

Symposium on Resilience Research for Global Development Challenges

AIR International Programs

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Developing an outreach model for green infrastructure to address flooding and sewage spills in *Ambos Nogales*

Zuniga-Teran, A., Lara-Valencia, F. Garcia-Perez, H., Murrieta, J.
Buechler, S., Spickard, G., Estrella, M.A., Castellanos, E.

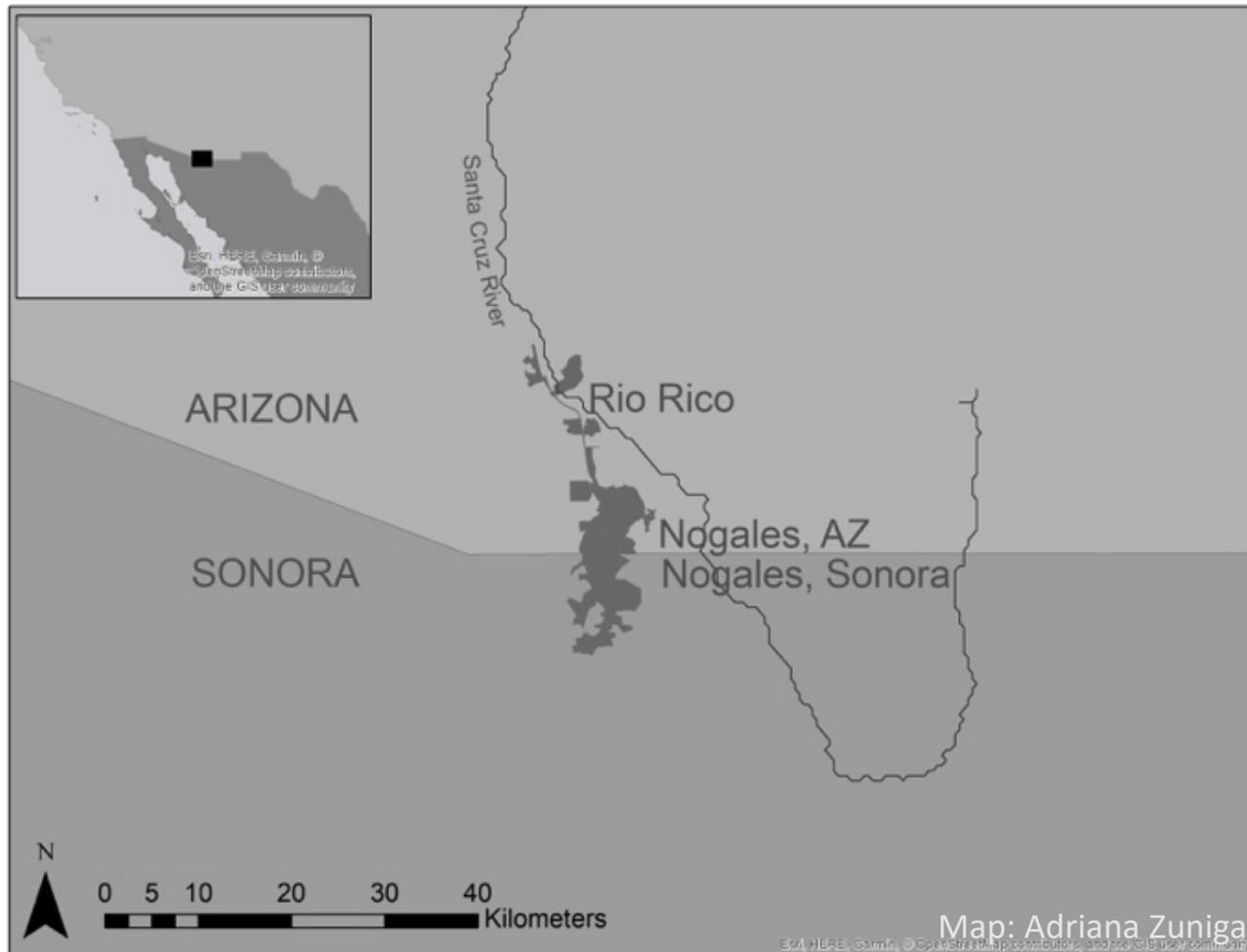
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Context – The Santa Cruz River and the Nogales Wash

Water flows north in the sister cities of Ambos Nogales



Context: Streets built on a creek

- *Ambos Nogales* were built on the banks of the Nogales Wash, with a sewage system underneath the streets.
- Flooding issues are not new, but they have been aggravated in the last 2 decades.



