



Beyond Reconstruction: Reflections on Post-Earthquake Recovery in Oaxaca, Mexico, after the 2017 Earthquakes

Beyond Reconstruction

Reflections on Post-Earthquake
Recovery in Oaxaca, Mexico,
After the 2017 Earthquakes

Edited by
Diane E. Davis / Lorena Bello Gómez / Enrique Aureng Silva



Beyond Reconstruction

Reflections on Post-Earthquake
Recovery in Oaxaca, Mexico,
After the 2017 Earthquakes

Edited by

Diane E. Davis

Charles Dyer Norton Professor of Regional Planning and Urbanism
Chair of the Department of Urban Planning and Design
Harvard University Graduate School of Design
(ddavis@gsd.harvard.edu)

Lorena Bello Gómez

Lecturer in Architecture
School of Architecture + Planning
Massachusetts Institute of Technology
(lobello@mit.edu)

Enrique Aureng Silva

Master in Design Studies '18
Irving Innovation Fellow '19
Harvard University Graduate School of Design
(silvaestrada.e@gmail.com)

©2019

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from the publisher.

This publication was funded by the
David Rockefeller Center for Latin-American Studies



Las Nutrias River, rubble, and wind farms in the Isthmus of Tehuantepec eleven months after the 2017 earthquakes.

retroceder, retraer, revirar, recoger,
repasar, reimaginar, refinar, reiniciar,
refundar, renegar, reexaminar, recontar,
reevaluar, reconocer, recapacitar,
recordar, revolucionar, reescribir,
reorganizar, re proyectar, replantear,
relansar, reacondicionar, reconectar,
reciclar, restaurar, retocar, realzar,
revolver, restituir, recolocar, reencontrar,
reaprender, realizar, revisar, relacionar,
reparar, reabrir, remover, reseñar,
reposicionar, repuntar, rediseñar, rehacer;
reconstruir:
renacer.

Table of Contents

Acknowledgements	10	F. Modular Infrastructure in the Public Realm	182
Part I. The Earthquake as Catalyst		<i>Xio Álvarez / Clarence Lee / María Peroni</i>	
A. Beyond Reconstruction	16	G. The Railroad As Conflict Zone	192
<i>Diane E. Davis / Jose Castillo</i>		<i>Melissa Gutiérrez</i>	
B. Challenges and Opportunities for Reconstruction	30	H. Embracing the Wind	206
<i>Lorena Bello Gómez</i>		<i>Enrique Aureng Silva / Rian Rooney</i>	
Part II. The Isthmus of Tehuantepec		Part IV: Enabling Constructive Change	
A. The Context: History & Geography of the Isthmus	48	A. From Risk to Resilience	228
<i>Rian Rooney</i>		<i>Douglas Ahlers</i>	
B. The Event: The 2017 Earthquakes & Their Aftermath	62	B. Education As Recovery	234
<i>Dení López / Betzabe Valdés</i>		<i>Judith Palfrey / Elizabeth Peacock-Chambers</i>	
C. Framing the Fault Lines	78	C. Infrastructural Connectivities	238
<i>Amaya Bravo-France / Evita Chávez / Sydney Pedigo</i>		<i>Gustavo Madrid</i>	
Part III. Proactively Strengthening Territories of Risk		D. University and Community	242
A. Learning From Debris	110	<i>Lilia Cruz / Vicente Marcial</i>	
<i>Dení López / Nadyeli Quiroz / Betzabe Valdés</i>		Conclusion.	
B. Reconstruction, Recyclability & Memory	144	Lessons from a Year in Post-Disaster Oaxaca	248
<i>Carlos Casaldud / Cristina Solís</i>		<i>Diane E. Davis / Lorena Bello Gómez</i>	
C. Community Educational Resilience	150	Appendix	
<i>Karen Mata / Eduardo Peláez</i>		A. Beyond Reconstruction.	262
D. Along Fault Lines	164	<i>ADV-9147 Spring '18 Course Syllabus</i>	
<i>Antonio Moya-Latorre / Daphne Xu</i>		B. Experiences in Reconstruction.	268
E. Infrastructural Public Space	176	<i>UNAM Symposium Program</i>	
<i>Loreta Castro Reguera</i>		C. Longterm Recovery After Major Earthquakes	270
		<i>DRCLAS Symposium Program</i>	
		References	274
		Contributors	286



PELIGRO
CASA DAÑADA

PELIGRO
CASA DAÑADA

Acknowledgements

The work presented in this volume is the culmination of one year of research and design collaboration undertaken jointly by the Harvard Graduate School of Design (GSD) and the Massachusetts Institute of Technology School of Architecture and Planning (MIT-SAP). We would like to extend our gratitude to Mohsen Mostafavi, Dean of the Graduate School of Design and the Alexander and Victoria Wiley Professor of Design at Harvard University, and to Hashim Sarkis, Dean of the School of Architecture and Planning at MIT, for their support. We also would like to acknowledge the multiple contributions of GSD Irving Innovation Fellow '19, Enrique Aureng Silva (MDes'18), our co-editor and the project's principal staff coordinator and teaching fellow during the year-long development of this project. Although many others also contributed to the success of this collaboration, we want to especially thank GSD Irving Innovation Fellow '18 Caroline Filice Smith (MAUD'17), who served as teaching assistant for the spring seminar, "Beyond Reconstruction", as well as Rian Rooney (MUP'19), who initiated and organized significant collaborations with university partners in Mexico, and Deni López (MDes'19/MAUD'19), who both on her own and with fellow teammates Betzabe Valdés and Nadyeli Quiroz, played a central role in organizing many of our contacts in Oaxaca and maintaining the project's high visibility.

This volume reflects upon the discoveries and ideas produced in three classes during the 2018 academic year; a summer research stay in the Isthmus of Tehuantepec, Oaxaca and follow up visit in January 2019; and two symposiums, one in Mexico City in the summer of 2018 and other in Cambridge (US) in the spring of 2019. The 2018 spring seminar, "Beyond Reconstruction: Mexico and 2017 Earthquakes," was co-instructed at the GSD by Diane Davis and Jose Castillo; the 2018 summer research was guided by Diane Davis (GSD), Professor Lorena Bello Gómez (MIT), and Monica Arzoz and Jimena González-Sicilia (Universidad Anáhuac); and the 2018 Fall Independent Study (GSD) and Workshop (MIT), "Beyond Reconstruction in Oaxaca, Mexico," were co-instructed by both Diane Davis and Lorena Bello Gómez. An additional symposium in Mexico in August 2018 was organized by Diane Davis and Manuel Perló at UNAM's Institute of Social Research. The project concluded with a final symposium and workshop at Harvard, with help from Pablo Allard, Lorena Bello Gómez and Enrique Aureng Silva. Travel and Research were possible thanks to the Harvard David Rockefeller Center for Latin American Studies, the GSD's Mexican Cities Initiative (MCI), the GSD Penny White Project Fund, MIT MISTI Mexico, and MIT SHASS Research Fund. This publication has been possible thanks to the generous support of Harvard David Rockefeller Center for Latin American Studies (DRCLAS.)

A project of this scope would not have been possible without the generous contributions of a talented team of scholars, experts, and students, and we want to use the opportunity to thank them for their contributions. During Davis and Castillo's spring 2018 course, we were fortunate to learn from the following speakers: Mauricio Benitez Iturbe, David Carrasco, Marianne Potvin, Jeff Rubin, Elisa Silva, Michael Hooper and Lorena Bello Gómez, who gave separate presentations and also attended weekly sessions. During the Mexico Symposium at UNAM Institute of Social Research, "Experiences in Reconstruction after the September 2017 Earthquakes," special thanks go out to Manuel Perló for securing financial support and for undertaking the difficult organizational preparations to showcase the following speakers: Edgar Tungui, Felipe de Jesús Gutierrez, Loreta Castro Reguera, Fernando Aguirre Sánchez, Antonio Azuela, Marcela Meneses, Monica Arzoz, Jimena González-Sicilia, Jorge Wolpert, Elena Nava, Carlos Zedillo, Adriana Chávez, Elena Tudela, Pablo Vaggione, Gustavo Madrid, Jose Pablo Ambrosi, and Carina Arvizu. During our two-day workshop at Harp-Helú Foundation's Casa de la Ciudad in Oaxaca, our special thanks to the foundation for their generosity and to the speakers: Ignacio Toscano, Andrea Quintana, Rolando Osorio, Ana Karen Sumano, Carlos Vichido, Elpidio Concha Arelano, Gonzalo Villalobos, Gerardo López Nogal and Tzinnia Carranza. During our visit to the Isthmus of Tehuantepec, we thank those who met with us such as Carlos Beedxe, Guiexhooba de Gyves, Rafael Mayoral, Tomás Chiñas, Gerardo de Gyves, Arturo Garcia Albino, Deyanira Aquino, Hageo and Porfirio Montero, Rogelio Cheng, Juan Rodriguez Cabrera, Álvaro Velázquez Maldonado, Lilia Cruz and Vicente Marcial.

During the Cambridge Symposium at the Graduate School of Design—*Beyond Reconstruction: Environmental, Social, and Infrastructural Challenges for Long-term Recovery after Major Earthquakes in Mexico & Chile*—special thanks go to Pablo Allard, Marcela Renteria and Harvard Recupera Chile program for making it possible, and to the speakers: Amaya Bravo-France, Evita Chávez, Sydney Pedigo, Rian Rooney, Enrique Aureng Silva, Deni López, Nadyeli Quiroz, Betzabe Valdés, Pablo Allard, Doug Ahlers, Iván Cartes, Judith Palfrey, Pilar del Canto, Lilly Peacock, Alex Mansfield, and Ana Maria Quirós. From our list of students we owe special thanks to Deni López López GSD (MAUD' 19, MDes' 19), Rian Rooney (MUP' 19) and to Antonio Moya-Latorre (MCP' 19) for their energy and work all along.

Numerous illustrations and original drawings are attributed to the creative production of over 30 students enrolled in the above mentioned classes: Xiomara Álvarez, Colleen Brady, Amaya Bravo-France, Weiyi Cao, Carlos Casalduc, Evita Chavez, Yona Cheung, Gina Ciancone, Erick Díaz, Se-

bastián Gaviria, Kim Geronimo, Vladimir Gintoff, Melissa Gutiérrez Soto, Deni López, Karen Mata, Santiago Mota, Antonio Moya-Latorre, Anita Nai-Tzu Cheng, Eduardo Peláez, Sydney Pedigo, Maria Peroni, Nadyeli Quiroz, Rian Rooney, Akemi Sato, Rodrigo Solé, Cristina Solis, Fernando Schrupp-Rivero, Betzabe Valdés, Finn Vigeland, Marisa Villareal, Kuangyu Xiong, Daphne Xu, Clarence Yi-Hsien Lee, and Erin Yook.

To all, we extend our deep appreciation and hope that you continue moving these ideas forward in your future work and collaborations.

Part I.

The Earthquake as Catalyst

Rethinking the University's Role in Disaster Recovery

Beyond Reconstruction: Mexico and the 2017 Earthquakes Diane E. Davis / Jose Castillo	16
Challenges and Opportunities for Reconstruction: A Collaborative Effort Lorena Bello Gómez	30

Beyond Reconstruction

Mexico and the 2017 Earthquakes

Diane E. Davis / Jose Castillo

A Call to Action

In September of 2017, Mexico experienced a series of devastating earthquakes that spread across wide swaths of the national territory, affecting not only the capital city but also several of the country's most historically, culturally, and politically significant states ranging from Morelos to Oaxaca to Chiapas. The trauma of the disaster hit far and wide, not only across Mexico but also among Mexican students abroad, including those from Harvard and MIT, who watched with dismay and found themselves glued to the television, internet, telephone, and print media in an effort to keep lines of communication open and remain apprised of the damage. Within days of the back-to-back reverberations, students in Cambridge, MA joined together to discuss potential ways to respond or provide disaster recovery aid. Among the most active students on the Harvard campus were those enrolled at the Graduate School of Design, whose professional commitments to the fields of architecture, infrastructure, landscape, historic preservation, and to a wide range of social equity, urban policy, and planning concerns revealed by the earthquake energized them and inspired their efforts to become actively involved.¹

As the students diligently worked to generate donations and organize a response from major corporations and other philanthropies in Mexico and elsewhere, they also reached out to faculty at the GSD. They requested approval for a special project-based class or research seminar focused on Mexico and the earthquakes, a petition which received curricular and financial support from Dean Mohsen Mostafavi and from the Department of Urban Planning and Design. This is when we entered the picture, pulling together a new course with just two months' notice. Building on four years of co-teaching studios and related courses on cities, urbanization, housing, and sustainability, the Davis-Castillo team hoped to use this opportunity to offer a new course, taking the earthquake as a point of departure to think

1. . According to Deni Lopez, one of the key students involved in this initiative, the initial September earthquake – which decimated the southern states of Oaxaca and Chiapas – mobilized a few Mexican students abroad, but interest in carrying out concrete aid actions only grew a few days later, when a second earthquake hit Mexico City (where many of the students' families lived). It was then that hundreds of fellow countrymen residing in Boston decided to gather in the auditorium of the Harvard

Kennedy School to discuss the best ways to help Mexico from abroad. Proposals ranged from the creation of financial aid funds to the development of new technologies to facilitate disaster response. However, most of them centered only on the area in and around Mexico City, and very few discussed the possibility of conducting research and creating new knowledge regarding medium and long-term recovery processes, a feature that our group considered essential to deal with upcoming moments of crisis.

differently about urbanism and the built environment, citizen mobilization, the relationship of risk to resilience, as well as Mexico's larger trajectories of urbanization.²

In mounting this course, titled "Beyond Reconstruction," we started with several premises. First and foremost, we wanted students to think about much more than the initial post-disaster recovery aims, which obviously included rescue, restoration of basic services, and efforts to repair or replace heavily damaged infrastructure. To be sure, we all were aware that there was significant need to remove the dead and injured, clear rubble, re-open roads, and re-establish electricity, water, and mobility. These were critical priorities that needed to be tackled before turning to the next important stage of recovery: addressing buildings, including private homes and apartments. While authorities were quicker to deal with public infrastructure, in part because it was necessary for facilitating both humanitarian aid operations and the turn to building recovery (or removal), the issue of what to do with damaged buildings was more complicated. This required extensive resources, new institutional mandates, negotiations with residents and neighbors, and the involvement of government officials.

The enormity of these challenges, and the fact that we were offering a course that would unfold over four months in a classroom thousands of miles away from the epicenter of the damage, inspired us to take a slightly different approach to rebuilding and reconstruction. We wanted to explore what the earthquakes revealed about larger and more longstanding patterns of risk, inequality, and precarity. We thus vowed to devote serious attention to ways in which the earthquakes might provide an "opportunity" to do things differently in the future – that is, to think about projects and actions that might set the regions damaged by the earthquakes on more resilient pathways, such that when the next crisis hit, they would not be so vulner-

2. Students from the GSD were interested in pursuing two different – but complementary – scholarly approaches. One large group worked with us to develop the semester-long course. A second group launched their own semi-autonomous research initiative to study the effects of the earthquakes in the most affected region in Mexico, a riverine corridor at the Isthmus of Tehuantepec in Oaxaca (the second-poorest state in Mexico). The latter was comprised of

three master's students: one in Critical Conservation (Betzabe), one in Landscape Architecture and Urbanism (Nadyeh), and one in Risk and Resilience and Urban Design (Deni). They decided to team up to work in five municipalities along the Las Nutrias River: Ciudad Ixtepec, Asunción Ixtaltepec, El Espinal, Juchitan de Zaragoza, and Santa Maria Xadani. Ultimately, these two groups merged, as the latter students enrolled in almost all of the GSD or MIT-led coursework.

able. This meant that in our call to action we would not just focus on the immediate post-disaster recovery. Rather, we would examine how existing conditions laid the foundation for the destructive impacts associated with the earthquakes and how cities, villages, neighborhoods, and families might be built, serviced, or mobilized differently so as to better withstand future shocks.

From the Urban to the Territorial

A second premise underlying the course was its purposeful focus on some of the most neglected parts of Mexico. In the aftermath of the earthquakes, the great majority of global and Mexican government attention turned to Mexico City, the nation's capital. Although the devastation wrought by the 2017 earthquakes was widespread, much of the initial press coverage – both in the US and in Mexico – focused almost exclusively on residents in Mexico City. But in keeping with the desire to focus attention "beyond" reconstruction and toward strengthening capacities to address longer term vulnerabilities that had increased the devastation, we wanted to examine those regions of Mexico that were affected by the earthquakes but that had not received as much attention as the capital. This included, most significantly, a large number of ignored villages, towns, and regions in the states of Morelos, Chiapas, and Oaxaca. And it was not just that we wished to focus on the most precarious populations in Mexico, we wanted to raise questions about the ways in which post-disaster recovery efforts are frequently developed with an eye to the most populous or politically salient locations affected by a disaster.

One of our objectives in the course was to examine how and why citizens and authorities might respond differently to disaster in big cities than in small towns, or in an industrial versus agricultural region – owing perhaps to the unequal distribution of technical capacities, the limited political power of residents in small villages, or even the legacy of experience with earthquakes. In Mexico City, where modern buildings existed side-by-side 19th and 20th century architectural typologies, residents had already learned how to mobilize and make demands following the 1985 earthquake. As such, when the September 2017 earthquake hit a little more than two decades later (on the same day, no less), citizens had precedents to turn to. They were already prepared to call for new financing arrangements, alternative governance mechanisms, a re-examination of land use planning and building regulations, and renewed calls for engineering, architectural, and urban design innovations. Leading these calls were a large cadre of activist citizens and professionals with the skills and commitment to respond to Mexico City's damaged neighborhoods.

In the more rural settings of Morelos, Chiapas, and Oaxaca, however, which host a preponderance of small villages where cultural practices and economic livelihoods revolve around rural settlements and subsistence economies, there was notably much less professional involvement (because architects and engineers were not as numerous as in Mexico City) and citizen activism. Moreover, the damage produced very different dilemmas for residents. The primary challenge was to recover an urban, social, and spatial fabric characterized by low density housing typologies and informal settlements spread across a sparsely populated landscape with limited opportunities for employment. In Mexico City, by contrast, middle and upper classes were disproportionately affected by the destruction, and damage to buildings and their physical recovery was a principal concern. Furthermore, in the outlying states it was primarily the rural poor who found their cultural traditions and economic practices in extreme jeopardy, preoccupations made more intense by the long-standing neglect of these regions and their urban settlements (whether by market forces or the social programs emanating from the central government). In a national context where budgetary decentralization has intensified over the last several decades, in accordance with neoliberal premises, the smaller towns and villages are at a huge disadvantage to find the resources, both financial and in terms of human capital, for recovery and rebuilding because of the rates of poverty in these regions. All these factors convinced us that these poorer, more disadvantaged sites should become our main focus.

In asking our students to turn their attention from cities to territories, that is from Mexico City to the poorer, less dense, and more agricultural regions, we laid out a series of clear curricular challenges. First, we asked our students to examine post-earthquake regions both historically and projectively, using the recent destruction as an opportunity to rethink, conceptually redefine, and proactively reconstruct or reconfigure prior patterns of urbanization. Second, we encouraged our students to use a variety of methodologies such as mapping (of landscapes, displacements, damage, etc.) and design techniques (applied to buildings, neighborhoods, cities, landscapes, institutional arrangements, etc.) – as well as archival, survey, planning, design, and critical conservation practices – to establish the groundwork for a more environmentally sustainable, socially resilient, culturally sensitive, and aesthetically profound urbanism, paying special attention to inequalities and injustices and seeking to remedy them through reconstruction practices. We read theory-heavy articles on the socio-political construction of risk discourses, on the limitations of the concept of resilience, and on the political economy of unequal development and urbanization. We invited experts involved in both theorizing and historicizing the field of disaster recovery, as

well as those who were involved as practitioners in some of the more recent major disasters that attracted global attention, from the earthquakes in Nepal and Haiti to the hurricane in New Orleans. The course was advertised as open to students in all programs at the GSD, particularly those in the Master in Design Studies (MDes) track focused on Risk and Resilience as well as those in Urban Planning and Design, with the hope that a transdisciplinary dialogue would produce more innovative and consequential strategies for constructing a new urban and territorial future in Mexico. As a group, we wanted to lay the conceptual and projective foundation for subsequent hands-on work in one of the more distressed regions of Mexico, and we used the spring seminar to frame those initiatives.

Starting in January 2018, the class met once a week, and structured its sessions around visiting speakers and deep conversations on a range of focus topics intended to generate new knowledge and new questions about the history, politics, governance, cultural traditions, and architectural practices in Mexico – as well as prior recovery efforts after disaster (See Appendix A for the course syllabus). Early on, we joined hands with students and faculty at MIT's School of Architecture and Planning, particularly Professor Lorena Bello Gómez, to establish a Harvard-MIT alliance that could be mobilized in the region over the next nine months. Students were asked to produce final research papers or projects that built on the methodologies noted above, and we encouraged all to propose an intervention (at any scale) or a critical rethinking of past practices, justified in terms of their proposed impacts on urbanization and urbanism using the criteria noted above. Students were advised that projects could range from critical interpretive essays to architectural prototypes, alternative land use plans, financing mechanisms, cooperative social arrangements, environmental infrastructures, governing institutions, regulatory transformations, or new forms of global knowledge exchange. As faculty instructors we wanted to establish as wide and open-ended a mandate as possible, with the expectation that the creativity and speculative potential of students would produce out-of-the box and innovative ideas.

Laying Possible Pathways

We were not disappointed. Although only a handful of the students enrolled in the class had any deep knowledge of Mexico, as a group they produced a wide range of possible interventions and proposed policy or design actions by drawing on their collective expertise in Design Engineering, Urban Planning, Urban Design, Landscape Architecture, and Architecture. Beyond their programmatic expertise, some students had professional or academic experience in post-disaster recovery, most had

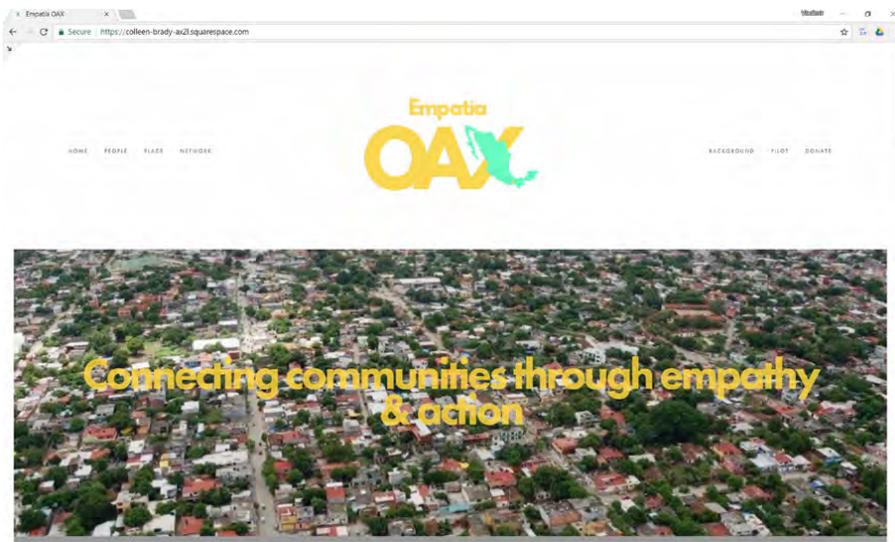
some familiarity with the developing world, and only a few had experience in rural development. Yet the combination of close and distant knowledge of Mexico, coupled with our recommendation that students work in teams, laid the groundwork for a series of projects that established new possibilities for reducing vulnerabilities in Mexico's more rural regions. The projects offered new forms of networked activism, new strategies for mixing rural and urban economies, new ways of mapping and documenting the earthquake, alternative uses of local culture to build disaster awareness and social connections, novel environmental projects for dealing with rubble, and new strategies for using existent institutions, like schools, to create proactive consciousness about built form and vulnerability.^{3,4}

A selected smattering of the final projects included the following:

Empatia OAX

This project features a website that exemplifies a communication system to empower and centralize community voices in disaster response. The website creates a network between communities by identifying central people and places in each community and facilitating connections horizontally between them.

Colleen Brady (MUP '18) / Vladimir Gintoff (MArch I, MUP '21)



The Extended Agropolis: diversified urban agriculture

The city is absorbing the rural without integrating its ways of living. This project proposes to mediate the urban-rural linkages formed through urbanization patterns created through constant migration and reterritorialization. This proposal's ambitions extend beyond what is traditionally known as "urban agriculture" by proposing the cultivation of crops at various scales of urban form—within urban, suburban, and peri-urban areas.

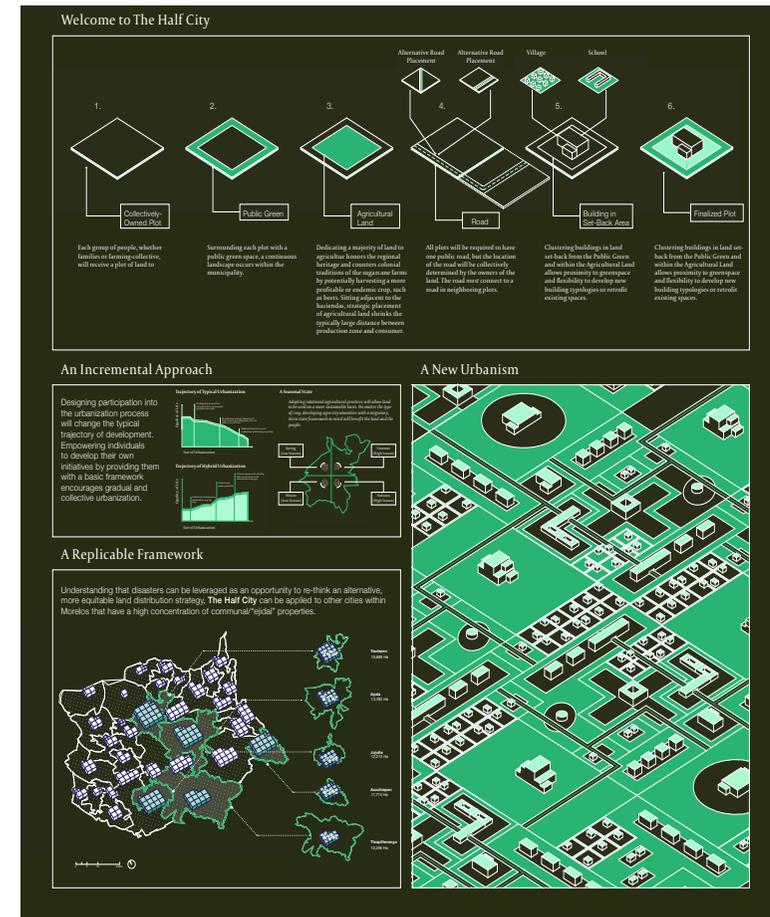
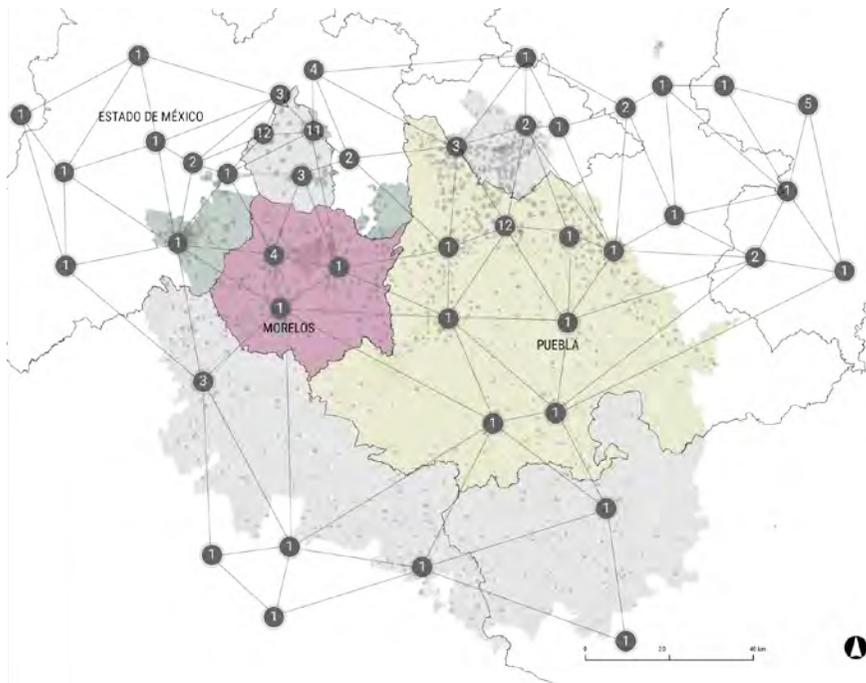
Erin Yook (MDes '18)

Rural Risk Reduction in Mexico

The project studies the Mexican post-earthquake house reconstruction program at national, state, ranchería and household levels, with the objective of (1) examining the post-earthquake housing development program implemented by the Mexican government, (2) analyzing how national reconstruction plans can be made more efficient at local level, and (3) making recommendations to increase program efficiency through the proposal of a new policy initiative.

Akemi Sato (MIT '18)

UNIVERSITIES LOCATED AROUND ESTADO DE MÉXICO, MORELOS AND PUEBLA



The Half City: a new model of participatory urbanization

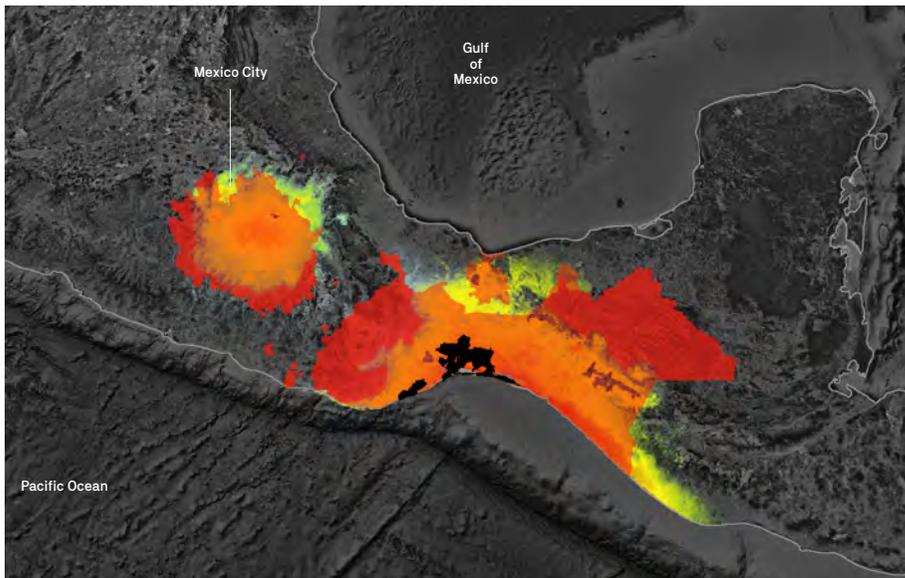
Using incremental, participatory urbanization, "The Half City" seeks to trigger a new method of organization that more evenly distributes resources, as current infrastructural use and placement is controlled by centralized authorities. It is a radical new model of gradual urbanization from the ground-up

Gina Ciancone (MUP '19) / Rodrigo Solé (MUP '18)

Shake Map

This research project territorializes the overlaps between the physical deformation of the ground due to earthquakes and the mobilization of federal resources to respond to purported emergencies on the ground. It maps the municipalities that were included in the Disaster Declaration for Municipalities in the DOF after the September earthquakes and compares these areas with the September 9th and September 17th telluric events that affected 40% of the Mexican territory. By georeferencing the flow of resources that are allocated for relief after a disaster of such magnitude, this research opens an avenue for accountability and measurement of impact.

Santiago Aurelio Mota (MDE '18, MDes '20)



23/730 municipalities (black) were attended directly by the office of the Federal Secretaries. 1/4 of the surface (123 municipalities in red) did not experience significant shaking. Source: Shakemap data for USGS event, from USGS Earthquake Hazards Program (<https://earthquake.usgs.gov/earthquakes>)

In its entirety, the spring course did more than produce a series of projects and ideas that documented the impact of the earthquakes and that offered new models for “rurbanism” that would allow residents in smaller towns a wider range of livelihood options to help mitigate the long term and secondary effects of a future earthquake. It also led to the formation of a group of dedicated students – specifically Deni López, Nadyeli Quiroz and Betzabe Valdés, who lived in Juchitán for three months in the summer of 2018– to continue their research and projects even after the end of the academic semester, working as much on their own as with faculty input and winning awards to travel to Mexico to extend and deepen their ideas.⁵ Some teams continued to work throughout the following year, including in a fall 2018 independent study offered at the GSD, fine-tuning the projects presented later in this book. In contrast to the spring 2018 course, the fall independent study focused only on Oaxaca – primarily the Isthmus of Tehuantepec, which had captured the imagination of only a few of the students enrolled in the original “Beyond Reconstruction” spring 2018 seminar.

Central to the evolving focus on the earthquakes’ impact in the Isthmus of Tehuantepec was a chance encounter with two architecture and urbanism faculty in Mexico City at the Universidad Anáhuac, Monica Arzoz and Jimena González-Sicilia, who became connected to our efforts via a GSD urban planning student, Rian Rooney. Rian had not enrolled in the spring course, but was in contact with the Anáhuac team, who had been requested by the Mexican government’s historic preservation agency to consider the earthquakes’ impact on key architectural and cultural sites in Ciudad Ixtepec and Asunción Ixtaltepec, close to Juchitán de Zaragoza.

By joining our divergent interests together, we collectively embarked on a cross-university summer research exploration of post-earthquake conditions in Oaxaca. Under the guiding assistance of Enrique Aureng Silva, who was originally enrolled in the spring 2018 seminar as a student completing his MA thesis in Critical Conservation (MDes), which focused on the relationship and tension between conservation goals and earthquake realities, the project thus entered yet another stage. With support from the GSD for his appointment as the Irving Innovation Fellow, Enrique worked with a small but dedicated number of Harvard and MIT students conducting fieldwork in Oaxaca during the summer of 2018.

After throwing themselves deeply into research, speculation, and projective reflections while in Oaxaca, students returned to Harvard in the fall of 2018 and enrolled either in the GSD independent study (offered by Davis) or workshop at MIT (offered by Bello) to work toward completion of their pro-

jects. The excitement generated through fieldwork over the summer spilled over into the hallways, thus motivating a new crop of students to contribute to the ongoing efforts in Oaxaca by enrolling in the courses at Harvard or MIT. Several of the students who opted for the GSD independent study pursued comparative projects focused on the challenges of rural development in other countries, including China and the United States, diving into a terrain of design and planning that is underdeveloped in the profession more generally. While not solely focused on Oaxaca, as was the case with the MIT students, the GSD projects allowed more comparative reflection on risk, resilience, and rural development across a range of contexts, with the hope that such information would be helpful to the Oaxaca-focused teams.⁶

Another group of enrolled students from Urban Planning and the Harvard Kennedy School turned their attention directly to the cultural, institutional, governance, and social context of Oaxaca, laying the foundations for further research that continued during the winter break. With support from Harvard's David Rockefeller Center for Latin American Studies, ten of these students returned to Oaxaca in January 2019. The projects presented later in this book come out of this one year journey, which involved different constellations of students, faculty, and stakeholders at Harvard and MIT, many of whom pursued direct fieldwork experience in Oaxaca either in August 2018 or January 2019. While not everyone who initially embarked on this mission almost two years ago saw their project to completion, their work must be seen as part of the cumulative knowledge-production that led to the set of final projects presented here.

Yet to Come

In what follows, we assemble all the pieces that informed and produced this ongoing intellectual voyage. In the next essay of this introductory section, we showcase parallel reflections from our faculty partner at MIT, Lorena Bello Gómez, who was directly involved in the coursework, fieldwork, and academic agenda-setting that produced our collective efforts over the past year. We then turn to three separate essays on the history of the region, the earthquake, and the multiple challenges that framed post-earthquake efforts in Oaxaca. This is followed by a separate section that showcases eight different projects that were developed by GSD and MIT student teams during the past year. A fourth chapter presents short commentaries from several of those who counseled or interacted with us during this project, in Oaxaca, Mexico City, or elsewhere. In service of focusing not just on projects developed for Oaxaca, but also on the broader role of universities as catalysts for innovation in disaster recovery, in this section we have included commentaries from Harvard-supported scholars who promoted

university-based engagement with disaster recovery elsewhere, notably in Chile. One of the final phases of our journey, in fact, was the mounting of a spring 2019 conference showcasing the Oaxaca work and comparing our collective experiences in Mexico and Chile, with valuable input from our academic colleagues. The volume closes with a short reflection on what we have learned collectively, as instructors, collaborators, and urban scholars interested in teaching and engaging with vulnerabilities and disasters. Our hope is that the book's closing remarks will serve as the beginning rather than the end of a longer-term conversation about how to combine research, theory, and practice in the service of constructive social change, especially in the wake of disaster.

3. See "Community Educational Resilience: A New Model of Education Preparedness" by Mata/Peláez in Part III of this volume.

4. Antonio Moya-Latorre's project "The Art Catalogue", produced during the spring 2018 course is referenced in "Along Fault Lines: Urban Affect Network" in Part III of this volume.

5. Together, Dení, Nadyeli and Betzabe received awards from the Penny White Project Fund, the David Rockefeller Center for Latin American Studies, and the International Travel Community Service Fellowship to conduct on-the-ground research for their project titled "Disaster as an Opportunity: Alternatives for Debris Management at the Los Perros Riverbank in Oaxaca, Mexico. As faculty, we were inspired by their initiative and ambition, and

carried forward similar fundraising initiatives for the rest of the students who joined ongoing research endeavors.

6. This final project was titled *Principles of Rural Planning: Understanding Mexican Challenges, Towards a Rural Paradigm* by Weiyi Cao, Finn Vigeland, and Kuangyu Xiong. This team of students did not join the January 2019 fieldwork in Oaxaca, and thus have not had the opportunity to develop their projects to a degree that could be included in this volume. But their accomplishments were part of the larger conversation that led to the knowledge-generation we hope this book provides, particularly with respect to the role of universities – and their students – in laying the groundwork for innovative and change-producing

action in the face of earthquakes and other natural disasters. Likewise, two of the students returned to China this past summer to pursue research on the politics of rural development in post-disaster regions of China, seeking more information about how and why the Chinese authorities used a natural disaster to reconfigure government priorities.

Challenges and Opportunities for Reconstruction

A Collaborative Effort

Lorena Bello Gómez

Learning from the field: A journey from center to periphery and back

“Do not monopolize your knowledge nor impose arrogantly your techniques, but respect and combine your skills with the knowledge of the researched or grassroots communities, taking them as full partners and co-researchers. Do not trust elitist versions of history and science which respond to dominant interests, but be receptive to counter-narratives and try to recapture them. Do not depend solely on your culture to interpret facts, but recover local values, traits, beliefs, and arts for action by and with the research organizations. Do not impose your own ponderous scientific style for communicating results, but diffuse and share what you have learned together with the people, in a manner that is wholly understandable and even literary and pleasant, for science should not be necessarily a mystery nor a monopoly of experts and intellectuals.”
Participatory Action Research: Orlando Fals Borda¹

When the first of the 2017 September earthquakes hit the ground of Mexico’s most vulnerable states – Oaxaca and Chiapas – MIT students and faculty had just returned from a month-long workshop in the Indian state of Gujarat. This area is prone to tsunamis, earthquakes, flooding, droughts, and man-animal conflict due to its proximity to the Gir Forest. The workshop was a collaboration with the Aga Khan Agency for Habitat (AKAHI) to study ways to diminish risk in these rural towns, sixteen years after the Bhuj Earthquake of 2001. Some MIT faculty had already worked in the same area back in 1998 before the earthquake and provided an excellent example of an approach to rural development without the lens of risk. AKAHI’s community engagement in the area since 2007 laid the groundwork for an excellent learning platform for the collaboration and produced a transformative experience for the students involved in the workshop during our field visit to Gujarat. After the visit, it became clear that reconstruction takes a long time, that infrastructure is key to reducing rural risk vulnerabilities, and that a sense of commons is lost in fragmented rural communities. Those ideas fueled the students’ design imagination during the fall semester.²

In those same days, MIT SPURS Fellow, Braulio Torres, together with Harvard and MIT students, organized a panel at MIT. He invited faculty to speak about our experiences in risk territories and to discuss the potential of both institutions to help Mexico in the aftermath of the catastrophe. During that panel, Diane Davis’ intention to teach a class on the earthquakes and recon-

1. Extracted from: <https://www.theguardian.com/world/2008/aug/26/colombia.sociology> (Accessed: May30th 2019)

2. The results of the summer-fall class can be found in “Disaster Resilient Housing in Rural Saurashtra.” (https://issuu.com/prurobinson/docs/05_07_18_housing_booklets__india-f/2)

struction the following spring at the GSD was revealed, and what followed is in this book. In this introductory essay, the reader can find some key discoveries gleaned from our field visit to Mexico in the summer of 2018 that became a source of inspiration for student research and subsequent projects. We think that the richness of this project is the result of its assemblage as a cross-disciplinary and cross-institutional undertaking from stakeholders in different universities, departments, and disciplines.

Mexico City

In mid-August of 2018, we arrived in Mexico, joining a group of Harvard GSD and MIT students and a group of faculty and students from the Universidad Anáhuac School of Architecture. Our group of faculty and graduate students included planners, urban designers, landscape architects, and architects, as well as students from Harvard's MDes program. The GSD/MIT team had already begun exploring post-earthquake strategies for several rural towns in the Isthmus of Tehuantepec. This group had conducted surveys, organized workshops with children, and met with local NGOs and government officials to better understand the context, reconstruction process, and potential opportunities in this severely damaged region. Our Anáhuac colleagues Monica Arzoz and Jimena González-Sicilia had also conducted research on this area the previous spring, and they would continue their work with students in fall 2018, in parallel with the US group. During our two-week workshop, we traveled from center to periphery and back, in a journey that crystalized directions and actions for work that would continue during the subsequent fall 2018 semester.

Our workshop began in Mexico City on August 17, 2018, with a day-long symposium organized in collaboration with the Institute of Social Research at UNAM. The symposium allowed participants and students to gain perspective from experts in the Mexican government and academia on reconstruction in the context of both Mexico City and the Isthmus of Tehuantepec. The morning session brought together the government and the civil society of *damnificados*—those whose homes had been damaged by the earthquake—to explain their experiences in reconstruction so far, almost one year after the September 2017 earthquakes. The afternoon session included reports from experts, who explained the challenges to be confronted in the reconstruction process. The experts also reviewed protocols to follow when trying to promote reconstruction in the Isthmus and presented projects that various architects had individually undertaken in some of the Isthmus' towns. It is also important to note that reconstruction was about to enter a period of limbo and uncertainty, as a new political party and administration was set to assume control of the federal government in December of

2018. We'd like to use this opportunity to thank all of the participants in the symposium for their generosity in sharing their experiences of reconstruction with us, and to especially thank Professor Manuel Perló for his efforts in making it possible.³

These sessions were rich and helpful, enabling students to contrast and compare, to confirm or refute findings that they had gathered during the spring seminar or their summer research. In the morning session, highlighted lessons and needs included: increased preparedness for damage mitigation; reconsideration of property insurance; implementation of online platforms to demonstrate ownership after catastrophes destroy evidence; reevaluation of densification through the use of air rights while considering scarcity of water and infrastructure; consideration of tangible and intangible losses and trauma; keeping efficient and open platforms to communicate with civilians; evaluation of the role of social networks; and amplification of public space performance. As an urbanist, I found this last point to be a paramount consideration in the design of cities that need to confront repeated disasters. In such cities, public space always becomes a 'first shelter' for those waiting to be rehoused.

The afternoon session on August 17 was key to synthesizing the challenges of reconstruction in the Isthmus of Tehuantepec and Oaxaca state more broadly. This is one of the most culturally rich and ethnically complex regions of Mexico. Settled since circa 3,500 BCE, the state's extremely rugged topography has resulted in a politically fragmented territory of 570 municipalities where 68 languages are spoken, with a majority of Zapotec and Mixtec Indigenous groups.⁴ Participants learned from sociologist Dr. Elena Nava that the majority of Zapotec people in the Isthmus have a cosmological relationship with the Earth that produces a sustainable manner of farming. Today, they also have a vulnerable agricultural economy. Zapotecs perceive, and evidence unfortunately indicates, that their land and traditions are under threat of damage and degradation from repeated government efforts to prioritize major infrastructural projects for the nation's energy and export needs. These national projects have historically focused on exploitative resource extraction, including a port, a dam, an oil refinery, and most recently, wind farms. All have failed to distribute benefits to existing village

3. A schedule of the morning and afternoon sessions can be found in an Appendix B to this volume; links to their recordings can be found below.

Morning Session: <https://www.youtube.com/watch?v=qG9fsyFzcGc>.
Afternoon Session: <https://www.youtube.com/watch?v=TbCn-NIkxJLU>

economies. Zapotecs resent the government's disrespect of their land rights in the development of these projects, the processes of which are perceived to be nontransparent. Negative interactions between the government and Indigenous people are unfortunately frequent, as more than half of the land in the state of Oaxaca is collectively owned by Indigenous populations.⁵ Due to these cultural and political differences, some of the Isthmus' population has sustained a low-level insurgency against the central government, one that peaks and manifests itself in conflict and resistance every time an infrastructural project or a new program is proposed.

Historically, some of the Isthmus' conflicts have surrounded: social and communal land; municipal limits; tension between locals and outsiders; migrants and migration; unions, especially the teachers union; family networks; differences between ethnic groups; generational differences; gender; environmental issues; and religion. With this history of oppression and resistance, we learned that conflict in the Isthmus is interwoven with its reconstruction. This society's history of self-organization to resist, yet be resilient, could be taken as an opportunity to start reconstruction *with* them, not *for* them.⁶

Given the strong role of women in the Isthmus' society, their involvement in reconstruction is crucial, especially because rates of alcoholism among the male population are high. *Tequio*, a collective work exchange tradition, can be applied to reconstruction, and rubble can be purposefully reused as an economic and environmental strategy. One of the speakers, Gustavo Madrid, constructed a school close to Monte Albán in Oaxaca with the help of 100 tequios, meaning one hundred weekends of communal work with women and children. Jose Pablo Ambrosi showed a civic center for children that was reconstructed in Juchitán de Zaragoza thanks to a collaboration between his own studio in Mexico City, student Nadyeli Quiroz from the GSD, Root Studio in Oaxaca, and a Swiss donation. This project showcased the repurposing of brick and rubble onsite to reconstruct building walls and public space pavements. Like many other architects working in reconstruction in Mexico, Carlos Zedillo conducted his work pro bono on weekends after the earthquake. His participatory work with the San Mateo del Mar community in the Isthmus responded to local heritage and ways of life. Pablo Vaggione shared UN Habitat's protocols

4. http://www.houstonculture.org/mexico/oaxaca_cultures.html. (Accessed May 25, 2019)

5. According to Dr. Nava, out of the 1,997,500 hectares in Oaxaca 78% are of "propiedad social" or Ejidios with 58,654 ejidarios and comuneros. 87% out of this communal land belongs to indigenous communities for a total of 1,356,196 hectares.

6. Learned from sociologist Dr. Gisela Zarembeg. More info found in "Conversando con Goliat" at www.conversatingwithgoliat.wixsite.com/misitio



"Experiences in Reconstruction After the September 2017 Earthquakes" symposium at Instituto de Investigaciones Sociales UNAM from the left: Monica Arzoz, Jimena González-Sicilia, Diane E. Davis, Lorena Bello Gómez

© Ariana Campos



© Lorena Bello

Ex-Convento Santo Domingo Tehuantepec on August 2018, almost a year after the earthquakes.

to address emergencies and reconstruction in towns similar to those that we would encounter in the Isthmus, while Carina Arvizú discussed the incoming government's ideas for these regions in Mexico. With these lessons in our mental backpack, we continued our trip.

Oaxaca City

From the center of the country, we traveled south to the capital of Oaxaca state: the city of Oaxaca de Juárez. The main purpose of our visit was to learn about Oaxaca's ancient patrimony and its condition after the September 2017 earthquakes. We also sought to learn from the local government about the existing challenges in the Isthmus's reconstruction. As in Mexico City, we spoke with practitioners who proposed that the catastrophe presents an opportunity to build back better, using creative processes. From Oaxaca City, we visited some of the surrounding towns, each of which specializes in different arts and crafts that make this region internationally famous. In different villages, we encountered alebrijes (spirit animals), black pottery, embroideries, and colorful weavings. We also tasted good mezcal, delicious mole and treaded the ancient paths of the Monte Albán ruins and the contemporary paths of the San Pablo Cultural Center. This Center was an adaptive reuse project funded by the Andrés Harp Helú Foundation, which specializes in Oaxaca's patrimony. The Foundation was also our host for a two-day workshop that we organized at their Casa de la Ciudad. Again, we here take this opportunity to thank the Foundation for their hospitality and to congratulate them for their outstanding work on cultural heritage conservation and adaptive reuse. We also thank all the participants in the workshop for sharing their time and insights.⁷

After the earthquakes, access to government funding for reconstruction was unfortunately inhibited by several issues related both to the underdevelopment of the Isthmus region and to ineffectiveness of government policy. These circumstances resulted in many *damnificados* not receiving funds and in many heritage buildings remaining damaged and untouched. Additionally, those who did receive funds were often obliged to rebuild in a manner at odds with the region's traditions, culture, and climate.



San Vicente Ferrer Church in Juchitán Oaxaca almost one year after the earthquakes.

7. Participants: Andrea Quintana, Ignacio Toscano, Rolando Osorio, Ana Sumano, Elpidio Concha Arellano, Gonzalo Villalobos, Sinan Casillas, Gerardo López Nogal, Tzinnia Carranza, Ramiro Ramirez, Giberto Gallardo y Nahú Rodríguez.

8. Akemi Sato's 2018 thesis discussed these issues in detail. "Rural risk reduction in Mexico: making national plans for post-earthquake reconstruction more effective at the local level". <https://dspace.mit.edu/handle/1721.1/118203>

9. FONDEN (Fondo de Desastres Naturales): Natural Disaster Fund to reduce the financial risk that typically follows a natural disaster

In order to receive funding for reconstruction of a damaged home, a *damnificado* must be formally registered as such. A variety of issues inhibited full registration of such *damnificados*, many related to the fact that most of them were low-income and rural. When government representatives reached villages or settlements, some *damnificados* were not present because they had been displaced to other villages. Others were working, and therefore could not be contacted. Due to poor government census information, many *damnificados* with similar names were confused with each other. Many others were also disqualified from aid because their homes were considered 'incomplete', while in reality these houses were often in the process of construction or were partly open to the air, as is typical in rural villages. Overall, the government's lack of capacity and the rigidity of categories further disadvantaged poor rural dwellers who had already been badly impacted.⁸

A total of 26,000 buildings were ultimately registered as damaged in 283 municipalities, 41 of them in the Isthmus. Additional earthquakes on September 19th and 23rd added 5,000 more damaged structures. But both topography and Oaxaca's dispersed urbanization interfered with gathering necessary data for the reconstruction of damaged buildings and the region's valuable patrimony. This effort was needed to receive the national recovery fund, FONDEN. With Oaxaca's rugged, extreme terrain and with thousands of small hamlets, or rancherías, to survey during the rainy season, the schedules for INAH and INPAC to produce technical sheets of affected historical buildings were too tight, even with the 896 people who helped.⁹ This was exacerbated by an absence of current data and the lack of a catalogued archive of Oaxaca's cultural heritage (!). Surprisingly, information generated for the reconstruction of patrimony was the first ever available data on these buildings. As a result, out of 587 affected historic buildings, only 190 had their data entered into FONDEN by mid-September 2017. Only 127 of these structures had their necessary restoration projects prepared by the deadline of mid-December 2017. And with few human resources available, INPAC had only finished 20 repairs by the end of August 2018, leaving most of the region's four-hundred-year-old patrimony sitting on wooden stilts awaiting reconstruction.

When one is reminded that Oaxaca alone experienced 19,939 tremors during 2018, one can understand the frustration of those residents who see their patrimony damaged and remaining unrepaired on wooden formwork today. Such a comparatively failed reconstruction could be an opportunity to rethink how to quickly produce needed catalogues and restoration programs with advanced 3D technology, to reconsider these protocols in case of catastrophes, and to rebuild with techniques that could be more resilient to earthquakes in the future.

Another important part of Oaxaca's patrimony is its vernacular housing. A great majority of the homes in the Isthmus have been built over three or more generations. They are beautiful airy constructions that respond to the extreme climate outside. We were already aware of the constraints and negative consequences that the FONDEN fund imposed on the reconstruction of homes lost during the earthquake. Both the extent of damage and the materials of reconstruction were not carefully considered by this national fund. Many in Oaxaca perceived that the national fund sped up demolition and the erasure of this valuable part of their heritage and memories. This came as a result of the fund granting more money for total losses and a mandate for homes to be reconstructed with industrialized materials that did not reflect the vernacular materials of the Isthmus. FONDEN's top-down, one-size-fits-all-solution to design, not only failed to address different ways of life, but also how houses protect from, and relate to, their differing immediate environments.

The Harp Helú Foundation attempted to counteract this demolition and erasure with the reconstruction of homes that both conserved vernacular culture and reinforced structures to sustain earthquakes in the future. While the results were very good, the average reconstruction budget of 30,000 dollars was controversial in comparison to the 6,000 dollars given by FONDEN. We considered alternatives: could there be an opportunity in the reconstruction of homes for the national fund to allow for the recovery of what was left? With materials included and even rubble? We asked whether growth could be considered a factor in the reconstruction process. In this manner, we imagined that houses could be rebuilt in modules, with smaller portions constructed initially and the possibility to grow in the future. To avoid future losses of vernacular housing, an NGO in the Isthmus, Bibani, tried to stop demolitions and prepared a guide that shows how to reinforce self-built houses to sustain future earthquakes.¹⁰ Another NGO, Eeco, presented a hybrid between a vernacular housing type for the San Mateo Del Mar community with a fascinating structural engineering design to overcome the risk of sitting on top of sandy ground.¹¹ With no further delay, we continued our travel south.

10. This guide can be accessed here: https://www.academia.edu/29655480/Cartilla_breve_para_refuerzo_de_la_vivienda_rural_de_auto-construcci%C3%B3n_contra_sismo_y_viento.

To learn about BIBANI: <https://bicisgdl.files.wordpress.com/2017/10/bibani.pdf> (Accessed on June 3, 2019)

11. Eeco's link: <http://eeco.org.mx/>



© Lorena Bello

Visit to Monte Albán. From the left: Jimena González-Sicilia, Rian Rooney, Monica Arzoz, Sebastián Gaviria, Lorena Bello Gómez, Enrique Aureng Silva, Diane E. Davis, Clarence Lee, Olivia Hansberg, Betzabe Valdés, Dení López, Mercedes Bidart, Daphne Xu.

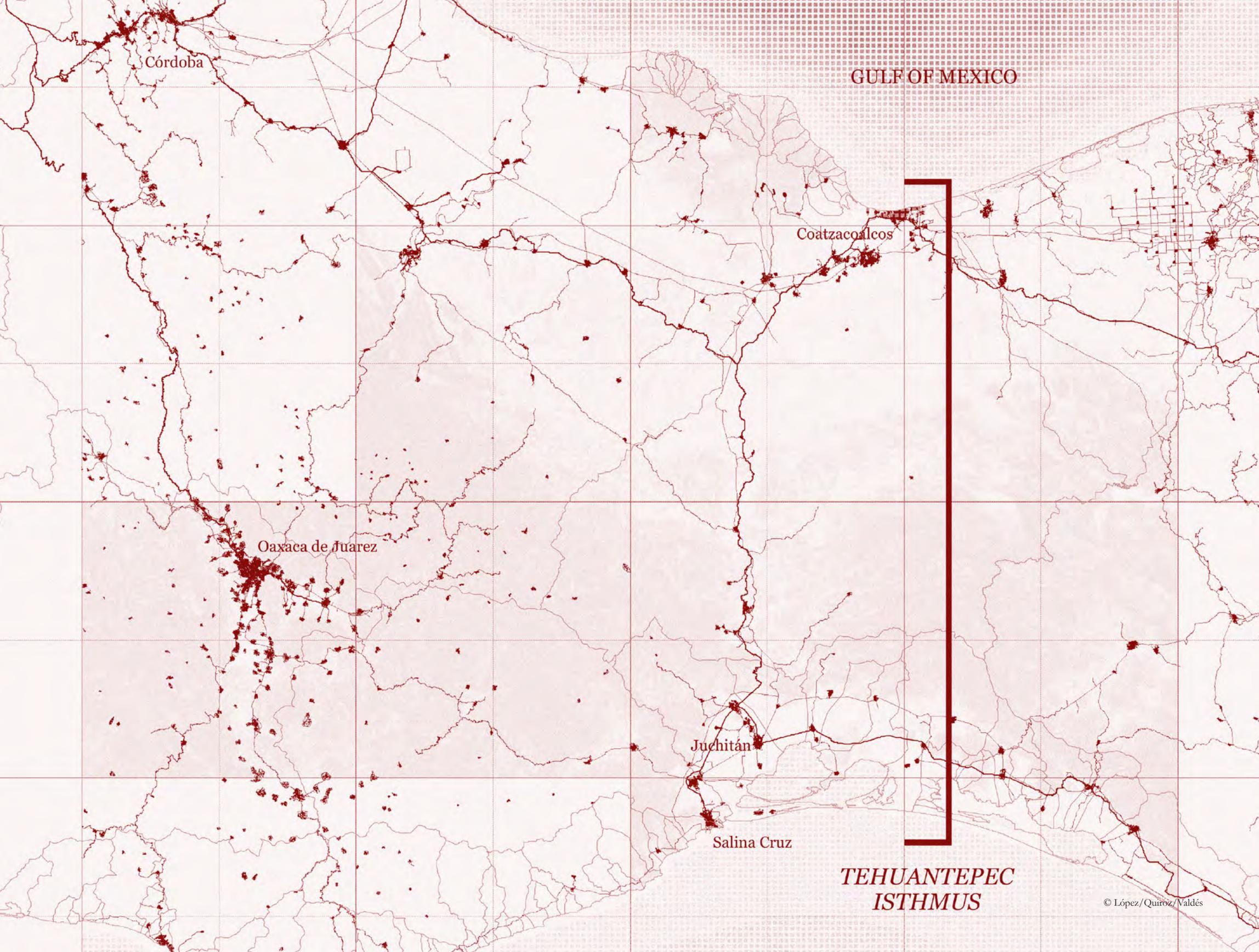
The Isthmus of Tehuantepec

The travel down from Oaxaca City to the Isthmus of Tehuantepec is a four-and-a-half-hour-long descent along a road with 600 curves. According to the Secretary of Infrastructure (SINFRA), the government has tried to improve this road for twenty years against the will of Isthmus communities, who have closed down the roads every time a new plan is proposed. The distance between the Isthmus and the rest of the nation is not only mental and cultural, but also physical, even though there is a small airport in Ixtepec. This makes one wonder how the proposed trans-isthmus train project from Coatzacoalcos to Salina Cruz will be received or constructed. As Juchitán de Zaragoza had been temporarily made inaccessible by disputes between armed groups, we stayed in Salina Cruz, visiting a network of small-to-medium-sized towns along the Las Nutrias river. The network of towns we visited included Tehuantepec, Juchitán de Zaragoza, San Mateo del Mar, Santa María Xadani, El Espinal, Asunción Ixtaltepec, Ciudad Ixtepec, Santo Domingo Chihuitan, La Ventosa and Unión Hidalgo. During their summer research work in the Isthmus, the students had already built trust with both local communities and the government. Together with the Anáhuac instructors, they organized our meetings with activists and leaders including Carlos Beedxe from "Radio Totopo", Guiexhooba de Gyves and Rafael Mayoral. For our time in the Isthmus we owe special thanks to GSD students Dení López, Nadyeli Quiroz, and Betzabé Valdés who spent three months in Juchitán de Zaragoza and gained the trust of the communities along the Las Nutrias River.

Our fieldwork and meetings permitted us to experience the earthquakes' effects and the state of reconstruction firsthand. It also led to our interaction and collaboration with the mayor of a small but important town in the Isthmus, called Ciudad Ixtepec. This town and its surrounds serve as a stop on the freight rail-based migration corridor from Central America called "La Bestia." As a result, the town has many social problems including competition for scarce jobs and insecurity. If constructed, the trans-isthmus corridor linking the Gulf of Mexico with the Pacific Ocean would pass through and include Ciudad Ixtepec. The mayor asked our students (U. Anáhuac / GSD / MIT) if they would undertake a strategic plan for reconstruction in the town, in which many historic sites were damaged and local livelihoods destroyed. We accepted. With some homework to do, we went back to Mexico City and had further discussions with experts at UNAM before we flew back to Boston, ready to start the semester.

Cambridge, MA

Back in Cambridge, Diane Davis and I co-instructed two courses in parallel, one each at the GSD and at MIT. The agenda of the independent study at the GSD, enrolling urban planning, urban design and MDes students, included: a) a critical evaluation of regional infrastructure and mega-projects; b) a reassessment of what aspects of the local cultural patrimony should be conserved or strengthened (buildings, traditions, livelihoods, community rituals, and so on); c) a commitment to developing new processes and practices of citizen involvement; d) new ideas about employment and community prosperity; and e) rubble recyclability and ecology. The workshop at MIT included students from both departments at SA+P, planning and architecture as well as students from the GSD's MAUD and MDes programs and focused on inventive forms of urban design and architecture that contribute to the aforementioned aims, including recovery of urban fabric, public space, infrastructure, heritage buildings and rubble recyclability as a top priority. What follows in this publication is the result of one year of research that looked beyond what was encountered in order to find opportunities for the future.



Córdoba

GULF OF MEXICO

Coatzacoalcos

Oaxaca de Juárez

Juchitán

Salina Cruz

**TEHUANTEPEC
ISTHMUS**

Part II.

The Isthmus of Tehuantepec: A Brief Overview

The Context: History and Geography of the Isthmus Rian Rooney	48
The Event: The 2017 Earthquakes and Their Aftermath Dení Lopez / Betzabe Valdés	62
Framing the Fault Lines: Fragmentation in Oaxaca's Preparation and Response Amaya Bravo-France / Evita Chávez / Sydney Pedigo	78

The Context

History and Geography of the Isthmus of Tehuantepec

Rian Rooney

The unique geographic qualities of the Isthmus of Tehuantepec make it an essential, strategic territory for (inter)national economic and political objectives. The narrowest part of Mexico – a 200km strip of land separating the Gulf of Mexico from the Pacific Ocean – the Isthmus also exists in a natural valley between the Sierra Madre del Sur and Sierra Madre de Chiapas.

The interest in this territory for its connective abilities in service of global trade continues to dominate national conversation, but the Isthmus is also notable for its natural resources – oil and gas, minerals, and, most recently, wind – a condition that has led to a history of extractive industries and ecological transformations. In order to better understand the political relations that have led the Isthmus to be a continuous target for capitalist enterprise, it is necessary to review the history of the region’s infrastructural and megaproject development and to go beyond the simplifications of the “resource curse.” Future policy and projects in the region ought to grapple with the historical decisions, both failures and successes, that have produced the Isthmus’s current conditions.

Why has the same model seemingly repeated endlessly with the same results? What are the political, economic and social relations from which megaprojects emerge? Who drives them, funds them and who are their beneficiaries? What federal and international laws have enabled these large-scale projects to be deployed across some of the most economically vulnerable and politically and socially fractured geographies in Mexico?

Foreign intervention in the Isthmus goes back to the Spanish conquest. Hernán Cortés himself identified the strategic importance of the region and attempted to convince the Spanish Crown to build an interoceanic route that could help the expansion of the Spanish Empire into the Pacific.

Later, Alexander Von Humboldt, in the documentation of his expedition through the Americas, highlighted three geographic points as strategic to maintaining the trading and military power of the Spanish Empire over the New Spain: the Isthmus of Tehuantepec, the Isthmus of Panama, and a potential route through the lakes of Nicara-

gua. These same three sites have remained relevant and sought-after, as both the Tehuantepec and Nicaraguan routes remain objects of speculation and development plans over a century after the opening of the Panama Canal.

Following the decline of Spanish power in the region, the United States became the dominant power interested in control of the Isthmus of Tehuantepec. The expansionist agenda of the United States, coupled with its victory over Mexico in the Mexican-American War in 1848, led the American government to impose political pressure on Mexico to gain control of the key trade route.

A series of surveying commissions were deployed to study the feasibility of a possible interoceanic canal or railroad link in conjunction with concessions given to foreign, private enterprises to economically exploit such routes. However, despite the pressures exerted by the US government and private capitalists, no connection materialized.

It was not until 1882 that Weetman Pearson, a British contractor, began to build the Trans-Isthmic Railroad under the rule of President Porfirio Díaz, as part of his larger project of Mexican modernization and rail development.

The railroad was fully completed in 1907, by which time oil had been discovered and began to be extracted in Minatitlán, Veracruz, in the northern part of the Isthmus. Through concessions, private interests including Pearson's Mexican Eagle Oil Company came to dominate the oil and rail industries in the early 20th century, despite the role of the Díaz government in infrastructure implementation and execution. The rail link did lead to temporary economic growth for the Isthmus, as it became the center of interoceanic trade for a brief period. However, the opening of the Panama Canal under United States control in 1914 quickly ended the Isthmus's fleeting "golden age." Throughout the Mexican Revolution, private operations in the region continued without much governmental interference.

It was not until the nationalization of oil companies and railroads in 1937 by President Lázaro Cárdenas that these industries became controlled by the state. Under Cárdenas, the federal government took on a stronger role in the development and provision of infrastructure in the Isthmus.



Isthmus of Tehuantepec and the course of Coatzacoalcos River. Diego Paines. 1774. 73 x 64 cm. Source. Mapoteca Manuel Orozco y Berra

2355.7a
Cover

THE

ATLANTIC & PACIFIC SHIP-RAILWAY

ACROSS THE

ISTHMUS OF TEHUANTEPEC,

IN MEXICO,

Considered Commercially, Politically & Constructively.

BY

ELMER L. CORTHELL,

Chief Engineer.

JANUARY, 1886.

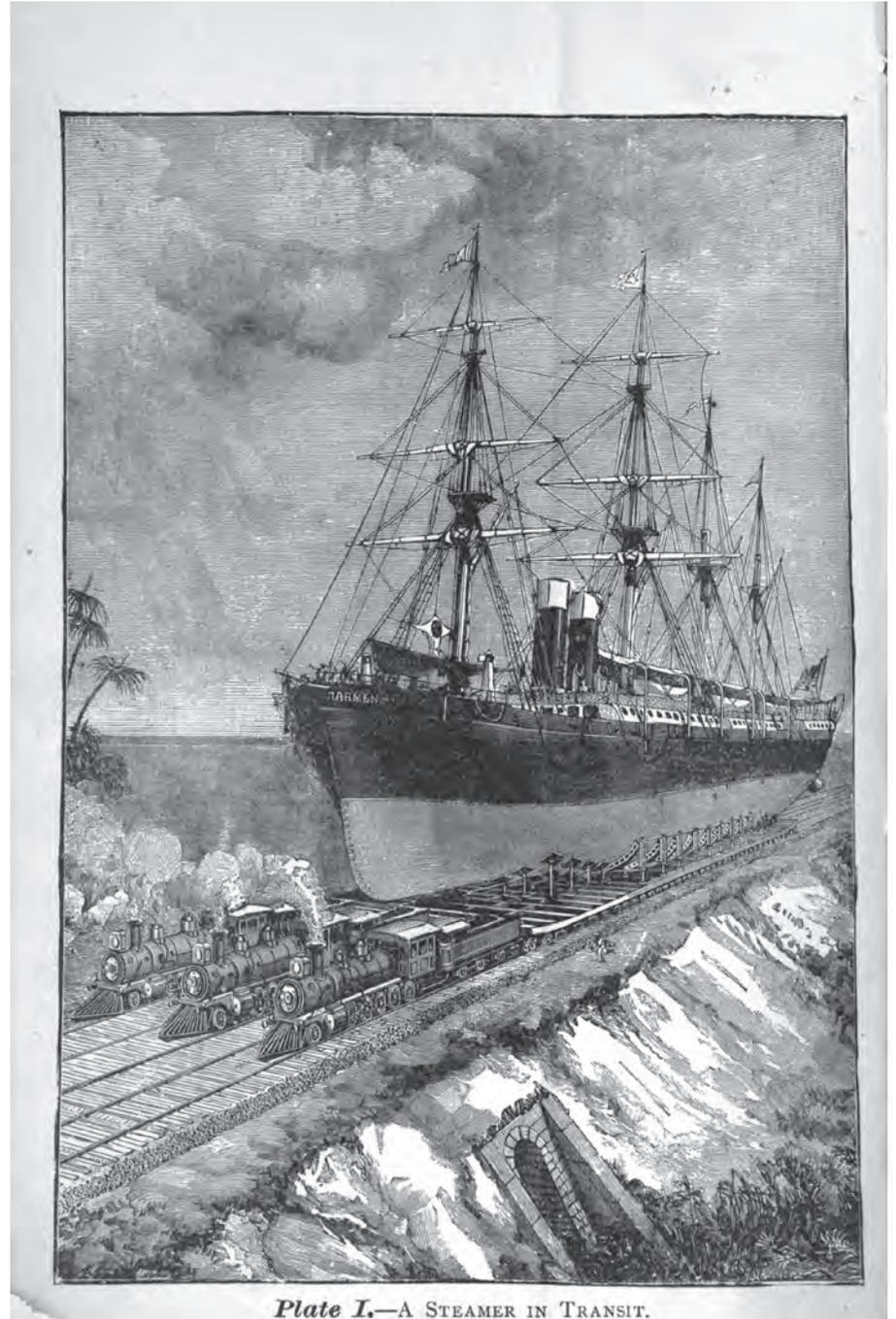


Plate I.—A STEAMER IN TRANSIT.

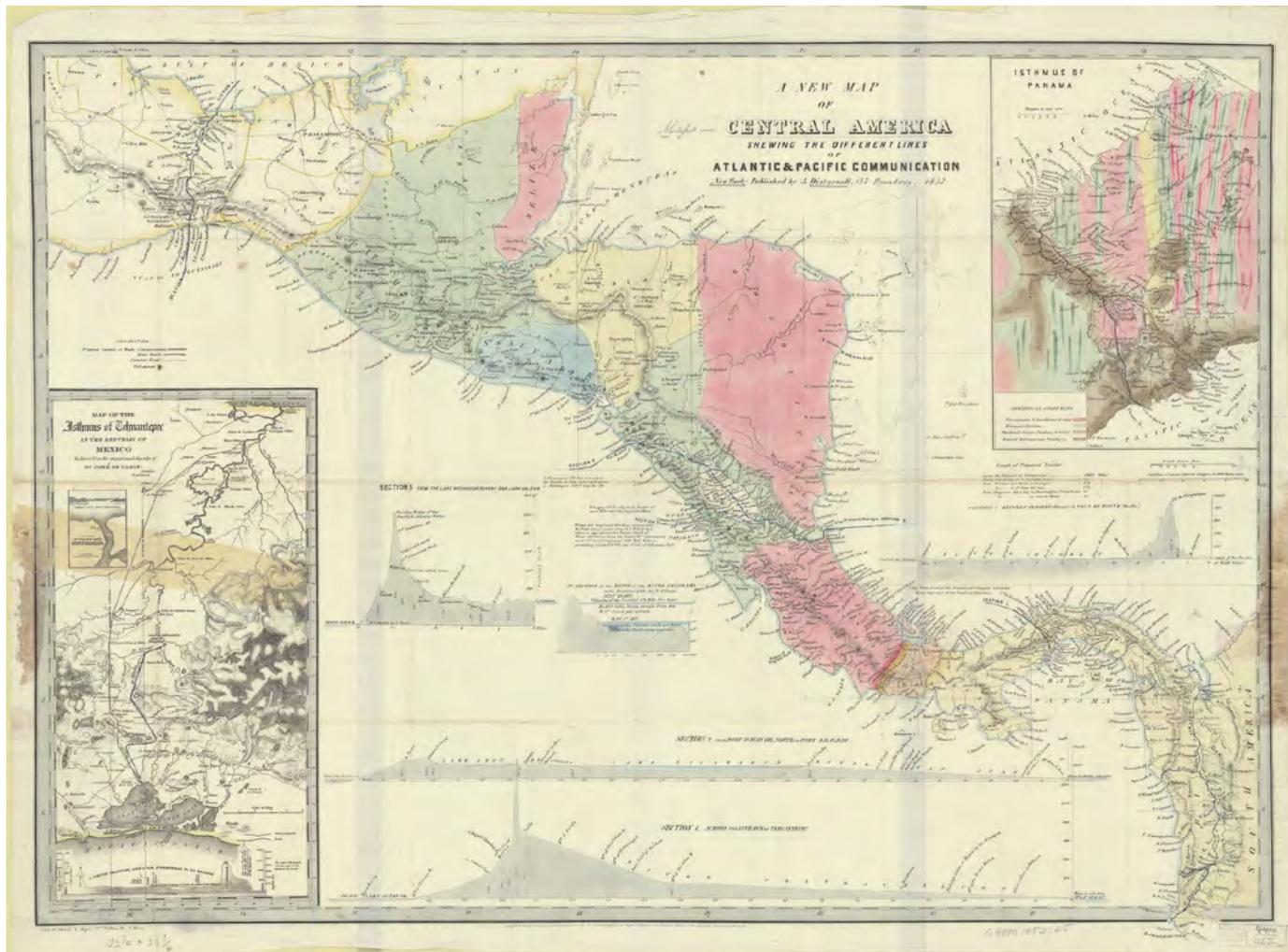
Cover and Frontispiece of *The Atlantic and Pacific Ship-Railway Across the Isthmus of Tehuantepec in Mexico, Considered Commercially, Politically & Constructively* by Elmer L. CortHELL. 1886

The Comisión del Papaloapan was established in 1946 to plan and build infrastructure and policy for development around the Papaloapan River basin in the central Isthmus. Ultimately the Comisión controlled an area of 46,500 square kilometers that included 357 municipalities in three states (264 in Oaxaca, 64 in Veracruz and 29 in Puebla). It held discretionary powers to plan and build anything related to hydrologic management, generation of energy, sanitary engineering, ports and navigation routes, highways, railroads, telecommunications, and the creation and expansion of human settlements. It also sought to establish measures to incentivize the agricultural and industrial development of the zone. This commission lasted until 1984, and radically transformed the Isthmus of Tehuantepec.

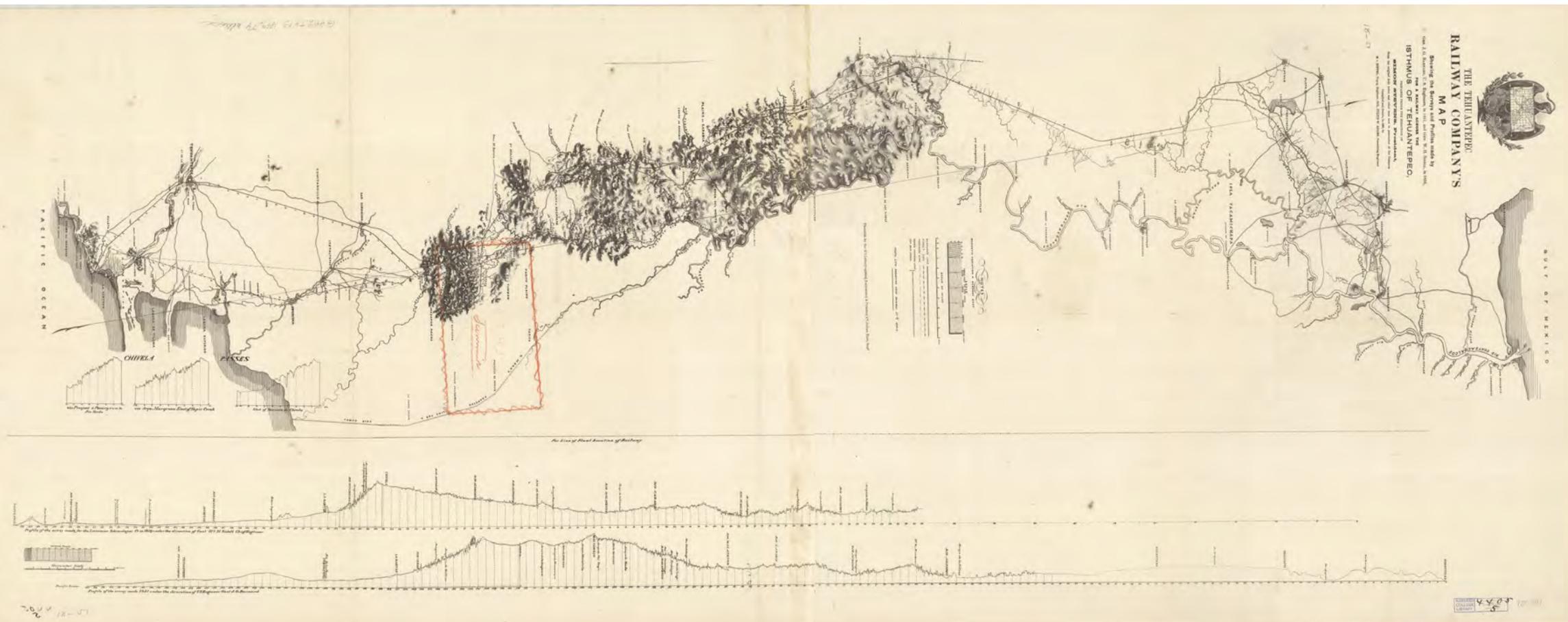
Through the Comisión del Papaloapan, the Mexican federal government and the World Bank attempted to make the Isthmus the breadbasket of the nation by cultivating monoculture commercial crops through agro-industrial projects, which had destructive environmental consequences on the tropical rainforest of the region. Key to these projects was the construction of dams, both for hydroelectric energy generation and for hydrologic management.

In 1964, the Benito Juárez Dam was built in the mountains to the west of the Isthmus to support a major new irrigation district in the southern valley. The lands around Juchitán and Ixtepec were transformed from arid to arable, which marked a significant shift in conceptions of property tenure and land claims in the region. The increased land value associated with its new economic potential for agriculture led to speculation and the privatization of land previously considered communal. As Binford notes, this new “security of production... made the land a valuable commodity, and its acquisition was sought both by local farmers and by persons from outside the region.” The resulting land accumulation and privatization of property led to a rise in landless wage laborers and deepened inequality in the southern Isthmus (Binford, 180). The Benito Juárez dam, interestingly, also supplies the large quantities of water needed for the operations of the Salina Cruz Pemex Oil Refinery, further underscoring the linkages and interdependencies of the Isthmus’s megaprojects.

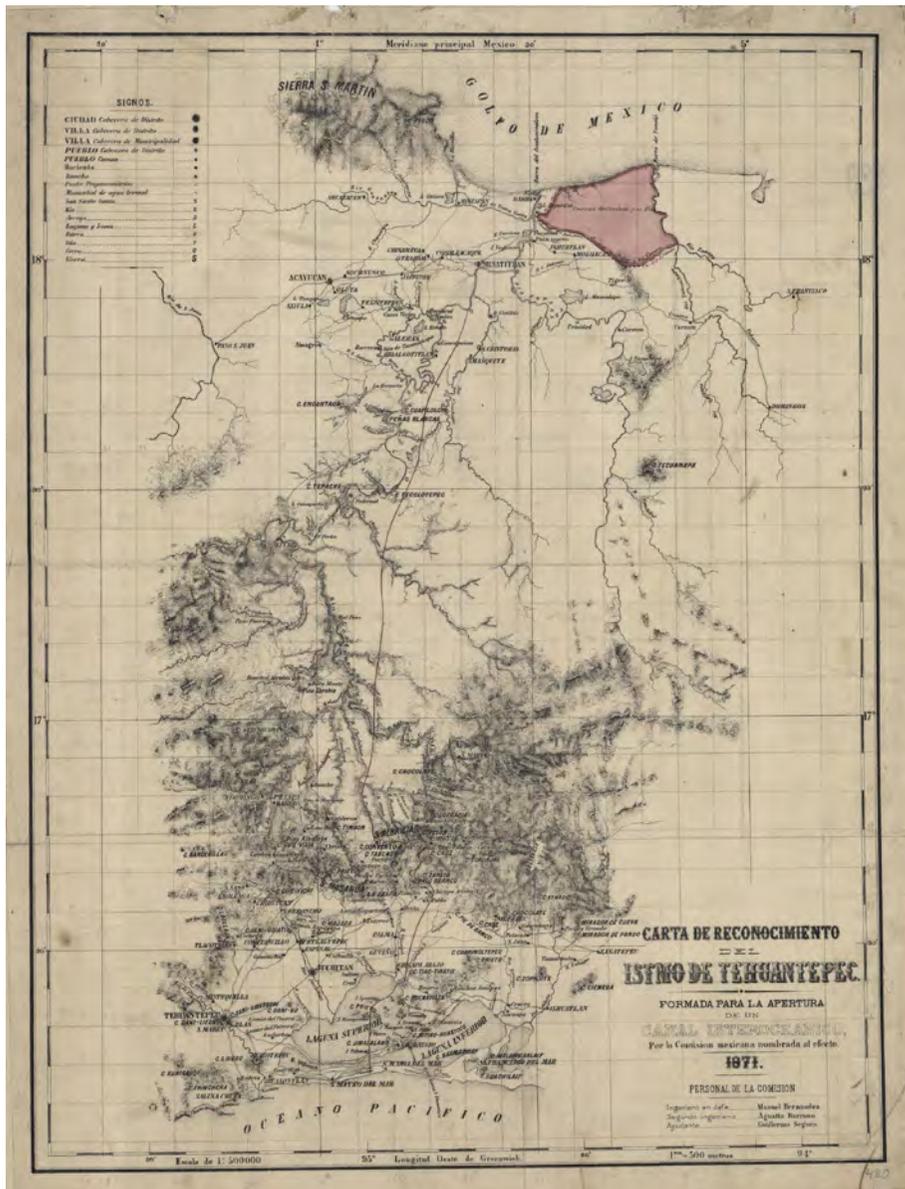
The Isthmus continues to hold significant global strategic value for trade and natural resources, and federal politicians continue to propose and endorse megaprojects



A New Map of Central America Showing the Different Lines of Atlantic & Pacific Communication
J Disternell. 1852. 59 x 80 cm. Source: Harvard Map Collection.



The Tehuantepec Railway Company's map showing the surveys and profiles made by Gen. J.G. Barnard, U.S. Engineers, in 1851 and Gen. W.H. Sidell in 1859 for a railway across the isthmus of Tehuantepec; prepared under the direction of Simon Stevens, President, from the original field notes and other data now in possession of the Company. M. v. Hippel, Topogr. Engineer, Col. Julius W. Adams, Consulting Engineer. 1869. 132 x 51 cm. Source: Harvard Map Collection.



Survey Map of the Isthmus of Tehuantepec for the Opening of an Interoceanic Canal Created by the Mexican Commission Responsible for that Matter. Secretaría del Estado y del Despacho de Fomento. 1877. 58 x 74 cm. Source: Mapoteca Orozco y Berra

in the region, citing their value as economic development strategies.

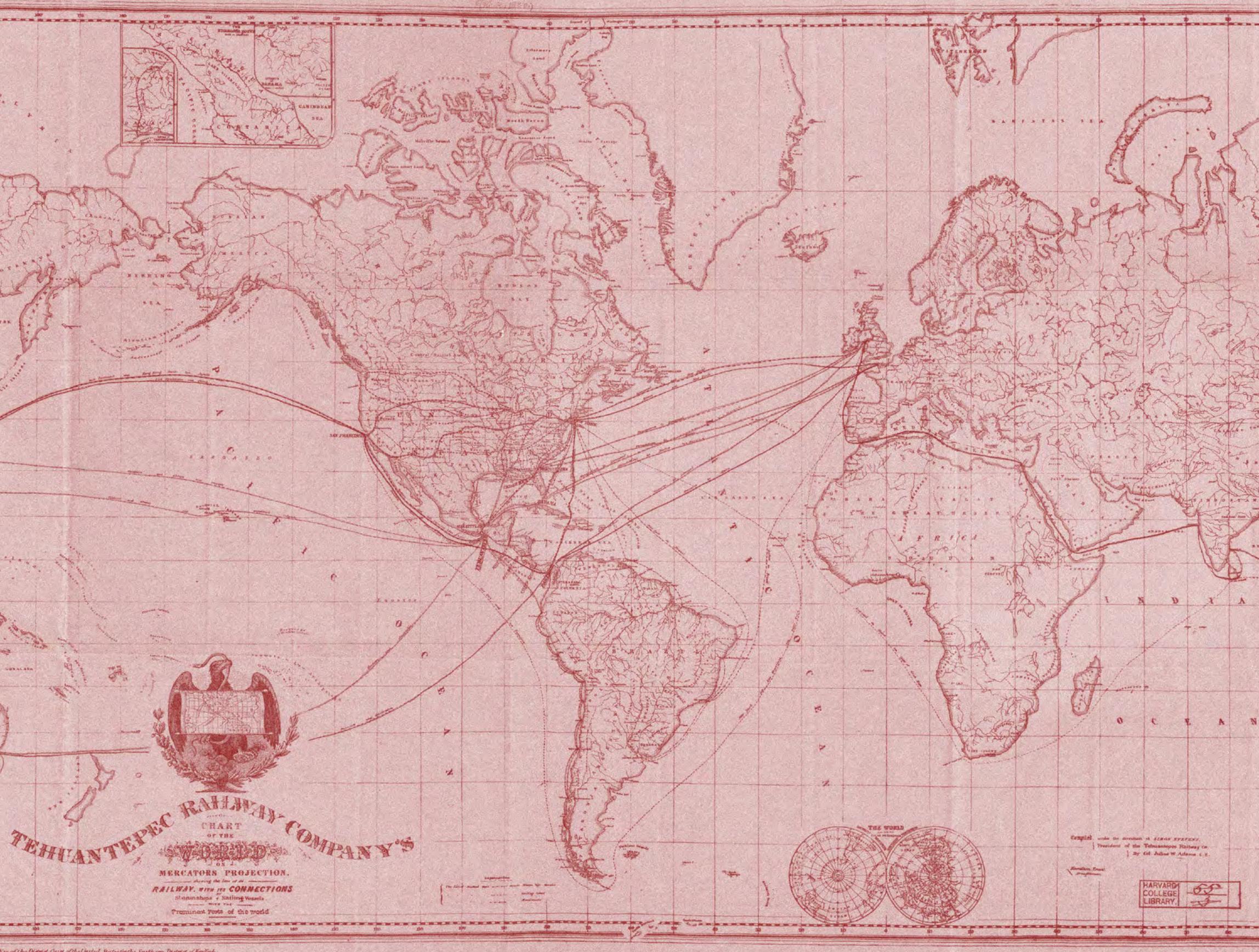
Since the 1990s, increasingly neoliberal policies in Mexico have reverted many national industries to private hands. The railroads are now, once again, owned by private companies that have shut down passenger service and minimized investment and operations.

Whether through federal governmental action or through privately-led enterprises, the provision of infrastructure and megaprojects has done little to strengthen local economic and social outcomes in the Isthmus, and in many cases has led to displacement and land dispossession through expropriation and changing land markets.

President Lopez Obrador has an opportunity to disrupt the recycled development narratives in the Isthmus, but his One-Hundred-Point Plan for Mexico appears to reinforce rather than break with the logic of his predecessors. The plans of previous presidents including Portillo's Alfa-Omega, Fox's Plan Puebla-Panama (PPP), Calderón's Logistical System of the Isthmus, and Peña-Nieto's Port of America Isthmus Plan and Special Economic Zone (SEZ) designations have all failed to bring economic and social development to the region (Navarro, 2018).

However, after decades of infrastructural neglect under both public ownership and private enterprise, refocused attention on the Isthmus after the 2017 earthquakes presents an opportunity to reconsider infrastructural development approaches and leverage historical projects to rebuild in a manner which supports national and local economic development and respects regional and Indigenous interests.

next page: Tehuantepec Railway Company's chart of the World on Mercator's projection : showing the line of its railway, with its connections by steamships and sailing vessels with the prominent ports of the world. Tehuantepec Railway Company. 1868. 41 x 69 cm. Source. Harvard Map Collection



TEHUANTEPEC RAILWAY COMPANY'S
CHART
OF THE
WORLD

MERCATORS PROJECTION.
Showing the line of the
RAILWAY, with its CONNECTIONS
Steamships & Sailing Vessels.
WITH THE
Principal Ports of the world

Scale of Miles
Scale of Nautical Miles
Scale of Kilometers



Compiled under the direction of **GEORGE W. SPENCER**,
President of the Tehuantepec Railway Co.
By **Col. John W. Adams, C.E.**



The Event

The 2017 Earthquakes and Their Aftermath

On September 7th, 2017, an 8.2 M_w earthquake ravaged the southern Mexican states of Oaxaca and Chiapas. It was the strongest one recorded to date, or, as some would call it, “the strongest of the century”.¹ Twelve days later, on September 19th, the North American plate broke in the center of the country, causing a 7.1 M_w earthquake that hit Mexico City and its surrounding states: Morelos, Puebla, and the State of Mexico. This second event happened on the same date as the most destructive one known to people from the capital, an 8.1 M_w earthquake that occurred 32 years earlier, in 1985.² As a result, global and national attention shifted to the capital, downplaying international response and engagement in areas like Oaxaca. A third earthquake, with an intensity of 6.1 M_w , hit the south of the country again on September 23rd, 2017. These events caused a simultaneous state of emergency in six of the thirty-two states, an unprecedented situation in the country.³

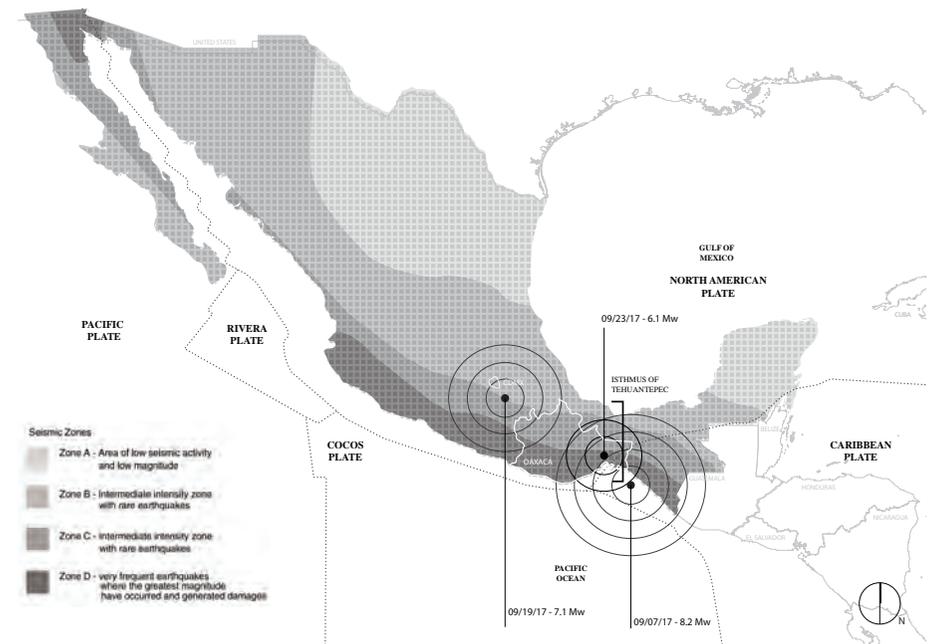
Earthquakes have historically devastated Mexico. Global seismic risk assessments conducted by the United Nations in the 1990s split Mexico into four categories of risk, from low hazard to very high hazard.⁴ Oaxaca is located on the Southern Pacific Coast, the region most at risk for large-scale earthquakes and with a long history of devastating tremors. Between 1900 and 2017, 85 earthquakes with magnitudes greater than or equal to 7.0 have shaken Mexico (Zavala-Orozco et al). Of those 85, nearly 10% have taken place in the state of Oaxaca. This has serious implications for local and national economies. A 2014 UN Development Programme Report found that among a study group of 40 countries, Mexico had the highest number of direct economic losses between 1981 and 2011 due to natural disasters, with 9% caused by earthquakes (UN D. Programme).

Responses varied significantly across Mexico. As civilians, state officials, soldiers, non-profits, private companies, and international aid groups mobilized swiftly to work in Mexico City, Oaxaca relied solely on fragmented federal state capacity. Civilians and local authorities in the provinces simply did not have the same experience and resources as the capital.

After the 1985 earthquake, Mexico City invested significant amounts of human and economic resources on preemptive strategies, including strict construction regulations. Commemorative earthquake drills, for example, are held every year on September 19th in all institutions and sectors, using the city's state-of-the-art seismic alarm system. In fact, the 2017 earthquake happened roughly two hours after the whole city conducted its yearly drill, when people knew exactly what to do.

By contrast, residents from places like the Isthmus of Tehuantepec in Oaxaca were seemingly unaware of the imminent danger they faced regarding earthquakes, and they had no previous experiences to build on. The last major earthquakes near the area happened in 1787 and 1931, but neither of them left a significant mark on the Isthmus. The intensity of the 1787 earthquake is unknown, as the National Seismological Service began operating in 1910, but the estimations are that it neared 8.6M_w. According to the Gazette of Mexico, it caused “the great Mexican tsunami”.⁵ The 1931 event ravaged Oaxaca City, the state capital. Both of them were felt in the Isthmus, but neither of them caused major damage that was recorded nor altered the region's lifestyle. In other parts of the state, however, they did give birth to new festivals and traditions, including the world renowned Guelaguetza (Lizama 2006)⁶. Yet, as previously stated, Oaxaca is significantly divided both geographically and socially, so the new seismically-aware culture did not reach the Isthmus of Tehuantepec.

There are indeed references that indicate that earthquakes in the Isthmus are recurring, but none of them suggest that tremors have been perceived as a threat. If anything, they have been perceived as routinary behavior in the natural environment. According to Vicente Marcial Cerqueda, a rural sociologist and long-term resident of Juchitan de Zaragoza, the traditional Zapotec calendar included a day named after earthquakes, called *Xu*. There are even clear distinctions in the language between tremors and major earthquakes, known as *xu ro'*. Nonetheless, there is no Zapotec word for rubble, which suggests one of two possibilities (or perhaps even both). The first is that traditional construction materials were not regarded as waste, as they consisted of earth, wood, palm trees, manure, and other organic elements. The second is that there were no major earthquakes in the region that caused



Map showing the four seismic zones of the Mexican Territory as well as the tectonic plates converging in it. Elaborated by López / Quiroz / Valdés

1. Redacción. “Terremoto de Magnitud 8,2, El Mayor En Un Siglo, Sacude El Suroeste de México, Deja Al Menos 61 Muertos y Miles de Afectados,” October 12, 2017, sec. América Latina. <https://www.bbc.com/mundo/noticias-america-latina-41197767>.
2. “SSN - Detalle de Sismo Seleccionado | UNAM, México.” Servicio Sismológico Nacional. <http://www2.ssn.unam.mx:8080/detalle/>
3. Redacción. “Cuán Preparada Estaba La Infraestructura de México Para Soportar El Impacto Del Terremoto Más Fuerte Del Último Siglo,” September 9, 2017, sec. América Latina. <https://www.bbc.com/mundo/noticias-america-latina-41209298>.

4. The United Nations International Decade of Natural Disaster Reduction conducted a demonstration project to evaluate hazardous seismic regions around the globe between 1992 and 1998 (Giardini et al). The Global Seismic Hazard Assessment Program (GSHAP) compiled regional maps to depict seismic hazards, separating regions into four main categories: low hazard (0-8% risk), moderate hazard (8-24%), high hazard (24-40%), and very high hazard (40%). Mexico features all four levels of risk throughout the country..

5. Sigüenza Orozco, Salvador. “Oaxaca. Los eternos segundos de una sismicidad histórica.” *Relatos e Historias en México, November 17, 2017*. <https://relatoshistorias.mx/nuestras-historias/oaxaca-los-eternos-segundos-de-una-sismicidad-historica>.
6. Guelaguetza, in Zapotec, refers to an ofrenda or gift that you have to give it back eventually after receiving it. Nowadays, it is the name of a festival commonly referred to as the “maximum party of oaxaqueños.” It was created in 1932 as a way to promote the Oaxacan culture, as well as to receive funds to recover from a decimating earthquake that destroyed Oaxaca City in 1931. The festival brings together the seven regions of Oaxaca, who send representatives to showcase local dance rituals and parades.

the level of devastation of the 2017 events, at least not since the opening of the Tehuantepec railway introduced “non-recyclable” industrialized construction materials at the beginning of the 21st century. According to Natalia Toledo Paz, another long-term resident of Juchitan de Zaragoza and co-founder of Colectivo Binni Biri⁷:

[Earthquakes were] not like this before. It did tremble, but it happened rarely. I remember vaguely that, when I was a kid, we used to go out to the patio of the house and kneel. My grandmother would then make us ask the earth for forgiveness. And then, we would go back inside the house. But that was years ago. This is unprecedented.

Furthermore, Mr. Marcial Cerqueda stated that a popular belief in the region was that earthquakes were signals for abrupt changes in weather; they were believed to “announce” temperature variations, heavy rains, or strong winds, and, therefore, were not regarded as dangerous. I later confirmed this in the following conversation I overheard between two local residents:

Individual A: Did you feel that tremble? It was not the wind. It was an earthquake. Listen to the dogs barking.

Individual B: But I don't think it's going to rain. The sky is clear. It must mean that the temperature will change.

This third quote from Claudina De Gyves Mendoza, a former resident of Ciudad Ixtepec, demonstrates the divide in seismic-awareness and culture between the Isthmus and other parts of Oaxaca:

The people [of Ixtepec] did not know what had happened. They thought it had only shaken there. The first person I contacted was my cousin, and she asked how we knew that there was an earthquake. I told her I felt it, that such intense tremors are felt everywhere. And she said, “well, since the light went out and we got cut off, we thought it had only been here.” At first, people did not realize the magnitude of what was happening. We have an airport and a battalion in Ixtepec. You would think that, at least, people would have received news from either of them, but not even the municipality quite understood what had happened.

This shows that there was no seismic culture that could prepare locals for what happened in 2017, a worrisome condition for municipalities in the most seismically active

region in the country. In fact, our survey showed that, 93.2% percent of the residents of Ciudad Ixtepec, Asunción Ixtaltepec, El Espinal, Juchitan de Zaragoza, and Santa Maria Xadani had never received training on how to act in case of an earthquake. Unfortunately, these five municipalities along the Las Nutrias River were the ones that the 2017 earthquakes hit the hardest. The official census of damage conducted by the Secretariat of Agrarian Land and Urban Development (SEDATU) states that roughly 58.10% of the 159,155 inhabitants of the region suffered either from partial or total loss of their houses.^{8,9}

As previously stated, this resulted in a response that relied heavily on federal state capacity. According to Malaquías López Cervantes, National Director of Health Planning and Development at the time of the crisis, President Enrique Peña Nieto and representatives from every Secretariat landed in Juchitan on September 8th, 2018, the morning after the first earthquake. After a tour of the towns, Peña Nieto assigned each stricken municipality to a specific Secretariat, who would supposedly oversee response and recovery efforts. Except for El Espinal, the rest of the towns in this study were assigned a “sponsor”. These “sponsors” were technically in charge of overseeing the recovery efforts in their respective municipalities, although some were substantially more involved in said process than others. The Secretariat of Health, for example, was in charge of helping the town that was hit the hardest: Asunción Ixtaltepec. As such, they coordinated the efforts to conduct the damage assessment, distributed incoming aid, and helped municipal authorities make their first decisions. Moreover, the President assigned SEDATU as the overall coordinator.

Nonetheless, this strategy did not flow as swiftly as expected. To begin with, there was no clear response plan, so solutions were created on-the-go. Furthermore, the federal, state, and local authorities had difficulties working together, as they had not done so before during an emergency of this magnitude. This is better expressed by the following quotes from Mr. Lopez Cervantes and Mr. Elpidio Desiderio Concha Arellano, SEDATU's delegate in Oaxaca:

Mr. López Cervantes: There was no long-term plan. The President's role was to go around the stricken communities and order people to work intensely to help them. Showing up

7. Colectivo Binni Biri is an organization created by Natalia Toledo Paz and her colleagues to help children from the most impoverished areas of Juchitan de Zaragoza recover from the mental toll the earthquakes put on them through artistic workshops.

8. INEGI. “Encuesta Intercensal 2015.” National Institute of Geography and Statistics, 2015.

9. SEDATU. “Censo de Viviendas Dañadas Por Los Sismos Del Mes de Septiembre de 2017,” 2018. <http://transparencia.sedatu.gob.mx/#>.

is not the same as having a plan. The only thing that resembles a disaster response plan in Mexico is the DN-III-E, but even that one is not concrete. In short, it says that “we need to do whatever is necessary to solve what we find.”

Mr. Concha Arellano: We did not solve things exactly as they should have been solved, partly because of the magnitude of the problem in Oaxaca and even in the country. We were not prepared for something like this. From now on, we need to be prepared and understand how different actors can work together.

What followed was a fragmented top-down response that disregarded the cultural context and built environment almost entirely and focused solely, at first, on the quick restoration of housing and primary services (like hospitals). This narrow-sighted response brought several complications with it. In Asunción Ixtaltepec, for example, the combination of urgency to clear the streets of rubble, the upcoming mayoral election bid, and the incumbent’s resources as a businessman in the construction industry, resulted in the creation of a humongous, unplanned, and unprotected riverside rubble landfill meant to protect the town against potential floods. It is important to note that the river crosses the town right at the center, and the only ways in and out are two bridges that pass right on top of the new landfill. This initiative got community backing for several reasons, including the lack of bottom-up capacity to deal with rubble, the pressing urgency to provide shelter and restore housing conditions, the widespread (and erroneous) notion that those materials could not be recycled or used for any productive purposes, and an unsubstantiated fear of imminent floods in the town. While the area does suffer from periodic inundations caused by hurricanes and intense rainfall, most of the damage concentrates in Juchitan de Zaragoza and Santa María Xadani, the two southernmost settlements along the river. According to Tomás Chiñas Santiago, President of the Las Nutrias River Basin Committee, floods are rarely caused by river overflows and are most often related to deficient urban sewage systems. In fact, the last registered river overflow happened in 2010, but it mainly affected the two aforementioned settlements and not Asunción Ixtaltepec. Despite receiving several warning and fines from environmental protection agencies in Mexico, the mayor of Asunción Ixtaltepec did not stop the landfill, which meets a short-term need for rubble removal, at the expense of grave environmental damage.¹⁰

In terms of housing provision, the National Fund

for Natural Disasters (FONDEN) distributed debit cards to each person that either lost their house completely or suffered partial damage, according to the official census.¹¹ The greatest amount a person could receive was 120,000 pesos (approximately 6,000 USD), 75% of which was to be used to buy construction materials from a pre-authorized store and the remaining 25% to cover labor costs. There were three problems with this solution. First, many of the vernacular construction materials such as wood, clay tiles, and adobe could not be bought at authorized stores. Second, given the shortage of resources and trained construction workers, labor and material costs skyrocketed right after the crises, rendering the aid amount insufficient. This situation pushed locals to give their aid packages to private developers that came to each town offering to demolish their traditional homes in exchange for a 40-square-meter concrete house that completely disregarded their lifestyle and climate conditions. Finally, the new dynamic resulted in unnecessary demolitions which further complicated rubble management.

Once more, these dynamics are better expressed by the stories from our interviewees. All the local residents we talked to expressed the same concern: that traditional houses were rapidly disappearing due to the reconstruction policies and ill-informed top-down responses. Mr. Marcial Cerqueda stated, for example, that he was pressured to demolish his traditional home:

Brigades of all kinds came to help. SEDATU managed them and was in charge of releasing the goal: demolish. That was their official slogan, even though [the National Center for Prevention of Disasters] CENAPRED recommends to shore up and assess the extent of the damage before making any decisions. Think about it; it was an excellent business. If in Juchitan there were 8,000 houses in a state of total loss and each one received 90,000 pesos in materials cards, there was a large money fund captive for private companies. Multiply it. There were 720 million captive pesos. Many entrepreneurs came to spin around. They rubbed their hands and toured the area with SEDATU. And they pressured demolition with false threats. They said that those who did not demolish did not get the 120,000 pesos. Then, people began to demolish without thinking first if it was right or wrong. [Federal officials] told me “demolish, demolish, demolish” and I said “mangos, mangos, mangos [no way, no way, no way].” This house belongs to my great grandmother. She left it for me. What were they thinking?

10. Ambiente, Procuraduría Federal de Protección al. “Clausura PROFEPA Zona Federal en Asunción Ixtaltepec, Oaxaca, Por Deposito de Residuos Provenientes de Sismos” <http://www.gob.mx/profepa/prensa/clausura-profepa-zona-federal-en-asuncion-ixtaltepec-oaxaca-por-deposito-de-residuos-provenientes-de-sismos>.

11. SEDATU. “Censo de Viviendas Dañadas Por Los Sismos Del Mes de Septiembre de 2017,” 2018. <http://transparencia.sedatu.gob.mx/#>.

This sentiment was shared by Olga Zuñiga Loera, the chief anthropologist of Cooperacion Comunitaria, a nonprofit working in reconstruction in Ciudad Ixtepec. She further elaborated on how the policy impacted some of these towns in a different way, reinforcing existing structures of resistance in some places while weakening community engagement in the others.

Several mayors gave the order to demolish affected houses, even without an expert's opinion. In Ixtaltepec, there are blocks where only one [original] house is standing and the rest were made by developers. They are experiments. Ixtepec is different. There is a strong and important civil organization that emerged since the '50s. In 2012, there was a fight against the mining companies, and they did not settle here. The same thing happened eventually with the wind companies, and now with the developer houses. We talk about the importance of not tearing down the traditional Istmeña homes. New approaches show a cultural ignorance of the way of life here. The 120,000 pesos that [SEDATU] gave out to people barely cover the cost of a house of 40-45 square meters. Additional financing is needed to recover what they had, and not everyone has access to it.

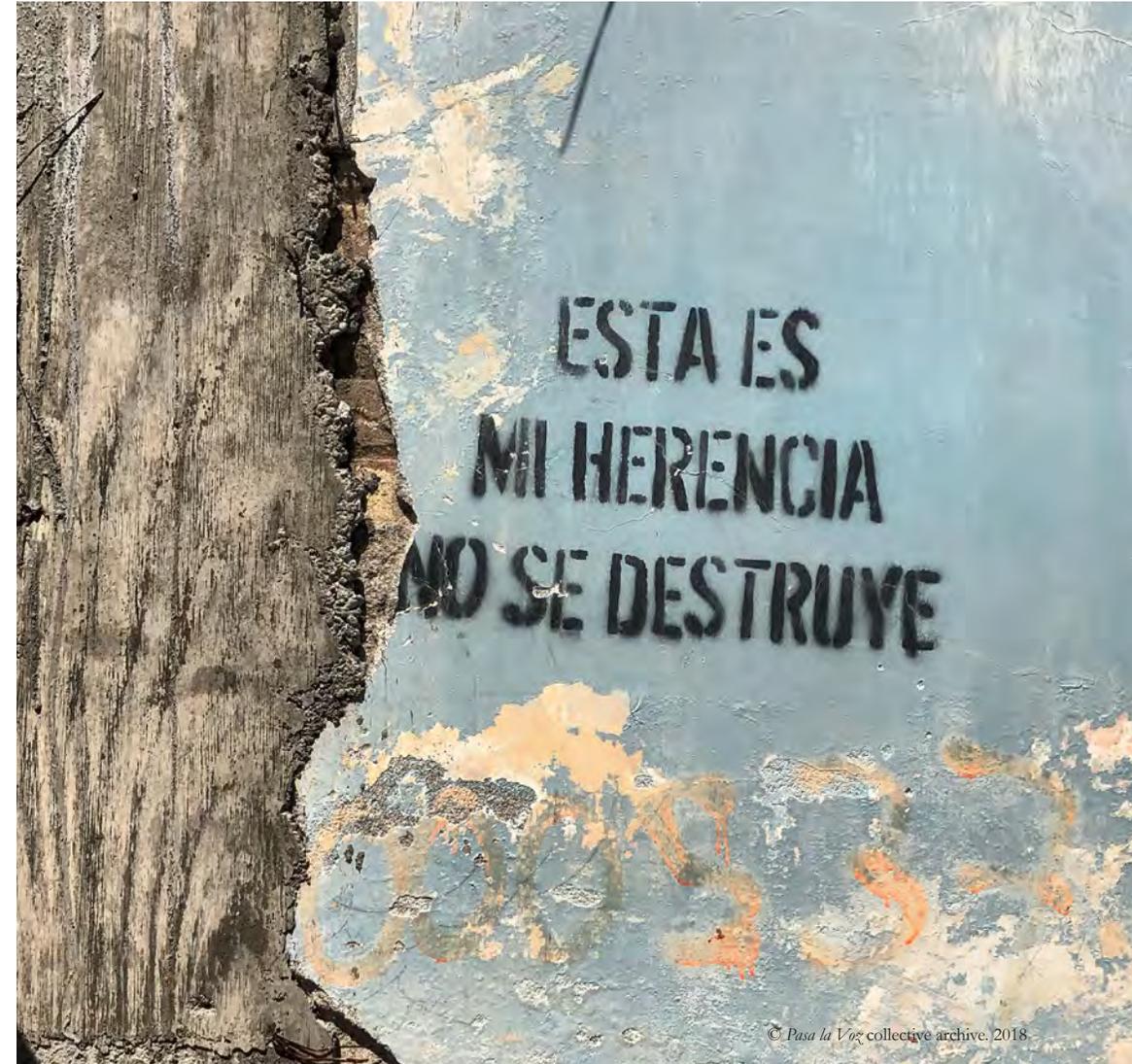
Ms. Zuñiga Loera further explained that, aside from urgency, fear and misinformation led people to take rash decisions regarding their homes. A big problem she mentioned is that President Peña Nieto triggered collective hysteria in Oaxaca a week after the earthquake by stating publicly that houses fell because they were made of earth.¹² Nonetheless, his claim lacked foundation, as most houses in the region were built of concrete or brick.

Deferring from widespread public policy, our model for new houses acknowledges that we are not building 40 square meters, a tiny cube, or an urban dwelling. We are building a traditional Istmeña home with everything that it implies. These houses were built with a specific brick technique, tizón y sogá, and without columns. But people were afraid of our proposal. They asked how it would be possible to not have any columns. There were dynamics that unraveled from this and, as outsiders, we did not see them at first. The family, the compadre, arrived and told them that the house was going to fall, they started to distrust something that had worked in the Isthmus for generations. Many people stopped wanting our help because of that.

Another demonstration of collective fear came Lilia Cruz Altamirano, another rural sociologist and long-term resident of Juchitan de Zaragoza. She explained how mis-

12. Zatarain, Karina. "Peña Nieto afirma erróneamente que 'la caída de viviendas [tras el sismo en Oaxaca] se debió a que están hechas de adobe.'" ArchDaily, México, 2017. <http://www.archdaily.mx/mx/880216/>

pena-nieto-afirma-erroneamente-que-la-caida-de-viviendas-tras-el-sismo-en-oaxaca-se-debio-a-que-estan-hechas-de-adobe



© Pasa la Voz collective archive, 2018

Inscription on the wall of a house of Ciudad Ixtepec: "This is my heritage. It must not be destroyed".

information regarding the aid packages created a cascading effect of civilian-led demolitions:

When the earthquake hit and the first aid came in, a rumor began about the possibility of receiving 120,000 pesos if your house was deemed a total loss. So people started to demolish their own homes. But they thought that they would get all of it in cash. They did not. Thirty thousand pesos were cash funds to pay for labor and ninety thousand came in a card that could only be used for materials in specific warehouses where they could not buy the materials that their houses were made from initially.

This claim was also backed up by Ms. De Gyves Mendoza, who added that the lack of contextualization in the reconstruction policy led to a complete oversight of true needs of the community and eventual loss of culture and identity.

There was a very strong omission from the state. No one came to explain what had happened. No one took the time to go to the public squares with specialists to clarify that this is something normal. There were incredible theories and paranoia: a volcano was being born, it was fracking, it was because of the mines... Nobody understood that this is natural. Moreover, SEDATU's program was terrible. Some cards got cloned, and they forced you to buy in certain establishments. In this region, we are brick-makers. Ixtaltepec's bricks are the best, but you could not buy them. [The cards] only [worked] in pre-authorized stores and brands. People ended up buying materials to re-sell. You could only purchase concrete, sand, steel mesh, and bathroom furniture, but what people needed the most were refrigerators and other appliances. Yet, they put a thousand obstacles to buy [the latter]. It was as if they wanted you to go to Oaxaca [City] to buy in Home Depot. Who was going to do that with all the pressures the earthquake put on people?

All of this led to one of the biggest problems that stemmed from the unplanned process: the loss of a familiar and longstanding past that was a foundation for people's identity. As developers convinced more and more people that their rapidly-built houses were the ultimate and easiest solution, the image of the traditional home was almost wiped out. Private developers came from different parts of Mexico, mainly from large urban areas like Mexico City. Therefore, they were not necessarily familiar with rural areas and small cities. Some of their companies were not strictly related to construction. A few of them were associated with big chains of supermarkets

such as Soriana and Aurrera, while others were part of much bigger private companies like Grupo Carso (owned by Carlos Slim, the richest man in Mexico). Sadly, there were also several reports of some "ghost" companies, who collected recovery funds from affected residents and proceeded to leave town. Miguel Covarrubias, explains that Istmeña homes consisted of interior rooms, with bathroom and kitchens outside, as well as an open hallway where where people could relax and have some fresh air in the shadow (Covarrubias 1946). This design reflected people's needs and adaptations to weather. Due to the extremely high temperatures, ventilation is essential in their day-to-day life. Nonetheless, the new developer houses are mostly enclosed and have all services on the inside (aside from being built with thin concrete slabs, a technique that responds poorly to warm weather). As Mr. Marcial Cerqueda and Ms. De Gyves Mendoza put it:

Marcial: [Developers] are building concrete homes for this heat of 45 or 50 degrees [Celsius]. That cannot be. How are people going to live there?

De Gyves: The housing models [the developers] are making are not even adequate. This solution that was apparently the least complicated is not suitable for this climate. And there is no turning back. It will stay forever.

Other aspects that the response failed to account for were the need for economic reactivation and changing market dynamics. Throughout the region, for example, many women depend on selling bread and totopos, a crispy corn chip that goes with every meal. To make it, they need special ovens, many of which collapsed during the earthquake. Nonetheless, FONDEN only offered 15,000 pesos (approximately 750 USD), which was nowhere near enough for people to reactivate their ovens and family economy. This resulted in further tensions with state officials, who were (justifiably) more worried about establishing basic urban services, while locals asked for further attention on matters other than housing. It is here where, in the absence of international aid, many local nonprofits arrived and intended to fill the gap between top-down and bottom-up action.

Likewise, new labor markets arose. As a stop on the route from Central America to the United States, the area became a hotspot for construction jobs offered, in part, to migrants. This was both positive and negative. The

good side of it was that the new dynamics helped de-stigmatize migrants to some local residents, particularly in Ciudad Ixtepec. Because this city has a main stop on the Tehuantepec railway and an official migrant shelter, it has historically had a significant influx of travelers. Nonetheless, interviewees told us that these people were generally perceived as “delinquents” who would not do anything for the good of the town. So, upon participating in the reconstruction process, some of these prejudices ceased. The negative side of this process, along with the model of developer houses, is that it contributed to the lack of permanence of new knowledge in the area. According to Ms. Cruz Altamirano:

Local masons started charging double per day because they were few. It was supply and demand at its most basic state. That resulted in the 30,000 pesos destined to labor being insufficient. If the 120,000 pesos by themselves were not enough in the first place, these new dynamics rendered them worthless.

Migrants, contrastingly, did not expect high-paying jobs; they just needed a short-term job that would give them enough money to keep going. Therefore, many of the safe construction techniques were learned by them and not local residents, who are ultimately the ones who will most likely modify their houses in the future through self-construction.¹³

This failed understanding of market dynamics and local lifestyles also materialized in the most basic of aspects in disaster response: food. Few would imagine that there could be such a thing as too many donations or too much food in a situation like this, but it did occur. As I understand it, this problem arose from the lack of plan as well, which gave space for well-intentioned people from other states to send waves of aid, in whichever form that came. The best example of this I found is the following anecdote from Ms. De Gyves Mendoza:

Amid the chaos [brought by the earthquake], there came a time when we did not know what to do with the tuna cans sent to us as aid. People did not want to eat tuna anymore. It is normal to send canned food in situations like this, but people do not eat like that here. Cans accumulated, and no one wanted them. [Francisco] Toledo started a very nice project in Juchitan of local kitchens. Then, the Melendre Committee decided to start the “basic basket.” Instead of sending canned food, they gave money to local people who sold totopos,

13. In Mexico, self-construction accounts for almost 70% of all the housing stock, in Redacción. “Por Qué México Es Proclive a Sufrir Tantos Terremotos y Tan Fuertes,” February 17, 2018, sec. Otras noticias. <https://www.bbc.com/mundo/noticias-41201053>.

shrimp, etc. That way, they created basic baskets of regional food. Afterward, other projects like this followed. Another was for clothes, and they bought from local artisans.

Once more, this situation increased tensions between locals and state officials, as the latter decided to filter incoming aid from other states to distribute it equitably. This was not well-received by locals, who regarded it as a highly-politicized move. With federal elections in the coming month of July, some residents argued that aid packages (which consisted of non-perishable goods), were being kept by municipal authorities to distribute during the upcoming political campaigns. Ironically, the authorities’ positive intentions to make sure aid got to everyone that needed it backfired and increased distrust. According to Ms. De Gyves Mendoza and Mr. Marcial Cerqueda:

Outsiders contacted us to say that they wanted to help, but they asked us to guarantee that the aid was not going to be channeled through the government, this is how they made sure that



Traditional Istmeña houses vs. examples of the new house models after the 2017 earthquakes

it was going to the people. That was everyone's concern. There was a lot of distrust. The worst thing is that everything happened during an electoral period and became a political campaign. All the candidates came to be photographed with the victims. One of them even rebuilt a church as fast as he could, but he did not even do it properly. He went for a tin sheet roof. Here, there are wind gusts that reach a speed of 200 km/hour. That roof will be blown away, but I'm sure he'll be fine. People will surely remember him positively for a while.

There is, of course, another side to this story. Some federal officials argue that it was very complicated to work in the area and provide help, as locals often try to cheat the authorities and obtain extra benefits. There are many accounts of people getting as many aid packages as possible by getting in line several times or asking family members to wait in line for them. Other well-known and frequent stories revolved around two or more people from the same family claiming federal reconstruction funds for the same lost property, or whisky bottles and flat screen TVs being sold out in local stores days after the first economic aid packages arrived. Mistrust and deceit, at a certain point, also came from locals. The best example in the interviews is the following story from Mr. Lopez Cervantes:

Locals did help us, but it was very complicated. They had a very unfavorable attitude sometimes. They expected [the authorities] to do all the work. A great tension arose, particularly with the army, because, upon arriving to help and asking for local support, they would receive answers like: "I will not help you. I'm not paid for doing this work, but you are. So do it." I understand that they were probably scared or did not quite know what to do to help, but they were not willing to cooperate with us either.

In short, the earthquake brought good and bad things to the Isthmus of Tehuantepec. It gave birth to new social dynamics and productive responses and even awakened dormant relationships that can potentially be good for the communities. Moreover, it acted as an opportunity to center resources on a historically neglected area. Nonetheless, the lack of a prevention culture and disaster response plan also resulted in a chaotic, fragmented, and contextually-unaware reconstruction process, despite good intentions of multiple actors across sectors and scales.

But more importantly, the crisis revealed other vulnerabilities that were already in place. These cannot and should not be downplayed by a new, narrow-sighted view of resilience as a mere "capacity to respond to earthquakes." New, directed thinking about earthquakes could present a barrier as much as it is a necessary asset, particularly when earthquakes become the sole focus of all efforts without an understanding of the interconnectedness of diverse vulnerabilities and urban systems. Reconstruction and robust resilience should go beyond bouncing back to preexisting flaws, especially in areas that are subject to diverse and recurring threats, disaster-related or otherwise.

Framing the Fault Lines

Fragmentation in Oaxaca's
Disaster Preparation and Response

Amaya Bravo-France / Evita Chávez / Sydney Pedigo

As the foundation upon which cities and communities are built, understanding the culture, context, and social identity of a place allows for effective approaches when addressing planning, development, and post-disaster needs. While the unique characteristics of Oaxaca are a key source of resilience and social cohesion for many communities, they also seem to pose potential complications and challenges when planning for and responding to disaster.

The many ways in which Oaxaca differs from other areas of Mexico influences and complicates the ways in which both development and disaster response programs and projects are implemented. These elements range from the region's topographical terrain and population dispersion to the ways in which its history of conflict and repression have manifested in new forms of protest and a lack of trust in "outsiders," such as governments, organizations, and other communities. These factors are often not considered in Mexico's policy and program design due to the complexities and lack of understanding around Oaxaca, the state's difficult history with the federal government, and systems of supremacy within Mexican society.

Effective and equitable responses to disasters depend upon a holistic understanding of the culture and circumstances of an area, as well as the ability to adapt programs in a context-appropriate manner (United Nations and World Bank). Here, we argue that Mexico's framework for disaster response, which has effectively addressed crises in Mexico City, does not translate successfully to Oaxaca. Additionally, the state's inability to strategically implement constructive development or planning programs creates vulnerabilities to disaster that exacerbate the effects of earthquakes and other catastrophes. By understanding the socio-cultural, geographic, and political characteristics of Oaxaca that uniquely shape the state's ability to plan for and respond to disaster events, governments and aid organizations can better adapt their recovery initiatives to accurately respond to future challenges. An analysis of the state's different types of fragmentation, its relationship with outside entities, and the failures that occurred after the September

2017 earthquakes can help pave the way for Oaxaca to develop a more resilient approach to disaster.

The work presented here began as part of an independent study project under Professor Diane Davis. Our team came together from a combination of research groups within the independent study focused on cultural processes, social dynamics, and pre-existing marginalities. Originally, the project sought to understand property negotiations and local dynamics of ejidos but later enlarged the scope to understand the ways that fragmentation across Oaxaca's socio-cultural, geographic, and political dynamics influenced the disaster response.

After the independent study in Fall 2018, the process included interviews during a ten-day trip to Mexico in January, independent textual research, and writing and creating a presentation and book chapter.

During the independent study class and in the following research phases, information was drawn from existing scholarly sources, studies, reports, news articles, government documents, and other spatial and database materials in both English and Spanish. These documents informed research into the history and processes of Oaxacan culture, political and social dynamics, disaster response, and comparison with Mexico City.

Fieldwork consisted of a series of semi-structured interviews with a variety of professionals and academics in Oaxaca de Juárez and San Jerónimo Taviche in Oaxaca state and in Mexico City, as well as remote calls. A total of 13 interviews provided insight into levels of government, institutions, NGOs, and social dynamics during a ten day period in January, 2019. The interviews were almost exclusively conducted in Spanish and all were recorded. Questions consistently focused on local dynamics and how Oaxaca's unique

characteristics affect planning and disaster preparation, with supplementary questions added based upon the interviewee's experiences. Each interview session assumed the interviewee had similar familiarity with Oaxaca's culture and usos y costumbres system as well as previous knowledge of the earthquakes. However, interview questions did not assume each person had the same perceptions of events or actors, allowing interviewees the opportunity to speak with freedom about their perceptions and beliefs. We would like to thank and recognize the contributions from all interviewees who took the time to speak with us and share their experiences and knowledge.

Mexico's Disaster Response Framework

Prior to the 2017 earthquake, Mexico City's 8.1 magnitude earthquake in 1985 was the most catastrophic earthquake in Mexico in nearly 200 years.¹ The devastation from this earthquake prompted the country to create a robust national strategy for disaster recovery and response. The subsequent investment in disaster risk management helped shape Mexico as a global leader for seismic response, particularly amongst other budget-restricted countries in the Global South (Vance). Within nine months of the 1985 earthquake, the federal government issued a study on the creation of a department dedicated to civil protection related to both natural and man-made disasters (World Bank). The publishing of the study was accompanied by the creation of a corresponding department, the National System of Civil Protection, or SINAPROC, which was intended to coordinate institutions, programs, and relationships among both the public and private sectors to institutionalize disaster risk management (OECD).²

Ten years after the creation of SINAPROC, the federal government

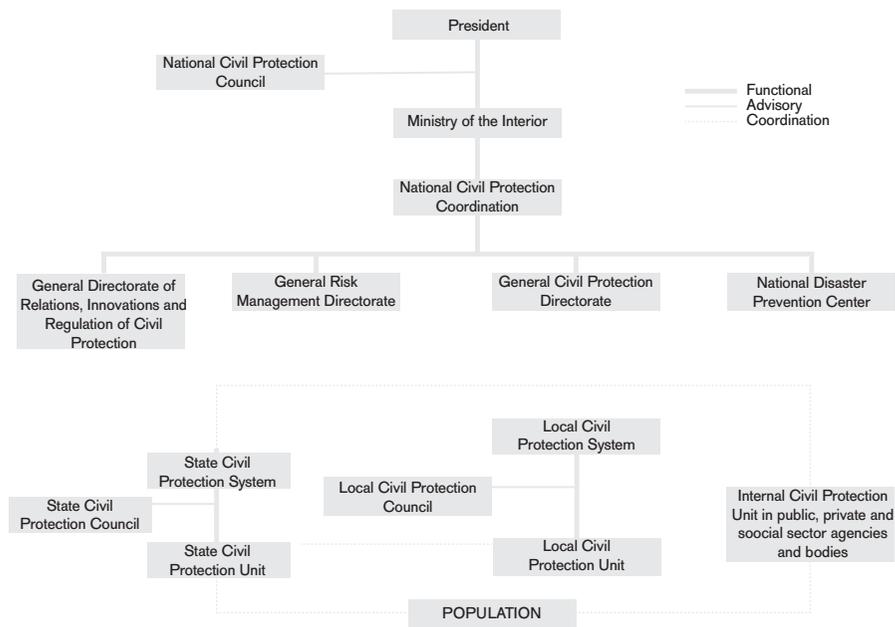


Casa de la Cultura in Asunción Ixtaltepec on August 2018, eleven months after the earthquakes.

1. By some estimates, the 1985 Mexico City earthquake killed approximately 10,000 people.
2. The creation of this department helped the federal government of Mexico prioritize disaster risk and resiliency and incorporate these practices into planning. Among the SINPROC's initiatives that helped Mexico gain its reputation as a global leader on risk and resilience was the creation of an early warning system comprised of 8,200 seismic

sensors throughout the most seismic-prone regions of the country and the institutionalization of disaster management (Leoni). In recent years, the federal government further bolstered resilience strategies through PLAN MX, a federal strategic initiative that delegates responsibility for rescue, aid and recovery operations to the Army and Navy in the event of a catastrophic event (Poole and Renique).
3. Since the creation of FONDEFEN, the national government has created the Natural Disasters

Preventative Trust (FIPREDEN) and the Fund for Natural Disaster Prevention (FOPREDEN), to support preventative actions in case of unforeseen adverse effects of disaster and investments in risk identification and reduction, respectively (World Bank).



Relationships in Mexico's framework for disaster response. Sources: Government of Mexico and Organization for Economic Co-operation and Development (OECD).

4. 100 Resilient Cities is a Rockefeller Foundation program that assists cities in becoming "more resilient to the physical, social, and economic challenges that are a growing part of the 21st century." Members of this program

receive financial, logistical, and administrative support in building a resilience strategy through access to experts and the sponsorship of a Chief Resilience Officer for the city. The program has since stopped recruiting cities.

bolstered support for the agency by creating a budgetary line item for disaster recovery, allocating at least 0.4% of the federal budget to the fund (World Bank). This Natural Disaster Fund, FONDEN, helped finance reconstruction of public infrastructure and low income housing and has evolved to include disaster risk management and comprehensive planning (World Bank).³ However, because both SINAPROC and FONDEN's approaches require collaboration between levels of government, the actual implementable success of these programs is largely dependent on the capacity of state and local governments, more so than federal capacity. Local context plays an important role in the delivery of SINAPROC's programs. Some Mexican cities have prioritized efforts for disaster risk management and have been proactive in taking steps beyond SINAPROC. Some of these proactive practices are simple, such as Mexico City's annual earthquake drill, held every year on the anniversary of the 1985 earthquake. Other practices are more substantial; for example, the creation of robust risk and resiliency strategies for four Mexican cities through their membership with the Rockefeller Foundation's 100 Resilient Cities Initiative. With the exception of one city, these local resilience strategies focus on earthquake risk management and recovery planning.

In Oaxaca, however, where inter-community collaboration is rare and resources are scarce, SINAPROC's disaster response framework faces barriers to implementation that are not as prevalent in other more cohesive and well-resourced places in the country. In addition, the involvement of the army through Plan MX often is negatively received by communities in Oaxaca because of the historic use of militarization as a means for control and exploitation (Poole and Renique). For these reasons, Oaxaca's local context mitigates

the successful delivery of SINAPROC's national framework and poses unique challenges to planning for and responding to natural disasters within the state.

The 2017 Earthquakes in Mexico City and Oaxaca

Mexico's framework for disaster response was not successful in responding to the effects of the earthquakes in Oaxaca because of existing systemic barriers to large-scale organizing, collaboration, and the mobilization of group resources. Additionally, historical tensions and issues surrounding the relationship between the federal government and Oaxaca's governments and society created complicating factors in deploying national aid to the region. When comparing the responses to the earthquakes that occurred on September 7 and 19, 2017 which predominantly affected southern Mexico and central Mexico, respectively, there was a large discrepancy in the federal government and civil society's response in Oaxaca and in the Mexico City area. While it is difficult to compare a city of over 20 million with a state of around 4 million people, several key differences are apparent from analyzing data and reporting in the short term and long term after the 2017 earthquakes.

As the capital and the most concentrated area of wealth in the country, Mexico City was already equipped with ample resources to plan for and respond to disaster and could draw from extensive experience with large earthquakes in the past. Residents in the city benefited from a culture of preparedness following the devastating 1985 earthquake, which prompted the creation of extensive planning efforts to equip the city for future disasters, including annual emergency drills, a sophisticated siren system, and stringent building codes (Godby). As a major global metropolis, Mexico City also has the advantage of prominent institu-

tional and international resources, including large Universities, foundations, and a chief resilience officer from the Rockefeller 100 Resilient Cities initiative. The majority of agencies and organizations tasked with disaster response, including the National Civic Protection System, the National Center for Disaster Prevention, and the Mexican army are also located in the capital, leading to more research, practice, and familiarity with the area (Global Disaster Preparedness Center). Comparatively, Oaxaca is one of the poorest states in Mexico, and has relatively little institutional research, funding, and resources available for disaster preparedness in the region. Even Mexico's sophisticated seismic alert system sensors in Oaxaca did not adequately warn residents there of the impending disaster, as only Mexico City has a public announcement system that reaches all of its residents in the event of an impending earthquake (Suarez et al.).

The two responses to the September 2017 earthquakes in Oaxaca and in Mexico City were also very different. Federal aid began working throughout Mexico City, its metropolitan region, and neighboring states within hours of the event, while many areas of Oaxaca and southern Mexico received no assistance for days or even weeks (Poole and Renique). Plan MX, the federal strategic initiative that determines governance following natural disasters, allowed for militarization of Oaxaca and Chiapas by the army and navy following the earthquake, limiting coordination efforts to outside entities unfamiliar with the region (Poole and Renique). While both medical/ rescue volunteers and donations arrived in Oaxaca immediately, there was no public strategy for organizing these resources, making it extremely difficult for aid workers to assist where there was demand or distribute materials and food to those in need (Relief Web). There were also numerous

accusations of politicization and hoarding of aid in the earthquake response in Oaxaca, with findings of donations being distributed under the banner of political parties or by public officials to bolster their reelection campaigns (Martinez). The lack of organization and transparency in Oaxaca resulted in food and material shortages as well as a functional shutdown of the state from several days to several months in certain areas (Relief Web).

In Mexico City, however, the Mexican government and an extremely proactive civil response swiftly attended to the second earthquake immediately, such that the city became operational again within days. The legacy left behind after the 1985 earthquake incentivized a faster government response and created a more active civil society, both of which were more prepared to address the earthquakes of 2017. The failures of the 1985 government, which took days to act and rejected international assistance, necessitated a tremendous public organizing to attend to the damage, creating many new civic groups and impacting the organization of future social movements (Davis, "Reverberations"). New civic organizations formed in 1985, such as *Topos de Tlatelolco*, have continued to exist and grown in capacity over the past decades, lending their experience and help after Mexico City's recent earthquake (BBC World News). Additionally, the public's discontent with the government's handling of the crisis led to the questioning of the legitimacy of elected leaders and catalyzed a political shakeup, building upon other issues that eventually resulted in a democratic transition that overturned the 70-year national control of the *Partido Revolucionario Institucional* (PRI) political party (Davis, "Reverberations"). Political groups responding to the September 2017 earthquakes, aware of the way the public's perceptions of aid efforts could

influence the outcome of the upcoming contentious 2018 elections, were also eager to garner support among residents of Mexico City, as the capital and site of a large concentration of the country's social, political, and economic capital. While the global media and outpouring of aid focused more on Mexico City as well, the greater capacity and coordination of non-governmental organizations additionally allowed for effective allocation methods throughout the metropolitan region (Partlow and Imison). Donations and material aid were distributed through an existing network of non-political community and humanitarian centers throughout the city, drawing on its robust system of organizations to reduce political corruption and co-opting of aid.

In addition to greater resources and institutional capacities in Mexico City, the response and collaboration from citizens was perhaps the most striking difference between the capital and Oaxaca following the two earthquakes. Residents in the capital leveraged their access to technology by using existing social media networks and new communication initiatives, such as the *#Verificado19s* online platform, to organize volunteers, direct resources and aid, and respond to needs across the city in real time (Hernandez). Working alongside the government, local groups and individuals coordinated their efforts to ensure emergency services reached every part of the city as quickly as possible (Fraser and Carvallo-Vargas). Oaxaqueños, on the other hand, were more likely to stay within their immediate community and wait for government help, in part due to their restricted communication methods, limited civic capacity, and weak connectivity and means of access between communities. Although there were complaints and accusations of government failures and unmet needs in both areas, this was predominantly more true

in Oaxaca. Many residents complained of government neglect and a slow response, as well as worries that much of the aid directed to Oaxaca was taken by various government actors or organizations who co-opted it for their own political gain (Villegas and Malkin). Mexico City's response was, perhaps, more successful not only because of the federal government's prioritization of the capital, but also because of the capacity of organizations, civic groups, and the public to work together alongside government aid there. Studies of disaster responses internationally indicate that a lack of a national plan and poor organizational communication are the most important reasons for poor disaster management and coordination (Bahadori et al.). Mexico City's capacity to communicate, collaborate, and address needs across communities in a timely manner allowed for a better implementation of their national plan, fueling a more positive narrative through the ability for active participation of all residents. While both disasters were marked by tragic losses, the predominant narrative in Mexico City was one of hope, cooperation, and pride, while in Oaxaca there was a distinct feeling of hopelessness and resentment.

Specificities of Oaxaca: Cultural, Geographic, Political

This top-down and external approach of the Mexican government's disaster response framework is not appropriate to the state's context and culture, and therefore ineffective at yielding positive outcomes after a crisis. As discussed, the Mexican government's response is based upon conditions in Mexico City, and responds to disaster more effectively there due to the collaboration and capacity of other organizations and the public in that region. Additionally, Oaxaca's geographic distance from the capital also played a major role, both in the way the state has

developed up until the present and in how the government chose to respond to need there. Davis notes how Latin American “state formation has proceeded quite unevenly, with the state reaching strongly into some population sectors and geographic regions of its territory while avoiding others” (“The Power of Distance” 598). Although some shortcomings in the delivery of federal aid and assistance in Oaxaca were most likely a result of racist and classist prejudices, Oaxaca’s distance geographically and culturally from the main institutions and practices of the Mexican state were also paramount to forming the unfamiliar context within which the Mexican framework for disaster response failed.

Oaxaca’s history, complex social dynamics, and distinctive geographic context of Oaxaca have affected and continue to shape many of the state’s unique characteristics, creating special considerations when responding to issues and working with communities in the region. The following analysis explores how many of the prejudices historically-imposed against

residents in Oaxaca continue to manifest today in disadvantages and inequities, resulting in residents being particularly vulnerable to events such as natural disasters. These unique characteristics of Oaxaca, divided into categories of socio-cultural, geographic, and political fragmentation, severely inhibit both the ability to plan for and mechanisms of responding to disaster. These fragmentations within the state complicate and impede Mexico’s framework for disaster response, which is based upon assumptions gleaned from the context of Mexico City, and ultimately failed at adequately responding to the September 2017 earthquakes in Oaxaca.

Histories of Discrimination and Conflict

Oaxaca’s cultural diversity dates back to the pre-columbian era, when, much like today, 16 different indigenous groups shared the region (Kowalewski). However, this diversity has also historically been a harbinger of conflict. Population estimates and migration patterns of pre-columbian Oaxaca indicate various disputes and histories of warfare between the 16

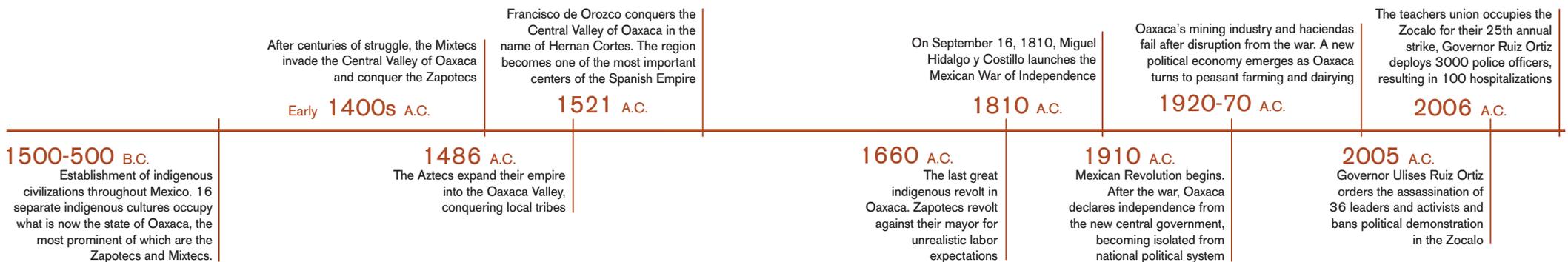
indigenous groups (Kowalewski). This conflict was only further exacerbated by the arrival of the Spanish in 1521 B.C.

The arrival of the Spanish in Mexico led to significant declines in population due to murder, disease, and exploitation even as the Spaniards built their empire by utilizing pre-existing conflicts between indigenous populations, especially apparent in land negotiations. When the Spanish began issuing titles for land, they required evidence of original ownership (Alexander and Kepecs). Nahua and Mixtec accounts of the Spanish conquest presented to Spaniards during these negotiations in the 1690’s detail two very different histories that favor their own groups and provide evidence of ownership over the same parcels of land (Souza and Terraciano). To this day, land disputes and other local conflicts in Oaxaca persist. Many indigenous groups refuse to work together because of these long-standing contestations and refuse to work with the government on regional projects because of the potential of sharing land or resources. This prohibits regional develop-

ment, which has further perpetuated the severe lack of resources that results from Oaxaquenos complicated relationship with government.

After the Mexican Revolution, Oaxaca declared independence from the new government of Mexico in protest. As a result, the state was isolated from many of the decision making processes over the past century. In following years, Mexico focused its agricultural investments into Northern states, resulting in extreme poverty and high fatality rates. The legacy of these investment trends continue to disadvantage Oaxaca, which is now second only to Chiapas in lowest GDP for the country and among the bottom three states for literacy rates (Sánchez et al).

Culturally, one of the most oppressive and lasting impacts that resulted from the Spanish colonization of Mexico was the creation of strong biases against indigenous populations. The caste systems created during the colonial era placed indigenous people at the bottom. For the most part, this has not changed. The systemic racism towards indigenous groups



A timeline of significant moments in history that inform Oaxaca’s current status.

“It’s better to leave Oaxaca to live a better life.”

-Jose Maria Villalobos, Advisor to the Mayor of Oaxaca City

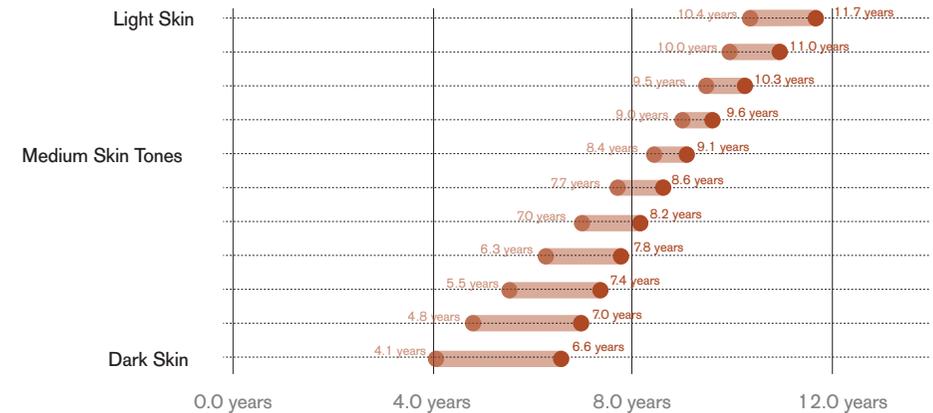
that resulted from the colonial era are significantly felt in Oaxaca, especially when looking at recent studies regarding disparities in wealth and income across skin tone. In 2017, Mexico’s National Institute of Statistics (INEGI) released the results of their Housing Survey, which, for the first time, asked respondents to identify their skin tone. The report revealed a 45 percent gap in educational attainment between darker skinned and lighter skinned Mexicans, with lighter skinned Mexicans reporting 3.5 more years of schooling on average than darker skinned Mexicans (Zizumbo-Colunga). Wealth follows a similar trend, with a 41.5 percent difference between average monthly income of lighter skinned and darker skinned Mexicans (Zizumbo-Colunga). Darker skinned Mexicans tend to belong to ethnic, cultural and linguistic minorities—populations that make up the majority of Oaxaca. Previous studies have identified disparities between education and wealth levels for indigenous communities versus non-indigenous peoples; however, most of these studies have explained away differences, using a lack of human capital or geographical differences as reasoning for the disparities (Cañedo). This 2017 report regarding skin tones is a strong indicator that racism has played a role in significant differences of opportunity for indigenous groups.

Elena Nava Morales, an anthropologist at Universidad Nacional Autónoma de México, has researched the impact of racism toward indigenous populations on funding and programming. She has found that indigenous communities are not only overlooked in funding priorities, but many of the programs that do receive funding

do not actually take into account the cultural practices of indigenous groups. In relation to disaster relief, construction materials that have been distributed for reconstruction are not sensitive to the indigenous practices throughout Oaxaca (Nava Morales). As a result, many indigenous groups have not utilized the resources allocated to them. The government does not only lose money in these situations, but people go without shelter for much longer than necessary because of these ineffective practices, compounding other health and community issues.

Traditions of Protest

In recent years, Oaxaca’s protests have predominantly taken place on the streets. According to former Oaxaca state government officials, a report investigated the average number of road closures due to social protest in Mexico and found Oaxaca to be the state with the highest frequency of road closures (Sánchez et al). While the report found there was an average of one road closure per month in Mexico, when broken down by state, Oaxaca has an average of 28 days per month. These protests have been successful in blocking unwanted government projects. In fact, according to several government officials, Oaxaca’s government has trouble completing large-scale projects because local municipalities will often protest activity on their land and demand resources in return for allowing development on their property. The most common request is for health services, such as clinics, hospitals, ambulances, or staff. This has presented a challenge in coordinating resources, particularly because the most commonly opposed projects are new



The relationship between skin color and years of education in Mexico. Source: Cañedo.

roads. Without roads to connect communities and because the government is consistently lobbied for more resource allocation throughout the state, it becomes difficult to plan for an annual budget, let alone any sort of funding to prepare for or react to a disaster.

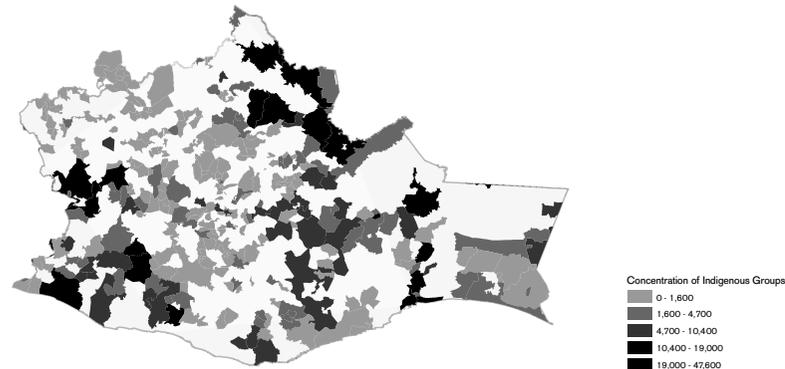
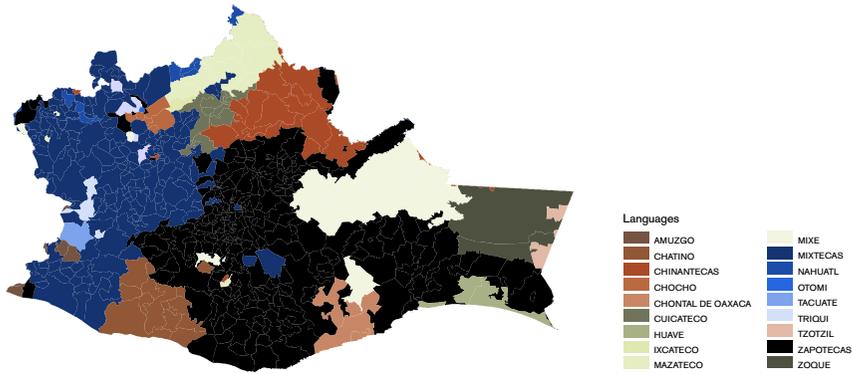
Path Dependent Impacts

Oaxaca’s unique social and cultural history has led to a complex and fragmented environment where different areas of the state operate independently rather than working together, and where mistrust and opposition rule over coordination and collaboration. The history of inter-tribal warfare, colonialism, and federal exploitation of natural resources have created a culture of learned isolationism and resistance to outside entities across Oaxaca’s thousands of communities. Not only have Oaxaca’s residents been historically marginalized by colonial

and federal systemic abuses, but individual communities are also pitted against each other by unequal resource and service allocation that compounds upon centuries of disputes between different indigenous groups. This socio-cultural fragmentation inhibits capacity building, and communication between different groups, thereby limiting possibilities for civic participation and collaboration to mobilize group resources and address large-scale systemic needs. In the event of a disaster, Oaxaqueños are less likely to work between communities, limiting an essential need for civic engagement and organizing in the context of Mexico’s disaster framework response.

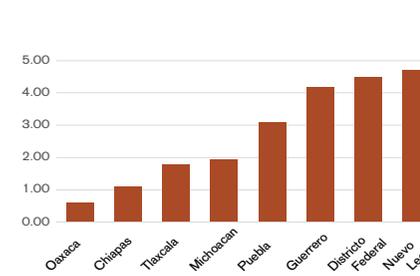
The Geography of Disaster Recovery

These spatial and geographic characteristics of Oaxaca not only impede physical and social connectivity but also limit inter-community relations that aid in

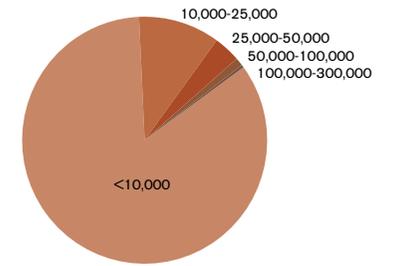


Oaxaca's Cultural Diversity

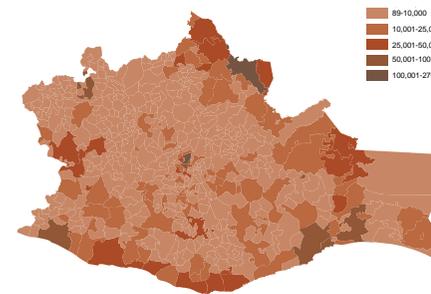
Oaxaca has the highest concentration of Mexico's indigenous population, with over 34% of the country's indigenous members calling Oaxaca home. This population is represented through 16 unique indigenous groups, each with their own traditions, customs, and languages. Oaxaca has the most native languages spoken out of any state in Mexico. Nearly 60% of Oaxaca's population speaks an indigenous language, as compared to 15% in the country of Mexico as a whole, and about 12% of people in Oaxaca are non-Spanish, monolingual speakers (Sanchez et al). Due to this, about half a million people in Oaxaca are not able to communicate outside of their ethnic group. While this diversity is what makes Oaxaca a cultural destination in Mexico, it also complicates communication across the state. Even though statewide materials can be translated into 16 different languages, Oaxaca's literacy rate, one of the worst in the country, further complicates the spread of information. Furthermore, historic conflict between groups and present-day grudges inhibit community collaboration when pursuing regional projects or responding to disaster.



Index of concentration of population of Mexican states. Oaxaca is the state with the lowest concentration of its residents Source: Sanchez et al.



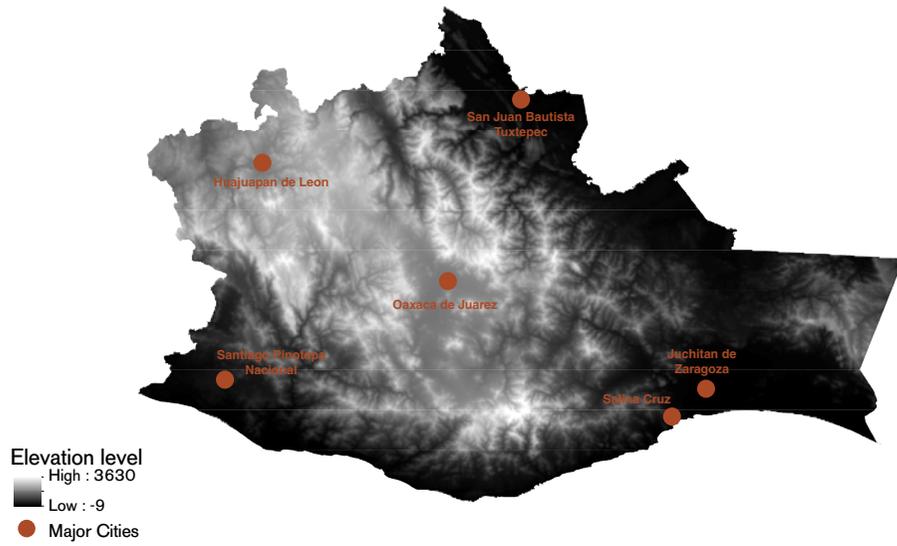
Share of Oaxacan municipalities by population size. The vast majority of municipalities have less than 10,000 residents. Source: INEGI.



Population density by municipality. Most areas of Oaxaca have a low number of residents relative to land area Source: INEGI.

Population Distribution

The distribution of Oaxaca's 3.9 million inhabitants across this geographic area is highly dispersed, making it difficult to access many people at once. In fact, Oaxaca has the highest rate of population dispersion, or alternatively, the lowest rate of population concentration, in all of Mexico (Sanchez et al. 11). While there are several urban areas in the state, the majority of residents live in over 12,000 small towns, with some populations less than 100 inhabitants and the majority under 10,000 inhabitants, distributed throughout the area with very little clustering (INEGI). Even the largest city and capital of Oaxaca, Oaxaca de Juarez, is only home to slightly under 300,000 people. This spatial fragmentation of communities across the state increases the number of necessary resources, services, and infrastructure in order to serve each town rather than being able to address multiple communities' needs at once through shared public benefits and emergency aid.

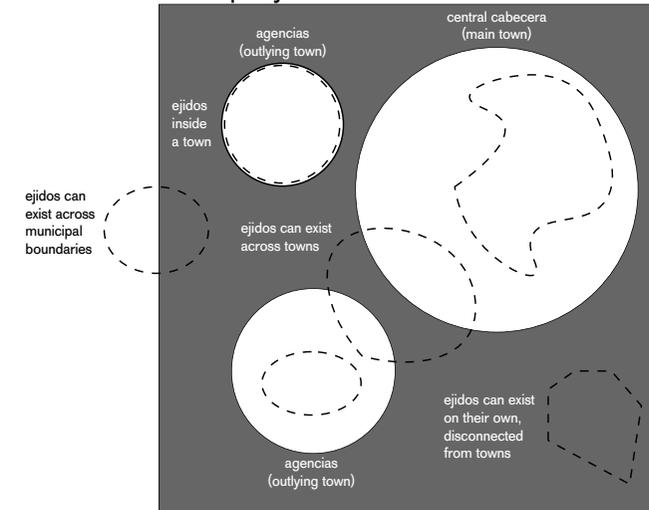


Oaxaca's major cities, defined as those with over 30,000 residents, are almost all separated from each other by the state's numerous mountain chains. This limits travel between economic hubs and population centers. Source: INEGI.

Topography & Geographic Fragmentation

The natural features of the state create physical barriers to connectivity, limiting access and coordination efforts between communities. At 36,200 square miles, Oaxaca is the 5th largest state by size in Mexico, with vast areas of undeveloped jungle and mountains (INEGI). The state is traversed by three different Sierra mountain chains, with altitudes reaching over 10,000 feet, that form a substantial barrier and create regional divisions, thus limiting access both to communities on the mountains and between those in the separated valleys. While Oaxaca's major cities are all located in its valleys, the metropolitan areas of Oaxaca de Juárez, Juchitán and Salina Cruz, Santiago Pinotepa Nacional, and San Juan Bautista de Tuxtepec are all separated by varying degrees of elevated and rural terrain (Sanchez et al. 10). This isolates many communities from each other and from outside aid workers, inhibiting cooperative relationships and the spread of information in times of crisis.

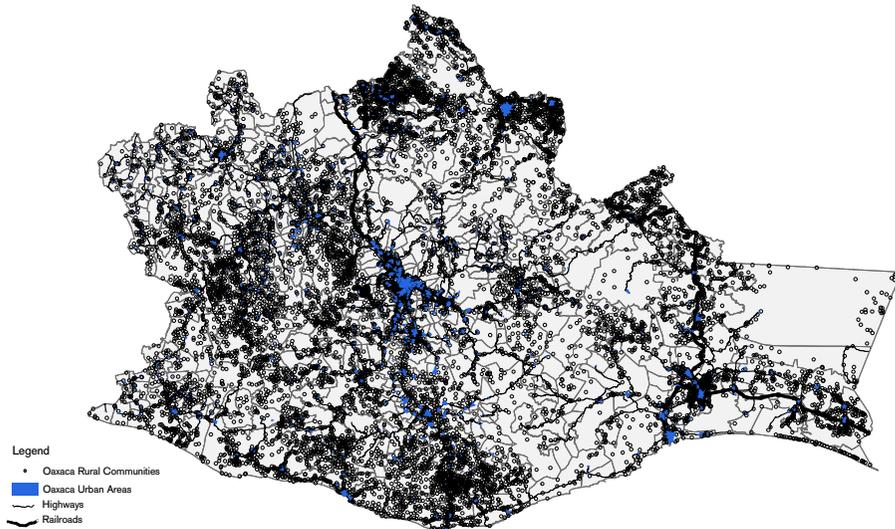
Municipality



Relationship between levels of governance in land ownership. Source: Polo and Danielson.

Land Tenure

In addition to the large number of towns in Oaxaca, the state's systems of communal land ownership, a product of its large indigenous presence and history of land reform movements in Mexico, creates nested systems of governance and decision-making over geographic areas. Each of Oaxaca's 571 municipalities is lead by the municipal president but may also have additional local leaders of smaller communities within a municipality, known as localidades. Mexican government land reforms throughout the 20th century also created the ejido, communally-owned land with its own decision-making body comprised of multiple participants that functions separately from the municipal government. Over 80% of land in Oaxaca is communally owned, with multiple ejidos usually delineated within a town or municipality (Llata Flores). This constitutes another level of local jurisdiction with which outside entities must consult when building infrastructure, planning for disaster, or executing emergency response and reconstruction. The need to negotiate and meet the demands of municipality, town, and ejido leaders not only poses a challenge when implementing economic growth and development projects but also when attempting to coordinate a large-scale disaster response and post-disaster redevelopment plan across the state.



The limited number of highways and railroads in Oaxaca are juxtaposed with the dispersion of many communities and relatively few clustered urban areas in the state Source: INEGI.

Transportation

Oaxaca's spatial fragmentation is further reinforced by its inadequate transportation systems between communities. As a result of Oaxaca's mountainous landscape, lack of investment, and complex systems of land ownership and governance, the state is highly underserved in terms of transit infrastructure and travel options. While the highway system has been significantly expanded in recent years, many communities are still not easily accessible by road, particularly those at higher elevations or in jungle regions. According to President Lopez Obrador, only about half of Oaxaca's 571 municipalities have a paved road leaving to their municipal seat (Mexico News Daily). Additionally, there are no public transportation options between communities in Oaxaca, and private taxi and bus services charge high rates that generally cost over a day's worth of wages for just a one hour drive (Sanchez et al. 15). These factors result in many isolated communities with limited access to larger urban centers, jobs, services, and resources, in turn creating pre-existing vulnerabilities in the form of restricted economic and collaborative opportunities. The limited connectivity is then not only a major impediment to development, but also a significant barrier to reaching communities and allocating resources after a disaster. Harder-to-reach communities are more likely to wait longer for aid, are less likely to be able to reach service provision points, and generally have fewer existing relationships with organizations or other communities outside their town that can be leveraged for cooperative reconstruction and recovery partnerships (Ramisetti-Mikler et al).

disaster response and access to those in need after a crisis. Because Oaxaca's residents are distributed across many communities throughout the state rather than concentrated in a few areas, it is more difficult task to provide infrastructure and aid services to support all residents equitably. The state therefore cannot benefit from economies of scale that would often allow towns to share resources such as schools, hospitals, and other services and programs. Additionally, Oaxaca's limited transportation infrastructure makes onerous the task of moving between towns and cities to address these needs.

The resulting low amounts of production and lack of economic development contributes a significant pre-existing vulnerability to disaster—overwhelming poverty and lack of resources that inhibit the recovery of Oaxaqueños. Without the provision of extensive outside assistance, affected communities find it hard to address issues of rebuilding, livelihood restoration, and long-term recovery. Additionally, the geographic dispersion of communities only further complicates the nature of political decision-making. In such ways, the geography of Oaxaca plays a unique role in determining the success or failure of relief efforts and should be incorporated into any Oaxacan disaster plan.

Political Fragmentation

The historical, social, and geographic elements of Oaxaca's poor response to the earthquake is also complicated by political elements, such as the politicization of aid allocations through the use

of military intervention to help distribute resources (Martinez). This instance is symptomatic of the complex role of politics in Oaxaca's disaster response, suggesting that political and governmental structures need to be accounted for in disaster planning and response. In Oaxaca, political complexities exist on an array of levels, from federal and state actors to the local towns and NGOs. As noted in the above sections on specific socio-cultural and geographic considerations in Oaxaca, political considerations are intermingled throughout each dynamic, influencing and being influenced in return. For example, Oaxaca's highway system is unfinished because of complicated land ownership structures which are often mediated by local political interests that originate from the various unmet needs of communities due to their social and historic disadvantages, which are often also caused in part by spatial dispersion and geographic characteristics (Cruz). The lack of a highway system in turn aggravates the spatial disconnect of Oaxacan towns and inhibits future collaboration across cultures and stereotypes, reducing the chance of regional organizing to change conditions. The spatial and social disconnect continues to contribute to antagonistic and slow-moving negotiations between the state highway agents and the towns, further reinforcing historical distrust and sour relations between local and state actors. Throughout almost all the examples and dynamics named in this chapter, the spatial, social, and political are all working on each other and being informed by another at the same time. Under the focus

Only 300 out of 571 municipalities have a paved road to their municipal seat. An hour long shared taxi on average costs a full day's wages.

of fragmentation, this section will pull out several political threads and outline how governmental complexity on the municipal and local level, allocation of power outside of the state government, and a volatility of larger projects may contribute to problems with disaster relief and preparation.

Background of Political Structures

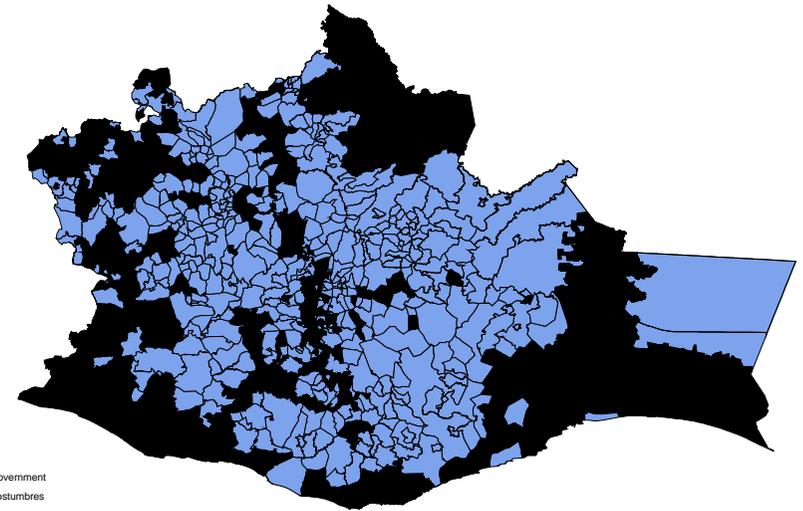
By nature of its unique social and spatial dynamics, Oaxaca is a complicated place to govern. According a former representative of the Oaxaca State Government in Mexico City, “only 10 people in the world know every municipality in Oaxaca” (Climaco). This is due in part to the multiple ways in which municipalities, large and small towns, and property rights are formed and influenced by the other—a system complicated in its own organizational right and often unclear to outsiders.

A unique aspect of Oaxaca’s political setup is its system of *usos y costumbres*. Legalized in 1995, *usos y costumbres* is an indigenous form of governance that allows municipalities to organize local political systems in a manner reflective of indigenous practices (Polo and Danielson). Similar to the complications of land tenure, *usos y costumbres* is a layer of governance that comes from indigenous heritage and is notable for the communal structures that often accompany it. With over 75 percent, or 481, of municipalities participating, *usos y costumbres* municipalities often employ collective decision-making structures and communal property rights (Sánchez et al). While the political structure of *usos y costumbres* can vary by municipality, inequity still exists as smaller or outlying towns within a municipality face exclusion from municipal funding or decision-making made by the main town of the municipality, a dynamic both amplified and informed



CNTE protest in April, 2018 includes request for reconstruction of schools damaged in earthquake. Source: Mexico News Daily.

by the history of social distrust between towns as discussed in the socio-cultural section (Eisenstadt and Rios). Inside the towns, however, *usos y costumbres* areas may have greater dimensions of equity than the political party municipalities and are often preferred by locals (Díaz-Cayeros et al). In such a way, each town and municipality has their own political system and intricacies that demand contextualized knowledge and, in many cases, years of relational capital in order to work with them. While a simultaneously coordinated and localized approach allows projects to succeed, after the earthquake, many communities were given the same building allocations or materials that did not fit their needs. This lack of knowledge of local dynamics is an impediment to development or public interest projects, as seen in the failure of state efforts to complete the highway system. Generally, when projects hit the ground they can operate well in some instances, yet interviewees stressed the impossibility of having an efficient, monolithic policy approach to Oaxaca. These complexities, require disaster plans and preparations to be based in local knowledge and accommodated to the political systems.



Formal Government
Usos y Costumbres

Oaxacan municipalities represented as *usos y costumbres* system (blue) or political parties (black), showing how very few municipalities use the national political party system. Source: INEGI.

Government: Turnover, Project Instability

Lastly, another framing component for understanding Oaxaca’s governmental structures is the limited capacity of the state government. As mentioned, Oaxaca is Mexico’s second-poorest state with a slower rate of economic growth than the national average, forcing Oaxacan communities to depend upon the federal government for project financing and resources (Sánchez et al). However, the limits on the state government extend beyond funding into human resources as well. One interviewee, Oaxacan government planning and health department employee Eugenio Coronado, recounted that two months prior to completion of a state agency project, he and his team were moved to another department that needed their skills more. The project they were working on, if completed, may have changed the tone of this chapter: it was the beginning of a regional framework

plan to cluster municipalities into 52 micro-regions based on social and cultural characteristics (Coronado). This would have allowed for greater attention to municipalities from the state as well as more collaboration across municipalities. Due to institutional limits and the demands of their new agency, the remaining staff members were unable to finish or transition over this project, resulting in the shelving of what could have been a shift to more regional yet localized planning in Oaxaca. This story points to how the government itself lacks proper employee expertise, that someone could be moved to a different department regardless of their experience, as well as its inadequate systems for transitioning projects or preserving institutional memory.

Additionally, this instability informed how Oaxaqueños receive and use aid from the government. There are stories of people damaging their homes further after the earthquake under the impression

that they would receive more aid, sometimes to be left without funds or materials for months; this highlights the need for greater clarity in governmental processes and abilities (Coronado). There are also reports of fraudulent builders who took relief funds without completing the building—the government was largely unwilling or slow to remedy the situation (Reza and Rodriguez). Such gaps in institutional memory, unstable bureaucratic processes, and lack of staff expertise can seriously hinder the ability to respond to disaster planning if these lessons are not noted and communicated throughout political shifts.

Why Political Dynamics in Oaxaca Require a Different Disaster Response

As the above dynamics continue to occur without clear resolution ahead, it is unlikely that communities will envision themselves moving beyond recovery to restoration, let alone finding the resources to do so. While the political dynamics of localized indigenous systems, non-governmental channels of power, and state government can contribute to the cultural and social diversity of Oaxaca, in the face of disaster these dynamics may instead obstruct the restoration of communities. And, by consistently depending upon federal aid for public works projects and community programs, Oaxaca's interest will continue to depend upon Mexico City politics. However, these federal interventions are not localized and culturally-embedded to a point of consistent success. At the same time, state agencies, due to lack of governmental capacity, histories of distrust, and distorted power relations, may not be a trusted intermediary for resources and planning approaches. Municipalities and towns in Oaxaca, with their layered political structures and unique needs, often do not organize with each other to craft positive demands for

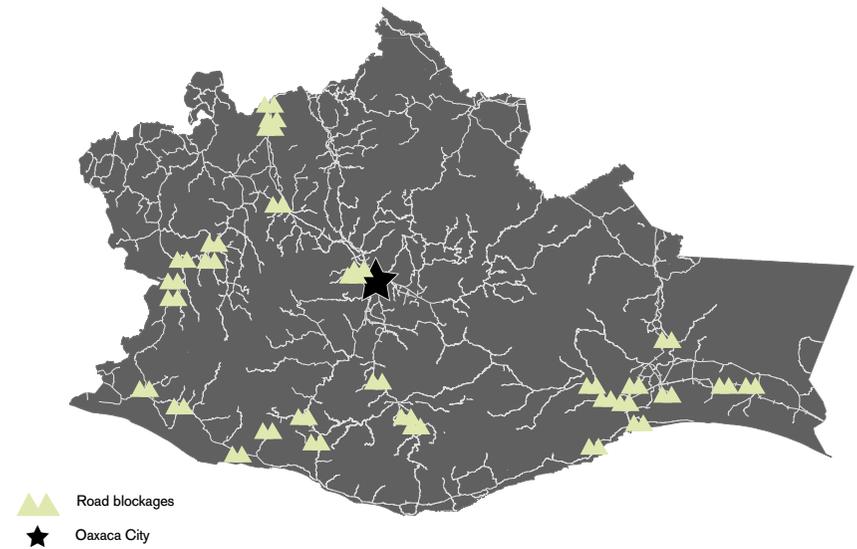
change, yet continue to face similar forms of disinvestment and cyclical, reactionary response from institutions. For disaster planning and response to work in Oaxaca, newly empowered players may be needed to bridge these politico-institutional dynamics with resources and trust.

Pathways Forward

Oaxaca faces a variety of complications in the implementation of pre-disaster planning and post-disaster response, however the state still has many potential pathways forward to address these issues. Many existing institutions and programs in Oaxaca are already trusted by municipalities, but are not being properly utilized in the distribution of information and resources to facilitate improved statewide outcomes. Disaster relief strategies that leverage these existing assets also provide hope of change in many long-term ways—the transition into more specific approaches and greater social cohesion in Oaxaca's disaster planning could open up room for other economic and social changes to occur.

The following recommendations are intended to improve Oaxaca's organizational capacity for disaster preparation and to build upon each other. Ideally, the programs would be adopted by an institution or organization that is already somewhat culturally-embedded throughout the various fragmented regions of the state and seen as a resource for communities through a history of trusted relationships and successful collaborative projects.

A strong potential candidate for successfully implementing the following recommendations would be local universities. Although Oaxaca's universities are not in one explicit network, there are at least 23 universities found across the state that frequently serve surrounding communities and work with local Oaxaqueños, both through project-based courses and



Road blockages in the past three years by the CNTE teacher's union, demonstrating the unreliability of road travel in Oaxaca. Source: Growth Dynamics Report.

independent research initiatives. In the following three recommendations, each is applied and explained through the lens of empowering a network of higher education centers to formally assist in disaster response and paired examples of other universities across the world that have successfully assisted with reconstruction and preparedness initiatives.

1. Create Trust Brokers: Disaster response and communication after the 2017 earthquake may have been more effective if strong relationships and lines of reliable communication had been previously established as a component of the resiliency plan. While such lines of communication do not require the group or actors to be from the same community, Oaxaqueños' skepticism of outsiders requires a level of community collaboration. In socially and geographically isolated areas, especially in times of emergency, pre-existing relationships of trust between

the community and an outside party are essential to guide effective and contextually-appropriate local aid and recovery strategies. Therefore, the creation and utilization of trust brokers, or people who are able to establish and maintain a strong positive relationship with rural indigenous groups, would be essential in the delivery of disaster response initiatives.

Many local universities already have a number of these trust brokers because of previous student or professor-led projects that have collaborated with nearby communities, and also because of high populations of university students that hail from these rural communities and are already therefore already trusted.

One case study for such a university-led response strategy that utilized pre-existing relationships to gain trust in a community is the National Polytechnic Institute of Oaxaca (IPN-CIIDIR). Many of the university's students are members of rural, indigenous communities and are

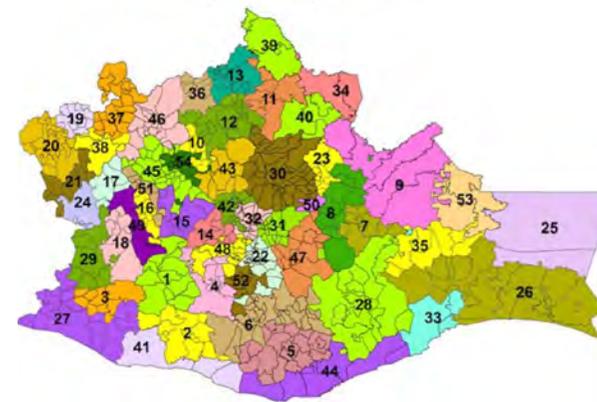
not only fluent in the appropriate language but also already trusted by residents. These students and their professors can, and often do, serve as intermediaries and empowered actors to formulate new disaster response and preparation initiatives as well as coordinate the implementation of government plans. In fact, a student connection led to an IPN project in San Jeronimo Taviche, a *usos y costumbres* town of about 1,500 people with large amounts of toxic waste contamination from a former foreign-owned mine. Due to the university's role, the severity of the pollution was uncovered and a remediation plan was created in consultation with the residents. This natural connection from a local student and the years of work spent on this project serve as a powerful example of how universities can broker relationships with insular communities in order to learn about and advocate alongside them for their needs in times of crisis.

2. Make Spaces for Cultural Advisors in Decision-Making Processes: Many of the programs in Oaxaca are developed with good intentions, but a lack of cultural understanding of indigenous practices, site-specific conditions, and local needs causes them to fail. The creation of an Office of Cultural Advisors or the appointment of individuals from particular regions to advise on programming prior to approval can ensure effective

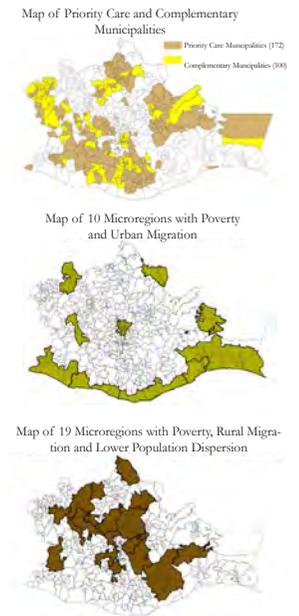
execution of disaster planning and response. Incorporating local knowledge into the programmatic and systems design processes can ensure funds are effectively spent where needed in ways that will positively impact communities, rather than being lost on programs that, even with good intentions, are not appropriate to the local context or do not address real needs in the community. Some changes to government spending have already come about based on anthropological studies of group dynamics and the unique characteristics of the region with high success rates and recognition, indicating that this is an area for further exploration and development. For instance, the success of programs focused on providing funds and resources to women, based on cultural observations of matriarchal-led communities within indigenous groups in Oaxaca, has led to many experts naming women-centered programming as a sound investment for Oaxaca. This type of culturally-specific program design, however, has not begun to be widely studied or implemented within the disaster response framework, but would be a strategic means of ensuring a more resilient Oaxacan society and more effective disaster management plans for the future. Given the need for long-term studies to inform culturally-appropriate disaster response strategies better, it is paramount that these efforts be conducted within a framework that will shape plans for future disaster responses rather than being a short-term strategy for after a crisis has already happened.

The creation of cultural advisors may

For disaster planning and response to work in Oaxaca, newly empowered players may be needed to bridge political-institutional dynamics with resources and trust.



This is a regional framework developed by the state planning department that clusters municipalities into 52 micro-regions, based on social and cultural characteristics, and planned in three stages. Source: COPLADE.



also highlight innovative, cost-effective solutions for disaster recovery that are culturally sensitive. Before the earthquake, IPN had already begun research into earthquake-resistant and culturally specific building methods.

The university has been exploring the use of ferro-concrete construction, which utilizes locally sourced and sustainable materials such as egg cartons, to produce designs that take into account traditional building methods and styles, capabilities, resources, and climate-specific needs.

Several of the university's buildings have been constructed with these methods, which are also being rolled out to communities affected by the 2017 earthquakes, and reflect the university's long-standing desire to be a part of disaster preparation and response.

This research is just one example of how locally-embedded groups with

expertise, such as universities, can use their academic and cultural knowledge to prepare communities for disasters.

3. Coordinate and Strengthen a Regional Disaster Response: As previously mentioned, Oaxaca's state planning agency had begun to make plans to divide the municipalities of Oaxaca into larger regions. Although the project remains uncompleted, this proposal provides an important vision for what regional decision-making and communication could look like for Oaxaca. Plans to increase regional connectivity would be beneficial for disaster planning because it would ease the process for large-scale infrastructural developments in the state as well as execution of plans. More resources could be shared across the boundaries of municipalities, towns, and ejidos and possibly create more jobs and connections.



© Sydney Pedigo

Ferro-concrete architectural technique researched by the IPN university in Oaxaca City to work with local materials and styles. The ferro-concrete method can be scaled to larger sizes and was used to construct the school's auditorium. Such use of materials and styles that are Partnering with the university, in this case, would allow for the ferro-concrete method to become more popular as people rebuild.



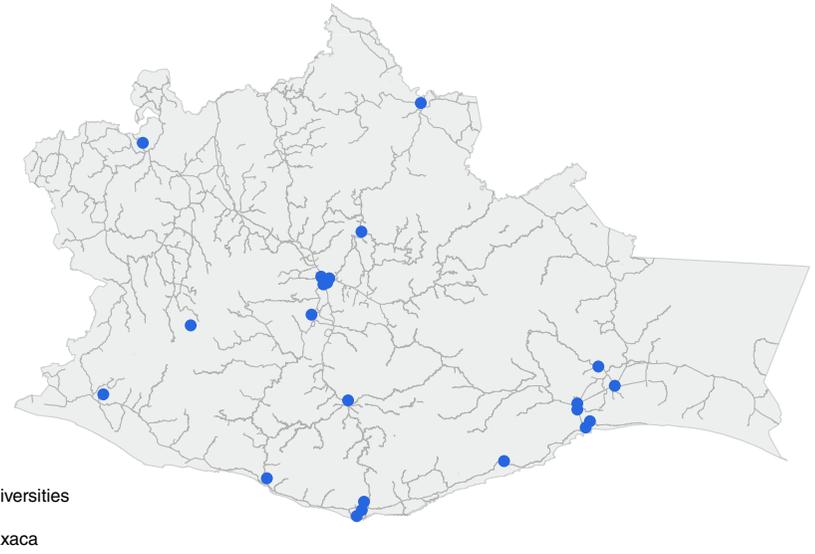
© Sydney Pedigo

This picture shows materials explored in the ferro-concrete method, including chicken wire and egg cartons. Such use of materials and styles that are more accepted and accessible to local towns have a great chance of being incorporated into the reconstruction efforts; however, construction credits and state resources need to support these other architectural methods and means.



© Sydney Pedigo

Town leaders from the usos y costumbres town of San Jeronimo Taviche discuss with IPN professors their plans for the future community center and remediation of mining pollution.



Universities shown dispersed throughout state. Source: Google Maps, 2019.

Examples of University Involvement in Disaster Preparation and Response:

Set up formal agreements of responsibilities for disaster situations through organizational structures	Memorandum of Cooperation between the University of Texas School of Nursing and the City of Austin (Pattillo and O'Day)
Partner with universities, even if far away, to create recovery plans based upon community insight	New Orleans ACORN members partnered with Cornell, Columbia, and Illinois to create a post-Katrina plan for the Ninth Ward that was resident-inspired (Reardon et al)
Help identify disaster subcultures, potential organizational barriers, and institutional gaps	Western University responded to 1997 flood by examining and restructuring university bureaucracy (Kennedy)
Create designated study tracks for disaster situations and response	University of Alabama offers non-engineering disaster master's program on disaster prevention and systems safety, the first track of its kind in the US in 2010 (Carsen)
Apply knowledge and execute evaluations post-disaster	University of Toledo conducted health evaluations in Nepal (Brickman et al)
Identify and archive damage and human needs	Tohoku University in Japan helped with victim identification, monitoring assessment, archiving disaster information, and other volunteer projects (Aoki and Ito)

Regional intermediaries would operate between multiple municipalities and the state government, just as municipalities serve as intermediaries between ejidos, towns, cities and state government.

In the absence of a strong state system of regional connections, the university network is already dispersed throughout the state in a nodal pattern and could be utilized as an efficient means of providing targeted and localized aid in the instance of disaster. Formalizing the roles and responsibilities of these institutions as well as the funding and aid allocations is a next step to create a regional network of university-based relief. This could be achieved by setting up more connections, with agreements in writing and made open to the public, between universities and foundations, NGOs, and governmental groups.

One potential program could be the establishment of a knowledge management program that would design and manage a curricula across universities for graduate level courses and training on resilience, adaptation, and rapid-response to address natural disaster. These courses would be targeted for faculty and staff in the university network, would be adapted to the circumstances of the regions of Oaxaca through a series of community-based learning and planning exercises, and could be delivered by a dedicated team of professionals who specialize in the field. A pilot program could be initiated at IPN-CIIDIR in Oaxaca City to test the program and begin to build a portfolio for funding applications in order to build out the program to other universities throughout the state.

Another potential path forward would be to fund and revive the existing network of community-based rural radio stations, a system that has been used with great success in the past, and partner them with universities to produce and disseminate

regular programming that increases the community's basic understanding on how to respond as a group to disasters. Establishing communal understanding and disaster plans well in advance of a crisis will streamline roles and responsibilities while also allowing a community to better prepare and act in the event of a natural disaster.

There are many examples of community-based mobilization processes, the utilization of group resources, and the role of universities in creating a process of disaster response literacy in rural and low literacy regions. These programs generate an enabling environment for other ideas to be discussed, proposed, and designed, and could be an excellent resource for Oaxaca.

Next Steps: Overcoming Fragmentation in the Search of Disaster Preparedness

These three recommendations could be applied to other institutions or even used as suggestions in the state's current disaster plan. However, this approach brings up the question of whether universities should step into this gap and coordinate disaster response—how long they should be doing so and how the state could transition into this responsibility in the future. One potential concern is the possibility of academic “voluntourism,” where class projects and student trips may not be adequately resourced or framed to provide help and instead provide false expectations or drain community resources. However, for interim efforts where more knowledge and attention would assist, using such culturally-situated and accessible sources of expertise as universities could be an avenue for disaster relief and preparation in areas that have been historically neglected by the government.

While the three steps above are elements of a thoughtful approach, the

above page also shows a list of international examples of universities involved in disaster planning and response.

Although Oaxaca faces many challenges as a product of its history, context, and current structural inequalities, there are viable pathways forward to build a more resilient state. While many innovations in general fields like medicine and safer construction will also help the state cope with future disasters, none of these designs or products in isolation will succeed without first addressing the dynamics that prevent the effective deployment of these interventions in Oaxaca. However, by identifying and unifying trustworthy actors and creating new systems for information-sharing, coalition-building, and increased connectivity, the state can begin to address barriers that inhibit an effective development and disaster response work.

As a place with a strong background in organizing around protests and cultural pride, Oaxaqueños have the capacity to come together under the right system to create better methods for addressing issues in their communities as a unified group. Through a regional, information-driven, and collaborative approach, universities can be one of such groups to lead this movement, drawing on their relationships with and local knowledge of communities as well as their larger network of institutional research and connections. However, with the rise of new technology and increased exposure to other groups through globalization and immigration, Oaxacan society will also most likely develop as a more connected entity with new mechanisms for creating stronger networks that can be utilized to address crises. Through increased means of civic participation and collaboration, Oaxaqueños will be better equipped to work alongside government actors to better guide and benefit from plans for and responses to disaster in the future.



Part III.

Proactively Strengthening Territories of Risk

Learning From Debris: A Detailed Journey for Participatory Research Dení López / Nadyeli Quiroz / Betzabe Valdés	110
Reconstruction, Recyclability & Memory: Resilient Schools Carlos Casalduc / Cristina Solís	144
Community Educational Resistance: A New Model of Education and Earthquake Preparedness Karen Mata / Eduardo Peláez	150
Along Fault Lines: Urban Affect Network Antonio Moya-Latorre / Daphne Xu	164
Infrastructural Public Spaces: Children's Recreational Center in Juchitán Loreta Castro Reguera	176
Modular Infrastructure in the Public Realm: Amplifying Public Space in Ciudad Ixtepec Xio Álvarez / Clarence Lee / María Peroni	182
The Railroad as a Conflict Zone: Immigrants and Their Journey above «La Bestia» Melissa Gutiérrez	192
Embracing the Wind: A Strategy for Community Wind Generation in the Isthmus Enrique Aureng Silva / Rian Rooney	206

Learning From Debris

A Detailed Journey for Participatory Research

Dení López / Nadyeli Quiroz / Betzabe Valdés

As Mexican students living abroad, the 2017 earthquakes marked the beginning of an important chapter in our academic careers. What started as a shared feeling of impotence, evoked by the distance between Mexico and us during such a crucial time, ended in a prolific collaborative research project that served as a basis for various academic endeavors, one of which we will share throughout this chapter. In what follows, we will explain an idea based on our journey as graduate students aiming to create new information regarding disaster recovery while attempting to help stricken communities in a context filled with complexity, instability, and uncertainty: the post-earthquake landscape at the Isthmus of Tehuantepec in Oaxaca, Mexico. In this area, we propose an educational framework to regard reconstruction as part of the urbanization continuum in vulnerable small cities prone to multiple (and recurrent) environmental threats. In other words, we will put forward a model that understands reconstruction as a crucial stage in the cycle of city building to advocate for the need to restore the built environment while increasing risk awareness and enhancing response capacities among communities that will face natural disasters periodically.

With the help of Gretchen Brion-Meisels, a lecturer in Prevention Science and Practice from the Harvard University Graduate School of Education, and Lorena Bello Gómez, a lecturer in Architecture from the Massachusetts Institute of Technology, we devised a multistep educational program to promote participatory reconstruction in the municipality of Asunción Ixtaltepec, Oaxaca. In short, our proposal centers on hiring local women (who were already involved in construction waste management) through pre-existing financial aid programs to rebuild a public space with rubble from the 2017 earthquakes, developing skills to reinforce their own houses as part of the second stage of the process (*Figure 1*). We claim that the success of a program like this could set a positive example for the other neighboring communities, allowing for inclusive design to become a catalyst for a more sustainable long-term recovery. Our goal is to foster the production of safer towns by providing people with the tools they need to reinforce their knowledge about construction systems.



Figure 1. Zapotec women scavenging steel among piles of rubble from the 2017 earthquakes next to the Las Nutrias River in Asunción Ixtaltepec, Oaxaca. Photo from the *Pasa la Voz* collective archive. 2018.¹

1. *Pasa la Voz* (Spanish) and Bicheeche Diiidxa' (Zapotec) essentially translates to "spread the message". It refers to the research organization created by Deni Lopez, Nadyeli Quiroz, and Betzabe Valdes in the summer of 2018.

2. Together, Deni Lopez, Nadyeli Quiroz, and Betzabe Valdes received awards from the Penny White Project Fund, the David Rockefeller Center for Latin American Studies, the International Travel Community Service

Fellowship, and Aeromexico to conduct the base research for this study, titled "Disaster as an Opportunity: Alternatives for Alternatives for Debris Management at the Los Perros Riverbank in Oaxaca, Mexico

To start, we will describe our research methodology and explain the importance of understanding disaster response and reconstruction as moments in which local governments and populations should participate, learn, and acquire skills that will help them in a similar situation in the future. Moreover, we will make a case to challenge existing top-down recovery schemes through models that build upon the particularities of disaster-prone communities to enable bottom-up action. We will also situate rubble management as a central concern in recovery, given its current negative environmental impacts and ability to act as a reconstruction asset. We will then explicate the geographic and social context in which we have worked for the past two years to describe the characteristics of the area that could allow us to put forward our particular proposal, which include workshops and skill-building sessions with adult women to learn how to reuse rubble in reconstruction through *tequio*, a local form of reciprocal collective work. Lastly, we will introduce our theory of change, describe our program and its activities in detail, and present our proposed evaluation methods.

Framing the Problem

The research project in which this proposal is based was conducted between November 2017 and January 2019 by three Master's degree students at the Harvard University Graduate School of Design.² The study used a mixed methodology approach, combining quantitative and qualitative methods, and it employed both remote and on-the-ground research. Initial archival reviews happened between November 2017 and April 2018, followed by a three-month data collection period in Mexico between May and August 2018, and a data processing period between August 2018 and January 2019. To understand perspectives on the ground, the

team conducted fifty-one interviews with key actors within the federal, state, and local government, academia, the private sector, non-profit organizations, and the local population. Moreover, the project included a cross-sectional randomized-sample survey on disaster recovery with 384 participants across the local population of the five municipalities, eleven mapping workshops with local women and children, extensive mapping and photographic documentation of rubble at the site, and a cartographic analysis of the combined results (Figure 2).

Interviewees were selected through snowball sampling and included five federal officials, five state officials, eight municipal officials, thirteen non-profit representatives, two private-sector workers, seven academics, and eleven residents. The research team identified a list of key players that could be targeted for initial meetings based on a review of press articles and other digital materials. From then on, the pool of interviewees grew based on referrals from the initial participants. All interviews were conducted in Spanish. Each person was officially interviewed once, and the conversations lasted between one and two-and-a-half hours. The interviews were structured around three open questions regarding the immediate response to the earthquakes of 2017, the state of recovery and rubble management until the point of the interview, and the role or potential role of each interviewee in post-earthquake action in Oaxaca. Recurring themes in the interviews were coded manually to create overarching categories, which later served to organize the contents of each conversation. After the interviews, some of the participants (particularly residents and non-profit representatives) offered to act as links between the research team and other community members, becoming central to the development of the site investigation.

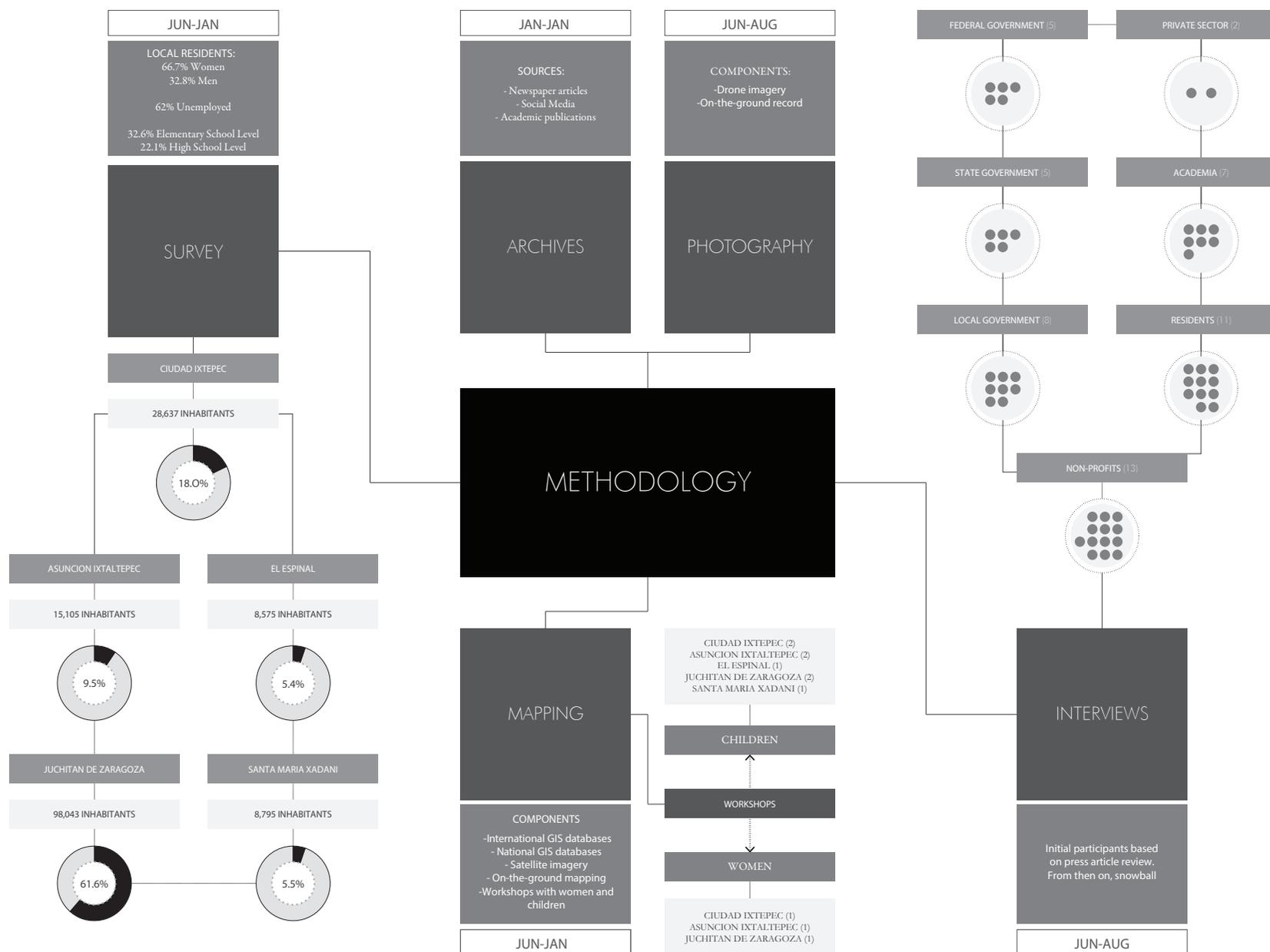


Figure 2. This diagram shows all the components of the methodology used to conduct this study, which include fifty-one interviews, a cross-sectional survey with 384 participants, a mapping analysis, the creation of a photographic record, and a thorough archival review. Diagram by Dení López and Betzabe Valdés, 2019.

The cross-sectional survey consisted of a randomized-sample survey with a margin of error of 5%. The sample size took into consideration that the target population in the five municipalities consisted of 159,155 inhabitants, and it required 384 complete surveys to get statistically significant results. The number of interviews per municipality was allocated in proportion to population size: 69 in Ciudad Ixtepec (17.99%), 37 in Asunción Ixtaltepec (9.49%), 21 in El Espinal (5.39%), 236 in Juchitán de Zaragoza (61.60%), and 21 in Santa María Xadani (5.53%). The participants needed to be eighteen years or older and had to have lived in the same residence for at least ten years to ensure they had witnessed the last major flood caused by river overflows, which happened in 2010. Since cadasters did not exist, the study randomly selected blocks to obtain one interview per block. The surveyed houses in each block were chosen systematically, beginning in the northwest corner and moving clockwise until surveyors obtained a response. If no one was willing to respond, the block did not have eligible residents, or if the block had no houses, surveyors moved on to the next randomly selected block. The survey contained 120 questions regarding personal identification, the Las Nutrias River, floods, earthquakes, rubble management, waste management, post-disaster aid perception, culture and identity, public space, and economy, safety, and health.³ The research team hired two groups of eight surveyors, all of whom were local young adults. The study lasted approximately five weeks.

The participatory mapping workshops served to qualitatively explore the value that the inhabitants of the region give to their urban and natural environment. Each workshop was carried out with groups of eight to ten adult women and children in each municipality to create visual representations that helped the re-

searchers identify the primary needs, concerns, and changes related to the earthquakes of 2017. The workshops studied three areas: seasonal floods, perception and interaction with the Las Nutrias River, and changes in the built environment after the earthquakes. Each session also served as a forum for environmental awareness that encouraged citizen participation in the reconstruction process.

Lastly, the mapping analysis serves a synthesis of the project's spatial findings, as it showcases the location of construction waste and the main problems regarding floods in the five municipalities studied. These maps were developed from diverse datasets with the help of Robert Pietrusko, Associate Professor of Landscape Architecture at the Harvard University Graduate School of Design. They include Geographic Information System (GIS) layers produced by the National Institute of Statistics and Geography (INEGI), spatial datasets produced by the team regarding the location of rubble (made with GPS trackers), and the outcome of eleven participatory mapping workshops conducted across the five municipalities. Even though preexisting GIS data is public, there were some instances in which it was challenging to obtain it. Therefore, the group worked with several government agencies to attain all data available regarding the geographic characteristics of the river, earthquake damages, topography, built environment, and official rubble disposal sites. Given the scarcity of information, the group also created its own mapping repertoire, which included water treatment and waste management infrastructure, unofficial rubble disposal sites, critical flood risk points along the river, landfills, flood-prone areas, and water runoffs. The photographic compilation used imagery from drone flights, tablets, and smartphones.

NUMBER OF DISASTERS RECORDED GLOBALLY vs TOTAL COST OF DAMAGES & TOTAL NUMBER OF DEATHS

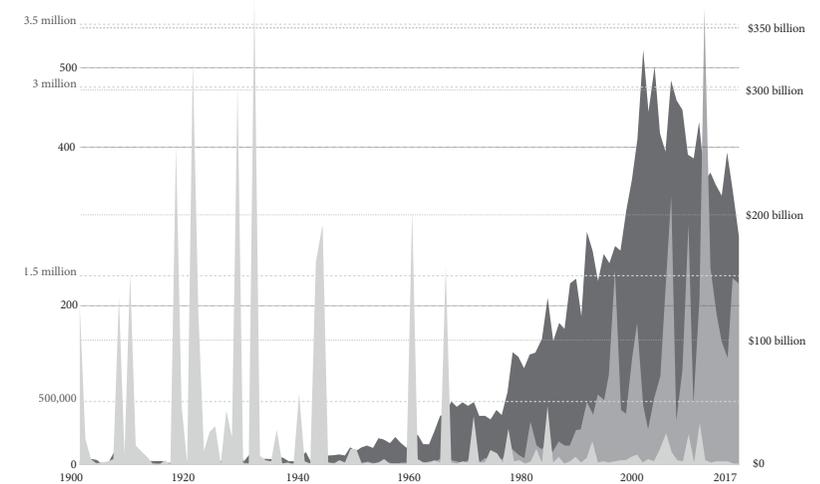


Figure 3. Graph showing number of global natural disasters in contrast to the total economic cost of damages resulting from them. Adapted from *Natural Catastrophes* by Ritchie & Roser, 2018.

3. The Las Nutrias River (the River of the Otters) is officially known as the Los Perros River (the River of the Dogs) in Mexico. This comes from an error in translation from Zapotec to Spanish, as the original name, Guiigui' Bi'cunisa is literally translated as river of the swimming dogs (otters, in Zapotec). Throughout the article, we will refer to the river by its original Zapotec name to respect the wishes of the locals who helped us conduct this study.

Post-Earthquake Recovery and Rubble Management at the Isthmus of Tehuantepec

As natural disasters become increasingly frequent in the face of changing climates, so does the claim that they represent valuable opportunities to incorporate innovative urban development models. Nevertheless, this idea is continuously overshadowed by the sheer urgency to restore the preexisting built environment (along with its problems) when catastrophes strike. Said urgency makes it difficult to consider the different characteristics of the affected sites, often resulting in decontextualized recovery models. While this conundrum is not new to urban planners and designers, there are few solutions to address it based on the systematic research of the long-term effects of disasters, particularly in underserved communities prone to recurrent environmental threats.

As shown in *Figure 3*, both the number of environmental disasters and the amount of money spent to cover related damages has exponentially grown in the past twenty years, suggesting that people's loss of patrimony is ever increasing (Ritchie/Roser 2018). Yet, recovery mechanisms worldwide have changed only minimally and seem to follow a steady top-down pattern. In contrast with the central role that federal governments and international actors take in the creation of guidelines and execution of plans to respond to environmental crises, there is a growing need to put forward recovery models that strengthen local response capacity, increase risk awareness, and allow cities to use long reconstruction periods as critical bottom-up learning moments to cope with future disasters. In other words, there ought to be a paradigm shift to challenge existing top-down disaster response schemes that tend to overlook the impor-

tance of integrating decentralized actions and are, therefore, quickly dismissed during emergencies (Daly et al. 2017).

As Marfai, Sekaranom, and Ward argue, inadequate infrastructure and poor maintenance, paired with a lack of communication between governmental institutions and local actors involved in solving problems, causes higher vulnerability levels (Marfai/Ward 2015). Therefore, governments should be less involved in implementing actual long-term recovery strategies and more focused on enhancing local capacity to deal with upcoming disasters. Among other things, this requires bettering links between stakeholders, particularly at the municipal level. Disaster governance structures should not only create seemingly efficient guidelines but also follow-up with decentralized capacity building for residents, local governments, and other institutions to develop functional recovery and prevention models (Daly et al. 2017).

This mindset also pushes for a more nuanced understanding of risk-prone cities, including their geographic particularities, cultural characteristics, economic conditions, and governance structures. According to the United Nations Development Programme, for example, women, boys, and girls are fourteen times more likely to die during disasters than men, mainly because of preexisting conditions of inequality that exacerbate imbalanced access to resources and services. (Habtezion 2013). This shows that disasters do not affect everyone in the same way, and suggests that new interventions need to put forward ways of working with the most affected groups within already vulnerable populations to allow for bottom-up action. As we will develop in detail later, our proposal will center on working with adult women to increase construction skills with recycled materials in a context where self-construction is a norm that they do not get to be a

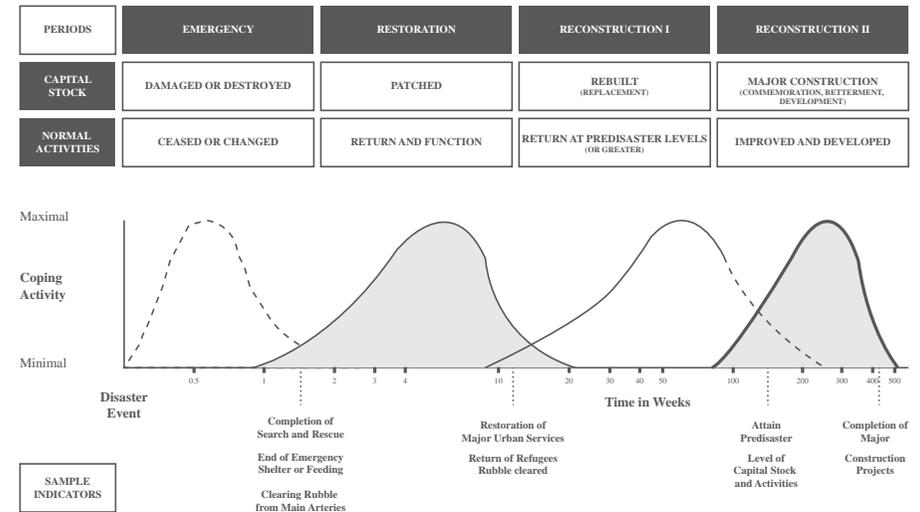


Figure 4. Model of disaster recovery activity. Adapted from *Reconstruction Following Disaster* by Haas, Kates, and Bowden, 1977.



Figure 5. Rubble management, an often undermined aspect of disaster recovery, is a central concern because of its potential relationship to all sectors pertinent to reconstruction: economic development, environmental fragility, institutional deficiencies, local capacity, infrastructure provision, housing production and cultural heritage. Diagram by Dení López (2018)

part of, and where said women could play a key role in increasing risk awareness among the rest of the population.

Another important feature to highlight is the idea to use reconstruction as a period to rebuild while augmenting knowledge about the causes and effects of natural disasters among local populations. Reconstruction is a period that does not only correspond to the few months of the emergency response, given that it can last up to a decade in the most underserved areas; its duration is directly related to the intensity of the disaster and the resources available in the stricken place (*Figure 4*). Therefore, it should be understood within a cycle in which numerous disaster-prone cities grow, redevelop, and imminently face cataclysms, to become a valuable period for urban settlements to rise while increasing pragmatic preemptive skills among their inhabitants.

The reconstruction stage is also crucial because it touches upon most of the sectors important to everyday urbanization like housing production, infrastructure provision, cultural heritage, socioeconomic development, institutional deficiencies, environmental fragility, and local capacity. However, it is challenging to arrive at actionable goals with such a broad framework in mind, particularly in developing nations. As shown in *Figure 5*, our program proposal will center on providing an alternative solution to one of the often-neglected but vital concerns in post-disaster recovery that, like the concept of reconstruction, can easily be linked to the all of the aforementioned sectors of everyday urbanization: rubble management.

Despite being recognized globally as a significant challenge, few plans exist that address post-disaster waste management in a contextualized manner, and notably, fewer do so in the Global South (Hooper 2018). As Brown et al. explain, this

happens because “financial, technical and expert resources in developing countries are generally a limiting, if not prohibitive, factor in achieving disaster risk reduction goals.” (Brown et al. 2011) Moreover, existing plans or guidelines are generally limited to describing what can be done with rubble rather than how to achieve such solutions, especially in contexts where resources were already meager in the first place. This often results in rubble mishandling, which can quickly turn a seemingly “manageable” disaster into a full-blown crisis (López López 2019).

According to Martin Bjerregaard, founder of Disaster Waste Recovery, and Aiden Short, founding director of the Urban Resilience Platform, dealing with construction waste is a complicated process that often results in the creation of unprotected landfills. This happens, in part, because officials tend to favor “simple” and quick fixes in the lack of a clear plan (or presence of a weak one). These actions raise significant environmental concerns, as debris usually contains a wide range of liquid and solid waste such as electronics, organic matter, vehicles, oils, solvents, industrial material, and other hazardous waste components.⁴ Given this, Brown et al. call for what will be the basis of this study, an analysis of a case where “environmental standards have been reduced, addressing why the decision was made, what information the decision was based on, and what the impact of the option was.” (Brown et al. 2011). As we will further elaborate, post-earthquake Mexico, and especially Oaxaca, is a highly instructive case for understanding the complexity of construction waste mismanagement.

As a brief background, the 2017 earthquakes hit the southern part of the Isthmus the hardest, leaving the corridor along the Las Nutrias River with the most proportional damage in the whole

country.⁵ This area includes five small and mid-sized cities: Ciudad Ixtepec; Asunción Ixtaltepec; El Espinal; Juchitan de Zaragoza; and Santa María Xadani. Roughly 58.10% of these cities’ 159,155 inhabitants suffered either from partial or total loss of their houses (*Figure 6*).^{6,7} In this area, the disaster left around 1,275,000 tons of construction waste (equivalent to nearly 12,200 blue whales), which were spread by municipalities and private companies along highways, streets, “temporary” landfills, and, unfortunately, the already heavily polluted bank of the river (*Figure 7 and 8*). This seemingly chaotic mishandling of construction waste was spearheaded by the creation of an unprotected riverside rubble landfill in the town of Asunción Ixtaltepec, Oaxaca (*Figure 9*), and worsened by an unfeasible rubble management plan, developed by the Secretariat of Environment and Natural Resources (SEMARNAT). In short, the SEMARNAT guidelines expected municipalities to use disposal sites located outside each town, which were also meant to be supervised and maintained in ways that exceeded local resources. This led to what could be perceived as a crisis in and of itself in terms of construction waste handling.

Despite the many uses that could be given to rubble (*Figure 10*), it is often perceived to be mere waste. As shown by the results of our study, roughly a third of the local population in these towns believe that rubble could be reused in any way (*Figure 11*). This speaks, in part, to the conflictive example set by the municipal authorities, who, in turn, are held accountable for the improper handling of waste, a task that surpasses their economic and human resources even in times without a crisis (*Figure 12*). This is evidenced, for example, through the ever-growing reports of seasonal floods that are usually provoked by overflowing and blocked

4. “Who Cleans up after Hurricanes, Earthquakes and War?” BBC News, n.d. <https://www.bbc.co.uk/news/resources/idt-d7bc8641-9c98-46e7-9154-9dd6c5fe925e>.

5. The Las Nutrias River (the River of the Otters) is officially known as the Los Perros River (the River of the Dogs) in Mexico. This comes from an error in translation from Zapotec to Spanish, as the original name, Guiiguí Bi’cunisa is literally translated as river of the swimming dogs (otters, in Zapotec). Throughout the article, I will refer to the river by its original Zapotec name to respect the wishes of the locals who helped us conduct this study.

6. INEGI. “Encuesta Intercensal 2015.” National Institute of Geography and Statistics, 2015

7. SEDATU. “Censo de Viviendas Dañadas Por Los Sismos Del Mes de Septiembre de 2017,” 2018. <http://transparencia.sedatu.gob.mx/#>.

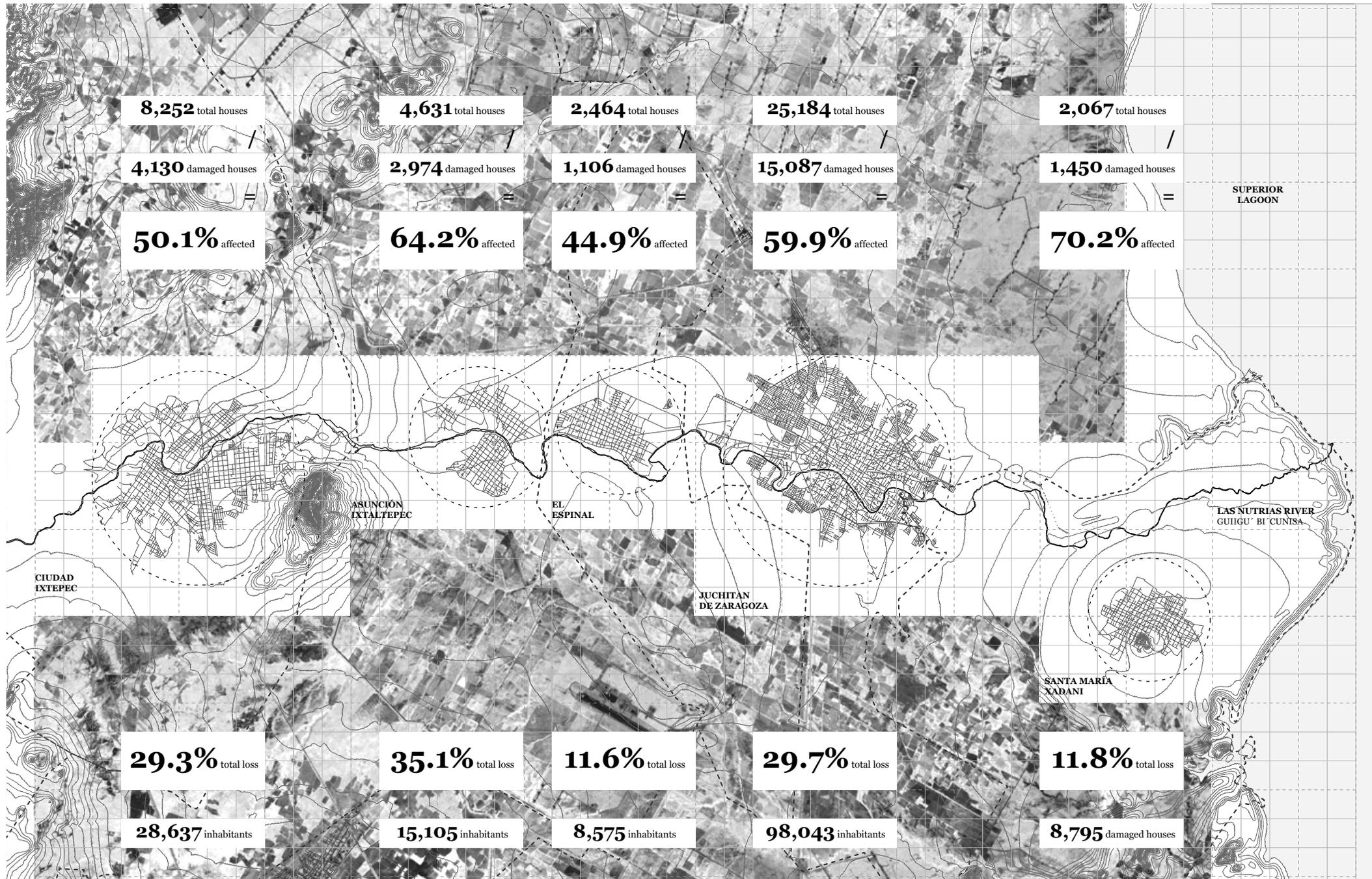


Figure 6. Percentage of damaged houses in the five biggest municipalities along the Las Nutrias River as a result of the earthquakes of 2017. Map by Nadyeli Quiroz Radaelli and Dení López, 2018.

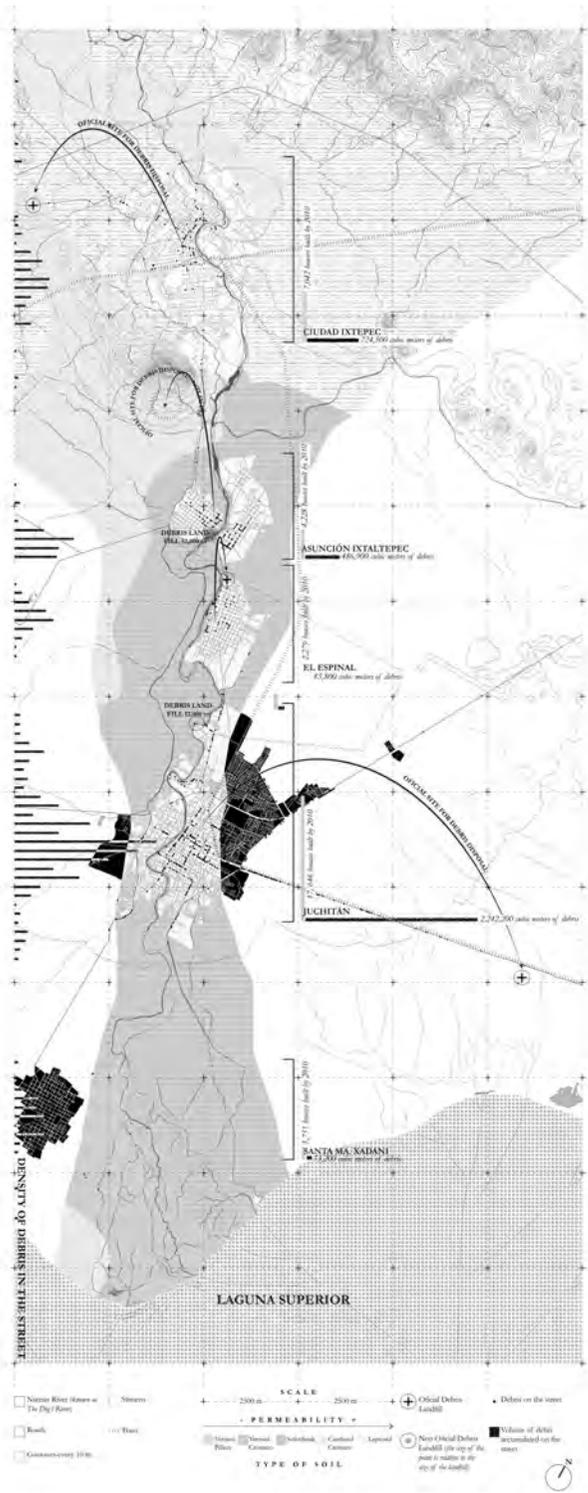


Figure 7. This map showcases the location of the official rubble disposal sites, designated by the Secretariat of Environment and Natural Resources (SEMARNAT), in contrast with the disproportionate landfill arbitrarily established along the Las Nutrias riverbank and the various locations of construction waste ten to eleven months after the 2017 earthquakes. Moreover, the graph on the left represents the accumulation of debris along the streets of each town. Map by Nadyeli Quiroz Radaelli, 2018.

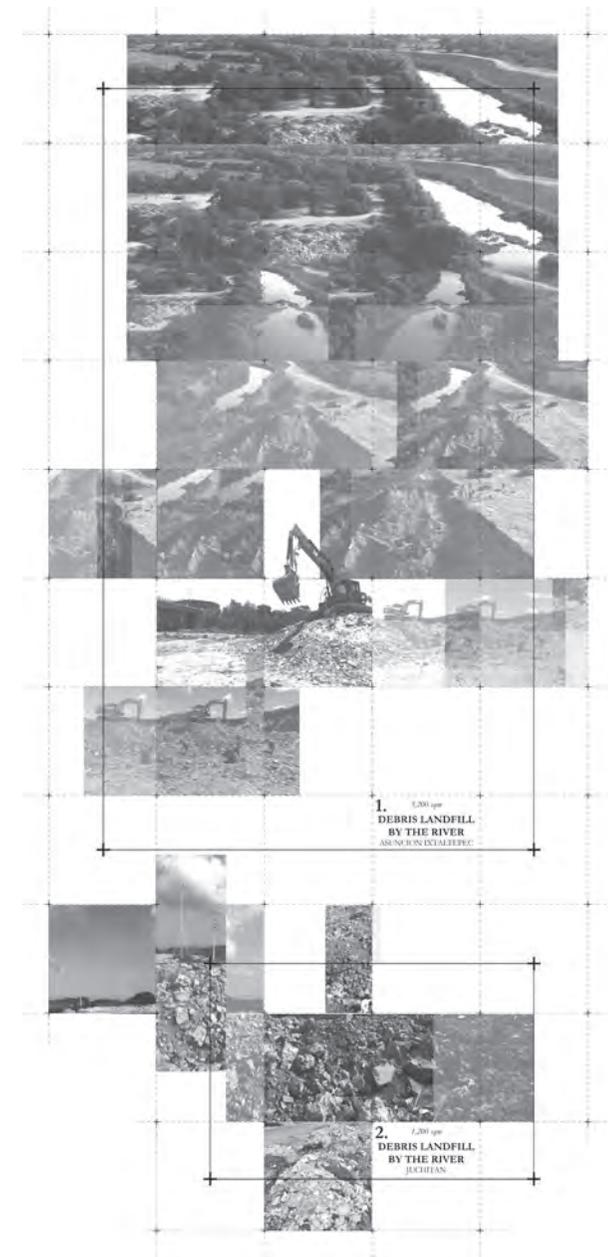


Figure 8. This diagram uses photography to compare the size of the official rubble dumpsites of Asunción Ixtaltepec and Juchitán de Zaragoza. These maps portray the inadequate earthquake response in terms of solid waste disposal and environmental damage. Map by Nadyeli Quiroz Radaelli, 2018.



Figure 9. Unprotected construction waste disposal site built on the Las Nutrias riverbank by the municipal authorities of Asunción Ixtaltepec, Oaxaca, after the 2017 earthquakes. The site spans almost 1.5 kilometers and cuts across the center of the town and was allegedly meant to act as a barrier against periodic floods.

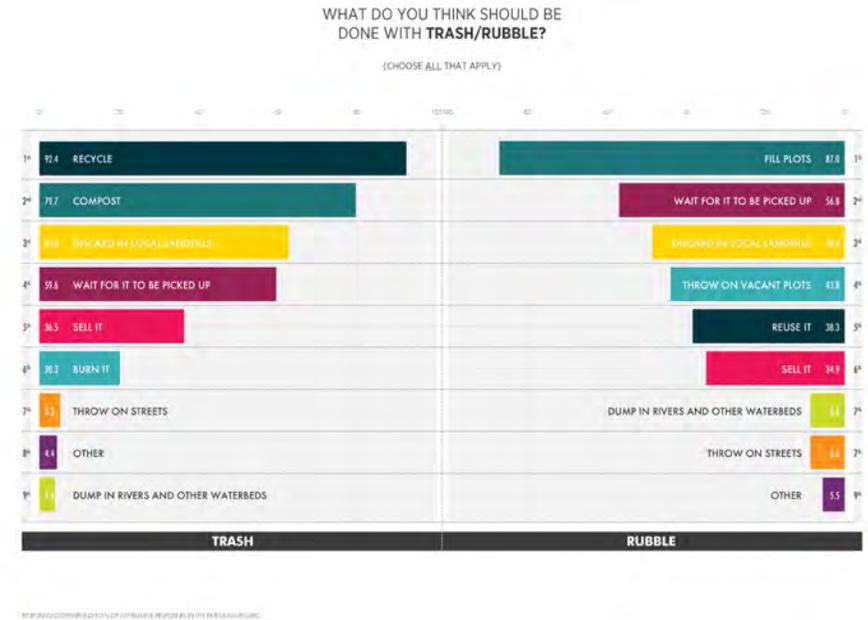


Figure 11. Cross-sectional survey results that compare what local residents think should be done with rubble and trash. Graph by Deni Lopez and Betzabe Valdes, 2019.

POTENTIALS AND GAPS FOR RUBBLE REUSE IN MEXICO

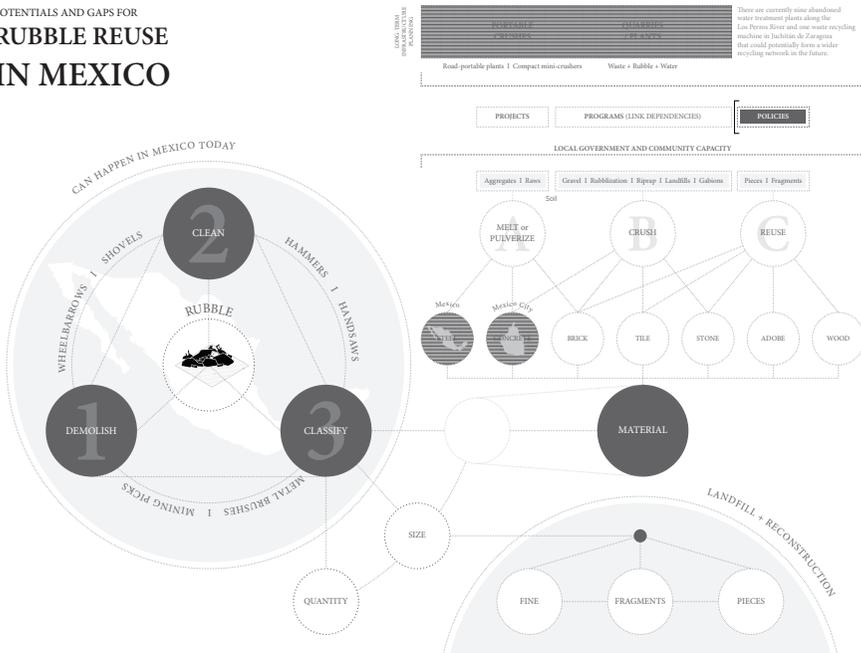


Figure 10. Potentials and gaps for rubble reuse in Mexico. Image by Deni López, 2018.

WHO DO YOU CONSIDER RESPONSIBLE FOR RESPONDING TO PROBLEMS CAUSED BY RUBBLE?

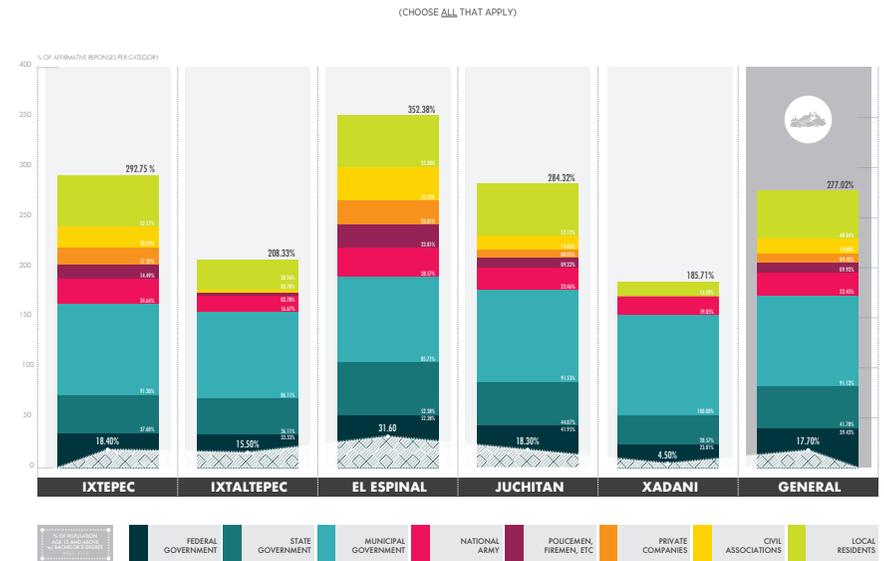


Figure 12. Relationship between educational level and perceived institutional accountability to deal with problems caused by rubble. Graph by Deni Lopez and Betzabe Valdes, 2019.

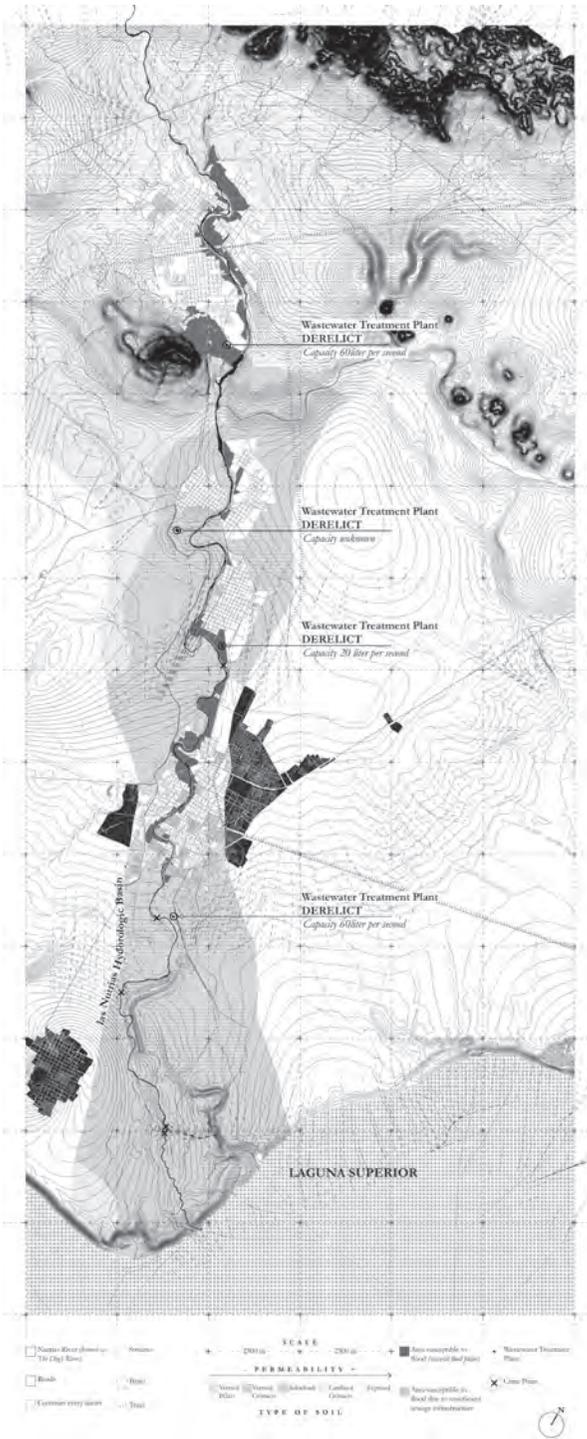


Figure 13. This image shows the contrast between the critical river overflow points and the floodable zones identified by local inhabitants during our mapping workshops. There is little to no relationship between said categories, which suggests that floods are most often produced by deficient sewage systems (a claim we confirmed through local interviews). Map by Nadyeli Quiroz Radaelli, 2018.



Figure 14. Floods in Juchitán de Zaragoza caused by increased rainfall and deficient sewage infrastructure. The green building on the left side of the image is an active kindergarten, where, according to the president of the Las Nutrias River Basin Committee has had a hepatitis outbreaks during past rainy seasons.



Figure 15. Riverside landfill and sewage output in Juchitán de Zaragoza.

sewage systems, which could potentially be exacerbated in upcoming years by rubble presence on the streets or along the river (Figures 13, 14, and 15).

Beyond the physical necessities present before and after a disaster, there is also a great need for social healing, both at the individual and community level. Nonetheless, this is difficult to achieve when recovery actions do not stem from, include, or even understand the strengths and weaknesses of a given society. If a grasp of such cultural traits is present when creating preemptive and response approaches, recovery actions may truly start to move in unison with communities, a much-needed strategy to condense top-down and bottom-up action that tackles multiple vulnerabilities at once throughout an extended time period. Neither one works entirely without the other, as both have assets that need to come together. Top-down action has increased resources and a wider vision of territorial scales, while locals have a better grasp of ever-present issues and their effects on their daily life. Both networks possess valuable knowledge but also threatening weaknesses that come afloat upon misunderstanding or undermining each other's worth. This is not a new idea in ontological research, but its practical outcomes are rare (Valdés 2019).

What is needed the most in order to integrate cultural traits in actionable goals is to identify them among current behaviors, disentangle them from negative traits acquired through time, and use them as already existing social forces that are both respectful towards the local context and useful for future development strategies. In other words, there ought to be a way of keeping cultural identity and rituals that come from life patterns of tradition while bringing them into modernity in fruitful ways that allow for local agency to be restored. This, of course, is a fairly

complex process when facing emergencies in unknown contexts, which is why long-term recovery needs to be regarded as a useful time period in disaster-prone cities both for healing from past cataclysms and preparing for new ones. We believe that there are cultural traditions found at the Isthmus of Tehuantepec that could be used to build on social mobilization and the recognition of local autonomy for a more integrated strategy during and beyond reconstruction.

At the Isthmus, cultural assets are ubiquitous but often misunderstood, resulting not only in their exclusion from the present post-earthquake recovery process, but also from past efforts for community development. It is as if their dichotomous nature as traditional behaviors acting in modern societies rendered them invident for both outsiders and locals to integrate in their actions. These assets are mainly related to a strong cultural identity, a deeply seeded nature for social mobilization, and existing networks of communal solidarity and cooperation. Nonetheless, said characteristics of the region have mingled with modernity in ways that do not necessarily make them obvious at first glance, decreasing people's agency and the capacity for further reflection regarding their inclusion in processes of urban development.

To understand community interactions better, it is also important to unpack their similarities, which mainly come from Zapotec culture. These are mainly related to the existence of La Flor Comunal (or, the Communal Flower), a model proposed by Juan José Rendón Monzón to unpack the core structure of these societies.⁸ He argues that all communities differ in setting secondary principles like traditional education, language, and cosmovision, but they share a few traits regarding communality. For him, communality in this region is not a finished entity,

but rather an ever-changing way of living that will experience gains and losses as culture evolves. Therefore, the Communal Flower depicts the four main aspects of daily life in indigenous communities as an ensemble of knowledge, institutions, and activities that result in communal life: communal territory; political power; work; and parties (Figure 16).

Perhaps the two most straightforward aspects of the Communal Flower to be regarded as assets for disaster recovery are work and parties, as they can be both easily related to actionable goals for community engagement. Moreover, the existing structures of political power that have historically worked to mobilize the region and allowed for sustained social cohesion, may also be used as the foundation for new models. Communal work, for example, includes a term known as *tequio*, a chain-like system of reciprocal and voluntary work that used to be heavily present in the creation of the built environment. It is defined as “collective work that is organized around projects of the formal municipal authority” and is based upon civic duty. Sadly, *tequio* in construction has all but disappeared in some of these towns, although it still applies for other purposes, such as parties. In these sense, parties show that solidarity and cooperation are still pillars of Zapotec societies, and could be regarded as assets during recovery.

Using celebrations for recovery in the state is also not a new concept, although it is perhaps a forgotten one. In 1932, one year after the earthquake that decimated Oaxaca City and its surroundings, a new festival known as *La Guelaguetza* was born to help the city recover from the damage it sustained. At the time, the idea was to foster dialogue between the regions, acquire funds for reconstruction, and promote further investment in the area, so the proposal centered on adapting a

pre-Hispanic celebration to suit those needs. Thus, *La Guelaguetza* is a celebration that showcases the cultural diversity of Oaxaca in a public setting. To this day, it is the most famous tradition in the state, and perhaps even in the country. However, this celebration is no longer associated with the disaster that gave birth to it, as hardly anyone knows its origins. It was never directly associated with vulnerability, and quickly lost its relationship to it. Moreover, some critique it as having become a staged celebration for touristic purposes, as it is now one of the main attractions in the region.

As a new tradition, however, it succeeded in adapting to new realities. As Eric Hobsbawm explained, it may be invented, constructed, and instituted, particularly if they are flexible enough to reference the past while incorporating the present. In his words:

The term “invented tradition” is used in a broad, but not imprecise sense. It includes both “traditions” actually invented, constructed and formally instituted and those emerging in a less easily traceable manner within a brief and dateable period (old or new) and establishing themselves with great rapidity. “Invented tradition” is taken to mean a set of practices, normally governed by overtly or tacitly accepted rules and of a ritual or symbolic nature, which seek to inculcate certain values and norms of behaviour by repetition, which automatically implies continuity with the past (Hobsbawm/Ranger 2005).

Putting all of this information together, we will move on to propose a pilot program in Asunción Ixtaltepec, Oaxaca, that encourages residents and local governments build on local traditions and to see rubble management as an asset for reconstruction after the earthquakes of September 2017. The overall idea is to implement a strategy to teach locals how to rebuild their public spaces with rubble, so



Figure 16. This model by Juan José Rendón Monzón (2011), known as *La Flor Comunal* (or, *The Communal Flower*), depicts the four main pillars of commonality in Zapotec societies: political power, parties, work, and territory.

8. Rendón Monzón, Juan José. "La Flor Comunal. Explicaciones para interpretar su contenido y comprender la importancia de la vida comunal de los pueblos indios." vdocuments.mx. 2011. <https://vdocuments.mx/la-flor-comunal-565dc2d59ea72.html>

9. The rest of this research was made exclusively by Dení López and Betzabe Valdés

10. El 70% de Mexicanos Autoconstruye su Vivienda, Desde la Informalidad. Publimetro México. Retrieved from <https://www.publimetro.com.mx/mx/noticias/2018/07/15/el-70-de-mexicanos-autoconstruye-su-vivienda-desde-la-informalidad.html>

they can then move on to replicate their knowledge in the construction of their own homes. We believe that such a collective process could be a highly symbolic action that, if successful, could be scaled up and be included in the current and future reconstruction processes (in which it would be ideally implemented right after the emergency concludes).

Rubble for Recovery⁹

We believe that creating an educational program led by academic experts and local women to rebuild public spaces using rubble could set a positive example in the earthquake-stricken communities of the Isthmus of Tehuantepec. Our goal is to foster the production of safer towns by providing people with the tools they need to reinforce their knowledge about construction systems. To do so, our proposal links seemingly disparate nuances of recovery in a single intervention, including the need to increase of risk awareness, facilitate bottom-up action, understand cultural contexts, and integrate rubble management in reconstruction. Ultimately, we intend to illuminate ways in which urban design and planning could benefit from educational frameworks for action that strengthen post-disaster development.

Our idea is to work with the federal and local governments, as well as with community members and academic experts to develop lasting ties and functioning participatory city-building mechanisms, a crucial social infrastructure for any disaster-prone area. We believe that a process like this should be understood and executed by local residents but managed by the municipality, so we will work together with them to oversee the whole process and hopefully develop a holistic understanding of resilient urbanization. This way, the municipality could continue to implement similar programs in the future and train more community members,

but the original participants could also do so organically in the face of ever-increasing self-construction, which accounts for almost 70% of Mexico's building stock.¹⁰ In short, we devised a multistep program for the municipality of Asunción Ixtaltepec to hire locals through pre-existing aid programs and financing mechanisms to improve the public realm while developing skills that would then allow them to reinforce their own houses as part of the second stage of the process. The group would work for a normal period of eight hours every day and be paid every two weeks.

Within Asunción Ixtaltepec, we chose to begin by rebuilding the "Margarita Maza de Juárez" Elementary School for several reasons. As shown in Figure 17, the school is located in the center of the town along the main avenue used to go from Juchitán de Zaragoza to Ciudad Ixtepe, making its location very valuable. Moreover, the school was "temporarily" rebuilt by the federal government using very precarious materials such as plastic and tin, in contrast with the more climatically adapted materials used previously like bricks and tile (Figure 18).

We put quotes on temporarily because a year and a half after the earthquakes there were no foreseeable plans to rebuild the school permanently. In addition, the school's structure is divided into classroom pavilions that resemble the structure of a traditional house, allowing us to easily explain to people how their new construction knowledge could be transferred to their private spaces. We also believe that many people would be interested in participating in the reconstruction of the school due to its relevance as a public space that has an impact in the whole community. To boot, we believe it is easy to find financing mechanisms through the Ministry of Education (SEP), who is in charge of providing educational infrastructure, and/or private

foundations to carry on this project given its urban and social importance.

Programmatic Theory of Change

We propose a program to connect four conditions that we believe ought to work together to increase the capacity of local governments and communities to deal with recurrent natural disasters. Firstly, the program builds upon the understanding that the reconstruction period of a disaster-prone urban area is an intense city building moment in which the involvement of communities is essential, mainly because they could acquire skills to help them recover from the present disaster while preparing for the next one. Secondly, the program advocates for the need to increase environmental risk awareness in communities that refuse to relocate in the face of recurring catastrophes. In other words, we will work with the idea that if people will continue living in the same cities regardless of their disaster-prone conditions, they should at least know as much as possible about their geographic environment to know what to expect from it. Thirdly, the program aims to bring together and reformulate unisectoral aid programs because the effects of a catastrophe cut across scales, government sectors, and political territories. Lastly, the program advocates for a culturally aware participatory process, that in this case, is the creation of a women-led network of reciprocal labor based upon a pre-existing social system of collective work known as *tequio*.

Building on the prior conditions, we believe that if we were to develop a program to hire women and provide them with technical assistance to rebuild a public space using rubble from the 2017 earthquakes, they could then develop skills that would allow them to reinforce or rebuild their own houses during a second stage of the same process (Figure 19). This intervention would then advocate for the need

to develop integrative disaster governance strategies that empower local administrations and communities through capacity building in everyday urbanization practices.

As we have previously explained, rubble mismanagement is a critical concern during reconstruction given its pernicious environmental effects, so we would like to see it as an asset to aid the recovery process at the Isthmus of Tehuantepec, create employment locally, preserve the remembrance of disasters, and provide safer construction systems for people to inhabit. Yet, given the potentially negative perception towards safety in using rubble for reconstruction, we do not believe that an intervention like ours should begin by rebuilding houses, but instead, it should begin in a public space (such as the elementary school of Asunción Ixtaltepec). This way, we would allow people to develop the skills first, learn how to use the new technique, see in action, and develop trust while setting an example for the rest of the community. Moreover, if we successfully convey the information for Asunción Ixtaltepec's locals to develop rubble-based reconstruction skills, they could set a positive example for the other neighboring communities as well.

Intervention Description

Phase 0

Prior to beginning the process, we believe that the whole community should be invited to participate in a design charrette, where a team of architects and engineers would come up with ideas alongside local residents to develop a school project that everyone approves. This would also serve as an initial trust-building stage, in which community members could get to know the team of professionals who will work with them in the future. Once the design is settled, the next step would be to gather a team of local residents to implement the project.

Initial participants should be recruited



Figure 17. The “Margarita Maza de Juárez” Elementary School is located along the main avenue in the center of Asunción Ixtaltepec, Oaxaca. Map by Dení López and Betzabe Valdés, 2018.



Figure 18. “Temporary” reconstruction of the “Margarita Maza de Juárez” Elementary School in Asunción Ixtaltepec, Oaxaca, 2018.

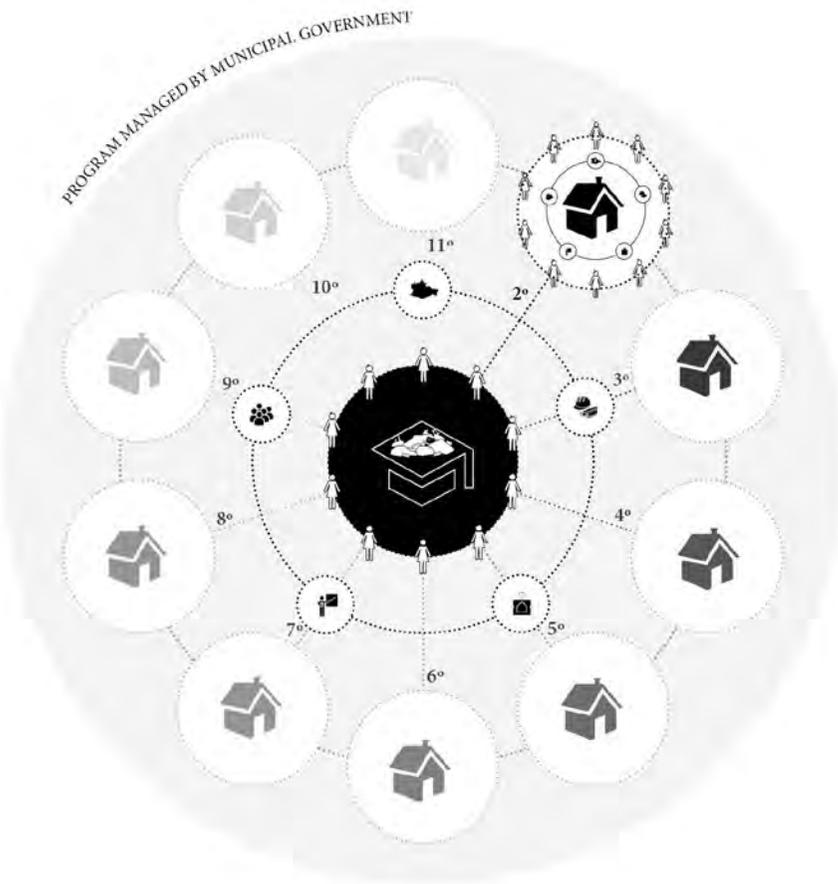


Figure 19. Diagram explaining program for rubble reuse and risk awareness through the construction of a public school in Asunción Ixtaltepec. Image by Deni Lopez and Betzabe Valdes, 2018.

based on need. For example, when we visited Asunción Ixtaltepec over the summer, we met regularly with an emerging group of women who got together to scavenge steel within the riverside rubble dump site and sell it by the end of the day (see Figure 1). Even though the activity was informal, it happened within the umbrella of regularized reconstruction because a crane operator was hired by the municipality to compact the rubble, and he let the women help him by cleaning the debris so they could earn a little extra money. These women lived in the most precarious areas of the town (next to the river) and did not receive government aid to rebuild their houses after the 2017 earthquakes, which prompted them to seek resources elsewhere. Yet, their working conditions bordered inhumane, and we believe they ought to be offered a better deal through a formal system. In our opinion, working with them as the initial group would be ideal because we know they could profit from both stages of the project. If this was not possible, we propose to carry out a survey to understand who could benefit from the process the most.

Phase I

Once the group of ten to fifteen members is settled, we would move on to the initial workshop stages. The introductory activity would be general risk awareness sessions (regarding floods, wind, earthquakes, deforestation, and waterbed pollution) and would last approximately one week. The goal would be to increase consciousness about their geographic context and different preparedness strategies. We propose to offer these workshops in partnership with our alma mater, the National Autonomous University of Mexico, a well-received institution that we know people trust based on our extensive fieldwork. This stage would also include a three-day workshop to get familiarized with the rubble construction technique, as

well as a simultaneous course led by a local expert to get the outsiders familiarized with the cultural norms and best practices for teaching in the area. Upon completion, the entire group (along with the experts) would transport riverside rubble to set up a “hospital” in the school patio, which is essentially an area to classify and separate rubble to extract the useful components. These hospitals are a necessary practice for future events, so setting one up will hopefully allow people to replicate the process in the future given that it could be put in place in their own backyards.

Phase II

Contrary to the common process of hiring outsider men, we propose that the SEP hires the ten to fifteen community members (mainly women) to rebuild the school during the first part of the construction process. This way, we would ensure that the group receives the tools and materials needed as well as a normal salary of around 8,000 MXN (400 USD) for the months spent in the first stage. This period would include time spent on risk awareness and capacity-building workshops. This group would also include one or two “phantom” members that do not have the physical capacity to work in construction (perhaps elderly women) but that could be able to take care of the participant’s children, prepare meals for the rest of the group, or even become managerial assistants. The entire group would work hand-in-hand with one architect, one engineer, one anthropologist, and one local educator, which would act as a complementary network of experts hopefully provided by a local foundation working in the area.

Phase III

Upon completion of the school, the group would move on to the second stage of the process, which would consist on applying the essential principles of *tequio* to have the same locals and experts going

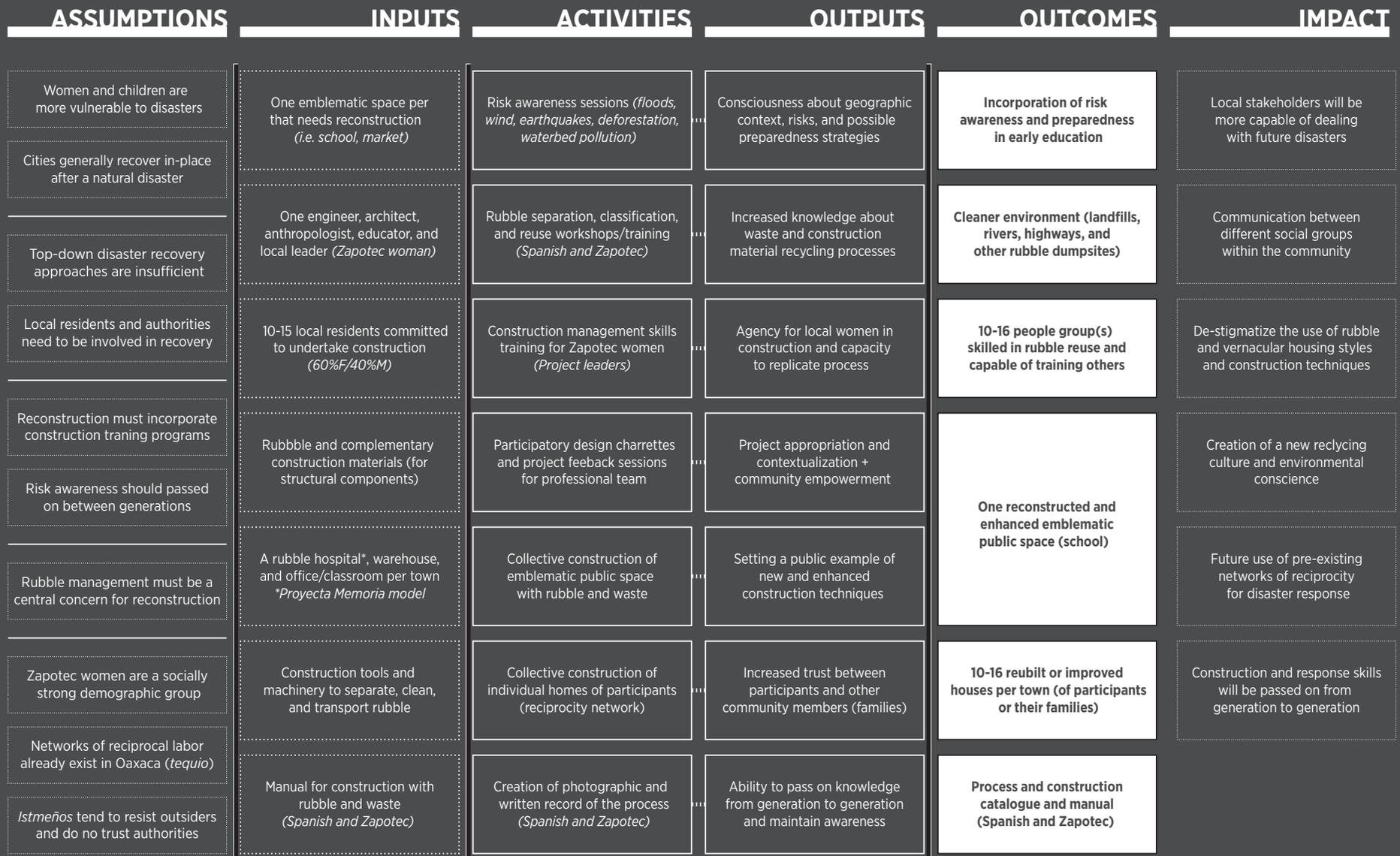


Figure 20. Theory of change and structure for pilot rubble reuse program in Asunción Ixtaltepec. Image by Deni Lopez and Betzabe Valdes, 2018.

to each of the participant's houses (or the house of whomever the participants choose) to improve, reinforce, rebuild, or extend it. Said houses would include those of, for example, the elderly women, who were also part of the group in the beginning. While hosting the group to work on each house, the owner would not be offered a salary. Instead, he or she would have access to a Fondo Nacional para el Desarrollo Nacional (FONDEN) aid package that does not restrict participants to buy materials in pre-established stores. The remaining members of the group would also be sponsored by FONDEN, who would offer them the same salaries as before, but this time to rebuild houses. In the end, there would be ten to fifteen houses rebuilt with the same technique as the school, done by the members of the community with funds from the government.

This whole process would ensure that participants would have a job and work together for at least two years, which is sufficient time to develop the necessary rubble-reconstruction skills in full. More than design tools, we seek to offer them a pragmatic construction skill set that is based on safe construction techniques. Moreover, our program/platform would also give priority in hiring the former participants to train future groups, understanding that communities and local governments should eventually take over the process without the continuing need for foreign experts. Our overarching goal is that local women could become the leaders in managing the reconstruction of public spaces and become central for moments of crisis, hopefully decreasing their vulnerability. More importantly, increased trust between the participants and other community members could push for outside developers to stop controlling reconstruction, allowing for locals to build houses that match their cultural and climatic needs.

Phase IV

The participatory construction will end with the creation of a photographic and written record of the process (both in Spanish and Zapotec), which will be distributed to participants, kept in the local library, and published online for open consultation. As for long-term impacts, we hope that the reciprocity network is able to trickle down to help other community members such as family and friends, creating an urban improvement strategy that can be continuously implemented to develop useful city-making and management skills throughout different generations.

Evaluation

Summative Evaluation

The intervention is a prevention program for future natural disasters, but it also acts in the present to recover from a recently passed one. Therefore, we propose to have two different types of measurement to be implemented after the completion of the whole process. First, we propose to measure the number of houses built using the rubble reuse technique we put forward for the school, which would hopefully be higher than the one sponsored directly by the program. The idea is that, upon completion of the process, the community could follow the set example and replicate it in their own houses through subsequent *tequios*. However, measuring how many homes are actually built with the technique is a challenging task that requires a door-to-door survey because the houses would most likely have a finish that looks just like a traditional one (making it hard to see which house was built with rubble and which one was not). For this reason, we propose to build on local partnerships that could help us locating some examples. We also propose to carry out focus groups with initial participants five to

ten years after completing the process to understand their changing urban needs regarding housing and public space to improve the program.

Second, we would like to measure our success in increasing risk awareness, which we propose to do via a randomized sample cross-sectional study to ask people questions about pressing environmental threats. We could also pursue open questions about their perception and knowledge about the area and its risks, much like we did during the past summer. Nonetheless, we recognize that this is an area that is much more difficult to measure, given that awareness campaigns will most likely not only happen because we promote them but also because other institutions do the same. Therefore, we could also carry out focus groups with initial participants to follow up on the prevalence of risk awareness over time.

It is important to note that the real impact of our program is set to work in the long run, and it would become evident when and if, for example, houses rebuilt with rubble do not fall during an upcoming earthquake (which we might not be around to witness). Another measurable long-term impact is to see whether women do take over the role of rubble managers and public space reconstruction leaders, which would then again be measured only after a subsequent disaster. We could also see over time if the amount of rubble along the river and other illegal dump sites decreases, although that could also suggest that it was finally moved to the predetermined landfills established by the SEMARNAT rubble management plan. Lastly, we would be able to see if any social network helps people with reconstruction. As for now, we would only have as results the completed school and houses, but that would hopefully change over time.

Formative Evaluation - Implementation

The program focuses on using rubble as a recyclable reconstruction material, which is a worldwide concern regardless of natural disasters and could be replicated in different scales and in different times. In India, for example, large amounts of construction-related debris are generated daily due to gentrification and ever-expanding cities, arising serious environmental concerns. As stated by Lucy Rodgers, another example, is post-war debris, which should also be a pressing concern for nations struggling with these situations. Therefore, this implementation of the program could be useful for different areas worldwide. However, there are some limitations to foresee such as mastering the specific techniques, obtaining the additional materials needed to implement it (such as wood posts), and controlling the final cost.

In our case, we could benefit from the school being divided into pavilions to use different construction techniques in each of them and expand the skill set of people, allowing for the program to expand beyond a single scope or method. In the end, we aim to create awareness through safe collective construction in a public space to set a positive example for at a community scale. Even though the construction methods could be different, the program advocates for the need to increase environmental risk awareness in communities that refuse to relocate in the face of recurring catastrophes, so the idea behind it would remain (and is what could be taken to use in other contexts). Moreover, the success of this could be measured by the number of people attending the construction workshops and getting involved in the program.

On the other hand, the social structure of *tequio* is unique from this area in Oaxaca; therefore, it would be difficult to replicate or build on it in other parts of

the world where reciprocity is not common. However, the program in other places could start the other way around, and begin through the creation of a platform to build these social networks. Different activities and incentives could be used to bring people together and agree to engage in a network of reciprocal labor. For example, in Argentina, there are different governmental aid programs (such as *Ampliar o Mejorar Tu Casa* or *Hacemos Futuro*) which are already thinking about the home reinforcement or collective public space production, but they do not work together.¹¹ Therefore, the intervention in this area would concentrate on creating networks and then moving forward with the multi-step implementation process.

Conclusions

Our proposal centers on putting forward a collective process of reconstruction that builds upon the strengths and needs of culturally specific vulnerable groups to create an environmentally-aware and resilient community. We developed a strategy to use rubble from the 2017 earthquakes to rebuild fifteen houses and a school in Asunción Ixtaltepec, Oaxaca, and advocate for a framework that is eventually able to continue regardless of political cycles. Therefore, participation and knowledge spread is of the utmost importance, particularly if women and other vulnerable groups are at the center of the process. In other words, this program intends to have an impact on the long-run and to allow Zapotec communities to respond in a better way when another disaster strikes by using preexisting social networks (such as *tequio*) as reconstruction assets.

In short, we had three goals in mind. First, we aimed to develop an environmentally conscious participatory process of urban production, management, and decision-making to equalize access

to economic opportunity. Second, we intended to create an urban improvement strategy that can be continuously implemented to develop useful city-making and management skills throughout different generations. Finally, we hoped to build a framework that increases the capacity of vulnerable culturally-specific groups to respond to natural disasters within environmentally risk-prone communities.

To complement the physical interventions, we believe that the main results of the process should be incorporated into the early educational curriculum, given that a shift towards a positive perception of collective action and risk awareness should be discussed from an early age. We would also like to put forward the idea that this process is not something that should happen at one time only, but should rather be part of a logic of city production in the future as well. In our opinion, it is crucial for governments to approach urban development understanding that knowledge should be preserved and passed along to future generations, especially in the face of increasing risk trends and changing climates.

The 2017 earthquakes in Mexico meant different things for everyone. In our case, they were the start of a new academic phase in which community involvement was central. By conducting research at the Isthmus of Tehuantepec in Oaxaca, we were able to understand the value of universities in post-disaster recovery, as they serve as an important link between societies, governments, and private institutions to facilitate the flow of neutral information. Our experience allowed us to explore the surface of the myriad of ways in which students and researchers can contribute to the medium and long-term recovery of disaster-stricken places. Not only is it our duty as producers of knowledge to discuss how to improve policies, but we could also be

on the ground and have great potential to make a difference in the short term.

We are firm believers that there is no single path to face risk or achieve resilience, so distinct interventions ought to occur to learn from each other's experience and contribute significantly to future interventions in similar situations. It is our hope that by sharing our findings we can inspire future students to go beyond the "normal" scope of academic work. We believe there is a great value in the ability of educational institutions to link seemingly disparate actors for the benefit and development of different communities. It is also crucial for those of us who work alongside locals to propose feasible and contextualized alternatives that understand the value of the local and the usefulness of the implementation means provided from top-down systems. It is worthless to think that the solutions lie only within one point of view.

11. *Ampliar o Mejorar Tu Casa* is a financial aid program initiated by the government of Argentina to help people improve or expand their homes, as well as to get access to basic urban services and infrastructure. On the other hand, *Hacemos Futuro* is a program intended to help adults advance their elementary education and receive training in various trades.

Reconstruction, Recyclability & Memory

Resilient Schools

Carlos Casaldue / Cristina Solís

In the list of historical precedents that deal with post-disaster scenarios, it is common to find projects that propose an immediate solution to the problems at hand. Those projects generally tackle the pressing demand for housing that people require, a basic-needs infrastructure, and secure the well-being of the citizens of the affected regions.

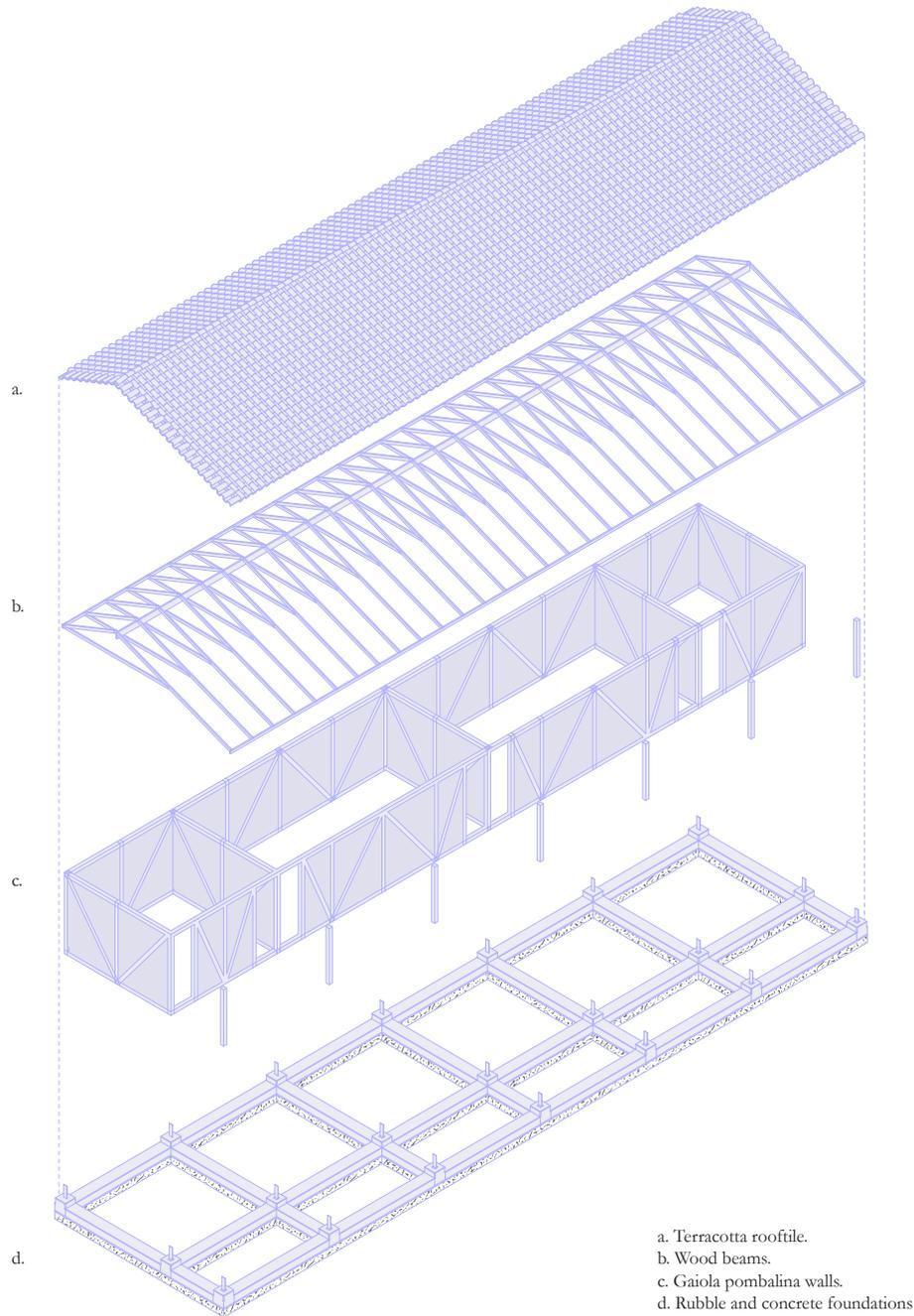
These solutions, while well intentioned, often require external forms of knowledge. This input of external capital, resources and intelligence diminishes with time, and the external agents that can operate and are responsible for securing a degree of normalcy become increasingly less pressed to act. For a project to be successful in truly securing the needs of affected people it has to address all the possible capacities that it can react to.

Since the last series of devastating earthquakes that impacted the region of the Isthmus in Oaxaca, Mexico, back in 2017, many of the affected buildings have started their process of reconstruction, however the solutions offered are often times one-dimensional. One example of this is the reconstruction of the elementary school “Margarita Maza de Juárez” in Asunción Ixtaltepec.

For our project we have proposed an alternative intervention in the premises of the school. The project would have to comply with the following potentials in order to address the multidimensional necessities that the region is facing. The first of these potentials is the need for public infrastructure. This reconstruction has to provide the standardized spaces that a public school has to comply with and, at the same time, imagine new ways of building in the region with unconventional materials.

The material chosen for the reconstruction project is now ubiquitous in the aftermath of the 2017 earthquakes. The use of rubble as a reconstruction material is interesting in the context of the Isthmus because of its abundance and is inexpensive considering the only real cost it poses is in its processing. By using the remnants of former buildings and vernacular materials, the architecture attempts to preserve the memory and identity of the place.

The second potential that we outline is the building’s capacity to teach to the present



Axonometric view of gaiola pombalina construction system

public new ways of construction. Using public infrastructure to demonstrate the potential applications of reusing rubble as a building material helps to erase the stigmas around it and expands the building knowledge of local agents.

This is done by carrying out applied training programs during the construction of the structures. By employing local labor, the program can teach locals about the processing and classification of the rubble and about the necessary structural parameters that the Isthmus requires. The recycled brick will enter the construction site from the beginning as we propose a rubble and concrete foundation to anchor the building.

Using Portugal's reconstruction methods as a precedent, this project proposes the "gaiola pombalina" as a way to re-utilize rubble in the reconstruction of infrastructure and homes. This system stabilizes the brick structure allowing for the safe use of rubble in the cavities that it creates. The roof is composed of a wood structure that sits on top of the gaiola pombalina walls, ultimately weather-proofed by terra-cotta tiles which are an important part of vernacular construction in Oaxaca.

The third of these potentials is that the building demonstrate a degree of risk preparedness. We need to design public buildings that are prepared for future disaster scenarios. One of the main problems that post-disaster projects should address is to serve as safe havens during another instance of a natural disaster.

By providing the school with an initial surplus of bathroom and cooking infrastructure, the building can double as a shelter for displaced families in the event of another earthquake. By locating the bathroom and kitchens between two classrooms they can serve two displaced families that can share these amenities while at the same time finding local



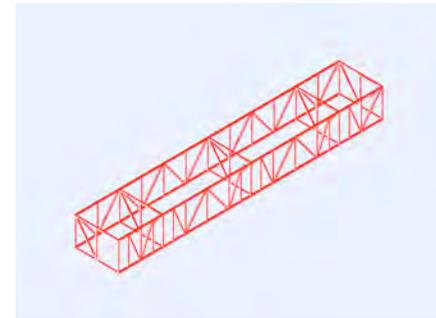
Margarita Maza de Juárez school before the 2017 earthquakes Source: Google maps



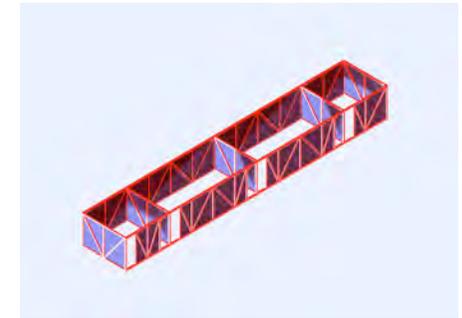
Margarita Maza de Juárez school post-earthquake reconstruction

support. The classrooms can in such instance be equipped with temporary partitions that can provide a large family with different spaces of accommodation and attempt to provide them with some degree of privacy.

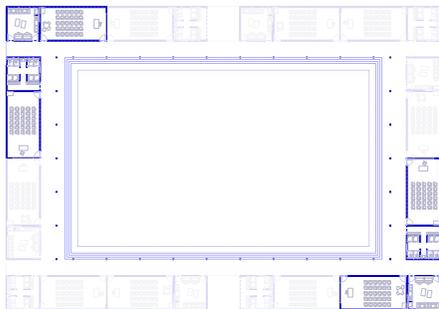
The project was conceived as a three phase construction. These phases can instruct different local laborers on the development of this new system. At the end of the three phases the project constitutes itself in the form of a courtyard building that can provide both the necessary exterior space that the children of the school require and a new space for community organizing and risk response.



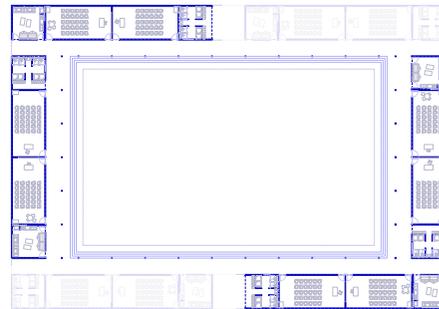
Wood frame system



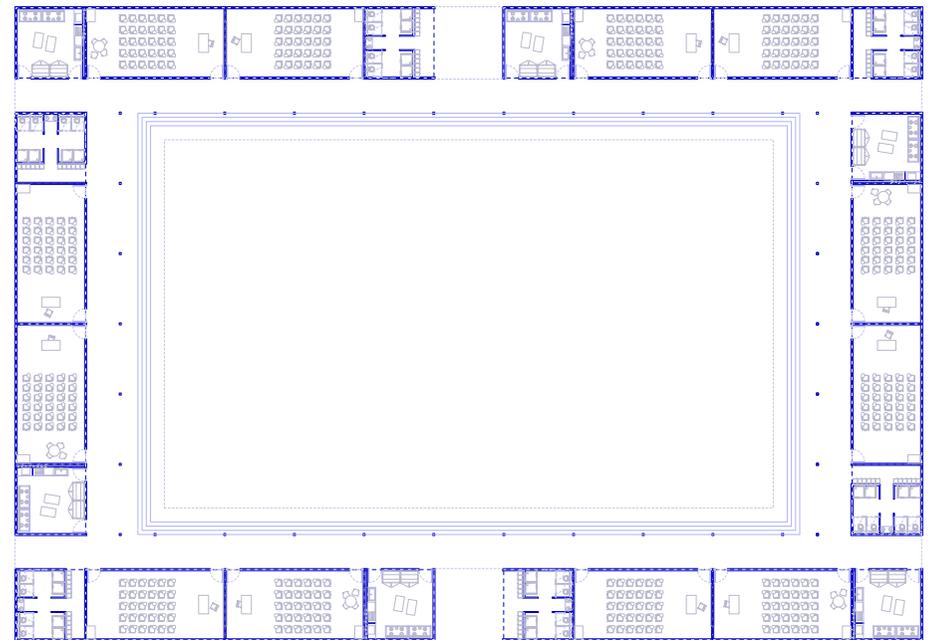
Rubble walls system



Phase 1 floorplan



Phase 2 floorplan



Phase 3 floorplan

Community Educational Resilience

A New Model of Education and Earthquake Preparedness

Karen Mata / Eduardo Peláez

The 2017 earthquakes revealed the fragility of public institutions and infrastructures, the weak urban role of schools, the lack of state capacity to promote more and better equipped schools across Mexico, the low level of education in southern Mexico, and the absence of real educational reform. Given this context of emergency, the Mexican government has promoted a plan to reconstruct more than sixteen-thousand schools¹ and to rebuild four-hundred new schools across the affected zone². However, the intentions behind the process of reconstruction have not included any substantial change, meaning that the reconstruction of schools will follow the same logic of its predecessors. Within this scenario, the disaster could be taken as an opportunity to rethink reconstruction plans for schools as something beyond a static and isolated recovery. Thinking of schools as centers for civic life and resiliency brings an opportunity to invest in an avant-garde concept of open, resilient schools linked to innovative pedagogy and community needs. In this way, a new concept of “community educational resilience” could emerge as an alternative pedagogical approach for seismic areas.

School Earthquake Preparedness in Mexico: Framing the problem.

In Mexico, education is based on a general curriculum and policies that are generated by the central government, most of the time responding to the conditions of big cities. From this centralized model, efforts have concentrated on building new physical structures and on enhancing current operations systems. Examples are the systematization of repetitive modules of schools in order to guarantee public education in rural areas (during the 1960s), and a national educational reform addressing the lack of quality among teachers (during the 2000s).

We propose to use the school curriculum as a way to create preparedness for natural disasters. The proposed changes in the curriculum will serve as a multiscalar approach to inform local economic and cultural activities in rural areas, creating a general

awareness and preparedness for disasters beyond political boundaries.

The earthquakes in Mexico revealed several problems in the organizational structure of the territory, especially when referring to schools. It was evident from the disaster that there was a lack of resilient consciousness and of state capacity to create safe and productive places for learning.

The rural areas of Mexico were the most affected by the earthquakes of September 2017. It is not by chance that poor educational performance, high levels of dropouts, and areas of more vulnerability in case of natural disasters match with the poorest areas of the country. The worst states in Mexico in terms of development outcomes are Chiapas and Oaxaca. There, the bad economy and lack of social resources show that education and public policy have not been redistributive and have not produced positive returns. (see graphic 01).

The results of non-comprehensive reforms have generated patterns of urbanization that put people with the fewer resources at risk while generating all kinds of inequalities and social conflicts at all scales – from local relationships to nation-wide influential teacher unions. Instead of building on the potential of each area, educational reforms and public policy neglect their intrinsic logics.

These areas are characterized by a different scale of economy, more regional relationships, strong cultural identity, and social diversity. After the disaster, Oaxaca and Chiapas appeared to be in a very bad position in terms of negative effects on the physical structures of schools. With more than 16,000 schools affected, 577 needing full reconstruction (267 in Oaxaca alone), the government will need to increase the budget for education more than 150% to return to predisaster status.

This shows a vulnerable political

framework that can be transformed through by-products of the new curriculum and by rethinking a more sustainable and resilient future for less urbanized areas in Mexico.

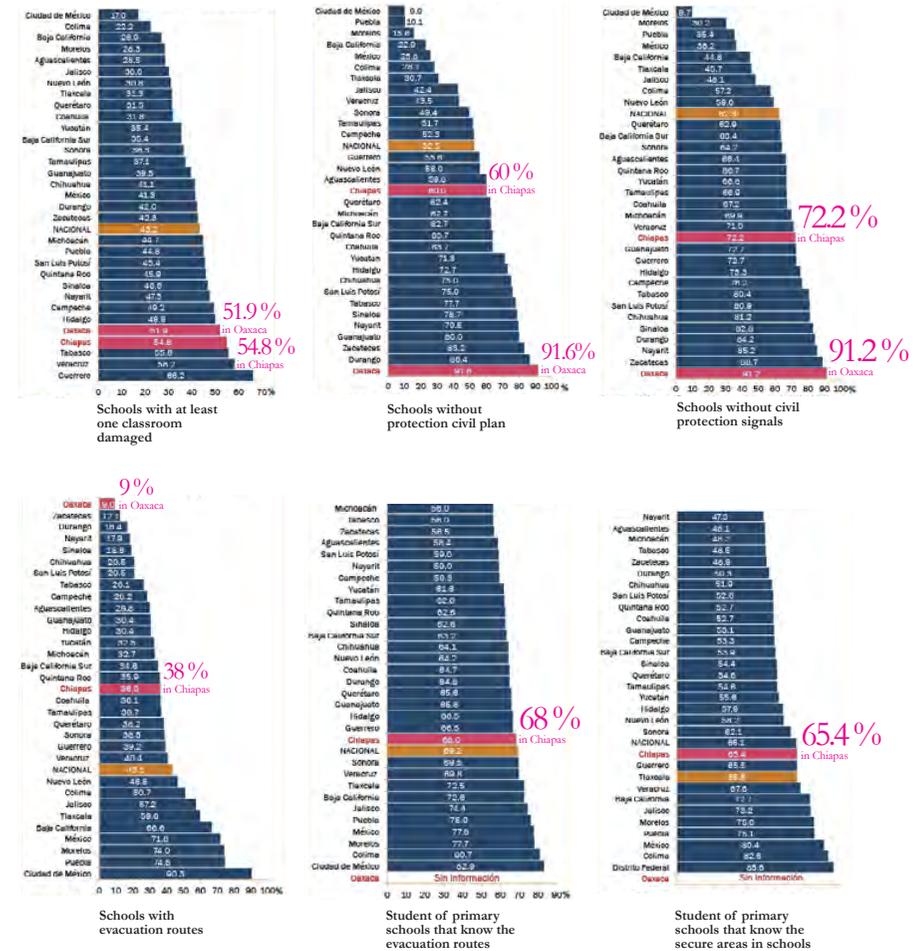
Government structures for the reconstruction of schools.

The physical space of schools in Mexico is a direct by-product of the educational curriculum. In Oaxaca, the Oaxacan Institute for the Construction of Educational Physical Infrastructure, IOCIFED, is the institution that aims to “organize, direct, coordinate, evaluate and carry out the state program of construction, repair, maintenance, rehabilitation, reinforcement, reconstruction, reconversion, habilitation and equipment of buildings and facilities destined to the service of education.”²³ At the federal level, the National Institute of Educational Physical Infrastructure, INIFED, is in charge of issuing norms and technical specifications, preparing guidelines for the administration of resources for educational infrastructure, carrying out follow-up actions in the state when incorporating federal resources, and coordinating the activities of prevention and damage repair caused by natural disasters in the educational physical infrastructure.

In addition, INIFED is “responsible for articulating efforts and promoting the participation of civil society, the private initiative and the educational community in the improvement and maintenance of school buildings.”²⁴

A new curriculum based on preparedness.

Since 1943, Mexico has followed a traditional education model that has had several amendments in its process. However, in 2016, President Enrique Peña Nieto officially launched a new educational reform that seeks the constant improvement and high development level of



Graphic 01. El sistema escolar ante los sismos de septiembre de 2017. Instituto Belisario Domínguez, Senado De La República.

1. <https://www.proceso.com.mx/506390/asciende-a-15-mil-nueve-escuelas-afectaciones-sismos>
2. <https://www.animalpolitico.com/2017/09/12-mil-escuelas-danadas-577-perdidas-total/>
3. <http://www.iocifed.oaxaca.gob.mx>
4. <https://www.gob.mx/inifed/que-hacemos>
5. Secretaría de Educación Pública. “Modelo Educativo para la Educación Obligatoria.” (2017, pp.27,28)
6. <https://www.dw.com/es/per%C3%BA-ni%C3%B1o-de-nueve-a%C3%B1os-construye-detector-de-sismos/a-40714397>

students with a humanist approach. This new educational model is based on an education with quality and equity where the training of students is the center of all educational efforts.

In this context, the curriculum of basic education is focused on an integral development of students to help them be prepared for the rest of their lives. In addition, it is the first time that the curriculum not only looks for an academic but also for personal and social development with an emphasis in socioemotional skills. However, the most interesting part of the curriculum is that it allows the individual and collective modification of its structure based on the real needs and resources of institutions depending on context, culture, environment, native language, and society.⁵

This can be seen as an opportunity to promote a better civic education and earthquake preparedness in areas that have been historically affected by earthquakes or are located in risk areas. As almost 30% of Mexico is in high and moderate risk conditions, the idea of earthquake preparedness is an urgent topic, especially on the western coast of Mexico. In this way, not only the physical structure of the educational institutions can cope with a possible disaster, but also society can be informed and mentally prepared.

Curriculum as an opportunity for social construction in earthquake preparedness.

The possibility to reorient the curriculum based on contextual features is a key factor to envision a different pedagogical approach that takes into account earthquake preparedness for those regions that are located in seismic zones in Mexico.

The progress and consolidation of a new program of preparedness will depend on the right match between a top-down

approach and a bottom-up initiative. In this context, people should be the main force of change to implement educational programs and allow children to have more voice and action in the implementation of those programs. Moreover, the Secretariat of Public Education in Mexico should provide incentives and increase the budget for extracurricular activities, to construct new spaces and to spread a culture of earthquake preparedness across Mexico. In addition, all the actions and strategies established in a new curriculum about earthquake preparedness have to be aligned to national and local disaster management plans in order to connect schools and communities with other actors such as national rescuers, police, firefighters and more.

The “Community Educational Curriculum” (CEC) Model

A curriculum for promoting resiliency and earthquake preparedness should link schools to the community. In addition, this curriculum should create awareness about disaster risk reduction through innovative activities, courses, and workshops. Therefore, the CEC model depends on two main pillars: children, youth, and communities that actively participate in the co-production of preparedness, and schools that are centers for learning about disaster risk reduction. The CEC’s goals are:

- The protection of children, teachers, directors, parents, and neighbors from death and injury in schools and other locations.
- The improvement of a disaster resilient citizenry through education.
- The creation of a learning and social development about disasters.
- The promotion of democratic processes to enhance earthquake preparedness.

- The urban importance of schools for a better quality of life for communities.
- Active participation of children, youth and other vulnerable communities in the educational and political agenda.
- Inclusion of a budget for disaster risk reduction in the annual plans of educational institutions.
- Creation of partnerships between local municipalities and/or educational institutions to have safe learning zones in schools and cities.

School and community preparedness

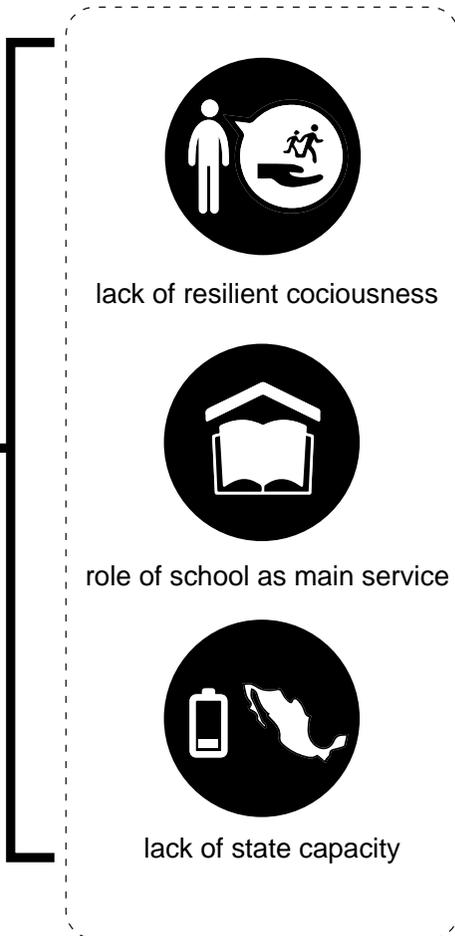
It is mandatory for an educational model to imagine and promote a new pedagogical structure that considers earthquake preparedness for schools in seismic zones.

It is important to understand that the way of learning is not about following protocols and rules, but it is about researching, proposing, and sharing strategies and projects about earthquake preparedness, and that success of this new model will depend on engaging adults and children in prevention. The Ministry of Education and other organizations who are involved in science, geology, and technology can scale events through national competitions to increase the awareness of earthquake prevention. For instance, in Peru, the Ministry of Education and the National Council of Science, Technology and Innovation launched a national competition for students, and a nine-year-old child won the competition with a detector of seismic movements made from simple materials.⁶ Another example can be found in India with the National School Safety Project (NDMA), where children and youth from different states of India came together and demonstrated their understanding of risk, school disaster management planning, and their role in monitoring and implementation.⁷

7. <https://ndma.gov.in/en/national-school-safety-programme-a-demonstrative-project>
8. <http://www.redocara.com/curativos-urbanos2016mx>
9. <http://www.crefal.org/aprenderico-2>



EARTHQUAKES



issues that emerged from the earthquake

MEXICO

+\$1 Billion
to recover them

16.000
damaged

577
need full reconstruction

OAXACA
2.965
affected in Oaxaca

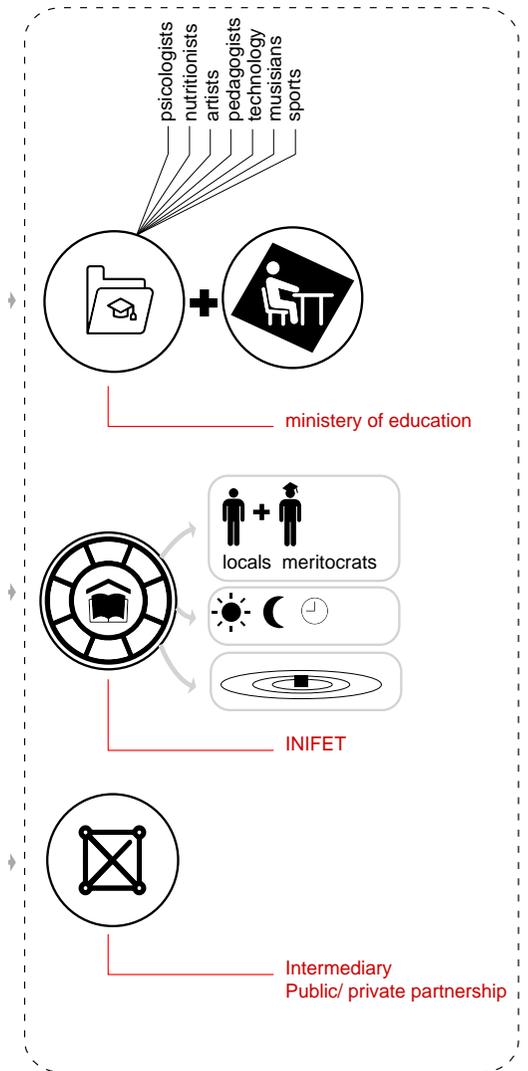
CHIAPAS
2.364
affected in Chiapas

\$2.700
per school

66%
damaged

267
need full reconstruction

numbers associated with recovery and education



possible approaches

Pedagogical approach based on projects: Learning by doing.

The traditional learning model of earthquake preparedness designed by “specialists” places children as receivers of information and procedures. Children have a passive learning and the success of those activities is measured by how much time is spent in evacuation drills and how many children can recognize signs to evacuate a building. However, the model should change to actively engage children and adults in the co-production of knowledge, actions, and protocols for earthquake preparedness and resiliency.

The idea of a new resilient citizen.

Children are living with everyday risks everywhere. Although there are many ways to learn how to overcome problems and difficulties during life, the school can be the place where children can reinforce their resilience. Hands-on educational activities, learning about past earthquake events, problem-solving projects about prevention, learning about the environment and climate change, and visiting affected zones are examples of how to increase awareness and resilience in children. Thus, the implementation of a curriculum that considers earthquake preparedness can promote a new generation of students with stronger, resilient skills and a better prepared society.

Guidelines for a new model of education.

Curricular activities: The community educational curriculum proposal seeks to empower children and communities in their resilience and earthquake preparedness.

One way to propose courses and activities to improve the competence of students is by allocating specific tasks for specific ages. For that reason, students have to be able to imagine and build

innovative alternatives to cope with an earthquake.

Generally, these kinds of actions begin with a recognition of the current physical state of the school, neighborhood or city. For instance, the collective *Bela Rúa* promotes an urban proposal for children called “Urban Curatives.” This proposal seeks to improve the critical thinking of students by actively recognizing some urban problems in the neighborhood that can affect them.⁸ This activity can be replicated in schools to recognize some problems that a school might face in and after a disaster. Hands-on educational activities can involve children in the production of prevention. For instance, evacuation signs and circles on a school patio can be painted and designed by children. In this way, students can have more awareness of the real value of evacuation, and they will feel like direct participants in the co-production of earthquake preparedness.

Furthermore, children and young adults can be part of planning for risk through the production of maps, emergency plans, emergency kits, and more tools for earthquake preparedness. These projects can represent a cross-disciplinary goal and the opportunity to connect different subjects through a single project. The Ministry of Education of Cuba promotes the creation of risk maps in order to understand students’ individual and group perceptions of disasters.⁹ Moreover, redesigning and rebuilding some spaces affected by the earthquake in the school and city is the best way to face the real problem and overcome it with collaborative actions.

Qualitative reasoning about earthquake preparedness provides a stronger understanding of the primary principles of the earthquake and helps to conceive new insight about the problem, based on people’s opinions and motivations. Therefore, through participatory work it could

be possible to pick up and share comments, feelings, and repercussions of an earthquake with children. These kinds of activities and projects reinforce emotional well-being and educational performance.

In quantitative reasoning, data and numerical assignments can be connected to the earthquake damage through research projects. The school can be the factor of earthquake assessment and preparedness of the community, showing numbers of people involved, goals and actions reached and urgent actions to solve. In addition, students can also learn from the analysis of simple structures to recognize how some buildings react during an earthquake better than others.

The new way of risk reduction and resilience education in schools has a radius of action beyond the boundaries of the school. Thus, the school is seen as the center for preparedness for the community that promotes workshops and programs during non-school hours. Extracurricular activities also follow the four modes of operation of curricular activities but have a main focus on how to improve the preparedness of families and communities in the city.

In addition, a model of workshops and courses on Saturdays is an effective way to promote these activities. Moreover, it also works very well when the activities of earthquake preparedness can be divided in two. A first session of one hour and a half of quantitative and qualitative reasoning, and a second session of more active work through hands-on activities in indoor and outdoor places.

In these sessions it is very important to highlight people’s perceptions about their contextual vulnerabilities and then work to create a map of risks, risk reduction alternatives, and new strategies of what to do when a disaster comes.

A set of principles for the curriculum

Based on this framework and theoretical understandings of transforming the curriculum as a tool for preparedness and social development, there is a set of propositions that work in local and territorial scales to embrace resiliency. This project aims to create a multiscale approach to education that helps to inform patterns of urbanization, urban development, and daily dynamics for pre- and post-disaster scenarios. The different scales of operations in which the curriculum needs to operate must respond to these basic conditions:

1. Visualization
2. Accumulation
3. Performance
4. Knowledge

Visualization refers to the idea of signals and the idea that everyone is able to see directions to safe places and ways to escape. Accumulation is thought of as a node of services in which people know that there will always be resources like food and water available in cases when they are needed. Performance is based on a sequence of actions that need to be done in order to be safe and put others in a safe situation. Knowledge is linked to the idea of “learning by doing,” and it aims to create knowledge about risk areas and the further set of actions that accompany this condition.

By creating a curriculum that responds to these principles, people will not just have better spaces for recreation and learning, but a set of ongoing processes build on the ideas of resiliency and recovery that will help them to continue and actually improve their lives.

From the classroom to the city, a multi-scale set of propositions for preparedness

Classroom scale: The classroom is a laboratory of ideas and projects. The new set of actions, activities, and programs im-

ply a reformulation of the physical space and tangible educational elements of the classroom. Classrooms and their furniture should be flexible to allow different uses of the space according to different projects. The arrangement and flexibility of the furniture should permit collaborative uses and easy stacking. In addition, each classroom is the starting point for preparedness and should have all the necessary signs and indications to be prepared if a disaster comes. In this way, the equipment and physical space of the classroom will transmit safety to children and youth.

School scale: The way this project envisions the relationship between education, community and the curriculum is by imagining schools, broadly, as safe nodes. Currently, schools are used as shelters after disasters or as places to host civic events. However, our proposition is different. It starts by creating a much larger framework in which schools could operate and be reshaped by local contexts. Linking activities and spaces inside the schools to serve larger programs of prevention will enable people to have better tools to recover.

Contrasting this idea with the principles mentioned above, schools should be points of accumulation, and dedicate specific areas to accommodate resources if a disaster happens. This should be accompanied by a certain performance or sequence of actions associated with the curriculum that could check a list of food and water provisions. For instance, as important as it is to line up the students in the courtyard before going to each classroom, it is also relevant to rotate students in schools to check and guarantee that there are enough resources available to suit the school's community in times of a disaster. This could be implemented during a semester in which every two weeks students from different grades could take turns and gain a sense of responsibility.

There could even be a class that teaches students how to manage disaster by taking care of their own school. This will also create knowledge for life and not only while students are in schools.

City scale: At the city scale, there are more actors involved when a disaster hits. Local residents and civil society, the police, the military, and firefighters. Trips or visits to the different departments of the city will help to create better knowledge of what they do and most importantly where to find them. These departments should also visit schools, not just to run regulatory inspections but to talk to students and better inform them about the processes to follow during a disaster. This could happen once a semester.

We also recommend taking the opportunity of classes to collaborate with local security and disaster response forces to plan ahead and organize students so that they know how to respond or where the safest places in the school and locality are to seek refuge or congregate after a disaster strikes. This can be done through mapping exercises aimed at preparing students and school personnel to react and at teaching students more about the areas around the schools. This could also provide more information to security and response forces so that they can make better plans.

There is also the possibility of creating and placing signage indicating safe and risk zones, as well as other information that could be in public spaces to help people know where to go in case of an emergency. The idea is to generate the knowledge and capacity needed for students and neighbors to perform better when needed. The program can be linked to the hour of community service needed by students to graduate from high-school.

Conclusion

Based on the situation that Mexico is going through and the challenges faced both by the current educational system as well as the effects caused by the earthquakes of 2017, intervening in the curriculum appears to be an urgent task for government officials. We envision that to implement a new educational curriculum will be very significant in creating more sustainable and resilient outcomes.

The guidelines presented in our CEC project serve to prepare any citizen, especially children, to know better ways to react in any place, not just in schools. This system keeps people connected to their built environment and to the processes related to human nature. Furthermore, a new curriculum that includes multiple scales – classrooms, schools, and the city – will help people to create a sense of preparedness over time.

If in 30 years another earthquake hits these areas of Mexico again, people will know what to do and how to operate because the processes will already be internalized in their daily practices. This is the only way to maintain mobility, economic activity, and a general way of life after a disaster.



Along Fault Lines

Urban Affect Network

Antonio Moya-Latorre / Daphne Xu

Along Fault Lines explores the potential role of art and culture in the reconstruction process. The idea – a social infrastructure connecting artists from around the world with local grassroots organizations in the Isthmus – originated from research on arts and culture in the region and developed from further reflection on the role of students and outsiders in the reconstruction process.

More than one year after the 2017 earthquakes, the Isthmus, a primarily rural region, remains the most affected in the country, with inadequate aid distributed to local residents and planning that does not account for local ways of living. While the area is physically rebuilding, it is also struck with the challenge of emotional recovery.

Almost like a natural response, the community of artists from the Isthmus and other regions in Oaxaca reacted to the shocking event. Many artists spontaneously contributed with whatever they had at hand to improve the living conditions of the affected communities. Some artists started painting murals on the walls that withstood the shock to bring attention to the strength of the “Istmeños”; some others organized workshops to keep children active while schools remained closed; some even sold works to collect funds for the reconstruction processes.¹

As most of its inhabitants still feel a deep sense of abandonment and helplessness, there is a need for a systematized psychological reconstruction in the Isthmus of Tehuantepec. Although there have been several local responses that try to reduce the post-traumatic stress of the region’s population, there is no infrastructure that connects existing initiatives and that makes them legible to a global audience. By creating a strong network within the Isthmus and bringing attention to existing grassroots organizations, there is an opportunity to channel resources from socially-engaged artists and cultural institutions around the world towards building the emotional resilience of the Isthmus.

Fieldwork in Oaxaca

After visiting the Isthmus of Tehuantepec in August 2018, we were struck by the idiosyncrasy of its population in relation to the rest of Oaxaca. The isolation of the region contributes to the diverse identities of each individual town. When we visited we quickly sensed the cultural richness of each place and the strong sense of identity and connection to land that local residents have.

Meanwhile, the isolation of the region also caused the slow and insufficient post-earthquake reconstruction of the region. There was a lot of frustration among varied stakeholder groups about the inefficiencies of reconstruction and the lack of understanding of local residents inherent in state-funded interventions. Our immediate reaction to the complexities of the region presented to us was that many more resources should be directed into local hands. We also discussed the lack of institutional support towards the healing and well-being of a population that feels neglected and misunderstood.

Reconstruction in a Culture of Resistance

Gaining a deeper understanding about the context of Oaxaca and the Isthmus – specifically about its history in relation to popular resistance movements, politically engaged art, and the tensions between local customs and global, neoliberal influences – was of great importance to us. While visiting the Isthmus, the cultural vitality and the strength of grassroots resistance was especially apparent.

We argue that the history of resistance against state megaprojects and international interventions in the region, the abundance of politically engaged artistic endeavors, and communal rituals of gathering can all be seen as opportunities in the processes of reconstruction. The

Isthmus is known as an area of social conflict – especially Juchitán – and it is often misunderstood by non-Istmeños. This condition has caused the failure of state and non-profit projects because they do not adequately account for local people. By developing greater awareness of a history of the Isthmus grounded in the people, we arrived at the idea of supporting socially-engaged art practices among local grassroots organizations to further propel the Isthmus through its reconstruction.

Emotional Resilience in the Isthmus

Imagine a web of solidarity made up of individuals, collectives, organizations and institutions who are committed to channeling energy and resources into local communities looking to reconstruct and heal. Along Fault Lines is an infrastructure that systematizes the knowledge exchange between local and global actors through an online platform and the coordination of socially engaged artist residencies in contexts such as the Isthmus of Tehuantepec, Oaxaca. We believe that by facilitating an exchange between local grassroots organizations and artists from around the world – in this case from places that have a history of earthquakes – we can spark opportunities for new affinity groups to reach beyond geographical borders.

We are interested in the intersection between urbanism and art. As outsiders who do not live in Mexico, we can look at places with a broader perspective and facilitate connections between local and global communities. As MIT students with backgrounds in art, we also have access to resources and networks around the world that would potentially be able to provide support to the local grassroots organizations in the Isthmus. We also identified a potential match between the needs of local grassroots organizations



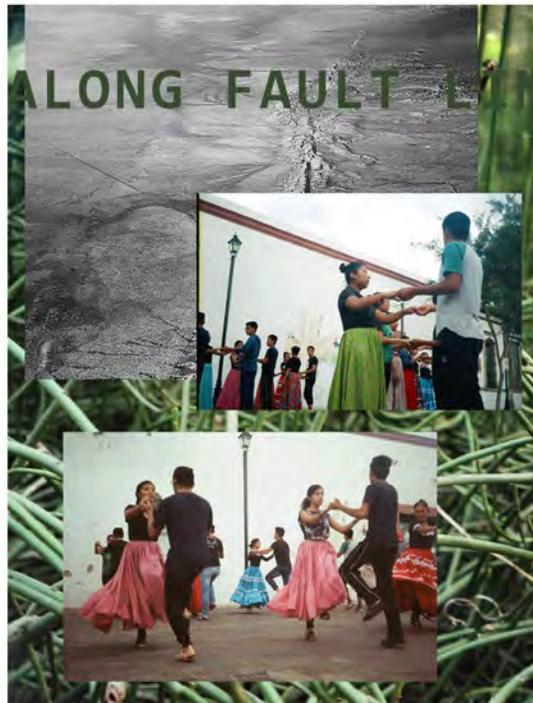
Mural from Colectivo Chiquitracas as it appears on “The Art Catalogue”, project by Antonio Moya-Latorre for ADV-9147 Beyond Reconstruction Spring 2018 course

1. Some of the most relevant responses by local artists were collected in an art catalog that Antonio Moya-Latorre put together for the Spring 2018 “Beyond Reconstruction” class at Harvard GSD. The catalog can be downloaded from the list of resources on the Along Fault Lines webpage: <https://www.alongfaultlines.com/resources>

Urban Affect Network

HOME LATEST

EARTHQUAKES IN OAXACA, MEXICO



HOME
 ABOUT
 PLACES
 OPEN CALLS
 RESOURCES
 U.A.N.
 SPONSORS

[LEARN MORE](#)Screenshot from alongfaultlines.com home page.

and those of socially engaged artists.

On the one hand, we identified that the institutional reconstruction in the Isthmus is mainly focused on the built environment, but there is no institutional support for the mental wellbeing of the affected communities. On the other, many artists around the world seek experiences in new contexts through residency programs. We believe that bringing in socially engaged artists as volunteers in contexts of vulnerability could allow for cultural and knowledge exchange.

By starting to connect organizations across the Isthmus with artists abroad using the alongfaultlines.com platform, we hope to facilitate cultural exchange along places that have experienced earthquakes. The local organization and artist would be encouraged to co-create art-based proposals that contribute to the emotional reconstruction of the community.

Other entities to consider include sponsors/donors, local media, local suppliers and businesses, local creative spaces, and local communities.

In this way, foundations and philanthropists with interest in spending their money on art-based social causes can support Along Fault Lines. Additionally, local donors, including foundations, local governments and particular individuals could contribute with targeted sponsorships to make specific projects/residencies possible.

In parallel, local media can contribute by promoting the projects that artists are going to work on during their residencies in order to start engaging with the community. Local suppliers and businesses can provide the necessary materials for the activities that take place during the residencies and can also benefit from an additional source of income. Local creative spaces across the various towns in the Isthmus can be sites for future projects, and local communities will work hand in

hand with the artists to co-define their needs and solutions.

While conceptualizing the project, we researched definitions of urban trauma and the ways in which artists have engaged with earthquakes around the world. This helped us refine our own definitions of socially engaged art and guidelines for methods we want to encourage in the projects that take place in the Isthmus.

In “Understandings of Coping: A Critical Review of Coping Theories for Disaster Contexts” by Manfred Zaumseil and Silke Schwarz, notions of collective coping and collective agency are described as involving the building of social capital through a series of networks used to promote certain interests. Unlike individual coping, feelings of solidarity, sense of community, and empowerment are integral to collective coping. We position our project in the framing of collective coping through the facilitation of support networks that reach across borders.

In *Urban Alchemy: Restoring Joy in America's Sorted-out Cities*, Mindy Fullilove describes “hysteresis”, a principle of physics that teaches us that the past conditions the future. The process of overcoming past destruction of communities involves not only stopping the source of injury but also reanimating the life of the community. She also reminds us that after being disturbed, systems return to stability, but that sometimes the stabilization point can be worse than before. We believe moments of urban trauma can be seen as opportunities to lurch forward in an upward spiral of recovery.

At the core of the methodology, we want to encourage the idea of the catalyst. The projects developed during the artists residencies involve participation and action and enable the community – once the artists leave – to continue working on its own and solve its problems under the coordination of the community leaders



© Antonio Moya-Latorre

One of the murals made possible by Una Mano Para Oaxaca in Asunción Ixtaltepec

that emerge during the process. Additionally, working together will develop a sense of solidarity and the possibility of new affinity groups.

To make all this possible, the projects need to respond to the following criteria:

1. Long term interventions: As opposed to short-term artistic interventions, the residencies facilitate the presence of artists for longer periods of time (1 to 12 months), as the unique way to address deeper challenges that the community might be facing.

2. Conceptual planning: Although the project itself has to be defined and developed once the artists start working on the ground, there needs to be a framework that has been previously co-defined by the UAN, the local organizations, and the artists.

3. Starting small: The artists have to start addressing very specific problems that lead the conversation to move forward to bigger issues that the community is going through.

4. Deep changes: Beyond the specific problems addressed, the development of the projects has to lead the community to question social structures they might be embedded in.

5. Co-production: During all stages of the residencies, the projects have to result from a co-production process between the community, the artists, and other agents involved.

Correspondingly, on our website, we highlight that we seek artists and projects that will:

- Address sociocultural and psychological elements that mediate the disaster experience and recovery.
- Create opportunities for risk reduction (including risk awareness and risk preparedness) and reconstruction of sense of place and collective identity.

- Channel resources into local grassroots activities and movements. Uplift local knowledge.

- Emphasize people's access to material, social, and political resources.

- Be in continual process through a long-term engagement with communities.

Current Status and Next Steps

As of December 2018, we have partnered with five local organizations: Una Mano Para Oaxaca, Sala de Lectura (Ra roonda nee ra riisidi binni), Foro Ecologico Juchiteco and Pasa la Voz. Respectively, they are based in Ixtaltepec, Ixtepec, Juchitán, and across the Isthmus. Una Mano Para Oaxaca facilitates community development and social entrepreneurship projects, including crafts trade workshops, cultural workshops, healing workshops and murals representing local trades. Ra roonda nee generates spaces for children and adults for pleasant and playful reading. Through different workshops, it fosters citizen participation and critical thinking about local culture. Foro Ecológico Juchiteco organizes workshops, festivals and seminars to enhance the ecological awareness in the community. Pasa la Voz promotes environmental education in post-disaster contexts by producing useful information that facilitates bottom-up reconstruction processes. They are interested in recycling rubble, generating risk awareness among the communities in the Isthmus, and building platforms to enhance public participation. We are currently speaking to Emilio Hernandez, an artist from Oaxaca with international experience in refugee camps.

All of the local organizations are grassroots efforts that have a commitment to working on the reconstruction of the region using socially-engaged art. Additionally, we intend to highlight on the website past art projects responding to earthquakes and specific earthquake contexts.

We have featured the work of Chilean artist Nicolle L'Huillier. Her sound installation *Diastrophisms* is done in collaboration with two artists, Tomas Sanchez Lengeling (Mexico) and Yasushi Sakai (Japan). The term diastrophism refers to the deformation of the Earth's crust as it folds and faults. The project "is a sound installation with a modular system that sends images through rhythmic patterns. It is built on a set of debris from the Alto Río building that was destroyed by the 27F earthquake in 2010 in Chile. With *Diastrophisms* [the artists] were looking for a poetical, critical and political crossing between technology and matter, in order to raise questions about the relationship between human beings and nature, and to consider the construction of memory in a community by questioning the notion of monument, as well as to imagine new forms of communication in times of crisis."² The nature of their collaboration reflects the spirit of *Along Fault Lines*, as they are artists from three countries prone to earthquakes.

We believe that continually inviting artists and local organizations into a larger network dedicated to building emotional resilience in response to urban traumas will make the *Along Fault Lines* platform stronger and more robust. *Along Fault Lines* is part of a larger project to develop a MIT-based Urban Affect Network that explores the intersection between urbanism and art while connecting relevant artists, community organizations, researchers, practitioners, and sponsors.

2. <https://nicolelhuillier.com/portfolio/diastrophisms/>



Infrastructural Public Spaces

Children's Recreational Center in Juchitán

Loreta Castro Reguera

On September 7th, 2017 a severe earthquake (8.2 Richter), with its epicenter on the Tehuantepec Gulf near the Oaxacan shoreside, dramatically affected the Isthmus region, particularly the town of Juchitán, head of the municipality. According to the Ministry of Territory and Urban Development (SEDATU), 13,485 buildings were damaged only in this town, producing 2,240,400 tons of debris. The earthquake's physical and environmental impact was exacerbated by the floods that already tend to paralyze the Isthmus during its rainy season. Altogether, floods, debris and its underdeveloped water infrastructure created a state of emergency that lasted for over a year.

In this scenario, the reconstruction process started. Different short-sighted strategies were applied in an effort to rebuild the Isthmus towns as quickly as possible. Some of these were more damaging than helpful: the lack of a long-term plan to rebuild towns, the removal of debris from the streets and its dumping in the river banks, and the reconstruction of houses out of cheap materials that disregarded the traditional methods which deliberately provide natural light, ventilation, and open spaces to a very particular population.

During the last year and a half, in Taller Capital, we have been searching for better design responses to increasingly frequent chaotic scenarios. The work that we have produced during the last six years is tightly related to responding with options to vulnerable situations through architecture, landscape, and urban design strategies. Under these circumstances, which are the strings that can be pulled and the elements that can bring stability when precise and fast answers are needed? To which pre-existing contextual conditions should an architect address in order to present cogent answers? During the process of this project, we discovered two important guidelines:

1. Putting together a team of on-site experts, exceptional researchers, and committed designers that are willing to share knowledge and time to respond to disasters.
2. Pushing donors who will fund a noble project that can catapult their company.

These two need to be present for a long time, as these projects are usually not easy to implement.

After several meetings with both team and donors, we came up with the following design question: Is it possible to rematerialize debris, product of natural disasters such as earthquakes, as the main material of the reconstruction process?

The Site

Juchitán de Zaragoza has 74,825 inhabitants (INEGI). Together with Ixtpec, Ixtaltepec, and El Espinal, it is one of the four towns settled along Río Los Perros (or Las Nutrias), and draws from the benefits that the water body offers. The flatness of the land, the 900 mm/yr of rainwater, and an underdeveloped drainage system, lead to the accumulation of rain in the urban area, limiting mobility in the town during and after storms because of the excess water. Additionally, and as stated before, the Isthmus is very vulnerable to earthquakes. During 2018, 30,350 tremors took place in the Mexican territory. 65.7% of them happened in the state of Oaxaca.

The Culture

The Isthmus of Tehuantepec's culture is a reference for the entire country. Strong women, their traditional outfits – composed by wide black skirts, colorful embroidered tops, and elaborate floral hairdos – and their relevant presence in public life are distinctive of the region. Local graphics and painting have been represented worldwide, headed by Francisco Toledo, who leads the school of Oaxaca. Zapotecs are one of the strongest Indigenous groups in Mexico, still preserving untouched language, traditions, and lifestyle. Juchitán has served as the cradle of this culture, nurturing it with its complex political, economic, environmental, and social context.

The Problem

After the destruction brought by the September 2017 earthquakes, the town faced severe issues. Reconstruction meant not only rebuilding lost homes and public buildings, but also addressing floods, understanding the destiny of debris, the efficiency of construction systems, and the reuse of materials. All these knitted together through culture and tradition.

As described before, most of the material products of demolition became severe pollutants for Río de los Perros. Sewerage infrastructure was highly damaged, provoking drastic health problems, especially during floods when water spills over the streets. Public spaces, hard to find in town and so necessary during chaotic times, were revealed to lack even basic maintenance.

Our studio was approached by the Austrian company MK Illumination, with offices in Mexico City, eager to help with donations to refurbish a specific public, damaged space that would improve children's quality of life. Our friends from Root Studio in Oaxaca, working in the reconstruction process in Juchitán, suggested that we join their efforts in reconstructing the severely damaged Children's Recreational Center Hidalgo (CRI Hidalgo) which was still lacking a project and money to refurbish its entire public space.

The Challenge

We visited Juchitán and invited Nadyeli Quiroz to join the team, as she was undertaking thorough research on the effects of debris in the river and its proximate territory. We then worked on formulating a hypothesis: Public spaces in Juchitán should be alternative water management infrastructures while becoming resilient spaces that are prototypes for efficient and sustainable construction systems.

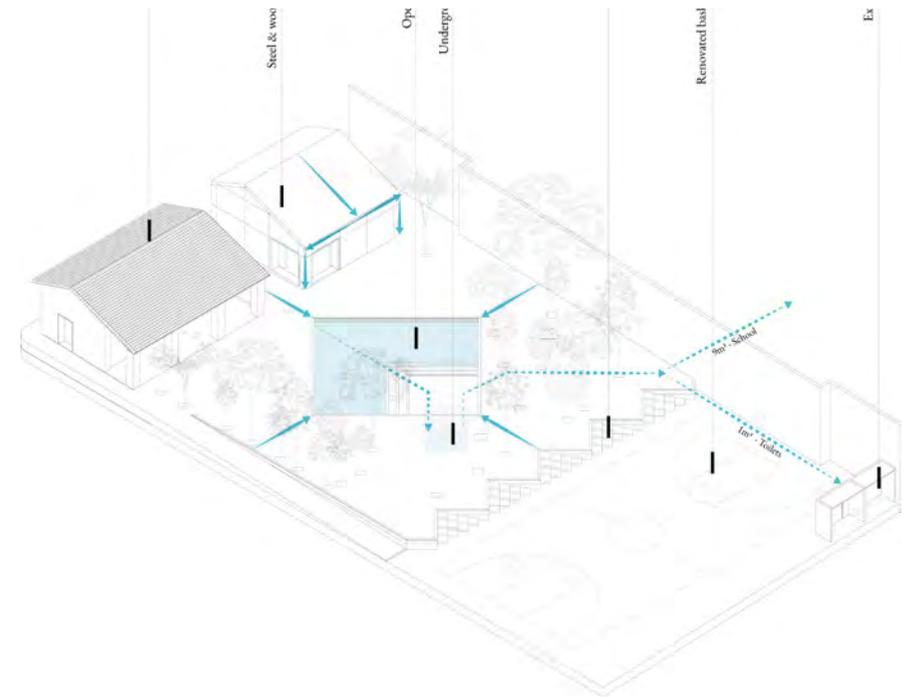


Figure 1. Axonometric of CRI Hidalgo showing the position of the new wood and metal workshop, following the volumetry of the adjacent library. The entire project focuses on rainwater harvesting through roofs and pavements to later store it underground for further use in the school and in toilets.



Figure 2. Left: Gaiola pombalino system in a building under renovation in Lisbon. The image shows the rigid wood structure filled with debris. Right: Brick was recovered and stored for later use during the post-earthquake period in Juchitán.



Figure 3. Rendering showing the open air cistern in the foreground and the workshop and graffiti wall behind. The composition of the ground and the materiality of the workshop are shown together with the use of space. The total area of the intervention is 754 m² of the total 1282 m² park.

1. The Gaiola consists of a set of plane trusses, called frontal walls, connected at the corners by vertical bars that are part of orthogonal frontal walls. Each frontal wall is made of a set of triangles, a geometry similar to the steel trusses of today. Since the triangle is a geometric figure that cannot deform without variation in the length of its sides, each frontal wall only needs to mobilize the axial force of its bars to resist forces in any direction in its own plan.

Therefore, the connection between orthogonal frontal walls by means of common vertical wood bars yields a tridimensional truss capable of resisting forces applied in any direction. In general, the space between the wood bars of the frontal walls is filled with weak masonry, and the surfaces are covered with a finishing material, making the Gaiola generally invisible.

The CRI Juchitán will hold an open air, rainwater cistern that, through filtering, will fill an underground water deposit. It will be a playground for children and an open-air auditorium with steps looking towards the basketball court. Additionally, in order to engage teenagers, it will host a small wood and metal workshop building and a 50 m² graffiti wall.

Strategy and Project

Is it possible to rematerialize debris and use it as the main construction material for CRI Hidalgo? The city of Lisbon, Portugal, which was completely rebuilt after the 1755 earthquake and fire through a system called *gaiola pombalina*,¹ meant to reuse debris instead of discarding it. In the Isthmus towns, the debris from collapsed buildings and, more importantly, bricks, are dumped in the streets to be later thrown away. The project focuses on using them as the main material in the reconstruction.

As shown in the diagram (Figure 1), the project essentially upgrades the role that public spaces play during natural disasters. CRI Hidalgo will hold a program generating activities for the youth on a daily basis, while working as a shelter for both humans and goods, during times of disaster. Architecture is materialized under the principle of reuse: dumped brick for ground modelling and pavements and debris for wall construction.

The design of the horizontal layer holding the open-air cistern, the step-grades, the playground and the existing vegetation is based on the geometry of traditional Istmeño embroidery. The unit is a brick. Part of its materialization consists of its recovery from the thousands of buildings that were damaged or that collapsed after the earthquake. The ground is elevated fifty centimeters, making it even with the planters that currently

occupy most of the park. This move eliminates borders between street and public space. It also helps generate slopes within the public space to collect rainwater from both roofs and ground in the open-air cistern. Water is later filtered and saved underground. Broad ramps facilitate movement in and through the site.

The workshop is a squared floor-plan building, designed by understanding the massing of Juchitán's traditional constructions, specifically the existing children's library building adjacently located on the site. The threshold to the center is formed by these two volumes. Sixty-centimeter-thick walls will be erected under the *gaiola pombalina* system: a rigid steel frame structure, later filled with debris. This will be covered by a light gable roof. Four large openings placed on the corners connect the workshop to the public space, making it easy to access and use. (Figure 3)

Next Steps and Lessons Learned

This project has been an important exercise in patience. When things seem to be ready to start construction, a delay appears. As time goes by, the expectations also become larger, forcing the project to continually adjust. Today the project is still waiting for part of the funding. An extra fundraising effort is being made by MK Illumination, who has been able to save \$100,000 USD of the \$250,000 USD needed. A campaign featuring local artists was launched in mid-March 2019. The team is hoping to have the funding completed by the end of July. Our aim is to have the CRI Hidalgo completely rebuilt by December 2019.

Modular Infrastructure in the Public Realm

Amplifying Public Space in Asunción Ixtaltepec

Xio Álvarez / Clarence Lee / María Peroni

Public space is a type of infrastructure. When affected, it creates large civic vulnerabilities within society, and at the same time it holds immense potential in addressing post-disaster resilience. Throughout our research, we have observed five basic functions of public space within metropolitan areas:

1. Public Space as Ritual: Urban space is not only a spatial but also a social construct. Its identity is co-developed by people, activities, and events. In an area such as the Isthmus where public space engages with the daily routine of the community at large and where the event is a public spectacle in itself, the interface of public space takes on a different role with the community that surrounds it. There is no better example of this than the markets that populate each of the cities that lie along the Rio los Perros. Each market holds an immense amount of civic importance as a space of public interaction and as a catalysts of local culture.

2. Public Space as Void: How do we deal with the collapse of public space in periods of disaster? In the cities of Juchitán and Ixtepec, the collapse of the spatial infrastructure of the market combined with its civic necessity meant that it had to be relocated elsewhere. In propagating normality in times of extreme trauma or circumstance, can we then propose a line of inquiry where we look towards an urban condition of the void – where spaces which are empty could be used as spatial buffers or backups in times of need? In doing so, can we envision the many gaps within the urban fabric as holding potential for different programmatic needs?

3. Public Space and Appropriation: The people of the Isthmus are extremely pragmatic and resourceful, and this can be shown in how they utilize and create public space. Streets can be instantly turned into spaces of celebration with the implementation of a simple fabric roof that gives them shade. Boundaries of space can be established with a single car parked perpendicular to the street. Is appropriation a way of reconciling a local bottom up grassroots culture with the traditional, top down modernist planning enforced by the State?

4. Many Publics: The Isthmus of Tehuantepec, and the state of Oaxaca, are host to



As a node, the Pistas provide a wide coverage of the city of Asuncion Ixtaltepec. Approximately 80% of the urban fabric is within a 10 minute walk of an already existing Pista. Their relative location to zones of major demolitions also suggest that these could be prime zones of infrastructural amplification.



The use of streets as an element of community making and gathering. The appropriation of the public reveals the necessity of the public infrastructure. Evidence of collectiveness is embraced through these shared spaces.

a large network of Indigenous cultures and minorities. In Juchitán 80% of its near 100,000 populace are Indigenous Zapotecs, and the city itself is home to a significant demographic of LGBTQ persons. The market, arguably Juchitán's most important public space, is an economic stronghold for Zapotec women. Their presence is a key part of propagating culture and of creating communal identity among the Indigenous population. We need to understand how public spaces can empower different demographics within such a culturally rich and diverse body and encourage interdependencies in an area historically known for conflict.

5. Public Space as Mediator: These traditions of public space are alive and well in the Isthmus. There is a history of communality and many regional traditions to this point, ranging from the more formal *tequios* – communal work to build homes or celebrate weddings – to the more informal parties in the streets. However, contemporary communal life and the spaces left for it in the urban fabric have developed some deficiencies in the face of modernization. As such, there are new roles that the public space needs to grow into to expand its influence.

With these five basic principles of public space observed, we would like to suggest new or augmented uses for public space in the urban fabric, specifically in the context of disaster response and reconstruction.

Continuing on our notion of public space as infrastructure, our module is an attempt to amplify existing public space to embed resilience and decrease vulnerabilities. The module is decentralized and autonomous, providing an alternative infrastructure for water and energy in times of disaster. The module has multiple options for configuration. These can be mixed and matched to suit different programmatic needs, space requirements

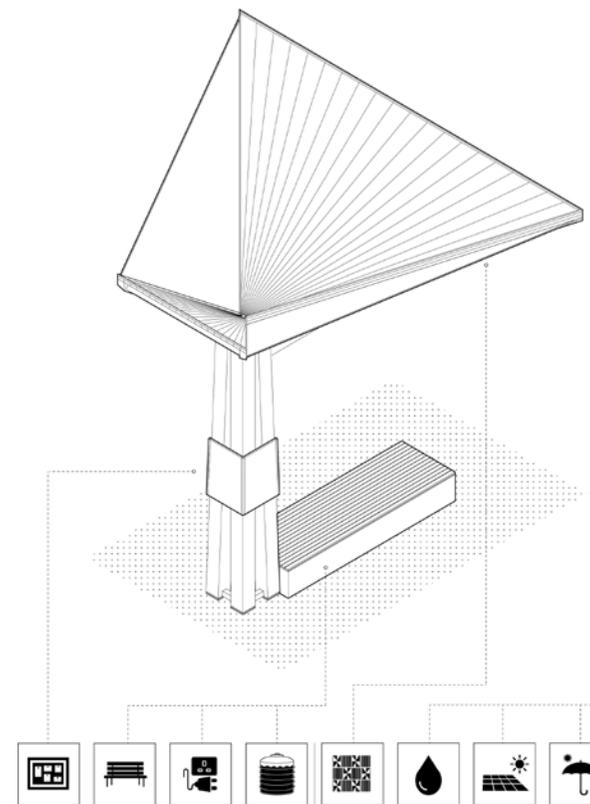
and emergency response conditions.

The state of Oaxaca is home to a long standing and rich tradition of crafted textiles and woven goods informed by the individual traditions of local Indigenous groups. As expressions of local culture, textiles offer a way of incorporating a collective identity into these modules and a way of boosting an economy for these trades. They offer an informal way of shading that ties in closely with their culture of color. Fabric can be strung from one module to the other in low density configurations. In these cases the modules could function as street furniture, or even street lamps. Locally crafted fabric could be used as an intermediary between these modules, providing shade and color to the existing public infrastructure. Higher density configurations can utilize these fabrics programmatically, perhaps indicating entrances into pavilions or different market stalls. In larger public spaces with multiple closed configurations these fabrics could act as a method of urban wayfinding in times of crisis. Different colors or patterns could be utilized to indicate different places of response.

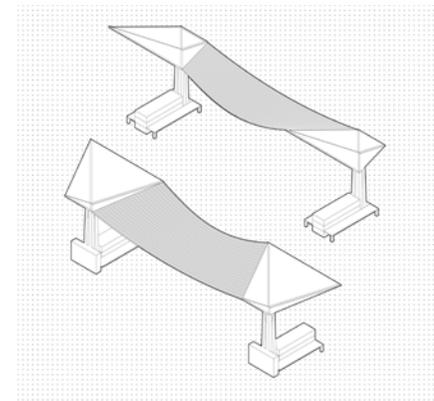
By nature of being a pattern-able unit, the system expands to fill the space and can be configured depending on the type of program and coverage the space requires. An array of units can be very sparse, acting as nodes in a larger landscape and functioning more as trellises for fabric than as structure themselves; or they might be more dense, concentrating resources and people together in a space.

One example of a small scale, low density deployment could be along a street. The modules function as street furniture, offering shade and some utility along the existing streetscape.

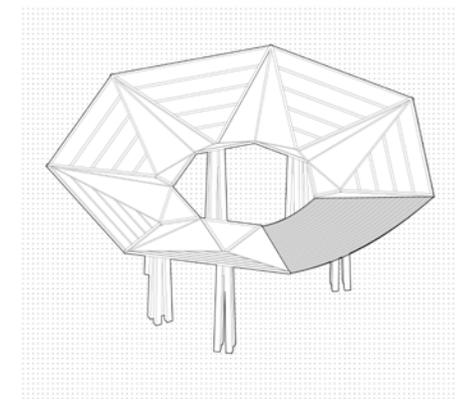
A medium scale, high density deployment might form the stalls and shading of a marketplace or a gathering space in a *pista* or plaza. In this arrangement, the



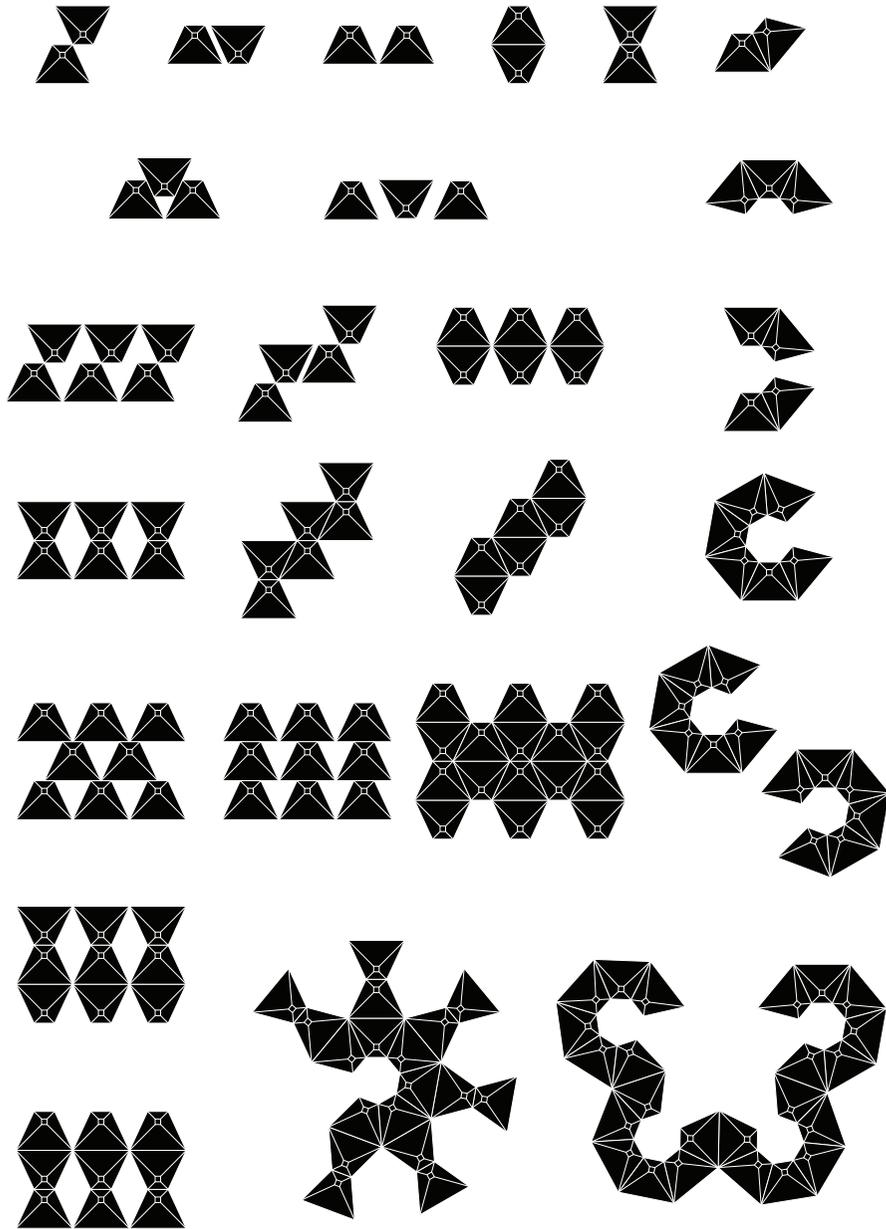
Axonometric detail of standard module. The structure transforms into a node for response after disaster. The module serves also for solar energy and rainwater capture and storage, its roof is a combination of local textiles and solar panels.



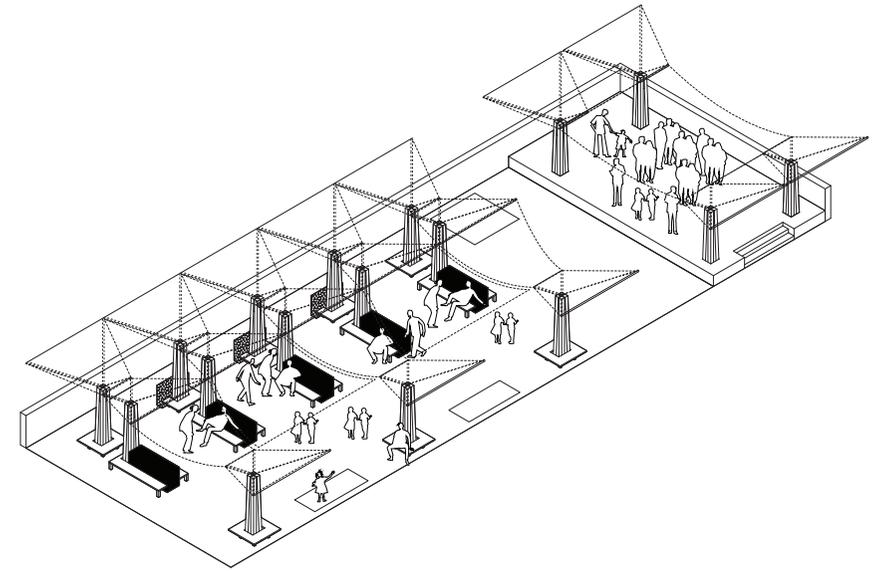
Module arranged in pairs on linear distribution.



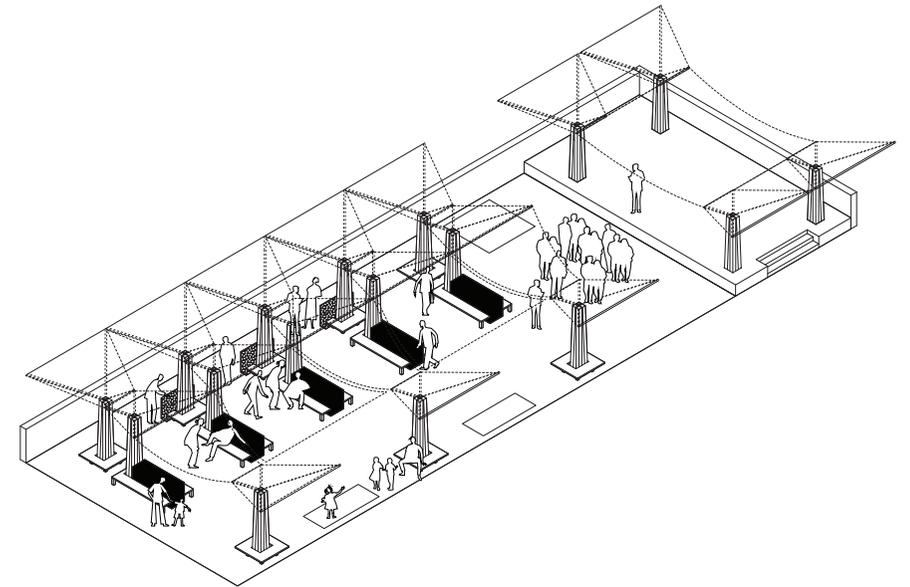
Module arranged in a circular array.



Schematic geometric arrangements of the module at different scales.



View of pista with modules and textiles.

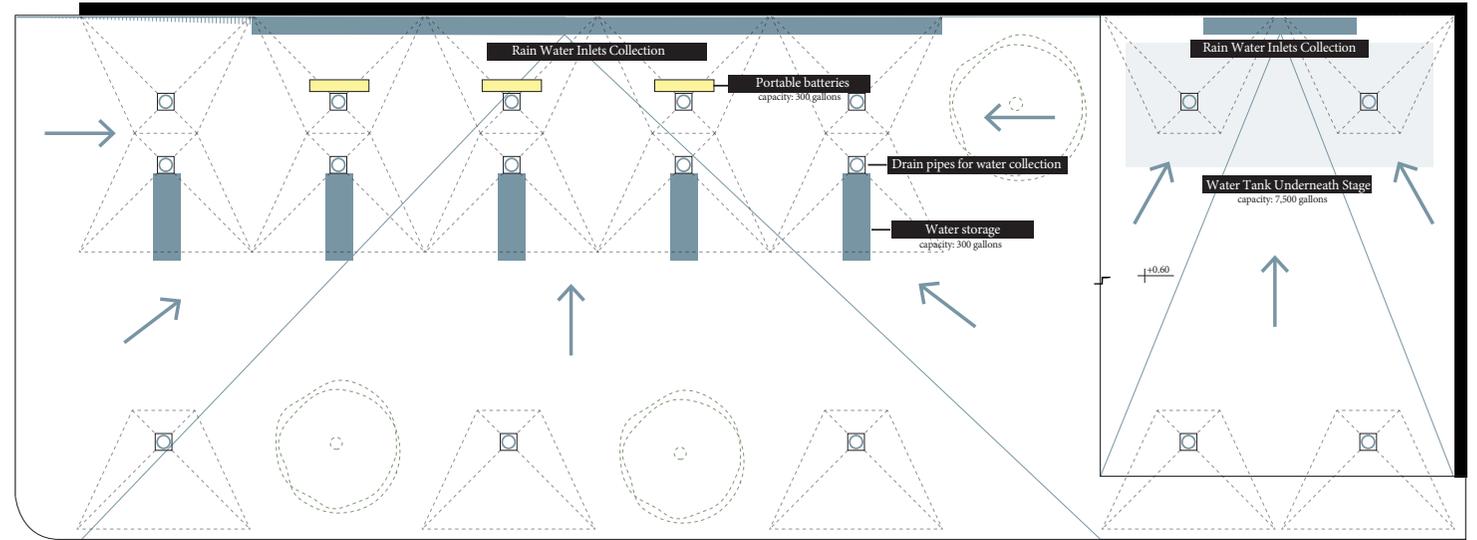


solar and rainwater collection surfaces of the roof provide shelter, which during a crisis can become a centralized location for the distribution of emergency services.

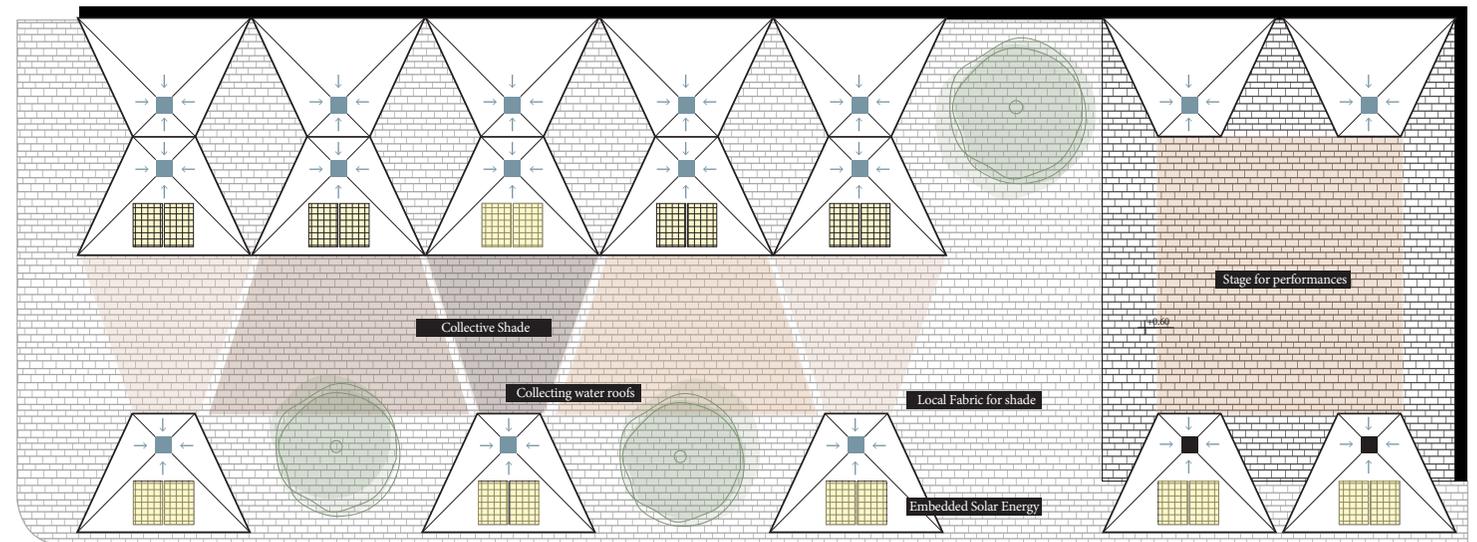
A large scale, medium density deployment might form kiosks and gathering spaces in a plaza. Similar to the medium-high configuration, this arrangement can be activated in times of crisis to not only provide energy and water from the stores it passively collects, but also to serve as an emergency service distribution center.

Throughout Asuncion Ixtaltepec, the Pista offers an open public space that is already utilized and integrated into the everyday rituals of community. Situated at multiple locations in the town, Pistas host a multitude of festivities and events. Their integration into the social fabric of Ixtaltepec provides an opportunity to amplify existing lines of infrastructure, and introduce new ones. Pistas have the potential to serve and support the community of Asuncion Ixtaltepec in times of emergency. They are meant to be public anchors that can provide the necessary infrastructure to improve and ameliorate disaster resistance as well as aspects of everyday life.

While we focused on Asuncion Ixtaltepec, we wanted to keep in mind that a solution might apply at many scales both locally and more regionally. As such, it made sense to pursue a modular design, something which might be presented as a kit of parts which resolves to a certain set of geometries but leaves a wide breadth of space for local and individual hacking and riffing on the design. The region has its own rich practices of craft and construction, and the design of the module is intended to work within that space rather than introduce new complexity.



Ground level plan showing groundwater collection proposal and battery recharge areas.



Photovoltaic Energy Production and Roofwater Collection, shade provided by the modules, local fabric and trees.

The Railroad as Conflict Zone

Immigrants and Their Journey Above «La Bestia»

Melissa Gutiérrez

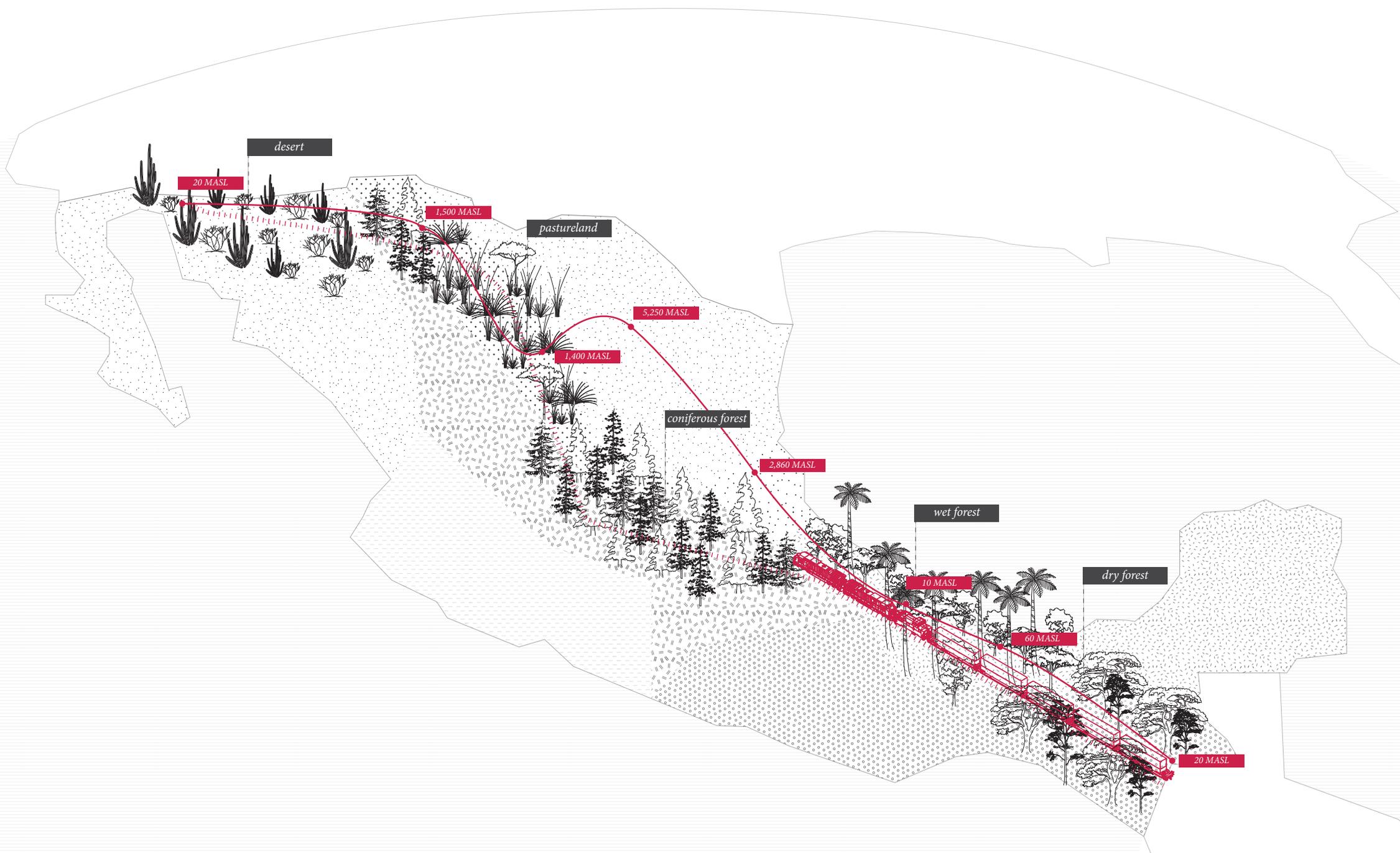
Mexico has a railroad network of more than twenty-six thousand kilometers operated by private sector concessionaires for the transportation of multimodal cargo. These railroads connect the southern and northern borders of Mexico, acting as an important infrastructural system for the economy of the country. However, in tandem with its official use as cargo train, this infrastructure serves as one of the biggest and most dangerous migrant corridors on Earth.

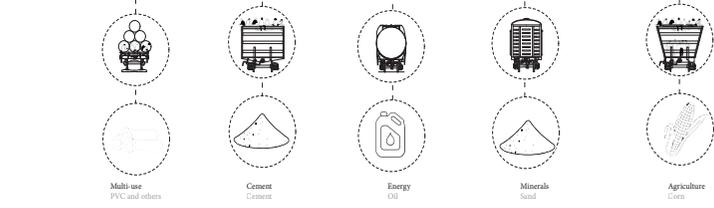
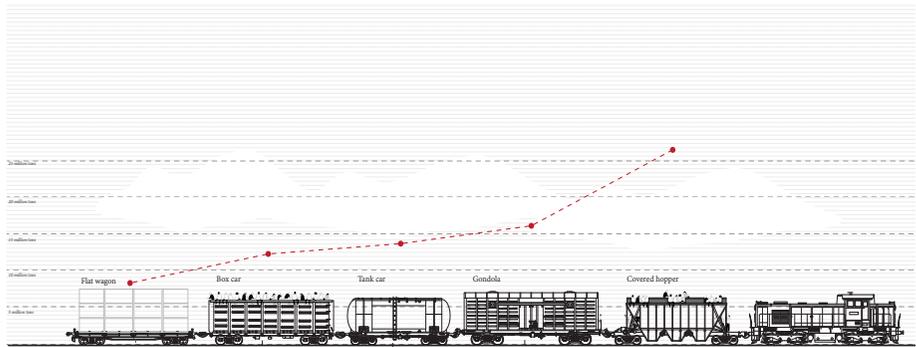
Loaded with heavy social and political layers, it is used informally by almost 150,000 migrants a year —primarily from El Salvador, Honduras and Guatemala — trying to reach the Mexican border with the United States of America (REDODEM 2017). Immigrants from the Northern Triangle and other countries from Central America try to escape from their vulnerable social and political situations looking for a better life.

According to the UN, there were twenty-six million Latin American immigrants living in the north of the continent in 2017. Some of them migrated while looking for better job opportunities or better education. But that's not the case for immigrants from the Northern Triangle. Having been expelled from their countries and living in precarious situations, these Latin American citizens find themselves in need of alternative transportation systems for their travel. The railroad infrastructure of “La Bestia” is one of the most popular means for this purpose.

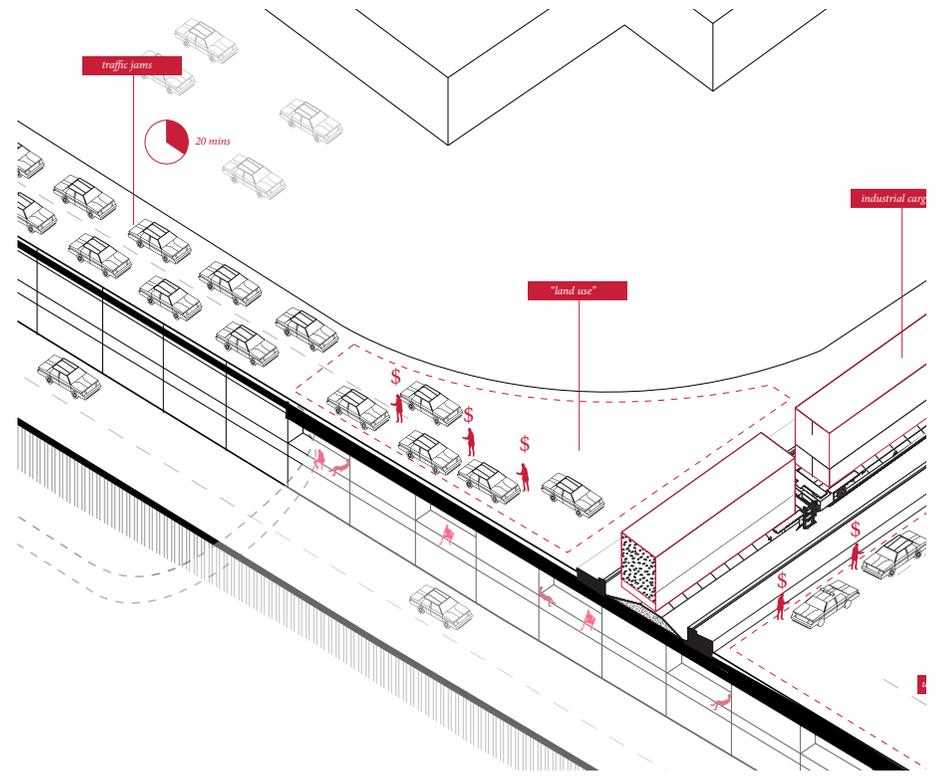
The people who undertake this difficult trip are escaping from their countries of origin due to violence and extreme poverty. In Honduras, the gangs known as “Maras” threaten and attack citizens. Their victims are young people between 15 and 39 years old. According to figures on wealth concentration in Honduras, 10% of Hondurans with the highest incomes account for about 42% of the total national income.¹ A mixture of misery, uncontrollable violence, political corruption and a general state of despair have forced citizens to migrate and risk their lives in the search for security and social and economic stability.

This project intends to make visible the situation of the immigrants in Mexico





Double use, double meaning.



La Bestia through industrial cities: Monterrey, Gonzalitos and Madero

“The Beast”, passing through large cities, crosses main and busy avenues, causing great traffic jams as the long train can interrupt traffic for almost 20 minutes. This is when migrants take advantage of the slow speed to get off the train in search of basic services and money. People involved in organized crime and local police agents abuse the migrants and illegally charge them for “floor rights” to allow them to ask for monetary donations on street corners. Migrant citizens make an average of 25 USD a day and must pay 10 USD daily for “floor rights”. Furthermore, the road infrastructure below the train is used as a shelter by migrants. They transform the space and use it to protect themselves during the night.

of total national aggressions (REDO-DEM 2017).

The immigrants that pass through the state of Chiapas walk 275 km to get to the municipality of Arriaga, where the first train station of the system is located. Migrants then travel 168 km more to get to Ciudad Ixtepec, their first stop in the state of Oaxaca, which has one of the highest rates of poverty, marginalization and unemployment in the country.

Ciudad Ixtepec has 24,000 inhabitants and has a privileged location, as it sits between the Pacific Ocean and the Gulf of Mexico. The city acts as an important bifurcation for the railroad system, as the train traffic can either continue through Oaxaca toward Mexico City or deviate to the state of Veracruz. Because of this constant migration flow, Ciudad Ixtepec, as most of the cities in the region, has developed a culture of rejection toward immigrants. Adding to the vulnerable economic situation of the city, which is susceptible to earthquakes, the presence of the migrants causes conflict among the residents.

Hermanos en el Camino, a space of hope

Due to fatigue, illness or hunger, some of the migrants need to get off the train; they have to wait for the cars to stop at one of the stations or to jump off the train while it is in motion. By the time they touch ground, migrants begin to expand the central network of “La Bestia” and become temporary residents of the towns and cities they visit. A very important part of this expanded network is the system of solidarity nodes created by the residents of these places, including shelters and diners.

“Hermanos en el Camino” (“Brothers on the Road”), is the shelter located in Ciudad Ixtepec. One of the most important shelters in the south of the country, it was

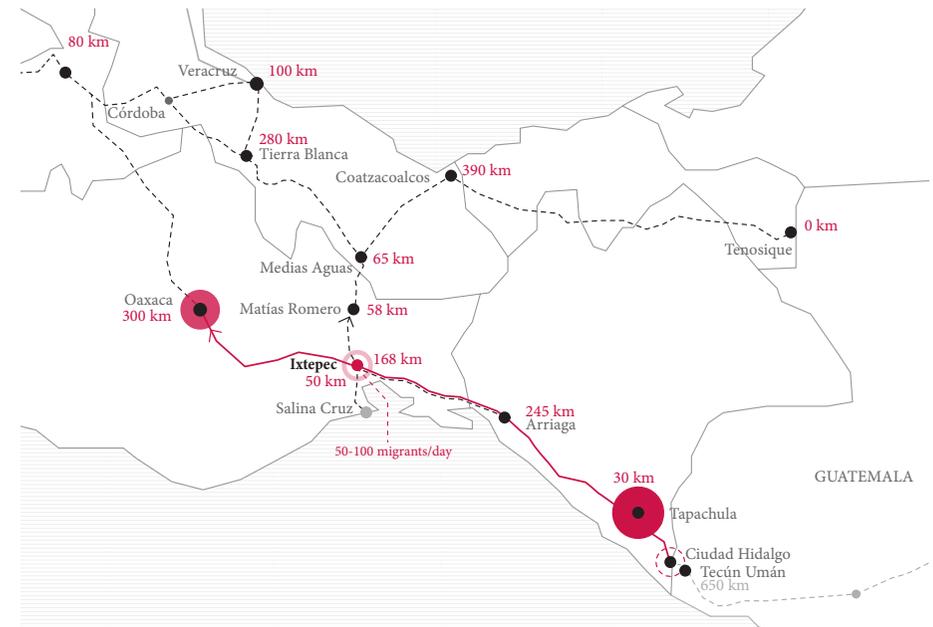
founded by father Alejandro Solalinde in 2007 and forms part of a network of eighty-four shelters established by the Catholic Church and other organizations across the country.

The shelter in Ciudad Ixtepec has a basic architecture but is one of the best ones along the route. Its architectural program includes a large dining room, a chapel, a soccer field, space for events, library, dormitories and bathrooms for men and women, laundry, nursery, and bakery. More than 120,000 migrants visit this shelter a year,⁴ which acts as a “safe heaven” node on the first stage of the journey.

Ixtepec: Zones of Conflict

Before getting into this “space of hope,” immigrants need to get off the train and walk for fifteen minutes until they get to the shelter. This zone of transit between the train station and the shelter has transformed into an urban “zone of conflict,” where immigrants begin to inhabit the city in “unconventional ways” and create distrust or discomfort among residents. Normally this area tends to have a negative connotation from the point of view of the residents, as they feel threatened by the constant presence of migrants who wait for up to twenty-four hours for the arrival of the next train.

The abandoned train station also acts as a visual and physical barrier through the city. The area surrounding the terminal was used when the train system still functioned, but is now deteriorated and forgotten. Its unused infrastructure has not received maintenance in years and creates a negative impression among citizens. This zone of conflict perpetuates and reinforces the rejection of locals toward migrants, as the space of the city that migrants tend to occupy is filled with negative connotations.



The journey in Mexican Territory. Passing through the Isthmus.

A Safe Heaven

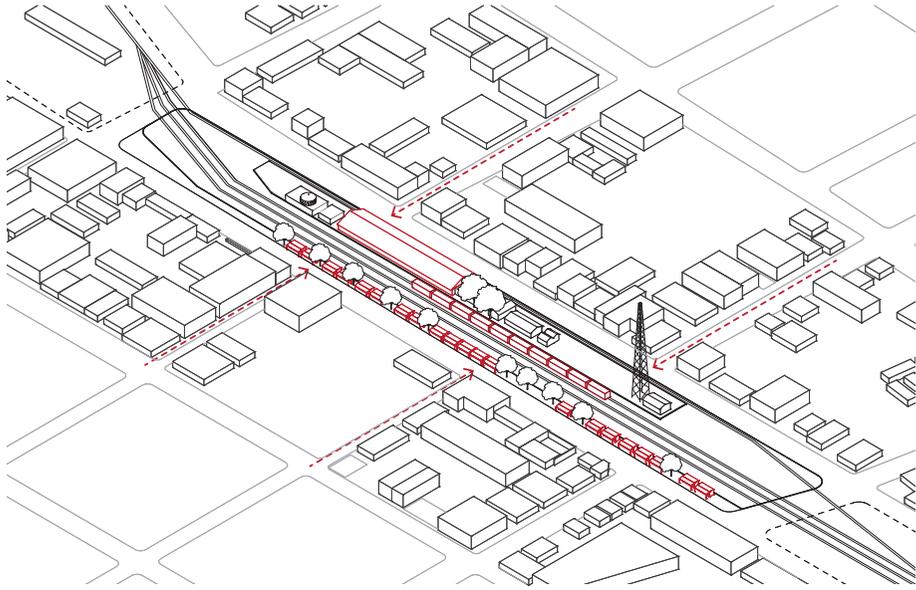
Nevertheless, this “conflict zone” has a lot of potential, as it is situated in the central area of the city, right between the two sections in which Ciudad Ixtepec is divided. Its closeness to the old market, now being reconstructed, underlines the importance of this zone in the everyday life of Ciudad Ixtepec.

The project intends to change the negative connotations associated with this particular urban area, giving back this space to the residents and creating alternative programs that can also be used as public shelters in case of earthquakes or other natural catastrophes. Changing the way in which the residents see this place can help mediate their relationship with the migrants that pass through the

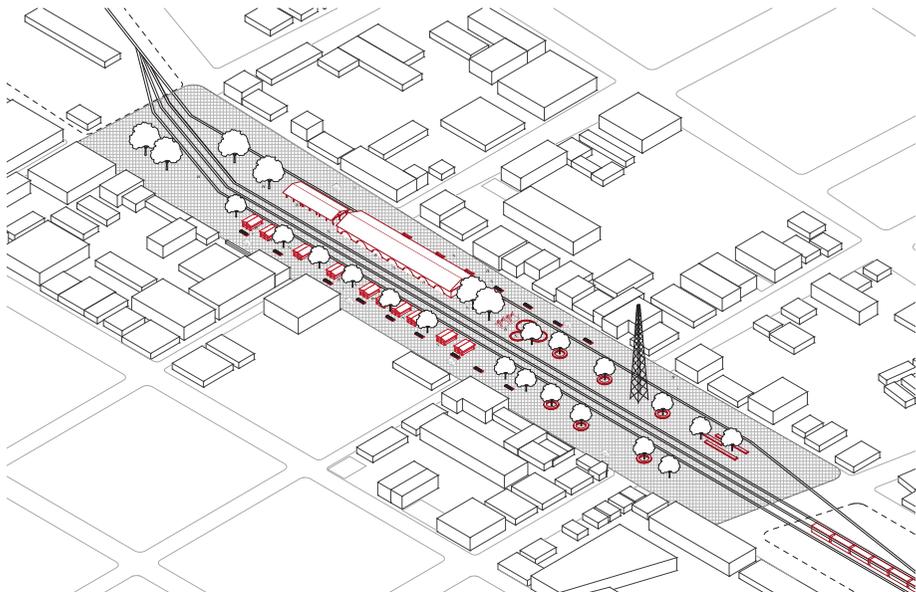
city and minimize their negative feelings toward them. Also, this zone can act as “safe heaven” for the incoming migrants, who will arrive at a safer zone, with better infrastructure to wait for the train that will take them on the rest of their journey.

The proposal will transform two hectares of this transit zone into a public space and shared street, acting as a connection node for the city and the market. The project consists of a series of strategies that will change the use of the area and turn it into a permeable and connective space:

1. Demolition of buildings: The first step is to demolish all buildings and structures in the area that are not used or are in poor conditions.
2. Shared street: This part of the project will unify the urban space, elimi-



The conflict zone: a physical barrier that interrupts mobility and disconnects the city.



Rearrangement of the street vendors and design of a public park for children and adults.

nating height differences or divisions that currently obstruct people's circulation, turning the area into a large square. A unified permeable surface will make this a friendlier zone; enforcement of speed limits and planting of trees for shading will make this a more livable area.

3. The station: The station will be restored and transformed into a dining room, housing a diversity of cultural programs for residents.

4. A new structure: The proposal includes a new, permeable steel structure to be used as a space for social and cultural events that can also function as a refuge in case of emergencies.

5. Relocation of street vendors: A new permeable structure will be built to accommodate vendors so that free circulation between the market and the public areas exists.

6. The big plaza: a park with playground and resting areas will be designed for children and adults. This space will function as a social and cultural node for the city with new uses and a new appearance, removing the current negative connotation of the area.

Conclusion

Along a path of racial and class discrimination against migrants, the lack of the most basic human rights makes the journey on "The Beast" a humanitarian crisis of alarming proportions.

As Rahul Mehrotra mentions in *Ephemeral Urbanism*: "The evolution of these shelters (and zones of conflict) should be a subject worthy of design" (Mehrotra, Vera 2017). As designers, we must rethink these "zones of conflict" and their connection with shelters, to try to find alternative ways to humanize their bulky and invasive architecture and the areas surrounding them.

Taking from Salottobuono and Agam-

ben's concepts, "to profane does not simply mean to abolish or cancel separations, but to learn to make new uses of them" (Agamben 2000). In this way, structures "could be reused, recycled or re-inhabited ... at the moment it is unplugged from the political power that charges it" (Salottobuono 2010).

Old stations, actual conflict zones, and other nodes of the system can be rethought and redesigned to change the negative connotation they have in communities. Migration is a humanitarian crisis that can not be solved without tackling the roots of the problem, but we can find architectural and urban strategies that mitigate the fatigue and threats that migrant citizens face in search of a better future.



Embracing the Wind

A Strategy for Community Wind Generation
in the Isthmus of Tehuantepec

Rian Rooney / Enrique Aureng Silva

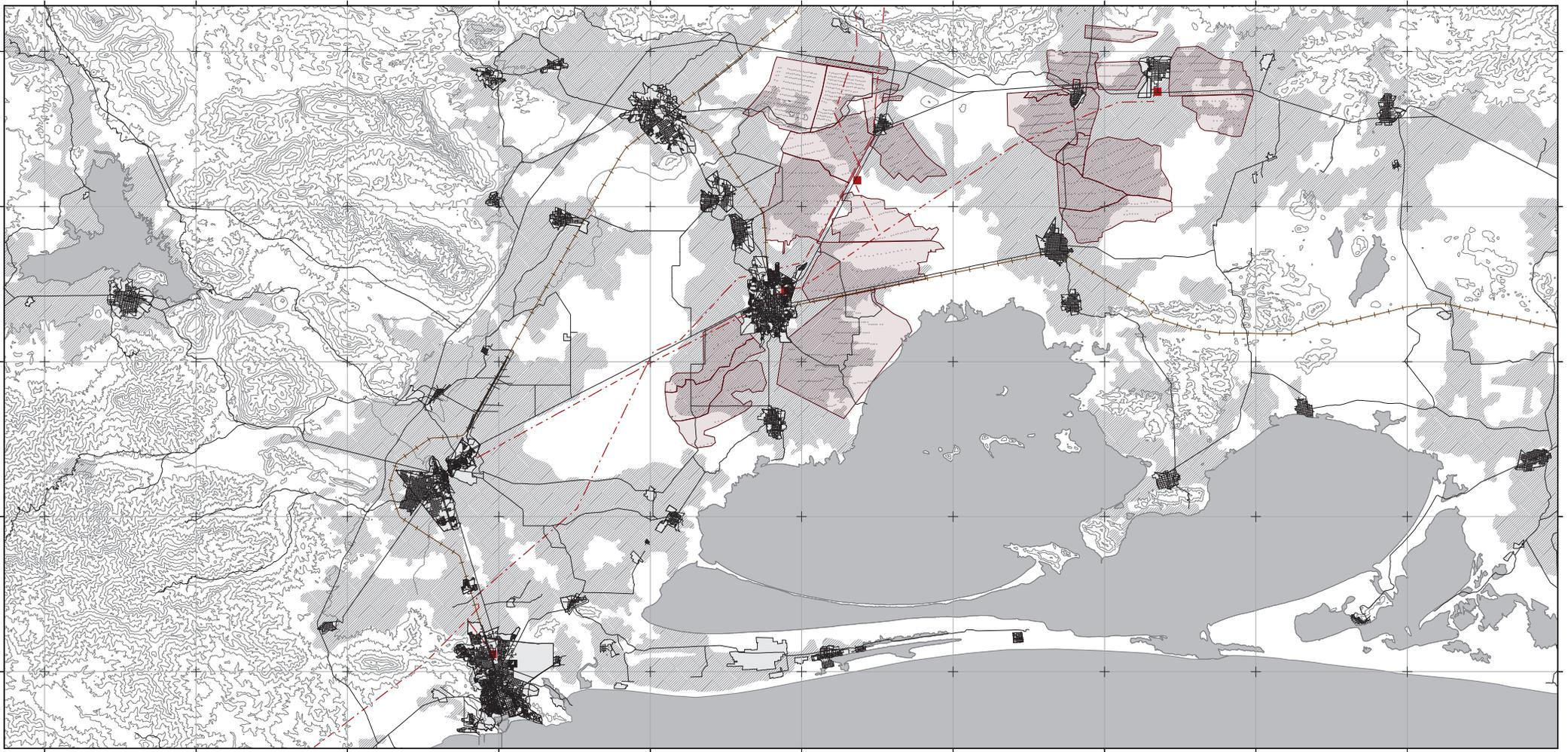
While the Isthmus of Tehuantepec has historically drawn attention for its strategic location for global trade and military control, the crisis of climate change and rise of renewable energy technologies in recent decades have reframed the region's position in speculative global crosshairs seeking its newly-valuable natural resource: wind.

Perhaps by mere geological coincidence, the Isthmus of Tehuantepec marks a natural break between the two mountain ranges that cut across the southern states of Oaxaca and Chiapas. This gap in the Sierras helps to produce some of the most consistent and powerful winds in the world.^{1,2}

Since 1994, over two dozen large-scale wind farms have been developed in the Wind Corridor of the Isthmus of Tehuantepec in the state of Oaxaca. Development has escalated rapidly in the last decade and has become increasingly contested as local, Indigenous groups resist and even block wind farm expansion “claiming impacts on their territories, livelihoods and identities” (Avila-Calero 993). Wind farm development in the Wind Corridor has been dependent upon an active deterritorialization of Indigenous and peasant lands, activated through global economic processes and mediated through the increasingly neoliberal Mexican nation-state.

At the same time, wind, and the lands over which it blows, have been harnessed to produce a new territory of global and corporate energy development, linking historically peripheral lands in southeastern Oaxaca with industrial operations throughout Mexico via high-voltage transmission lines and the capital flows of international energy companies. Essential to these ongoing territorializations and deterritorializations are the privatization of land tenure systems and the neoliberal development policies that have emerged against the backdrop of the escalating global climate crisis.

The Southern Isthmus of Tehuantepec, and more broadly the state of Oaxaca, are remarkable for their large Indigenous populations and communal land-tenure traditions. Local Indigenous ethnic groups (primarily Zapotecs and Huaves) have historically maintained a culture of local, regional independence marked by an emphasis on “the unity



Map of the southern Isthmus of Tehuantepec showing topography, road infrastructure, rail infrastructure, urban settlements, national transmission lines, wind parks in operation and agricultural land. Source: INEGI. Produced by the authors

1. Global Wind Atlas. <https://globalwindatlas.info/en/area/Mexico?print=true>

2. Earth: a global map of wind, weather and ocean conditions. <https://earth.nullschool.net/#current/wind/surface/level/orthographic=-96.03,15.40,3000>

of the pueblo against outside incursions (Oaxacan, Mexican, European, and North American) and the pueblo's willingness and capacity to defend its resources and autonomy through various forms of resistance" (Rubin 117).

Following the Mexican Revolution, the 1917 Mexican Constitution established mechanisms for the redistribution of lands and the legalized reintroduction of social property through ejidos. Ejidos are officially federally-owned lands on which individual ejidatarios are allowed usufruct rights over individual parcels.

A second form of recognized social property are "communal lands," often recognized as comunidades agrarias, representing "the formal recognition or restitution of collectively-owned Indigenous lands"; however, Indigenous communities that have not been able to "prove" claims to ancestral lands have often filed claims through the ejido system (Smith 176-177).

Historically under both systems, governance of the shared lands has been administered by an elected assembly of leadership, the ultimate authority over territorial decisions of land use and allocation.

Approximately 51% of land in Mexico is regarded as social property, compared with nearly 78% in the state of Oaxaca, the highest concentration in Mexico (Dunlap 634). These social land tenure systems may be seen as mechanisms for the assertion and demarcation of Indigenous territory.

Deterritorializing Indigenous Social Property

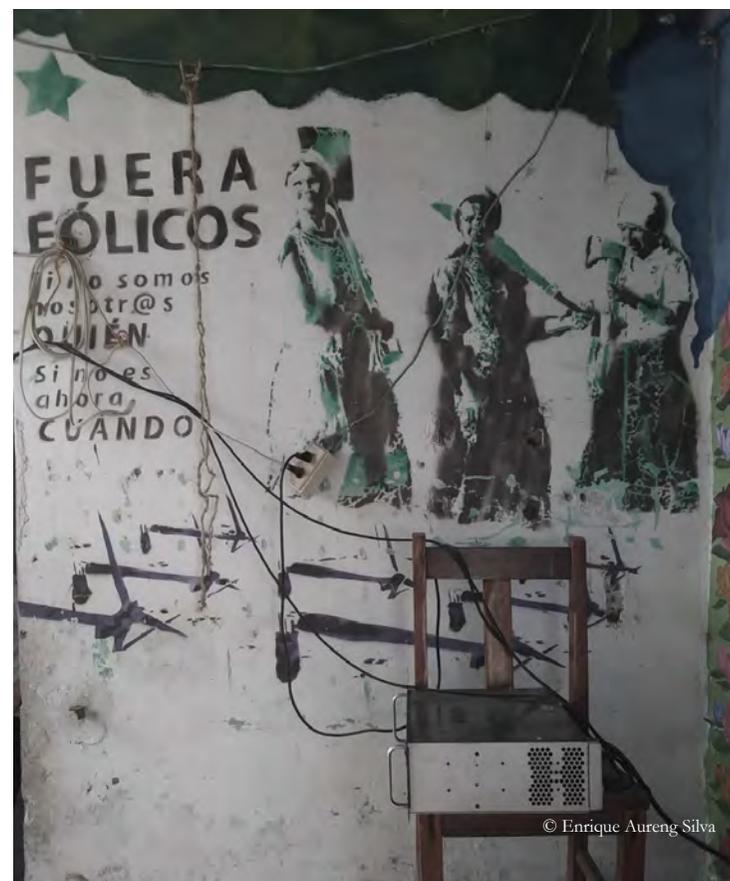
Neoliberal reforms of the 1990s set in place a series of policies that have further complicated the sovereignty and authority of Mexican social property regimes. In 1992-93, several amendments to the Mexican Constitution, the Agrarian Law Reform and PROCEDE (Program for the

Certification of Ejido Land Rights and the Titling of Urban House Plots) laid the groundwork for the privatization of ejidos and other communal lands through a mission of regularization and measurement to certify land claims.

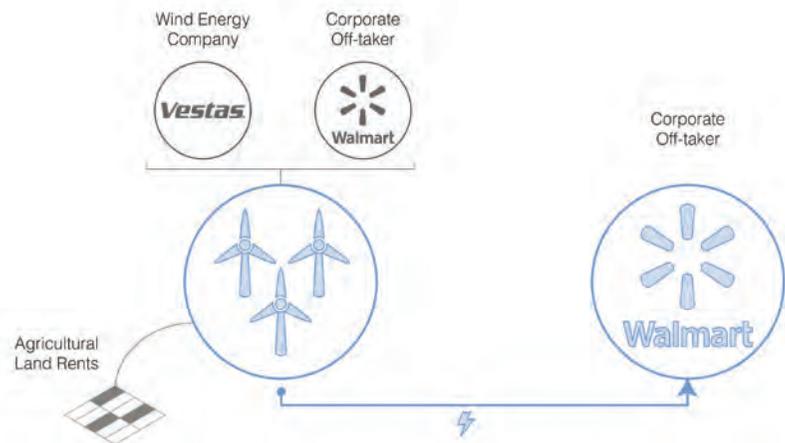
The logic of PROCEDE, in a preview of the argument that Hernando de Soto would put forth in *The Mystery of Capital* at the end of the decade, claimed that "once all rural property has been 'regularized' under the existing laws, then capital investment and efficient rural development can ensue" (Stephen 141). As a result of these shifts, social property could become partitioned and sold under certain circumstance<s, opening up land historically designated for residential and agricultural uses to foreign investment, speculation and development. In the same era, the North American Free Trade Agreement and the Electric Energy Public Service Law "allowed local landholders to individually contract land with private interests...and gave private-sector companies the ability to participate in electric power generation" (Howe and Boyer 222). Parcelization and titling, then, have provided the framework for the subversion of the communal assembly, and have allowed energy companies to sign long-term leases with individual landowners to develop wind parks and infrastructure.

More recently, national Mexican energy reform and climate policy have worked to further destabilize social property regimes and Indigenous sovereignty. Under President Calderon (2006-2012), Mexico passed some of the most ambitious climate change mitigation legislation in the Latin-American region, aiming to transition to 35% of energy from "clean" sources by 2024 (Howe and Boyer 216).

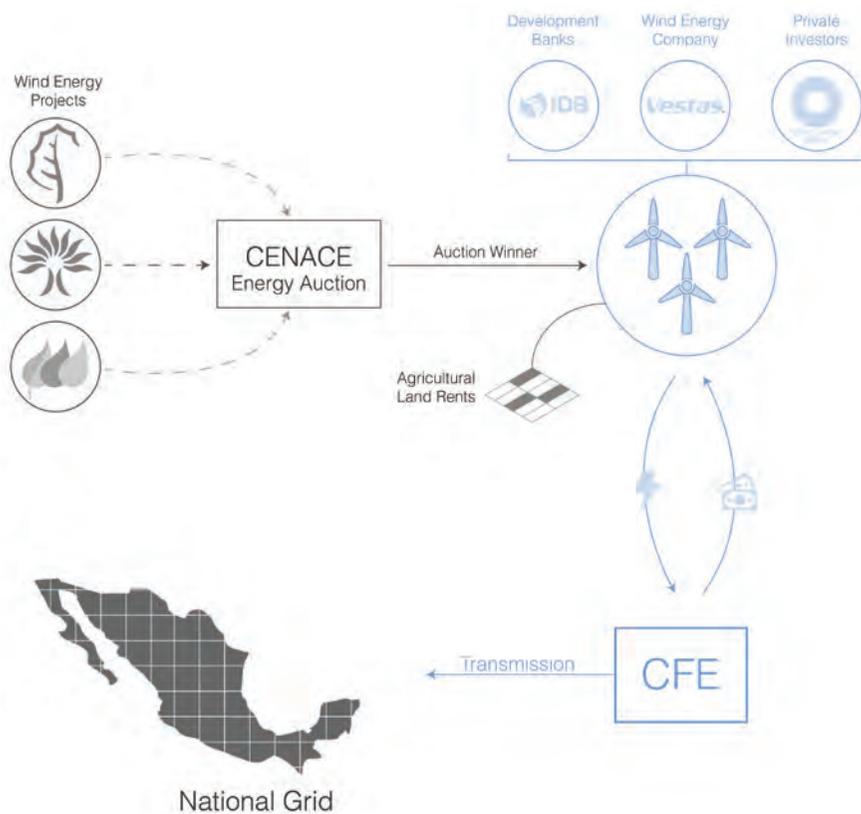
These aggressive targets have coincided with even more aggressive policies of energy privatization, opening up electrical production fully to the private sector



Mural painted on a wall at Radio Totopo's (community radio station) headquarters in Juchitán, Oaxaca: "Eolic [projects] get out! If we don't do it, who will? If not now, then when?"



Self-supply model diagram



Independent Power Producer diagram

through the establishment of an energy market.

In 2013, the nation adopted the Energy and Utility Act which “mandates that social property holders must negotiate and eventually surrender their land to energy companies in regions of development interest,” placing national energy development as the most important of land uses to the direct benefit of private energy companies (Dunlap 637).

The ongoing case of wind energy development in the Isthmus of Tehuantepec underscores the inherent tensions between industrial development -- regardless of whether it is “green” -- and Indigenous place-based relationships to land. Private property is seen as essential to unlocking traditional, capitalist development schemes, but the imposition of this system and the resulting (de)territorialization challenge Indigenous sovereignty, distance local impacts and outside benefits, and reinforce existing inequalities.

Constructing a Global “Green” Territory

The emergence of over two dozen wind parks across the Southern Isthmus has constituted a new territory of “green” energy development, linking ejidos and comunidades agrarias to national and global networks of capital through a “sustainable development” logic.

Mexico’s energy reforms and policies, however, have not operated in national isolation. Global, foreign interest in renewable energy has also targeted the Southern Isthmus for wind development, resulting in a trajectory which has favored international forces and private developers and has provided limited benefits to local communities (Juárez-Hernández & León, 2014).

In 2004, the United States NREL (National Renewable Energy Laboratory), with financing from USAID (United States Agency for International Development) produced a report on wind energy

potential in Oaxaca, including a map that clearly indicates the world-class resource capability that is special to the Isthmus. This document, which bears the logos of Federal and Oaxaca State energy and development agencies and where wind energy potential is measured on a scale of 1 to 7 -- and where sure enough Indigenous lands and settlements are left absent -- can be read as a roadmap to new territories of contestation. Since NREL and USAID published this report in 2004, wind park development in the Isthmus has exploded, as the Mexican nation-state has used policy to make the map real. Foreign companies interested in developing in the Wind Corridor pushed the government to divide the territory, resulting in a “new simplified geometry of blocks...superimposed on the existing intricate maps of agricultural fields, forests, rivers, wetlands, villages, small roads, peasant collectives and private properties” (Avila-Calero 997)

Up until the 2014 Energy Reform, the dominant model of wind farm development in Mexico was a process called *autoabastecimiento*, or “self supply”. Under this model, wind farms were developed privately with corporate purchase agreements in a joint-venture between the wind farm developer and a corporate off-taker. Developers in the Isthmus are international wind turbine companies, and the consumers include some of the largest corporations in Mexico including Walmart, Coca-Cola and CEMEX. According to Howe and Boyer, the autoabastecimiento scheme has come to ensure the “dominance of private-sector ownership of Oaxaca wind power production” and “all but guaranteed that renewable electricity will be consumed solely by corporate partners” (221). Moreover, the Federal Electricity Commission (CFE), the state-owned utility that controls electricity provision for Mexico, has used this model to leverage private companies into provid-



© Rian Rooney

ing the infrastructure -- the high voltage power lines -- that “evacuate” electricity out to their corporate consumers.

This strategy has produced the uneven infrastructural networks that Graham and Marvin call “premium network spaces”. Corporate industrial consumers, receiving discounted rates and fulfilling clean energy quotas, are linked directly to wind turbines on rented Indigenous lands, developed by European renewable companies, and financed through international investment funds and development banks. At the same time, local electrical infrastructure remains unreliable and residents pay high prices for electricity which, ironically, is generated all around them (Howe and Boyer 225).

A key element to the energy question, which is still unfolding, is the 2014 Energy Reform that was brought into law under President Peña-Nieto’s administration. Through a series of laws and regulatory changes, the Energy Reform has “opened almost all areas of the oil, gas and power industries to private participation and competition, with no foreign investment restrictions,” drastically and rapidly liberalizing the energy sector (Lopez-Velarde).

The reform leaves significant government control over the new market, but it does away with the *autoabastecimiento* model that has thus far driven wind development in the Isthmus. Instead of corporate partners, private companies can now enter into direct power purchase agreements (PPAs) with the CFE, via auction, and sell energy directly into the national grid. The full impact of this change is yet to be seen, but it does not suggest a slowing in the drive to develop the Isthmus for wind energy.

It does, however, potentially offer up additional opportunities for other ways of participating in energy generation at the community level. In addition to PPAs, the Energy Reform rules allow for “private

cogeneration” and “net-metering,” which allow for independent energy producers to “sell” their surplus energy back into the grid at a rate equal to its retail cost to consume. This provision is the same idea that drives small-scale residential solar in the United States and elsewhere and could prove an opportunity to pursue a new way toward energy independence and value generation in the Isthmus.

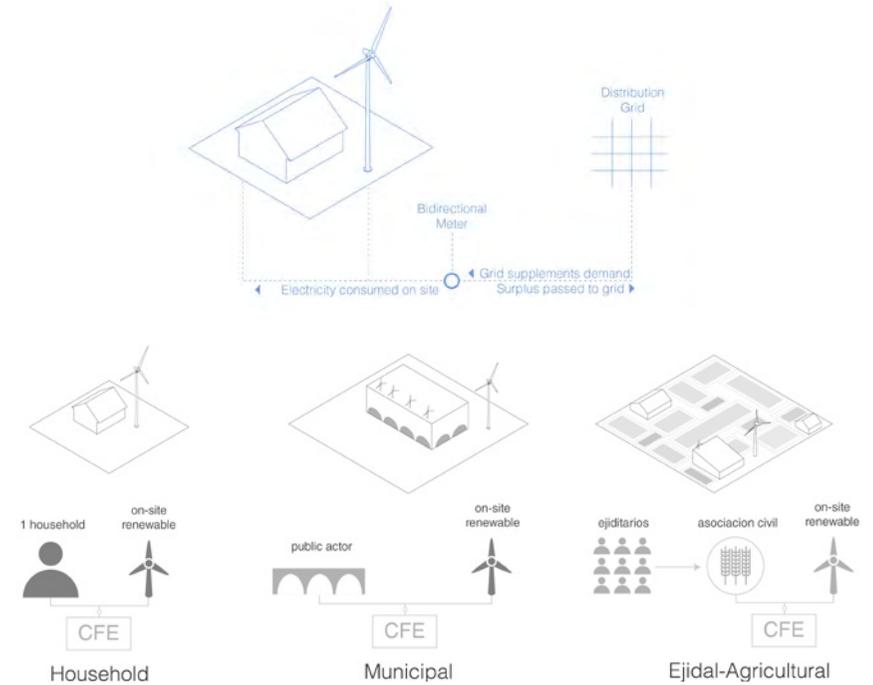
“Green” development, contrary to popular narratives, has proceeded in the Isthmus in a manner that mimics the extractive and problematic methods of the traditional energy industry, mobilizing local and Indigenous communities against neoliberal energy production amid a larger context of global climate crisis. Although some local efforts have sought a third way, pursuing a cooperatively-owned, community wind farm on an existing comunidad agraria, current trends of Indigenous deterritorialization for wind development will not advance a more sustainable future nor combat the existential threat posed by climate change.

Yansa and Community Wind

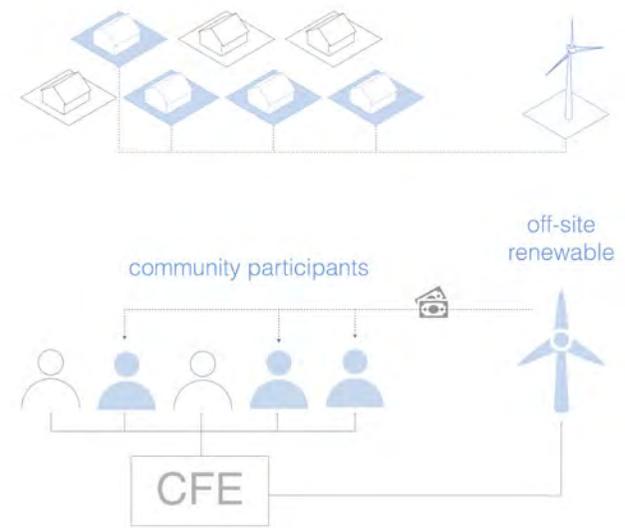
National and state law and international agencies and agreements have worked to attract private investment in the Isthmus of Tehuantepec but have undermined existing economies and livelihoods without adding significant protections or participation opportunities for local communities.

This spatial disconnect between the site of production and the site of consumption reinforces the uneven and unequal power relationships associated with traditional energy production and consumption patterns.

In the course of our investigation into the mechanisms of wind energy development in the Isthmus, we encountered a failed, alternative project: the Yansa-Ixtepec Community Wind Farm. Yansa sought to flip the wind energy development



Net metering distributive generation schemes currently allowed by CFE



Potential community distributive generation scheme

paradigm in the Isthmus, putting forward a model through which the community could maintain control of production and see revenues from energy sales, not simply ground rents for turbines and infrastructure. The project was well-organized, had received the unanimous support of the ejido on which it would be placed, and had secured loans and investors to finance the project – cost for the development of the farm was estimated at \$200 million for 44 large-scale turbines that would account for 100 MW in installed capacity, approximately 15% of the total energy consumption in the state of Oaxaca (Hoffmann, 12).

The project demonstrates significant promise for the possibility of an alternative form of development in the Isthmus, one that is controlled by the residents, respects existing societal structures, values and governance systems, and brings significant community benefits (both financial and non-financial). The Yansa-Ixtepec project, however, failed to be realized. Ultimately, the bodies that would be set up to conduct business on behalf of the community wind farm were not formally recognized by the government agencies administering the energy auction, CFE and CENACE (National Center of Energy Control), and therefore could not get a contract to sell into the grid. It appears that bureaucracy, corruption and corporate favoritism are some of the major roadblocks standing in the way of alternative development strategies.

Yansa represents a break from the 150 years of federal and internationally-backed projects in the territory – the possibility of a third way, as suggested by Avila-Calero (1007).

Resurgence of Centralized State Energy

The election of President Lopez Obrador in 2018 reframed the national energy and electricity discourse in Mexico. Pushing back on the arrival of foreign

and private power producers under the Peña-Nieto administration, AMLO delivered an alternative vision that seeks to strengthen state control over energy in his list of 100 commitments for the Fourth Transformation of Mexico. Somewhat contradictorily, Lopez Obrador's plans call to continue development of alternative and renewable energy and to repair and enhance the country's six oil refineries (including one in Salina Cruz) and construct a new one in Tabasco. To meet clean energy commitments, the President has largely cooled on wind and solar power, which have been primarily developed by the private sector, and wants to modernize Mexico's sixty existing hydroelectric dams. In a move that shocked the renewable energy industry, Lopez Obrador delayed and then cancelled the 2019 renewable energy auction, the process which had enabled the continued growth of private renewable projects in the Isthmus and elsewhere. The new administration's centralization scheme of energy generation and management has been reactionary. While it attempts to counterbalance the neoliberal model fostered by the last two administrations, it fails to address the fundamental problem that has historically affected the people of the Isthmus: accumulation by dispossession.

In addition to these policies to re-establish the state's control over energy production and distribution, AMLO has sought to strengthen and defend the state electricity utility, the CFE. The Mexican government allocates significant subsidies to domestic electricity bills each year to keep electricity affordable to citizens. Approximately 98% of Mexican households receive some form of electricity subsidy, and the average residential subsidy is for 60% of the total bill. Annually, the federal investment in electricity subsidy is around \$4.5 billion USD, larger than federal expenditures on transportation, agricul-

ture and social welfare programs, and ten times greater than the budget allocated for 2019's earthquake reconstruction program. While the subsidies help to make electricity costs more affordable to citizens, the massive annual expenditures by the government also work to ensure the continuation of the status quo for the CFE and for residents. Without financial pressure to innovate, the CFE has not pursued cheaper and more sustainable alternative energy sources. The subsidy funds, however, represent a significant opportunity for state-led innovation in the Mexican energy sector.

Embracing the Wind: Small-Scale Community Distributed Generation

One of the emancipating qualities of renewable energy is that it can allow for the decentralization and reconstitution of the existing energy system through distributed generation and local consumption. As opposed to the highly centralized infrastructures and management structures that are essential to fossil fuel energy systems, renewables offer the possibility of community control and increased democracy and transparency in management. However, thus far in the Isthmus, wind energy production not brought local energy independence and reliability nor economic benefits.

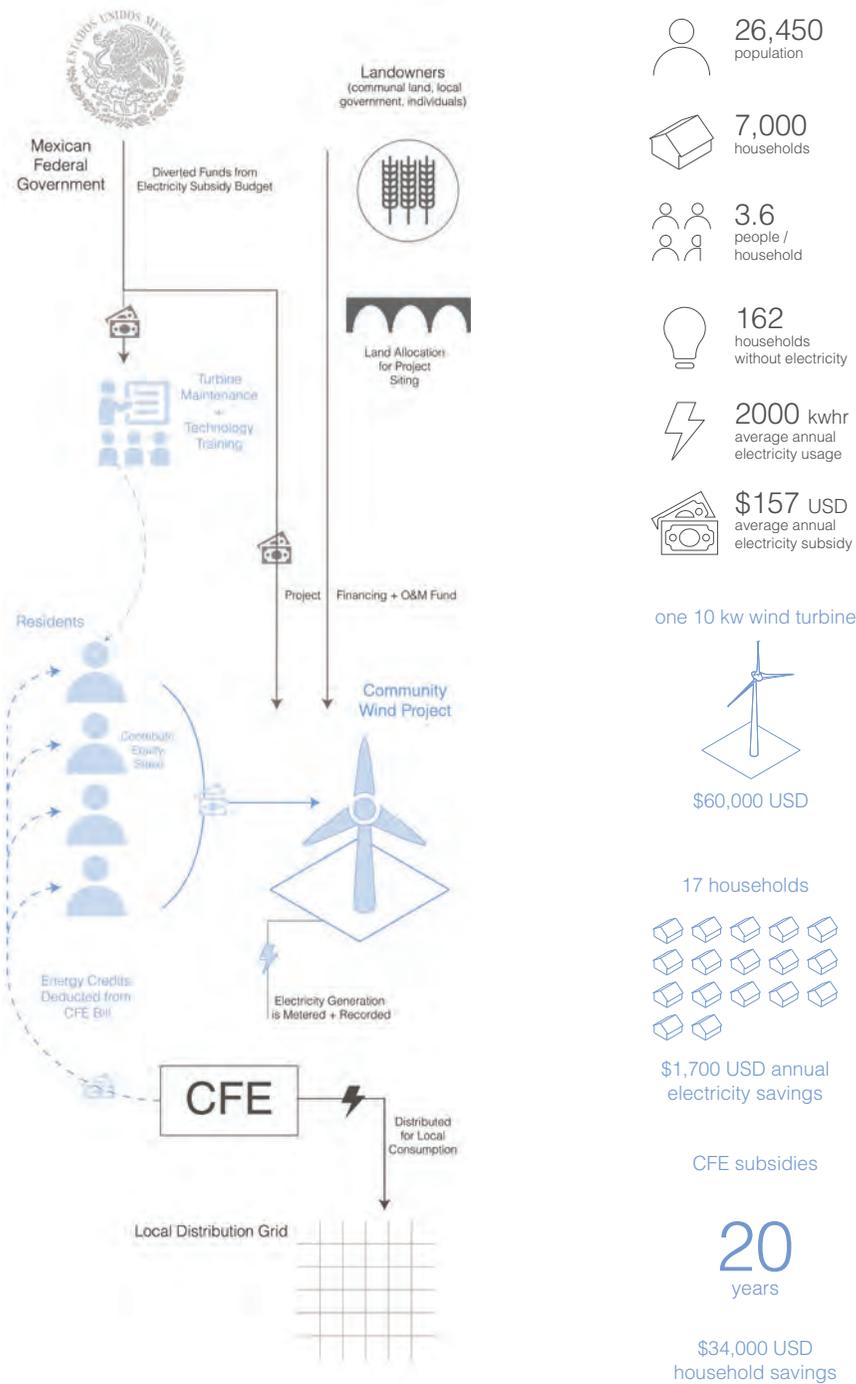
The legislation and policies promoting national sustainability have not addressed benefits for local populations, and the private sector-led interest in wind energy development has enabled a lack of accountability in environmental and social impacts locally. Wind farm projects have been linked with human rights concerns, primarily related to rights of Indigenous people, land rights, lack of adequate consultation and security concerns.

Some contend that construction and investment in wind farms has deepened inequality among locals. Inspired by both

the intentions and failures of Yansa, our team began to investigate how a smaller-scale project might be able to take advantage of the availability of this naturally available, renewable resource and proven community interest.

The net-metering and distributed generation allowances ushered in under the Energy Reform offer the beginnings of a framework for small-scale generation and alternatives to state and corporate energy dominance. Current law allows for producers with systems of 500 kilowatts or fewer to connect directly to the grid without a permit. Through net-metering, producers can receive 1-to-1 credit for electricity generated that can be counted against their consumption. However, the current configuration of the net-metering policy provides significant challenges for the creation of community-driven energy projects. Presently, policy requires that the site of production and site of consumption be co-located, using a single, on-site meter to measure electrical inflows and outflows.

This political and technical arrangement limits how and which individuals, organizations and institutions can participate in distributed generation. Individual households and municipal governments can participate, utilizing small on-site wind turbines to meet the energy needs of a house or public building. In the course of our research, ejidatarios expressed interest in harnessing wind energy for agricultural functions, but under the current system, grounded in the private property regimes reinforced under CFE grid connections, shared electricity production and consumption is a difficult proposition. In theory, an ejido could establish a singular entity, with its own meter and a CFE account, however, this requirement illustrates one of the limits to collective, distributed electricity adoption.



Potential community distributive generation scheme and benefits for Ciudad Ixtepec

The high upfront capital costs of even small-scale renewable systems (PV panels and wind turbines) and the need for land for project siting leave the opportunity of local, renewable generation out of reach for most residents in the Isthmus and throughout Mexico.

Given these limitations for net-metering and distributed generation, we advocate for the Mexican Energy Regulatory Commission (CRE) to make a regulatory change to enable community distributed generation. As we define it, community distributed generation would allow the site of production to be separate from multiple sites of consumption, thereby enabling a single project to serve multiple participants. This fundamental change could then allow existing social groups, neighbors, ejidos, and other organizations to leverage collective power and resources to make projects attainable and distribute project benefits.

Under this model, participants could contribute different resources to a project based on their financial situation, time and skills. One project household might contribute land on the outskirts of the city to site a turbine, while others could contribute upfront money to purchase the equipment and still others might chip in with maintenance and management. Credits for electricity generated could then be redistributed to participants through agreed-upon methods based on need and contribution.

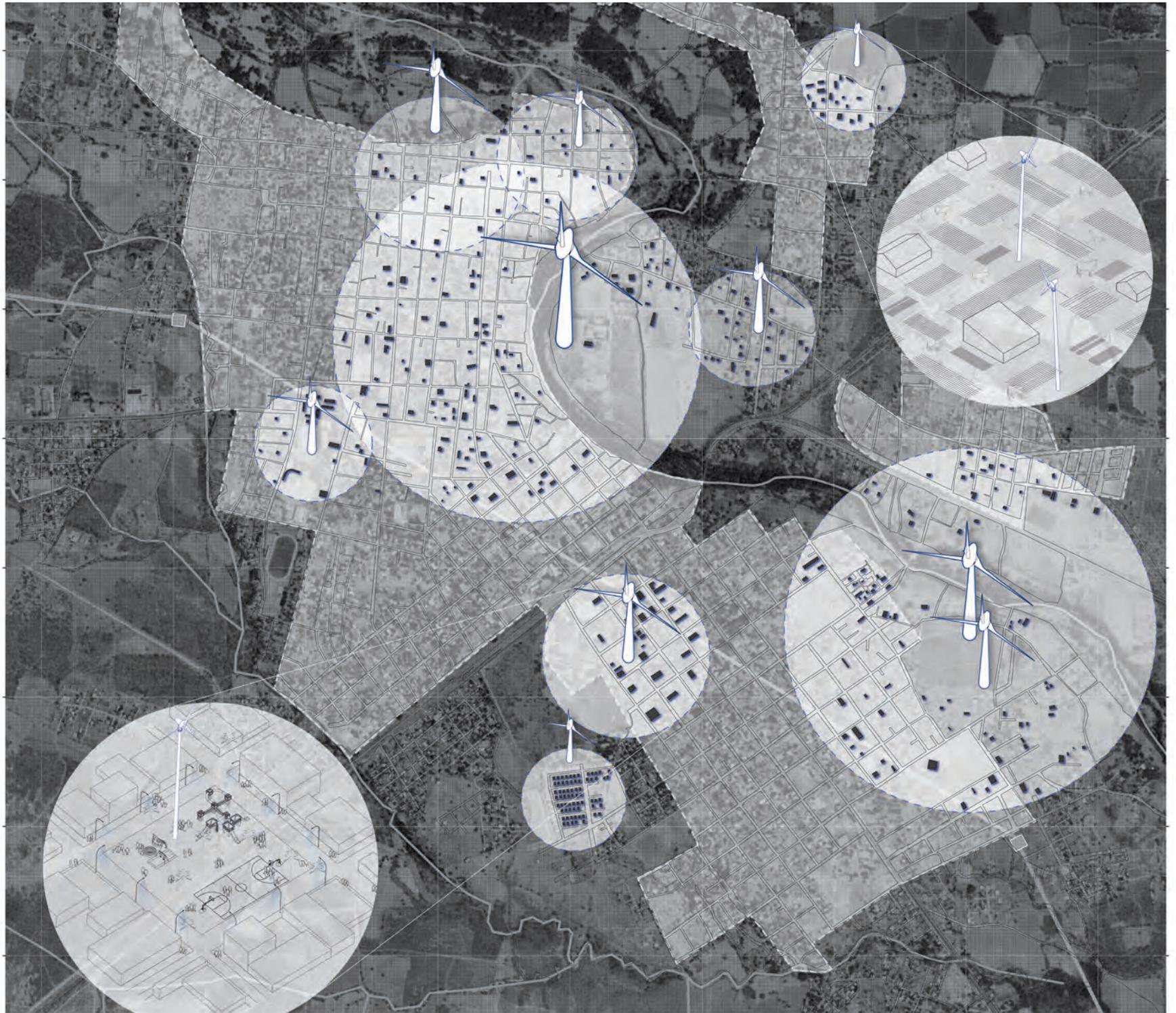
Even with allowances for collective participation, existing electricity subsidies and the high initial investment costs for a wind project present challenges for adoption. However, with the escalating costs of subsidies, the federal government would be served by investing in initiatives that can secure electricity independence. If the government were to redirect money earmarked for subsidies to help finance community renewable projects through a

fund, it could begin to remove households from its subsidy payment obligations as those projects came online and became self-sustaining. At scale, this model could have transformative impacts for local energy sovereignty and frees the state budget for social investment in other areas.

The 2017 earthquakes revealed the tenuousness and fragility of infrastructure in the Isthmus and the limitations of the federal government to respond adequately to these disasters. Research in this volume (López, Quiroz, Valdés) suggests that existing, local networks and institutions provide the necessary trust, cooperation and capacity to better address and mitigate future risk and ongoing stresses.

The destruction of homes has also triggered an unfortunate trend. Of the homes that have been rebuilt, many were reconstructed quickly and departed from the traditional and local vernacular materials that naturally keep homes cool. Cement block has replaced adobe, as people came to worry about the safety and security of traditional building styles. Ultimately, this reconstruction will cause long-term economic burden on families as the energy necessary to cool these structures will inevitably increase. It is, then, within this context of the 2017 earthquakes and their aftermath that Mexico ought to consider opening the opportunity for community distributed generation to its citizens.

The Isthmus of Tehuantepec has the wind, independent spirit, and existing social networks to pilot community distributed projects. Now is the time for Mexico to embrace those qualities and empower the region.



Schematic vision for community wind generation in Ciudad Ixtepec, Oaxaca



Part IV.

Enabling Constructive Change

Territories of Risk: From Risk to Resilience Douglas Ahlers	228
Education as Recovery: Educational Interventions in Chile After the 2010 Earthquake Judith Palfrey / Elizabeth Peacock-Chambers	234
Infrastructural Connectivities: A Conscious Infrastructure for Mexico Gustavo Madrid	238
University and Community: Towards a Virtuous Connection Lilia Cruz / Vicente Marcial	242

From Risk to Resilience

Territories of Risk

Douglas Ahlers

When we look at the concepts of risk and resilience, we need to start by understanding the underlying terms. Risk is defined as a probability. Risk is the probability of a set of outcomes arising from some future event that itself has a probability of occurring.

The terms risk and uncertainty are often interchanged, but we distinguish the difference as risk involving “probabilities of possible outcomes [that] are known or at least estimable,” whereas uncertainty is used in “situations where such probabilities cannot be estimated.”¹ This is an important differentiation when it comes to classifying risk and determining strategies of resilience. Howard Kunreuther and Mark Pauly point out the difference between known risk (K) and unknown risk (u), where it is difficult to estimate the probability of an event’s occurrence and/or the probability of the outcomes that will arise from that event if it does occur.² Building resilience for unknown risks (uncertainty) is difficult, but that does not make the impacts any less real. Terrorist attacks and unmapped fault lines are prime examples of unknown risks with significant consequences. For our purposes, we will focus on known risks where we can formulate strategies for resilience.

Resilience is defined by the United Nations International Strategy for Disaster Reduction (UNISDR) as: “The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management.”³ We would add one additional concept to the definition of resilience, and that is to “avoid” the hazard in the first place (prevention). Not all disasters can be prevented, but certainly, man-made disasters such as climate change or oil spills could be avoided through effective prevention strategies if they can be (and are) acted on in time. Inherent in this definition of resilience is the concept of a system that is exposed to a shock.

Resilience is also defined as a probability: the probability that the system will be able to avoid, resist, absorb, accommodate, and recover from a shock. Systems can be physical (built or natural environments), economic, social, or cultural systems. Hence, resilience can apply to the probability that physical, economic, social, and cultural shocks can be avoided, absorbed, and recov-

1. American Academy of Actuaries, Risk Classification Work Group. “On Risk Classification.” Public Policy Monograph

2. Kunreuther and Pauly also make the distinction between unknown risk, where the probabilities are unknown, versus unknowable risk, which are events that we have not contemplated as possible.

3. United Nations, General Assembly. Report of the Open-Ended Intergovernmental Expert Working Group on Indicators and Terminology Relating to Disaster Risk Reduction

ered from. Resilience can be seen as the probability of a system to survive. System survival includes the ability of a system to bounce back and reconstitute itself after a perturbation.

Implicit in the UNISDR definition of resilience is the concept that resiliency can exist at the various phases of the disaster life cycle. In the field of Emergency Management, these time periods are generally considered to be prevention, preparedness, response, and recovery. However, a more comprehensive view of the phases of a disaster include the addition of mitigation and adaptation, as well as a division of preparedness into the categories of preparing to respond, and preparing in advance of a disaster to recover. Finally, Haas, Kates, and Bowden suggest segmenting the recovery phase into the restoration phase (short-term restoration of habitability), the recovery phase (long-term recovery), and the recovery II phase also known as the betterment phase (Haas 1977).

Since many disasters happen in areas that have repetitive risk (places where future disasters are likely), the recovery phases merge with the pre-disaster phases of prevention, mitigation, adaptation, and preparation. We can think about the extended life cycle of a disaster as:

- Prevention
- Mitigation
- Adaptation
- Preparation of Response
- Preparation of Recovery (Advance Recovery)
- Response (Emergency Phase)
- Restoration (Short term Recovery)
- Recovery (Long Term Recovery)
- Recovery II (Betterment)⁴

Resilience may (or may not) exist at each of these timeframes.⁵ The best way to think about resiliency is as a probability along a sliding scale from 0 to 1, where zero is not at all resilient (0% probability of being able to withstand a system shock), and where one is fully resilient (100% probability of being able to withstand a shock).

James Reason proposed a model for risk that has become known as “The Swiss Cheese Model.” The Model comes from the study of industrial accidents, human errors, and technological systems failures, but it is a very helpful model for understanding disaster risk and resilience. The analogy is of several slices of swiss cheese lined up in a row, each with various sizes and placement of holes. A threat of a disaster only turns into a disaster if each of the holes of the slices line up in such a way as to allow a disastrous event to occur. Reason explains:

“Defenses, barriers, and safeguards occupy a key position in the system approach... Their function is to protect potential victims and assets from local hazards... In an ideal world each defensive layer would be intact. In reality, however, they are more like slices of Swiss cheese, having many holes.... The presence of holes in any one “slice” does not normally cause a bad outcome. Usually, this can happen only when the holes in many layers momentarily line up to permit a trajectory of accident opportunity—bringing hazards into damaging contact with victims.” (Reason 768).

Each of the phases above will have their own level of resiliency from 0 to 1. For example, a community may be only 15% resilient in regard to mitigation, but 75% resilient in regard to preparedness to respond. Note that these resilience levels are for an event of magnitude (M) and as M changes, so too does the probability of resilience along the 0 to 1 scale. For example, in an earthquake, unreinforced adobe buildings may be resilient (showing light to moderate damage) at a peak ground acceleration (PGA) of $M = .2g$, but they may have no resiliency (complete building failure) at $M = .5g$ PGA. Increasing resiliency (making the “slice” less holey) will decrease loss for all values of M. Adding seismic retrofit to adobe can increase resiliency so that at $M = .2g$ PGA there will be only slight non-structural damage, and at $M = .5g$ PGA the retrofitted adobe building may only have moderate to extensive damage instead of complete building failure (Webster 628).

Certain systems may be very resilient and strong and/or adaptable by nature, whereas other systems may be inherently weak and vulnerable. Construction type (as in the case of adobe above), poverty, lack of resources, weak or ineff-

4. The Betterment Phase of Recovery may include mitigation, adaptation and preparedness for future disasters, but it may also (or alternatively) include other non-risk-reduction betterment activities. For example, the Betterment Phase is often used to apply

best practices for planning and zoning, or to eliminate inefficiencies or to upgrade facilities or technologies, or to make social changes, or to do economic development, or to add more affordable housing, or to address problems of inequity.

5. Note that these phases of a disaster lifecycle are not discreet and mutually exclusive time periods, they often overlap in the years, months and days leading up to the disaster and in the weeks, months and years after the event.

fectual government, war or conflict, lack of rule of law, corruption, lack of clear land-title, lack of building codes/enforcement, lack of a construction industry, lack of engineering expertise, immobile/non-transferable livelihoods (non-portable skills), lack of availability and affordability of insurance, lack of access to credit, and ethnic, religious, age, or gender discrimination, are all factors that can limit the inherent resiliency of a community (often expressed in terms of the “vulnerability” of a place).

But specific actions can be taken to increase the level of resiliency for even the most vulnerable community at any of the pre- and post-disaster phases. In fact, investments in resilience often have a disproportionately greater impact on lower-resourced communities. We often measure disaster losses as a percent of Gross Domestic Product (GDP). If two communities experience the same disaster, but one community has a high GDP and the second community a low GDP, the damage losses as a percent of GDP are much higher (more burdensome) for the second community. Low-income communities are often disproportionately “cost burdened” by disaster losses. So, the Sendai Framework for Disaster Risk Reduction has set one of its seven targets as, “reducing direct economic losses in relation to global GDP”⁶ (Build resiliency to limit losses in lower income communities).

The Sendai Framework sets one of its “priorities for action” as “Investing in disaster risk reduction for resilience.” In other words, taking action steps and implementing strategies to increase resilience. We can identify several possible resilience strategies:

- (1) Retreat (land use policy)
- (2) Harden (withstand shocks)
- (3) Flexible and pliable design (absorb shocks)
- (4) Redundancy (tolerable losses)
- (5) Recoverability (the ability to bounce back)
- (6) Community Capacity Building
(resources and capital, including social capital)
- (7) Transference
(transfer the risk/shock, often through insurance and reinsurance)

We have proposed that a key concept of resilience is that of layers and of building resilience at each of the layers. No one strategy or defense alone will be the answer. For example, in the areas of mitigation and adaptation, New Orleans learned that levees alone were not a sufficient level of resilience. Barrier island restoration, coastal wetlands restoration, storm surge barriers, elevated homes, raised mechanical systems, flood-proof building materials, swales, water-management parks, strategies/designs to “live with water,” universal hazard insurance coverage, and managed retreat are all layers of mitigation and adaptation that are necessary to move resilience closer to 1 on the sliding scale for these phases of the disaster life cycle. Had this mix of resilience strategies involving retreat, hardening, flexible/adaptive design, redundancy, and risk transference been in place, the catastrophic losses in New Orleans would have been significantly reduced.

When the layers of resilient strategies within each disaster life cycle phase make that phase more fully resilient, and when this is true for each subsequent phase, the system as a whole can be thought of as resilient. Moving from risk to resilience therefore means taking a systems approach toward risk management and building layers of resilience at each phase.

6. United Nations, General Assembly. Sendai Framework for Disaster Risk Reduction 2015-2030.

Education as Recovery

Educational Interventions in Chile
After the 2010 Earthquake

Judith Palfrey / Elizabeth Peacock-Chambers

Knowledge accumulated during the last twenty years in terms of physical and mental health support for children in post-disaster scenarios has shown the importance of re-establishing normal routines and regular schedules as soon as possible after catastrophes. For most children, this means going back to school, a haven of security and predictability, an important venue for the provision of services to heal the wounds from the tragedy, and a place to bring communities together.

After the earthquake on February 27, 2010, that hit the Biobio Region, Harvard University's David Rockefeller Center for Latin American Studies' Recupera Chile initiative chose to base many of the disaster recovery activities in schools. This choice was made because of lessons learned after previous disasters in Turkey, Indonesia, and Louisiana and because of the vision of several strong education partners in towns that were badly hit by the earthquake and its subsequent tsunamis.

A national telethon raised money to build temporary housing (or, mediguas) for displaced persons and to shore up schools. Furthermore, shipping containers were donated to towns to use as temporary school structures. In the small town of Perales—where all of the homes were destroyed and families were left stranded in crowded displaced-person camps—the town's health provider, a nurse with three years of training, created a school-like environment in an abandoned building and made sure that the children had a place to study and receive regular meals. Over time, the town was provided with a brand new container to serve as a school, which became the town center—a safe place to gather, to play soccer, and to sell locally made crafts. This pattern of the school as shelter and town center repeated all over the affected region.

Over the succeeding months, as the physical reconstruction began in seaside towns, roads, bridges, stores, and other structures began to emerge. Schools became the place where adults began to identify the needs of the affected children and families. Life in the camps was rough, often brutal, and the memories of the disaster were very present and scary. Children showed traumatic effects in their behavior in school by acting out and calling attention to their pain. Initially, the school teachers and administrators were unsure of what they could do.

An early role that the Recupera Chile team played was to provide the school teachers with a forum for expressing their concerns and a space in which they could ask questions about how to best respond to the children's needs. Members of Recupera Chile came from the Psychiatry Department at the University of Concepción and from the Boston Children's Hospital. Listening carefully

and in collaboration with the school, the Recupera Chile team designed programs to meet the needs of the families of small children, teaching them how to engage with small kids, how to decrease their worries, and to provide comfort and reassurance.

In the schools of the Tomé area, motivated school leaders began to ask how they could widen the purview of the school and fill some of the gaps the disaster had created after damaging the traditional service sector. Together with the school principal of Dichato—a particularly creative school leader—Recupera Chile launched the idea of “La Escuela en Realidad.” In this project, the school transformed into a living, vital instrument of support and growth for the families of the community. The team decided to emphasize three areas: health and mental health; language and literacy; and love of the sea.

Regarding the first area of focus, the lack of health and mental health services for children after the disaster was a big challenge. Because the medical infrastructure had been impacted by the earthquake, many of the issues related to children’s mental health, vision, hearing, and dental problems had gone unrecognized. Working with the Medical School and the Kinesthesiology Programs at the University of Concepción, La Escuela en Realidad was able to identify children who needed mental health treatment, glasses, dental work, and wax removal to improve their hearing. The Kinesthesiology team developed preventive interventions to decrease stress and improve the children’s self-confidence, self-calming, and self-care. The new emphasis on health in the school also led to the planting of a garden and to a more health conscious meal plan for children and staff. Since many of the concerns involved young children, La Escuela en Realidad instituted programs on early language development and literacy. Using curricular materials developed by the Fundación Oportunidad para Un Buen Comienzo, early language and literacy promotion was added to the regular school activities.

The Love of the Sea program grew as a way to get the children back into their local environment, one that was associated with fear and destruction. During the summers, the Recupera Chile team partnered with Fundación Mar de Chile to provide educational programs about marine life, nautical themes, and seafood nutrition. These programs introduced children to the many trades and careers that are closely connected with the sea, providing them with new outlets for recreation and learning.

Over several years, the Love of the Sea program enjoyed greater acceptance by the school, the community, and the parents. Three years ago, the town was willing to allow the school to build a nautical center on the beach. The

Center’s building has room for classes and for storing kayaks and Optimists (small sailboats) that are increasingly popular because they are easy and safe for young children to learn to sail. The formation of the Nautical Center caused an entire transformation in the relationships of the town. Parents began to take on leadership roles in the design and running of the center. They organized programming and funding of special events. They worked with the school to ensure a strong educational program and adequate opportunities for the town children to learn about the sea.

The experience of Recupera Chile—directly integrated with the schools and with the educational growth and mental health support for children and families—shows that as communities face new disasters a strong ally for any recovery program should be the local school.

Infrastructural Connectivities

Thinking a Conscious Infrastructure for Mexico

Gustavo Madrid

For many decades, Mexico's development was based on the constant provision of services and equipment for its rapidly growing population. At the end of the Mexican Revolution (1910-1917), good part of the population was abandoned and neglected, so great efforts were made in terms of national infrastructure: roads, schools, and hospitals multiplied throughout the length and breadth of the country to address the needs of the people.

After a period of expansion that lasted almost all of the twentieth century, the neoliberal development model—which limited the management of infrastructure by the State—and the economic crisis following the signing of the North American Free Trade Agreement (NAFTA) caused a deceleration process of the aforementioned building model during the early 1990s. In the last thirty years, we have witnessed, almost silently, how Mexico has entered into a period of systemic infrastructural crisis. This reality has led the country into a state of historical backwardness, even when compared to other Latin American countries, a situation from which it is urgent to leave as quickly as possible.

Infrastructure is the neural network of any contemporary society and it is not possible to expect its adequate economic, social, and cultural development if the people are not allowed to build efficient networks on which not only customers, but goods, ideas, and changes can travel. Nations with the best economic and social equity rankings are those that have developed high-level communication infrastructures. It would be enough to look at the submarine optical-fiber-cable map to find out where the economic centers that dominate the planet are currently located.¹ In this scenario, small urban cores end up representing greater territories and spheres of power due to the communication capacity they possess. The Netherlands, for example, a small country inhabited by only 17 million people, has the most important port in Europe (Rotterdam) and one of the financial capitals of the world (Amsterdam).

This “Dutch Secret” is based on a wide infrastructural network that includes rail mobility, extensive telecommunications, and a river system that has been developed for centuries. Furthermore, a powerful administrative management system allows all these components to work efficiently.

Moreover, the Nordic countries—including Iceland—have developed large and small infrastructure networks that connect them to each other, forming a complex and broad platform that has led to the well-being of its inhabitants.

In Mexico, however, the enormous inequality in which locals inhabit can be easily linked to the way infrastructure has been historically developed. As an example, the construction of the railway network—which began at the end of the nineteenth century—expanded widely in the northern and central areas of the country and with much less momentum in its southern and southeastern territories. The difficulties of the topography, as well as the complexity of social dynamics, the low population rates, and the absolute abandonment of indigenous communities, did nothing but hinder other infrastructural plans. Since then, the lack of well-planned infrastructure has taken its toll on the human development of these regions. Compared to other parts of the country, the existence of infrastructure in the south has only allowed for industrial and commercial development in favor of few elites, and has paradoxically generated the emigration of millions of underprivileged people from the south to the north.

According to the Instituto Nacional de Estadística y Geografía (INEGI), in the state of Oaxaca, only 25% of the economy is based on industrial activities and only 15% is linked to manufacturing ones. These numbers reveal that the economy is totally focused on the provision of services, a reality that portrays the limited infrastructure in the region.

When planned correctly, infrastructure can support the productive activities of society and allow for their economic growth. Interconnection with other local and global actors is relevant, since our status as a global society obliges us to continuously interact with almost any part of the world.

Nowadays, we receive new information at all times and are accustomed to getting access to live news in any part of the globe. The invention of the Internet, one of the most relevant infrastructures of the contemporary era, represents one of the great advances of our civilization. However, the importance and efficiency of this and other infrastructures lie in their complexity: for the internet to work, an intricate structure of technical networks, devices, servers, satellites, etc.—built through time—allows our data to travel at great speeds through virtual space.

For this reason, infrastructural networks are a major part of the world we inhabit, and their expansion and continuous improvement is already one of the greatest challenges we face as a globalized society. For example, internet access is now a factor when measuring human development and has become a way to bring equality to the people. Local infrastructure must be developed according to the particularities of each place and follow the real requirements of its inhabitants. Perhaps the biggest mistake made in recent

times when trying to integrate and extend technical networks on the planet—and the reason for the repeated failures in the Oaxaca context—is the large disconnection between territory, society, and infrastructural visions.

It is important to understand the scale of each territory so that we can plan, design, and build infrastructural networks that are not only operational, but sensitive to the environment and to local populations, including their traditions, ideologies, and ways of living.

University and Community

Towards a Virtuous Connection

Lilia Cruz / Vicente Marcial

The effects of the earthquake that shook the southeastern regions of Mexico on September 7, 2017, can still be seen today in Juchitán, Oaxaca. Almost two years after the event, most of the public spaces and a lot of houses are still collapsed. The municipal government building, the Church of San Vicente Ferrer and the Casa de la Cultura have not received other interventions than external wood reinforcing. The only public space standing today is the Foro Ecológico Juchiteco, which was rebuilt by a civil entity.

Furthermore, the great majority of public schools are functioning in an irregular way. Children keep studying while listening to the noise created by the rebuilding efforts, their current classrooms only separated from construction tools and workers by a thin metallic mesh. Many houses are incomplete and plenty of vacant lots are still visible around the city. The majority of demolished houses—built with traditional techniques and materials, such as brick, wood and clay-tiles—have been substituted by small cubic concrete houses (real full-scale ovens) built by private foreign companies.

However, the ubiquitous devastation has not diminished the urge to recover from the disaster. Istmeños are confident they will eventually rebuild their homes, their city, and their heritage while their willpower is propelled by solidarity efforts of institutions from other parts of the country and beyond who strengthen these hopes. A multitude of experts have come to Juchitán and to the whole region of the Isthmus of Tehuantepec to understand the situation to propose alternatives and solutions. Geologists, engineers, architects, sociologists, doctors, psychologists, and many other professionals have gotten involved with local communities to help find the answers to some of the problems faced by the affected society.

The presence of universities and higher education institutions thus has become really relevant. Apart from being spaces for teaching, learning and researching, universities should aspire to go beyond campus and engage with their surrounding communities and societies. All the knowledge acquired by students in the classrooms should be made available to the people, establishing a sort of dialogue between the university and the local population.

Following this logic, a semblance of the work of students from American universities—who unified their efforts and created networks to exchange accumulated knowledge on the post-disaster situation of the Isthmus of Tehuantepec—has been portrayed in the previous chapters of this volume.

According to each team's expertise, groups of students and faculty reviewed the most pressing issues. Learning from other similar phenomena around

the world, the students groups pointed towards better ways to address the problems they encountered. Their biggest contribution, however, has been making their research and design capacities available to our community. Students analyzed the causes and effects of the earthquake and studied similar cases in other parts of the world. Their projects have not only suggested ways of addressing the difficult rebuilding tasks, but have gone beyond reconstruction and have identified the disaster as an opportunity for change.

While working together, we have to understand that to overcome catastrophes—not only in terms of infrastructure, but also of psychological and human resources—we also need to learn to be resilient and to be better prepared for future, and probably more destructive, events.

In this way, university engagement and its connection with the community has transformed into a more human enterprise, becoming a sort of sounding box in which the needs and concerns of the underprivileged people of our region meet with students to discuss their vision of change for the benefit of the whole society living in Juchitán and the Isthmus of Tehuantepec.



EL CARMEN

ISCELANEA DEL CARMEN

14783

14783

vela

UNIVERSIDAD
CLAVE: 20MSU0054G *Colegio Educativo*
CENDI PREESCOLAR PRIMARIA SECUNDARIA
Tu opción educativa in

Conclusion

Lessons From a Year in Post-Disaster Oaxaca

Diane E. Davis / Lorena Bello Gómez

Concluding Remarks on Pedagogy and Practice

As noted at the outset of this volume, our focus on Oaxaca derives from a concern with its extreme poverty, its contested territorial history, its fragmented political geography, and the uniqueness of its cultural, social, and economic conditions. Many of these features have been discussed in other sections of the book. Suffice it say that they all have contributed to the long-term neglect and regional marginalization, leading to the chronic vulnerabilities and infrastructural as well as economic problems addressed by students with their focus on Oaxaca and the Isthmus of Tehuantepec in the aftermath of the 2017 earthquakes. It would make sense to frame any proactive effort to address the long-term challenges of this region through the lens of resilience. But it also is important to recognize that chronic risk is also pervasive in these territories, and thus we must think about risk reduction as much as resilience as we ponder Oaxaca's future.

Indeed, in the context of Mexico's Isthmus of Tehuantepec it may be impossible to think about the future without recognizing and preparing for risk. Risk is everywhere. It takes many forms. It affects peoples' lives in myriad ways, not merely in the threat and likelihood of yet another earthquake in this seismically active region. Both in the Isthmus and around the world, risk manifests itself in environmental vulnerabilities and climate change disasters. It haunts us in the unthinkable but all too common appearance of intense conflict over resources and political power. It scares us with the spread of health epidemics that circulate through face-to-face contact and other nefarious routes. And it still confronts us in the old-fashioned way: in the form of financial and market risk, which in recent years have been exacerbated by overbuilding and the mortgage crisis, some of which are owed to the globalization of investments in the built environment as much as to the destruction or abandonment of housing in the face of environmental disasters. All of these forms of risk are pervasive, even beyond Mexico. But in the past year or two they have come to define much of the debate over Mexico's southeastern regions as well as the future of the Isthmus, particularly now as current national plans for a tourist-oriented "Mayan Train" and other cross-Isthmus megaprojects threaten to undermine the ecology and local traditions of the region, thus producing local pushback, even as they will require government investment and debt-financing that may increase dependence on external investors.

The explosion of infrastructure and building projects for this region, of which the Mayan Train is merely one, owes partly to pressures from investors to find new outlets for accumulation (Harvey 1982, 1985) or to more current trends of rural resource extraction necessary to continually fuel the engines

of planetary urbanization (Brenner 2014). In recent years, both logics have fueled the “wildly civilized” growth of cities and exploitation of their hinterlands or further regions in ways that consume critical environmental resources and transform spatial conditions to drive new forms of unsustainability and risk, including the laundry list of concerns noted above. Whatever form it takes, the world today is replete with a range of risks and precarities produced by current or prior patterns of urbanization. Oaxaca is no stranger to these trends, and the current battle over energy and rail infrastructure investments in the Isthmus (which has the geographical “advantage” of potentially linking western with eastern waterways so as to compete with the Panama Canal as a global node of exchange) now threatens to pit foreign investors against both local residents and the more nationalist administration of Andrés Manuel López Obrador. The windfarm project proposed in this book can be seen as a proactive response to precisely this kind of development, with its focus being to reduce or at least redistribute the economic, environmental and social risks associated with monopoly control of energy resources in the Isthmus.

As residents of vulnerable cities and regions try to stay ahead of the game by thinking proactively about environmental, social, and political vulnerabilities on the horizon, it is the notion of resilience that has taken the policy, design, and urban planning worlds by storm. From the Rockefeller Foundation’s new global initiative (where cities around the world competed to be branded as among the world’s 100 most resilient), to the barrage of academic conferences and new study centers hosted by universities and multilaterals, to the programs sponsored by technology corporations and design firms (including the joint IBM-AECOM or UN-Habitat recent piloting of a disaster resilience scorecard), to the US State Department’s appropriation of resilience as a thematic rationale for international aid (built around the understanding that environmental vulnerabilities, broadly defined, are linked to problems of poverty, conflict, and violence), resilience is now the watchword of our times. It is promoted as the rationale for a new and expanding repertoire of tools -- from novel technologies to reconfigured mapping and building products -- that will guide us to a secure urban and global future.

1. “The Isthmus of Tehuantepec rail line; Interest from China and backbone of the Special Economic Zones (ZEES).” *Mazatlan Post*, July 11, 2018.

But resilience is a tricky word, readily veering into the ideological. Defined as the ability to cope and adapt so that individuals or communities survive and thrive, resilience is all about optimism. Whether conceived in terms of “bouncing back to normal” after a disaster, or as a means of re-establishing system equilibrium after a shock, embracing resilience means having faith that with enough attention and effort, the future can be better. However, such assumptions often ignore the inter-relationalities of risk. There are trade-offs among forms and patterns of resilience, not just among different residents or locations in the same city but also in terms of immediate versus long-term gains in livability, such that coping strategies in some domains (say environment) may actually reinforce the structural problems that create risks in other domains (say inequality). To the extent that social, economic, and environmental ecologies are connected, both locally and across scales that link cities to regions and beyond, any resilience strategy must be grounded in an appreciation of how risk unfolds across the entire landscape of a territory and as part of a networked system embedded in a larger global ecology.

Designing in Vulnerable Territories: Thinking Proactively

Design thinking helps prepare us for confronting this complexity. But we must do more than merely acknowledge that any single project or intervention will have implications far beyond its targeted scope, both in scalar and sectoral terms. Just as important, as we do so we must collectively embrace a focus on risk, such that we are prepared to build, design, and plan for constructive action in a context of multiplying and inter-connected vulnerabilities, which themselves unfold at both a local and regional scale. These lessons have not been lost on our students, many of whose projects seek to link the strengthening of social capacities to new forms of infrastructure design and development, for example. Yet to continue the task of proactively designing for vulnerable territories at risk, we may also need to develop new guiding principles and paradigms.

In the heyday of modernism, professional designers, architects, and planners were motivated by dreams of order, a commitment founded on the belief that tensions between the natural and the built and social environment could be managed if not overcome. When modernist paradigms ruled, the tendency to build bigger and better reinforced faith in the inevitability of progress, and the sense that any new urban or built environmental challenge could be resolved if enough technology, money, and creativity could be thrown at it. In the current era, and particularly in the case of Oaxaca, we see both hope and potential in the smaller-scale, bottom-up, targeted interventions that lay a pathway for constructive change by mobilizing human

capital, collective action, and creativity in ways that depart from top-down practices associated with master planning or mega-project development.

Such actions and sensibilities are not merely appropriate responses to conditions in Oaxaca, whose territorial landscape is formed by small villages and community-based institutions accustomed to deliberation and consensus. In a time of accelerating risks, we must begin to recognize that many of the strategies associated with the modernist agenda have created insurmountable problems for us today. Because of this, in addition to new building and design techniques, we need a new way of thinking about the form, function, and connectivity of cities and regions that can respond and counter the strategies of the past, and we must frame these plans for the present in the context of their impacts on the future. One way to do so is by rethinking teaching and research priorities to reflect this new form of futurist thinking in a world at risk. In addition to the huge commitment to enabling more robust and resilient forms of urbanism that make sense in the context of future ecologies of risk, we are learning to value and embrace flexibility as a concept to amplify the design of urban infrastructures, land uses, and buildings, sometimes even embracing the benefits of informality over formality, if only to allow for dynamism rather than fixity in city form and function. We are also learning how to identify, map, and communicate urban and environmental risks in ways that are legible to citizens and city-builders, with the hope that they in turn will support the design and building practices that identify the future as a reference point for building better cities today. Some of the projects presented in this book have taken this mandate to heart by offering new ways to mobilize and strengthen local citizens in Oaxaca so they can act now and also prepare for the next disaster, whether through activation of public space, building of schools out of rubble, or mobilizing art in the service of social connection.

But empowering citizens to push back against risk also requires a critical posture, since the notion of risk can also be appropriated ideologically. The stark truth is that risk does not reside only in the domain of science and the “factual;” risk — as a notion — is deeply informed by power and social questions, including who has the right or authority to define risk, how risk is distributed, and who pays and who gains from it. In that sense, it is important to avoid the “tyranny of risk” as a defining principle for action, and to understand that discourses of risk can be abused (as much as used positively) to justify displacement, controls on citizens, limits on space, and other forms of exclusion that challenge the social and equity principles that also frequently guide constructive work. In the case of the earthquake, for example, federal authorities made blanket calculations about which houses were at risk and

why — a set of decisions that fueled industry demands to jumpstart new housing construction, and that often led to unnecessary demolition. For all these reasons, strategies to deal with risk and foment resilience must be grounded in knowledge generated from communities and their residents, who know best what is actually at stake in efforts to reduce vulnerabilities and secure a better future.

From Resilience to Risk and Back

Academics, professional designers and planners, and post-disaster policymakers must be prepared to confront all these dilemmas with communities as partners. In much of the work on cities in conflict and post-conflict settings, where the daily experience of risk can be so overwhelming that standard design and reconstruction strategies are impossible to implement because of social and political instability, who or what is at risk is under constant debate and not entirely clear. Complicating efforts to minimize risk is the fact that in many settings around the world, multiple forms of risk overlap in ways that call into question action strategies built around a singular framing of the problem, whether scalar or disciplinary. As with resilience, the intertwining of risks in contemporary life requires a whole new way of thinking about cities and regions, their form and governance, and the territorial and built environmental context in which they are embedded (Davis 2019). Confronting this reality will require inter-disciplinary interaction and dialogue among the various design, planning, and architectural professionals, who will need allies in the social sciences, biological, engineering, technology, and public health professions. Our partnership with colleagues in Chile, reflected in the essays in this book, is one example of such triangulation and how it can lend new insight into the challenges of post-disaster recovery and action. Although such cross-disciplinary aims have always been central to design and planning practice, in today's world the range of risks we face means that the number and array of disciplinary partners continues to expand way beyond the building sciences and the familiar domains for urbanism.

All this means that there may even be an upside to the emergence of risk and to disaster events like the Mexican earthquakes of 2017: they hold the potential to create new disciplinary synergies and to bring a wide range of disparate experts within and outside the university together to jointly address the multiple vulnerabilities of landscapes and contemporary lifestyles. Academic institutions like Harvard and MIT are trying to keep up with the pace of the enormous changes common to what Ulrich Beck calls our “global risk society,” but like all institutions governed by bureaucratic inertia, they are slow to change (Beck 1999). Not so their students. As such, it is those ensconced in the trenches of design and planning exercises, such

as those offered through our year of research and coursework, that might be best situated to fuel the fires of innovation by opening their arms to new disciplinary partners for risk assessment and thinking outside the box when it comes to moving beyond reconstruction and addressing ongoing risk and vulnerability. The ideas and projects imagined by our students will need the validation and involvement from the communities they are inspired to serve, as well as from local authorities and institutions who will be central to the implementation of these ideas. But there also is a role for universities or other institutions whose students and faculty are committed to viewing the larger scales, socio-political contexts, and ethics of such project interventions, who can assess and frame the larger human impacts of well-intentioned actions at the manageable scale where constructive change will have to start.

From Reconstruction to Retrofitting in Oaxaca: Disaster as an Opportunity

The work presented in this volume was developed with precisely these aims in mind. As faculty and students, we joined together behind the belief that even in communities facing chronic vulnerabilities and accelerating risk, there is scope for responding to natural disaster with potentially transformative projects and ideas. Such hope and optimism is needed precisely when the damage is enormous, as occurred during the devastating earthquakes that hit some of the poorest regions of Mexico in 2017, including Oaxaca. For a variety of reasons, most of which have been presented or discussed in prior essays, Mexico's national authorities failed to rebuild and reconstruct in a manner that adequately responded to the basic needs of residents living in the poor and isolated towns of Oaxaca's Isthmus of Tehuantepec. Yet despite these failures, the earthquake revealed a series of missed opportunities and unexplored avenues for action that hold the potential to proactively address the longer-term vulnerabilities facing the region and its citizens.

In the Isthmus, the most pressing vulnerabilities include sustained out-migration of the labor force, engrained poverty, lack of trust in state and federal authorities, and limited involvement of local authorities in major infrastructural decisions affecting both the built environment and individual resident and town livelihoods. Inadequate roadway and transport connectivity, clean water supply and management, and limited provision of electricity have loomed large as among the most critical servicing deficits that have negatively impacted the region. When the earthquake hit, these already inadequate infrastructures were further challenged, and most were temporarily disturbed or disabled. As such, once town life returned to normalcy and citizens sought to rebuild their homes and livelihoods -- with a one-time government housing subsidy and a large dose of sweat equity -- these preexisting infrastruc-

tural disruptions and deficits did not disappear. While some individuals hard hit by the earthquake were able to "bounce back" in a way that suggested resilience, the same could not be said for the built environment and its infrastructure. In short, Tehuantepec society demonstrated resilience, but the urban fabric did not.

This realization motivated us to turn our attention directly to the social and economic risks and vulnerabilities wrought by the area's longstanding infrastructural and investment neglect, and not merely the disaster itself. Our students dedicated their creative energies to projects that could be mounted in a post-earthquake environment, but with an intent to address the conditions that rendered these towns so extremely vulnerable to episodic disaster in the first place. As a group, students focused less attention on rebuilding needs produced by the "natural" disaster that arrived in the form of an earthquake, and more on the retrofitting needs of a region where years of neglect and infrastructural precarity had already formed the basis for a much greater and more long-lasting "man-made" disaster. These vulnerabilities were produced by chronic state neglect, human and resource exploitation motivated by exploitative capital, and irregular or substandard infrastructural decisions made with an eye to greasing the wheels of public and private sector priorities, wholly independent of the pressing needs of citizens. A more challenging situation for generating individual and built environmental resilience would be hard to imagine.

Rather than shying away from these challenges and the politics or cultural practices from which they emanated, our students assessed, absorbed, incorporated, and collaboratively generated novel planning and design strategies to help overcome them, with the aim of strengthening individual and infrastructural resilience within and across the towns that comprised the region. Over the course of a year of research, analysis, fieldwork, and engagement with both local citizens and authorities in a variety of locations in the Isthmus, our student teams shifted their priorities from rebuilding or recovering what was lost to identifying new avenues for strengthening local capacities to remedy or retrofit longstanding infrastructural deficits and other pressing vulnerabilities. In that sense, we use the term 'retrofit' here not simply to refer to a structural repurposing, but also to refer to the task of remediating or reversing chronic infrastructural vulnerabilities that existed long before the earthquake. With a projective commitment to recasting or

reconfiguring pre-earthquake institutions and social, spatial, and economic practices, our students developed projects intended to reduce chronic vulnerabilities in ways that would strengthen both individual and infrastructural resilience.

Project Pathways and Threads

Our various student teams developed their projects separately, each pursuing different priorities and sites but cognizant that all were focusing on interconnected vulnerabilities in a single region. Groups identified different problems and scales of action ranging from the human to the territorial. We set up a process that allowed students to combine different modes of research and that required different types of deliverables: conventional class readings and assignments, fieldwork, independent study, workshop, and a public symposium. These pedagogical and experiential ingredients provided the epistemological infrastructure for student engagement with Oaxaca and with the unique social, cultural, and spatial conditions of the Isthmus of Tehuantepec. Different teams mixed and threaded elements in different ways, in combination with self-driven independent research, to formulate the what, how, and why of their propositions. Field research enabled workshop participants to actually see, experience, and engage with the disruption caused by the earthquake. This was a deeply ethnographic immersion that sometimes eludes post-disaster recovery agencies who are driven by urgency, programmatic mandates, and a pre-given menu of best practices.

This fieldtrip exposed students to local knowledge, which served as a basis for identifying a disconnect between many conventional post-disaster policies and priorities (in Mexico and elsewhere) and what residents themselves identified as being needed to reduce risk vulnerabilities in the Isthmus. At the same time, the social and physical distance between Oaxaca and Cambridge not only allowed students to look elsewhere for ideas and inspiration; it also permitted students some respite from the sense of futility that can flower in conditions of chronic vulnerability. The Isthmus of Tehuantepec, as indicated earlier, can readily be seen as an institutional palimpsest of ineffective, self-interested, and openly exploitative efforts by political and economic elites, mapped onto a rich culture of indigenous practices and traditions, with the two worlds seemingly on a collision course. The introduction to this book documents the lack of trust and the failure of federal and state authorities to acknowledge and constructively embed local institutions, cultures, and priorities into disaster recovery efforts.

Because the culture and natural resources of the Isthmus of Tehuantepec have been depleted over the centuries, leading to the enrichment of out-

siders more than the Istmeños themselves, our students were motivated to reverse or reconfigure this exploitative history. They understood the Isthmus of Tehuantepec as a geography whose ecological, topographical, and morphological elements were physically interlinked in rhizomatic fashion. They dedicated themselves to understanding and applying design to engage this terrain, identifying interconnected and systemic threads that could spread reconstruction horizontally across this rich social and ecological landscape. Students embraced trauma through the arts, thereby engaging the profound cultural richness of the area; they simultaneously repurposed rubble and the social practice of *techio* to enhance memory, ecology, and education so as to remedy social ills while rehabilitating and restoring fabric; and they envisioned and territorially remapped an institutional and ecological rehabilitation of the region's wind and water infrastructure. They even tackled the humanitarian dimensions of the current crisis by providing design-driven safe havens for Central American refugees fleeing injustice via the *La Bestia* migrant train that passed directly through the Isthmus. With these various projects our students created a tapestry of interventions for the region, crafted from multiple threads woven together through projective design sensibilities, humanitarian planning aspirations, and an over-arching commitment to reforming exploitative power structures and strengthening human capacities in ways that could help produce a more resilient Isthmus.

The twentieth century is sometimes understood as having brought trauma, injustice, corruption, and tragedy to Mexico, its 1910 Revolution notwithstanding. To many in the Isthmus, the modernism of the twentieth century was in fact no better than the oppressive nineteenth century dictatorship of Porfirio Díaz, precisely because it was associated with a Leviathan state (Davis 1994) that favored the capital city and alternated between dominating, exploiting, and neglecting Mexico's regions (Rubin 1997). Whatever the origins, the result was a steady erosion if not obliteration of regional cultures and traditions, including those in the Isthmus that have been further challenged if not destabilized by the earthquake. However, it can be said that Mexico's twentieth century also produced a humanitarian and innovative form of modernism, that of Hannes Meyer, who among others aligned with the socially-conscious modernism that originated in Europe in the Bauhaus, and brought it to Mexico under the receptive eye of the post-revolutionary Mexican government. The ideas associated with the Bauhaus can in fact be understood as embodying a fusion of Art, Arts & Crafts, and Design that hold the potential to promote the equality of women, the valorization of indigenous culture, and the building of a progressive political agenda capable of transforming both social relations and physical spaces.

It is this latter framing which sustained our efforts in the Isthmus, and in so doing we have drawn inspiration directly from one of the Bauhaus' most poetic exponents: the weaver Anni Albers, who traveled to Oaxaca in the 1930s and generated seminal textile work in response to what she saw. Albers' tapestry, inspired by the Zapotec ruins of Monte Alban outside Oaxaca City, is a powerfully abstract design whose colors, weave, and composition suggest a contemporary (1930s) understanding of landscape and abstraction, but whose form replicates and celebrates the indigenous textile traditions associated with this region (Albers 1965).

The textile is a powerful, and to our minds projective, symbol not just of Oaxaca's past but also its future – one in which indigenous communities appropriate modernity in the service of their own local interests by applying cutting-edge practice in resilience, sustainability, design, and planning as a rebuttal to the exploitation of the past and as a blueprint for a more resilient future. This is the vision to which we collectively aspired during our year in Oaxaca, and we continue to be committed to its realization.



Anni Albers, *Monte Alban*, 1936. Silk, linen, wool. 146 x 112 cm (57 1/2 x 44 1/8 in.)
Harvard Art Museums/Busch-Reisinger Museum, Gift of Mr. and Mrs. Richard G. Leahy, BR81.5
© The Josef and Anni Albers Foundation / Artists Rights Society (ARS), New York



Appendix A. Beyond Reconstruction: Mexico and the 2017 Earthquakes

ADV-9147 Spring 2018 Course Syllabus

Diane E. Davis / Jose Castillo
TF: Caroline Filice Smith

This research seminar examined post-earthquake Mexico by using the recent disaster as an opportunity to rethink, conceptually redefine, and proactively reconstruct or reconfigure new forms of urbanization in Mexico.

Students used a variety of methodologies such as analytical mapping and design techniques as well as archival, survey, planning, ecological, engineering, and critical conservation practices to establish the groundwork for a more socially vibrant, environmentally sustainable, culturally sensitive, and aesthetically profound urbanism, paying special attention to the inequalities and injustices played out across urban space and territories and seeking to remedy them through novel reconstruction practices.

The course was opened to students in all programs at the GSD, so that a trans-disciplinary dialogue produced more innovative and more consequential strategies for constructing a new urban and territorial future in Mexico.

The class met once a week, structured around a visiting speaker, readings, and deep conversation on a range of focus topics intended to generate new knowledge as well as critical questions about the history, politics, governance, cultural traditions, and architectural practices in Mexico. These themes served to contextualize our discussion of prior and current efforts to recover from crisis or disaster in Mexico and elsewhere. Students produce a final research paper or project that leads to a proposed intervention (at any scale) or a critical rethinking of past practices, justified in terms of its proposed impacts on urbanization and urbanism using the criteria noted above.

Learning Objectives

- Compare, contrast, and analyze practices of disaster recovery in Mexico and elsewhere, using both standard metrics and critical interpretive lenses.
- Recognize and document how long political, economic, and cultural histories intersect with contemporary state and citizen responses to crisis and disaster, across both 'urban' and 'rural' territories.
- Situate and challenge contemporary discourses on disaster response and recovery within theories of modernization, crisis, and the 'natural'.
- Identify the various ways that various stakeholders – from NGOs and the state, to civil society – intersect, through cooperation, co-option, and conflict in times of 'crisis' or 'disaster.'
- Critically reflect on various methodologies deployed to achieve post-disaster aims.

- Develop the analytical skills to propose post-disaster recovery projects that challenge long-standing urbanization patterns and their unequal distributional impact.

- Offer projective ideas and grounded proposals for the case of Mexico that, if implemented, could alter the lives of citizens affected by recent disasters in that country.

Part I. The Who, What, and Why of “Recovery”

Davis, D. (2015). *From Risk to Resilience and Back: New Design Assemblages for Confronting Unknown Futures*. *Topos*, 90.

On Crisis and ‘Natural’ Disasters

These readings build on conceptual and definitional debates about what constitutes a disaster, natural or otherwise. By focusing on ‘crisis’ and not merely disaster, we also are able to discuss the ways in which the contemporary political and territorial history of Mexico (which has been disrupted by the earthquake) itself emerged from a crisis of sorts – namely, the Mexican Revolution, which evolved in the context of tensions produced by uneven development and the stark distinction between urban and rural areas.

Zeiderman, A. (2012). *On Shaky Ground: The Making of Risk in Bogotá*. *Environment and Planning A*, 44(7), 1570-1588.

Smith, N. (2008). *Uneven development: Nature, capital, and the production of space* (3rd ed.). Athens: University of Georgia Press. 1-92.

Easterling, S. (2010). Mexico’s revolution 1910-1920. *International Socialist Review*, 74.

Serres, M., & Feenberg-Dibon, A. (2014). *Times of crisis: What the financial crisis revealed and how to reinvent our lives and future*. New York; London: Bloomsbury Academic.

Medina, S. (2017, November 01). *Un Desastre Antinatural*. Nexos. Retrieved from

<https://www.nexos.com.mx/?p=34383>

Temporality and Permanence (Thinking about Progress and Modernity)

We asked critical questions about the epistemological assumptions underlying efforts to recover, with special attention to whether the reference points for recovery are the past, the present, or the future. We did so in part by engaging with theories of modernization, which build on certain ideas about what constitutes progress, and by asking students to think about what types of societies they will want to reproduce or produce in the context of disaster.

Latour, B., & Porter, Catherine. (1993). *We have never been modern*. Cambridge, Mass.: Harvard University Press. 1-13.

Bauman, Z. (2000). *Liquid modernity*. Cambridge: Malden, MA: Polity Press; Blackwell. Pp. 1-15 and 113-118.

Redfield, R. (1930). *Tepoztlan, A Mexican Village: A study of Folk Life*. Chicago, Ill.: The University of Chicago Press. 1-97.

Germani, Gino. (1981). *The Sociology of Modernization*. New Brunswick, N.J.: Transaction Books. 113-147.

Franzen, J. (2015). *Carbon Capture*. *The New Yorker*, 91(7), 56.

Goldman, J. (2005). *Warsaw: Reconstruction as Propaganda*. In L. Vale & T.J. Campanella (Eds.) *The Resilient*

City: how modern cities recover from disaster. Oxford; New York: Oxford University Press. 135-158.

Narratives of Disasters in the Local and Global Imaginary

The course dived into the question of narratives, examining how protagonists involved in disasters create meaning through the stories they tell about the trauma they have faced. Conversely, we examine the ways in which storytellers — both fiction and non-fiction writers, as well as actors involved in reconstruction — talk about disaster. Our aim is to think more reflectively about the role of communication and storytelling in representing the challenges of disaster, in linking

disasters to other experiential conditions, or producing new forms of meaning in the face of crisis and disruptive change.

Rubins, J. (1992, February 16). *How Capitalism Causes Earthquakes*. *The New York Times*. [Review of Jonathan Franzen’s *Strong Motion*].

Eder, R. (1992, February 02). *Shaky Town East: Strong Motion*. *Los Angeles Times*. [Review of Jonathan Franzen’s *Strong Motion*].

Giles, Jeff. (2002). *A shock to the system: Haruki Murakami’s stories are set in Japan in the month after Kobe*. *The New York Times Book Review*, 107(33), 5. [Review of Huki Murakami’s *After the Quake*].

Keeley, B. (2002). *Shaken and stirred*. *Far Eastern Economic Review*, 165(48), 70-71. [Review of Huki Murakami’s *After the Quake*].

Poniatowska, E. (1988). *The Earthquake: To Carlos Monsivais*. *The Oral History Review*, 16(1) 7-20.

Garner-Prateres, J. (2012). *After the Earthquake: Literary Responses to Catastrophe in Mexico City, 1985-2000* (Doctoral Dissertation). Brown University, Department of Hispanic Studies, Providence, RI. Pp. 77-112

Rozario, K. (2005). *Making Progress: Disaster Narratives and the Art of Optimism in Modern America*. In L. Vale & T.J. Campanella (Eds.) *The Resilient City: how modern cities recover from disaster*. Oxford; New York: Oxford University Press. Pp. 27-54.

Emergency and Exception

We explored the social construction of emergencies and so-called states of exception, linking the preoccupation with certain disasters or crises to forms of power and to the desires and capacities of certain actors to establish their authority over what Habermas has called “thelife-world”. Building our discussion around this notion, as well as Giorgio Agamben’s classic writings on states of exception and Hannah Arendt’s explorations of humanitarian violence, we will begin to explore the conditions under which certain crises or related challenges are considered normal or routine, as opposed to exceptional.

Swyngedouw, E. (2010). *Apocalypse Forever?* *Theory, Culture & Society*, 27(2-3), 213-232.

Weizman, E. (2011) *The Least of All Possible Evils: Humanitarian violence from Arendt to Gaza*. London; New York: Verso. 27-58.

Kleinfeld, M. (2007) *Misreading the Post-Tsunami Political Landscape in Sri Lanka: The Myth of Humanitarian Space*. *Space and Polity*, 11:2, 169-184.

Ek, R. (2006). *Giorgio Agamben and the Spatialities of the Camp: An Introduction*. *Geografiska Annaler: Series B, Human Geography*, 88(4), 363-386.

Lambert, L. (2016). *The Architecture of the State of Emergency in France*. *Harvard Design Magazine* (Spring-Summer 2016).

Verification, Accountability, and the Role of Citizens vs. State

This week we continue to explore the social construction of emergencies and so-called states of exception, but move beyond the abstract notion of the state to de-construct the variety of actors involved in governance decisions, including citizens, professional planners, political parties, and locally elected authorities. In addition to establishing the “assemblage” of actors involved in post-disaster reconstruction, and identifying paradoxes or contradictions in the way they frame expectations about what should be done, we also examine arguments about whether and how these post-disaster assemblages might strengthen or weaken democracy, governability, and/or equity.

Zeiderman, A. (2016). *Adaptive Publics: Building Climate Constituencies in Bogotá*. *Public Culture*, 28(2 79), 389-413.

Simone, A. (2004). *People as Infrastructure: Intersecting Fragments in Johannesburg*. *Public Culture*, 16(3), 407-429.

Bluhdorn, I. (2014). *Post-Ecologist Governmentality: Post-Democracy, Post-Politics and the Politics of Unsustainability*. In E. Swyngedouw & J. Wilson (Eds.) *The Post-Political and its Discontents: Spaces of Depoliticisation, Spectres of Radical Politics*. Edinburgh: Edinburgh University Press. 146-166.

Davis, D. (2005). *Reverberations: Mexico City’s 1985 Earthquake and the Transformation of the Capital*. In L.

Vale & T.J. Campanella (Eds.) *The Resilient City: how modern cities recover from disaster*. Oxford; New York: Oxford University Press. Pp. 255-280.

Boano, C., & García, M. (2011). *Lost in translation? The challenges of an equitable post-disaster*

reconstruction process: Lessons from Chile. *Environmental Hazards*, 10(3-4), 293-309.

Part II. The Where of Recovery Urban Bias

We addressed the issue of urban bias, both in Mexico as well as in the literature on national development. This provides a basis for us to understand how and why cities tend to be better served than rural areas in the face of disaster. It also gives us an opportunity to try to identify the particular challenges associated with disaster recovery in a city as opposed to other types of locations, including the countryside, or even in rural areas where urbanization is changing social, political, and infrastructural needs.

Davis, D. (2016). *Reflections on the Relations between Development and Urbanization: Past trajectories and future challenges*. *International Journal of Urban Sciences*, 20(1).

Wilson, J. (2013). *The Urbanization of the Countryside: Depoliticization and the Production of Space in Chiapas*. *Latin American Perspectives*, 40(2), 218-236.

Cook, N., & Butz, D. (2015). *Mobility Justice in the Context of Disaster*. *Mobilities*, 1-20.

Graham, L. (2012). *Razing Lafitte: Defending Public Housing from a Hostile State*. *Journal of the American Planning Association*, 78(4), 466-480.

Tellman, B., Bausch, J., Eakin, H., Anderies, J., Mazari-Hirart, M., Manuel-Navarrete, D., & L. Redman, C. (2018). *Adaptive Pathways and Coupled Infrastructure: Seven centuries of adaptation to water risk and the production of vulnerability in Mexico City*. *Ecology and Society*, 23.

Nature, Culture, and Society

The class focused on larger theoretical and conceptual debates about the distinction between the human and non-human. Yet it also situates these questions in the context of Mexican political and cultural history, and their impact on the national imaginary as well as on the grounded practices that inform and are informed by those legacies. This historical legacy not only explains part of the Mexican

state's neglect of rural areas in Mexico, thus revealing the source of many of the urban biases discussed in the prior week. It also offers a series of practices and experiments related to property, land rights, collective agency, and alternative models of organizing territory that might be reconsidered in the post-earthquake context.

Latour, B. (2004). *Politics of Nature: How to bring the sciences into democracy*. Cambridge, Mass.: Harvard University Press.

Rubin, J. (1996). *Decentering the Regime: Culture and Regional Politics in Mexico*. *Latin American Research Review*, 31(3), 85-126.

Van Der Haar, G. (2005). *Land Reform, the State, and the Zapatista Uprising in Chiapas*. *Journal of Peasant Studies*, 32(3-4), 484-507.

Lomnitz-Adler, C. (2001). *Deep Mexico, Silent Mexico: An anthropology of nationalism*. Minneapolis: University of Minnesota Press. Pp. 122-145 & 165-196.

Part III. The How of Recovery Multiple Lenses on Disaster Planning

We looked more carefully at the literature focused on disaster recovery, trying to coal some lessons about the process of postdisaster reconstruction, who is involved, what has been disrupted and what remains operational, and how these dynamics facilitate success versus failure.

Lincoln Land Institute. (2016). *After Great Disasters: How Six Countries Managed Community Recovery*. Cambridge, Mass: Lincoln Institute of Land Policy. Ch. 1 (introduction) and Chapters 4 (Japan), 5 (India) and 6 (Indonesia) and 8 (conclusion).

Killing, A., & Boano, C. (2016). *Reconstructing the City: The potential gains of using urban planning and design practices in recovery and why they are so difficult to achieve*. In Sanderson, D., Kayden, J. & Leis, J. (Eds.) *Urban Disaster Resilience: New dimensions from international practice in the built environment*. New York, NY: Routledge, Taylor & Francis Group. 35-53.

Stodart, V. (2016). *Regulatory barriers and the provision of shelter in post-disaster situations: Housing, land and property (HLP) issues in the recovery of Tacloban, the Philippines, after 2013 Typhoon Haiyan*. In Sanderson, D., Kayden, J. & Leis, J. (Eds.) *Urban Disaster Resilience: New dimensions from*

international practice in the built environment. New York, NY: Routledge, Taylor & Francis Group. 105-119.

Smith, D. (2016). *Petty trade and the private sector in urban reconstruction: learning from Haiti's post-earthquake Iron Market*. In Sanderson, D., Kayden, J. & Leis, J. (Eds.) *Urban Disaster Resilience: New dimensions from international practice in the built environment*. New York, NY: Routledge, Taylor & Francis Group. 157-171.

Oliver Smith, A., & Goldman, R. (1988). *Planning Goals and Urban Realities: Post Disaster Reconstruction in a Third World City*. *City & Society*, 2(2), 105-126.

Monserrat, L. (2017, November 14). *Las Lecciones de Japon*. *Letras Libres*. Retrieved from <http://www.letraslibres.com/mexico/revista/las-lecciones-japon>

Resilience vs Risk

We entered into debate over the concepts of risk and resilience, building on discussions of the power relationships involved in defining a situation as one of risk versus resilience, and asking questions about the value of these concepts – especially the notion of resilience — in the context of post-disaster recovery. To advance these aims, we situated this discussion in the context of questions about the scales (and temporalities) in which risk is a meaningful concept, using classic writings by Ulrich Beck that focus on risk as a global phenomenon linked to processes of modernization, and asking questions about how concepts of risk and resilience may or may not resonate for individuals, as opposed to communities or even nations.

Ghertner, A., Ranganathan, M., Davis, D., Simone, A., Zeiderman, A., Anand, N. (2017). *Review Forum: Endangered City, By Austin Zeiderman and Hydraulic City, By Nikhil Anand*. *Environment and Planning D: Society and Space*.

Beck, U. (1992). *Risk Society: Towards a new modernity*. London; Thousand Oaks, Calif.: Sage Publications. Vale, L. & Campanella, T.J. (2005) *The Resilient City: how modern cities recover from disaster*. Oxford; New York: Oxford University Press. 3-27 & 335-356.

Davis, D. (2012). *Toolkit for Urban Resilience in Situations of Chronic Violence: Executive Summary*.

Cambridge, MA: MIT Center for International Studies.

Schilderman, T. (2016). *How Does Reconstruction After Disaster Affect Long-Term Resilience?* In Sanderson, D., Kayden, J. & Leis, J. (Eds.) *Urban Disaster Resilience: New dimensions from international practice in the built environment*. New York, NY: Routledge, Taylor & Francis Group.

Davis, D. and M. Potvin (2017). *Resilience, Security, and Spaces of Migrant Refute*. In P. Bourgeau (ed.), *Handbook of Migration and Security*. Edward Elgar Press.

Mapping, Representation, Communicative, and Reconstructive Tools: Limits and Possibilities

We turned our attention to a wide range of tools used in disaster recovery, asking critical questions about their use in expanding knowledge, consciousness, efficiency, collective action, and other outcomes.

Latour, B. (2015). *Waiting for Gaia: Composing the Common World through Arts and Politics*. In A. Yaneva & A. Zaera-Polo (Eds), *What is Cosmopolitical Design?: Design, nature and the built environment*. Burlington, VT: Ashgate.

Appadurai, A. (2012). *Why enumeration counts*. *Environment & Urbanization*, 24(2), 639-641.

Petersen, K. (2014). *Producing Space, Tracing Authority: Mapping the 2007 San Diego wildfires*. *Sociological Review*, 62, 91-113.

Potvin, M. F. (2016). *'Humanitarian hybrids': new technologies and humanitarian resilience*. In Sanderson, D., Kayden, J. & Leis, J. (Eds.) *Urban Disaster Resilience: New dimensions from international practice in the built environment*. New York, NY: Routledge, Taylor & Francis Group. 182-196.

Anderson, B. (2010). *Preemption, Precaution, Preparedness: Anticipatory action and future geographies*. *Progress in Human Geography*, 34(6), 777-798.

Collier, S. (2008). *Enacting catastrophe: Preparedness, insurance, budgetary rationalization*. *Economy and Society*, 37(2), 224-250.

Hidalgo, S., & Lajous, A. (2017, November 01). *“¿11 segundos demasiado tarde?” Los límites y obstáculos de la alerta sísmica en la Ciudad de México*. *Nexos*. Retrieved from <https://www.nexos.com.mx/?p=34379>

Appendix B. Experiences in Reconstruction After the September 2017 Earthquakes

Auditorio de Investigaciones Sociales
Ciudad Universitaria, UNAM, CDMX
August 17th, 2018

Morning Session

9.30 am - Introduction

Diane E. Davis (Harvard University Graduate School of Design)
Dr. Manuel Perló (Investigador del Instituto de Investigaciones Sociales UNAM)

10.00 am - Ing. Edgar Tungui (Comisionado de la Comisión RTT-CDMX)

11.00 am - Dr. Felipe de Jesús Gutiérrez (Secretario de Desarrollo Urbano y Vivienda CDMX)

11.30 am - Coexisting with Cracks: Proposal for the Reconstruction of Parque Deportivo La Cananea in Iztapalapa

Arq. Loreta Castro Reguera (Directora en Taller Capital)
Dr. Manuel Perló (Investigador del Instituto de Investigaciones Sociales UNAM)

12.00 am - From Emergency to Execution: Lessons Learned

Ing. Fernando Aguirre Sánchez (Subcomisionado de la Comisión RTT-CDMX)

12.30 am - Dr. Antonio Azuela (Investigador del Instituto de Investigaciones Sociales UNAM)

01.00 pm - Dra. Marcela Meneses (Investigadora del Instituto de Investigaciones Sociales UNAM)

Afternoon Session

03.30 pm - Challenges of Reconstruction in the Region

Diane E. Davis (GSD), Lorena Bello (MIT), Jimena Gonzalez-Sicilia,
Monica Arzoz (U. Anáhuac)

03.45 pm - Panel 1: State Programs and Institutions in Regional Recovery: The Experience so Far

Jorge Wolpert (CONAVI), Elena Nava (UNAM), Carlos Zedillo (Infonavit)

04.45 pm - Panel 2: Building Resilience: Local and Multilateral Approaches

Adriana Chávez (IDB), Elena Tudela (UNAM, Infonavit),
Pablo Vaggione (ONU-Habitat)

05.50 pm - Panel 3: Shifting to Context-Specific Approaches: The Case of Oaxaca Region

Gustavo Madrid (CC Oaxaca), Jose Pablo Ambrosi (Taller Capital),
Carina Arvizu (SEDATU)

06.50 pm - Closing Remarks

Diane E. Davis (Harvard University Graduate School of Design)
Dr. Manuel Perló (Investigador del Instituto de Investigaciones Sociales UNAM)

Appendix C. Environmental, Social, and Infrastructural Challenges for Long-term Recovery after Major Earthquakes in Mexico & Chile

Gund Hall & Adams House
Harvard University, Cambridge, Massachusetts
April 18-19th, 2019

Lessons from Oaxaca and Chile

Wednesday, April 17th, Room 112. Gund Hall, GSD

6.00 pm - Opening Exhibition

6.20 pm - Thinking Beyond Reconstruction

Diane E. Davis (Harvard University Graduate School of Design)

6.30 pm - The Isthmus of Tehuantepec:

Three Research Approaches to Post-Disaster Opportunities

Framing the Fault Lines: fragmentation in Oaxaca's disaster preparation and response

Amaya Bravo-France / Evita Chavez / Sydney Pedigo

Embracing the Wind: A Strategy for Community Wind Generation in the Isthmus

Rian Rooney / Enrique Aureng Silva

Disaster as an Opportunity: Alternatives for Debris Management at Las Nutrias Riverbank

Dení López / Nadyeli Quiroz / Betzabe Valdés

7.20 pm - Recupera Chile:

A Survey of Disaster Response and Recovery Efforts in Southern Chile

Responding to Chile's 27F Earthquake and Tsunami (2010-2011)

Pablo Allard (Universidad del Desarrollo)

Integrated Disaster Recovery Approach Recupera Chile (2011-2019)

Doug Ahlers (Harvard University)

Heritage Preservation as Part of Recovery Recupera Chile (2011-2019)

Ivan Cartes (Universidad del Bío Bío)

8.10 pm - Discussion and Final Thoughts

Diane E. Davis (GSD), Elisa Silva (Enlace Arq.), Judith Palfrey (Harvard Medical School)

The Role of Universities in Disaster Recovery

Thursday, April 17th, Common Lower Room. Adams House.

9.00 am - The Role of Universities in Disaster Recovery Discussion Panel

Lorena Bello (MIT), Ivan Cartes (Universidad de Bío-Bío), Diane Davis, GSD

Doug Ahlers (HKS), Judith Palfrey (HMS), Pablo Allard (Universidad del Desarrollo)

10.15 am - Bottom Up Community Involvement

Pilar del Canto (Recupera Chile), Lilly Peacock (UMass), Alex Mansfield (JRWA),

Lorena Bello (MIT), Marcela Rentería (DRCLAS)

12.00 pm - Lessons Learned

Ana María Quiros (Chamber of Innovation and Technology of Ecuador)



References

Part II.

The Context: History and Geography of the Isthmus of Tehuantepec

Binford, Leigh. "Political Conflict and Land Tenure in the Mexican Isthmus of Tehuantepec." *Journal of Latin American Studies*, vol. 17, no. 1, 1985, pp. 179–200.

Call, Wendy. "Can't Get There from Here: Transit Infrastructure and The Isthmus Megaproject". ICWA Letters – The Americas. <http://www.icwa.org/wp-content/uploads/2015/10/WLC-4.pdf>

Connolly, Priscilla. *El Contratista De Don Porfirio : Obras Públicas, Deuda Y Desarrollo Desigual*. 1.st ed. Sección De Obras De Historia. México, D.F.: El Colegio De Michoacán : Universidad Autónoma Metropolitana-Azcapotzalco : Fondo De Cultura Económica, 1997.

Cosío Villegas, Calderón, González Navarro, González Y González, and Calderón, Francisco R. *Historia Moderna De México v.7. Historia*. México: Editorial Hermes, 1955.

Dalton, Margarita. *Breve Historia De Oaxaca*. 1.st ed. Serie Breves Historias De Los Estados De La República Mexicana. México: El Colegio De México, Fideicomiso Historia De Las Américas : Fondo De Cultura Económica, 2004.

Navarro, Luis Hernandez. "The Trans-Isthmus Corridor." Chiapas Support Committee , 14 Aug. 2018, chiapas-support.org/2018/08/14/the-trans-isthmus-corridor/.

Orozco, Gilberto. *Tradiciones y Leyendas Del Istmo De Tehuantepec*. México: [Publisher Not Identified], 1995.

Ortega Martínez. *Salina Cruz : Monografía*. Mexico: S.n.], 2006.

Payán Porras, and Universidad Autónoma Metropolitana. Unidad Xochimilco. Departamento De Educación Y Comunicación. *Reflexiones Sobre El Megaproyecto Del Istmo De Tehuantepec : Recursos, Problemática Y Futuro*. 1a ed. México, D.F.: Universidad Autónoma Met-

ropolitana, Unidad Xochimilco, Departamento De Educación Y Comunicación, Departamento De Del Hombre Y Su Ambiente, Departamento De Producción Agrícola Y Animal, 2001.

Peimbert, Angel, and Mexico. Secretaría De Comunicaciones Y Obras Públicas. *Ferrocarril Nacional De Tehuantepec; Reseña Histórica Y Resumen General De Los Trabajos Llevados a Cabo Durante La Administración De Los Sres. S. Pearson & Son Ltd*. Hasta El 31 De Diciembre De 1906. México: Tip. De La Dirección General De Telégrafos, 1908.

Reina, Piñón Jiménez, and Reina, Leticia. *Economía Contra Sociedad : El Istmo De Tehuantepec, 1907-1986*. 1.st ed. México, D.F.: Nueva Imagen, 1994.

Reina, Leticia, and Instituto Nacional De Antropología E Historia. *Historia Del Istmo De Tehuantepec : Dinámica Del Cambio Sociocultural, Siglo XIX*. Primera Edición. ed. Colección Historia (Instituto Nacional De Antropología E Historia (Mexico)). Serie Logos. México, D.F.: Instituto Nacional De Antropología E Historia, 2013.

Toledo, Alejandro. *Geopolítica Y Desarrollo En El Istmo De Tehuantepec*. Mexico: Centro De Ecología Y Desarrollo, 1995.

The Event: The 2017 Earthquakes and Their Aftermath

Lizama Quijano, J. "La Guelaguetza en Oaxaca: fiesta, relaciones interétnicas y procesos de construcción simbólica en el contexto urbano," México: CIESAS, p.357. 2006.

Covarrubias, Miguel. *Mexico South: The Isthmus of Tehuantepec*. 1st ed. New York: Alfred Aknopf, 1946.

Interviews made by lead project researchers:
Marcial Cerqueda, Vicente, Oaxaca, 6.5.18.
Toledo, Natalia, Oaxaca, 5.28.2018.
De Gyves Mendoza, Claudina, Oaxaca, 6.23.18
López Cervantes, Malaquías, Cuernavaca, 7.5.18.
Concha Arellano, Elpidio, Oaxaca, 8.25.18.
Chiñas, Tomás, Oaxaca, 5.25.18.
Zuñiga Loera, Olga, Oaxaca, 6.30.18. | Cruz Altamirano, Lilia, Oaxaca, 6.5.18.

Framing the Fault Lines: Fragmentation in Oaxaca's Disaster Preparation and Response

Affourtit, Lorraine. "Embodying Decolonial Democracy: The Teachers' Union and the People's Guelaguetza in Oaxaca, Mexico." *Journal of Labor and Society*, vol. 22, no. 1, 2019, pp. 77–102. Wiley Online Library, doi:10.1111/wusa.12385.

Alexander, Rani T., and Susan Kepecs. *Colonial and Postcolonial Change in Mesoamerica: Archaeology as Historical Anthropology*. University of New Mexico Press, 2018.

Aoki, T., and K. Ito. "What Is the Role of Universities in Disaster Response, Recovery, and Rehabilitation? Focusing on Our Disaster Victim Identification Project." *IEEE Communications Magazine*, vol. 52, no. 3, Mar. 2014, pp. 30–37. IEEE Xplore, doi:10.1109/MCOM.2014.6766081.

Bahadori, M., et al. "Barriers to and Facilitators of Inter-Organizational Coordination in Response to Disasters: A Grounded Theory Approach." *Disaster Medicine And Public Health Preparedness*, vol. 11, no. 3, June 2017, pp. 318–25.

Brickman, K., et al. "The University of Toledo Disaster Response Mission: Nepal." *Annals of Global Health*, vol. 82, no. 3, Aug. 2016, p. 420. www.annalsofglobalhealth.org, doi:10.1016/j.aogh.2016.04.169.

Butler, Peter. "A Tale of Two Mexican Earthquakes." *Jumpstart Blog*, 19 Sept. 2018, <https://blog.jumpstartrecovery.com/mexican-earthquakes-1985-2017/>.

Cañedo, Ana. "Bridging the Indigenous Wage Gap in Mexico." *The Cornell Policy Review*, 19 July 2017, <http://www.cornellpolicyreview.com/bridging-indigenous-wage-gap-mexico/>.

Carsen, Dan. "University of Alabama Debuts Disaster Response Study Track." *Engineering News-Record*, July 5, 2010. [https://advance-lexis-com.ezp-prod1.hul.harvard.edu/api/document?collection=news&id=urn:contentItem:7YXG-WFG0-Y934-71VN-00000-00&context=1516831](https://advance.lexis-com.ezp-prod1.hul.harvard.edu/api/document?collection=news&id=urn:contentItem:7YXG-WFG0-Y934-71VN-00000-00&context=1516831).

Cohen, Jeffrey H., and Bernardo Ramirez Rios. "Internal Migration in Oaxaca: Its Role and Value to Rural Movers." *International Journal of Sociology*, vol. 46, no. 3, July 2016, pp. 223–35. Taylor and Francis+NEJM, doi:10.1080/00207659.2016.1197721.

Culture in City Reconstruction and Recovery. United Nations Educational, Scientific and Cultural Organization; World Bank, 2018, <https://openknowledge.worldbank.org/handle/10986/30733>.

Davis, Diane E. "Reverberations: Mexico City's 1985 Earthquake and the Transformation of the Capital." *The Resilient City*, edited by Lawrence Vale and Tom Campanella, Oxford University Press, 2014.

Davis, Diane. "The Power of Distance: Re-Theorizing Social Movements in Latin America." *Theory and Society*, vol. 28, no. 4, Aug. 1999, pp. 585–638.

Díaz-Cayeros, et al. "Traditional Governance, Citizen Engagement, and Local Public Goods: Evidence from Mexico." *World Development*, vol. 53, no. C, 2014, pp. 80–93.

Eisenstadt, Todd A. "Usos y Costumbres and Postelectoral Conflicts in Oaxaca, Mexico, 1995-2004: An Empirical and Normative Assessment." *Latin American Research Review*, vol. 42, no. 1, 2007, pp. 52–77. JSTOR.

Eisenstadt, Todd A., and Viridiana Ríos. "Multicultural Institutions, Distributional Politics, and Postelectoral Mobilization in Indigenous Mexico." *Latin American Politics and Society*, vol. 56, no. 2, 2014, pp. 70. ProQuest, <http://search.proquest.com.ezp-prod1.hul.harvard.edu/docview/1534326812?accountid=11311>, doi:<http://dx.doi.org.ezp-prod1.hul.harvard.edu/10.1111/j.1548-2456.2014.00232.x>.

FONDEN_paper_M4.Pdf. http://www.gfdrr.org/sites/gfdrr/files/publication/FONDEN_paper_M4.pdf. Accessed 4 May 2019.

Fraser, Barbara, and Fabian Carvallo-Vargas. "Emergency Response After Mexico's Earthquakes." *The Lancet*, vol. 390, no. 10102, Sept. 2017, pp. 1575–1575.

Giardini, Domenico, Grünthal, Gottfried, Shedlock, Kaye M., & Zhang, Peizhen. "The GSHAP Global Seismic Hazard Map." INGV

Annals of Geophysics. Vol 42, No 6 (1999). <https://www.annalsofgeophysics.eu/index.php/annals/article/viewFile/3784/3848>

Godby, Steven. "This Is Not a Drill: How the 1985 Disaster Taught Mexico to Prepare for Earthquakes." *The Conversation*, Sept. 2017, <https://theconversation.com/this-is-not-a-drill-how-1985-disaster-taught-mexico-to-prepare-for-earthquakes-84499>.

"Government Will Spend 2.5 Billion to Pave Oaxaca's Roads." *Mexico News Daily*, 24 Dec. 2018, <https://mexiconewsdaily.com/news/2-5-billion-pesos-to-pave-oaxaca-roads/>.

Hernandez, Sophia. "Verificado19s: Help from Technology in the Aftermath of Mexico's Earthquake." *Equals Change Blog*, 31 Oct. 2017.

"Intercensal Survey 2015." Instituto Nacional de Estadística y Geografía (INEGI), 2015, <http://en.inegi.org.mx/programas/intercensal/2015/>.

"Isthmus of Tehuantepec." *Encyclopedia Britannica*, <https://www.britannica.com/place/Isthmus-of-Tehuantepec>.

Kennedy, Michael. *Emergent Groups and Disaster Subculture: A University's Response to the July 28, 1997 Flood*. 2005.

"Lack of Action on Quake-Damaged Schools Provokes Border Protest." *Mexico News Daily*, 22 Mar. 2019, <https://mexiconewsdaily.com/news/lack-of-action-provokes-border-protest/>.

Leoni, Brigitte. *Mexico: Lessons from 1985 Earthquake - UNDRR*. <https://www.unisdr.org/archive/52756>. Accessed 4 May 2019.

Llata Flores, Jaime Andres de la. *The Social Property in Mexico*. Instituto Nacional de Estadística, Geografía e Informática (INEGI).

Martínez, Cesar. "Denuncian Que Lucro Por Sismo Continúa." *Reforma*, 18 Sept. 2017.

Mexico Country Case Study Report: How Law and Regulation Supports DRR <https://www.undp.org/content/dam/undp/library/crisis%20prevention/disaster/MEXICO%20COUNTRY%20CASE%20STUDY%20REPORT%20How%20Law%20and%20Regulation%20Supports%20DRR.pdf>. Accessed 4 May 2019.

"Mexico: Earthquakes-Sep 2017." Relief Web: United Nations Office for the Coordination of Humanitarian Affairs, Sept. 2017.

"Mexico Global Disaster Preparedness Overview." Global Disaster Preparedness Center: The American Red Cross and the International Federation Red Cross and Red Crescent Societies, <https://www.preparecenter.org/countries/mexico>.

Morales, Irving. "Terremotos En México, 100 Años y Contando." *La Data*, <http://www.ladata.mx/s04c02/index.html>. Accessed 4 May 2019.

Nicholas, Linda, et al. "Prehispanic Colonization of the Valley of Oaxaca, Mexico." *Human Ecology*, vol. 14, no. 2, 1986, pp. 131–62. JSTOR.

"OECD Reviews of Risk Management Policies: Mexico 2013 | READ Online." OECD Library, https://read.oecd-ilibrary.org/governance/review-of-the-mexican-national-civil-protection-system_9789264192294-en. Accessed 5 May 2019.

Orozco, Nayeli Meza. "Los 8 Sismos Más Devastadores En La Historia de México." *Forbes México*, 18 Sept. 2015, <https://www.forbes.com.mx/los-8-sismos-mas-catastroficos-en-la-historia-de-mexico/>

Owolabi, Kunle. "Has the Legalization of 'Usos y Costumbres' Contributed to the Persistence of PRI Rule in Oaxaca? An Analysis of Legislative and Gubernatorial Elections, 1992-2001." *Foro Internacional*, vol. 44, no. 3, 2004, pp. 474–508.

Partlow, Joshua, and Paul Imison. "Mexico May Now Have Too Much Earthquake Aid." *The Washington Post*, 22 Sept. 2017, https://www.washingtonpost.com/world/the_america/mexico-may-now-have-too-much-earthquake-aid/2017/09/22/31b02a4c-9fa1-11e7-b2a7-bc70b6f98089_story.html?utm_term=.aec521179bb7.

Pattillo, Marilyn M., and Trish M. O'Day. "Disaster Response: The University of Texas School of Nursing Experience." *Nursing & Health Sciences*, vol. 11, no. 4, Dec. 2009, pp. 378–81. PubMed, doi:10.1111/j.1442-2018.2009.00500.x.

Planet, Lonely. "Oaxaca Travel | Mexico." Lonely Planet, <https://www.lonelyplanet.com/mexico/oaxaca-state>. Accessed 31 May 2019.

Polo, Carlos Sorroza, and Michael S. Danielson. Political Subsystems in Oaxaca's Usos y Costumbres Municipalities: A Typology Based on the Civil-Religious Service Background of Mayors. Oxford University Press, 2013. <http://www.oxfordscholarship.com.ezp-prod1.hul.harvard.edu/view/10.1093/acprof:oso/9780199936267.001.0001/acprof-9780199936267-chapter-7>.

Poole, Deborah, and Gerardo Renique. "Cashing in on the Quakes: In the Wake of Recent Earthquakes That Have Ravaged Mexico, the Government Capitalizes as the People Organize and Rebuild." *NACLA Report on the Americas*, vol. 49, no. 4, Oct. 2017, pp. 387–90. Crossref, doi:10.1080/10714839.2017.1409004.

Ramisetty-Mikler, Suhasini, et al. "Conceptual Framework and Quantification of Population Vulnerability for Effective Emergency Response Planning." *Journal of Emergency Medicine*, vol. 13, no. 3, 2015, pp. 227–38.

Reardon, Kenneth M., et al. "Commentary: Overcoming the Challenges of Post-Disaster Planning in New Orleans: Lessons from the ACORN Housing/University Collaborative." *Journal of Planning Education and Research*, vol. 28, no. 3, Mar. 2009, pp. 391–400. SAGE Journals, doi:10.1177/0739456X08327259.

Reina, Leticia. "Poblamiento y Epidemias En El Istmo de Tehuantepec Siglo XIX." *Descatos*, vol. 1, 1999, pp. 1–20, http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1607-050X1999000100011.

Rodriguez, Oscar, and Abraham Reza. "The Defrauded of Juchitán." *Milenio*, 9 Apr. 2018, <https://www.milenio.com/estados/los-defraudados-de-juchitan>.

Sanchez, Rafael Rivera, et al. Growth Diagnostic for the State of Oaxaca: Isolation and Its Role in the Low Productivity Trap. Harvard University Kennedy School of Government, Nov. 2017.

Shepherd, Alison Victoria. "Government versus Teachers: The Challenges of Educational Progress

in Oaxaca, Mexico." *Current Issues in Comparative Education*, vol. 17, no. 1, 2015, pp. 27–35.

Snyder, Michael. "After the Quake: In Southern Mexico, a Community Is Still Reeling from a Devastating Natural Disaster." *Slate*, 13 Nov. 2017, <https://slate.com/news-and-politics/2017/11/istmo-de-tehuantepec-southern-mexico-is-still-reeling-from-septembers-earthquake.html>.

Sousa, Lisa. "The 'Original Conquest' of Oaxaca: Nahuatl and Mixtec Accounts of the Spanish Conquest." *Ethnohistory*, vol. 50, no. 2, Apr. 2003, pp. 349–400. Crossref, doi:10.1215/00141801-50-2-349.

Suarez, Gerardo, et al. "A Dedicated Seismic Early Warning Network: The Mexican Seismic Alert System (SASMEX)." *Seismological Research Letters*, vol. 89, no. 2A, Feb. 2018, pp. 382–91.

Tanner, James G., and Kaye M. Shedlock. "Seismic Hazard Maps of Mexico, the Caribbean, and Central and South America." *Tectonophysics*, vol. 390, no. 1–4, Oct. 2004, pp. 159–75. Crossref, doi:10.1016/j.tecto.2004.03.033.

"Teachers to Hit the Streets; Three Days of Protests Planned." *Mexico News Daily*, 30 Apr. 2018, <https://mexiconewsdaily.com/news/teachers-strike-three-days-of-protests-planned/>.

Treat, Jonathan. "After the Earth Shook: Photographs of Destruction, Resilience, and Recovery in the Isthmus of Tehuantepec, Oaxaca, Mexico." *NACLA Report on the Americas*, vol. 49, no. 4, Oct. 2017, pp. 391–97. Crossref, doi:10.1080/10714839.2017.1409005.

Vance, Eric. "Earthquake Tests 25 Years of Mexican Engineering." *Scientific American*, <https://www.scientificamerican.com/article/earthquake-tests-25-years-of-m/>. Accessed 4 May 2019.

Vigo, Gabriela. Emergent Behavior in the Immediate Response to Two Disasters: The 1985 Mexico City Earthquake and the 1994 Northridge Earthquake in Los Angeles. ProQuest Dissertations Publishing, 1996. hollis.harvard.edu, <http://search.proquest.com/docview/304364853/?pq-origsite=primo>.

Villegas, Paulina, and Elizabeth Malkin. "As Mexico Earthquake Aid Mounts, Many Fear It Will Be Diverted." *The New York Times*, 11 Sept. 2017.

Ward, Steven N. "A Technique for the Recovery of the Seismic Moment Tensor Applied to the Oaxaca, Mexico Earthquake of November 1978." *Bulletin of the Seismological Society of America*, vol. 70, no. 3, June 1980, pp. 717–34, <https://pubs.geoscienceworld.org/ssa/bssa/article-abstract/70/3/717/101999/a-technique-for-the-recovery-of-the-seismic-moment?redirectedFrom=fulltext>.

"Who Are Los Topos, Mexico's Volunteer Rescuers?" *BBC World News*, 21 Sept. 2017, <https://www.bbc.com/news/world-latin-america-41346536>. Accessed 5 May 2019.

Zizumbo-Colunga, Daniel. "Study Reveals Racial Inequality in Mexico, Disproving Its 'race-Blind' Rhetoric." *The Conversation*, <http://theconversation.com/study-reveals-racial-inequality-in-mexico-disproving-its-race-blind-rhetoric-87661>. Accessed 31 May 2019.

Interviews made by lead project researchers: Adriana Abarodia, consultant on sustainable public and private investment

Rafael van Dyke, former Head of UN Development Programme offices in Chiapas and Oaxaca
Leticia Valle, Sub-sec. of the Oaxaca Department of Arts and Culture

Eugenio Coronado, Coordinator at Oaxaca's state department of health, formerly at the Oaxaca State Department of Planning
Juan Pablo Morales, General Coordinator of the Committee for Social Policy Evaluation at the Secretary of Social Development
Fidel Mendez Florian, General coordinator of Evaluation and Informs at the Governor of Oaxaca's Office

Armando Alberto Gomez Cruz, consultant for public administration of local governments in Oaxaca

Jose Maria Villalobos, advisor to the mayor of Oaxaca de Juarez, formerly at Secretary of Health and Department of Planning

Dr. Lidia Argelia Juarez Ruiz, professor of community infrastructure and social development at the IPN-CIIDIR

Professor Margarita Rasilla Cano, professor of rural development at the IPN-CIIDIR

Professor Jose Luis Caballero Montes, professor of educational development at the IPN-CIIDIR

Tania Carrasco, anthropologist of indigenous culture and former advisor at the WB Mex
Elena Nava Morales, anthropologist and professor at UNAM

Hugo Felix Climaco, former representative of the Oaxaca State Government in CDMX
Emiliano Rodriguez Nuesch, Director at Pacifico, an org. on disaster communications and a 100 Resilient Cities Platform Partner

Part III.

Learning From Debris: A Detailed Journey for Participatory Research

Brown, Charlotte, Mark Milke, and Erica Seville. "Disaster Waste Management: A Review Article." *Waste Management* 31, no. 6 (2011): 1085–1098. <https://doi.org/10.1016/j.wasman.2011.01.027>.

Daly, P., Ninglekhu, S., Hollenbach, P., Duyne Barenstein, J., and Nguyen, D. (2017). Situating local stakeholders within national disaster governance structures: Rebuilding urban neighbourhoods following the 2015 Nepal earthquake. *Environment & Urbanization*, 29(2), 403-424

Habtezion, S. (2013). Gender and Disaster Risk Reduction. *Gender and Climate Change - Asia and the Pacific*. United Nations Development Programme.

Hobsbawm, E. J., and T. O. Ranger. *The Invention of Tradition*. Cambridge: Cambridge University Press, 2005.

Hooper, M. "When Diverse Norms Meet Weak Plans: The Organizational Dynamics of Urban Rubble Clearance in Post-Earthquake Haiti." *International Journal of Urban and Regional Research* [In Press] (2018).

López López, Dení. "Disaster Planning Across Scales: Post-Earthquake Rubble Management in Oaxaca, Mexico." Harvard University, 2019.

Marfai, M., Sekaranom, A., and Ward, A. (2015). Community responses and adaptation strategies toward flood hazard in Jakarta, Indonesia. *Natural Hazards*, 75(2), 1127-1144.

Rendón Monzón, Juan José. “La Flor Comunal. Explicaciones para interpretar su contenido y comprender la importancia de la vida comunal de los pueblos indios.” vdocuments.mx. 2011. <https://vdocuments.mx/la-flor-comunal-565dc2d59ea72.html>

Ritchie, H., & Roser, M. (2018). Natural Catastrophes. Retrieved from <https://our-worldindata.org/natural-catastrophes>.

Valdés López, Betzabe. Cultural Assets for Disaster Recovery: A study of community involvement at the Isthmus of Tehuantepec after the 2017 earthquakes. Harvard University, 2019.

Community Educational Resilience: A New Model of Education and Earthquake Preparedness

Ajuntament de Barcelona. The Educating City. Barcelona. 1990

Arum R. 2000. *Schools and Communities: Ecological and Institutional Dimensions*. Annual Review of Sociology 26:395–418

Bibliodigitalibd.senado.gob.mx. 2018. El sistema escolar ante los sismos de septiembre de 2017. [online] Available at: http://bibliodigitalibd.senado.gob.mx/bitstream/handle/123456789/3764/reporte_50_221117_web%20%282%29.pdf [Accessed 11 Apr. 2018].

Bingler S, Quinn L., Sullivan K. 2003. *Schools as Centers of Community: A Citizen's Guide for Planning and Design*. Washington, DC: U.S. Department of Education.

Chung, C. 2002. *Using Public Schools as Community-Development Tools: Strategies for Community-Based Developers*. Joint Center for Housing Studies of Harvard University, Neighborhood Reinvestment Corporation. Woolner, Pamela. School Design Together. New York: Routledge, 2015.

Along Fault Lines: Urban Affect Network

Fullilove, Mindy Thompson. *Urban Alchemy: Restoring Joy in America's Sorted-out Cities*, 2013.

Zaumseil, Manfred, Silke Schwarz, Mechthild von Vacano, Gavin Brent Sullivan, and Johana E. Prawitasari-Hadiyono, eds. *Cultural Psychology of Coping with Disasters: The Case of an Earthquake in Java, Indonesia*. New York: Springer, 2014.

Proactively Strengthening Territories of Risk: Children's Recreational Center in Juchitán

M. Lopes, et. Al. “Pombalino Constructions: Description and Seismic Assessment” in *Structural Rehabilitation of Old Buildings. A. Costa et al eds. Building Pathology and Rehabilitation 2*. Springer-Verlag Berlin Heidelberg. 2014. Proactively Strengthening Territories of Risk: Children's Recreational Center in Juchitán

The Railroad As Conflict Zone: Immigrants and Their Journey Above «La Bestia»

Agamben, Giorgio. “What Is a Camp?” Theory out of Bounds, Means without End: Notes on Politics, University of Minnesota Press.

Albergue Hnos. En El Camino. <http://www.hermanosenelcamino.org/>.

“Border Patrol Strategic Plan 1994 and Beyond: National Strategy.” Homeland Security Dig Lib, <https://www.hsdl.org/?abstract&did=721845>.

Brown, Ben. “El Ferrocarril En México.” Centro INAH Chihuahua, July 2015, <http://www.inahchihuahua.gob.mx/articulos.pl?id=68>.

Cruz Roja Mexicana. Mensajes de Autocuidado Para Personas Migrantes. Mapa de Asilos y Comedores, Agosto 2015.

Ferromex. La Fuerza Que Mueve México. www.ferromex.com.mx. 2019.

Fondo de la OIM para el Desarrollo. Directorio de Casas y Albergues Para Personas Migrantes En México. 2017.

“GTPM | Organizaciones y Redes de Sociedad Civil a Favor de La Infancia Migrante.” Red Nacional de Organismos Civiles de Derechos Humanos. Todos Los Derechos Para Todas y Todos.

Huerta, Renzo. Hermanos En El Camino. Albergue de Migrantes. 2014, https://www.youtube.com/watch?time_continue=27&v=dWDoAVQDzyQ

Humane Borders. Fronteras Compasivas 2018, <https://humaneborders.org/>.

International Migration Report 2017: Highlights(ST/ESA/SER.A/404). United Nations, Department of Economic and Social Affairs, Population Division (2017), https://www.un.org/en/development/desa/population/migration/publications/migrationreport/docs/MigrationReport2017_Highlights.pdf.

International Organization for Migration (IOM). “Deaths Recorded in the Americas.” Missing Migrants: Tracking Deaths Along Migratory Routes, 2018, <https://missingmigrants.iom.int/region/americas>.

Landa, Pablo. “Nuevo Norte: Itinerarios Migrantes En Guadalajara.” El Arquí, <http://elarqui.com/2017/09/05/nuevo-norte-itinerarios-migrantes-en-guadalajara/>.

Larkin, Brian. “The Politics and Poetics of Infrastructure.” Annu. Rev. Anthropol, 2013.

Lesser, Gabriel, and Jeanne Batalova. “Inmigrantes Centroamericanos En Los Estados Unidos.” The Online Journal of the Migration Policy Institute. Migration Information Source, 2017.

“Mapeo Ruta Migrante.” Arquitectos Con La Gente, <http://arquitectosconlagente.com/ruta-migrante-mapeo/>.

Mehrotra, Rahul, and Felipe Vera. Ephemeral Urbanism. Does Permanence Matter? 2017.

Meléndez, José. Por Qué Salieron Los Hondureños de Su País? 2018, <https://www.eluniversal.com.mx/mundo/por-que-salieron-los-hondurenos-de-su-pais>.

Red de Documentación de las Organizaciones Defensoras de Migrantes. El Estado Indolente: Recuento de La Violencia En Las Rutas Migratorias y Perfiles de Movilidad En México. Informe 2017, REDODEM 2018.

Red de Documentación de las Organizaciones Defensoras de Migrantes. Migración En Tránsito Por México: Rostro de Una Crisis Humanitaria Internacional. Reporte 2016.

Red DH Migrantes. <https://reddhmigrantes.wordpress.com/albergues/>.

Salottobuono. Manual of Decolonization. 2010.

Simple, Kirk. “La Caravana Migrante Llega a La Frontera Con EE. UU.; El Viaje Apenas Empieza.” The New York Times, 2018, <https://www.nytimes.com/es/2018/04/25/caravana-migrante-frontera/?smid=fb-espanol&smtype=cur>.

Suárez, Jimena, et al. A Trail of Impunity. Thousands of Migrants in Transit Face Abuses amid Mexico's Crackdown. Sept. 2016.

Embracing the Wind: A Strategy for Community Wind Generation in the Isthmus of Tehuantepec

Adams, M. (2014, September 17). The Resurrection of Mareña Renovables. Retrieved March 28, 2019, from <http://www.renewableenergymexico.com/the-resurrection-of-marena-renovables/>

Avila-Calero, Sofia. “Contesting Energy Transitions: Wind Power and Conflicts in the Isthmus of Tehuantepec.” Journal of Political Ecology, vol. 24, no. 1, 2017, p. 992-1012

Binford, Leigh. “Political Conflict and Land Tenure in the Mexican Isthmus of Tehuantepec.” Journal of Latin American Studies, vol. 17, no. 1, 1985, pp. 179–200.

Burnett, V. (2016, July 26). Mexico's Wind Farms Brought Prosperity, but Not for Everyone. Retrieved March 1, 2019, from <https://www.nytimes.com/2016/07/27/world/americas/mexicos-wind-farms-brought-prosperity-but-not-for-everyone.html>

Call, Wendy. “Can't Get There from Here: Transit Infrastructure and The Isthmus Megaproject”. ICWA Letters – The Americas. <http://www.icwa.org/wp-content/uploads/2015/10/WLC-4.pdf>

Dunlap, A. (2018). Counterinsurgency for wind energy: The Bii Hioxo wind park in Juchitán, Mexico. *The Journal of Peasant Studies*, 45(3), 630-652.

García Beltrán, Y. M. (2018, May 14). Identity and Resistance at the Isthmus of Tehuantepec, Oaxaca. Retrieved March 25, 2019, from <https://www.ritimo.org/Identity-and-Resistance-at-the-Isthmus-of-Tehuantepec-Oaxaca>

Heffron, R. & McCauley, D. (2018). What is the 'Just Transition'? *Geoforum*, 88, 74-77.

Howe, Cymene and Dominic Boyer. "Aeolian Extractivism and Community Wind in Southern Mexico." *Public Culture*, vol. 28, no. 2 79, 2016, pp. 215–235.

Hoffmann, Julia. "The Social Power of Wind: The Role of Participation and Social Entrepreneurship in Overcoming Barriers for Community Wind Farm Development; Lessons from the Ixtepec Community Wind Farm Project in Mexico." MA thesis, Lund University. 2012.

Huesca-Pérez, M., Sheinbaum-Pardo, C., & Köppel, J. (2018). From global to local: Impact assessment and social implications related to wind energy projects in Oaxaca, Mexico. *Impact Assessment and Project Appraisal*, 36(6), 479-493.

Juárez-Hernández, S., & León, G. (2014, July). Wind Energy in the Isthmus of Tehuantepec: Development, Actors and Social Opposition. Retrieved March 25, 2019, from https://probedes.iiec.unam.mx/en/revistas/v45n178/body/v45n178a6_1.php

Lillian, B. (2018, January 16). Mexico Court Puts Stop To 396 MW Wind Farm. Retrieved March 27, 2019, from <https://nawindpower.com/mexico-court-puts-stop-396-mw-wind-farm> Mexico's Oaxaca to Hit 4 GW of Wind Capacity by 2018. (2016, March 23). Retrieved March 30, 2019, from <https://renewablesnow.com/news/mexicos-oaxaca-to-hit-4-gw-of-wind-capacity-by-2018-518139/>

Lopez-Velarde, Rogelio, et al. "Electricity Regulation Mexico." Getting The Deal Through, Nov. 2018, gettingthedealthrough.com/area/12/jurisdiction/16/electricity-regulation-mexico/

More wind power projects expected this year in Mexico. (2018, January 20). Retrieved March 27, 2019, from <https://mexiconewsdaily.com/news/more-wind-power-projects-expected-this-year/>

Navarro, Santiago, and Renata Bessi. "The Dark Side of Clean Energy in Mexico." *Aviropa*, 14 Feb. 2016, avispa.org/the-dark-side-of-clean-energy-in-mexico/

Navarro, Luis Hernandez. "The Trans-Isthmus Corridor." Chiapas Support Committee, 14 Aug. 2018, chiapas-support.org/2018/08/14/the-trans-isthmus-corridor/.

Orozco, Ricardo. (2008, January). Desarrollo del proyecto eólico en la región del Istmo de Tehuantepec. *Investigación y Ciencia*, 42, 18-21.

Rubin, J. (1994). COCEI in Juchitán: Grassroots Radicalism and Regional History *. *Journal of Latin American Studies*, 26(1), 109-136. Smith, Derek A., Herlihy, Peter H., Kelly, John H., & Ramos Viera, Aida. (2009). The certification and privatization of indigenous lands in Mexico. *Journal of Latin American Geography*, 8(2), 175-207.

The Clean Development Mechanism. (n.d.). Retrieved March 22, 2019, from <https://unfccc.int/process-and-meetings/the-kyoto-protocol/mechanisms-under-the-kyoto-protocol/the-clean-development-mechanism>

Part IV.

Territories of Risk: From Risk to Resilience

American Academy of Actuaries, Risk Classification Work Group. "On Risk Classification." Public Policy Monograph, November 2011, www.actuary.org

Haas, J. Eugene, Kates, Robert W., and Bowden, Martyn J., eds. *Reconstruction Following Disaster*. The MIT Press, Cambridge, Massachusetts, 1977.

Kunreuther, Howard, and Pauly, Mark. "Insuring Against Catastrophes." *Risk Management and Decision Process Center*, The Wharton School of the University of Pennsylvania, April 2009.

Reason, James. "Human error: models and management," *BMJ*, 320(7237): 768-770, March 18, 2000, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1117770/>

United Nations, General Assembly. Report of the Open-Ended Intergovernmental Expert Working Group on Indicators and Terminology Relating to Disaster Risk Reduction. Adopted by the United Nations General Assembly, A/71/644, Feb 2, 2017. https://www.preventionweb.net/files/50683_oiewgreport-english.pdf (update to the publication entitled "2009 UNISDR Terminology on Disaster Risk Reduction").

United Nations, General Assembly. Sendai Framework for Disaster Risk Reduction 2015-2030. United Nations Office for Disaster Risk Reduction. Resolution adopted by the United Nations General Assembly, A/RES/69/283, June 3, 2015. https://www.unisdr.org/files/43291_sendaiframeworkfordrren.pdf

Webster, Frederick A., and Tolles, E. Leroy. "Earthquake Damage to Historic and Older Adobe Buildings During the 1994 Northridge, California Earthquake." 12th World Conference on Earthquake Engineering, paper no. 0628, 2000.

Conclusion

Lessons From a Year in Post-Disaster Oaxaca

Albers, A. (1965). *On weaving* (1st ed.] ed.). Middletown, Conn.: Wesleyan University Press.

Beck, U. (1999). *World risk society*. Cambridge; Malden, Mass: Polity Press.

Brenner, Neil. (2014). *Implosions - explosions : Towards a study of planetary urbanization*. Jovis.

D. Davis (1994) *Urban Leviathan: Mexico City in the Twentieth Century*. Philadelphia: Temple University Press.

D. Davis (2019). "Reducing Vulnerabilities Through Urban Design: Interventions for resilience in communities at risk." In A. Sideris-Loukatis and T. Banerjee (eds.), *The New Companion to Urban Design*, New York: Taylor and Francis.

Harvey, D. (1982). *The limits to capital*. Oxford: B. Blackwell

Harvey, D. (1985). *The urbanization of capital: Studies in the history and theory of capitalist urbanization*. Baltimore, Md.: John Hopkins

Rubin, J. (1997). *Decentering the Regime: Ethnicity, Radicalisms, and Democracy in Juchitan, Oaxaca*. Durham, NC: Duke University Press.

Contributors

Editors

Diane E. Davis is Charles Dyer Norton Professor of Regional Development and Urbanism and Chair of the Department of Urban Planning and Design at Harvard's Graduate School of Design. Before moving to the GSD in 2011, Diane served as the head of the International Development Group in the Department of Urban Studies and Planning at MIT, where she also had a term as Associate Dean of the School of Architecture and Planning. Trained as a sociologist, Davis's research interests include the relations between urbanization and national development, comparative urban governance, socio-spatial practice in conflict cities, and new territorial manifestations of sovereignty. Her primary focus has been Mexico. A prior recipient of research fellowships from the John D. and Catherine T. MacArthur Foundation, the Heinz Foundation, the Ford Foundation, the Social Science Research Council, the United States Institute for Peace, the Andrew W. Mellon Foundation, and the Carnegie Corporation of New York, Davis recently completed two long-term research projects in the areas of shelter and mobility, including "Rethinking Social Housing in Mexico" (funded by INFONAVIT) and "The Role of Political Leadership in Transformative Urban Transport" (funded by the Volvo Research and Educational Foundations), the latter of which recently was published by Oxford University Press.

Lorena Bello Gómez is Lecturer at MIT's Department of Architecture since January 2013, where she teaches students fundamentals of the design of the built environment ranging from the scale of the object and buildings, to that of the city and larger territories. Lorena's research focuses on large scale territorial implications of infrastructure and urbanization as catalysts for design. She examined this topic with her PhD in Urbanism "Hybrid Networks", first under the guidance of the late Manuel de Sola-Morales and finished under Joan Busquets of the Harvard GSD (PhD'15). In 2014 Lorena founded TERRALAB, to continue this research with studios and projects. Since then, she has collaborated with the Andrew W. Mellon Foundation in Spain (2016), the Aga Khan Foundation in India (2017-2018), Fundación Social in Colombia (2017-2018), TUMO Foundation in Armenia (2018) and the David Rockefeller Center for Latin American Studies in Mexico (2018). Lorena has engaged in workshops with Universities in Colombia, Japan, Spain, Mexico and China. Lorena holds a B.Arch in Architecture and Civil Engineering with honors from the Polytechnic University of Catalonia, UPC (ETSAB:B.Arch '05), a Masters of Architecture in Urban Design from the Harvard School of Design (GSD:MAUD'11), and a European PhD in Urbanism from UPC (ETSAB:PhD'15).

Enrique Aureng Silva received his Bachelor of Architecture from Universidad Nacional Autónoma de México (UNAM) in 2012, graduating with honors and being awarded the Gabino Barreda medal for academic excellence. He graduated from the Master of Design Studies at the GSD in 2018, where his final thesis was awarded the Project Award for the best Open Project of the MDes track. His current research focuses on the intervention, transformation and reuse of historic buildings in Latin America, especially in post-disaster scenarios. He has been co-editor of Open Letters, Oblique Journal and of Platform 11 and most recently received the Irving Innovation Fellowship to advance his research, co-teach an option studio at the GSD and work on this volume. When not thinking architecture or editing texts, he writes fiction in the form of short stories.

Guests

Doug Ahlers is a Senior Fellow at the Program on Crisis Leadership at the Harvard Kennedy School of Government where he researches and writes about disasters and disaster recoveries around the world. Mr. Ahlers is a cofounder of Recupera Chile, an initiative of the David Rockefeller Center for Latin American Studies at Harvard University. Recupera Chile is a multi-year project focused on helping earthquake and tsunami devastated Chilean communities recover and rebuild. Ahlers also founded the Broadmoor Project, a collaborative redevelopment effort between the Katrina-devastated Broadmoor New Orleans neighborhood and the Kennedy School, where he served as a faculty member, teaching courses in disaster recovery management and resilience. He has been a Fellow at Stanford University's Center for International Security and Cooperation, a Senior Fellow at the Belfer Center for Science & International Affairs and a Fellow at the Shorenstein Center for Press, Politics and Public Policy at Harvard. Mr. Ahlers has served on the Smithsonian Institution's National Board and the board of the National Democratic Institute for International Affairs.

Jose Castillo is an architect living and working in Mexico City. He holds a degree in architecture from Universidad Iberoamericana in Mexico City as well as an MArch and a DDes degree from Harvard University's GSD. Alongside Saidee Springall he founded arquitectura 911sc, an independent practice based in Mexico City. Among their built projects are the expansion of the Spanish Cultural Center, the transformation of the Sala Siqueiros and the CEDIM campus in Monterrey. They are currently designing the City of Film in Mexico City as well as the competition-winning Guadalajara Performing Arts Center, which is currently under construction. Castillo is member of the advisory board of LSE Cities and Urban Age as well as of SciArc's Future Initiatives program.

Loreta Castro Reguera was born in Mexico City in 1979, where she studied Architecture at the School of Architecture of UNAM. She has a Master in Architecture from Mendrisio Academy of Architecture, and a Master in Urban Design with Distinction from the Harvard GSD. Loreta has focused her work on the possibilities of solving urban water related issues through design. As a result, she has been awarded with several scholarships and prizes such as the 2010 Druker Travelling Fellowship Award, the Global Gold Prize and Latinamerica Gold Prize of the 5th edition of the LafargeHolcim Awards for La Quebradora Hydric Park, and the recent inclusion in the National Creators System of Mexico. In 2010 she founded Taller Capital with José Pablo Ambrosi, an architecture firm that mostly designs public spaces and housing under the premise of addressing some of Mexico's most pressing issues, with the underlying subject of sustainable water management.

Lilia Cruz holds a bachelor degree in Rural Sociology from the Universidad Autónoma Metropolitana (UAM), a master's in Regional Rural Development from Universidad de Chapingo and a doctoral degree in Geography by the Universidad Nacional Autónoma de México. Due to her Zapotec origins, her studies and professional career has centered around emergent social movements in the Isthmus, the tension between the autonomous territorial construction of the rural Isthmus and the neoliberal development discourse and the role of peasant communities in the defense of food sovereignty. Lidia currently works in Diconsa, a branch of Mexican Food Security, which is part of the Secretary of Agriculture and Rural Development.

Gustavo Madrid was born in 1975. He is a Mexican architect by the Autonomous Metropolitan University of México (UAM). He holds a DEA and a PhD Diploma in Urbanism from the Polytechnic University of Catalonia, Spain (UPC) with Cum Laude. At UPC, Gustavo was part of the research team of the university. He won a mention in the Holcim Awards 2011 and the UPC Extraordinary Prix for his PhD thesis in 2014. Gustavo was Director in the Casa de la Ciudad Oaxaca for more than four years and now leads Espacio Entre Tiempo Estudio, a consulting firm based in Mexico City with a strong focus in urban planning, green infrastructure and energy.

Vicente Marcial is a sociologist, writer, editor, and translator of diidxazá (Zapotec spoken in the Isthmus of Tehuantepec). As an advisor to the Federal Congress, he supported the approval of the General Law of Language Rights of Indigenous Peoples (2000-2003). He was part of the pioneer team to plan and start the National Institute of Indigenous Languages (2005-2012). Since 2017, he has designed and implemented a municipal public policy – Diidxazá Xtinu Municipal Program – to revitalize the Isthmus' Zapotec in Juchitán. Vicente is currently the Director of Culture in the Municipality of Juchitán (2019-2021).

Judith Palfrey is the T. Berry Brazelton Professor of Pediatrics at Harvard Medical School and a Senior Associate in Medicine at Children's Hospital, Boston. Dr. Palfrey has worked for the past 8 years as on the Recupera Chile project as one of the Harvard faculty leads. She has been particularly responsible for the children's health and mental health work through La Escuela en Realidad in conjunction with the Dichato, Chile school.

Elizabeth Peacock-Chambers is an Assistant Professor at the University of Massachusetts Medical School Baystate campus. She completed her pediatric residency in the Boston Combined Residency Program at Boston Medical Center and Boston Children's Hospital in 2013. She became involved in the public health component of Recupera Chile in Dichato in June 2012. In collaboration with other team members, she developed a holistic approach to address unmet health and mental health needs in the community. Her research currently focuses on supporting the early development of children and families affected by substance use disorders.

Students

Xio Álvarez is an MArch/MCP at MIT. Her background is in civic data and performance programs in the context of American local governments. She is interested in how data can be physicalized through design in response to crisis and disaster; especially to the benefit of marginalized and underserved communities.

Amaya Bravo-France is currently a Master of Urban Planning candidate at the Harvard Graduate School of Design. A native of Washington, D.C., she completed a BS in environmental science and smart cities at the University of North Carolina at Chapel Hill. Amaya previously worked at the intersection of sustainability and urban/regional planning at the Trust for Public Land in San Francisco and the North Carolina Sustainable Energy Association.

Evita Chávez is a Master of Urban Planning candidate at the Harvard Graduate School of Design from Los Angeles, California. She received her B.A. in Urban and Environmental Policy from Occidental College, where she developed an interest in addressing the causes and impacts of housing unaffordability, particularly in Latinx communities. Prior to the GSD, Evita worked as a Legislative Assistant for a State Senator in California, where she successfully staffed landmark legislation on accessory dwelling units.

Carlos Casalduc is currently a student at MIT where he is completing his Masters in Architecture. He is currently working on his thesis project on architecture's material being by examining the embedded histories of architecture as they pertain to their material decay and weathering. Carlos graduated from his bachelor degree on environmental design in architecture from the University of Puerto Rico in 2016. He has worked for architecture practices in Puerto Rico, Mexico and Brazil.

Melissa Guitierrez is currently a Master of Science in Architecture Studies in Urbanism (SMarchS) candidate at the School of Architecture and Planning at MIT. Melissa is the recipient of the 2019 Julian Bejnart and NUVU Awards to do research on her Thesis topic on border urbanism, to examine urban design responses to the political exceptions of migration. Melissa holds a BArch with a concentration on Landscape and Urbanism from Universidad de Monterrey. She graduated with honors with her thesis "Munis" that examined design for new public learning spaces for Mexican children.

Clarence Lee is a current Masters of Architecture Candidate at the Massachusetts Institute of Technology (MIT), holding a Bachelors in Design in Architecture from the University of Sydney. Born in Bangkok, Thailand, he has since lived in Singapore, Malaysia, and Australia before moving to Boston. Prior to his arrival in the US, he spent the past year working on high end residential projects in Sydney's Eastern Suburbs. His interests lie in exploring new forms of vernacular construction and cultural expressions of public space.

Deni López studied architecture at the National Autonomous University of Mexico, where she graduated with a merit diploma in 2015. During her undergraduate studies, she spent a year at the Czech Technical University in Prague and was part of the first

multidisciplinary team to participate in the Solar Decathlon Europe, held in Versailles, France in 2014. Afterward, she collaborated with architecture firms such as Estudio Lamela and JSa in Mexico City. She holds a dual master's degree in Design Studies (with a focus on Risk and Resilience) and Architecture in Urban Design from Harvard University, where the National Autonomous University of Mexico, the Fundacion Mexico en Harvard, the National Fund for Culture and Arts, and the National Council of Science and Technology sponsored her studies. Her research interests focus on analyzing and improving disaster recovery plans in marginalized communities prone to recurring social and environmental threats.

Karen Mata is an urban designer working at Sasaki. She has been involved on private development projects and master plans; both in the US and abroad, with high focus on social inclusion, civic spaces, resilience, and environmental awareness. Karen graduated with a Master of Architecture in Urban Design with Distinction (2018) at Harvard Graduate School of Design. Before that, she practiced in an architecture and urban design firm in Venezuela. Karen holds a degree as Bachelor in Architecture mention "Summa Cum Laude" from Universidad Simon Bolivar (USB) in Venezuela. In the US she participated with a Community Land Trust Corporation called Neighborworks Blackstone River Valley where she lead community based projects related to public space. She has participated in community meetings with NOAA discussing SLR threats for Boston. . In Colombia, she engaged community approaches working within an Integral Development Program called "Progresia Fenicia" focusing on affordable housing and preventing gentrification.

Antonio Moya-Latorre is a musician and an architect who became an urban planner. Thanks to the La Caixa fellowship program, he pursued the Master in City Planning at Massachusetts Institute of Technology. Antonio works on the diffusion of art to contribute to the progress of vulnerable populations in Spain and Latin America and believes in the need for universal access to culture. Antonio's professional career can be followed on his platform A+M (www.amaseme.net), a space where he reflects on urban regeneration through architecture, music and art.

Sydney Pedigo is an urban planning master's student at the GSD. She has a bachelor's degree in interdisciplinary health and philosophy from Vanderbilt University and has worked in program evaluation and research in the past. At the GSD, her studies and projects have focused on risk, climate adaptation, and neighborhood planning.

Eduardo Peláez is a Peruvian architect and cofounder at Aula. His work focuses on social justice projects, critical urban studies of uneven spatial development, and adaptation and disaster risk reduction of vulnerable communities. His work at Aula, an awarded social entrepreneurship, has positively impacted children's learning processes through collaborative workshops and co-creation of learning spaces. He has been a lecturer and teaching assistant at Pontificia Universidad Católica del Perú, Universidad de Lima, and Harvard Graduate School of Design. As a designer, Peláez worked at 51-1/Supersudaca, Ministry of Education of Peru, Inter-American Development Bank in Mexico, Design for Disasters & Chat Architects in Thailand, and Kounkuey Design Initiative in Kenya. Peláez received a Bachelor of Architecture from Pontificia Universidad Católica del Perú and a Master in Design Studies from Harvard University Graduate School of Design with a fully funded scholarship.

María Peroni is an architect and researcher, Fulbright and Becal scholar currently enrolled in the Master of Architecture in Urban Design at Harvard Graduate School of Design. While at Harvard, María has been selected as a fellow for the Puerto Rican Winter Institute and collaborated as a research assistant for the Sanitation Infrastructure Studio. Before coming to the United States, she studied architecture at the School of Architecture, Design, and Arts of the National University of Asunción, and as an exchange student in the Iuav University of Venice where she started her passion for urban studies, water and design. Since then, María has focused her work on the intersections between hydrological resources and urbanism exploring different strategies in which water relates to infrastructure and citizenship. Additionally, María has collaborated in Paraguay with the Aqua Alta association, participating in a number of workshops and exhibitions, including the 2014 Venice Biennale of Architecture.

Nadyeli Quiroz is a licensed architect in Mexico with five years of professional practice on projects that range from interior to urban design. She graduated with Summa Cum Laude honors from a B.A. in Architecture at the Universidad Nacional Autónoma de México (UNAM). Currently pursuing two master's degree at the Harvard Graduate School of Design (GSD) on Landscape Architecture and on Design Studies on Urbanism, Landscape and Ecology, Nadyeli was awarded the Dean Merit Scholarship Grant for both degrees as well as several scholarships from Mexican institutions. She is interested on the convergence of public space, nature, ecology and the built environment, through projects focused on the regeneration of ecosystems mediated by the community. Nadyeli has worked before with artists, on public office, for developers, as an independent professional and lately as teaching assistant at the GSD. She is currently on an internship in MASS Design Group, a non-profit architecture firm based in Boston.

Rian Rooney holds a master's degree in Urban Planning from the Harvard University Graduate School of Design and a Bachelor of Arts in Architecture from Columbia University. At Harvard, Rian's work focused on energy, infrastructure, and climate-related land use changes. He has previously lived in Valparaiso, Chile and in Medellín, Colombia, where he cofounded an exhibition space called Latienda. In summer 2019, Rian will return to Colombia as a participant in the Field Stations program of the Wright-Ingraham Institute.

Cristina Solís is a MArch. student at MIT where she is about to start a Thesis on the topic of Borders. During her education at MIT, she has done work in Puerto Rico, Brazil and Mexico with a focus on reconstruction in low-income communities. Cristina received her Bachelor of Science in Architecture from Arizona State University in 2015.

Betzabe Valdés graduated from the National Autonomous University of Mexico as an Architect in 2015. During her time there, she was a research assistant for public health experts inside and outside the university and she participated in multidisciplinary projects such as CASA UNAM, a sustainable housing prototype developed for the Solar Decathlon Europe of 2014. She later worked as an architect at Estudio Lamela and as a project assistant at the Arthur Ross Architecture Gallery of Columbia University. She holds a master's degree in Design Studies, with a concentration in Critical Conservation, from the Harvard University Graduate School of Design. Her thesis research focused on the potential incorporation of traditions and social norms in the long-term recovery process of areas affected by natural disasters, with emphasis on the Isthmus of Tehuantepec in Mexico.

Daphne Xu (AB, MCP) is interested in the politics and poetics of urban transformation. She works at the intersection of urban design, civic media, and public art.

Enrolled Students

ADV-9147 – Beyond Reconstruction: Mexico and the 2017 Earthquakes.

Harvard University Graduate School of Design / Spring Semester 2018

Instructors: Diane E. Davis / Jose Castillo

TF: Caroline Filice Smith

Colleen Brady, Gina Ciancone, Kim Geronimo, Vladimir Gintoff, Dení López, Karen Mata, Santiago Mota, Antonio Moya-Latorre, Eduardo Peláez, Nadyeli Quiroz, Akemi Sato, Rodrigo Solé, Marisa Villarreal, Erin Yook.

4.184 – Architectural Design Workshop – Beyond Reconstruction in Oaxaca, Mexico

MIT School of Architecture + Planning / Fall Semester 2018

Instructor: Lorena Bello Gómez

Xiomara Álvarez, Carlos Casalduc, Melissa Gutiérrez Soto, Clarence Yi-Hsien Lee, Dení López, Antonio Moya-Latorre, María Peroni, Cristina Solís, Betzabe Valdés, Daphne Xu.

ADV-9201 – Oaxaca Independent Study

Harvard University Graduate School of Design / Fall Semester 2018

Instructor: Diane E. Davis

Amaya Bravo-France, Weiyi Cao, Evita Chavez, Anita Nai-Tzu Cheng, Yona Cheung, Erick Díaz, Sebastián Gaviria, Sydney Pedigo, Rian Rooney, Fernando Schrupp-Rivero, Finn Vigeland, Kuangyu Xiong.



Editorial and Graphic Design
Enrique Aureng Silva

Proofreaders
Rian Rooney / Francesco Buccella

This publication was typeset in
Akzidenz Grotesk Old Face and Garamond.

©2019

