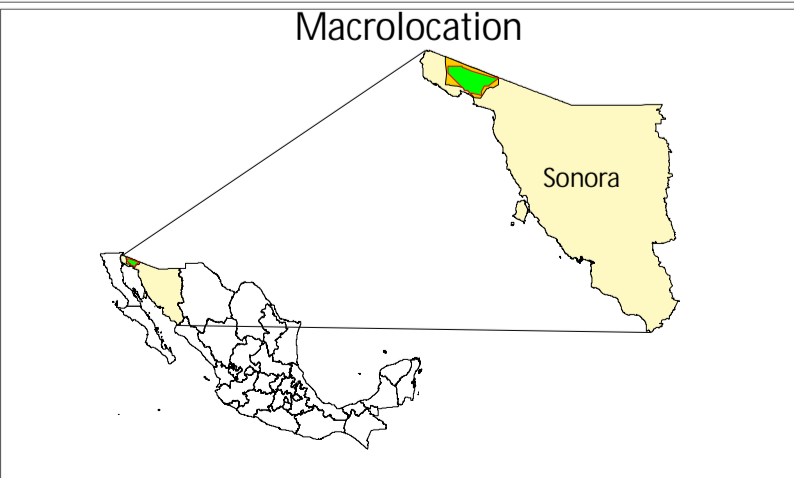
Monitoring Route



Area of Nomination for World Heritage Pinacate and Gran Desierto de Altar Biosphere Reserve

CONANP
Regional Direction Northwestern and Upper Gulf of California

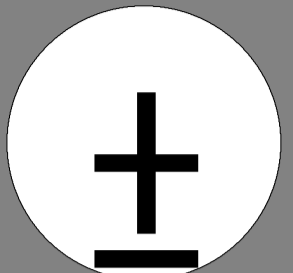
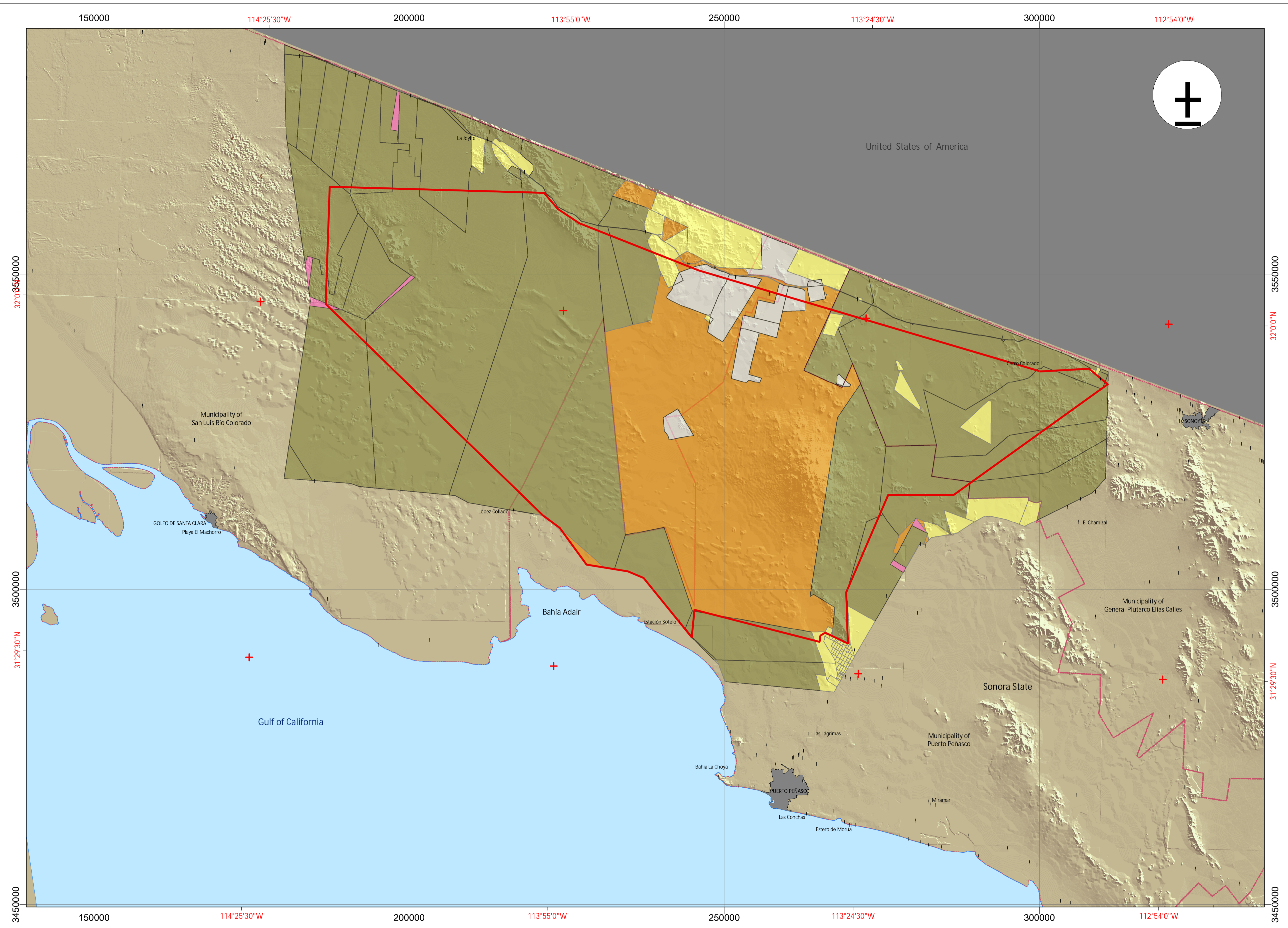
Symbology	
Nominated Property Boundary	Sonoran Pronghorn (Endangered species)
Cities	Bighorn Sheep (Threatened species)
Towns	Native Fish
	Acuatic Systems/Tinajas
	Riparian and Acuatic System of the Sonoyta River
	Sierras and Valleys
	Dune System



Sources of Cartographic Information

The National Commission of Natural Protected Areas
The National Institute of Statistic and Geography
Reserve Directorate

Cartographic Specifications
Projection: UTM
Datum: Itrf92
Zone: 12
Scale: 1:300,000
Graphic Scale: Kilometers
Conservation Objects



**Area of Nomination for World Heritage
Pinacate and Gran Desierto de Altar
Biosphere Reserve**

Regional Direction Northwestern
and Upper Gulf of California

Symbology

- Nominated Property Boundary
- Cities
- ! Towns
- Municipal Boundary

Type of Property

- Private Property
- Private Possession
- Ejidal Possession
- Communal Land
- Conanp Properties

Macrolocation

Sources of Cartographic Information

The National Commission of Natural Protected Areas
The National Institute of Statistic and Geography
Reserve Directorate

Conanp properties inside the Nominated Property: 145,299.73 Ha.
Communal Land inside the Nominated Property: 309,907.62 Ha.