The Ambos Nogales flood of 1930, prompted the construction of the earliest storm water management infrastructures with the construction of the Nogales Wash canal in Ambos Nogales. A shared infrastructure.

Flooding issues in Nogales, Sonora

- After 9/11/2001, concerns for national security in the U.S. resulted in the construction of a less permeable border wall.
- Nogales, Sonora experiences severe flooding events.
- Nogales, Arizona experiences sewage spills.



Flood in Nogales on July 12, 2008
KOLD News 13

Green infrastructure: A decentralized solution

Green Infrastructure Builds Resiliency

- 1** Vegetation-based green infrastructure practices can mitigate carbon pollution.
- 2** Build green infrastructure like rain gardens and permeable pavement to manage flooding.
- 3** Reduce dependence on imported water and save money. Let water soak into the ground to recharge local groundwater supplies.
- 4** Keep water local. Capture runoff in cisterns and rain barrels to reduce municipal water use.
- 5** Plant trees and green roofs to mitigate the urban heat island effect.
- 6** Use living shorelines, buffers, dunes and marsh restoration to reduce the impact of storm surges.

EPA
United States
Environmental Protection
Agency

For more information on green infrastructure, see:
www.epa.gov/greeninfrastructure

Problem statement

- One of the biggest challenges for the wide implementation of GI is ensuring its long-term maintenance¹
- **Community engagement** is critical for project ownership and maintenance.²



Roundabout with GI, where community engagement was conducted.

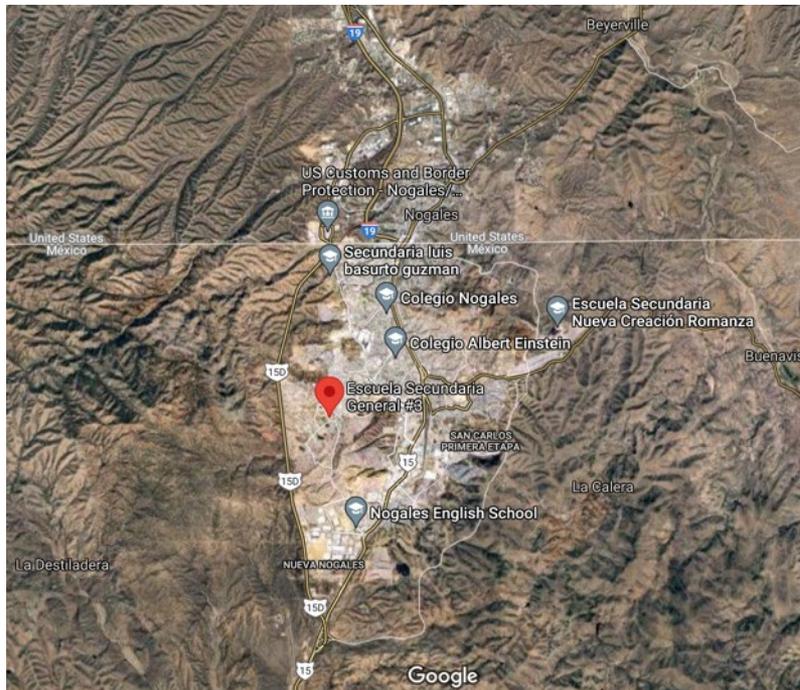


Roundabout where community engagement was NOT conducted.

