Conceptualizing an application of sociohydrology to predict the long-term effects of drainage projects on colonia flood risk

Sydney Weyand, Dr. Inci Guneralp, and Dr. Burak Guneralp

Texas A&M University

WATER MANAGEMENT & HYDROLOGICAL SCIENCE
TEXAS A&M UNIVERSITY

GEOGRAPHY
TEXAS A&M UNIVERSITY

Outline

- Introduction
- Methodology
- Implications
- Future Research

Floods are one of the most damaging and common forms of natural disasters.

Structural mitigation

Lake Parramatta,New South Wales © 2005 Greg Harper

Structural mitigation

Lake Parramatta,New South Wales © 2005 Greg Harper

Los Angeles River through downtown evening © 2009 Downtowngal @ https://commons.wikimedia.org/

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Sacramento River Levee © 2007 Henry W. Schmitt

Non-structural mitigation

Non-structural mitigation

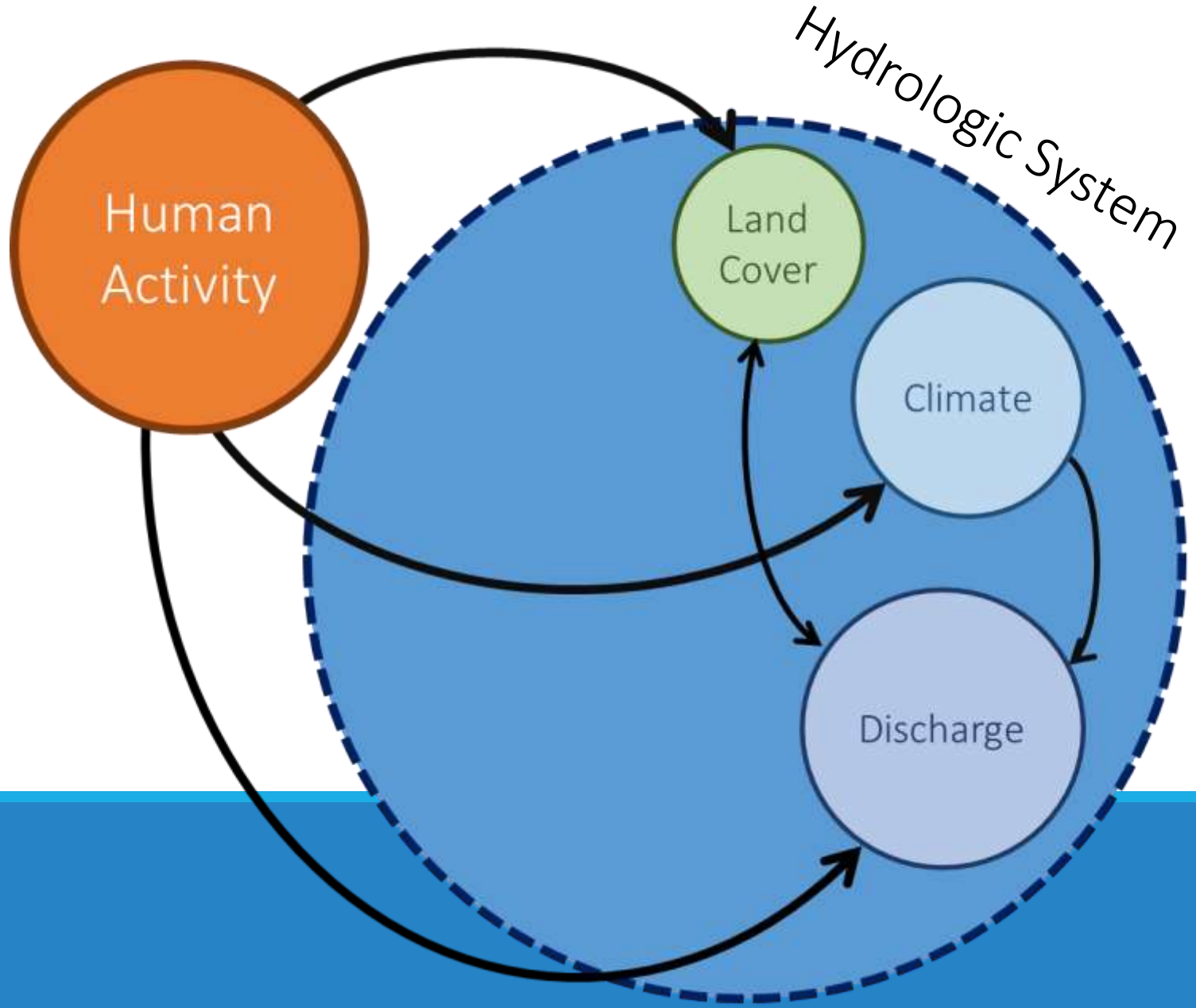
What is sociohydrology?