Cartographic Specifications

Projection: UTM
Datum: Itrf92
Zone: 12
Scale: 1:300,000

Graphic Scale: Kilometers

Land Ownership



MISIÓN PERMANENTE DE MÉXICO
ANTE LA UNESCO

UNE-00191

París, a 21 de febrero de 2013

Estimada Señora Sanz:

Hago referencia a la comunicación de la Unión Internacional por la Conservación de la Naturaleza (IUCN), fechada el 20 de diciembre de 2012, en la cual el Sr. Tim Badman, Director del Programa de Patrimonio Mundial, solicitaba información adicional sobre la candidatura mexicana de la Reserva de la Biosfera El Pinacate y Gran Desierto de Altar para su inscripción en la Lista de Patrimonio Mundial de la UNESCO, como seguimiento a la misión técnica de evaluación que efectuó el IUCN in situ del 23 al 30 de octubre de 2012.

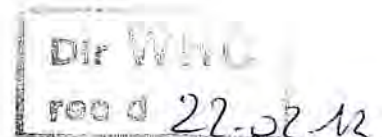
Al respecto, en anexo remito 3 sobres cerrados que contienen la información adicional solicitada, así como el original de la comunicación No. FOO-0086 que el Mtro. Luis Fueyo Mac Donald, Titular de la Comisión Nacional de Áreas Naturales Protegidas, dirige al Sr. Badman.

Agradeciéndole de antemano su amable atención a la presente, aprovecho la ocasión para enviarle un cordial saludo.

Atentamente,

Min. Mauricio Escanero
Representante Permanente Alterno
Encargado de Negocios, a. i.

A la
Sra. Nuria Sanz
Jefa de la Unidad de América Latina y el Caribe del
Centro de Patrimonio Mundial
Sector de Cultura
UNESCO



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Polguita

L. A. Balsano
J. Jove

**COMISIÓN NACIONAL DE ÁREAS
NATURALES PROTEGIDAS**

OFICINA DEL C. COMISIONADO

OFICIO NÚM.- FOO 0086

Ciudad de México a, 12 FEB 2013

**TIM BADMAN,
DIRECTOR WORLD HERITAGE
PROGRAMME, IUCN.**

In reference to your kind letter from December 20th, 2012, and proceeding in time to provide the supplementary information you referred to as part of the evaluation process and new considerations emerged during the visit and technical mission carried on to the Pinacate and Gran Desierto de Altar Biosphere Reserve from October 23-30th of 2012.

With respect to the clarification of information as you kindly requested in your communication, referred to as: Point 1, to provide an indication of our position in relation to the possibility to consider modifications to the boundary of the nominated property in order to:

- i. Include additional areas of the dune field extending beyond the boundaries of the nominated property so as to coincide with the boundaries of the national biosphere reserve.
- ii. Reduce the discrepancy between the nominated property and the national biosphere reserve by refining the buffer zones within and on the margins of the nominated property, considering the relevant disturbing factors and management needs, in a way that would maximize the extent of the property, while providing effective buffer zones.

On behalf of the Mexican Government I want to express our appreciation for the request of the IUCN to clarify the boundaries of the nominated property and its buffer zone, because it gives us the opportunity to modify our original proposal and improve it, by expanding the surface and ensuring its integrity and management, and to provide our position in the subjects the IUCN requested.

The new boundaries of the nominated property are clearly presented in the corresponding maps we are sending annex to this communication. These boundaries were established taking into account the "Operational Guidelines on the World Heritage Convention", mainly paragraphs 99 to 102 referring to the boundaries for an effective protection of the nominated site, and paragraphs 103 to 107 that determine the guidelines for the buffer zones.

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The description of the new boundaries of the nominated property coincide with the boundaries of the national Biosphere Reserve, established by presidential decree in 1993 as a Natural Protected Area, with a total surface of 714,566-50 hectares.

El Pinacate and Gran Desierto de Altar Biosphere Reserve (and nominated property) limits to the North with the International Border Line between USA and Mexico over 140 kilometers; to the South the limit is the railroad that goes from Puerto Peñasco to San Luis Río Colorado, Sonora, a distance of 83 kilometers (boundaries which that area shares with Alto Golfo de California y Delta del Río Colorado Biosphere Reserve). To the East, the border is established by the federal road number 8 over 60 kilometers. To the West, the limit is the extreme area of dunes of the Gran Desierto de Altar over 70 kilometers long.

In order to grant effective protection of the nominated property, the buffer zones surrounding it, to the South, East and West are:

- 1) To the South, a portion of the national Alto Golfo de California y Delta del Río Colorado Biosphere Reserve. This natural protected area grants legal protection and management to 934,756 hectares of terrestrial, marine, coastal and wetland ecosystems. It has a surface of approximately 408,760 hectares of terrestrial and coastal habitats, immediate to the property, where activities are regulated for conservation and sustainable purposes. This gives an added layer of protection to the property.
- 2) To the East of the Nominated Property, the buffer zone includes a surface of 161,737.34 hectares of the Sonoran Desert, with natural constraints that do not allow the development of primary activities in an intensive way; traditional agriculture and livestock are incipient and there are few inhabitants living in isolated *rancherías*. The region East of the highway number 8 Sonoyta-Puerto Peñasco, has a land use program developed by the State Government of Sonora, that regulates hunting activities for a few wildlife species in registered UMAS (Management and Conservation Units). The external border of this Buffer zone was design to include land with low number of inhabitants and established UMAs.
- 3) To the West, it includes the vast sand dunes fields of El Gran Desierto de Altar, and is part of the immediate setting of the nominated property. The surface of this zone is 193,134 hectares. It consists of shifting great dunes, without people living there, and the only tourism traditional activity since 1960 are the crossings of dunes, once or twice in a year, by organized ATV clubs from San Luis Río Colorado. There are extraordinary views of this attractive and changing landscape. The boundary of this buffer zone, including the main features of the natural surroundings, was drawn by a straight line running from North to South from the point of the International Border line to the intersection with the perimeter line of Alto Golfo de California y Delta del Río Colorado Biosphere Reserve.

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To the North, divided by the International border line, in the State of Arizona, USA, there are three protected areas: Organ Pipe Cactus National Monument, Cabeza Prieta National Wildlife Refuge, and Barry M. Goldwater Range, functioning as an extensive buffer zone that maintains the connectivity between them and El Pinacate. These protected areas cover a surface of 619,348 hectares.

The new surface of the Nominated Property maximizes the extent of the property, while providing effective protection. (See Map of the Nominated Property and Buffer Zones).

Total Surface of the Nominated Property: 714,566-50 hectares

Total surface of the Buffer Zones (East and West): 354,871.34 hectares

Surface of Alto Golfo de California y Delta del Río Colorado Biosphere Reserve immediate to the nominated property: 408,760 hectares

Extreme geographical coordinates of the Nominated Property:

31°27'53.58" to 32°22'07.81" North Latitude, and
113°0'0.87" to 114°23'56.64" West Longitude.

The new surface enhances the consistency of the Nominated Property but does not modify the Outstanding Universal Value nor the Criteria under which inscription is proposed. (We are including seven different maps with the nominated property new limits: Zoning, topographic, vegetation, geomorphologic, conservation objects, land ownership and monitoring route)

With respect to Point 2 of the IUCN communication, where we are asked to indicate our position to consider the eventual inclusion of the adjacent Humedales de Bahía Adair Ramsar Site in the nominated property, we state the following: This Ramsar Site is in the East side of Alto Golfo de California y Delta del Río Colorado Biosphere Reserve and south of the Nominated Property, functioning as a buffer zone.

Unquestionably the wetlands of Bahía de Adair have unique natural characteristics and values that during the Mission all of the participants and experts involved had the opportunity to recognize and confirm. It is part of the biogeographic region and is closely related to the Nominated Property, as part of an ancient delta that continues to play an important ecological role of a coastal wetland in an extremely desert environment.

However, at present our position is not to include at this time Humedales de Bahía Adair Ramsar Site in the Nominated Property. There are management and social involving processes that are underway, and a proposal of this importance requires a good level of social and governmental consensus and participation, as those already attained for the Nominated Property, (as per paragraph 123 of the Operational Guidelines). We will wait

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to see how the nomination process for El Pinacate y Gran Desierto de Altar Biosphere Reserve concludes.

With these positions and the information provided on behalf of the Mexican Government, we expect to have fulfilled the IUCN request for supplementary information that by this means we officially submit, and we appreciate the advice received to improve the proposal of this nominated property to the List of the World Heritage Convention.

**YOURS SINCERELY,
EL COMISIONADO NACIONAL**

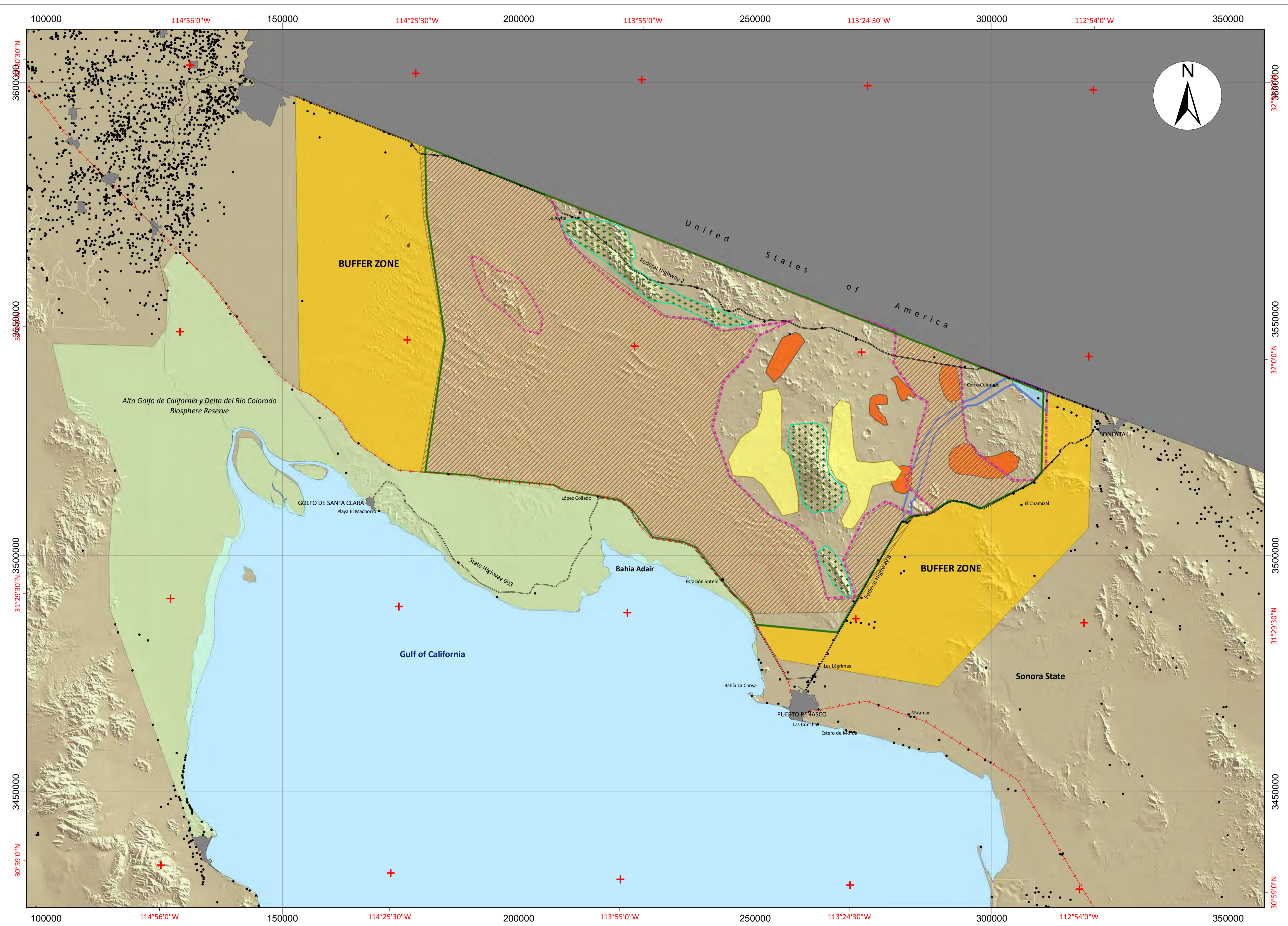
Luis Fueyo Mac Donald
LUIS FUEYO MAC DONALD

"por un uso responsable de papel, las copias son remitidas por correo electrónico"

C.c.e.p.-

Emb. Mario Chacón Carrillo, Secretario General de la CONALMEX, S.E.P
Emb. Arturo Hernández Basave, Director General para la Organización de las Naciones Unidas, S.R.E
Mauricio Escanero Figueroa, Encargado de la Misión Permanente de México ante la UNESCO, SRE.
Enrique Lendo Fuentes, Titular de la Unidad Coordinadora de Asuntos Internacionales, SEMARNAT.
Mariana Bellot Rojas, Directora General de Desarrollo Institucional y Promoción, CONANP.
Francisco López Morales, Director de Patrimonio Mundial, INAH
Carlos Castillo Sanchez, Director Región Noreste y Alto Golfo de California, CONANP.
María Pía Gallina Tessaro, Directora de Patrimonio Mundial Natural y Programa MaB, CONANP.
Federico Godínez Leal, Director de la Reserva de la Biosfera El pinacate y Gran Desierto de Altar, CONANP.
Archivo.

LFM/MBR/PCT

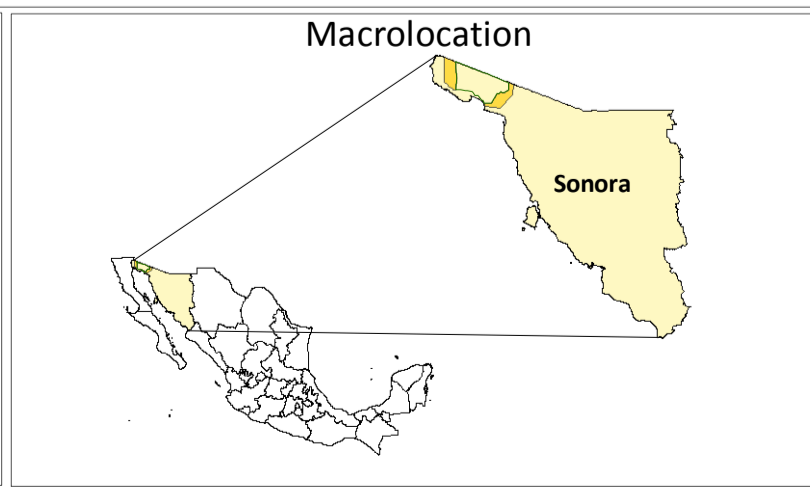


Area of Nomination for World Heritage Pinacate and Gran Desierto de Altar Biosphere Reserve