1. Zuniga-Teran et al. 2019. Challenges for mainstreaming green infrastructure in built environment professions. *Journal of Environmental Planning & Management* .
2. Zuniga-Teran & Gerlak, (2019). A multidisciplinary approach to analyzing questions of justice issues in urban greenspace. *Sustainability*, 11, 3055.

Community engagement model

- We worked with a middle school in Nogales, Sonora to develop a community engagement model, which can be replicated in other schools and eventually scaled up to the Nogales Watershed.
- We partnered with local government (IMIP), NGO (WMG, Semillas), and scientists (COLEF, ASU).



Escuela Secundaria #3 – Humberto Campos Varela, in Nogales, Sonora

Project activities

1. Visit to the school - Escuela Secundaria #3
2. Drawing contest – art as an engagement tool
3. GI workshop - Participatory design process
4. Implementation – Demonstration project



Visit to the school - Escuela Secundaria #3 in Nogales, Sonora, Mexico

Drawing contest

- Content analysis of drawings according to themes and subthemes
- Introduction to green infrastructure

Imagen 13
[N32, femenino, Sonora]



Imagen 2
[N39, femenino, Sonora]



Drawing contest at Secundaria #3

Participatory design workshop

Dr. Joaquín Murrieta (WMG) facilitated the participatory design workshop for the school.



Participatory design workshop

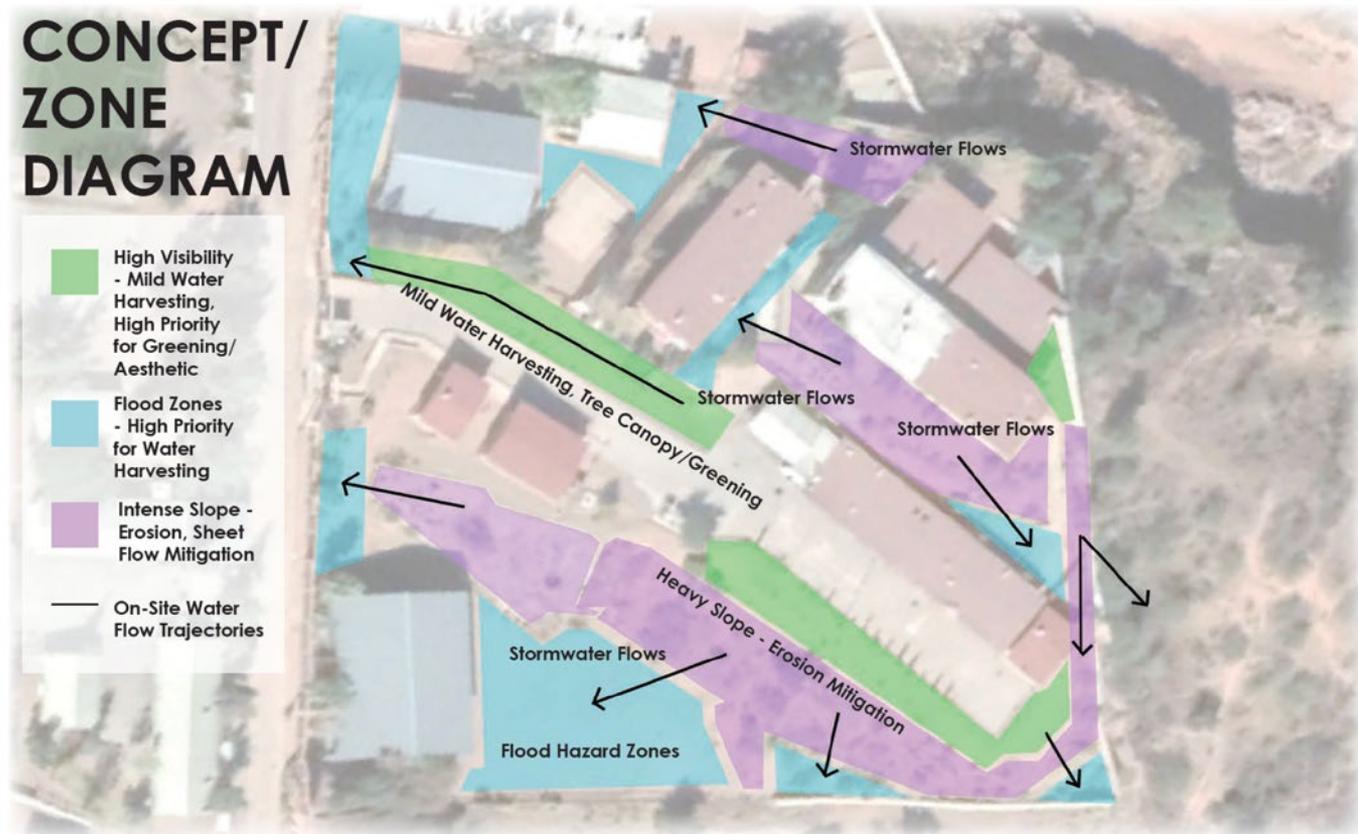
Students identified areas that experience flooding and erosion at their school, and potential areas for GI.



