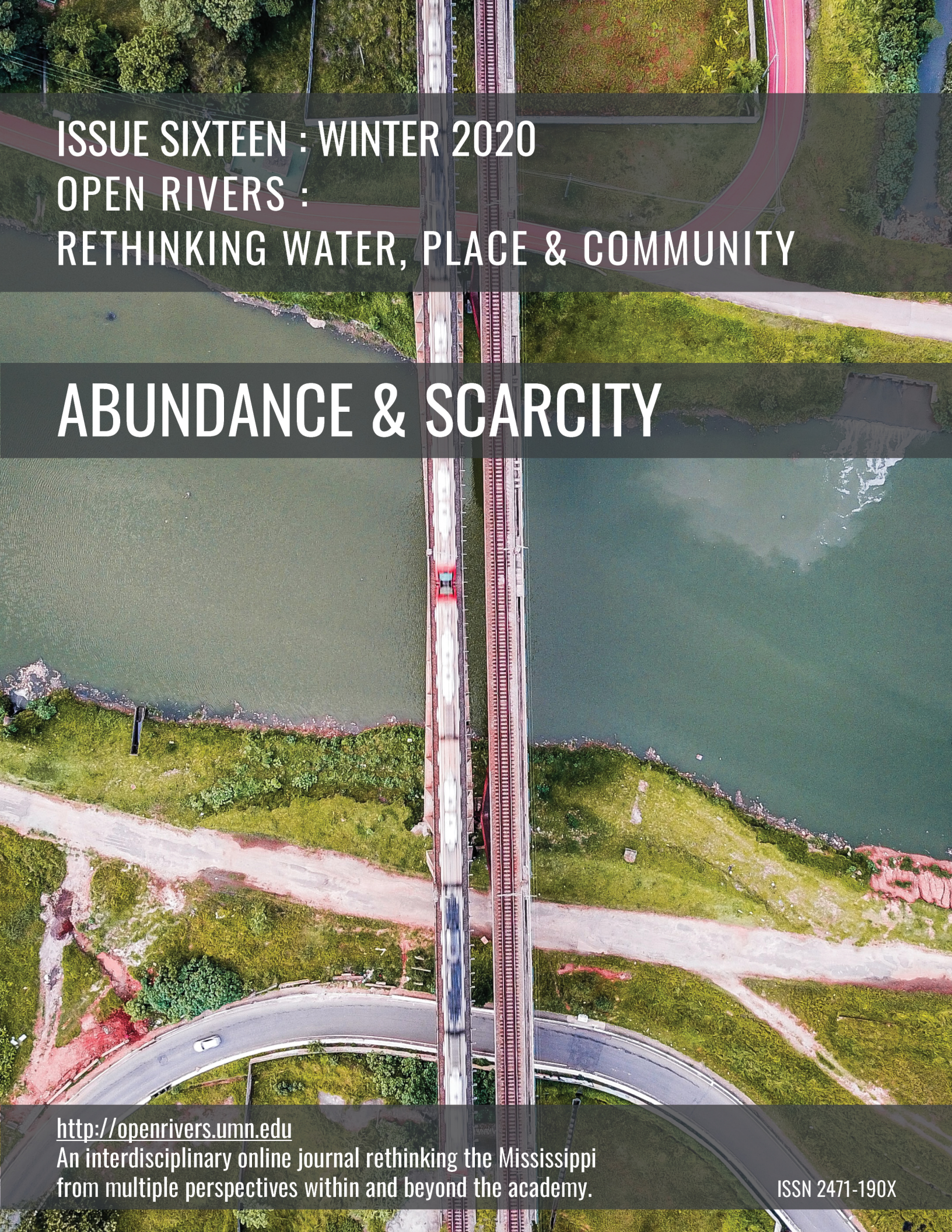


ISSUE SIXTEEN : WINTER 2020
OPEN RIVERS :
RETHINKING WATER, PLACE & COMMUNITY

ABUNDANCE & SCARCITY

http://openrivers.umn.edu
An interdisciplinary online journal rethinking the Mississippi
from multiple perspectives within and beyond the academy.
ISSN 2471-190X

The cover image is courtesy of Sergio Souza.

Open Rivers: Rethinking Water, Place & Community is produced by the University of Minnesota Libraries Publishing and the University of Minnesota Institute for Advanced Study.

Editors

Contact Us

Open Rivers
Institute for Advanced Study
University of Minnesota
Northrop
84 Church Street SE
Minneapolis, MN 55455

Telephone: (612) 626-5054
Fax: (612) 625-8583
E-mail: openrvrs@umn.edu
Web Site: http://openrivers.umn.edu

ISSN 2471-190X

Editorial Board

CONTENTS

INTRODUCTION

INTRODUCTION TO ISSUE SIXTEEN

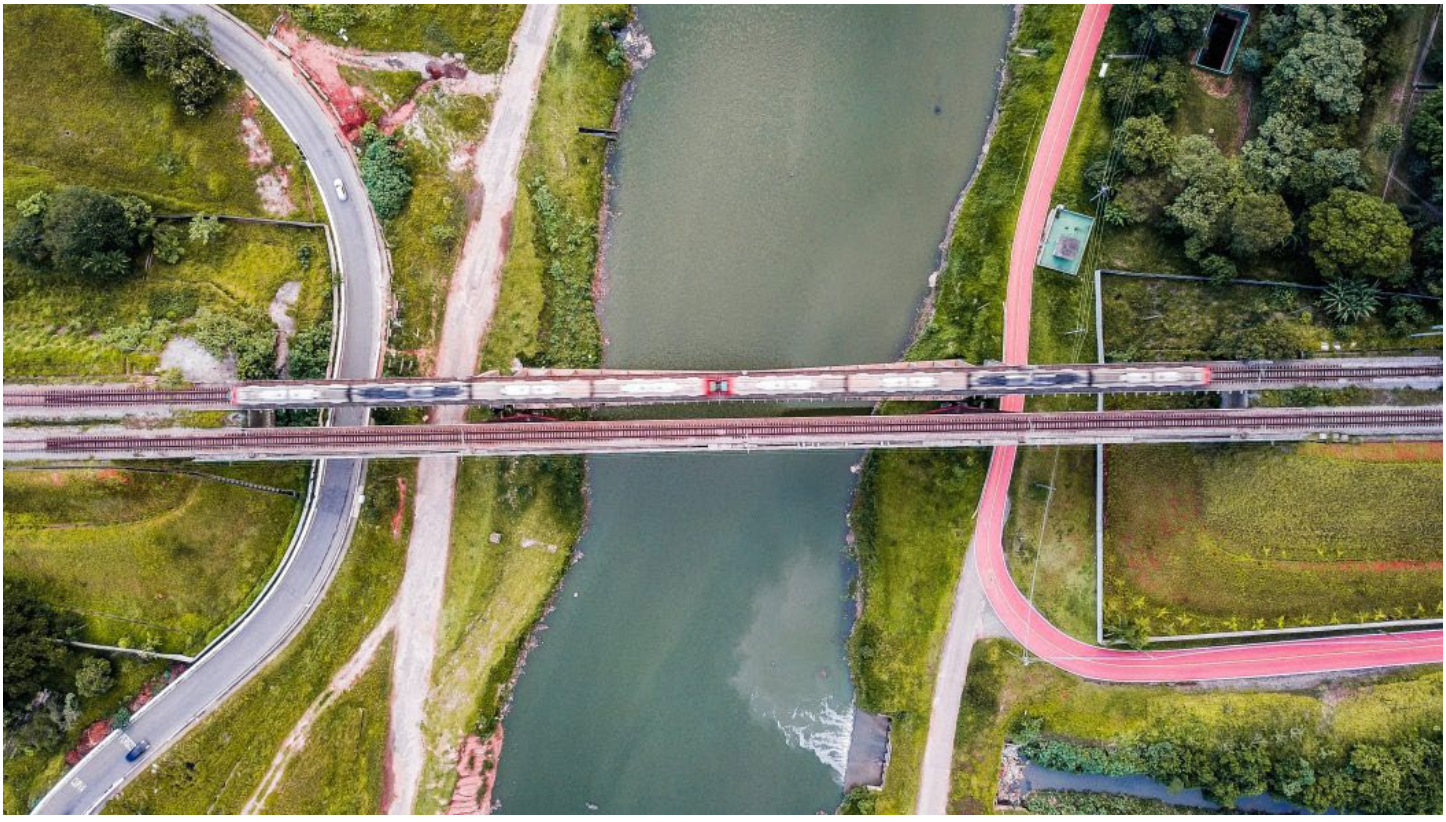
By Patrick Nunnally, Editor

There's a saying among water professionals that the public only cares about water when there is too much or too little, when there is a flood or a drought. Most of the pieces in this issue of *Open Rivers* speak to these conditions: flood or, if not drought, at least water scarcity. Debika Banerji and Craig Colten write of differing responses to floods happening in contexts that are half a world apart—Banerji in India and Colten in south Louisiana. Leslie Johnson writes about traditional water management in India as an important response to conditions of scarcity.

Water scarcity is a fact of life in much of the American West, and David Morrison and Jessica Rossi-Mastracci both explore iconic landscapes of that region. The west is changing, of course, with climate being one of the drivers of that change. Olivia Navarro-Farr and writers from the Center for Changing Landscapes both speak directly to matters of climate change and water.

Finally, my discussion of Dolores Hayden's book *The Power of Place* points out how the ordinary landscape around us is part of our sense of who we are. This is surely true for the water components of those landscapes as well.

The connection among all of these pieces is that they all point toward being more intentionally



Intersections of roads, railroads, drainage, and river. Image courtesy of Sergio Souza.

aware of how we live with water. Even in water-rich Minnesota, there is not enough to do whatever we want, whenever we want, for as long as we want. A changing climate adds uncertainty. All these pieces, in disparate ways, point toward important aspects of our water futures.

Happy reading!

Recommended Citation

Nunnally, Patrick. 2020. “Introduction to Issue Sixteen.” *Open Rivers: Rethinking Water, Place & Community,* no. 16. https://editions.lib.umn.edu/openrivers/article/introduction-to-issue-sixteen/.

DOI: https://doi.org/10.24926/2471190X.7204

About the Author

Patrick Nunnally coordinates the River Life program in the Institute for Advanced Study at the University of Minnesota. He serves as editor for Open Rivers and was one of the lead scholars for the University’s John E. Sawyer Seminar which focused on the Mississippi River and was funded by the Andrew W. Mellon Foundation.

FEATURE (PEER REVIEW)

ERODING MEMORIES AND ERECTING RISK ON THE AMITE RIVER

By Craig E. Colten

Editor's note: This feature article has been peer reviewed.

Baton Rouge, Louisiana owes its existence to the Mississippi River. The city is perched atop a terrace at the first upriver site that is immune from annual inundation. Ocean-going ships glide up the turbid waterway and converge with the barge loads of cargo pushed from the upstream hinterland. Refineries and grain elevators cluster along the riverfront where they receive and disperse commodities as part of a dynamic global commerce. This geographic situation helped establish Louisiana's capital and made it a river city.

Slab-on-grade house that flooded, Ascension Parish. August 2016. Image courtesy of the author.

Protected by natural elevation and massive levees, the metropolitan region has become complacent about the risk of regular flooding, and suburbs have sprawled outward from the old elevated riverfront core. Indeed, the combination of natural elevation and federal barriers have proven effective for Baton Rouge. Yet a massive flood in 2016 recalled a similar, but less destructive event in 1983, and several additional floods in the intervening years. The two major calamities had nothing to do with the Mississippi River. The much smaller Amite River and its tributaries, which flow from southern Mississippi across rural land and suburban communities to the east and southeast of the city, were responsible for these two destructive events. Several interrelated factors have dramatically increased risk to residents and businesses in this river basin. They include largely unchecked development into flood-prone areas, the increasing frequency of high-volume rainfall events, and rising sea levels that will alter the hydrology of these near-coastal communities.

This article is a modest extract of an interdisciplinary research project that considers the historical responses to floods and the role of social memory in risk reduction as expressed in public policy in three parishes that shared in the 2016 devastation. These parishes coped with the 1983 flood, and their officials took some coordinated steps to minimize future flooding in the intervening years. However, mitigation moves slowly, and much slower than real estate development. Aiding and permitting growth and boosting parish tax bases has taken precedence over safety. A review of measures taken between the two major floods, a series of focus groups conducted with public officials, and a review of parish council actions following the 2016 flood inform this historical review, which seeks to uncover the influence of flood memories in flood mitigation and local planning, and ultimately the risks for residents in this basin.[1]

Attention to how effectively a society builds the memory of past floods into its risk reduction and planning efforts is particularly significant in both inland flood zones and coastal areas (Colten and Grismore 2018). McEwen and colleagues (2017) have examined the role of social memory in creating more sustainable flood resilience. They point out the importance of "active remembering" and "active forgetting" (McEwen et al. 2017, 20) in shaping public awareness with flood risk and how this translates into interaction with flood management. They argue that flood-resilient communities are built on active memories and knowledge of past events that inform flood management (McEwen et al. 2017, 15). This knowledge is not consistent across an impacted community and certain segments of society have greater recollection of flood events than others, while there is also uneven trust in the use of memory to shape public policy that ultimately affects all residents to some degree. This particular article focuses on how memories guided those shaping public policies and will not delve into the equally significant topics of social vulnerability and well-being.

Memory studies intersect with the voluminous literature on the importance of adaptive planning in coastal cities, although it is seldom mentioned (Leichenko and Thomas 2012; Solecki, Leichenko, and O'Brien 2011). A prominent theme in this literature is the potential impacts of major tropical weather events, especially hurricanes, and the steps that can be taken to lessen their devastation (Leichenko and Thomas 2012). Studies have focused on vulnerable shore counties or megacities (Cutter et al. 2007; Uitto 1998). While such settings are important concerns, they have neglected issues that are pertinent to places like the Amite River basin where suburbs of a mid-sized city are sprawling outward across a largely inland location with no actual coastal frontage. It is a location familiar with extreme tropical weather events but does not face direct assault from storm surges. With rising seas, however, coastal effects are creeping inland.

Baton Rouge and other riverfront cities well beyond the littoral will be facing greater and greater exposure to offshore forces. This emerging situation requires a fundamental reorientation of how communities address risk. Additionally, such locations tend to have policies and planning practices anchored in inland concepts, and revamping them to accommodate the slow landward creep of coastal influences likely will move slower than sea-level rise, particularly in coastal Louisiana. Finally, sea-level rise will impede the drainage of inland rivers, particularly those that drain into the Gulf of Mexico across the deltaic plains. Riparian flooding, associated with both tropical weather events and intensifying storms, will be exacerbated inland. Areas that once faced modest risk will confront higher flood stages as the shallow, near-sea-level lakes are subject to wind-driven "tilting" which may block river discharges and cause backwater flooding. Over time, these circumstances will render structural protections and mitigation policies geared solely toward inland riparian risks obsolete. Inland locations with no archived memories of dealing with coastal problems are beginning to face profound challenges due to changing environments in areas developed with little regard for coastal conditions. Inland rivers are connected to maritime environments in many ways, and this is particularly true in the Amite River basin, which is connected directly to the coast—even if that is not apparent to all who live there.

Solecki and colleagues (2011) make the pertinent point that disaster risk reduction and climate change adaptation are seldom aligned. This circumstance is even more pronounced in areas the public does not consider as coastal and therefore not exposed to the types of changes wrought by sea-level rise. The Amite River basin is a dramatic example of this incongruence. Local leaders have been attempting to reduce an inland risk, but increasingly must factor in adapting to climate change.

Amite River Basin and Risk

The Amite River is unimpressive compared to many larger waterways, although it is much appreciated locally. It flows from a portion of the Pleistocene Terrace in Mississippi that stands over 300 feet above sea level, passing through pine forests and dairy pastures. It was once a favorite retreat for sport fishing, tubing, and canoeing; however, commercial operations have heavily altered its hydrology by strip mining citronelle gravel deposits. Off-road vehicles now roar across the sand and gravel bars that choke the river's course. The Amite cuts through the "Grand Canyon" of Louisiana near Fluker's Bluff as it winds across the Florida Parishes headed to its confluence with its principal tributary—the Comite River. Just upstream from this junction, the floodplain widens and becomes more suburban than rural. Much of Baton Rouge and nearby communities, while protected by levees from Mississippi River floods, drain eastward into this basin, and as a consequence face greater flood risk from the Amite. The topographic gradient of the Amite tapers off below the confluence, and the combined flows meander over a low-lying floodplain for the final 55 miles to Lake Maurepas, which is connected to Lake Pontchartrain by a short bayou that winds through cypress swamps. Across the river's lowest section, suburban developments have been most extensive (Figure 1). The lower-most segment of the river is near sea level and is a transition zone between purely riparian conditions and an area that can be directly influenced by sea-level rise and storm-surge induced backwater flooding.

Three parishes (the local version of counties) occupy Louisiana's lower portion of the basin and share higher flood risks. With a site about 200 miles upriver from the mouth of the Mississippi River, Baton Rougeans tend to consider themselves inland inhabitants. A drive to either of the nearest beaches on Grand Isle or Biloxi

takes about two hours, adding to the prevailing notion of isolation from coastal influences. East Baton Rouge (EBR) has the largest population of the three parishes and was home to more than 440,000 people in 2015. As the metropolitan hub, it has been exporting residents to the two suburban parishes since the 1960s. Livingston Parish more than doubled its population between 1980 and 2015 and now has over 133,000 residents. Ascension saw a similar doubling during that span to reach its 2015 population of more than 113,000. To shelter their burgeoning populations, Livingston Parish added nearly 32,000 housing units while Ascension's total climbed more than 26,000 between 1980 and 2015. Excluding Baton Rouge, that amounts to over 58,000 new housing units added from the eve of the 1983 flood until the year before the next calamity. The capital city saw over 56,000 units added, but not all were within reach of Amite River flooding.

Several related factors spurred the suburban surge during the 1970s and early 1980s. The overall urban population increase, tied in part to the growth of state government and the expanding petrochemical complex in the region, attracted residents and put pressure on Baton Rouge's housing stock. Controversy surrounding school desegregation in the 1970s prompted many residents to flee Baton Rouge for predominately white neighboring parishes that had efficient connections to the capital via newly completed

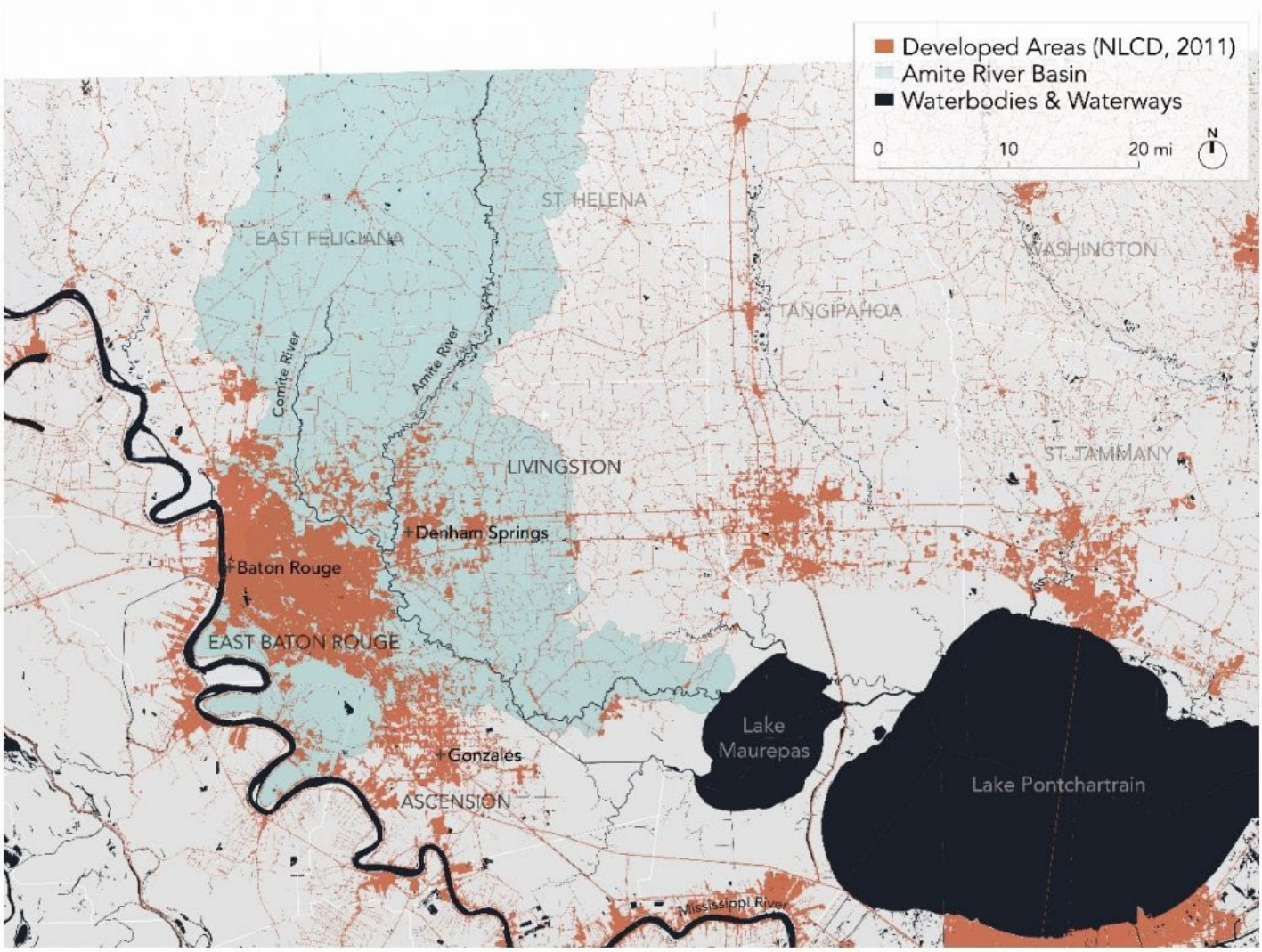


Figure 1. Amite River Basin. Graphics by Tanvi Shah, used with permission.

interstate highways. Additionally, less expensive real estate and lower parish taxes appealed to young families.

Repeat floods stand at the center of any discussion of flood memories and mitigation. When properties suffer damage multiple times, the memories accumulate. In theory, the repository of experience should influence decision making. In the Amite River basin, high-water risks have not deterred development. Nearly half of East Baton Rouge Parish is in the Federal Emergency Management Agency (FEMA) designated 100-year floodplain, yet some 80 percent of the rapidly growing suburban community of Central, at the convergence of the Amite and Comite Rivers, is so designated. Downstream, about 70 percent of Ascension Parish is in the high-risk zone. Livingston Parish has some rural and elevated territory, but also has grown into the flood zone. Some of the worst impacts of both the 1983 and 2016 floods occurred in the parish seat of Denham Springs. The FEMA flood zones are material delineations of flood risk—based on previous hydrologic and meteorological conditions. They represent one form of flood memory, albeit one commonly contested and challenged at the local level for inhibiting potential development. For decades, public officials have noted the tendency for residential growth to intrude on land that was avoided historically as flood prone (East Baton Rouge Parish Planning Commission 1983; Flood Control Project Evaluation Committee 1985; Governor's Interagency Task Force on Flood Protection and Mitigation 1990; Figure 2). Formal demarcation of flood zones has not prevented development nor provided adequate safety for residents.

Figure 2. Catholic church in French Settlement. This structure is in the oldest part of the community that is on higher ground and did not flood. New development has proceed into lower areas of the parish. Image courtesy of the author.