"The science of people and water, a new science that is aimed at understanding the dynamics and co-evolution of coupled human-water systems."

(Sivapalan et al, 2012)

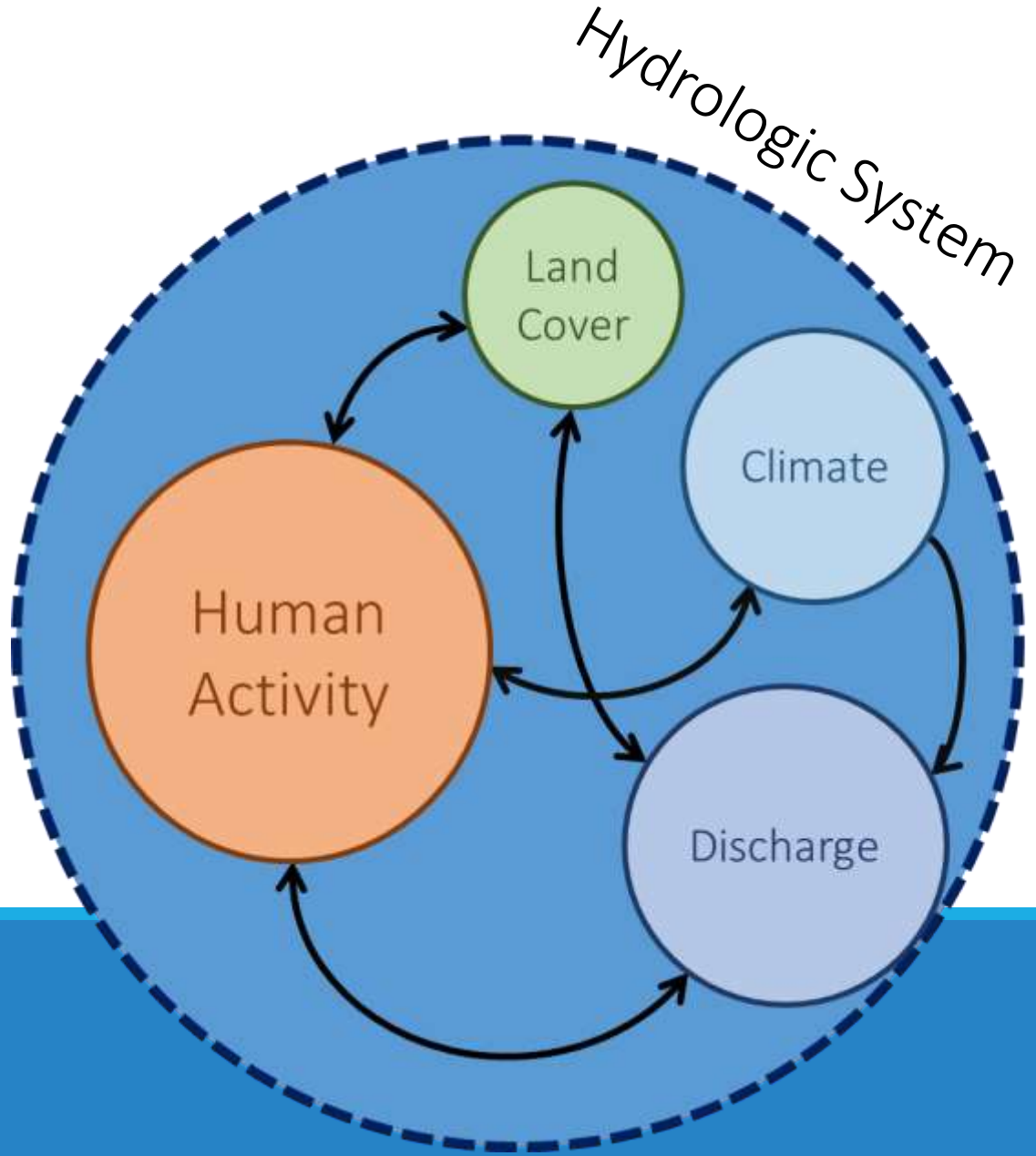
Traditional hydrology

Human activity **drives** the system.



Sociohydrology

Human activity **works within** the system.



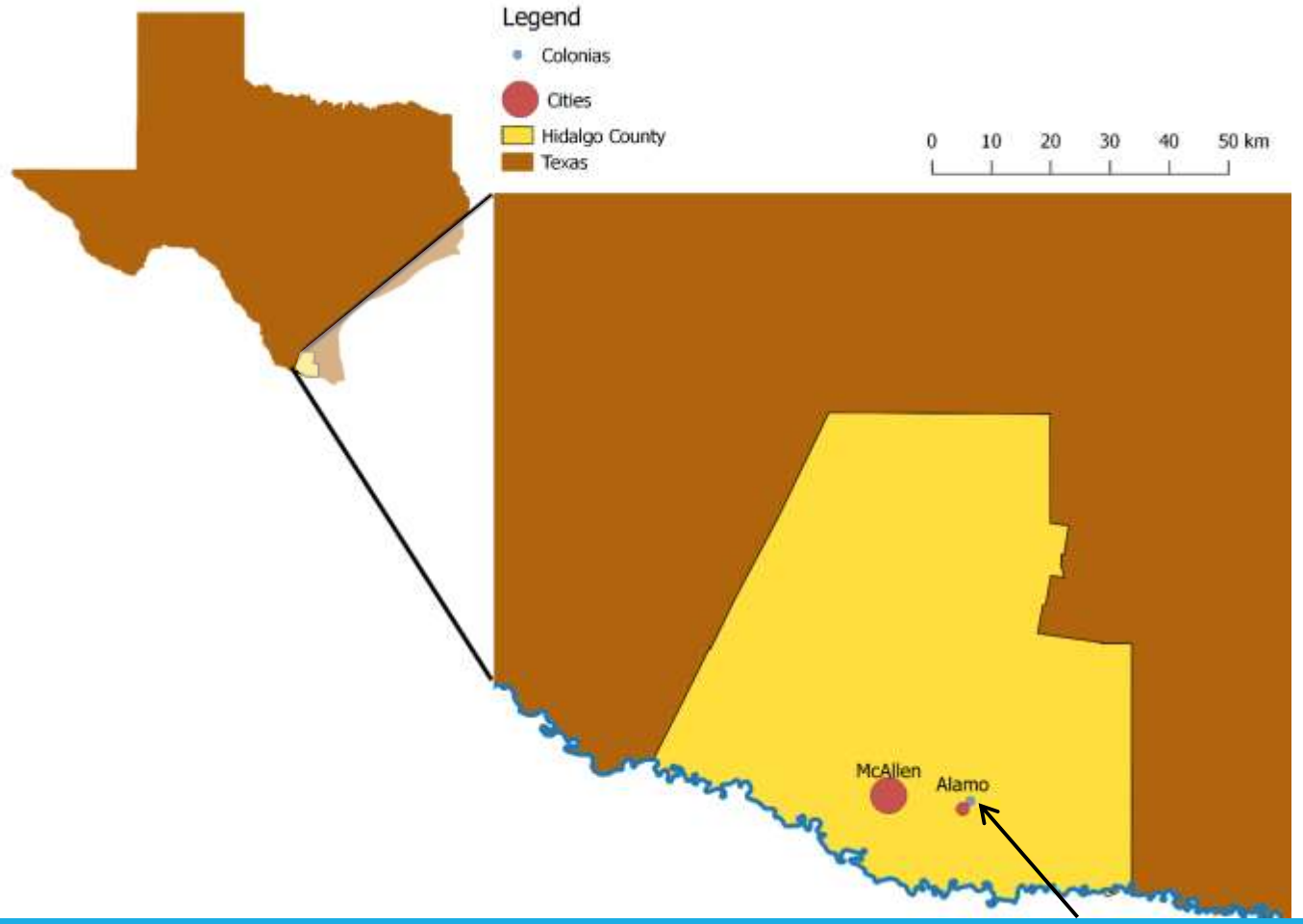
Research objectives

1. Examine flood risk in colonias within Hidalgo County, Texas, and the potential impacts the Alberta Drainage Project

2. Create paired hydrologic/hydraulic flood models with systems dynamics methodology

3. Analyze how potential policies could influence long-term risk

Study area


Legend
Colonias
Cities
Hidalgo County
Texas
0 10 20 30 40 50 km
McAllen
Alamo

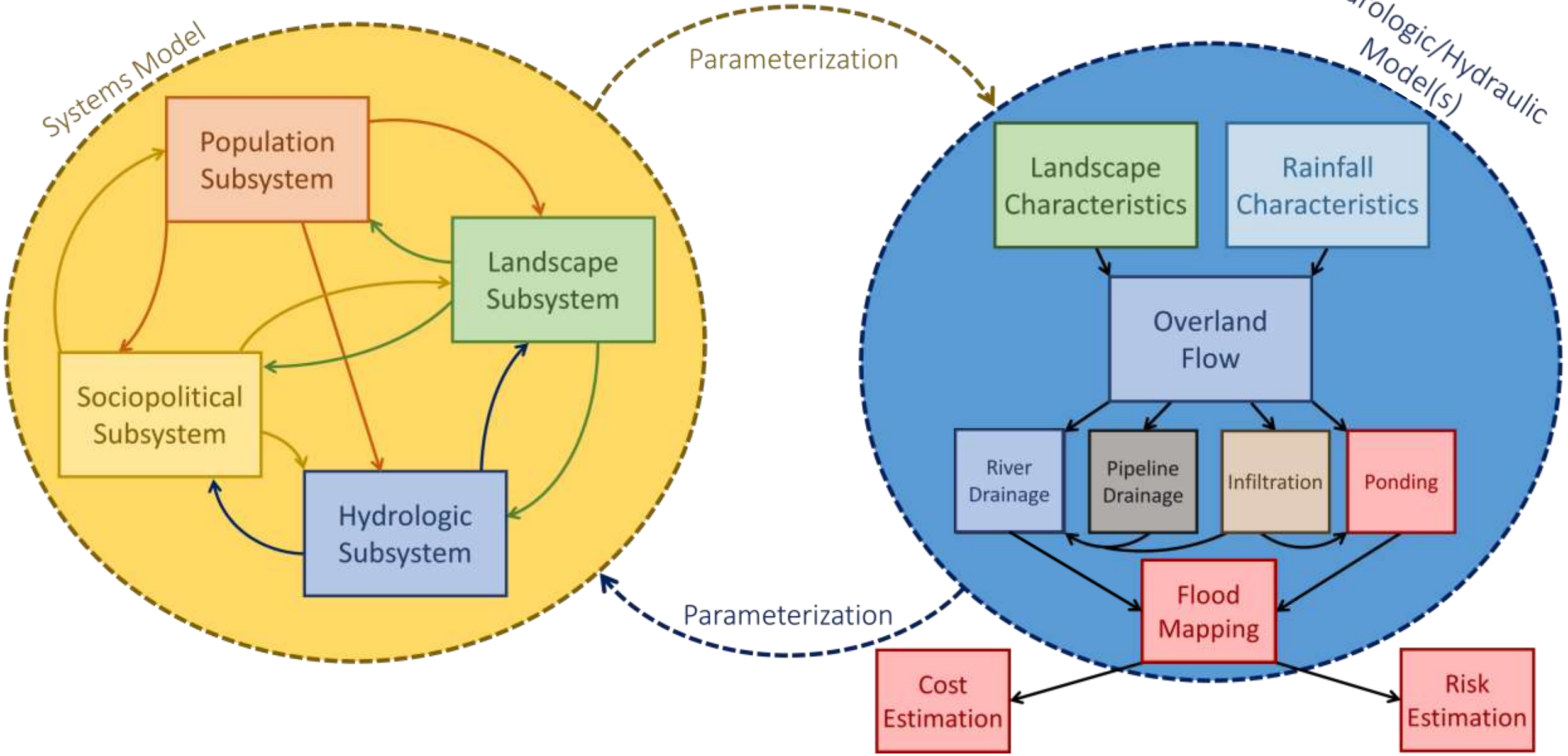
Alamo Drainage Project

- Community-led effort
- Expands Alamo's flood drainage infrastructure
- 6 colonias, ~1000 residents, affected
- Construction began May 2016

Local residents long with Precinct 4 commissioner Joseph Palacios and Hidalgo County Sheriff Eddie Guerra break ground on a drainage project Wednesday May 18, 2016 in Edinburg, Texas © 2016 Delcia Lopez

Conceptualization : What do we need?

SYSTEMS MODEL	HYDROLOGIC/HYDRAULIC MODEL(S)
Simplified hydrologic processes	**Detailed** hydrologic processes
Simplified landscape characteristics	**Detailed** landscape characteristics
Human population characteristics	Detailed **infrastructure** schematics
Sociopolitical characteristics	Detailed **topography and maps**


Systems Model
Population Subsystem
Landscape Subsystem
Sociopolitical Subsystem
Hydrologic Subsystem
Parameterization
Parameterization
Hydrologic/Hydraulic Model(s)
Landscape Characteristics
Rainfall Characteristics
Overland Flow
River Drainage
Pipeline Drainage
Infiltration
Ponding
Flood Mapping
Cost Estimation
Risk Estimation

Implications

- Assist local leaders with policy-making decisions
- Maximize the drainage project's long-term socioeconomic utility
- Improve understanding of the indirect and long-term effects of infrastructure projects
- Direct sustainable development

Going forward…

- **Next step**: complete base models

- **Challenges**:
  - Must sufficiently capture human behavior without overwhelming complexity
  - Must efficiently incorporate sociopolitical parameters into the hydrologic/hydraulic model(s)

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