Middle school students proposed GI in different areas of their school.

Participatory landscape design

Landscape architecture student (G. Spickard) used data from workshop to create a conceptual design for the school.



2nd workshop– *Jardines de Lluvia para mi Escuela*

Ciclo | Infraestructura verde y salud urbana

Escuela Secundaria General # 3 Profr. Humberto Campos Varela



**Segundo taller de planeación
Jardines de lluvia para mi escuela**

24 septiembre
de 2020
10:00-11:30 h

10:00 h **Bienvenida y presentación de autoridades invitadas**
Dra. Adriana Zuñiga Terán, College of Architecture,
Planning & Landscape Architecture, UA
Mtro. Justin Dutram, Vicepresidente asistente,
Iniciativas para México y Asuntos Globales

Proyecto piloto de infraestructura verde en Nogales, Sonora
Alianza Interuniversitaria Sonora-Arizona- UA, El Colef y ASU
Dra. Adriana Zuñiga Terán, College of Architecture,
Planning & Landscape Architecture, UA
Dra. Hilda García Pérez, El Colegio de la Frontera Norte, El Colef
Dr. Francisco Lara Valencia, School of Transborder Studies, ASU

10:10 h **Proyectos de infraestructura verde en escuelas
en la región Sonora-Arizona**
Dr. Joaquín Murrieta, Watershed Management Group

10:20 h **Taller: cosecha de agua de lluvia y los jóvenes de Nogales**
Dra. Hilda García Pérez, El Colegio de la Frontera Norte
Profa. Margarita Estrada, Directora, Escuela Secundaria General # 3,
Humberto Campos Varela

10:30 h **Diseño de un jardín de lluvia en la Esc. Sec. Gral. # 3,
Humberto Campos Varela**
Arq. Gabrielle Spickard, Planning & Landscape Architecture, UA

10:50 h Preguntas y respuesta

Proyectos complementarios:

11:10 h **Dra. Stephanie Buechler**, School of Geography & Development, UA

11:20 h **Dr. Francisco Lara Valencia**, School of Transborder Studies, ASU

11:30 h Clausura

Participatory landscape design

With input by the school community and stakeholders, the design was finalized.

MASTER PLAN

A plan to internally manage significant amounts of runoff and flooding, mitigate erosion, dramatically increase on-site tree canopy, improve site accessibility and circulation, and provide valuable social and educational space.

Hardscape Pedestrian Pathway.
(Expansions of existing sidewalks)

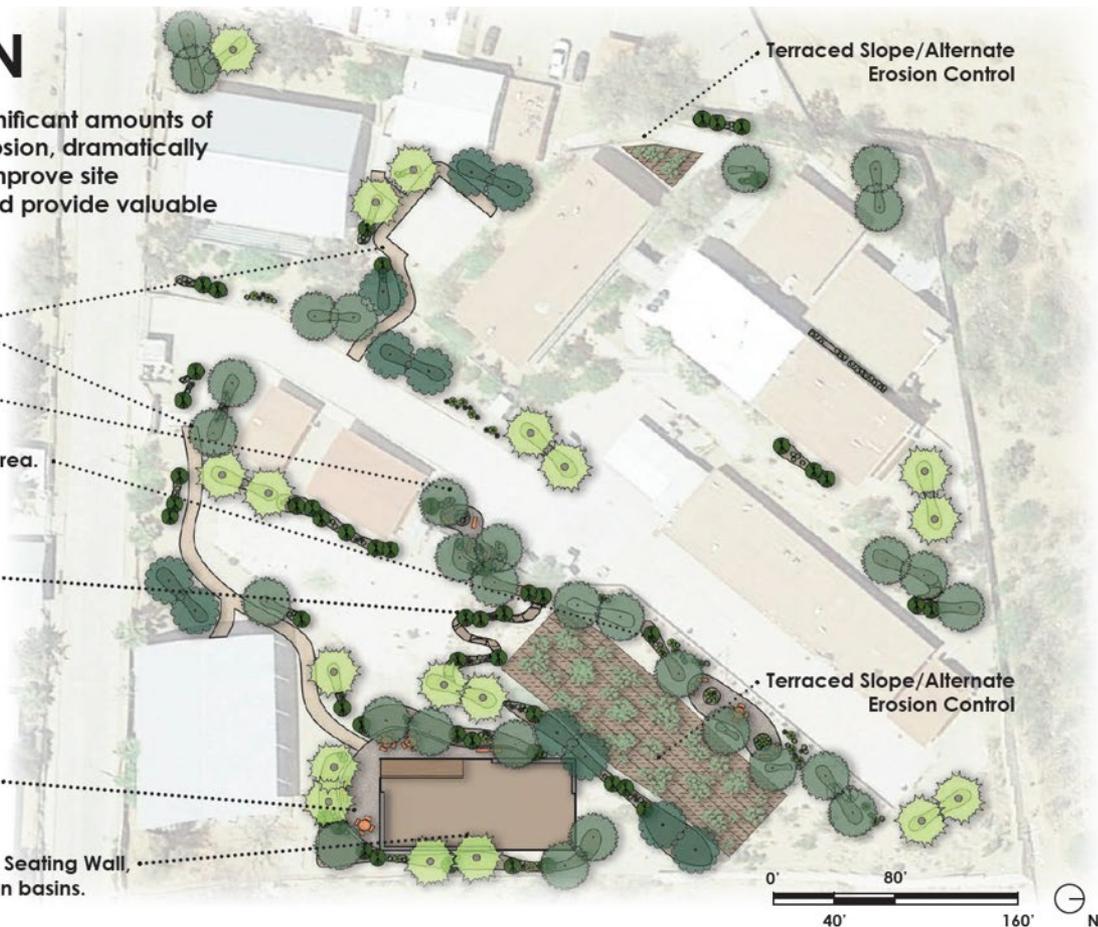
Pollinator Garden Gathering Area.

Cacti/Succulent Garden Gathering Area.

Rocked Winding Swales.

Shaded Gathering Area with Seating.

Sunken Sports Field/Event Space with Seating Wall, ADA Ramp, and surrounding detention basins.



Participatory landscape design

SUNKEN SPORTS FIELD/EVENT SPACE





Implementation of pilot project at the middle school– May27, 2021

Implementation of GI at Secundaria #3

- We received donations –trees, plants, materials, and the use of machinery.
- Volunteers (students, faculty, neighbors, IMIP, stakeholders) worked together to implement a demonstration project at the school.

Lessons learned

- People (children) are **aware** of the stormwater challenges in Ambos Nogales and there is **enthusiasm** for greening their city.
- Important **synergies** exist when efforts are concentrated.
- **Engaging** the community in the planning, design, and implementation of GI was useful for leveraging resources and for attracting participants.
- Through this process, we extended **networks** and built **capacity** around GI.
- Scaling up this model will enhance resilience in Ambos Nogales.



Team of faculty and students from UArizona, ASU, COLEF, with WMG, IMIP, and middle school staff and faculty

¡Muchas gracias!

Adriana Zuniga

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