Flooding in the Amite River basin is far from a rare occurrence and should be a vital part of local flood memories. Between 1973 and 2016, the river rose at least a foot above its 29-foot flood stage 34 times (Figure 3). Four times during that span, floods occurred twice within a single calendar year. Prior to 2016, the flood of record was the 1983 event. Over a three-day span in April that year, much of southwest Mississippi and southeast Louisiana experienced 8–12 inches of rainfall, and this precipitation swelled the Amite and Comite to record levels. The Amite crested at just over 41 feet at Denham Springs, while the Comite reached 29.7 at Joor Road (USACE 1983, 3; USGS 1996). The river waters inundated over 357,000 acres, with about 6,800 acres of that area devoted to residential and commercial land uses. Damage estimates for urban properties exceeded $114 million. It was a devastating event for the three main riverside parishes. Yet, a local floodplain manager characterized the event as nothing new, only more costly due to poor follow through on previous flood mitigation plans (Emmer 1986).

Memories of the 1983 Flood in Public Policy

Even before the 1983 tragedy, Louisiana's legislature passed a flood control act (Louisiana State Legislature 1982) calling for "long-term solutions to flood problems and protecting existing developments in flood prone areas without encouraging further development in those areas" (Joint Legislative Committee 1985). While this act recognized prior floods, local governments did little to embed memories of the 1983 flood into policies, such as well-known procedures that include zoning, restricting development in recently inundated areas, and relocation. Efforts in the

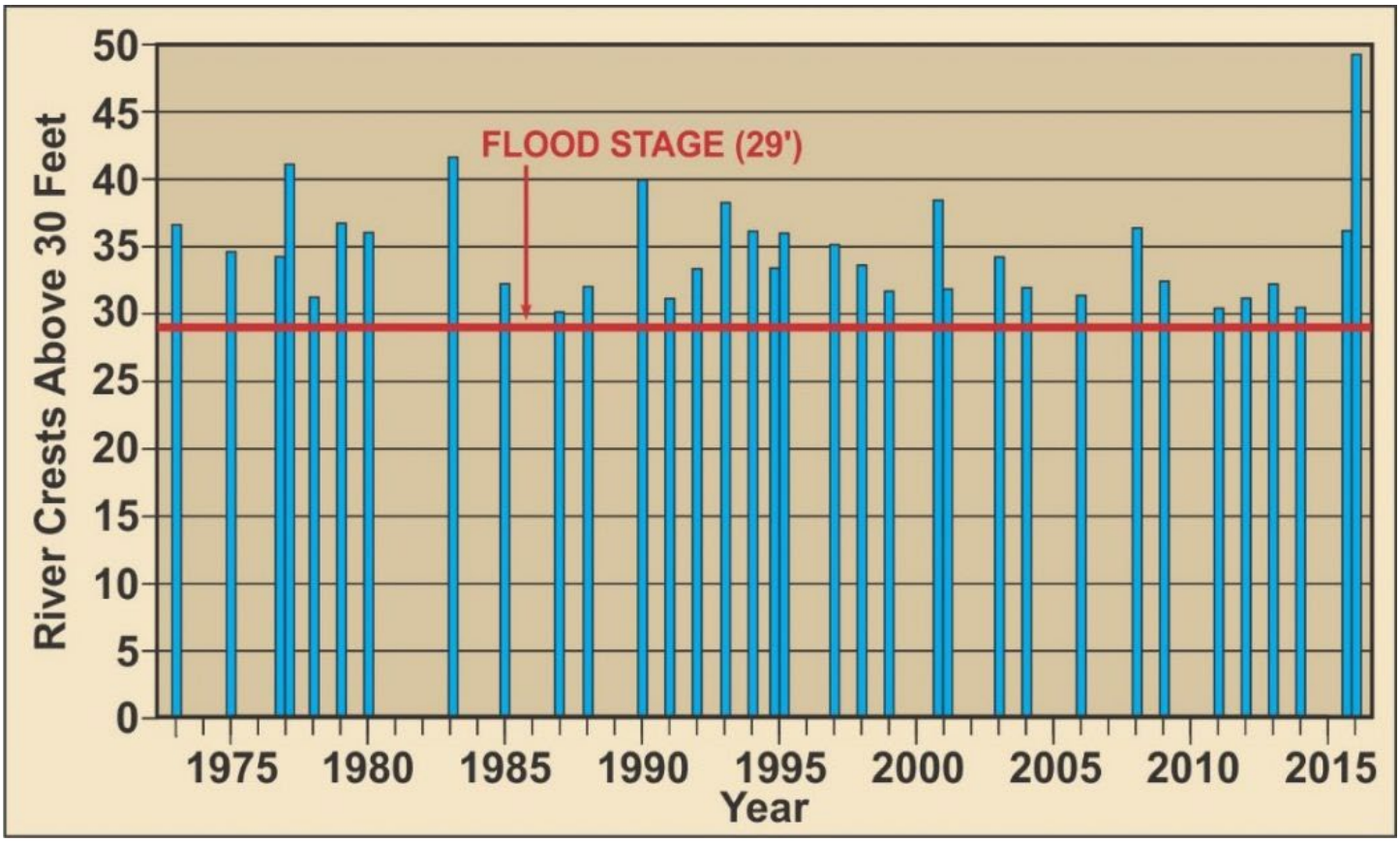


Figure 3. Amite River Stages at least one foot above flood stage at Denham Springs, 1973-2016. Source: U.S. Geological Survey, graphic by Mary Lee Eggers.

post-1983-flood period fell exclusively into risk reduction with no heed to an emerging concern with the land loss crisis at the state level—which was associated with sea-level rise and climate change (CRCL 1989).

All too commonly, locations must endure extreme hazardous events to motivate public action to reduce risk. This was certainly the case after the 1983 flood. A spate of studies, recommendations, and project adoptions provided the appearance of a vigorous response to the record inundation. Despite an initial sense of urgency, mobilizing to assess, design, and fund mitigation and to enact land-use guidelines moved at a very deliberate pace—which was especially true in suburban areas where government was seen as an intrusion on private property rights. Critics of the slow-moving response charged that, "short-sighted planning is unfortunate because the flood victims will pay for the agency's inadequate flood damage reduction planning as well as having to pay for the project" (Emmer 1986, 134). A vocal critic of local planning efforts declared that structural projects with high price tags and limited geographic scope, rather than land-use restrictions, were more politically viable, and that East Baton Rouge Parish officials had "flood amnesia" (Dunne 1987b). In addition, according to the focus group participants of this project, many homeowners in Livingston Parish were younger at the time and willing to take on rebuilding. Thus, their efforts to recover and remain in place tended to eclipse the fear of future inundations. These actions typified what McEwen and colleagues (2017) refer to as active forgetting. In addition, all public policies were directed towards inland, riparian, not coastal threats.

At one of the multiple scales of public policy, the state launched a flood control program to assist localities in funding programs to reduce flood damage (Joint Legislative Committee 1985, I-2). It provided funds for channel modification, stormwater detention, levees, and canals, as well as relocation assistance for impacted residents. The program specifically excluded funding projects that would encourage additional development in flood-prone areas. It offered a commitment to mitigation and even helping families move out of harm's way. Yet, with a cap of $100,000 per construction project, the state effort would have minimal impacts (Louisiana Department of Transportation and Development n.d.). As with the 1982 state legislation, it recognized the need to discourage development in flood-prone areas, but offered little actual deterrence.

One of the most ambitious risk reduction plans after the 1983 flood was a proposal to construct a diversion canal to re-route a portion of the Comite's floodwaters westward into the Mississippi River. Progress on this proposal moved slowly. Frustration with the protracted process emerged as early as 1987, when Governor Edwin Edwards criticized the U. S. Army Corps of Engineers (the Corps) for making little headway on the diversion project and declared the state would take over the flood control efforts (Dunne 1987a). Nonetheless, there was still nothing to show when a 1990 flood briefly rekindled flood memories and the sense of urgency.

That same year the Corps released its environmental impact statement on the diversion. Army engineers estimated that the diversion would lower flood crests by as much as five feet on the lower Amite River and potentially reduce damage in Denham Springs by 80 percent. Moving through its formal protocol, the Corps declared that the Comite River Diversion was the most economically feasible option and would be superior to various nonstructural options or a reservoir. The environmental impact statement pointed out that residential and commercial development would continue even without the diversion. It also declared that the diversion's impacts would be felt most directly on farm and forest land—not urban areas (USACE 1990, 16, 124). These observations acknowledged that land-use restrictions would be unlikely to impede development.

Also in 1990, a task force formed by the governor endorsed the Comite River Diversion as feasible and affordable with a federal 50/50 cost share. The task force considered a host of other options and supported local regulations in line with the National Flood Insurance Program (NFIP) and advocated voluntary relocation as the "method of choice" for reducing flood hazards in high-risk areas—rather than rebuilding on site (Governor's Interagency Task Force on Flood Protection and Mitigation 1990, 13). The options it recommended would place most costs on localities and the federal treasury while allowing cost sharing for the diversion plan. Still in 1990, there was no tangible progress on the structure's actual construction, although proponents of the diversion optimistically predicted that work might begin on the $62 million project as early as 1996 (Baton Rouge Advocate 1990).

A follow-up engineering report offered a less-than-optimistic view of the diversion's benefits. It concluded that its flood-reduction benefits would be most beneficial in the Comite River basin—not the lower Amite. The authors concluded that parish-based projects to improve drainage in East Baton Rouge and Livingston would accelerate drainage into the waterway and exacerbate flooding in the lower basin (Harza Engineering 1995, 2). Given this forecast, the report recommended revisiting a flood retention reservoir option on the Amite.

Progress on the diversion continued to stretch out over the years. In 2000, the Corps completed its design for the Comite River Diversion, and tax-averse local voters demonstrated a persistence of flood memories when they approved a millage to provide matching funds for the structure.

Figure 4. Slab-on-grade house that flooded, Ascension Parish. August 2016. Image courtesy of the author.

Work finally began on the first component in 2003—two decades after the flood that inspired it (ARBDWCD 2015). Yet, only the first isolated component was ever finished, and the incomplete diversion offered no relief to residents who endured the record rainfall and tragic flooding in August 2016.

Meanwhile during the 1990s, the parishes continued independent efforts to reduce riparian flood risk. East Baton Rouge and Livingston focused on drainage, while Ascension pushed ahead with a levee to fend off water coming from upstream and pumps to push the excess flow across the lower basin's low-gradient topography. They also enacted policies in alignment with the NFIP so that residents would be eligible for federal flood insurance, but did not enact policies that went beyond the bare-bones FEMA standards. Despite its flaws, such as paying for flooded homeowners to rebuild in place and allowing local governments to reduce the size of the flood zones through challenges to the flood maps, the NFIP functions as a type of risk reduction (Horn and Brown 2018; Klein and Zellmer 2014). Ascension Parish adopted ordinances and codes in the 1990s to enable its residents to participate in the NFIP and use fill to raise new houses above the base flood elevation (Figures 4 & 5). East Baton Rouge and Livingston parishes made similar policy adjustments (Ascension Parish Focus Group 2018; East Baton Rouge Parish Focus Group 2018; Livingston Parish Focus Group 2018; Moree 2012). Each parish recognized the need to adopt a standard based on the most recent record event and enacted ordinances that required homeowners whose properties suffered substantial damage to rebuild at least a foot above the highest measured flood (Ascension Parish Focus Group 2018; East Baton Rouge Parish Focus Group 2018; Livingston

Figure 5. House constructed on fill, Ascension Parish, August 2016. Image courtesy of the author.

Parish Focus Group 2018). With an eye toward increasing property tax revenues, the policies allowed development and construction, but imposed no effective restrictions on expanding suburbs. As a consequence, property taxes soared between 1980 and 2015. For the two smaller parishes that were aggressively expanding into the floodplain, their assessors saw revenue rise by more than 90 percent.

Since its inception in 1981, the Amite River Basin Commission supported basin-wide approaches and advocated for multi-parish participation. With the release of FEMA's first set of Flood Insurance Rating Maps in the 1980s, flood zones became cartographically visible. FEMA updated those maps in 2005, and with support from the commission, the parishes participated in the federal insurance program—mostly in line with the basic FEMA standards. The basin commission also advocated for ordinances to regulate the use of fill to raise houses above the base flood elevation. This practice allows construction in the 100-year floodplain, but displaces floodwater and risk to other locations. Divergent local priorities limited implementation of mitigation policies. In 2015, only EBR had an ordinance that mandated developers offset fill with flood-retention basins (ARBDWCD 2015, 4-5). Despite its encouragement, the commission had no regulatory authority within the basin and had to rely on the individual parishes to manage risk reduction. The parishes operated within their geopolitical boundaries; consequently, their approaches focused on internal benefits, namely allowing development to continue in the floodplain with minimal mitigation. Due in part to these practices, repetitive flood losses have been a chronic problem in the basin (CHART 2009). As of 2015, 75 percent of the repetitive flood loss claims were filed by individuals with property in the 100-year flood plain (ARBDWCD 2015, 4-6). Despite reminders, homeowners, with the assistance of the NFIP to rebuild on site, continued to live and buy new homes in high-risk areas with little discouragement from local policies. Insurance encouraged active forgetting, as has been the case in other locations (Klein and Zellmer 2014).

After the 2016 Flood

Encouraging Immediate Return

The 2016 flood brought temporary chaos to the Amite River basin. Historic rainfall dumped up to 30 inches on a portion of the basin over the course of five days and the Amite crested over 46 feet at Denham Springs. The most rapid rise of the river occurred overnight on August 14 and caught many people unaware. Some were able to evacuate, but many awoke with water in their homes, only to discover that high water covered evacuation routes. Some 5,000 evacuees sought temporary shelter. The flooding caused more than a dozen fatalities and over $8 billion in damages. FEMA initially tabulated over 135,000 houses damaged, with 50,000 enduring major damage. Some 75 percent of the housing stock in Livingston Parish and about a third in Ascension suffered damage (Colten 2017; Figure 4). In the immediate aftermath, the state requested $4 billion in disaster aid to fund recovery efforts. The scope of this calamity far exceeded the 1983 event, when only 5,400 homes received the major damage classification (USACE 1983). Not only was the flood water higher by five feet, but the number of houses in flood-prone territory was also much larger. This was not a natural disaster, but one shaped by inadequate archiving of flood memories and decisions to develop in the flood zone (O'Keefe, Westgate, and Wisner 1976; Steinberg 2000; White 1945).

One of the first responses was to expunge the new flood as part of the public policies that

incorporated flood memory. At the time of the flood, parish policies stated that homes suffering major damage had to be raised a foot above the record flood as determined by federal agencies. The parish councils in East Baton Rouge and Ascension promptly deleted the 2016 event as the flood of record and retained the 1983 event as the benchmark (Ascension Parish Council 2016; Hardy 2016). They declared the 2016 flood was too extreme to be used as standard for redevelopment, and thus removed a major event from official flood memory and consequently lowered safety standards. Until FEMA updates its maps and incorporates the recent flood events, the flood zones remain fixed and form the basis for flood insurance. The local policy adjustment allowed many residents to avoid the expense of elevating their houses and thereby encouraged their return to areas proven to be susceptible to flooding. These decisions are the most direct evidence of a deliberate attempt to actively "forget" the record flood in the interest of restoring as much of the tax base as quickly as possible. Officials feared a mass exodus that would have triggered plummeting real estate values and sales tax revenues. Such a revenue drop would severely undermine parish infrastructure rebuilding and ongoing support for schools and other parish institutions. To further augment a return to damaged homes, the parishes temporarily waived ordinances that prohibited residing in mobile homes or travel trailers on residential lots, and they waived permit fees tied to rebuilding (Ascension Parish Council 2016b; East Baton Rouge Parish Council 2016; Livingston Parish Council 2016). These temporary policy waivers enabled residents to remain in place as they restored their primary dwellings.

Among the three parishes, flood insurance subscriptions increased between August 2016 and December 2018. The percentage of homeowners purchasing FEMA-backed flood insurance policies increased between 51 and 70 percent. East Baton Rouge saw the percentage increase from 13 to 22 percent, Livingston rose from 23 to 39 percent, and Ascension increased from 24 to 37 percent (Mosbrucker 2019). This points toward flood memory retention, for the time being.

Improving Drainage in the Upper Basin

Another key response to restore residential confidence in local flood control was a concerted effort in EBR and Livingston parishes to unclog drainage ways. Numerous concrete-lined drainage ditches in East Baton Rouge were obstructed with debris at the time of the August downpour and caused flood waters to back up into neighborhoods and houses. Parish drainage systems in Livingston Parish received criticism for similar reasons. The upstream parishes undertook swift action to clean out the canals and ditches that would hasten the flow of future runoff (East Baton Rouge Parish 2018; Grueskin 2019; Jacobsen 2017). Livingston also invested a huge portion of federal disaster funds to clear snags in the Tickfaw River—a waterway in the eastern portion of the parish that is not part of Amite basin (Livingston Parish Council 2017). As it focused on drainage, the parish lost its ability to participate in FEMA's Community Rating System after the federal agency questioned its permitting construction in flood zones (Kennedy 2019). Nonetheless, the parish has worked with FEMA to offer an optional buyout or home elevation program for residents who have endured multiple floods (Fambrough 2018). Additionally, the parish council began discussing fill restrictions in 2019 (Mitchell 2019a). These most recent efforts reflect some enduring recollection of past flooding.

Concern with adequate drainage sparked one of the biggest controversies following the flood. Local officials claimed that solid concrete barriers set atop the middle of the interstate highway crossing Livingston Parish functioned as a dam, impeded the flow of excess river water, and exacerbated flooding upstream from the highway. This resulted in a lawsuit against the state department of transportation (Hardy 2017a).

East Baton Rouge Parish is pushing for rules that will require preserving low-lying wetlands as open space in new subdivisions as flood retention areas (Hardy 2019). Additionally, EBR has launched a major stormwater drainage study. It focuses on drainage—which ultimately seeks to send runoff downstream—and not safe development practices (East Baton Rouge Parish 2018). A recent U. S. Army Corps of Engineers evaluation indicates augmented drainage will not adversely impact lower basin parishes (Mitchell 2019b). The parish's efforts are being aided by federal funding of the Comite River Diversion now projected for completion in 2021 (Stole 2018). That structure will redirect a portion of the upstream flow away from Ascension Parish—a modest nod to inter-parish cooperation. Its report also calls for cooperation among all parishes that rely on the Amite to transport storm runoff (East Baton Rouge Parish 2018). The plan is in the second of three phases; however, until it is completed, it will not guide policy changes. Approval of subdivisions in risky areas continues as the study moves forward.

Downstream Responses

The urge to restore drainage capacity offered hope to upstream residents, but posed a very different situation for downstream Ascension Parish. It is situated on the coastal plain with a nearly invisible gradient, which minimizes stream velocity through the lower course to Lake Maurepas. More water, arriving there faster, increases flood risks. Ascension relies in part on a diversion canal built in the 1950s to accommodate any surges from upstream. The canal bypasses natural meanders and follows a direct path toward the lake. Local observers noted the canal had not been properly maintained and was not operating at its design capacity in 2016 (Hardy 2017b). Ascension also has pump stations to aid in the removal of local floodwaters and a modest levee system to protect some developed areas above the diversion canal. The August 2016 flood overwhelmed these mitigation systems.

Ascension has allowed developers to use fill to raise new developments above the base flood elevation (Figure 5). The focus group pointed out that only subdivisions developed prior to 2007 experienced damage from the flood (Ascension Parish Focus Group 2018). In June 2017, the parish council opted to defer discussion of an ordinance limiting the use of fill (Ascension Parish Council 2017). In 2019, the parish revisited fill restrictions and passed an ordinance that limits development in the 100-year floodplain and requires elevating structures higher than the minimal base flood elevation and using means other than fill. The parish president promptly vetoed the act and called for further study (Mitchell 2019a, 2019d). The parish council eventually approved a compromise that only limits fill as the exclusive means of raising houses in the lowest areas of the parish (Mitchell 2019c). Thus fill remains an option in much of the parish and one that is preferable to developers, but one that displaces floodwaters to other areas. The parish has increased the capacity required for flood retention ponds in new subdivisions (for 25-year storms), but the existing drainage system is not designed to handle that level of storm runoff (Ascension Parish Focus Group 2018). This imperils those subdivisions not adequately raised and creates a mismatch between drainage and retention systems.

Ascension Parish also has hired an engineering firm to design an extension of its levee system to provide additional protection. This action met with opposition and a threatened lawsuit to block it by upstream Livingston Parish. Officials there claimed the levee would back up future floodwaters into their jurisdiction. Such inter-parish conflicts reflect the internal orientation of policymaking, despite calls by the river basin authority to implement a basin-wide plan (Jacobsen 2017). A rapprochement has emerged between Ascension and Livingston that will allow Ascension to proceed with design plans for its levee (Mitchell 2019c).

Absence of Climate Change Adaptation

East Baton Rouge has embarked on an examination of its drainage system in the wake of the 2016 floods and intends to use its findings to guide further policy adjustments. At the request of citizens, the parish has committed to taking climate change into account in its future planning. This is the one explicit example of merging risk reduction and climate change adaptation expressed at the local level (East Baton Rouge Parish 2018).

In 2007 Louisiana produced its first Master Plan for a Sustainable Coast (CPRA 2007). At five-year intervals, it updates this document filled with assessments of sea-level rise and the related land loss. It presents bold plans for coastal restoration and represents a catalog of concerns and responses to changing environmental conditions associated with climate change—even if that terminology is soft-peddled (CPRA 2012, 2017). Plans include marsh restoration, levees, sediment diversions, and rebuilding barrier islands primarily for parishes directly in contact with the coast. The state's planning touches on the lower Amite River basin wetlands which are adjacent to Lake Maurepas, but does not extend further inland (CPRA 2012, 2017). A second state agency has also launched an ambitious campaign to develop adaptive strategies for "future environments" (LA SAFE 2019). Its efforts to date also fail to extend inland. Both programs are remarkable in a state heavily tied to the petrochemical industry with leaders who are reluctant to speak the words "climate change," yet they retain a tight focus on coastal land loss and make no attempt to expand to consider all impacts of climate change.

Memory Eclipsed

A tragedy occurred in the Amite River basin in August 2016—slightly more than three decades after the previous record flood. The calamitous result was not solely the consequence of an abnormal rainstorm, although meteorology and hydrology contributed. As forewarned in 1985, expansion of development into flood-prone areas placed people and property in harm's way. Public policies enabled this expansion and were equally culpable in what was not a natural disaster, but a disaster rooted in human decisions and actions. Fundamental to this was the eclipse of flood memories, or active forgetting, in public policies that enabled aggressive development in risky areas across three parishes.

Participants in the focus groups convened in 2018 were largely unfamiliar with the impacts of the 1983 flood and the steps taken in the intervening years. The shallow depth of flood memory is not unexpected and is not a criticism of relatively young professionals or others who arrived to the region in recent years. Nonetheless, professional capacity is handicapped by the lack of institutional awareness of the previous worst flood tragedy in the area's history and the absence of tools to

perpetuate knowledge of that event and adaptations implemented in its wake.

Following the 2016 tragedy, studies primarily addressed the flood risk as one of drainage, not development, and as an inland riparian problem and not a littoral issue tied up with sea-level rise and climate change. Despite calls for inter-parish cooperation and basin-scale mitigation, local governance remains the geopolitical framework. Within that context, it has taken more than two years for parish governments to begin seriously addressing policies that will influence land use and development. In the meantime, homeowners have increased their reliance on flood insurance—at least for now. The slow movement toward policy adjustment might be a factor in increased flood insurance purchases, but it also presents an opportunity to infuse inland policies with coastal concerns and simultaneously reduce risk for fluvial and littoral hazards. There is still time to actively remember the 2016 flood in local policy.

Perpetuating flood memories is increasingly pertinent in both coastal and near coastal locations around the world. Riparian risk reduction alone offers diminishing protection. Blending climate change adaptation with disaster risk reduction offers one way to ensure a higher degree of safety both along the shore and inland from the coast.

Acknowledgments

Funding for this research came from the National Academies of Science, Engineering, and Medicine and the Robert Wood Johnson Foundation. I am deeply grateful for research assistance provided by Audrey Grismore, Kelly Haggerty, and Ria Mukerji.

