

## APPENDIX

TABLE A  
The Primary Benefits of the Tren Maya as Projected by the Government

<i>Type</i>	<i>Description</i>
Boost to regional economic development	<ul style="list-style-type: none"> <li>● Creation of jobs and economic opportunities in the southeastern region of Mexico (estimated between 945,000 and 1.5 million jobs in 5 years)</li> <li>● Stimulation of private investment in the area</li> <li>● Diversification of the local economy beyond traditional tourism</li> </ul>
Improvement in connectivity and mobility	<ul style="list-style-type: none"> <li>● Efficient connection between major urban and tourist centers of the Yucatan Peninsula: 1,554 km of railway across Chiapas, Tabasco, Campeche, Yucatán, and Quintana Roo</li> <li>● Capacity to transport over from 65,000 daily passengers in 2023 to 233,000 passengers in 2050 conditional on the completion of the project stages</li> <li>● Reduction in travel times for residents and tourists</li> </ul>
Promotion of tourism	<ul style="list-style-type: none"> <li>● Diversification of tourism beyond traditional destinations</li> <li>● Promotion of cultural and archaeological tourism in less visited areas</li> <li>● Expected increase in tourism economic spillover in the region</li> </ul>
Territorial and urban reorganization	<ul style="list-style-type: none"> <li>● Planned development of new urban and commercial zones</li> <li>● Improvement in infrastructure and public services in communities along the route</li> <li>● Creation of new economic development poles</li> </ul>
Modernization and diversification of the regional economy	<ul style="list-style-type: none"> <li>● Attraction of new industries and services to the region</li> <li>● Promotion of local and regional value chains</li> <li>● Projected creation of around 30 new industrial parks along the route</li> </ul>

Source: Prepared by the authors, based on documentation review, primarily: UN-HABITAT 2020; Fonatur 2020.

**TABLE B**  
**Main Impacts Associated with the Tren Maya**

<i>Impacts</i>	<i>Type</i>	<i>Characterization</i>	<i>Specifics</i>
Environmental	Deforestation and loss of vegetation cover	<ul style="list-style-type: none"> <li>● Removal of native vegetation for railway construction and associated infrastructure</li> <li>● Fragmentation of continuous forest ecosystems</li> <li>● Loss of natural carbon sinks</li> </ul>	<ul style="list-style-type: none"> <li>● Reported felling of over 9 million trees.</li> <li>● Estimated loss of more than 6,000 hectares of forest</li> <li>● Potential impact on 23 protected natural areas, including the Calakmul Biosphere Reserve</li> <li>● Affects ecosystems such as evergreen tropical forests, semi-evergreen tropical forests, and tropical deciduous forest</li> </ul>
	Impact on karst systems and underground water bodies	<ul style="list-style-type: none"> <li>● Alteration of the structure and functioning of cenotes and caves</li> <li>● Risk of contamination to underground aquifers</li> <li>● Modification of natural drainage patterns</li> </ul>	<ul style="list-style-type: none"> <li>● Risk to over 100 cenotes in the Yucatán Peninsula</li> <li>● Potential alteration of underground water flows in an area of influence up to 50 km from the railway line</li> <li>● Impact on the structural integrity of caves and underground systems</li> </ul>
	Habitat fragmentation and biodiversity impact	<ul style="list-style-type: none"> <li>● Disruption of natural biological corridors</li> <li>● Isolation of flora and fauna populations</li> <li>● Increased edge effect in forest ecosystems</li> </ul>	<ul style="list-style-type: none"> <li>● Impact on critical biological corridors for species such as jaguar, ocelot, puma, tapir, and spider monkey</li> <li>● Impact on at least 987 species of fauna, particularly in the karstic aquatic environments</li> <li>● Interruption of migratory routes for birds and butterflies</li> </ul>

	Acoustic and atmospheric pollution	<ul style="list-style-type: none"> <li>● Increased noise levels in previously pristine areas</li> <li>● Increase in greenhouse gas emissions</li> <li>● Alteration of behavioral patterns of local fauna</li> </ul>	<ul style="list-style-type: none"> <li>● Estimated increase in CO<sub>2</sub> emissions due to train operation</li> <li>● Potential impact on air quality within a radius of up to 5 km from the track in urban areas</li> </ul>
	Alteration of coastal ecosystems and wetlands	<ul style="list-style-type: none"> <li>● Modification of coastal dunes and mangroves</li> <li>● Risk of accelerated coastal erosion</li> <li>● Alteration of hydrological cycles in wetlands</li> </ul>	<ul style="list-style-type: none"> <li>● Potential impact on over 200 km of coastal ecosystems along the route</li> <li>● Impact on at least 5 mangrove areas protected by NOM-022-SEMARNAT-2003</li> <li>● Risk of salinization of coastal aquifers in an area of influence</li> </ul>
	Impact on Protected Natural Areas	<ul style="list-style-type: none"> <li>● Degradation of ecosystems in conservation zones</li> <li>● Increased anthropogenic pressure on previously isolated areas</li> <li>● Risk to endangered species in protected habitats</li> </ul>	<ul style="list-style-type: none"> <li>● Directly crosses or indirectly affects 23 state Protected Natural Areas</li> <li>● Direct impact on the Calakmul Biosphere Reserve, a UNESCO Mixed Heritage site.</li> <li>● Potential impact on more than 500,000 hectares of protected areas in total</li> </ul>
	Alteration of landscape and ecosystem services	<ul style="list-style-type: none"> <li>● Modification of the natural aesthetics of jungle and coastal landscapes</li> <li>● Reduction in local climate regulation capacity</li> <li>● Alteration of pollination and seed dispersal cycles</li> </ul>	<ul style="list-style-type: none"> <li>● Visual impact along a corridor of more than 1,500 km in length</li> <li>● Reduction in climate regulation services in deforested areas</li> </ul>
	Long-term geological and environmental risks	<ul style="list-style-type: none"> <li>● Increased vulnerability to natural phenomena such as hurricanes and floods</li> <li>● Risk of sinkholes and collapses in karst zones</li> <li>● Potential exacerbation of climate change effects in the region</li> </ul>	<ul style="list-style-type: none"> <li>● Projected increase in flood risk in low-lying areas crossed by the train</li> <li>● Identification of at least 100 critical points with a high risk of karst collapse along the route</li> <li>● Estimated increase in local temperatures in urbanized areas associated with the project</li> </ul>

Social	Displacement and relocation of communities	<ul style="list-style-type: none"> <li>● Forced relocation of families and communities along the train route</li> <li>● Loss of land and property for local residents</li> <li>● Disruption of existing social structures and community networks</li> </ul>	<ul style="list-style-type: none"> <li>● Impact on 1,454 localities across the 5 states involved in the project</li> <li>● Expropriation of over 30,000 private homes in cities such as Campeche</li> <li>● Direct impact on at least 50 Maya Indigenous communities</li> </ul>
	Changes in land tenure and land use	<ul style="list-style-type: none"> <li>● Modification of ejido (communal land) and community property regimes</li> <li>● Conversion of agricultural and forest lands to urban and tourism uses</li> <li>● Increase in territorial conflicts and property litigation</li> </ul>	<ul style="list-style-type: none"> <li>● Impact on more than 177 ejidos and agrarian communities in the Yucatan Peninsula</li> <li>● Land use change in over 100,000 hectares of previously agricultural or forested land</li> <li>● Boundary conflicts in affected ejidos</li> <li>● Expropriation of approximately 198,000 hectares of ejido and private lands</li> </ul>
	Impact on local and regional economic structure	<ul style="list-style-type: none"> <li>● Transition from traditional economies to service and tourism-based economies</li> <li>● Increased economic dependence on the tourism sector</li> <li>● Displacement of local economic activities</li> </ul>	<ul style="list-style-type: none"> <li>● Projection of a 50% increase in tourism activity in the region</li> <li>● Projected increase in the cost of living in communities near train stations</li> <li>● Risk of job loss in traditional sectors such as agriculture and artisanal crafts</li> </ul>
	Alteration of cultural practices and traditional ways of life	<ul style="list-style-type: none"> <li>● Erosion of Maya indigenous customs and traditions</li> <li>● Changes in patterns of natural resource use and traditional knowledge</li> <li>● The commodification of local culture for tourism</li> </ul>	<ul style="list-style-type: none"> <li>● Impact on cultural practices in more than 150 Maya indigenous communities</li> <li>● Impact on at least 25,000 sites registered along the train route</li> <li>● Risk of indigenous language loss in impacted communities</li> <li>● Alteration of Maya pilgrimage routes and ceremonial sites in at least 50 localities</li> </ul>
	Demographic and migratory changes	<ul style="list-style-type: none"> <li>● The influx of workers and new residents to communities along the route</li> </ul>	<ul style="list-style-type: none"> <li>● Projection of population increase in major cities along the route over the next 10 years</li> <li>● Estimated arrival of 200,000-300,000 temporary workers</li> </ul>

		<ul style="list-style-type: none"> <li>● Potential emigration of youth from rural communities to urban centers</li> <li>● Alteration of the ethnic and cultural composition of local populations</li> </ul>	<ul style="list-style-type: none"> <li>● Risk of depopulation in small rural communities</li> <li>● Projected increase in floating population in tourist areas</li> </ul>
	Impact on local governance and political structures	<ul style="list-style-type: none"> <li>● Alteration of traditional forms of government and decision-making in Indigenous communities</li> <li>● Increased federal influence in local affairs.</li> <li>● Potential increase in political tensions between different levels of government</li> </ul>	<ul style="list-style-type: none"> <li>● Modification of traditional governance structures in at least 100 indigenous communities</li> <li>● Creation of new governance instances in 19 planned “development poles”</li> <li>● Increased military presence in the region</li> <li>● Intensification of political conflicts in affected municipalities</li> </ul>
	Pressure on public services and local infrastructure	<ul style="list-style-type: none"> <li>● Increased demand for basic services such as water, electricity, and sanitation</li> <li>● Need to expand educational and health infrastructure</li> <li>● Increased pressure on waste management systems and public transportation</li> </ul>	<ul style="list-style-type: none"> <li>● Projection of increase in potable water demand in tourist areas</li> <li>● Estimated 60% increase in solid waste generation in high-impact tourist areas</li> <li>● Increase in public transportation demand in major cities along the route</li> </ul>
	Impact on security and social cohesion	<ul style="list-style-type: none"> <li>● Potential increase in crime and social problems associated with mass tourism</li> <li>● Erosion of traditional community support networks</li> <li>● Increase in social conflicts due to rapid changes and inequalities</li> </ul>	<ul style="list-style-type: none"> <li>● Projection of increase in crime rates in new tourist centers</li> <li>● Risk of increase in social problems such as alcoholism and drug addiction in affected communities</li> <li>● Potential increase in social conflicts related to land and natural resources</li> <li>● Erosion of traditional conflict resolution mechanisms in impacted Indigenous communities</li> </ul>
	Changes in cultural heritage and regional identity	<ul style="list-style-type: none"> <li>● Transformation of the cultural landscape of the Yucatan Peninsula</li> </ul>	<ul style="list-style-type: none"> <li>● Direct or indirect impact on heritage sites</li> </ul>

		<ul style="list-style-type: none"><li>● Risk of loss or alteration of archaeological and heritage sites</li><li>● Changes in the perception and representation of Maya culture</li></ul>	<ul style="list-style-type: none"><li>● Risk of damage to 3 UNESCO World Heritage Sites (Calakmul, Chichén Itzá, and Uxmal)</li><li>● Alteration of the landscape and cultural context of at least 15 major archaeological zones</li><li>● Transformation of cultural narratives in the region's tourism promotional materials</li></ul>
--	--	--	--

Source: Prepared by the authors based on documentation review, primarily: Business & Human Rights Resource Center 2024; Lagos 2022; UNESCO 2021; CEMDA 2020; and Núñez Rodríguez 2020.

TABLE C  
Main Irregularities, Controversies, and Criticisms of the Tren Maya

<i>Phase</i>	<i>Type</i>	<i>Description</i>
Planning	Absence of comprehensive feasibility studies on the project's technical, economic, and environmental viability prior to its inception	<ul style="list-style-type: none"> <li>● Changes in the original route without adequate technical justifications on at least 3 occasions</li> <li>● Absence of a comprehensive Master Plan before the commencement of construction</li> </ul>
	Inconsistencies in budget and financing	<ul style="list-style-type: none"> <li>● Increase in initial cost from 120-150 billion pesos to over 500 billion pesos</li> <li>● Shift from a mixed (public-private) financing scheme to a completely public one</li> </ul>
	Opacity and lack of affected local community involvement in the decision-making and planning process	<ul style="list-style-type: none"> <li>● Refusal to provide detailed information on contracts and bids</li> <li>● Absence of public minutes from key planning meetings</li> <li>● Absence of participatory mechanisms for affected and interested communities and sectors</li> </ul>
Impact assessment	Rushed completion and approval of Environmental Impact Assessments (EIAs) with significant omissions.	<ul style="list-style-type: none"> <li>● EIAs conducted after the commencement of works in project sections</li> <li>● Omission of cumulative and synergistic impacts in the assessments</li> <li>● Approval of EIAs in record time, some in less than 1 month</li> </ul>
	Inadequate or incomplete assessments of the project's effects on local communities and cultural heritage	<ul style="list-style-type: none"> <li>● Absence of detailed anthropological studies in affected Indigenous communities</li> <li>● Omission of comprehensive impact assessment for archaeological sites along the train route</li> <li>● Lack of consideration of long-term impacts on social cohesion</li> </ul>
Indigenous consultation	Failure to meet the criteria of being free, prior, informed, and culturally appropriate	<ul style="list-style-type: none"> <li>● Only 3.6% of the indigenous population in affected municipalities participated in the consultation</li> <li>● Consultations were conducted after the commencement of works in affected states</li> <li>● Absence of translation of key documents into Indigenous languages in some informative assemblies</li> </ul>

	Lack of complete and timely information	<ul style="list-style-type: none"> <li>● Delivery of incomplete information on EIAs of consultative assemblies</li> <li>● Absence of detailed technical studies in materials provided to local communities</li> <li>● Insufficient time for document review, with less than 1 week in many cases</li> </ul>
	Pressure in the consultative process	<ul style="list-style-type: none"> <li>● Reports of intimidating military presence in consultative assemblies</li> <li>● Allegations of social program benefits were conditioned on project approval</li> <li>● Exclusion of critical voices in assemblies, according to independent observers</li> </ul>
Construction	Commencement of works without all required permits and studies	<ul style="list-style-type: none"> <li>● Commencement of works before the final approval of corresponding EIAs</li> <li>● Felling of more than 10,000 trees without proper forestry permits</li> </ul>
	Unforeseen damages during execution	<ul style="list-style-type: none"> <li>● The discovery of over 25,000 archaeological monuments was not initially contemplated</li> <li>● Unauthorized deforestation of more than 3,000 additional hectares beyond what was planned</li> <li>● Impacts on caves and cenotes during the construction of Section 5, with reported collapses</li> </ul>
	Irregularities in contracting and bidding	<ul style="list-style-type: none"> <li>● Direct assignment of main contracts without public bidding</li> <li>● Reported unjustified cost overruns in construction contracts</li> </ul>
Legal and political aspects	Militarization of the project	<ul style="list-style-type: none"> <li>● Complete transfer of the project to SEDENA (Ministry of National Defense) in 2023</li> <li>● Military presence in construction sites</li> </ul>
	Declaration of the project as a National Security Matter	<ul style="list-style-type: none"> <li>● Presidential decree in 2021 declaring the project a matter of National Security</li> <li>● Refusal to provide detailed information on transparency requests following the decree</li> <li>● Use of this classification to expedite permits in project sections</li> </ul>
	Disregard for judicial resolutions	<ul style="list-style-type: none"> <li>● Continuation of works despite suspensions ordered by federal judges</li> <li>● Disregard of Supreme Court resolutions related to the project</li> <li>● Modification of laws and regulations in States to evade compliance with court rulings</li> </ul>

Source: Prepared by the authors based on documentation review, primarily: González Díaz 2023; Greenpeace 2022; Lagos 2022; and UNHCHR 2019.



## REFERENCES

- Business & Human Rights. 2024. México: Activistas ambientales revelan afectaciones a cenotes y cuevas por Tren Maya. Business and Human Rights Resource Centre. <https://www.business-humanrights.org/es/últimas-noticias/méxico-activistas-ambientales-revelan-perforaciones-a-cenotes-y-cuevas-como-parte-del-proyecto-del-tren-maya/>
- Centro Mexicano de Derecho Ambiental (CEMDA). 2020. Postura del Centro Mexicano de Derecho Ambiental respecto al Proyecto Tren Maya. Centro Mexicano de Derecho Ambiental, A.C. <https://cemda.org.mx/postura-del-centro-mexicano-de-derecho-ambiental-respecto-al-proyecto-tren-maya/>
- Gobierno de México. Fondo Nacional de Fomento al Turismo (Fonatur). 2020. Desempeño del Proyecto de Construcción del Tren Maya. Auditoría de Desempeño: 2019-3-21W3N-07-1384-2020. [https://www.asf.gob.mx/Trans/Informes/IR2019c/Documentos/Auditorias/2019\\_1384\\_a.pdf](https://www.asf.gob.mx/Trans/Informes/IR2019c/Documentos/Auditorias/2019_1384_a.pdf)
- González Díaz, M. 2023. 5 datos del Tren Maya, el multimillonario proyecto que atraviesa la selva para unir al México más pobre con el más turístico. BBC News Mundo. December 14, 2023. <https://www.bbc.com/mundo/articles/cpex5jqjn51o>
- Greenpeace. 2022. Reporte técnico del análisis de la manifestación de impacto ambiental modalidad regional del proyecto Tren Maya Tramo 5 Sur. <https://www.greenpeace.org/static/planet4-mexico-stateless/2022/06/177e038c-reporte-análisis-técnico-tren-maya-tramo-5-sur-revisado-1.pdf>
- Lagos, A. 2022. Los últimos hallazgos en la ruta del Tren Maya: 25.000 monumentos arqueológicos, 129 entierros humanos y pinturas rupestres. *El País*. May 3, 2022. <https://elpais.com/mexico/2022-05-04/25000-monumentos-arqueologicos-129-entierros-humanos-y-pinturas-rupestres-los-ultimos-hallazgos-en-la-ruta-del-tren-maya.html>
- Núñez Rodríguez, V. 2020. Los misteriosos ‘polos de desarrollo’ del Tren Maya. Rompeviento Tv. August 2, 2020. <https://www.rompeviento.tv/los-misteriosos-polos-de-desarrollo-del-tren-maya/>
- Office of the United Nations High Commissioner for Human Rights. (UNHCHR). 2019. El proceso de consulta indígena sobre el Tren Maya no ha cumplido con todos los estándares internacionales de derechos humanos en la materia. United Nations.

<https://hchr.org.mx/comunicados/onu-dh-el-proceso-de-consulta-indigena-sobre-el-tren-maya-no-ha-cumplido-con-todos-los-estandares-internacionales-de-derechos-humanos-en-la-materia/>

United Nations Educational, Scientific and Cultural Organization (UNESCO). 2021. La salvaguardia del patrimonio cultural y natural en la ruta del Tren Maya: El camino hacia el desarrollo sostenible. United Nations. <https://www.unesco.org/es/articles/la-salvaguardia-del-patrimonio-cultural-y-natural-en-la-ruta-del-tren-maya-el-camino-hacia-el>

United Nations Human Settlements Programme (UN-HABITAT). 2020. Impact of the Tren Maya. <https://onu-habitat.org/index.php/onu-habitat-analiza-el-impacto-del-tren-maya?s=08>