Regional Direction Northwestern and Upper Gulf of California

Symbology

Nominated Property Boundary	Cities	Sonoran Pronghorn (Endangered species)	Riparian and Acuatic System of the Sonoyta River
Buffer Zone	Towns	Bighorn Sheep (Threatened species)	Sierras and Valleys
Alto Golfo de California y Delta del Río Colorado Biosphere Reserve.	Train Railway	Native Fish	Dune System
	Roads	Acuatic Systems/Tinajas	



Sources of Cartographic Information

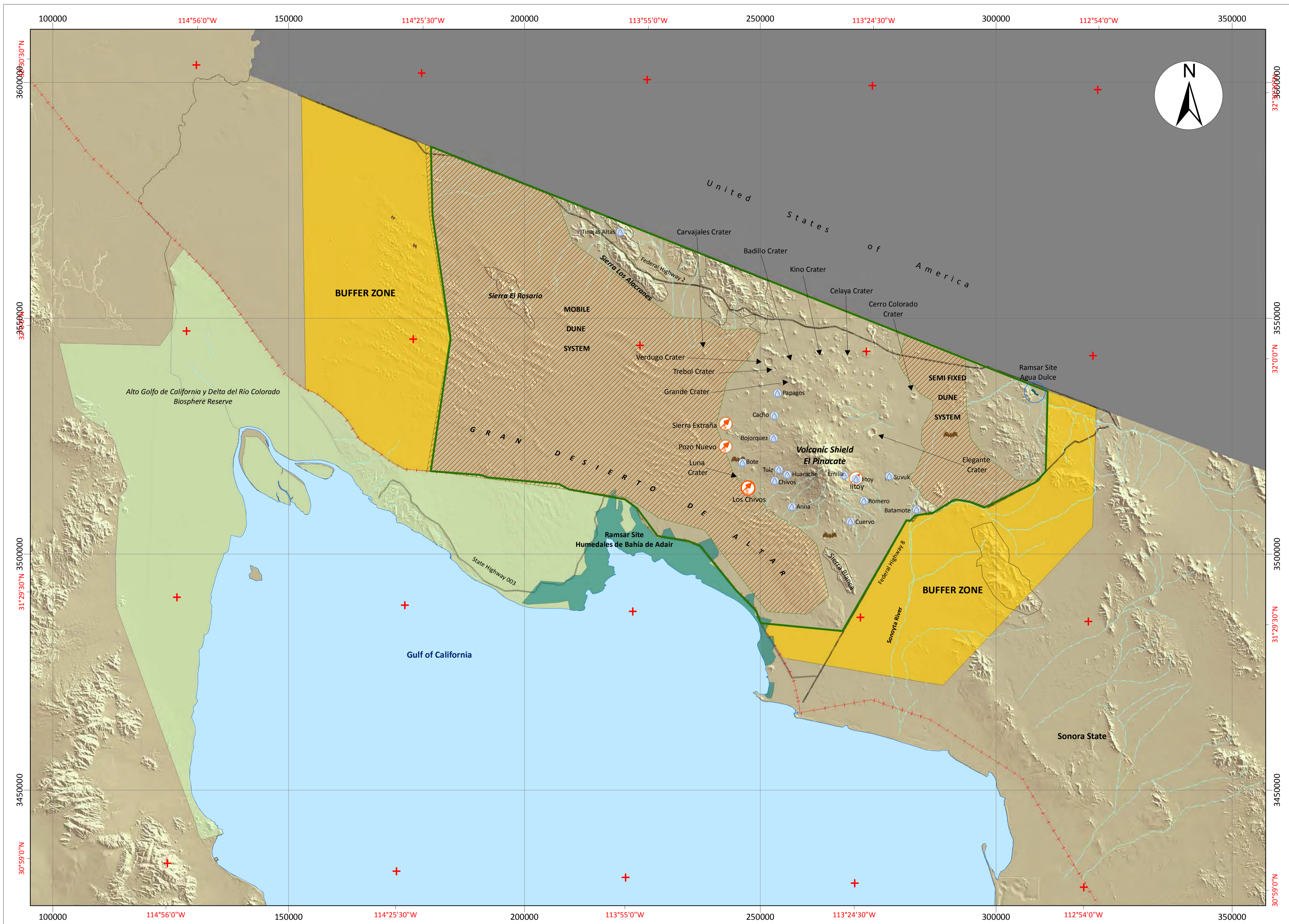
The National Commission of Natural Protected Areas
The National Institute of Statistic and Geography
Reserve Directorate

Cartographic Specifications

Projection: UTM
Datum: Itrf92
Zone: 12
Scale: 1:400,000

Graphic Scale: Kilometers

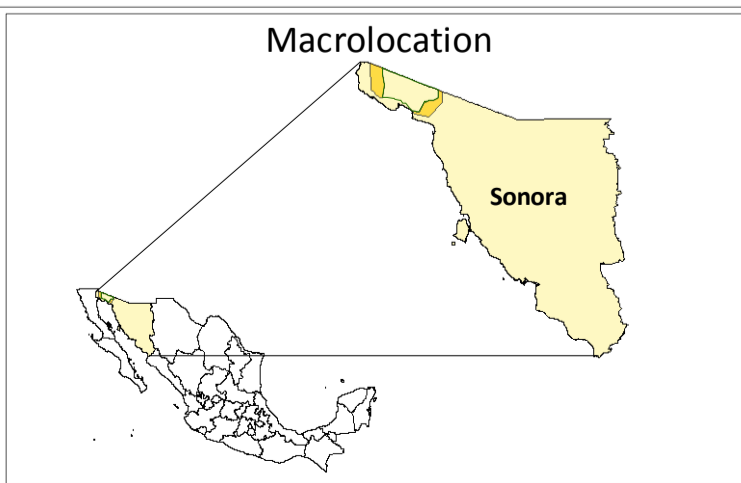
Conservation Objects



Area of Nomination for World Heritage Pinacate and Gran Desierto de Altar Biosphere Reserve



Symbology			
Nominated Property Boundary	Train Railway	Tinajas	Granitic Mountain
Buffer Zone	Roads	Archaeological Sites	Dune System
Alto Golfo de California y Delta del Río Colorado Biosphere Reserve.	Sonoyta River	Bat Cave	
	Affluent Water	Ramsar Sites	



Sources of Cartographic Information

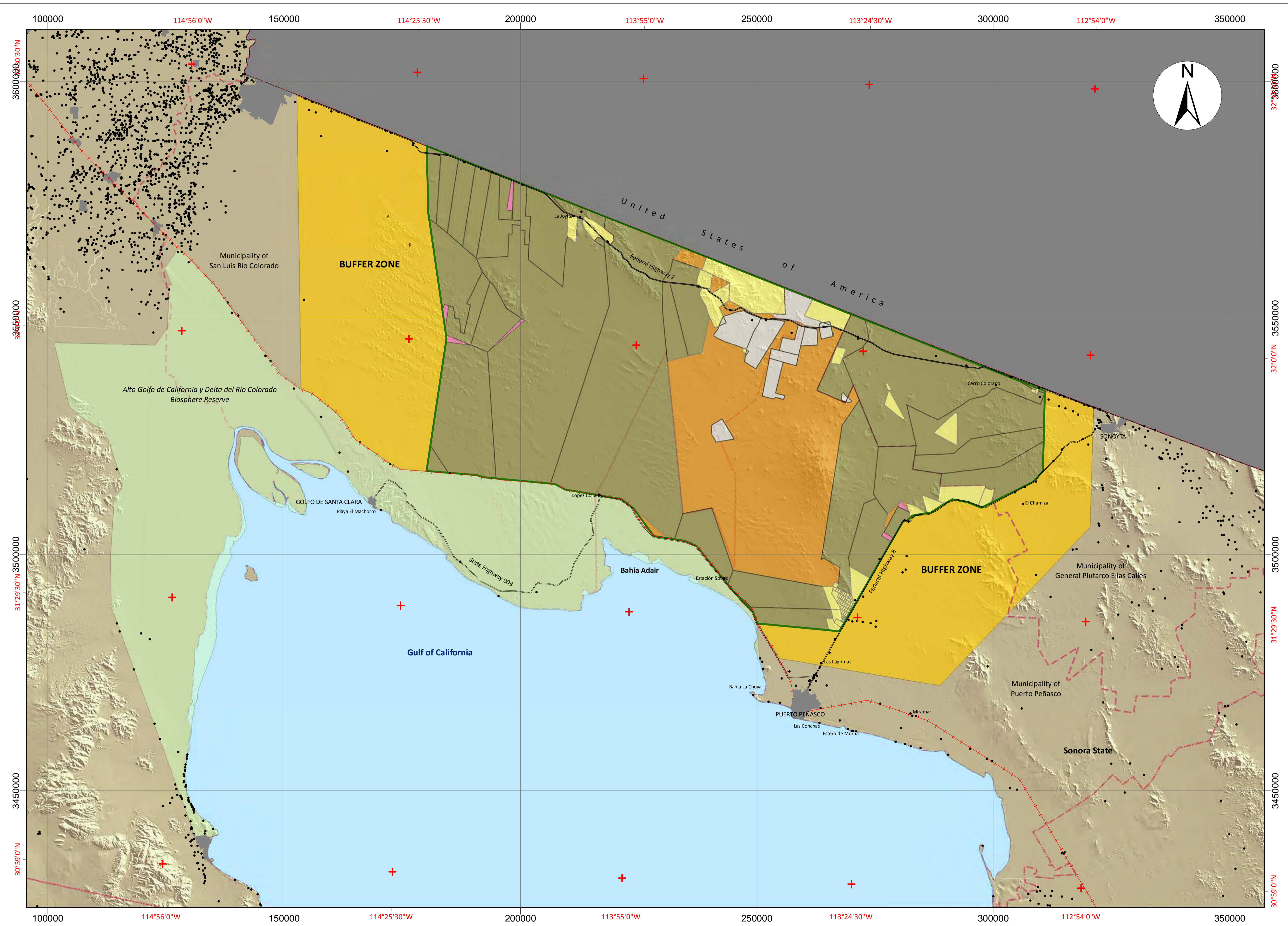
The National Commission of Natural Protected Areas
The National Institute of Statistic and Geography
Reserve Directorate

Cartographic Specifications

Projection: UTM
Datum: Itrf92
Zone: 12
Scale: 1:400,000

Graphic Scale: Kilometers

Geomorphologic Map

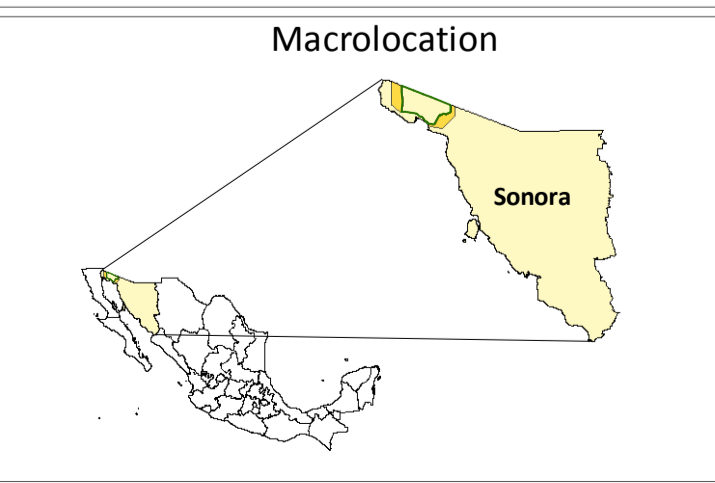


Area of Nomination for World Heritage
Pinacate and Gran Desierto de Altar
Biosphere Reserve

CONANP
 Regional Direction Northwestern and Upper Gulf of California

Symbology

Nominated Property Boundary	Cities	Private Property	Communal Land
Buffer Zone	Towns	Private Possession	Conanp Properties
Municipal Boundary	Train Railway	Ejidal Possession	
Alto Golfo de California y Delta del Río Colorado Biosphere Reserve.	Roads		



Sources of Cartographic Information

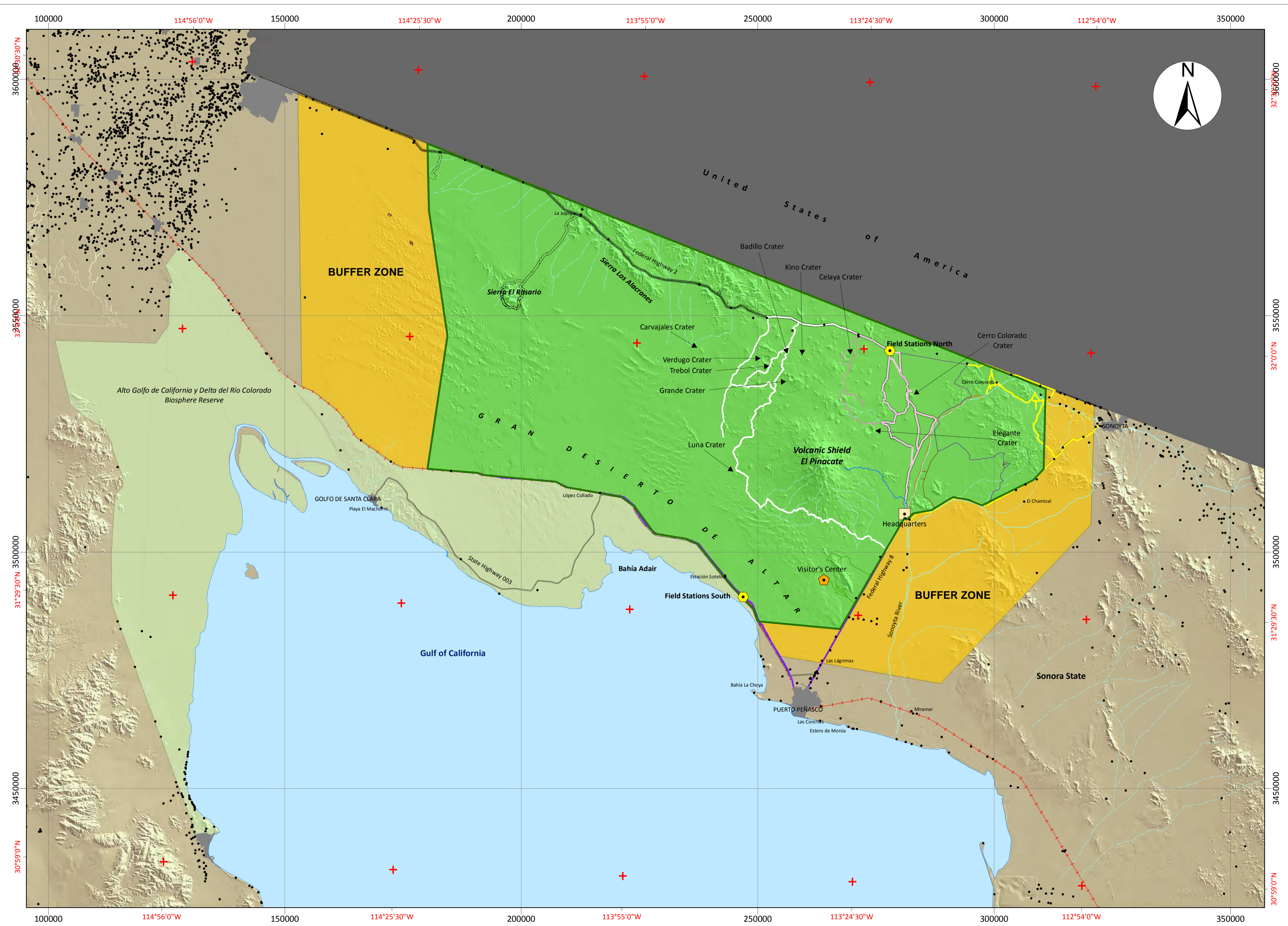
The National Commission of Natural Protected Areas
 The National Institute of Statistic and Geography
 Reserve Directorate

Conanp properties inside the Nominated Property: 145,299.73 Ha.
 Communal Land inside the Nominated Property: 309,907.62 Ha.

Cartographic Specifications

Projection: UTM
 Datum: Itrf92
 Zone: 12
 Scale: 1:400,000
 Graphic Scale: Kilometers

Land Ownership

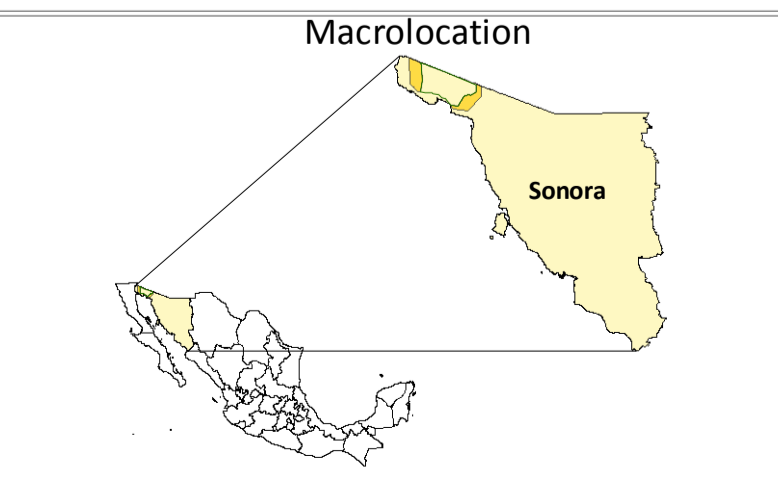


Area of Nomination for World Heritage
Pinacate and Gran Desierto de Altar
Biosphere Reserve



- Symbology**
- Nominated Property
 - Nominated Property Boundary
 - Buffer Zone
 - Alto Golfo de California y Delta del Río Colorado Biosphere Reserve.
 - + Train Railway
 - Roads
 - Cities
 - Towns
 - Headquarters
 - Visitor's Center
 - Field Stations
 - ~ Sonoyta River
 - ~ Affluent Water

- Monitoring Route**
- Route 1
 - Route 2
 - Route 3
 - Route 4
 - Route 5a
 - Route 5b
 - Route 6
 - Route 7
 - Route 8
 - Route 9



Sources of Cartographic Information

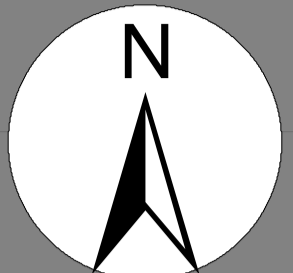
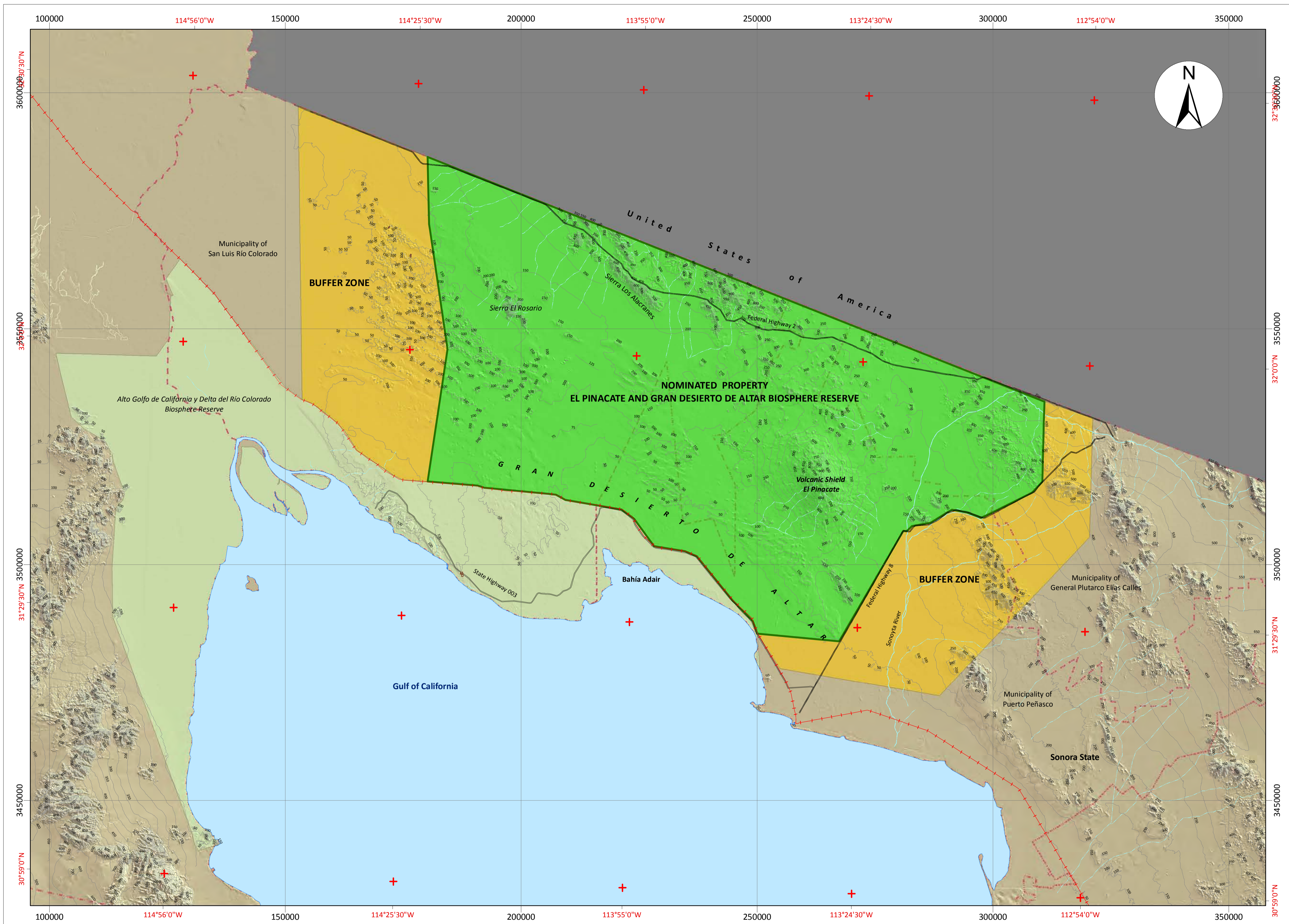
The National Commission of Natural Protected Areas
The National Institute of Statistic and Geography
Reserve Directorate

Cartographic Specifications

Projection: UTM
Datum: Itrf92
Zone: 12
Scale: 1:400,000

Graphic Scale: Kilometers

Monitoring Route



Area of Nomination for World Heritage
Pinacate and Gran Desierto de Altar
Biosphere Reserve

Regional Direction Northwestern
and Upper Gulf of California

Symbology

- Nominated Property
- Nominated Property Boundary
- Buffer Zone
- Alto Golfo de California y Delta del Río Colorado Biosphere Reserve.

Symbology

- Contour Topographic (m.a.s.l.)
- Municipal Boundary
- Train Railway
- Roads
- Sonoyta River
- Affluent Water

Macrolocation

Sources of Cartographic Information

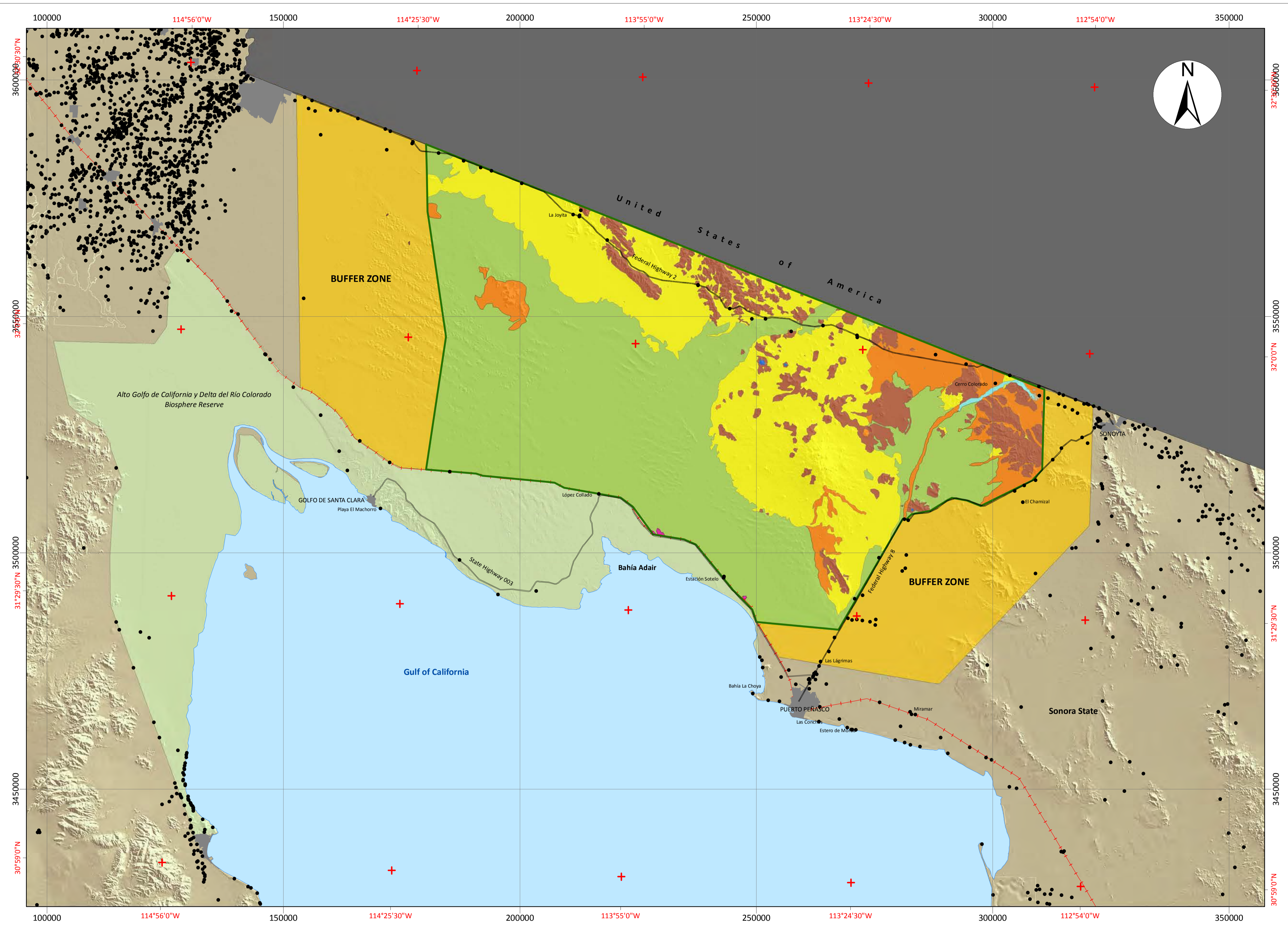
The National Commission of Natural Protected Areas
The National Institute of Statistic and Geography
Reserve Directorate

Cartographic Specifications

Projection: UTM
Datum: Itrf92
Zone: 12
Scale: 1:400,000

Graphic Scale: Kilometers

Topographic Map



Area of Nomination for World Heritage
Pinacate and Gran Desierto de Altar
Biosphere Reserve

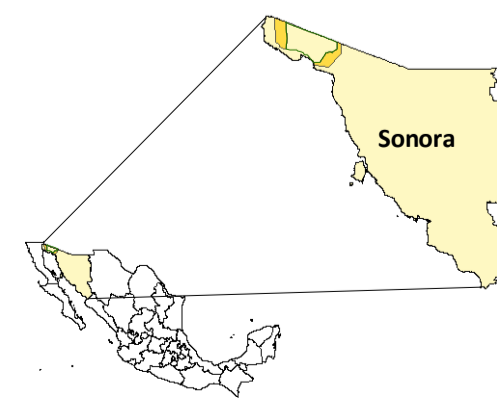


Regional Direction Northwestern
and Upper Gulf of California

- Symbology**
- Nominated Property Boundary
 - Buffer Zone
 - Alto Golfo de California y Delta del Río Colorado Biosphere Reserve.
 - + Train Railway
 - Roads
 - Cities
 - Towns

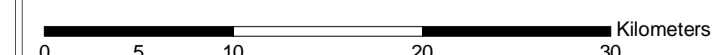
- Symbology**
- Types of Vegetation**
- Coastal/Interior Dunes and Plains
 - Creosote Bush-Bursage Desert Scrub
 - Mesquite Woodland
 - Palo Verde-Mixed Cacti Desert Scrub
 - Salt Bush/Salt Marsh
 - Semi-Desert Grassland/Chaparral
 - Touchwood-Limberbush Desert Scrub

Macrolocation



Sources of Cartographic Information

The National Commission of Natural Protected Areas
The National Institute of Statistic and Geography
Reserve Directorate

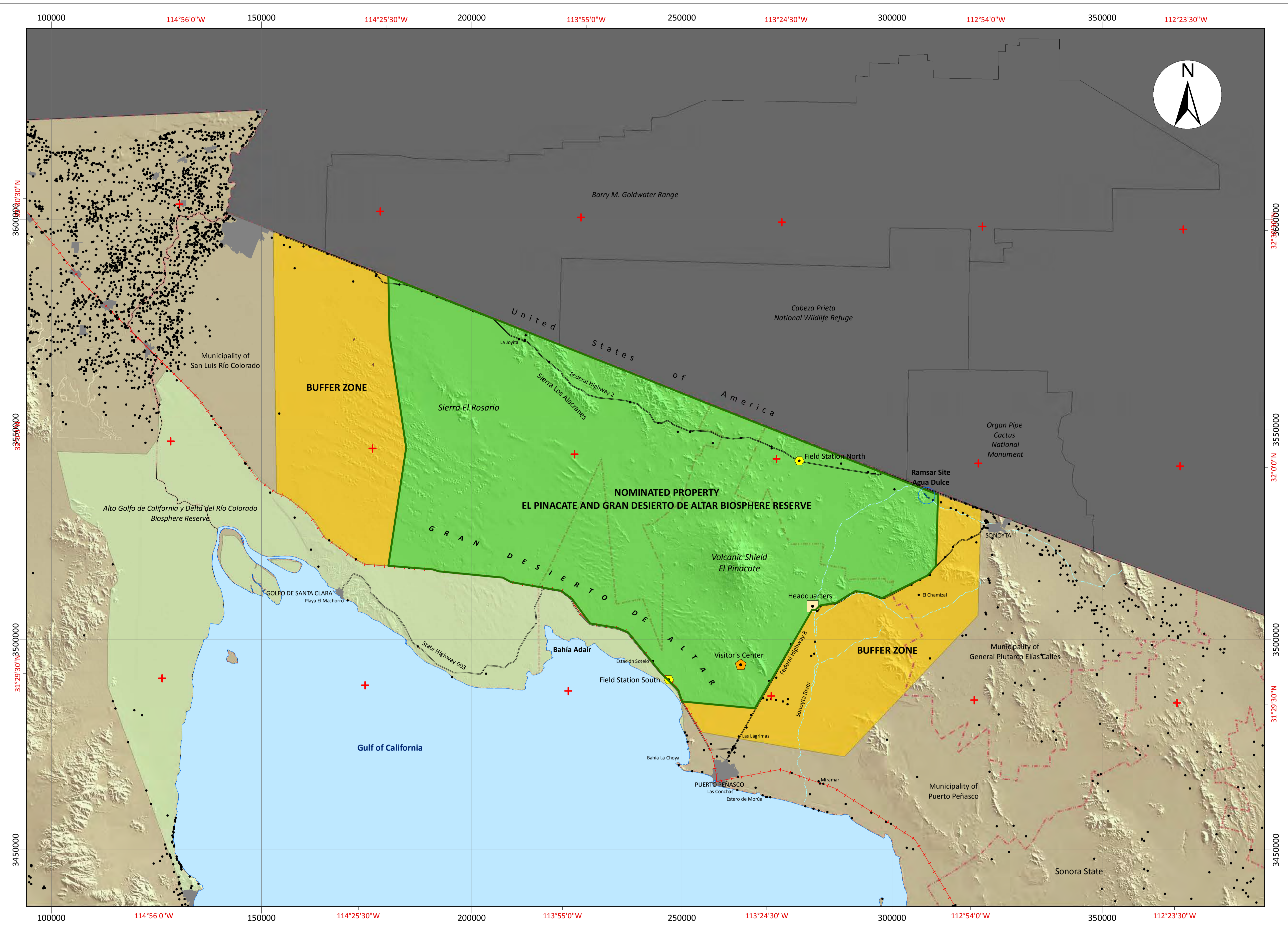


Cartographic Specifications

Projection: UTM
Datum: Itrf92
Zone: 12
Scale: 1:400,000

Graphic Scale: Kilometers

Vegetation Map

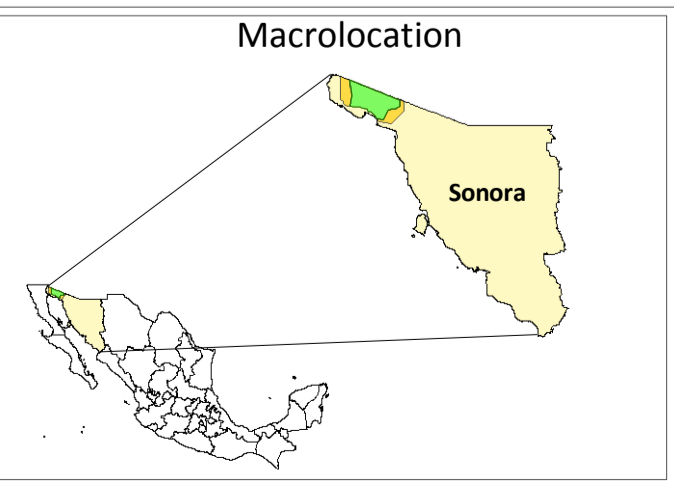


Area of Nomination for World Heritage
Pinacate and Gran Desierto de Altar
Biosphere Reserve

CONANP
Regional Direction Northwestern
and Upper Gulf of California

Symbology

Nominated Property	Headquarters	Cities	Train Railway
Nominated Property Boundary	Visitor's Center	Towns	Roads
Buffer Zone	Field Station	United States of America.	Sonoyta River
Ramsar Site Agua Dulce	Municipal Boundary	Alto Golfo de California y Delta del Río Colorado Biosphere Reserve.	



Sources of Cartographic Information

The National Commission of Natural Protected Areas
The National Institute of Statistic and Geography
Reserve Directorate

Surface Nominated Property: 714-556-50.00 Has.
Surface Buffer Zone: 354,871.34 Has.

Cartographic Specifications

Projection: UTM
Datum: Itrf92
Zone: 12
Scale: 1:450,000
Graphic Scale: Kilometers

Zoning Map

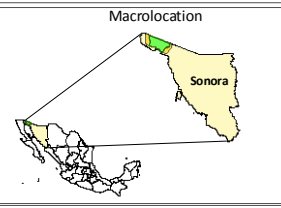


Area of Nomination for World Heritage Pinacate and Gran Desierto de Altar Biosphere Reserve

Regional Direction Northwestern and Upper Gulf of California

Symbology

Nominated Property	Headquarters	Cities	Train Railway
Nominated Property Boundary	Visitor's Center	Towns	Roads
Buffer Zone	Field Station	United States of America.	Sonoyta River
Ramsar Site Agua Dulce	Municipal Boundary	Alto Golfo de California y Delta del Río Colorado Biosphere Reserve.	



Sources of Cartographic Information

The National Commission of Natural Protected Areas
 The National Institute of Statistic and Geography
 Reserve Directorate

Surface Nominated Property: 714-556-50.00 Has.
 Surface Buffer Zone: 354,871.34 Has.

Cartographic Specifications

Projection: UTM
 Datum: Itrf92
 Zone: 12
 Scale: 1:1,350,000
 Graphic Scale: Kilometers

Zoning Map