References

ARBDWCD (Amite River Basin Drainage and Water Conservation District). 2015. *Floodplain Management Plan*. Baton Rouge: ARBDWCD.

Ascension Parish Council. 2016a. Minutes of Council Meeting, October 6, 2016, Gonzales, Louisiana.

———. 2016b. Minutes of Council Meeting, November 3, 2016, Gonzales, Louisiana.

———. 2017. Minutes of Council Meeting, June 1, 2017, Gonzales, Louisiana.

Ascension Parish Focus Group. 2018. Gonzales, Louisiana, May 16, 2018.

Baton Rouge Advocate. 1990. "Comite Diversion Project Praised at Public Hearing," *Baton Rouge Advocate* 11 July 1990, 3B.

CHART (Center for Hazards Assessment, Response, and Technology). 2009. *Repetitive Loss Areas Analysis, #9: City of Baton Rouge Area, Greenwell Springs Area*. New Orleans: University of New Orleans.

Colten, Craig. 2017. "Floods Collide with Sprawl in Louisiana's Amite River Basin." *Focus on Geography* 60. DOI: 10.21690/foge/2017/60.2f.

Colten, Craig E., and Audrey M. Grismore. 2018. "Can Public Policy Perpetuate the Memory of Disas-

ters?" *RCC Perspectives* 3: 43–52.

CPRA (Coastal Protection and Restoration Authority of Louisiana). 2007. *Integrated Ecosystem Restoration and Hurricane Protection: Louisiana's Comprehensive Master Plan for a Sustainable Coast*. Baton Rouge: CPRA.

———. 2012. *Louisiana's Comprehensive Master Plan for a Sustainable Coast*. Baton Rouge: CPRA.

———. 2017. *Louisiana's Comprehensive Master Plan for a Sustainable Coast*. Baton Rouge: CPRA.

CRCL (Coalition to Restore Coastal Louisiana). 1989. *Coastal Louisiana, Here Today and Gone Tomorrow: A Citizen's Program for Saving the Mississippi River Delta Region to Protect Its Heritage, Economy and Environment*. Baton Rouge: CRCL.

Cutter, Susan, Laurie Johnson, Christina Finch, and Melissa Berry. 2007. "The U.S. Hurricane Coasts: Increasingly Vulnerable." *Environment: Science and Policy for Sustainable Development* 49 (7): 8–21.

Dunne, Mike. 1987a. "Amite Flood Control a Long Way Off." *Baton Rouge Advocate,* March 2, 1987, 1A.

———. 1987b. "EBR has Flood Eggs in Structures Basket." *Baton Rouge Advocate,* April 5, 1987, 12A.

East Baton Rouge Parish. 2018. *Stormwater Master Plan Implementation Framework*. Baton Rouge: HTNB.

East Baton Rouge Parish Council. 2016. Council Meeting Minutes, August 22, 2016, Baton Rouge, Louisiana.

East Baton Rouge Parish Focus Group. 2018. Baton Rouge, Louisiana, May 17, 2018.

East Baton Rouge Parish Planning Commission. 1983. "Preliminary Report to EBR City-Parish Planning Commission." *Land Use Development Study*. Baton Rouge: East Baton Rouge Parish.

Emmer, Rod. 1986. "The Disaster that Doesn't Have to Happen: The Baton Rouge Flood of 2001." *Flood Hazard Management in Government and the Private Sector: Proceedings of the Ninth Annual Conference of the Association of Floodplain Managers, April 29–May 3, 1985*. New Orleans: FMHI Publications, 131–45. http://cidbimena.desastres.hn/docum/crid/Marzo2006/CD2/pdf/eng/doc10039/doc10039.htm.

Fambrough, Kevin. 2018. "FEMA Program Offers Flooded Denham Springs Residents Chance to Elevate, or Sell." *Livingston Parish News,* September 7, 2018. https://www.livingstonparishnews.com/news/fema-program-offers-flooded-denham-springs-residents-chance-to-elevate/article_3aa-21cee-b29e-11e8-ab40-d30ae7c78780.html.

Flood Control Project Evaluation Committee. 1985. *Louisiana Flood Control Program*. Baton Rouge: Louisiana Legislative Committee on Transportation, Highways and Public Works.

Governor's Interagency Task Force on Flood Protection and Mitigation. 1990. *Final Report*. Baton

Rouge: State of Louisiana.

Grueskin, Caroline. 2019. “Massive Drain Cleanup Underway.” *Baton Rouge Advocate,* January 20, 2019, 1B.

Hardy, Steve. 2016. “More than 32K Homes Can Stay on the Ground after Metro Council Exempts Many from Elevation Requirement.” *Baton Rouge Advocate*, September 14, 2016. http://www.theadvocate.com/baton_rouge/news/article_4d8763b2-7a99-11e6-8efd-8bdcd69602e9.html.

———. 2017a. “Lawsuits Target I-12 Median Wall, Embankment in Flooding but Getting State to Pay Is no Sure Bet.” *Baton Rouge Advocate,* August 12, 2017. https://www.theadvocate.com/baton_rouge/news/courts/article_6594e962-7c81-11e7-83f8-2745a703290f.html.

———. 2017b. “Work Moves Forward on Projects to Revitalize Lower Amite River and Maurepas Swamp.” *Baton Rouge Advocate,* October 8, 2017. https://www.theadvocate.com/baton_rouge/news/environment/article_d6c40fc2-ab53-11e7-8bbe-83814a23e2d9.html.

———. 2019. “Proposed Anti-Flooding Rule Headed to Metro Council.” *Baton Rouge Advocate*, February 19, 2019, 1A, 4A.

Harza Engineering. 1995. *Amite River Flood Control Program*. Baton Rouge: Amite River Basin Drainage and Water Conservation District.

Horn, Diane, and Jared Brown. 2018. *Introduction to the National Flood Insurance Program*. Washington, DC: Congressional Research Service 7-5700.

Jacobsen, Bob. 2017. *August 2016 Flood Preliminary Report: Amite River Basin*. Baton Rouge: Amite River Basin Drainage and Water Conservation District.

Joint Legislative Committee (Joint Legislative Committee on Transportation, Highways, and Public Works, Louisiana Legislature). 1985. *Louisiana Statewide Flood Control Program Guidelines and Procedures*. Baton Rouge.

Kennedy, Emma. 2019. “Livingston Council Unanimously Approves One-Foot Freeboard above Base Elevation After FEMA Audit.” *Baton Rouge Advocate*, June 13, 2019. https://www.theadvocate.com/baton_rouge/news/communities/livingston_tangipahoa/article_ee26eac0-8e2a-11e9-ad16-e7891eabbe9a.html.

Klein, Christine A. and Sandra B. Zellmer. 2014. *Mississippi River Tragedies: A Century of Unnatural Disaster*. New York: New York University Press.

LA SAFE (Louisiana’s Strategic Adaptations for Future Environments). 2019. *Our Land and Water: A Regional Approach to Adaptation*. Baton Rouge, LA: Louisiana Office of Community Development Disaster Recovery Unit, April 2019.

Leichenko, Robin. 2011. “Climate Change and Urban Resilience.” *Current Opinion in Environmental Sustainability* 3: 164–168.

Leichenko, Robin M., and Adelle Thomas. 2012. “Coastal Cities and Regions in a Changing Climate:

Economic Impacts, Risks and Vulnerabilities." *Geography Compass* 6 (6): 327–33

Livingston Parish Council. 2016. Council Minutes, Denham Springs, Louisiana, September 9, 2016.

———. 2017. Council Minutes, Denham Springs, Louisiana, July 27, 2017.

Livingston Parish Focus Group. 2018. Denham Springs, Louisiana, June 5, 2018.

Louisiana Department of Transportation. N.d. "State Flood Control Program—Description/Information." *Louisiana Department of Transportation and Development*. http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Public_Works/Flood_Control/Pages/Flood_Control.aspx.

Louisiana State Legislature. 1982. Act 351: An Introduction to the Louisiana Statewide Flood Control Program. LA St. Leg. Reg. Session. Passed November 1982.

McEwen, Lindsey, Joanne Garde-Hansen, Andrew H. O. Jones, and Franz Krause. 2017. "Sustainable Flood Memories, Lay Knowledge, and the Development of Community Resilience to Future Flood Risk." *Transactions of the Institute of British Geographers* 42 (1): 14–28.

Mitchell, David. 2019a. "Ascension Adopts Tougher Building Rules." *Baton Rouge Advocate*, May 19, 2019, 1B, 2B.

———. 2019b. "Corps: EBR Drainage Upgrades Won't Worsen Amite Flooding." *Baton Rouge Advocate,* December 27, 2019, 1A.

———. 2019c. "Livingston, Ascension Sign Levee Deal." *Baton Rouge Advocate,* January 26, 2019, 1A, 5.

———. 2019d. "Since August 2016, Ascension has Struggled to Find Consensus on Growth Restrictions to Avoid Floods." *Baton Rouge Advocate,* June 6, 2019. https://www.theadvocate.com/baton_rouge/news/article_48af5890-87cf-11e9-b9a5-8ffdbdb93d8c.html.

Mosbrucker, Kristen. 2019. "More Residents Buying Flood Insurance." *Baton Rouge Advocate,* July 17, 2019, 1A, 4A.

Moree, Kara. 2012. "History of Floodplain Management in Ascension Parish." PDF file, accessed February 15, 2019. ascensionparish.net/downloads/planning/020612historyfloodplainascension.pdf.

O'Keefe, Phil, Ken Westgate, and Ben Wisner. 1976. "Taking the Naturalness out of Natural Disasters." *Nature* 260: 566-567.

Solecki, William, Robin Leichenko, and Karen O'Brien. 2011. "Climate Change Adaptation Strategies and Disaster Risk Reduction in Cities: Connections, Contentions, and Synergies." *Current Opinion in Environmental Sustainability* 3 (3): 135–141.

Steinberg, Ted. 2000. *Acts of God: The Unnatural History of Natural Disasters in America*. Oxford: Oxford University Press.

Stole, Bryn. 2018. "U.S. Army Corps of Engineers Announces Project Funding, Including $14 Million

for Comite River Diversion Canal." *Baton Rouge Advocate,* June 11, 2018. https://www.theadvocate.com/baton_rouge/news/politics/article_365b3416-6da4-11e8-b1cf-131fcb33db0c.html.

Uitto, Juha. 1998. "The Geography of Disaster Vulnerability in Megacities." *Applied Geography* 18 (1): 7–16.

USACE (U.S. Army Corps of Engineers), New Orleans District. 1983. *April 1983 Floods, Amite River Basin, Final Report*. New Orleans: USACE.

———. 1990. *Final Environmental Impact Statement: Amite River and Tributaries, Louisiana*. New Orleans: USACE.

USGS (United States Geological Survey). 1996. *Flood Tracking Chart: Amite River Basin Louisiana*. Baton Rouge: USGS Open File Report 96–649.

White, Gilbert F. 1945. "Human Adjustment to Floods." *Research Paper 29*. University of Chicago, Department of Geography.

Footnotes

[1] As part of an interdisciplinary team, I conducted three focus groups with officials from the three impacted parishes: Ascension, East Baton Rouge, and Livingston. Local officials with responsibilities in flood management, drainage, public works, planning, and hazard mitigation were invited to attend a gathering to discuss flood memories and policy adjustments since the 1983 flood. I prepared a list of questions, secured university Institutional Review Board (IRB) approval, and carried out the recorded focus groups in May and June 2018. Observations about the focus groups stem from a review of the transcripts which did not identify individual speakers. My observations do not reflect official public policy for the respective parishes.

Recommended Citation

Colten, Craig E. 2020. "Eroding Memories and Erecting Risk on the Amite River." *Open Rivers: Rethinking Water, Place & Community,* no. 16. https://editions.lib.umn.edu/openrivers/article/amite-river/.

DOI: https://doi.org/10.24926/2471190X.6812

About the Author

Craig E. Colten is the Carl O. Sauer Professor of Geography at Louisiana State University. He has been researching and writing about the historical geography of living with risk in Louisiana for the past twenty years. He is the author of *An Unnatural Metropolis: Wresting New Orleans from Nature* and *Southern Waters: The Limits to Abundance*. He currently working on the long-term approach to coastal land loss in the lower Mississippi River delta region.

FEATURE

FLOOD NARRATIVES OF THE LOWER SUBARNAREKHA RIVER CORRIDOR, INDIA

By Debika Banerji

The Indian scenario of an alluvial river is that of miseries and mishap during the monsoon season when the river breaches its banks. The floodplain dwellers suffer and yet they continue to live on, coping with the challenges meted out to them. The flood experience is embedded in the everyday experiences of the villagers. Narratives by the flood-affected people of the river are a valuable form of data for research.[1] Oral histories of people who inhabit the flood-affected parts of a river corridor help in assessing their vulnerability—both physical and psychological. These accounts span the scope of human experience from fear, to terrible tragedy, to even humor. [2] Theories of economic rationality cannot always explain the behavior of the floodplain dweller, who does not always frame his or her action on the basis of rational economic thinking; rather it is shaped by traditions and norms. [3] However, most of the time it is the basis of

Carrying rushes from the river. Image courtesy of the author.

livelihood that causes a family to cling to vulnerable sites. Most of the villagers are dependent on the river for their livelihood and hence would like to stay in the flood-affected regions. The data and research suggest that the public sector needs to play a more active role in rehabilitation of the most vulnerable villages within the corridor, in order to minimize flood damage and promote the environmental restoration of the river corridor. The ecological restoration would minimize the effects of the flood pulse and bring about an ecological harmony in the area. This article analyzes the human reactions of the villagers through examining their testimonials and seeks to establish the importance of such voices in flood mitigation. The testimonials of the villagers living in the corridor region of the Subarnarekha River are an important component of this study, carried out by researchers from Visva-Bharati University.

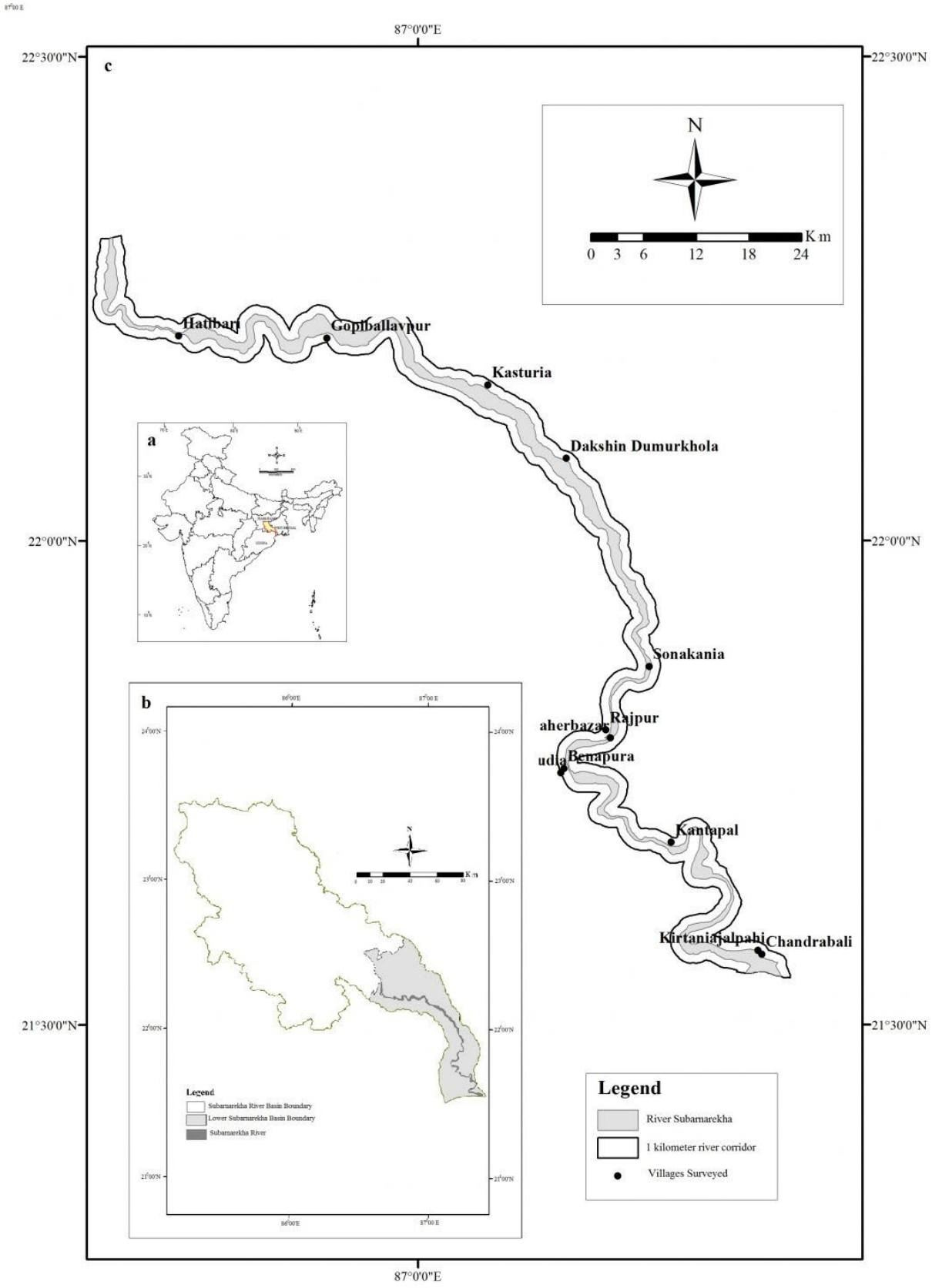
The Study Area

The Subarnarekha River is a part of the Chotanagpur River system, a plateau in the eastern part of India. It generally falls in the tropical monsoon climate region with a marked hot and dry season, a pronounced monsoon season, and a mild winter season. Rainfall received by the river comes during the monsoon, which spans from the month of June to August. The season of the retreating monsoon experiences mild rainfall and sometimes tropical cyclones that occur from September to November. This is a meso-scale river, which covers an area of around 19,300 km^2. The river leaves the Chotanagpur Plateau and enters the plains, meandering its way across the mud flats to meet the mighty Bay of Bengal. [4] The name Subarnarekha means “the thread of gold” and the sands of the river and some of its tributaries are auriferous, but without much prospect of mining and extraction.[5] Small quantities of gold (auriferous traces) are present in the sand. The gold is extracted by the locals by various Indigenous methods.

The Lower Subarnarekha River basin has been delineated on the basis of homogeneous geology and geomorphology. This portion of the river basin has low relief (0 to 20 m), very low slope (0^0 to 2^0), and flows over older and younger alluvium in the plains. The Subarnarekha is flood prone in this area where major floods are rare, but annual occurrences of floods of lesser magnitude are common. The lower river corridor is a one kilometer buffer extending to both sides of the main channel, which is around two kilometers in the lower stretch. The geological history as well as the occupational history of the river makes it an interesting aspect of study.

Narratives as a Way of Assessing Perception

In these geographical regions, floods are common and people have an abundance of stories that share their experiences with floods. Flooding vulnerability can broadly be divided into two types: the real physical vulnerability from the flood incidents and the psychological trauma that is felt during the incident. The physical condition does determine the perception about the river as well as floods. Flood narratives of the villagers are a way of assessing their psychology and trauma during flood incidents. It is the aim of this study to assess how the vulnerabilities are felt and to use this database as a way of dealing with flood conditions in the area. The Indian flooding scenario comprises tales of physical vulnerability that are lost among the mundane reports or data on floods. The real horror that makes the villagers feel endangered can only be understood through their narratives. These stories can form the basis of identifying the vulnerable groups and hence identifying their plights.



Map showing the Subarnarekha River and the villages surveyed between Chandrabali and Hatibari. Map courtesy of the author.

Methods of Surveying

The study involved visiting villages within the river corridor (around a one km buffer zone) at selected sites. All these villages are located in the lower part of the basin where the river dissipates onto the floodplain after leaving the plateau (which is within the alluvial zone of the river). The sites fall in the same homogeneous geologic unit. However, a micro-analytical study reveals variations in morphological aspects across this unit. The flood pattern is different; the intensity increases as there is a change in channel morphology downstream.

A structured questionnaire survey was conducted by the research group (researchers from Visva-Bharati University, who helped with the collection of the data), questioning people from different walks of life who lived very close to the river or had some kind of economic link with the river.[6] The data collection took place between the post-monsoon months of December 2015 to March 2016 and in December 2017 (in three phases). The interviews were transcribed and the narratives grouped under certain themes for a better analysis of meaning from their response. The objective of the study was to understand the general psychology of the people that made them stay so close to the river. This included finding out how vulnerable they felt, their memories of the experiences they had during floods, their attitude towards their environment, and their views about the aid received during these flood events.[7] Using survey methods to attain this information, however, has certain disadvantages. It is not easy to communicate across barriers, and the village folk are reluctant sometimes to express their views. It is also difficult to extract all the information that is required for a thorough understanding. People are reluctant to speak as they feel that they would not achieve any material benefit from such interviews. Some are uninformed and have biased opinions that reflect their varied perceptions on the flooding situation. Sometimes it becomes difficult to express the gravity of a situation by just narrating incidents. But nonetheless, such an attempt was made to give more value to the voices that are usually ignored and to try to paint a more realistic picture of the situation. These narratives help establish how perceptions are created. The knowledge from these views can be used as a basis of a more comprehensive understanding of the flood conditions and can help in the formation of a more people-oriented mitigation program.

These oral histories were codified according to some themes on which the questionnaire was composed as well as the objectives of the study.[8] The following paragraphs deal with the themes that emerged after gathering information on the various perspectives.

Proximity to the River: Living within the River Corridor

The location of the village determined the responses of the villagers. Their psychology and flood vulnerability was molded by questions of "How safe do we feel?" during floods. All the villages surveyed are within one kilometer of the main channel that has been delineated as the buffer zone and considered most vulnerable to flooding in the lower course of the river.

The villagers are mostly poor, with agriculture and fishing being their primary occupation. They are dependent on the river for their livelihood and this ranges from agriculture and fishing to bathing and even sand extraction. "Everything we get from the river, we use: to build houses, to make food, to take a bath. The river is important," explains Tapas Bauri, a fisherman.

Sand extraction by unscientific means is a common problem in some places. The sand is illegally mined, causing degradation in the river's health and the environment of the riparian zone of the river. Some portions of the river such as Sonakania have been degraded as extensive sand is being excavated from the bars and bed of the river. As a resident of Sonakania village recounts:

> There is extensive sand excavation leading to massive floods and a degradation of the environment. It is an illegal activity and we have been unsuccessful to stop it. Last year a child died as he fell into an excavation pit when he and his friends had come to immerse idols (in the river) after a religious festival. I have tried to protest but to no avail. The sand miners are back after a few days of being evacuated by the police.[9]

The people living within a few meters of the river have this constant threat of floods, and such unscientific means of sand extraction increases this threat. Every year there are minor floods which affect the villages closer to the channel more than some of the other villages that lie farther away from the main channel. Some parts of the river are more vulnerable than the others due to active bank erosion during the floods, and here the flood narratives range from helplessness to harrowing tales as seen in Dakshin Dumurkhola village. A villager recounts:

> Every year the floods come. They wash away our houses. Can you see where the river is now? Our village was located right over there a few years back. Each year we are pushed back bit by bit (as the river encroaches) and we lose everything and start from the beginning. The wall of water every year (during the monsoon floods) is our biggest fear.[10]

Sand excavation near Sonakania Village. Image courtesy of the author.

The effects of the annual floods are less disastrous in villages having stone embankments. These embankments have arrested the bank erosion and prevent the flood waters from entering the villages (stone embankments are more common in Odisha). As recounted by a villager in Rajpur, "flood is not so frequent in our village, so we do not fear floods." Flood losses are minimal in Rajpur in contrast to Saherbazar, which lies on the opposite bank. Thus, location of the village plays a major role in understanding the flood effects on the lives of the people.

The flooding regime, on the other hand, determines the land use practiced along the banks of the river. The land-use and land-cover changes in some of the regions have followed the patterns of flooding. According to eyewitnesses' accounts, a major flood in Gopiballavpur Village in 1978 destroyed a cashew (*Anacardium occidentale*) plantation when a mid-channel bar was submerged by the flood waters. In Kasturia village the villagers have changed their cropping pattern to accommodate the flood occurrences every year. A governmental project to build a resort on a mid-channel bar near Kasturia was being undertaken in 2016, which showed a lack of concern for the floods that occurred there. In contrast to the government agenda, the recent 2008 floods have left a major impact on the memories of the people, where a shift in the main channel has directly influenced the land cover of many parts of the river corridor.

A house submerged in the flood waters near Rajgat in 2008. Image courtesy of the author.

The 2008 Flood: Memories from a Major Flood

A major flooding event in 2008 is fresh in the memories of most of the villagers, and they describe this flood with a lot of emphasis and detail. Though eight years had passed, the event seems to have etched a place in the minds of most of the people. Even those who cannot recollect or are too shy to speak, when probed, nod their heads in assent, gesticulating about the water level during the flood. Some respond with emotions about the problems they had to face during the floods as their houses were washed away and they sought shelter in school buildings and on highways. The flood waters did not recede for four days, as recounted by most of the eye witnesses.[11] A resident of Sonakania village says that the degradation of the river has led to an increase in the flood frequency as the natural flow of the channel was arrested and destroyed and the character of the channel has changed.[12] The 2008 flood proved their fears. In parts of the corridor where the flood lessons were learned, some people instead of moving away from the corridor are opting to build brick and cement houses. The Indira Awas Yojana Plan (a rural development plan for providing houses for the poor) is being implemented in some of the villages. The villagers feel safer living in brick houses as they know that the structures would survive even when the flood waters submerge them. Testimonials of the 2008 horrors are preserved in the actual form of two submerged houses near Rajghat. A villager recounts how the water levels rose in the secondary channel in 2008 (the secondary channel gets disconnected from the main channel during seasons of low water), submerging the two brick buildings on both sides of the road.[13] These belonged to two brothers who fled the area after the incident. The houses were used as shops (as well as for residential purposes) and a lot of their goods were destroyed by the flood waters. The 2008 floods formed a benchmark for understanding and recollecting the events associated with the yearly flooding phenomena in this region which has been vividly etched in the memories of the villagers. The government needs to learn from these stories when acting on mitigation measures in order to understand the magnitude of the destruction caused by the floods.

Interaction among the Actors and Adaptation to Flood Situations

The Subarnarekha River is essentially not a very dynamic one: it is predictable and the people who live so close to her have learned to read into her ways and moods (gathered from the narrations of the villagers). The villages that are at close proximity suffer the direct brunt of the floods. In Dakshin Dumurkhola Village they have learned the lessons the hard way. Every year the flood waters reclaim more and more land. So the villagers found an indigenous means (locally devised way from locally derived materials) to combat this problem. A villager explains:

> We make a temporary boundary wall with bamboo and mud. We use a plastic sheet as a layer to protect the wall from getting washed off. This wall acts as a break to the first waves of flood water that enters the village. Thus the damage is partially reduced and we get the chance to move and seek shelter.[14]

Living with the vagaries of nature is part of the lives of the villagers living in Dakshin Dumurkhola. Some harbor mixed feelings and blame their luck for their miseries. In addition, the government is blamed for inadequate measures to combat floods, be it their lack of concern to build and maintain embankments, lack of proper flood shelters, or inadequate warning systems for a speedy relocation. Most of

the villagers even feel that the compensation is inadequate and they debate about the nature of relief that is provided.

Interactions and perceptions vary not just between the villagers in the same area but between the different states. The Subarnarekha River flows mainly in the states of Jharkhand, West Bengal, and Odisha. The concern here was the perception of different treatment among the states of Odisha and West Bengal through which the lower Subarnarekha River flows. There were varied responses. Some people seemed happy, but some perceived that the people living in the other state were better off in terms of flood mitigation received. However, it is of a great importance to analyze the relationships that exist between the villagers and the government.

Strategies and Tactics: Dealing with Flood Emergencies in the Public Sector

> Jumla Seikh of Saherbazar: You are from the government? You are surveying? They come and survey and not do much... [Irritation] Come here when there are floods, then you would see for yourself how we live![15]
>
> Padmamoni of Sonakania: I tell the *Boro Babus* (officials) when they come to do something. They just survey and leave the place. They hardly look after the station [gauge] in front of my house. Can you please tell the *Boro Babus* about how we are living? Please help us! [16]

A temporary embankment near Dakshin Damurkhola. Image courtesy of the author.

The government plays some role in the flood mitigation plans including building embankments along the flood-affected banks, providing compensation after the floods in the form of food and some money, and converting the temporary houses into permanent structures. However, a lot more could be done according to the villagers. There is a general air of neglect and unconcern about implementing a proper plan for the flood aid that needs to be given.[17] The dissatisfaction among the villagers is clear from the above statements. It seemed that the word "survey" rings a bell to them, but this gives them a negative feeling about the surveyors. There are surveys that result in many plans implemented for quick relief during the floods. Primarily, food packets are supplied to the people after a flood and in some places some compensation of three thousand to four thousand rupees (55.62 USD) is paid per family to repair the washed away or broken houses (cost of repairs are more than 1 lakh rupees or 1390 USD). A villager of Rajhati village (near Rajghat) speaks against the present state government which issues rations (subsidized food provision) on the basis of number of rooms per house rather than income or damage during the floods.[18] By this policy, a poor man with a mud house having more than four rooms in his house would not receive any government help during the emergency. There is a general feeling of neglect and selective mitigation meted out to the people.

One villager explains that "the help is inadequate. We suffer every year during the monsoons when we suffer heavy damage."[19]

Fishermen weaving and repairing nets. Image courtesy of the author.

The ignorance of the bureaucrats about the actual situations that prevail is well reflected by the testimonials. They need to concern themselves not only with the flooding phenomena, but also need to address the ecological losses that are inflicted upon the corridor. This loss has a close relationship with the flooding phenomena and can be historically justified from the accounts that have been cited.

Living within the River Corridor: Choices of the People

When given the choice to live close to the river or to move far away, there was a division of opinions. But even then, most of the villagers would like to stay despite the flooding problems in their area. People had learned to adjust themselves to the river's moods, and their lives had become so entangled with this environment that they could not imagine leaving.[20] To the village folks, the question seemed incredible; they had not seen much beyond their world that revolved around their homes. As Ramesh Khamri of Gopiballavpur Village narrates, "the river is important as we use its rock, sand, and soil for our livelihood. It is ingrained in our very system of living."[21] Sand extraction adds an extra source of income and even the eroded pebbles sifted out of the rivers are used in their houses for construction purposes. Some people who are fishermen are directly

Shrimp fished out of the river. Image courtesy of the author.

dependent on the river for their livelihood. As recounted by Tapas Bauri of Kasturia village:

> We use the river for fishing, irrigation, and bathing purposes. It is impossible for us to think of moving away. Where would we go, leaving behind our ancestral homestays, the only bit of land we have? We are landless people and we earn very little working in other people's land. The river is very important to us.[22]

By contrast, the badly affected villagers of Dakshin Dumurkhola would gladly move away if given an opportunity. These villagers lead a miserable life during the monsoons, losing their land every year to the floods, being pushed into abject poverty and misery. The less river-dependent villagers, such as those living in Saherbazar village near Jaleswar, would not mind moving somewhere else if they were given a choice. These people work in Jaleswar town for their livelihood and are not farmers or fishermen. The river gives

Residents of the flood-affected village of Dakshin Dumurkhola. Image courtesy of the author.

them little economic gain. They continue living in the ancestral houses of their forefathers, but given a choice, many would be happy to move away, as recounted by Khudinisi, a widow living in Saherbazar:

> I have been facing problems of flooding but I am still staying in this place because I have no other place to go. If given an option I will move away. The river is just used [by us] for washing clothes and bathing. [23]

The flood mitigation policies of the government are not effective, as the problem is looked at in a compartmentalized way and not a holistic one. The real long-term challenges are not addressed, as relocation is not considered as an option by the government. Hard structural engineering provides temporary relief to the people.

What the Future May Hold for the Voices: Hope?

The testimonials recorded in this research act as voices of these villagers, individual views that get lost in the masses and give a new meaning to look into the past.[24] The whole idea of talking to the grass-root level people helped the researchers to gain knowledge that was sometimes unexpected and shocking. The plight of the people inhabiting the lower Subarnarekha River basin became clear as the interviews helped in getting a better understanding of the situation at hand. The real picture of helplessness during the floods became clearer as people narrated their fear and anxiety, and this could be more easily related to the landscape and the natural processes that were taking place.[25] Site determined their decision to stay or move away from the river, because even if they felt vulnerable, many people are willing to stay as little option is offered to them. A general dependency on the river for earning a livelihood was pronounced. But it was seen that the locals were more than willing to move away if given alternative options of livelihood that would clearly decrease their dependency. It was also seen that the vulnerability attached to the flood incident increased with the bank erosion conditions along the river. The villages that were situated on the eroding part of the river bank felt most vulnerable from flood situations. So the psychological trauma is directly related to the physical conditions that are seen in the area. The threat that the river poses on the villages like Dakshin Dumurkhola, the human-induced degradation of the river due to sand excavation in Sonakania and Gopiballavpur, and the submerged houses near Rajghat inspire villagers' own tales to recount the fear, loss, and helplessness during the floods. It is these voices that get lost in pages of governmental reports or flood data. Yet the narratives can form an important database for understanding more about mitigation programs that need to be implemented.

Footnotes

[1] Andrew Holmes and Margaret Pilkington, "Storytelling, Floods, Wildflowers and Washlands: Oral History in the River Ouse Project," *Oral History Society* 39, no. 2 (2011): 83–94. doi: www.jstor.org/stable/41332167.

[2] Stephen Sloan, "Oral History and Hurricane Katrina: Reflections on Shouts and Silences," *The Oral History Review* 35, no. 2 (2008): 176–186. doi: www.jstor.org/stable/20628031.

[3] Katherine Donovan, "Doing Social Volcanology: Exploring Volcanic Culture in Indonesia," *Area* 42, no. 1 (2010): 117–126. doi: 10.1111/j.1475-4762.2009.00899.x.

[4] L.S.S. O'Malley, "Chapter 1—Physical Aspects," in *Bengal District Gazetteers, Balasore*, ed. L.S.S. O'Malley (West Bengal, Calcutta: The Bengal Secretariat Book Depot, 1907), 8.

[5] N. Kumar, "Chapter 1—General," in *Ranchi District Gazetteer*, ed. N. Kumar (Bihar, Patna: Superintendent Secretariat Press, 1970), 7.

[6] Joy Preston, "Collected Personal Accounts of the Lewes Floods of October 2000," *Oral History Society* 30, 2 (2002): 79–84. doi: http://www.jstor.org/stable/40179685.

[7] Hellen Nyakundi, Stephen Mogere, Isaac Mwanzo, and Andre Yitambe, "Community Perceptions and Response to Flood Risks in Nyando District, Western Kenya," *Journal of Disaster Risk Studies* 3, 1 (2010): 346–366. doi: 10.4102/jamba.v3i1.35.

[8] Meghan Cope, "Coding Transcript and Diaries," in *Key Methods in Geography,* eds. Nicolas Clifford, Shaun French, and Gill Valentine (London: Sage Publications, 2010), 440–452.

[9] Interview with Padmamani Devi, homemaker, interviewed by author 5 February, 2016.

[10] Interview of a resident of Dakshin Damurkhola village (name not disclosed), 6 February, 2016.

[11] Interview with Harimohan, farmer, interviewed by author 11 March, 2016.

[12] Interview with Padmamani Devi, homemaker, interviewed by author 5 February, 2016.

[13] Interview with Bholamalia, farmer, interviewed by author 11 March, 2016.

[14] Interview with Munna Bauri, farmer, interviewed by author 6 February, 2016.

[15] Interview with Jumla Seikh, businessman, interviewed by author 4 February, 2016.

[16] Interview with Padmamani Devi, homemaker, interviewed by author 5 February, 2016.

[17] Frank Messner and Volker Meyer, "Flood Damage, Vulnerability and Risk Perception—Challenges for Flood Damage Research," *UFZ Discussion Papers* (2005): 1–24. https://www.ufz.de/export/data/2/26222_Disk_Papiere_2005_13.pdf.

[18] Interview with Bholamalia, farmer, interviewed by author 11 March, 2016.

[19] Interview with a farmer (name not disclosed), interviewed by author 10 March, 2016.

[20] Tadahiro Motoyoshi, "Public Perception of Flood Risk and Community-based Disaster Preparedness," in *A Better Integrated Management of Disaster Risks: Toward Resilient Society to Emerging Disaster Risks in Mega-cities*, eds. S. Ikeda, T. Fukuzono, and T. Sato (Tokyo: Terrapub and Neid, 2006), 121–134.

[21] Interview with Ramesh Khamri, agricultural labourer, interviewed by author 25 December, 2015.

[22] Interview with Tapas Bauri, fisherman, interviewed by author 26 December, 2015.

[23] Interview with Khudnisi, daily labourer, interviewed by author 4 February, 2016.

[24] Linda Shopes, "What is Oral History?" in *The Making Sense of Evidence on History Matters: The U.S. Survey on the Web*. http://historymatters.gmu.edu/mse/oral/oral.pdf.

[25] Michael Siegrist and Heinz Gutscher, "Flooding Risks: A Comparison of Lay People's Perceptions and Expert's Assessments in Switzerland," *Risk Analysis* 26, no. 4 (2006): 971–979. doi: 10.1111/j.1539-6924.2006.00792.x.

Recommended Citation

Banerji, Debika. 2020. "Flood Narratives of the Lower Subarnarekha River Corridor, India." *Open Rivers: Rethinking Water, Place & Community,* no. 16. https://editions.lib.umn.edu/openrivers/article/flood-narratives/.

DOI: https://doi.org/10.24926/2471190X.6886

About the Author

Debika Banerji is a researcher and a lecturer in geography. She did her M.Phil. from Jawaharlal Nehru University and has recently completed her doctoral degree from Visva-Bharati, Santiniketan focussing on riverscapes. She is interested in cultural landscapes and can be seen prowling around Kolkata in order to capture its essence. She has published a number of articles and book chapters on fluvial landscapes as well as on Kolkata's cultural identities identifying them through various cultural signatures.

FEATURE

THE GIFT OF WATER

By Leslie A. Johnson

India today faces a wide variety of issues related to water management. These include flooding during the several-month monsoon season, a lack of water during the dry season, depletion of groundwater stores, and unreliable water pipelines bringing water into cities (Kumar, Kar, and Jain 2011; Sagar, Rajeevan, and Rao 2017; Shah et al. 2003; Verulkar et al. 2010). Yet while India may be a well-cited example of a place struggling to create new forms of water infrastructure, it is hardly alone in the task. Over the past several decades, there has been an increasing awareness globally of the need to manage our water resources in ways that better conserve, reuse, and protect our water supplies (O'Hogain and McCarton 2018, vi). In the world of design and planning,

Children swinging on the pond's banyan tree. Image courtesy of the author.

this acknowledgment has led to growing support for a shift away from grey infrastructure to green infrastructure; that is, rather than projects relying on pipes, pumps, ditches, and detention ponds, solutions are derived from nature. The necessity behind this shift is evident when discussing issues related to climate change, growing populations, and water quality (Dong, Guo, and Zeng 2017, 281); but, often, issues identified still tend to focus largely on technical aspects of a water system, or utilitarian needs that must be addressed. A changed social relationship between people and their water systems has been less studied. The intention of this article is not to promote any particular physical infrastructure, but rather, to highlight that when designing water management systems, we must consider the sociocultural factors that surround them. That is a shift away from our current practices regarding water management, where a host of infrastructural, legal, and societal barriers create a removed relationship between people and their water systems. Looking to Indian traditional water management offers a refreshing contrast, where water is clearly valued, as their accompanying social and cultural practices imply.

Travels in Dhamori, India

In December 2017, I traveled to Dhamori, a rural village in central India, with Professor Alpa Nawre, a landscape architect and assistant professor of landscape architecture at the University of Florida. With support from the Landscape Architecture Foundation and the Indian Parliament, she led a group including two landscape architecture students (myself included), an engineer, and an architect to Dhamori to address issues of water management. We spent several weeks carrying out research, assisting with workshops to engage the local community, and meeting with village leaders and regional stakeholders. Through these efforts, we created a

View of Dhamori and the village pond. Image courtesy of the author.

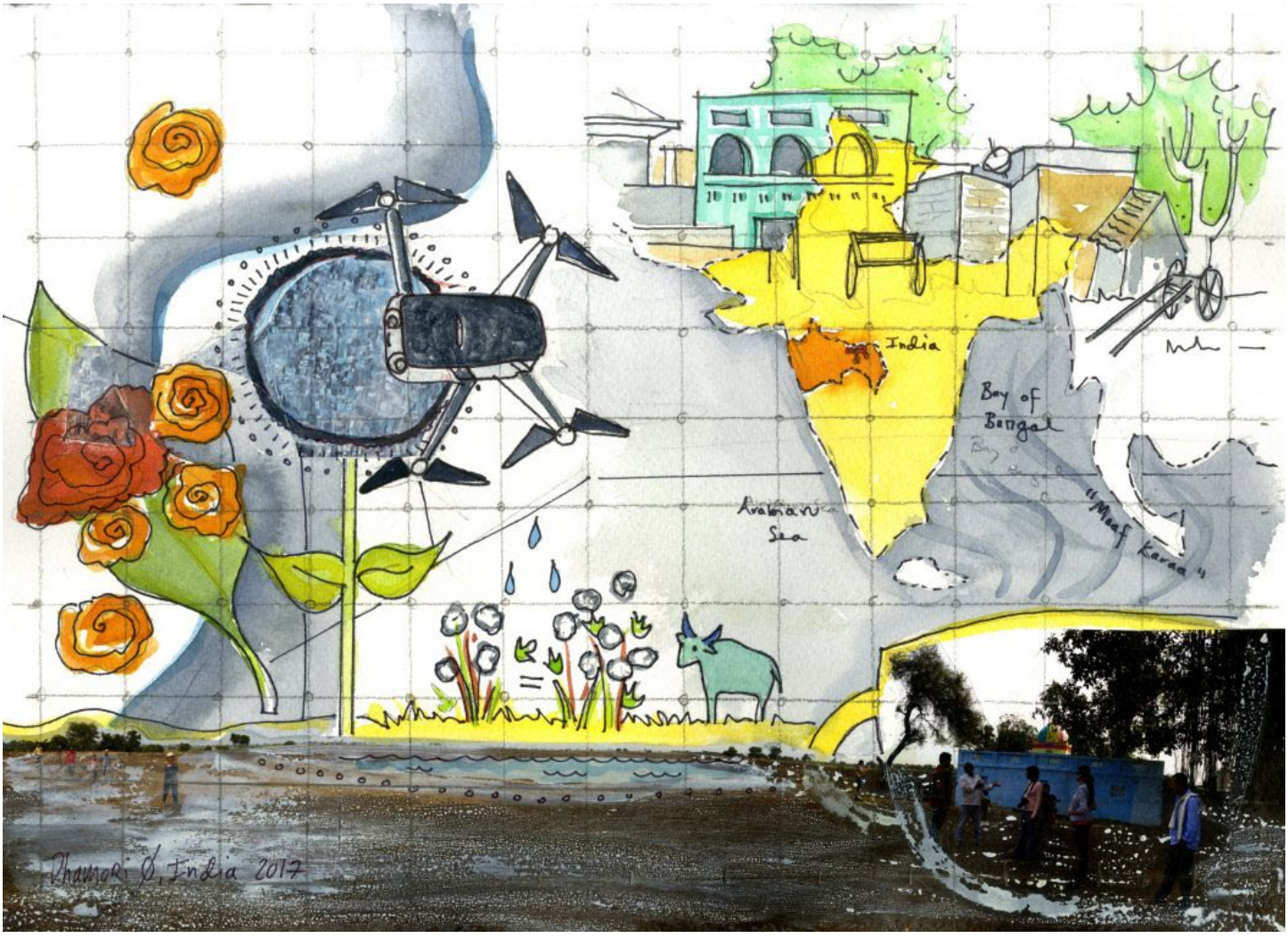
village development plan, which we presented to the village, and we constructed a playground with the assistance of local donors. The final product was a report submitted to the Parliament's existing village development initiative, the Sansad Adarsh Gram Yojna (The Member of Parliament's Model Village Scheme or "SAGY"). To learn more about the Dhamori Village Masterplan, visit https://www.criticalplaces.org/works/dhamori-village-masterplan.

Part of the development plan drew from traditional water management strategies. While a water tower in the village provides villagers with drinking water, there is a lack of water for irrigation, and our plan recommended additional catchment ponds and wells to supplement their farming needs (Nawre 2017). These farm ponds are a long-standing form of traditional water management and have purposes beyond the single function of holding water. A large, existing pond in the village is one of the primary gathering places for the community and where many of the village's important cultural festivals take place. This versatility, serving both utilitarian and sociocultural needs, is a common feature among Indian traditional water management systems. As we carried out this project in Dhamori, it became clear that the sociocultural aspects of Indian traditional water management systems represent a dimension of water management that is not commonly discussed today. Indian traditional water management systems, and how their communities historically interacted with them, have the capacity to provide valuable insights as we explore new forms of water management and seek to improve our relationships to our water systems.

Presentation of development plan to Dhamori residents. Image courtesy of the author.

Defining Indian Traditional Water Management

Indian traditional water management can generally be defined as the structures that Indian communities built to catch, hold, and store rainwater prior to the British colonization of India in the mid-eighteenth century. Examples include *bandhas*, which are stone check dams that stretch across streams in the Thar Desert to divert monsoon rainfalls and deposit silt onto their farm fields. In the cities of Bikaner and Dwarka, most houses, temples, even some commercial properties use *tankas*, small underground tanks, to collect and store drinking water. *Tankas* consist of small holes in the ground and are often lined with beautiful tile work that also keeps the water cool. *Baolis* or *bavadis* are stepwells, which are stairs that allow access to a water body even as the water levels change. Stepwells, such as the Chand Baori in Rajasthan, are ornately carved and decorated stone structures, and in addition to holding water, are places for "cool, quiet retreats during the hot summers" (Dande et al. 2016, 17–18). The particular physical form of traditional Indian water management varies throughout India, as each of these methods is suited to peculiarities of a certain area. Some areas may use constructed ponds, while other areas build small dams, canals, wells, and trenches. People may use the



Dhamori mapping graphic. Image courtesy of the author.

water gathered from these systems for drinking, irrigation, livestock, cooking, hygiene, and other household chores. While their forms and water uses may differ, however, they have shared qualities. These techniques are locally derived solutions suited to particular environments that developed from people's deep knowledge of their land and their resources. These techniques are appropriate to the given climate, topography, and precipitation patterns. Their systems are usually dependent on only local materials, are typically low cost, and of low environmental impact. They are typically decentralized, meaning they are usually local catchment systems maintained by an adjacent community as a community resource, rather than being conveyed a long distance to serve a distant population.

Most strikingly, these traditional water management systems are not solely utilitarian. Rather, there are a host of social and cultural values that accompany them, an aspect of water management not typically discussed in the United States. In fact, as these ancient practices were developed, "Water came to be regarded as precious and its conservation and preservation was sanctified by religion" (Dande et al. 2016, 16). Water bodies in Indian communities traditionally were significant social gathering places where people carried out important cultural rituals (Mishra 1993, 42; Nawre 2013, 140; Singh 2004, 4). For instance, the villagers of Mithila still gather by their *dulha taal*, the community pond, to select bridegrooms and honor Sita, the wife of Rama (an avatar of the god Vishnu) (Mishra 1993, 56). In Chhattisgarh, devotees of Rama "were the great specialists in the art of pond-building. The earth work was that of divine nature for them." Families engaged in this occupation "did not cremate their dead. They preferred burial because for them nothing was more valued than earth" (Mishra 1993, 30). Traditional stepwells had varying functions depending on their location. While some stepwells only served as a means of irrigation, stepwells built in the village, on its edge, or along a trade route were often community gathering and resting spaces. There are places in India that still use many of these water management systems, although not to the scale that they were used prior to British colonization.

See aerial video of Dhamori, India.

The decline in Indian traditional water infrastructure is due to many reasons, but largely that its use was devalued and replaced with grey infrastructure systems, which were lauded in the nineteenth and twentieth centuries. These include hundreds of large-scale dams that have been constructed in India over the last seventy years, with the intention of providing irrigation for food security, for generating power, and for drinking water. Yet these massive development projects, such as Bhakra-Nangal Dam and Sardar Sarovar Dam, have also been highly criticized for displacing communities and degrading the environment (Cullet and Gupta 2009, 167–168).

Prior to colonization, crops grown in India were often for sustenance; however, during the period of British colonization, India began to grow more cash crops, requiring more groundwater outputs and exceeding existing local catchment capacities (Gadgil and Guha 1993, 116). There was also a shift in perception of water ownership from being a shared community resource to being a private one (Cullet and Gupta 2009, 161). After India's independence in 1947, the Indian government continued to follow practices similar to the prior government (Cullet and Gupta 2009, 162). In the 1950s, it became increasingly common to build grey infrastructure water systems that transported water resources over far distances, rather than further investment in additional local water catchments (Nawre 2013, 140). These are sometimes known as river-linking projects, the rationale being that some areas of India have surplus water supplies, while other areas have shortages, therefore linking rivers through canals will help distribute water more evenly and protect against flooding. Criticism of these projects parallel social and environmental controversies surrounding big

dams. Interlinking projects are "hugely expensive and not cost effective, will lead to suboptimal use of water resources," and "changed structures of channels may lead to increasing the salt gradient, water loss, seepage and saline pollution of soil in the transporting section" (Cullet and Gupta 2009, 171–172). In his 2009 TEDIndia talk, the prominent twentieth-century water conservationist Anupam Mishra recalls when these canals were constructed. "We had full-page advertisements some thirty or twenty-five years ago when these canals came. They said, 'Throw away your traditional systems, these new cement tanks will supply you piped water.' It's the dream, and it became a dream also." Shortly after construction, many of the canals became filled with sand or were overtaken by water hyacinth. "Soon the water was not able to reach these areas, and people started renovating their own structures" (Mishra 2009).

Today, there is a growing awareness of the value these localized catchment systems bring to communities, particularly for environmental reasons such as groundwater recharge and having backup systems when larger-scale systems fail. As India and the rest of the world explore new methods to support the needs of their communities and environments, Indian traditional water management provides an interesting counter to how many contemporary water systems operate and are maintained. The technical knowledge these contemporary systems provide is of vital importance, but also worthy of study is the strong social and cultural relationship between pre-colonial Indian communities and their water systems. This sociocultural aspect of water management is one that grey infrastructure and even green infrastructure, which mimics the natural water cycle, have explored the least.

Defining Grey and Green Infrastructure Systems

The value of water that was intrinsic in Indian traditional water infrastructure is not present in many of our current grey infrastructure standards. In terms of physical make-up, grey infrastructure is a type of drainage system usually constructed from concrete and steel (Dong, Guo, and Zeng 2017, 281), although it is not limited to these, as it can also include ditches and detention ponds. An example of a grey infrastructure system would be rainfall hitting the pavement, draining into a street gutter, and being piped away, perhaps to a river or other water body. The purpose is to remove the rainfall from the street as quickly as possible, a linear model of moving the water from Point A (the street) to Point B (the waterbody). A large-scale example may be water pipelines that carry water from mountain reservoirs far distances to meet the needs of people in distant cities. In their book, *A Technology Portfolio of Nature Based Solutions Innovations in Water Management*, O'Hogain and McCarton (2018) explain the linear model of grey infrastructure systems. This system takes water from its source, uses it, treats it if necessary to remove harmful pollutants, then discharges the water into the natural environment. Under this flawed system, water is frequently moved over large distances, whereas rainwater and other surface water flows are often unused, and water infrastructure systems are used to swiftly move this water out of the area (O'Hogain and McCarton 2018, ix).

O'Hogain and McCarton recognize the flaws in such systems. This linear approach "can be said to focus on function and to solve a narrowly defined problem in a given timeframe and for a given cost" (O'Hogain and McCarton 2018, 5). Instead, the authors advocate for solutions that not only address singular problems, but look for opportunities within projects to supply added value. This added value can include "adaptation to climate change, wastewater treatment, ecosystem restoration or resource recovery,

biodiversity, and recreational amenities" (5). Specifically, O'Hogain and McCarton point toward nature-based solutions that are inherently multifunctional, dynamic rather than static, and operate within levels of uncertainty, therefore increasing adaptability of a system. For instance, a nature-based solution to a project that addresses flooding may also provide new habitat areas and account for changing water levels rather than attempting to halt flooding all together (5-6.) To address more efficient use of water, the authors recommend a "circular economy" that does not dispose of water after a single use. Rather, wastewater, and the potential nutrients, chemicals, and particulates within it, are to be seen as resources. Acknowledgment of the worth of water, the authors continue, calls on people to "to act differently, think differently and interact differently" with water and emphasizes the integration of water stewardship into all government, planning, and education considerations and projects (ix). They conclude that a new human-water relationship is required.

Green infrastructure is a step toward the goal of multipurpose water systems. Green infrastructure is broadly defined as a series of "nature-based solutions" that manage resources (Wild, Henneberry, and Gill 2017, 180). Examples include permeable paving, rain gardens, and tree trenches, which are underground storage facilities that capture stormwater for trees and groundwater recharge. Green infrastructure typically includes solutions that are cost effective, low-energy to maintain, and have a positive environmental impact, which parallels with aspects of Indian tradition management mentioned previously. Additionally, green infrastructure can include benefits to increasing biodiversity, improving water quality, and restoring ecosystems. These systems seek to "design nature in," essentially integrating the design into the existing context, rather than the traditional grey infrastructure approach resulting in designs that are "superimposed on natural surroundings" (O'Hogain and McCarton 2018, ix). Proponents of green infrastructure often describe the numerous environmental benefits these systems offer, but they do not typically focus on the relationship between these water systems and the people around them. While green infrastructure provides benefits to a community, it is not always visible, and an individual may easily walk over permeable paving without recognizing it as green infrastructure or as a water management system. While someone may notice the large, healthy trees along a green street, they may not know that it is due to the tree trenches below ground. Green infrastructure has many benefits, but there is still a need to improve awareness and increase human connection to these systems.

The Sociocultural Lessons of Traditional Indian Water Management

The Value of Water

How a community uses their water reflects how they value it. In using grey infrastructure systems that treat water as an inconvenience, such as street gutters with the aim of moving water off-site as quickly as possible, a community is not viewing their water as a valuable resource. The value of water in Indian traditional water systems contrasts with that of grey infrastructure systems, and even goes a step beyond the primarily environmental basis of green infrastructure. Indian traditional water management not only served multiple purposes, as with green infrastructure, but was also imbued with spiritual significance. Elements and actions surrounding Indian

traditional water systems can be described as "operational aspects" and "ideational aspects" (Singh 2004, 3). The "operational" attributes include the functional aspects of how the system works, while "ideational aspects" are the related water beliefs and practices (4).

One such example includes the practice of installing statues of deities along the pond's banks to offer the pond protection. In times of heavy rainfall, the water level would rise until it touched the deity's feet, after which, surplus water would be released through an overflow drain. This action prevented any threat to the pond's structural integrity, and the pond was "protected jointly by the human and divine force" (Mishra 1993, 36.) Such statues, as well as ceremonial pillars placed in the middle of a pond, also functioned as a way of measuring the pond's capacity. It was a cause for celebration when the water level reached the statue's base or a certain mark along the pillar, as it signaled to villagers that their water supply would last throughout the year (Mishra 1993, 36–37.) These "ideational aspects" are derived from an underlying sentiment that water is a gift to be valued, both for survival and spiritual wellness, and, therefore, in many Indian communities, water bodies were traditionally places of social and cultural significance (Nawre 2013, 140; Singh 2004, 4). Traditional water infrastructure in India was highly functional as a means of gaining water, while additionally serving a social and cultural function for many Indian communities. While the practical components of these systems may be contextually dependent, the relationship between these communities and their water systems can be looked to as examples, as societies around the world examine our current grey infrastructure water management practices.

Community gathering under the pond's banyan tree. Image courtesy of the author.

The Versatility of Water

Opportunities for community gathering have not typically been discussed during the design of grey infrastructure systems, although they occasionally appear in green infrastructure projects. Considering the main types of grey infrastructure—channels, pipes, sewers, ditches, dams, and so on—there has been little to no attempt to entice people to gather around these features. This does not need to be the case. Certain types of Indian traditional water management served a vital social function to their communities. One excellent example is the Indian *talaab*, or pond. Indian *talaabs* are a vital form of infrastructure that has been used for centuries to capture monsoon rainfall and store the water for later use. The monsoon season and its heavy downpours begin around June and can last until the beginning of September, with little to no rain for the rest of the year. *Talaabs* were developed as a form of infrastructure to ensure that people had access to water after the monsoon season had passed. While their primary purpose is that of rainwater capture, they became vital sociocultural spaces, as well. As Alpa Nawre explains in her article, "Talaab in India," the edges of *talaabs* have three commonly found features: "large shade trees,

Dhamori Pond edge. Image courtesy of the author.

steps leading to the water in certain sections, and small temples or other religious markers" (Nawre 2013, 137). Under the trees and by the steps, people often gathered socially for leisure and for religious festivities. Historically, there were often religious markers that signaled to passersby upon their approach to the *talaab* that this was a sacred space, requiring them to take off their shoes and refrain from spitting or littering (Mishra 1993, 42).

There are opportunities to integrate social functions into our grey infrastructure systems. Detention ponds, for example, are used to hold water to prevent flooding, but they can serve a multitude of functions, not unlike that of a *talaab*. In Irene Klaver's (2015) article, "Accidental Wildness on a Detention Pond," she describes how a local detention pond in Texas becomes a place in her neighborhood where people regularly go to walk their dogs. Members of the Hindu community go there to celebrate the Diwali Festival of Light. Pelicans take up residence on its shores (Klaver 2015, 47). This was not the intention behind its construction, but it has taken on unexpected social and environmental dimensions, an "emerging of a cultural nexus and environmental imagination around storm-water structures" (51). Klaver's article describes how green infrastructure offers an alternative

Dhamori Pond and its adjacent path. Image courtesy of the author.

approach for stormwater and wastewater management that lends additional environmental value to a water system. However, she still expresses that, "What is under-developed in these approaches is the potentiality for a cultural component in the projects. How could they be green, but also create situations, places of encounter?" (51). There is potential to include sociocultural considerations into planned water systems that current approaches in grey infrastructure and green infrastructure have left largely unexplored.

The *talaab* and other types of Indian traditional infrastructure, such as stepwells, existed as places that merged utilitarian and sociocultural needs. Designers and planners can help facilitate enhanced social opportunities near stormwater features and other types of gray infrastructure through elements such as shade trees, walking paths, and seating, thereby improving opportunities to create "places of encounter."

In addition to holding water and becoming places for social gathering, ponds added value to their communities through animal and plant life. As Anupam Mishra (1993) writes in his book, *The Ponds are Still Relevant,* aquatic life, such as fish and crabs, could be found in many traditional Indian ponds, which lent additional value as a food source. Trees planted along the pond edges—often mango, peepal, banyan, and goolar trees—not only gave shade for people and helped prevent erosion and evaporation, they could also be harvested. Trees and ponds together were so ubiquitous that they were said to be in a "special relationship," that if one were to fail, the other would be sure to follow (Mishra 1993, 43). This is a vastly different approach to water management than grey infrastructure, which, as defined by the Natural Water Retention Measures (NWRM), is "designed to avoid any type of ecosystem to grow on it" (NWRM 2019). As mentioned earlier in the comparison of the linear versus the circular economy of water, creating systems of water management that support multiple uses demonstrates an improved relationship with our water infrastructure.

The Celebration of Water

Indian traditional water management practices included celebrations around water, and language that denoted respect for this resource. These celebrations even extended to the system's maintenance. For instance, for a *talaab* to remain functional, it must be continually desilted. Today, for many remaining ponds in India, this process is viewed as a large administrative problem. However, in past centuries prior to British colonization, the desilting process took place during an annual festival, which the local community undertook together. It was often a festive occasion, and community members donated their labor. Those who participated received the collected silt, viewed as "Prasad," a present, that could spread over fields to enrich the soil (Mishra 1993, 45). This is an approach to water system maintenance imbued with cultural significance and value, rather than a purely utilitarian practice. In Rajasthan, the driest region in India, water catchment ponds are integral to their villages. Thus, many villages have the word for pond, *sar*, in their village name (10).

To share and create water sources, such as ponds, tanks, and communal wells, especially to supply water to the needy, was considered a "virtuous act," and in southern India, creating water basins was historically viewed as "one of the 'saptas-antanas,' (seven kinds of wealth)" (Singh 2004, 5). Even the individual components of the water system were lauded. "Apra" is the Hindi term for the overflow feature in ponds, and it is still a popular name in Rajasthan, meaning "godly" and "top level of intelligence" (Bachpan n.d.; Mishra 1993, 32-33). In Chhattisgarh, the Chher-festival was usually celebrated in the summer, as this was the most advantageous time for pond repairs.

The festival involved people going door to door singing and collecting donations of grain from different households. The grain collected contributed to a public fund, which was used to finance pond maintenance (Mishra 1993, 74). In these examples, people had a personal connection to water systems, and celebrated their creation and ongoing maintenance.

This celebration of water is a far cry from our current relationship with water systems, which tends toward the negative, if thought of at all. Perhaps no example better illustrates this than how those of the English-speaking community relate to water in our language. In Matthew J. Tucker's (2019) work, "Hydrosocial Territories of the Anthropocene," he describes the need for a changed water lexicon, rather than the current vocabulary assigned to water management. When discussing water management strategies in the English language, we often describe these systems using vocabulary such as, "capture, detention, retention, dead storage, impoundment, treatment, infiltration, drainage, discharge" (Tucker 2019, 6). The image of a "detention pond" paints a very different scene than a *talaab*, yet their basic purpose—to hold water—is the same. It is the relationship of people with these catchment systems that diverges. Encouraging people to understand the worth of water, and to celebrate it, is vital to the success of new forms of water management. A changed approach to water management will require a new vocabulary that gives value to water and demonstrates a more positive human-water relationship.

The Fluidity of Water

Borders are one major aspect of water management that differs between grey infrastructure and certain types of traditional Indian water infrastructure. Grey infrastructure, such as concrete canals, sea walls, channels, and dams, creates a starkly defined water to land border. Infrastructure designed in this way is meant to keep water in a specific, predictable location. Compare this to an Indian stepwell or a stepped pond, where stairs descend into the water, allowing people to reach the water's edge as it fluctuates throughout the year. The edge is flexible. People gather along the stepwells for ritual bathing, washing clothing, and socializing (Livingston and Beach 2002, xi). Water is not expected to stay at a certain level or in a certain place. Both on a small and large scale, this allowance for flexibility and fluidity is an advantageous mindset to cultivate, particularly as sea levels rise, and storm surges become more frequent. We are faced with the reminder that water-land borders only exist as lines on a map, and not in reality. Rather than a border between water and land existing as a line, it is more useful and accurate to think of it as a zone or gradient (Matson 2017).

There are places and projects seeking to move past this water-land binary, and create new forms of water management that respect natural processes, such as "floods, erosion, storms, etc.," termed by Saskia Sassen as a "Third Space," where "the boundaries between nature and artifice are blurred" (Tornatora 2018, 138). In Anuradha Mathur and Dilip da Cunha's (2009) book, *SOAK: Mumbai in an Estuary*, they explore ideas for designing a "fluid threshold" between land and sea that allows for inundation of certain areas of Mumbai during the monsoon rains and boosts resilience along the city's edge. The Netherlands has numerous programs that parallel the ideas of a "Third Place." An entire national program called "Room for the River" promoted re-naturalizing edges along Dutch rivers to allow for partial flooding, rather than creating barriers (Tornatora 2018, 138). Much of the city of Rotterdam is below sea level. But rather than building higher levees, their planning perspective is, "In essence, to let water in, where

possible, not hope to subdue Mother Nature: to live with the water, rather than struggle to defeat it" (Kimmelman 2017). The Sand Motor on the Netherland's Delfland Coast is an experimental form of water management where sand is deposited in the sea, and dispersed by natural currents along the beaches, as a means of coastal defense (De Zandmotor n.d.). In China, as well, the work of Turenscape looks for new forms of water infrastructure. Along a section of river in the city of Liupanshui, their project proposed removing its concrete pipes, and instead transitioning to wetlands and ponds to hold increasing water volumes (Tornatora 2018, 138.) When designing new forms of water management, we must challenge the cultural notion that water and land are entirely separate entities and that water must stay within certain lines.

A New Human-Water Relationship

Let us return to where we began, in the village of Dhamori, India. Dhamori does not rely on its traditional water infrastructure today. While the village's largest feature is a sizable pond, the villagers get their drinking water from the water tower filled with water from a reservoir 40 miles away. The pond's water levels fluctuate dramatically throughout the year, filled by runoff and rain during the monsoon season, and falling drastically during the summer. A few farmers run hoses from it to their fields for irrigation. But while the pond's utilitarian function has declined, its social function has remained. Its banks are mostly unvegetated, but there are trees scattered around the edges. A path stretches around the pond's perimeter. It sits along the village's main road, and it is one of the most popular gathering places in town. People stop, sit, and chat under the trees. Children play cricket next to it, and a mosque and a temple are directly adjacent. During certain festivals, such as Durga Pooja and Ganesh Chaturthi, a procession of villagers will

Aerial view of Dhamori Pond. Image courtesy of the author.

walk to the water's edge and submerge a statue of the respective god. The sociocultural aspect of Dhamori's central pond has become arguably its most important purpose.

It would be overly simplistic to say grey infrastructure has no place in modern water management, or advocate for mere replication of Indian traditional water management, whether in India or elsewhere. Water towers, storm drains, and water pipes are undoubtedly valuable, and installing traditional water management systems would not solve all the water-related issues facing the world today. Grey and green infrastructure methods provide important contributions. For instance, when designing water systems such as detention ponds, particularly in residential neighborhoods, one must consider the safety and legal issues accompanying them. A detention pond can be a valuable feature, but for residents to safely use it, its "bounce," the additional volume that the water level fluctuates over its typical water elevation, must be measurable and monitored. Yet approaching this challenge from the standpoint of water as a life-giving element, rather than a life-taking one, radically changes the type of solutions we create. Studies comparing "uniuse detention basins" versus "multi-use detention basins" have frequently found residents more in favor of multi-use systems, even occasionally ranking visual and recreational amenities as more important than their flood-control capabilities (Lee and Li 2009, 8). To yield maximum benefits, solutions likely need to be hybrids incorporating the most advantageous attributes of grey, green, and traditional forms of water infrastructure, and in these new systems, water must be viewed as the precious resource it is.

Water is not merely a utilitarian, technocratic management issue; it is a cultural, social issue, as well. Developing a new perspective of water management is an opportunity for our entire society. The role of people and culture is key, and we can look to traditional water practices for guidance. These examples demonstrate that water management systems can be highly versatile, serving not only functional and environmental purposes, but also social and cultural ones. Indeed, an improved social awareness of water systems will increase people's sense of stewardship for the environment. Water management systems and our language describing them can be positive and celebratory, and an end to a strictly land-water duality will result in more resilient and dynamic land-water borders. Such improved water management will enhance the relationship we have among ourselves, our communities, our environments, and the water that supports us all.

References

Bachpan. n.d. "Meaning of Apra." *Hindu Girl Names*. *Accessed January 22, 2020*. https://www.bachpan.com/meaning-of-apra.aspx.

Cullet, Philippe, and Joyeeta Gupta. 2009. "India: Evolution of Water Law and Policy." In *The Evolution of the Law and Politics of Water*, edited by Joseph W. Dellapenna and Joyeeta Gupta, 159–175. Dordrecht: Springer Academic Publishers.

Dande, R., A. Bele, P. P. Padgilwar, and N. Kulkarni. 2016. "Sustainable Rain Water Harvesting Techniques Prevailing in Ancient India." *International Journal on Theoretical and Applied Research in Mechanical Engineering (IJTARME)* 5: 16–24.

De Zandmotor. n.d. "Introduction." Zandmotor Delflandse Kust. Accessed May 2, 2019. https://www.dezandmotor.nl/en/the-sand-motor/introduction/.

Dong, Xin, Hao Guo, and Siyu Zeng. 2017. “Enhancing Future Resilience in Urban Drainage System: Green Versus Grey Infrastructure.” *Water Research* 124: 280–289.

Gadgil, Madhav, and Ramachandra Guha. 1993. *This Fissured land: an Ecological History of India*. Berkeley and Los Angeles: University of California Press.

Kimmelman, Michael. 2017. “The Dutch Have Solutions to Rising Seas. The World Is Watching.” *The New York Times,* June 15, 2017.

Klaver, Irene. 2015. “Accidental Wildness on a Detention Pond.” *Antennae, The Journal of Nature in Visual Culture* 33: 45–58.

Kumar, Ganesh S., Sitanshu Sekhar Kar, and Animesh Jain. 2011. “Health and Environmental Sanitation in India: Issues for Prioritizing Control Strategies.” *Indian Journal of Occupational and Environmental Medicine* 15 (3): 93–96.

Lee, Jae Su, and Ming-Han Li. “The Impact of Detention Basin Design on Residential Property Value: Case Studies Using GIS in the Hedonic Price Modeling.” *Landscape and Urban Planning* 89 (1–2): 7–16.

Livingston, Morna, and Milo Beach. 2002. *Steps to Water: The Ancient Stepwells of India*. New York: Princeton Architectural Press.

Mathur, Anuradha, and Dilip da Cunha. 2009. *SOAK: Mumbai in an Estuary*. Mumbai, India: Rupa & Company.

Matson, Zannah Mae. 2017. “A Geometry of Borders: The Infrastructural Points that Construct the Line.” In *Investigating Infrastructure: a forum*. *Society + Space*. Online Journal. Accessed April 2, 2019. http://societyandspace.org/2017/10/09/a-geometry-of-borders-the-infrastructural-points-that-construct-the-line/.

Mishra, Anupam. 1993. *The Ponds Are Still Relevant*. New Delhi, India: Gandhi Peace Foundation.

———. 2009. “The Ancient Ingenuity of Water Harvesting.” [Video file]. Retrieved from https://www.ted.com/talks/anupam_mishra_the_ancient_ingenuity_of_water_harvesting?language=en.

Nawre, Alpa. 2013. “Talaab in India Multifunctional Landscapes as Laminates.” *Landscape Journal* 32 (2): 137–150.

———. 2017. “Dhamori Village Masterplan.” Retreived from https://www.criticalplaces.org/works/dhamori-village-masterplan

NWRM. n.d. “Grey Infrastructure.” *Natural Water Retention Measures (NWRM)*. Accessed May 1, 2019. http://nwrm.eu/node/3837.

O’Hogain, Sean, and Liam McCarton. 2018. *A Technology Portfolio of Nature Based Solutions: Innovations in Water Management*. New York: Springer Books.

Sagar, S. Karuna, M. Rajeevan, and S. Vijaya Bhaskara Rao. 2017. “On Increasing Monsoon Rainstorms over India.” *Natural Hazards* 85 (3): 1743–1757.

Shah, Tushaar, Aditi Deb Roy, Asad S. Qureshi, and Jinxia Wang. 2003. “Sustaining Asia’s Groundwater Boom: An Overview of Issues and Evidence.” In *Natural Resources Forum*, 27 (2): 130–141. Oxford, UK: Blackwell Publishing Ltd.

Singh, Nandita. 2004. “Water Management Traditions in Rural India: Valuing the Unvalued.” In *18th European Conference in Modern South Asian Studies*. Lund University, Sweden, 6–9 July, 2004. Accessed April 5, 2019. http://www.diva-portal.org/smash/get/diva2:481013/FULLTEXT01.pdf

Tornatora, Marina. 2018. “The Third Space Between Land and Water.” *TECHNE—Journal of Technology for Architecture and Environment* [Online], 15: 134–142. Accessed May 12, 2019. http://www.fupress.net/index.php/techne/article/view/22115/21268

Tucker, Matthew J. 2019. “Hydrosocial Territories of the Anthropocene.” In *Fresh Water: Design Research for Inland Water Territories*, edited by Mary Pat McGuire and Jessica M. Henson. New York and San Francisco Bay Area: Applied Research & Design Publishing.

Verulkar, S. B., N. P. Mandal, J. L. Dwivedi, B. N. Singh, P. K. Sinha, R. N. Mahato, P. Dongre et al. 2010. “Breeding Resilient and Productive Genotypes Adapted to Drought-Prone Rainfed Ecosystem of India.” *Field Crops Research* 117 (2–3): 197–208.

Wild, T. C., J. Henneberry, and L. Gill. 2017. “Comprehending the Multiple ‘Values’ of Green Infrastructure–Valuing Nature-based Solutions for Urban Water Management from Multiple Perspectives.” *Environmental Research* 158: 179–187.

Recommended Citation

Johnson, Leslie A. 2020. “The Gift of Water.” *Open Rivers: Rethinking Water, Place & Community,* no. 16. https://editions.lib.umn.edu/openrivers/article/the-gift-of-water/.

DOI: https://doi.org/10.24926/2471190X.6896

About the Author

Leslie A. Johnson is a landscape designer working in urban design at the architecture firm Perkins and Will. In 2017–2018, she worked with Professor Alpa Nawre examining water management and rural development strategies in Dhamori, India, which served as the foundation for the ideas of this article and her 2018 capstone, “Water Wisdom,” collaborating with Alpa Nawre, John Koepke, Rebecca Krinke, and Vinay Gidwani in the University of Minnesota’s Department of Landscape Architecture. She wishes to extend special thanks to Alpa Nawre and John Koepke, whose insights proved invaluable in the writing of this article.

GEOGRAPHIES

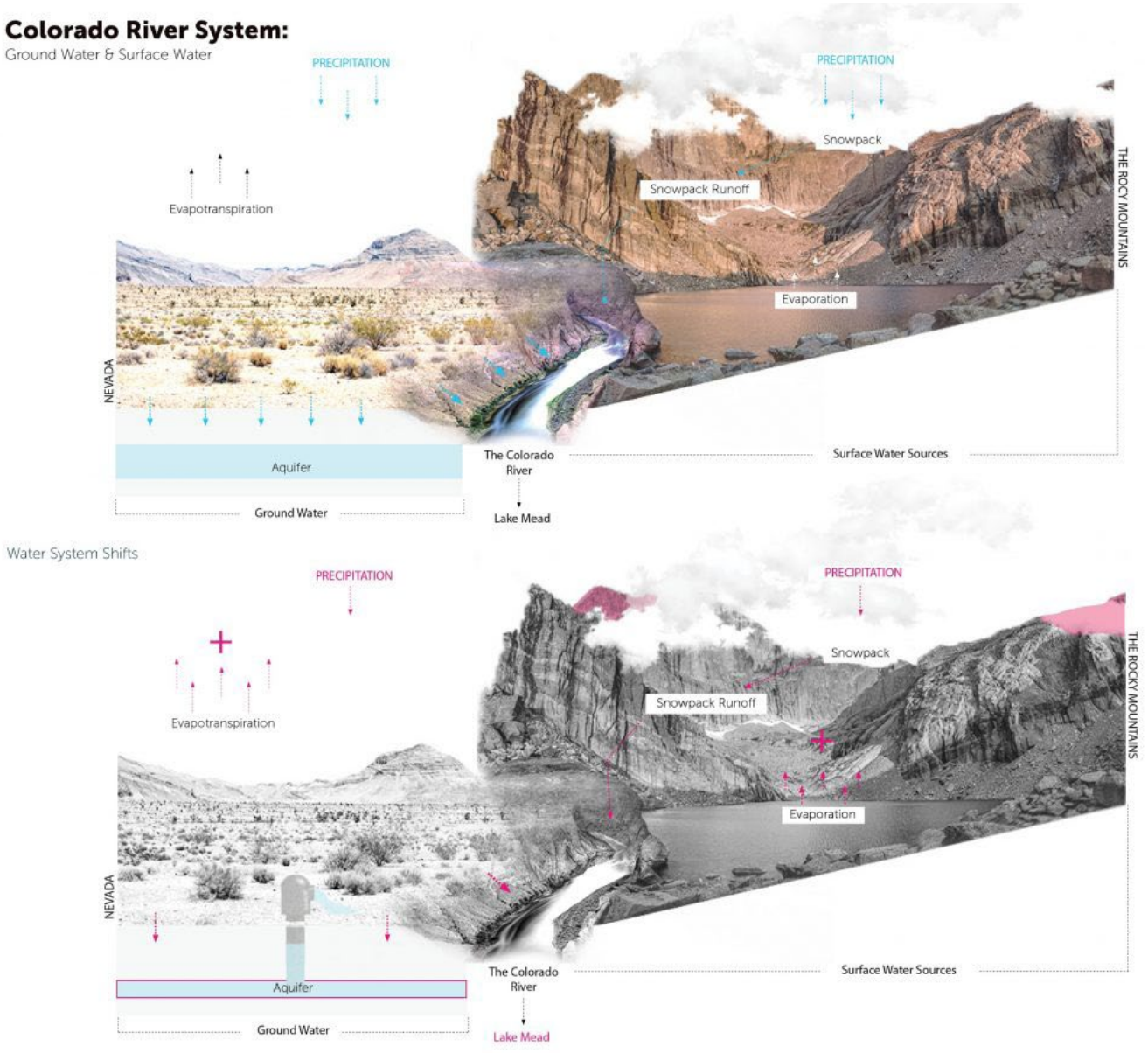
INVISIBLE INFRASTRUCTURE: DOCUMENTING THE HIDDEN FLOOD CONTROL INFRASTRUCTURE IN LAS VEGAS

By Jessica Rossi-Mastracci

Las Vegas. A city branded by sin, vice, and extravagance. A city where "anything goes," including gambling, the Strip, partying, strip clubs, and more recently, legal marijuana. Visitors rarely venture outside of the Strip, Fremont Street, or perhaps out to the Hoover Dam, and see only green, lushness, opulence, and a portrayal of paradise in the desert. The many fountains, lawns, and golf courses seem to defy nature in a place where the average summer temperature is 100° F. In addition, the sprawling gated suburbs look like they should be in the Midwest, and reinforce a vision of the American dream with single family homes, green lawns, and white picket fences. Despite appearances, however, water is scarce in Las Vegas. Located in the Mojave Desert, there are few local water resources and the city relies almost entirely on

Detail from original image with a view along the Flamingo Arroyo Wash and Bike Trail where the wetland is fed primarily by urban runoff. Image courtesy of the author.

water from the Colorado River that is imported over hundreds of miles. As well, infrequent but severe storms cause widespread flooding, which sometimes turn deadly. To combat this, the region has built a complex network of flood control water infrastructure to collect and move flood water swiftly out of the urban area. Further digging into policy, built form, and land use highlights the complexity and contradictions in the region around water.



Graphic describing current water system and impacts due to climate change projections. Image courtesy of Erin Schregardus, Yungui Cai, and Collin Wenberg.

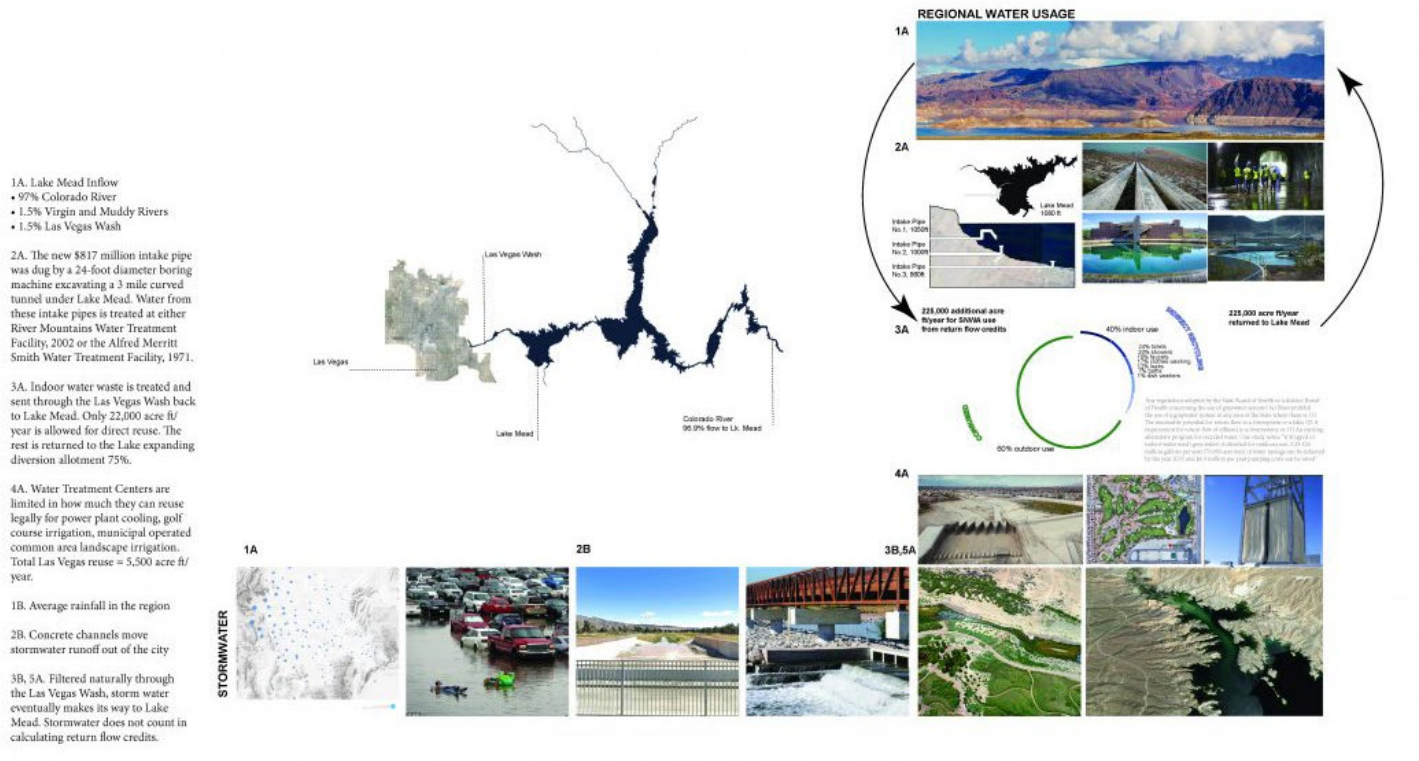
Context

During the Fall of 2019, I developed and taught a master of landscape architecture design studio at the University of Minnesota. The course brief charged students with developing innovative urban and landscape forms that address water scarcity and future uncertainties due to climate change in the rapidly growing desert city of Las Vegas, Nevada.

The students and I visited for a week in September and met with University of Nevada-Las Vegas landscape architecture students and faculty, residents, ecologists, planners, hydrologists, and Southern Nevada Water Authority representatives. We interviewed local residents and water experts to gain a perspective on their relationship with water and to understand policy, planning, and decision-making frameworks. We visited sites around the city to understand impacts of these policies on the built and natural environments. The photographs, drawings, diagrams, and site research in this article came out of the work produced by students and studio site visit.

Water + Las Vegas

Water is by far the largest challenge in the region, both too much and too little. Located in the Mojave Desert, Las Vegas has limited local water sources and relies on the Colorado River water infrastructure to provide 90 percent of its water. This begins as rain and snowmelt in the Rocky



Graphic describing the regional domestic water system and flood control infrastructure in Las Vegas and Clark County. Image courtesy of Sonali Devarajan, Christopher Ototo, Sheng Dong, and Tyler Smith.

Mountains, imported over thousands of miles through a series of channels, reservoirs, and aqueducts, and ultimately distributed to approximately 40 million people across seven western states and the country of Mexico.[1] Each state manages, imports, sells, and distributes their legally determined water allocation or budget. Locally this is done by the Southern Nevada Water Authority.

It rains on average a meager four inches over about 20 days a year. Half of that is in winter as gentle rain over the entire valley, and is welcomed by residents. The other half happens in summer monsoons where short but intense rain events scatter the valley unevenly, and heavy rain in one place could cause flash flooding downstream.

Topographically, the Las Vegas Valley is surrounded by mountains on three sides and acts like a bowl, capturing rainwater from the adjacent mountains through a series of washes and alluvial fans, with the Las Vegas Wash and Lake Mead at the end. During the summer monsoons, flooding often happens suddenly and severely since both urban runoff and rainwater from the mountains are directed through the city.

Since 1991, the Clark County Flood Control District has spent $1.9 billion to construct flood control infrastructure to intercept, slow, and move flood water efficiently out of the urban areas. Currently there are 650 miles of flood channels and 100 flood control basins built with another 25 years of projects anticipated as the

A flood control channel within the city, collecting trash. Image courtesy of the author.

Edge of residential community, bike trail, and ephemeral wetland in the Las Vegas Wash. The wetland is fed by discharged reclaimed wastewater, groundwater, and urban runoff. Image courtesy of the author.

urban area continues to grow.[2] The infrastructures are located both within the urban fabric as detention basins, streets, and flood control channels, and on the edges of town as flood diversion infrastructure. While construction began prior, most of this has been built in response to the 1999 storm where a 100-year storm event caused widespread flooding. Two people died and thousands more needed to be rescued when parking lots, streets, and first floors of casinos flooded with fast moving water. All in all, the storm caused $20 million in damages.[3]

To gather and channel urban runoff from streets, adjacent parking lots, and building roofs, a network of earthen, rock riprap, and concrete flood control channels crisscross the region. Often located in between neighborhoods, most have eight-foot tall concrete masonry unit walls lining each side. The channels collect large amounts of garbage and feel as if the city ignores them. Some are dry most of the year, while others are continuously wet and receive treated water from adjacent wastewater treatment plants.

Detention basins are the largest piece of infrastructure, which average 100 acres each and can be as large as 240 acres. Water is moved through streets and flood channels to the basins, which fill up and release the captured rainwater slowly to not overwhelm the downstream system. At least 20 feet deep, the basins are engineered to be large enough to capture an extreme rain event, yet empty within 24 hours to be prepared for the next storm. Many are in the middle of neighborhoods, with fences and gates to keep most people out, and look like empty dirt pits or lots waiting to be developed. Occasionally some have parks, among the few public spaces in Las Vegas, which are mainly lawn and passive open spaces that can flood without needing repair. On the edge of town, flood diversion infrastructure intercepts water moving off of the adjacent mountain ranges and diverts around neighborhoods located in the water's path. As a landscape architect, this infrastructure is fascinating as it creates a secondary network through the city dictated by topography, urban development, and remnant space.

Photo study of the textures at the edge of a detention basin. Image courtesy of Sheng Dong.

Red Rock Detention Basin at the northwest of Las Vegas, which intercepts flood water coming off of La Madre Mountains and Red Rock Canyon National Conservation Area. Image courtesy of the author.

The inlet of the Tropicana Detention Basin, where a public park sits within a piece of flood control infrastructure. Image courtesy of the author.

Looking into the Tropicana Detention Basin, where a public park sits within a piece of flood control infrastructure. Image courtesy of the author.

Water infrastructure at the eastern edge of Las Vegas that intercepts flood water coming off of Frenchman Mountain. Image courtesy of the author.

Opportunities + Challenges

Within this engineered landscape, there are signs of life where vegetation has started to take over. Cracks in the concrete-lined channels, gaps in between rock riprap, or space at the edges of earthen berms create the perfect niche for willows, sunflowers, cattails, sage varieties, and cottonwood trees to find just a little bit of water and soil to grow. These linear channels have become habitat corridors for birds; between the draw of the Clark County Wetlands Park and flood control channels, the network attracts 300 species of migratory birds including many that are endangered or threatened. A novel urban ecosystem, the channels host colonies of released pet turtles and goldfish as well as carp and crappies that have found their way upstream from Lake Mead. In a brief period, the channels have become a critical ecological and infrastructural corridor for the region and beyond.

The region has begun to build bicycle and walking paths in some of the channel corridors. While minimal now, they have the opportunity to create a city-wide connected pedestrian network. There are many opportunities to enhance this network by creating shade, seating, and wayfinding. This is a critical piece of public space network in a city where most residents must drive to access park or open space.

The flash flooding events often catch residents by surprise, including the growing homeless population that lives at the edges of detention basins or in the channels. Throughout these areas, the presence of people is highly visible through informal camps, large amounts of garbage and debris, and furniture both left by people and carried from upstream during a storm. This has been documented in great detail in popular

Ephemeral wetlands along the Las Vegas Wash fed by discharged reclaimed wastewater, groundwater, and urban runoff. Image courtesy of the author.

Along the Flamingo Arroyo Wash and Bike Trail, where the wetland is fed primarily by urban runoff. Image courtesy of the author.

media, including a 2014 article in VICE and a 2019 article in HuffPost.

With the lack of a larger regulatory framework or land-use plan, many developers have built within natural washes, which has interrupted historic water flow movements, produced more flooding, and increased the need for additional flood control infrastructure. Also, developers are not required to build stormwater infrastructure or manage flood waters. As a result, the Regional Flood Control District "fits" the infrastructure in the spaces in between communities.[4] To connect the pieces, channels often make strange turns, some almost at 90 degree angles, and then dip under urban areas into a culvert or pipe, reappearing miles later. Each turn or culvert increases the potential for overflow and flooding. More infrastructure is under construction today, trailing behind the rapid and sprawling urban development.

Development in the Valley has pushed almost to the edges of the bowl, constrained by natural features and federally owned land. The exception is at the southern edge where Las Vegas is continuing to sprawl south unrestrained, merging with the nearby towns of Henderson and Enterprise. This situation has created a clash between urbanized areas and natural systems. However, in this battle, urbanization wins when natural systems can be disrupted, controlled, and altered for the sake of urban and economic growth, creating tensions between natural and built environments and exacerbating vulnerabilities.

A brief glimpse at future projections outlines the instability and vulnerability of the Colorado River as a water source. Due to climate change and increased urban and agricultural demand, recent projections show that Lake Mead will fall below 1000 feet in elevation a quarter of the time by 2040 and almost half of the time by 2060.[5] This elevation is too low to withdraw water from and for the Hoover Dam to generate hydroelectricity, and it will trigger severe mandatory water cuts to all of the basin states. Las Vegas is hedging its bets and in 2015 finished an $817 million construction project to build a lower pipe (referred to as the Third Straw) from Lake Mead at 860 feet in elevation.[6] In effect, the Southern Nevada Water Authority will have the ability to extract and sell water long after Los Angeles, Phoenix, Tucson, and San Diego will have either found an alternate water source or will have disappeared entirely.

Southern edge of Henderson, Nevada where development lines a wash coming down from Black Mountain and Sloan Canyon National Conservation Area. Image courtesy of the author.

Perceptions of Water, Infrastructure, and Society

Through our meetings, locals acknowledged they live in a region that does not have enough water and that shortages have increased in recent years. The policy and regulatory responses have focused on water conservation through conversion to low-flow fixtures and drought tolerant vegetation, while still maintaining pools, golf courses, and water fountains. The responsibility for water conservation falls primarily on residents, where tiered pricing for domestic water imposes steep costs for using above what is deemed "appropriate." Conversely, the Strip still appears to operate how they want to, with lush tropical plantings, expansive lawns, and extravagant fountains. The business-as-usual mentality, even in the face of extreme weather, increased drought, and decreasing water resources ignores the dramatic effects of climate change on the region and larger territory. There is a perceived fragility of the economy—as it is almost wholly dependent on tourism and related services—and a quiet fear of what would happen if visitors' perception of the city or behavior had to change.

With this in mind, there are opportunities to rethink our relationship with water, whether it's too much or too little. Through the coursework, I asked students to question our role as designers, using the city of Las Vegas as a test site. We considered:

- What would Las Vegas look like if it embraced its identity as a desert city rather than trying to convert it to a green and lush landscape?

- How can embracing natural patterns and flows inform how we could live, consume resources, and develop new patterns of urbanism? What if regional or territorial differences were determined based on resource availability, reconceiving of floodwater as an asset?

- How can Las Vegas' DNA as a place that embraces speculation, takes chances, and attracts people from all over inform a new form of urbanism for arid cities?

Student work in response ranged from reimagining detention basins as tourism and spectacle, deconstructing walls along neighborhoods and flood control channels, creating public space in the channel corridors, reconceiving the urban fabric as an ecological bird corridor, reducing impermeability in streetscapes and parking lots, to rethinking the water infrastructure and urban framework to reduce dependence on the Colorado River as a water source. The students then quantified the impact of their design: amount of runoff reduced by increasing permeability on all of the urban streets and parking areas in Clark County; access to public space increased by breaking or removing the walls in all of the stormwater channels; and increased density and attraction by programming the 50 largest detention basins. Within this experimental and speculative work, we see the potential for landscape architecture, design, and urban planning to reimagine how our cities look, function, and adapt to future changes.

While we may not experience weather fluctuations as extreme as the West specifically, the weather in the Midwest is predicted to become more extreme with climate change: increasing precipitation will increase flooding, decrease agricultural productivity, increase runoff and

pollution, and decrease the quantity of clean water due to pollution from runoff and groundwater contamination.[7] Worldwide water scarcity and climate change impacts will increase pressures in ways we don't know yet: from increasing global agriculture pressures, to water scarcity, to flooding, to future climate change refugees. Our role as citizens is to ask probing questions and to push designers, planners, and policymakers to think innovatively and speculatively on the form and function of our built environment.

Footnotes

[1] Pat Mulroy, ed., *The Water Problem: Climate Change and Water Policy in the United State*s (Washington, D.C.: Brookings Institution Press, 2017).

[2] Max Michor, "Looking back at 1999 Las Vegas Flood 20 years later." *Las Vegas Review-Journal* (July 8, 2019). Retrieved October 20, 2019, from https://www.reviewjournal.com/local/local-las-vegas/looking-back-at-1999-las-vegas-flood-20-years-later-1701236/.

[3] Jesus A. Haro, Harold R.Daley, and Kim J. Runk, *The Las Vegas Flash Floods of 8 July 1999: A Post-event Summary*, (Las Vegas: National Oceanic and Atmospheric Administration Western Region, 1999). Retrieved October 10, 2019 from http://gustfront.ccrfcd.org/pdf_arch1/Flood%20Event%20Reports/1999-07-08-nws-kml.pdf.

[4] As understood through conversations with Clark County Regional Planning.

[5] David G. Groves, Jordan R. Fischbach, Evan Bloom, Debra Knopman, and Ryan Keefe, "Future Vulnerabilities to Colorado Basin Water Deliveries," in *Adapting to a Changing Colorado River: Making Future Water Deliveries More Reliable Through Robust Management Strategies*, (Santa Monica, CA: RAND Corporation, 2013), 31-42.

[6] CBS News, "Las Vegas uncaps Lake Mead's 'third straw' for water supply," *CBS News* (September 24, 2015). Retrieved October 2, 2019, from https://www.cbsnews.com/news/las-vegas-uncaps-lake-meads-third-straw-for-water-supply/.

[7] Kenny Blumenfeld, "Keys to Understanding Our Changing Climate," (St. Paul, MN: Minnesota Department of Natural Resources, 2017). Retrieved June 3, 2019.

Recommended Citation

Rossi-Mastracci, Jessica. 2020. "Invisible Infrastructure: Documenting the Hidden Flood Control Infrastructure in Las Vegas." *Open Rivers: Rethinking Water, Place & Community,* no. 16. https://editions.lib.umn.edu/openrivers/article/invisible-infrastructure/.

DOI: https://doi.org/10.24926/2471190X.6906

About the Author

Jessica Rossi-Mastracci teaches in Landscape Architecture at the University of Minnesota. Her work investigates new ways of adapting to future unknown water conditions in extreme landscapes.

IN REVIEW

TIME IN THE CANYON

By David Morrison

A bit over half a century ago, Colin Fletcher walked, in two months, from one end of Grand Canyon National Park to the other. The book he wrote about that trek, *The Man Who Walked Through Time* (1967), is still a joy to read. It is part day-by-day travel journal, and part backpacking guide, but the heart of the book is his meditation on time and nature—and how we humans fit in. That Fletcher, a slightly overweight, middle-aged city dweller, made the strenuous journey on foot through the rugged, inhospitable desert is a great story, and the insights he gained are inspiring.

Rocks over one billion years old are exposed in the Grand Canyon of the Colorado. Image courtesy of the author.

The impressive view that no self-respecting tourist ought to miss.
Image courtesy of the author.

The Grand Canyon of the Colorado is one of those familiar immensities that most of us think we know—very big, a mile deep. Even so, actually seeing the Canyon for the first time can be a shock. Fletcher described the utterly disorienting effect of his first view of the Grand Canyon. He had casually detoured there on a cross-country trip to see the "impressive view that no self-respecting tourist ought to miss" and was unprepared for what he saw (5). "In that first moment of shock, with my mind already exploding beyond old boundaries, I knew that something had happened to the way I looked at things" (6). This was from the man who some years earlier had walked the length of California, a thousand miles from Oregon through the Sierra Nevada and Death Valley to the Mexican border. He found the Grand Canyon "mysterious and terrible—and beckoning," and thought at once, "If a route existed I would walk from one end of the Canyon to the other" (6). A year later he did just that.

For the susceptible, like Fletcher, like me, like countless others, the urge for an impromptu walk into the Grand Canyon is a strong one. On the upper reaches of the Bright Angel Trail, it is possible to see people wearing flip-flops and even gold-lamé sandals, clearly walking down-canyon on the spur of the moment. On the fourth day of a recent backpacking trip, 3,500 feet below the Canyon's rim, my friend and I encountered two

The Canyon: mysterious and terrible and beckoning. Image courtesy of the author.

fast-moving young Frenchmen, *alpinistes*. They were wearing gym clothes, carried no packs, and had two empty water bottles. They were in the middle of a 25-mile day hike, most of it the same route that we (no longer in our twenties) were taking six days to do. We insisted—in two languages—on filling their water bottles, and they bounded off like gazelles. Two days later as we approached the rim, we ran into them again. "Did you make it out before dark?" "Well, no."

The well-worn Bright Angel Trail follows Garden Creek down into the inner canyon. Video courtesy of the author.

Colin Fletcher, on the other hand, was not proposing a spur-of-the-moment jaunt on well-worn tourist trails for his two-month Canyon trek. There were in fact no trails, or only animal trails, on much of his proposed route, and little or no water available. At the time he left, it was not even known if a route existed. He made the careful preparations of the experienced desert backpacker; he was, after all, the author of *The Complete Walker* (1968), the encyclopedic and inspiring guide to backpacking that is still in print. In *The Man Who Walked Through Time,* we learn a good deal about the planning, the gear, the arrangements for re-supply of water and food, the advice from earlier hikers, and so on. But mostly we get to know the charming, self-deprecating, observant, contemplative man that was Colin Fletcher.

Like so many others, he was struck by the Grand Canyon as "above everything else a geological phenomenon" (96). The sheer expanse of exposed rock—thousands of vertical feet over scores of miles—makes it an illustration *par excellence* of the effects of geological processes over vast stretches of time. Fletcher carried with him a small book on geology, "for stimulation" and to help him understand how and when the Canyon came to be (96).

Much of his route was on broad terraces thousands of feet below the Canyon's rim. When you have made your way down, down, down from the South Rim to the Tonto plateau, you find yourself in a broad open valley, what he called "a country of space and light" (56). It is very different from the view up at the rim, where the Canyon drops off so precipitously from the plain that the usual points of reference in a landscape are gone, and the scale of what you are looking at is difficult to grasp. However, down on the Tonto, among the shrubby blackbrush, prickly pear, and occasional small mesquite tree, you have the high cliffs above you on the south and also far away to the north. It is a huge valley, but it seems somehow a familiar sort of landscape, until with a start, you realize, as Fletcher did, that looking at those high cliffs "two miles away, or three, or five—your eye passes without recording it across a gap broad enough to contain the Colorado" (66). And it's not just a gap, but the Inner Gorge, a chasm more than a thousand feet deep.

Below the rim, a country of space and light where your eye passes without recording it across a gap broad enough to contain the Colorado. Image courtesy of the author.

When the swing of the Tonto Trail takes you to the edge of that Inner Gorge, you see that "the black and twisted rocks that rise steeply from the river come to an abrupt end. A horizontal line cuts across the agonized folding of the schists; and laid neatly along this line, like a huge, flat crust on a black, half-eaten pie, lies a slab of uniform brown sandstone" (142). The lower rocks, more than a billion years old, are the roots of mountains once as high as the Rockies. Those mountains were worn down to a plain, which sank beneath a shallow sea. There they were covered with the sediments that became that brown sandstone. "This Tapeats sandstone, two hundred feet thick, runs in an even and almost unbroken line along sixty miles of the Inner Gorge" (142). This marks the Great Unconformity, a gap in the geological record.

> Between the creation of the schists and the creation of the sandstone there had elapsed a period of 500 million years… It occurred to me that I had a scale for measuring those 500 million years. A scale independent of numbers. For it so happened that 500 million years was also the time that had elapsed between the creation of the piecrust Tapeats sandstone and my journey through the Grand Canyon. And all

Much of Fletcher's route was on broad terraces thousands of feet below the rim. Image courtesy of the author.

> I had to do to see what had happened in those 500 million years was to look up and around. (142, 143-144)

More than a month into his trek, Fletcher stopped for a few days on a sandbar by the river, since "interludes in which you sprawl and do nothing are great occasions for seeing important things that you have always been too busy to notice" (175). Reclining in the shade of a small willow, more or less ignored by the animal inhabitants of the sandbar, he reflected on the experience.

> I had moved closer to the pulse of life. I had heard a new counterpoint to the unique basic rhythm of the universe. And in it I recognized the common grain that ran through everything I knew existed, including me.
>
> We all of us experience this oceanic feeling, I think, at some time or other. . . . Now, on Beaver Sand Bar, the sense of union had become explicit, intimate, totally involving. It embraced everything. Not only man and beaver and mouse, lizard and rattlesnake and toad,

The trail swings close to the Inner Canyon, with a view of more than a thousand feet of contorted Precambrian rock rising from the river's edge, topped by the horizontal "piecrust" of the Tapeats sandstone. Image courtesy of the author.

Sandy shores along the Colorado river are perfect for interludes in which you sprawl and do nothing. Image courtesy of the author.

> sandfly and slug. Not only thicket and willow tree. Not only the sand bar. But the rock as well. The rock from which the sand bar's sand had been fashioned. The rock that was the foundation across which and probably from which had been stretched the whole pulsating, interlocking web of life. And with the rock and the plants and the animals, even with the wind and its cloud shadows, I felt, now, a sense of common origin and direction. A sense of union so vibrant that when I looked back afterward I sometimes felt that the whole experience on Beaver Sand Bar was like a perfect act of physical love. For the union was total and natural and selfish and unselfish and beautiful and holy, and at the same time riotously good fun. And while it lasted nothing else mattered, nothing else existed. (177-178)

Colin Fletcher is no longer with us, but we are lucky to have this narrative of his long walk through the Grand Canyon and his reflections on the experience. The geologic record so beautifully on display everywhere in the Canyon illustrates what he called "the huge and horrifying vaults of time"—the uncountable years during which Earth was an utterly impossible place for humans to exist (218). We are, as he says, newcomers here. Although today it is more obvious than ever that we have no guarantee of our continued existence as a species, in *The Man Who Walked Through Time* we have an antidote to despair. It is essentially a hopeful book, in which Fletcher reminds us there is still beauty, and there is still a place for us, if we want it, "in the rolling cadences of geologic time" (227). And it is a great story of an amazing hike!

References

Fletcher, Colin. 1967. *The Man Who Walked Through Time: The Story of the First Trip Afoot Through the Grand Canyon.* New York: Alfred A. Knopf, Inc.

———. 1968. *The Complete Walker*. New York: Alfred A. Knopf, Inc.

Recommended Citation

Morrison, David. 2020. "Time in the Canyon." *Open Rivers: Rethinking Water, Place & Community,* no. 16. https://editions.lib.umn.edu/openrivers/article/time-in-the-canyon/.

DOI: https://doi.org/10.24926/2471190X.6802

About the Author

David Morrison is a retired graphic designer and visual artist. The main focus of his artwork for several decades has been the landscape of the St. Croix river. He is an avid gardener with an abiding interest in native plant communities wherever he finds himself. At home in Saint Paul he has converted his small, city yard into pollinator-friendly gardens—to the apparent delight of local butterflies and bees. (Sadly, no Bombus affinis spotted yet.) Recent years have found him backpacking in the desert Southwest, becoming familiar with a very different flora. In his spare time, he plays music with friends whenever possible and enjoys learning foreign languages.

PERSPECTIVES

THE URBAN MISSISSIPPI: VALUING CONNECTIONS IN A CHANGING CLIMATE

By Emily Green, Bree Duever, and Amit Pradhananga

Social scientists have long noted the value in humans connecting with their communities—through both social bonds and emotional attachment to their local natural surroundings. Whether socially focused or environmentally or both, such connecting benefits people and places. Place attachment has been linked to positive human health impacts (Scannell and Gifford 2017; Stedman 2002). It can lead people to more highly value and more actively take care of their surroundings (Gosling and Williams 2010; Junot, Paquet, and Fenouillet 2017). Scannell and Gifford (2010) have also shown a correlation between place attachment and increased tendency for people to work together on specific pro-environmental projects. Meanwhile,

The urban Mississippi River flowing by downtown Saint Paul. Image courtesy of Nattapol Pornsalnuwat.

our research group, the Center for Changing Landscapes (CCL), and others have found that people who feel greater social attachment to their community are more likely to engage in local water resource protection activities (Brehm 2006; Pradhananga and Davenport 2017).

As social science researchers who explore human values and beliefs related to environmental matters, we in the CCL are intrigued by the phenomenon of community attachment in both its environmental and social dimensions. We are primed to recognize attachment themes when they appear in our survey or interview data. And we continually seek to further our understanding of their importance and role in the face of today's urgent, complex environmental challenges. For example, in 2016 a team of our researchers surveyed residents of Minnesota's North Shore to explore their views on climate change. Among other questions, they sought residents' views on changes and impacts occurring globally relative to those predicted locally—for example, higher average summer temperatures, more intense precipitation events, a decrease in maximum wintertime snow depth, and a later average date when snow levels reach the one-foot depth that is desirable for many winter sports. Not surprisingly, survey respondents were much more concerned about local changes and impacts than global ones. From these and others of our studies, we can stress a recommendation for those working to boost local public engagement or promote behavior changes to mitigate climate change: focus your efforts on the local landscapes with which your target audience connects. A feeling of

Sunset relaxation at Shadow Falls overlook, Saint Paul. Image courtesy of Visit Saint Paul.

connection to a place can be a powerful driver for environmental values and actions.

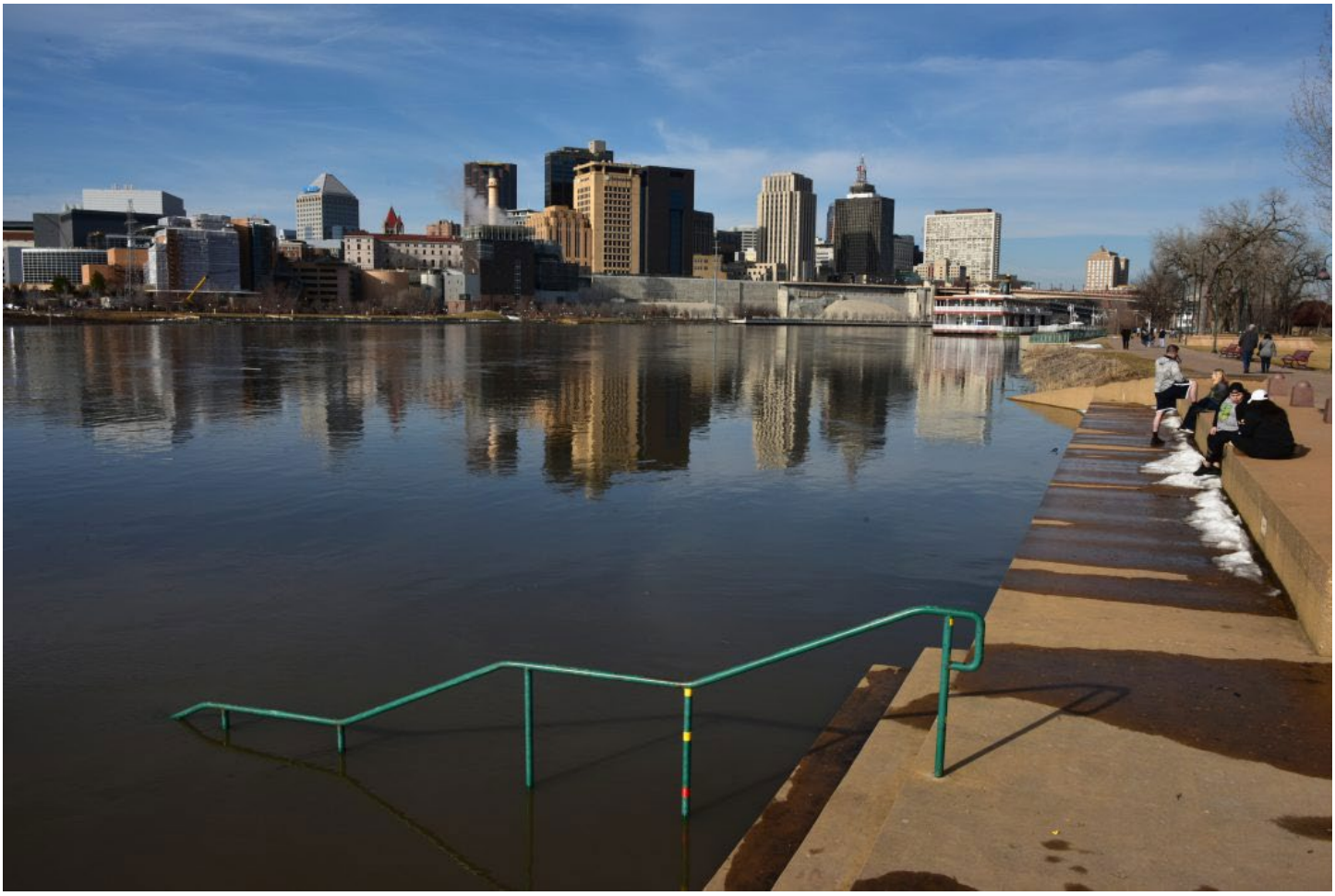
The connection between people and their community is not the only kind of connection that we think about at CCL. Indeed, the connection concept has multiple applications to our work in the context of current environmental challenges. There is the interconnectedness of landscapes—especially via water bodies—and how (or whether) people understand the potential impact of upstream actions on downstream water bodies. There is also the importance of connections in the form of collaboration. The increasingly apparent effects of climate change point out the need to replace "silo thinking" with collaboration across sectors, levels, and locations, to cope with and limit its impacts. Recognizing the pressing need for collaborative connections, the Center for Changing Landscapes created the seminar series "Climate Connections" to support existing connections and forge new ones among Twin Cities' environmental professionals and those whose work is impacted by climate change. The seminars are designed to create space for networking and conversing across sectors, and to facilitate knowledge sharing related to problems or solutions.

Saint Paul's riverfront historically has lacked opportunities for human connection and access to the river. Image courtesy of Visit Saint Paul.

Climate Connections Seminar—Exploring Connections

A fall 2018 Climate Connections seminar explored all these forms of connections in relation to the future of the urban Mississippi River in St. Paul. Our starting point was the pathbreaking work of the Great River Passage Initiative (GRP) to both increase the physical connections between downtown St. Paul and the river, and to facilitate the sense of connection that the city's residents and visitors feel to the urban Mississippi. In alignment with CCL's North Shore study findings, the GRP builds on the idea that helping people feel more connected to their local stretch of river will boost the public's value of and willingness to invest in protecting river health and quality; it will also bolster the river's value to the city. The scenic and cultural value of the river was long neglected by nineteenth- and twentieth-century city planners and developers, who viewed the river largely for its utility. In contrast, the GRP Master Plan, adopted in 2013 by the St. Paul City Council, presumes that improving human access to and connections with the river will fuel St. Paul's vitality and enhance its identity as a nationally esteemed river city.

At the seminar, Mary deLaittre (then GRP initiative manager; now executive director of the GRP Conservancy) spoke about the GRP's



Mississippi River flooding in 2019, near downtown Saint Paul. Image courtesy of August Schwedfeger (http://schwerdfeger.name).

visionary, connection-building projects and goals for St. Paul's 25 urban riverfront miles, detailing three efforts currently being launched. The first is a "River Balcony," which is conceived as a "publicly accessible bluff-edge experience" running through downtown, facilitating greater connectivity between people and the riverfront. The second is a River Learning Center to house river-oriented educational programming and potentially the local National Park Service headquarters. The third is the East Side River Initiative aimed at rejuvenating a 2,000-acre largely industrial area below St. Paul's East Side bluffs. Yet even as she spoke enthusiastically about these projects and the overarching vision of a solidly river-identified city, deLaittre acknowledged the complications posed by climate change to the GRP's planning and implementation work.

For example, the potential for more extreme water-level fluctuations limits which investments and developments are feasible near the river's edge, and how riverside programming and businesses are run. Planners, policymakers, and citizens must face the increased probability of extreme weather-related complications such as floods, landslides, blowdowns, and droughts. According to deLaittre, "The reality of climate change must be factored into everything we do." It necessitates the prioritization of flexibility in all project concepts and implementation.

Indeed, climate change throws an unprecedented monkey wrench in our societal drive to plan and design landscapes and assume stability of infrastructures into the future. Planning related to rivers may be especially challenged;

Mississippi River flooding in 2011 at Harriet Island Regional Park, Saint Paul. Image courtesy of August Schwedfeger (http://schwerdfeger.name).

as meteorologist Paul Huttner said in a Spring 2016 *Open Rivers* interview, rivers are "a barometer of climate change," highly vulnerable to the extreme weather volatility that is one of its hallmark features. The Mississippi basin offers strong evidence to support that assertion, including severe rain-induced flooding that caused massive, costly damage and loss of life in St. Louis and Cape Girardeau, Missouri in 2016. Our Minnesota section of the Mississippi has not escaped the increased volatility. In just over two months of 2013, the water level at St. Cloud went from the seventh-highest to the third-lowest reading ever. Downtown St. Paul has experienced flooding multiple times in the past decade, including in 2010, 2011, 2014, and 2019. The 2014 flood saw the Mississippi river cresting at over 20 feet near downtown, making it the sixth-highest crest on record. While flooding isn't new, climate change has likely fueled the frequency and intensity of extreme rain events in many areas, which can magnify the difficulties of protecting downtown infrastructure and residents, and necessitate greater coordination to do so (Mallakpour and Villarini 2015; Maurer et al. 2017).

Landscape Connections

The increased weather volatility associated with climate change spotlights the river's function as a landscape connector. Extreme rain events can cause sharp spikes in the amount of trash, soil, nutrients, and other pollutants washed into waters and carried from upstream landscapes to downstream. During the Climate Connections seminar, Patrick Hamilton, director of Global Change Initiatives at the Science Museum of Minnesota, stressed that "the future of our urban river will be determined by the decisions we make upstream." He stated that one of the Mississippi's most valuable functions is supplying drinking water to 1.1 million Twin Cities residents. Currently, the quality of this river-sourced drinking water is good. He gave substantial credit to the Twin Cities' excellent water management investments, especially our well-designed urban stormwater system. But he alluded to the connection theme in noting the critical water-protective function of the forested headwaters landscape. Intact, forested riparian areas and watersheds are known to perform important water quality functions, including stabilizing and filtering nutrients and sediments, moderating water temperatures, and regulating downstream flow (Haigha, Jansky, and Hellinc 2004). Upstream land use changes—namely the rapid conversion of forested lands to agricultural production—have been linked to increased downstream sediment and nitrate levels. Climate change substantially complicates that picture. Increased precipitation and shifts in seasonality of precipitation are further driving increases in soil runoff. In a future that likely holds more frequent and extreme rain events, and thus more runoff, it is reasonable to expect increased water quality challenges in the urban stretch of the Mississippi.

While water quality degradation clearly relates to the connection theme, so does protection. As Hamilton asserted, the long-term protection of our urban river will depend upon the implementation of upstream land-use practices and management. He named several land management strategies he considers critical for long-term protection of the urban river: reducing loss of forest lands in the headwaters region, promoting and expanding the use of perennial and cover crops on upstream agricultural lands to reduce soil runoff, and supporting the use of converted agricultural lands for solar energy production, noting the corollary benefit of facilitating the necessary energy infrastructure transition. He added that farmland with solar panels can simultaneously benefit farmers economically by supporting cattle grazing or the production of certain crops.

Connection as Collaboration

The climate change context accentuates the importance of connections in the form of collaboration in landscape planning initiatives such as the Great River Passage. During the fall 2018 Climate Connections seminar, Dr. Kate Brauman, lead scientist for the Global Water Initiative at the University of Minnesota Institute on the Environment, spoke about the pressing need for collaboration among scientists and city planners and leaders given the difficulty of predicting specific climate change impacts in a given area or for a given body of water. As the GRP planning and implementation processes illuminate, planners need good data to inform their long-term visioning and planning around the urban river. Brauman explained that good computer models, built from an accumulation of solid data, can lead to stronger and more meaningful predictions that can effectively guide planning in the face of uncertainties. However, scientists must seek and receive input from city planners and leaders to understand what kinds of data are most needed and useful, and they should undertake targeted research explicitly to help leaders plan for and respond to real-world challenges. Collecting and sharing meaningful data is crucial for informing the visioning and planning of our future landscapes. Good data can also help

Researchers with UMN Center for Changing Landscapes have found that for natural resource professionals, building strong relationships and working in genuine partnership with landowners can substantially improve the outcome of water quality protection efforts. Image courtesy of the Center for Changing Landscapes.

focus conversations on necessary technical and policy solutions. For example, data indicates that increasing water storage capacity in upstream agricultural lands can help protect urban water quality by reducing runoff (Johnston, Braden, and Price 2006). Brauman stressed that "building resilient landscapes will require leaders who can absorb scientific data and translate findings into policy."

Clearly, accomplishing the essential upstream landscape protection and runoff reductions to protect the urban stretch of the Mississippi will require more than data. It will require engaging upstream landowners to embrace and implement key land-use practices. Our CCL research has shown that for natural resource professionals, building strong relationships and working in genuine partnership with landowners can substantially improve the outcome of water quality protection efforts (Nelson, Davenport, and Kuphal 2017). Meaningful water quality protection will also likely require state and federal funding to support shifting upstream agricultural practices and potentially to compensate farmers for implementation of key practices. That, in turn, may require a concerted effort to cultivate a more nuanced public understanding of the upstream-downstream connections, not to mention the value of upstream investments and support for leadership dedicated to taking the necessary steps forward. As Brauman stressed, ensuring that our upstream Mississippi landscape is resilient and our downstream water quality remains good in a climate-altered future will require "systematic approaches, not piecemeal ones."

Overall, the Climate Connections seminar highlighted the multiple forms of connection—to place, within landscapes, and among sectors—in relation to long-term visioning, planning, and

Kayakers enjoying the urban Mississippi River. Image courtesy of Visit Saint Paul.

protection of the urban Mississippi. By improving connections between people and the river, the GRP promises to elevate the river's civic and cultural value. However, in the face of climate change, we must invest in building, demonstrating, and understanding connections across sectors, across the landscape, and between humans and their environment, if we are to fundamentally preserve the river's health and value for the long term.

References

Brehm, Joan, Brian Eisenhauer, and Richard Krannich. 2006. "Community Attachments as Predictors of Local Environmental Concern." *American Behavioral Scientist* 50 (2): 142–165.

Gosling, Elizabeth, and Kathryn J.H. Williams. 2010. "Connectedness to Nature, Place Attachment and Conservation Behavior: Testing the Theory among Farmers." *Journal of Environmental Psychology* 30 (3): 298–304.

Haigha, Martin, Libor Jansky, and Jon Hellinc. 2004. "Headwater Deforestation: A Challenge for Environmental Management." *Global Environmental Change* 14: 51–61.

Johnston, Douglas M., John B. Braden, and Thomas H. Price. 2006. "Downstream Economic Benefits of Conservation Development." *Journal of Water Resources Planning and Management* 132 (1): 35–43.

Junot, Amandine, Yvan Paquet, and Fabien Fenouillet. 2017. "Place Attachment Influence on Human Well-being and General Pro-environmental Behaviors." *Journal of Theoretical Social Psychology* 2: 49–57.

Maurer, Edwin, Gretchen Kayser, Laura Doyle, and Andrew Wood. 2017. "Adjusting Flood Peak Frequency Changes to Account for Climate Change Impacts in the Western United States." *Journal of Water Resource Planning and Management* 144 (3): 1–12.

Mallakpour, Iman, and Gabriele Villarini. 2015. "The Changing Nature of Flooding across the Central United States." *Nature Climate Change* 5: 250–254.

Nelson, Paul, Mae Davenport, and Troy Kuphal. 2017. *Inspiring Action for Nonpoint Source Pollution Control: A Manual for Water Resource Protection*. St. Paul: Freshwater Society.

Pradhananga, Amit, and Mae Davenport. 2017. "Community Attachment, Beliefs and Residents' Civic Engagement in Stormwater Management." *Landscape and Urban Planning* 168: 1–8.

Scannell, Leila, and Robert Gifford. 2010. "The Relations between Natural and Civic Place Attachment and Pro-environmental Behavior." *Journal of Environmental Psychology* 30 (3): 289–297.

———. 2017. "The Experienced Psychological Benefits of Place Attachment." *Journal of Environmental Psychology* 51: 256–269.

Stedman, Richard. 2002. "Toward a Social Psychology of Place: Predicting Behavior from Place-Based Cognitions, Attitude, and Identity." *Environment and Behavior* 34 (5): 561–581.

Recommended Citation

Green, Emily, Bree Duever, and Amit Pradhananga. 2020. “The Urban Mississippi: Valuing Connections in a Changing Climate.” *Open Rivers: Rethinking Water, Place & Community,* no. 16. https://editions.lib.umn.edu/openrivers/article/the-gift-of-water/.

DOI: https://doi.org/10.24926/2471190X.6874

About the Authors

Emily Green has worked as a researcher, writer, and editor with the Center for Changing Landscapes (CCL) since 2017. She is passionate about exploring the constraints and motivators for civic engagement in water protection and climate change action among different communities, and working to understand and promote connections of all kinds among people, issues, and landscapes. Emily has an M.S. degree in conservation biology from the University of Minnesota and an undergraduate degree in English. She lives in south Minneapolis, within blocks of the Mississippi River, and walks along the river pathways most days of the year. Apart from her CCL work, she is active in her neighborhood and Minneapolis Park Board initiatives to protect and restore the unique Mississippi gorge.

Bree Duever is a researcher at the Center for Changing Landscapes where she is involved with research projects focused on community-centered decision making with our water resources. Bree is also the logistics coordinator for the Kawe Gidda-naanaagadawendaamin Manoomin project, a collaboration between University researchers and tribal partners to better understand and protect wild rice. Her research interests include exploring what creates meaningful natural resource consultation between state agencies and tribal nations and how to support inclusive decision making in natural resource management. She obtained her B.A. in English at the University of Wisconsin Stevens Point and her B.S. in environmental sciences, policy, and management from the University of Minnesota Twin Cities. Bree lives in south Minneapolis and enjoys exploring the many state parks throughout Minnesota with her family.

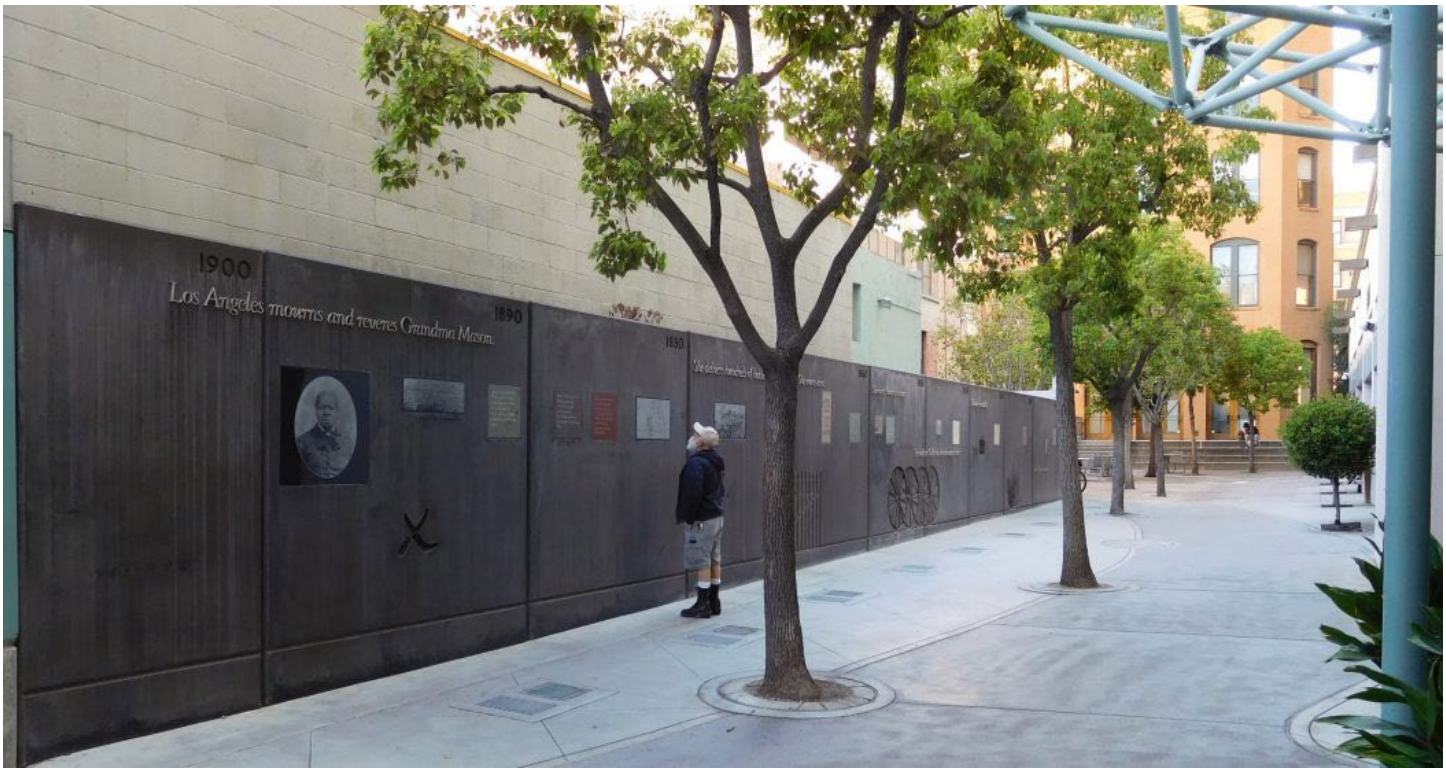
Amit Pradhananga has worked as a senior researcher with the Center for Changing Landscapes since 2006. In that role he designs and leads research projects focused on exploring the human and policy dimensions of natural resources especially related to water resources, invasive species, parks and trails management, and climate change adaptation; and investigating the drivers and constraints of conservation behavior and community engagement in natural resource management. He is especially interested in understanding constraints and strategies to engage racially and ethnically diverse community members in natural resource issues and water resource protection. Amit has a Ph.D. from the University of Minnesota. He is from Nepal and has lived in Minnesota for 15 years.

PRIMARY SOURCES

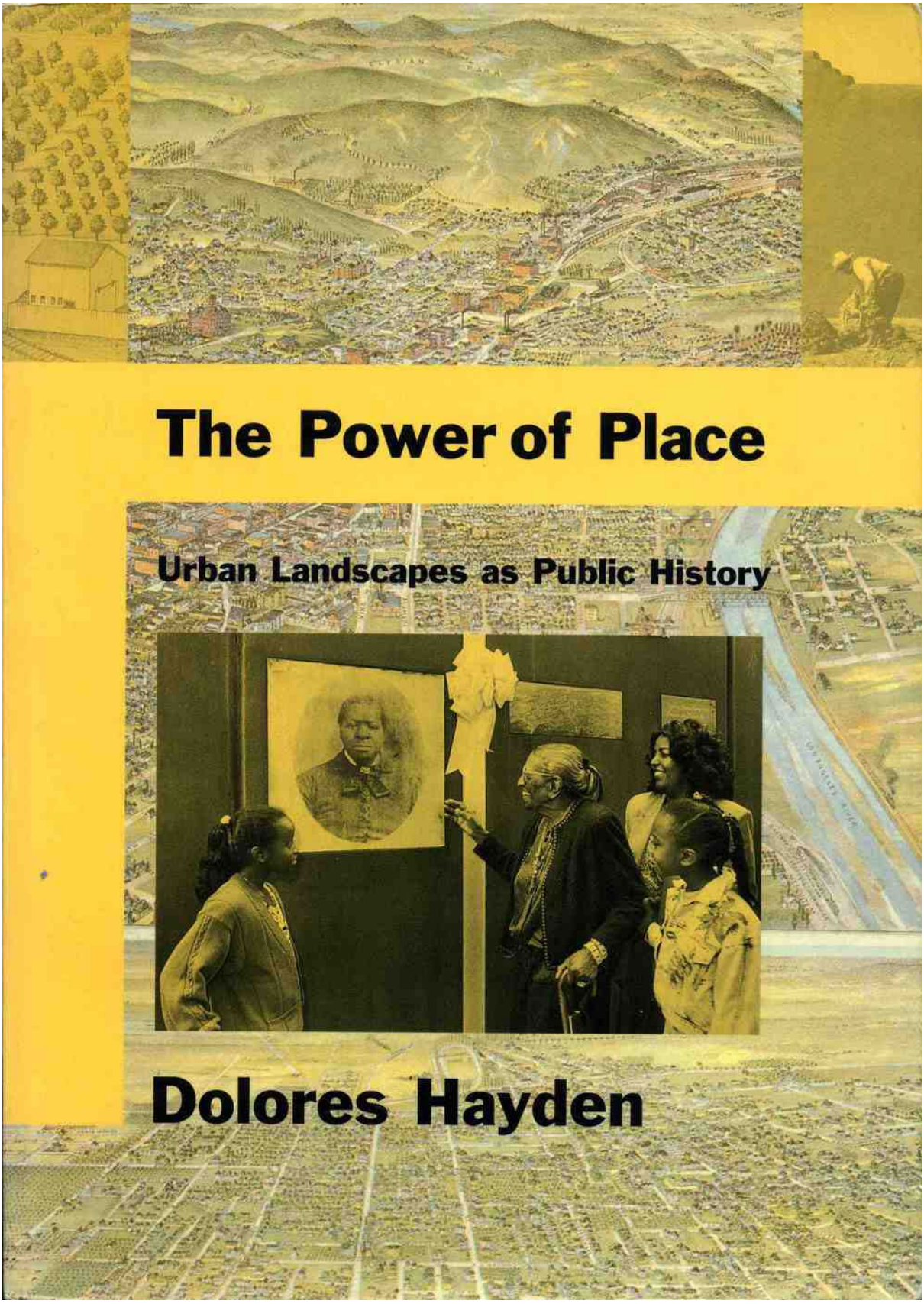
THE POWER OF PLACE: FINDING ENDURING VALUE(S) IN THE LANDSCAPES THAT SURROUND US

By Patrick Nunnally

Dolores Hayden's book, *The Power of Place: Urban Landscapes as Public History* (1995), has been a "primary source" for my thinking and practice since it came out in the mid-1990s. By "primary source" I mean a text and set of ideas that I come back to over and over, that have informed my work so deeply that I can actually now no longer remember how I did my work before I came across the book. It is therefore "primary" for me in the sense that it has become a starting point, a foundation for many generative ideas that have found their way into my teaching, writing, and program work. And it is a "source" because I turn to it again and again, finding new concepts, expressions, and ways of thinking every time.



Biddy Mason park, a surprising "pocket park" in downtown Los Angeles honoring Mason who was moved to California as a slave in 1850, was freed, and became a successful midwife and landowner. Image courtesy of Don Barrett (CC BY-NC-ND 2.0).



Hayden, Dolores. 1995. 'The Power of Place: Urban Landscapes as Public History.' Cambridge: The MIT Press.

Hayden's book arises from and describes the Power of Place project, which she and colleagues conducted at UCLA for several years in the 1980s and 1990s. The heart of the project was to make vivid places in the urban landscape that have been underrepresented or misrepresented by planners, preservationists, and many academic historians, landscapes important to working class communities, women, racial or ethnic groups. Working in response to historic preservation practice at the time, the Power of Place project highlighted how the histories of communities can be and should be part of the urban landscape, even if the material connections to that place are gone. For example, the pre-World War II Japanese flower market on First Street in Los Angeles was eradicated by the forced removal of Japanese and Japanese-Americans during the war. Although the buildings themselves are gone, the Power of Place worked with descendants of the market growers to understand its importance and develop artistic representations of the flowers to be etched into the sidewalk on the site of the old market.

There are two parts of the book that I return to over and over in my teaching and practice. The first part is the way Hayden defines a sense of place, grounding her work in particular places and their histories. As she puts it, "'Place' is one of the trickiest words in the English language, a suitcase so overfilled one can never shut the lid. It carries the resonance of homestead, location, and open space in the city as well as a position in a social hierarchy" (15). Not only does she create space for a sociocultural as well as physical dimension of "place," but she also attends to the varieties of physical spaces that hold meaning and memory for people. Rather than just being concerned about monumental architecture, or "natural" areas, she acknowledges that "natural features such as hills or harbors…frame the lives of many people and often outlast many lifetimes" (9). Drawing these two components together is what made this work innovative at the time and why it continues to resonate today.

The other foundational concept in the book for me is Hayden's use of story to amplify themes that cut across usual ways of understanding population differences. Admittedly, "story" and "theme" are very broad-based ideas, but Hayden brings them together when she writes, "public culture needs to acknowledge and respect diversity, while reaching beyond multiple and sometimes conflicting national, ethnic, gender, race, and class identities to encompass larger common themes, such as the migration experience, the breakdown and reformulation of families, or the search for a new sense of identity in an urban setting" (8–9). The means by which these themes are heard, understood, and shared is often through story.

Biddy Mason's story makes up the center of Hayden's book and is perhaps the most well-developed project by the Power of Place. Mason came to Los Angeles in 1851 as a slave and won freedom for herself and her family in an 1856 court case. From that point until her death in 1891, she was a pillar of Los Angeles' small African-American community, serving as a midwife, and holding status as a homeowner and community builder. From her earnings, she was able to purchase several lots in what is now downtown Los Angeles, and transfer them to members of her family, establishing an important presence in the city. Working with local community partners and artists, the Power of Place project helped establish Biddy Mason Park in this area and inscribe the presence of her community onto public space bounded by Third and Fourth Street, between Broadway and Spring Street. Biddy Mason's story is a woman's story, an African-American story, an entrepreneurial story of community formation. Her story defines intersectionality without using that term specifically.

Case studies from the Power of Place project make up much of the book, but it's important to understand that the practice, and the book, are grounded explicitly in theoretical concepts that continue to have currency in the academy

Portrait of Biddy Mason (1818-1891).

and elsewhere. I am not a theory-forward practitioner, but I do understand the ways Hayden invokes the work of Henri Lefebvre in her work. For Lefebvre, societies organize spaces to enact both economic production and social reproduction. With apologies for drastically oversimplifying complex ideas, I would extend the point to say that American cities, and the countryside also, for that matter, can be usefully understood through the lens of these twin imperatives. The creation of wealthy and working-class neighborhoods, or the spatial relationships that have wealthy people in proximity to environmental assets while low-income people and communities of color are located near environmental hazards, are not accidental or the result of some "natural" set of forces that determine how cities are laid out. The histories of who has been placed in relation to which waters—whether the monumental waters of Twin Cities lakes and the Mississippi River or mundane waters of creeks that overflow—is a central part of my work and my own public-facing scholarship; Hayden and Lefebvre help me articulate the narratives of how the world we inhabit was created. Public-facing scholarship needs strong, accessible theoretical bases for the claims that it makes about public issues, theoretical frameworks that can sometimes be taken for granted within a discipline. It's not always sufficient to tell members of the public, or agency staff, that "the Mississippi River is a created place." Making the argument that the river has been shaped for economic means since settlers arrived, and that Indigenous societies saw the river as a social as well as economic place can lead to further, fruitful discussions about the multiple futures possible for the river.

So if *The Power of Place* is a "primary source" for me, it behooves me to explain how it is part of my practice. Hayden's conception of themes that respect but that also transcend the identities of particular groups has regularly come to mind as I have worked with various groups planning the future of the St. Anthony Falls Heritage Zone in Minneapolis. For three decades or more, agencies such as departments of the City of Minneapolis, the Minneapolis Park and Recreation Board, and, more recently, the National Park Service, have told stories of captains of industry who conquered the falls and put them to work making flour to feed the world. These are still important stories; General Mills and Pillsbury, both of which originated at the falls, are globally important companies. But my question remains: How do we find river stories that resonate with new residents in the city, or people for whom the traditional pieties about capitalist accomplishment don't mean much? Put another way, what river stories need to be told in this place that will be important to the people of Minneapolis' future, the population of which will more than likely be more ethnically and racially diverse, as well as older, than at present. Perhaps Hayden offers us some guidance when she writes of the importance of "the migration experience, the breakdown and reformulation of families, or the search for a new sense of identity in an urban setting," all of which, I imagine, speak to people who already know the river is important as well as newcomers (9).

Elsewhere in the Twin Cities Mississippi River corridor, planners are pursuing similar strategies. The Minnesota Historical Society has for a number of years been gathering community insights on what stories are central to the place that is now occupied by Historic Fort Snelling, the confluence of the Mississippi and Minnesota Rivers known to Dakota people as *bdote* and considered to be their origin place on earth. Farther downstream, the St. Paul Great River Passage program is very intentionally engaging with a broad cross-section of community members as it plans for the future of this 17-mile stretch of the Mississippi. In both of these instances, as well as the work at St. Anthony Falls, planners are working to create a Hayden-style "sense of place" for the Mississippi beyond its mythologized, Mark Twain–oriented past. River stories must go beyond the simplified mythologies and include Indigenous people, working people, women, communities of color, and others in a more

nuanced understanding of how the urban river system has been changed to meet contemporary needs. Only by adding complexity and transparency to overlooked narratives of our water system (of which the Mississippi River is the most visible part) will we be able to respond appropriately to the climate change that is happening.

Here again, it turns out, Hayden is exemplary. All of her case studies involve finding ways for people in a particular community to tell their own stories, facilitated, perhaps, by a public artist or a graduate student, but owned and directed by the community itself. Hayden's examples show us that adding complexity and nuance to the stories told in and by and about a place is not just a matter of hiring a different consultant, but of listening to the people who have the deepest experience with a place. This change is hard for overworked public agency staff, where often the most efficient approach—hiring someone who has delivered good results in the past—is attractive. But if "placemaking" is not simply to be "place-taking," we must listen to the people who have valued this place before, starting with the communities that are Indigenous.

We can no longer be satisfied telling just the river stories we have told for decades. Although we will always need to have some "River 101" content in our programming, both on campus and off, that is necessary but not sufficient. Issues of a changing climate, and recurring questions of environmental equity and justice demand that we extend the scope and depth of our knowledge, and bring that knowledge to the public in innovative ways. For me, Dolores Hayden's *The Power of Place: Urban Landscapes as Public History* continues to be a roadmap to future work.

Bibliography

Hayden, Dolores. 1995. *The Power of Place: Urban Landscapes as Public History*. Cambridge: The MIT Press.

Recommended Citation

Nunnally, Patrick. 2020. "The Power of Place: Finding Enduring Value(s) in the Landscapes that Surround Us." *Open Rivers: Rethinking Water, Place & Community,* no. 16. https://editions.lib.umn.edu/openrivers/article/the-power-of-place/.

DOI: https://doi.org/10.24926/2471190X.7194

About the Author

Patrick Nunnally coordinates the River Life program in the Institute for Advanced Study at the University of Minnesota. He serves as editor for *Open Rivers* and was one of the lead scholars for the University's John E. Sawyer Seminar which focused on the Mississippi River and was funded by the Andrew W. Mellon Foundation.

TEACHING AND PRACTICE

SCIENCE 101: TEACHING SCIENTIFIC ANTHROPOLOGY IN THE AGE OF "ALTERNATIVE" FACTS

By Olivia Navarro-Farr

I am a professional archaeologist and researcher, but my primary role is that of teacher. I teach a range of courses in both anthropology and archaeology at a liberal arts school in the eastern Midwest. I typically offer at least one or more introductory classes each year. In these classes, students tend to represent diverse disciplines and grade levels whereas in upper division courses, students tend to be geared towards more specialized fields such as anthropology, sociology, and/or archaeology. As an archaeologist who teaches undergraduates, my classes have always dealt with elements of scientific process in research at various levels. One mainstay is discussing how scientists reconstruct ancient climate in order to more fully understand the conditions which

Scorched vegetation inside the Maya Biosphere Reserve at the Archaeological site of El Peruito following attempts to illegally invade the area in 2017. Image courtesy of Ever Sánchez of the Instituto de Antropología e Historia de Guatemala (IDAEH).

gave rise to major changes in paleoenvironment and therefore created conditions within which evolutionary forces could (re)act. Though I have periodically referenced how human-induced environmental changes are wreaking havoc and making impacts on our current evolutionary trajectory that we are ignoring as a global society, much to our detriment, I had not created specific content permitting consideration of these realities from archaeological perspectives. More specifically, I have not devoted, in any one of my classes, a specific section describing the challenges of archaeology in the Anthropocene. Therefore, when asked to contribute to a professional discussion about the Anthropocene and its importance with respect to teaching at a recent professional meeting, my responses to which are the subject of this brief article, I initially felt underprepared. Ultimately, however, I felt participating in this discussion would offer a perfect opportunity for me to learn how others present this information to students. At the same time, it also provoked me to think about the ways that I do cover material related to climate change, and how science literacy in general is so essential to critical thinking. I've also been challenged to deeply consider how I approach content delivery of items such as paleoclimate reconstruction, human-induced climate changes, and the impacts of such changes on our research today. Can I link these items together more deliberately? Can I link these items to present discourses on skepticism about science founded in a lack of trust or understanding of what science is? Can I build

From left, Sarah Van Oss (College of Wooster Class of 2016) and Haley Austin (College of Wooster Class of 2016) seen documenting a stela fragment at the site of El Perú-Waka' in 2015. