

Part Four

Physical Environment



Cardon Cactus

Photo: Claudio Contreras

This section offers a discussion of the possible impacts the construction and operation of the border fence might have on the physical environment, specifically on water, air and soil. Also included is a description of the types of physical barrier that are already present on the border and their associated impacts.

POSSIBLE IMPACTS OF BORDER FENCE CONSTRUCTION AND OPERATION ON THE PHYSICAL ENVIRONMENT

SPECIALIST DISCUSSION

*Juan Manuel Rodríguez Esteves and
José Luis Castro Ruiz*

INTRODUCTION

The border between the United States and Mexico extends approximately 3,185 km from Tijuana, Baja California to Matamoros, Tamaulipas. The construction of a physical barrier in this region will significantly alter the physical environment, which is the product of millions of years of evolution. The main environmental impacts will present themselves differently in each of the components: water, air and soil; and their effects will manifest directly in the quality and health of the flora, fauna and human populations at the border. In this section we present the main potential impacts on the physical environment that may be brought about by the construction of the border fence between the United States and Mexico, according to the discussion held by specialists at the Technical-Scientific Workshop that took place in Tijuana.

MAIN IMPACTS IDENTIFIED

WATER COMPONENT

- a. *Obstruction and modification in relief flow, drainage and streams*
When the course of rivers and streams is blocked and in areas where the natural drainage network has been altered, standing water, sudden overflows

and floods are frequently observed as a result of rainwater or snow melt, which affects ecosystems as well as human settlements and increases the risk of flooding in lower altitude areas. In addition, the obstruction and modification of waterways leads to runoff deflection toward the low-lying areas which are frequently agricultural irrigation areas or human settlements.

b. Reduction in aquifer recharge capacity

The reduction in infiltration leads to rapid aquifer depletion, which affects the availability of water for communities.

c. Risk of flooding

In areas where waterways have been diverted without the proper complementary projects, there is an increased risk of flooding; this risk increases when heavy rains are registered upstream along the basin.

d. Public health problems

Standing water rapidly initiates the incubation process of some species of mosquitoes and flies which transmit various diseases. This can cause severe public health problems when combined with high temperatures and diet deficiencies in the communities.

AIR COMPONENT

a. Generation of Suspended particles

The soil exposed by the effects of vegetation removed is subject to erosive processes that include vehicular and human traffic. The presence of the fence directly promotes this phenomenon which can generate particles that become suspended in the atmosphere.

b. The emission of air pollutants from fixed and mobile sources

The equipment, the vehicles and the combustion processes from human activities generate a significant number of gases (including greenhouse effect gases) and particles that pollute the atmosphere.

SOIL COMPONENT

a. Modification of the physical and natural environment

The construction of a fence slightly over 1,120 km long will produce changes

in the physical and natural landscape by incorporating anthropic elements that contrast with the region's natural elements. Moreover, there will be changes in land use and modification of the terrain (topography) when the physical environment is transformed by fence construction.

b. Soil compaction

Transit of heavy equipment and motor vehicles related to border security, as well as human foot traffic, would cause soil compaction, which would hinder the development of plant communities in the region.

c. Loss of infiltration capacity

The loss of infiltration capacity required for the water to reach the aquifers would also be associated with soil compaction and the deflection of waterways caused by the physical barrier and vehicle traffic.

d. Pollution from solid and liquid waste

The introduction of vehicles and people would lead to the production of solid and liquid waste in regions where the environmental impact associated with human activity is not yet intensely present.

e. Erosive processes

Modifying the balance between the border's natural systems (soil-water-organisms) would accelerate erosion, due to the elimination of the vegetative cover and soil compaction.

f. Introduction of non-native materials and substances

Human traffic along and through the border fence would lead to the introduction of materials and substances which are foreign to the natural environment. The moment those materials and substances complete their useful cycle they can end up as solid waste (trash) and liquid waste (polluting discharge).

AVAILABLE INFORMATION

The participants in this discussion group agreed that, although dispersed, there is important information available that may enable us to diagnose the problems. Among the information sources are the following:

- a. International Boundary and Water Commission (IBWC)
- b. Aerial photographs.
- c. Lawsuits from environmental groups on both sides of the border
- d. The U.S. Army Corps of Engineers
- e. Reports from various NGOs
- f. National Forest Inventory
- g. Various products generated by INEGI, USGS, CONAGUA, etc.
- h. Fixed and mobile monitoring stations in California and Arizona

RESEARCH AND INFORMATION GAPS

Although there is a great variety of information that may be used to objectively predict the potential impact of the fence, some aspects still need to be worked on, such as:

- a. Information on ecosystem fragmentation in the U.S.-Mexico border region.
- b. Nonexistence of a regional Environmental Impact Assessment.
- c. The predictions for potential impacts at different scales are not precisely known.
- d. There is no specific program to monitor air pollution on a binational basis

SOLUTIONS TO RESEARCH AND INFORMATION GAPS

The following are the strategies proposed by the participants of the physical environment discussion group:

- a. Identify the agencies that are sources of information on the subject
- b. Propose mechanisms for bilateral information exchange
- c. Create a website to concentrate the information from the various sources
- d. Create simulation models to reflect the possible environmental impacts
- e. Promote projects to research and monitor the effects of air pollution in the binational border region
- f. Perform periodical air quality measurements

POSSIBLE SOLUTIONS TO THE IMPACTS

The proposals for mitigating and avoiding the potential impacts of the fence range from the design of the physical barrier to the operation of the fence.

Following are some of the proposed measures:

- a. Design alternatives to the fence
- b. Use non-permanent construction methods
- c. Use permeable material
- d. Use Live fences
- e. Reduce the road imprint
- f. Use of markers

INSTITUTIONS THAT COULD PARTICIPATE WITH INFORMATION OR RESEARCH

The discussion group identified some institutions that tentatively may coordinate to implement a strategy for generating information and designing interdisciplinary research projects. These include:

- a. CONACYT
- b. Environmental Groups
- c. California Regional Water Quality Control Board
- d. Contractors in charge of fence design and construction
- e. Indian Nations
- f. NOAA
- g. IBWC
- h. CONAGUA
- i. INE
- j. SEMARNAT
- k. State and city water management organizations

CONCLUSIONS

The results of past engineering works such as the border fence enable us to foresee short term that there will be problems in the three components analyzed in this document. Construction of a border fence between the United States and Mexico would generate more problems than benefits. The potential impacts discussed herein would not only affect the region's physical environment, but also the biota and the environment in general, even the nearby population settlements. The design of the border fence must be restated from its original version to make its construction and

operation friendlier to the physical, natural and social dynamics of its binational region.

DISCUSSION GROUP PARTICIPANTS

Francisco Bernal
Oscar Romo
Paul Ganster
Carlos Angulo Guerrero
Fernando Macías Cruz
Gonzalo Bravo
José Uriel Ordóñez Pérez
Laura Silvan
Mary Kelly
Poliopro Martínez Austria
Juan Manuel Rodríguez Esteves
José Luis Castro Ruiz

Analysis of the Potential Impacts of the Border Fence on the Physical Environment

Water

Impact	I. Modification in relief flow, runoff and streams	II. Reduction in aquifer infiltration capacity	III. Risk of flooding
Description	In areas where the natural drainage network has been altered, standing water, sudden overflows and floods are frequently observed.	A reduction in infiltration leads to rapid aquifer depletion.	In areas where waterways have been diverted without the proper complementary projects, there is an increased risk of flooding, exacerbated by heavy rains registered upstream along the basin.
Available Information	<ul style="list-style-type: none"> • Information from the IBWC on the international border. • Aerial photographs. • Lawsuits from environmental groups. • Information from the U.S. Army Corps of Engineers. • Reports from NGOs. • National Forest Inventory. • Maps from INEGI, USGS, BLM, CONAGUA. 	<ul style="list-style-type: none"> • Information from the IBWC on the international border. • Aerial photographs. • Lawsuits from environmental groups. • Information from the U.S. Army Corps of Engineers. • Reports from NGOs. • National Forest Inventory. • Maps from INEGI, USGS, BLM, CONAGUA. 	<ul style="list-style-type: none"> • Sensitive area studies (COLEF) • Information from CONAGUA • Information from the IBWC (hydrometric bulletins)

Water

Impact	I. Modification in relief flow, runoff and streams	II. Reduction in aquifer infiltration capacity	III. Risk of flooding
Research or Information Gaps	<ul style="list-style-type: none"> Information on ecosystem fragmentation in the northern border. Nonexistence of a regional Environmental Impact Assessment. The predictions for potential impacts are unknown. 	<ul style="list-style-type: none"> Information on ecosystem fragmentation in the northern border. Nonexistence of a regional Environmental Impact Assessment. The predictions for potential impacts are unknown. 	<ul style="list-style-type: none"> The extent of the effects.
Solutions to Research or Information Gaps	<ul style="list-style-type: none"> Identify the agencies that are sources of information on the subject. Generate mechanisms for bilateral information exchange. Create a website to concentrate the information. Create simulations or models to reflect the possible impacts. 	<ul style="list-style-type: none"> Identify the agencies that are sources of information on the subject. Generate mechanisms for bilateral information exchange. Create a website to concentrate the information. Create simulations or models to reflect the possible impacts. 	<ul style="list-style-type: none"> Identify the agencies that are sources of information on the subject. Generate mechanisms for bilateral information exchange. Create a website to concentrate the information. Create simulations or models to reflect the possible impacts.
Possible solutions to the potential impacts	<ul style="list-style-type: none"> Design alternatives to the fence. Use non-permanent construction methods. Use permeable materials. Live fences. 	<ul style="list-style-type: none"> Design alternatives to the fence. Use non-permanent construction methods. Use permeable materials. Live fences. 	<ul style="list-style-type: none"> Construction of alternate relief drainage based on hydrological design.

Analysis of the Potential Impacts of the Border Fence on the Physical Environment (continued)

Water

Impact	I. Modification in relief flow, runoff and streams	II. Reduction in aquifer infiltration capacity	III. Risk of flooding
Groups that are currently working on the subject or that could work on it	<ul style="list-style-type: none"> • Environmental groups, California Regional Water Quality Control Board, contractors in charge of construction, Indian Nations, NOAA, IBWC, CONAGUA, INE, SEMARNAT, water utilities. 	<ul style="list-style-type: none"> • Environmental groups, California Regional Water Quality Control Board, contractors in charge of construction, Indian Nations, NOAA, IBWC, CONAGUA, INE, SEMARNAT, water utilities. 	<ul style="list-style-type: none"> • Environmental groups, California Regional Water Quality Control Board, contractors in charge of construction, Indian Nations, NOAA, IBWC, CONAGUA, INE, SEMARNAT, water utilities.

Water

Impact	IV. Obstruction of waterways	V. Problems in high risk zones	VI. Public health problems caused by stagnant water
Description	<p>When rivers and streams are obstructed, rainwater or snow melt is retained in specific areas, which increases the risk of flooding in lower-lying areas.</p>	<p>The obstruction and modification of waterways leads to runoff deflection toward lower-lying areas, which many times correspond to areas under agricultural irrigation.</p>	<p>Stagnant water rapidly initiates the incubation process of some species of mosquitoes and flies which carry disease.</p>
Available Information	<ul style="list-style-type: none"> • Sensitive area studies (COLEF) • Information from CONAGUA • Information from the IBWC (hydrometric bulletins) 	<ul style="list-style-type: none"> • Sensitive area studies (COLEF) • Information from CONAGUA • Information from the IBWC (hydrometric bulletins) 	<ul style="list-style-type: none"> • Sensitive area studies (COLEF) • Information from CONAGUA • Information from the IBWC (hydrometric bulletins)
Research or Information Gaps	<ul style="list-style-type: none"> • The extent of the effects. 	<ul style="list-style-type: none"> • The extent of the effects. 	<ul style="list-style-type: none"> • The extent of the effects.
Solutions to Research or Information Gaps	<ul style="list-style-type: none"> • Identify the agencies that are sources of information on the subject. • Generate mechanisms for bilateral information exchange. • Create a website to concentrate the information. 	<ul style="list-style-type: none"> • Identify the agencies that are sources of information on the subject. • Generate mechanisms for bilateral information exchange. • Create a website to concentrate the information. 	<ul style="list-style-type: none"> • Identify the agencies that are sources of information on the subject. • Generate mechanisms for bilateral information exchange. • Create a website to concentrate the information.

Analysis of the Potential Impacts of the Border Fence on the Physical Environment (continued)

Water

Impact	IV. Obstruction of waterways	V. Problems in high risk zones	VI. Public health problems caused by stagnant water
<p>Possible solutions to the potential impacts</p>	<ul style="list-style-type: none"> • Create simulations or models to reflect the possible impacts. • Construction of alternate relief drainage based on hydrological design. 	<ul style="list-style-type: none"> • Create simulations or models to reflect the possible impacts. • Construction of alternate relief drainage based on hydrological design. 	<ul style="list-style-type: none"> • Create simulations or models to reflect the possible impacts.
<p>Groups that are currently working on the subject or that could work on it</p>	<ul style="list-style-type: none"> • Environmental groups, California Regional Water Quality Control Board, contractors in charge of construction, Indian Nations, NOAA, IBWC, CONAGUA, INE, SEMARNAT, water utilities. 	<ul style="list-style-type: none"> • Environmental groups, California Regional Water Quality Control Board, contractors in charge of construction, Indian Nations, NOAA, IBWC, CONAGUA, INE, SEMARNAT, water utilities. 	<ul style="list-style-type: none"> • Environmental groups, California Regional Water Quality Control Board, contractors in charge of construction, Indian Nations, NOAA, IBWC, CONAGUA, INE, SEMARNAT, water utilities.

Water

Impact	I. Generation of suspended particles	II. The emission of air pollutants from fixed and mobile sources
Description	Soil exposed due to vegetation removal is subject to erosive processes that include vehicular and human traffic. This phenomenon can cause suspended particles in the air.	The equipment, the vehicles and the combustion processes from human activities generate a significant number of gases - particularly greenhouse gases - and particles that pollute the atmosphere.
Available Information	<ul style="list-style-type: none"> • Fixed and mobile monitoring stations in California and Arizona. • Catalogs of the equipment that will be used. 	<ul style="list-style-type: none"> • Fixed and mobile monitoring stations in California and Arizona. • Catalogs of the equipment that will be used.
Research or Information Gaps	<ul style="list-style-type: none"> • There is no specific program for monitoring air pollution. 	<ul style="list-style-type: none"> • There is no specific program for monitoring air pollution.
Solutions to Research or Information Gaps	<ul style="list-style-type: none"> • Promote research and monitoring projects on the effects caused by air pollution in the border region. • Perform periodic air quality assessments. 	<ul style="list-style-type: none"> • Promote research and monitoring projects on the effects caused by air pollution in the border region. • Perform periodic air quality assessments.
Possible solutions to the potential impacts	<ul style="list-style-type: none"> • Develop alternative designs to physical barriers. • Use non-permanent construction methods. • Use permeable material. • Use live fences. 	<ul style="list-style-type: none"> • Develop alternative designs to physical barriers. • Use non-permanent construction methods. • Use permeable material. • Use live fences.

Analysis of the Potential Impacts of the Border Fence on the Physical Environment (*continued*)

Soil

Impact	I. Modification of the physical and living environment	II. Soil compaction
Description	<p>Construction of the fence will produce changes in the landscape that will disrupt the flow of the region's natural elements. Moreover, there will be changes in land use and modification of the terrain (topography) when the physical environment is transformed by fence construction.</p>	<p>Transit of heavy equipment and motor vehicles related to border security, as well as human foot traffic, would cause soil compaction, which would hinder the development of plant communities in the region.</p>
Available Information	<ul style="list-style-type: none"> • Information from the IBWC on the international border. • Aerial photographs. • Data contained in lawsuits from environmental groups. • Information from the U.S. Army Corps of Engineers. • Reports from NGOs. • National forest inventory. • Maps from INEGI (Mexican National Institute of Statistics, Geography and Information Technology), USGS, BLM. 	
Research or Information Gaps	<ul style="list-style-type: none"> • Information on ecosystem fragmentation in the northern border. • Nonexistence of a regional Environmental Impact Assessment. • The predictions for potential impacts are unknown. 	
Solutions to Research or Information Gaps	<ul style="list-style-type: none"> • Identify the agencies that are sources of information on the subject. • Generate mechanisms for bilateral information exchange. • Create a website to concentrate the information. • Create simulations or models to reflect the possible impacts. 	

Soil

Impact	I. Modification of the physical and living environment	II. Soil compaction
Possible solutions to the potential impacts	<ul style="list-style-type: none"> • Develop alternative designs to physical barriers. • Reduce the road imprint. • Use non-permanent construction methods. • Use permeable material. • Use live fences. • Use of markers. 	
Groups that are currently working on the subject or that could work on it	<ul style="list-style-type: none"> • Environmental groups, contractors in charge of construction, Indian Nations, the three levels of government. 	

Analysis of the Potential Impacts of the Border Fence on the Physical Environment (*continued*)

Soil

Impact	III. Loss of infiltration capacity	IV. Pollution from solid and liquid waste	V. Erosive processes	VI. Introduction of non-native materials and substances
Description	The loss of infiltration capacity required for the water to reach the aquifers would also be associated with soil compaction and the deflection of waterways cause by the physical barrier and vehicle traffic.	The introduction of vehicles and people would lead to the production of solid and liquid waste in regions where the environmental impact associated with human activity is not yet intensely present.	Modifying the balance between the border's natural systems (soil-water-organisms) would accelerate erosion, due to the elimination of the vegetative cover and soil compaction.	Human traffic along and through the border fence would lead to the introduction of materials and substances which are foreign to the natural environment, that may later end up as solid and liquid waste.
Available Information	<ul style="list-style-type: none"> • Information from the IBWC on the international border. • Aerial photographs. • Data contained in lawsuits from environmental groups. • Information from the U.S. Army Corps of Engineers. • Reports from NGOs. • National forest inventory. • Maps from INEGI (Mexican National Institute of Statistics, Geography and Information Technology), USGS, BLM. 			
Research or Information Gaps	<ul style="list-style-type: none"> • Information on ecosystem fragmentation in the northern border. • Nonexistence of a regional Environmental Impact Assessment. • The predictions for potential impacts are unknown. 			
Solutions to Research or Information Gaps	<ul style="list-style-type: none"> • Identify the agencies that are sources of information on the subject. • Generate mechanisms for bilateral information exchange. • Create a website to concentrate the information. • Create simulations or models to reflect the possible impacts. 			

Soil

Impact	III. Loss of infiltration capacity	IV. Pollution from solid and liquid waste	V. Erosive processes	VI. Introduction of non-native materials and substances
Possible solutions to the potential impacts	<ul style="list-style-type: none"> • Develop alternative designs to physical barriers. • Reduce the road imprint. • Use non-permanent construction methods. • Use permeable material. • Use live fences. • Use of markers. 			
Groups that are currently working on the subject or that could work on it	<ul style="list-style-type: none"> • Environmental groups, contractors in charge of construction, Indian Nations, the three levels of government. 			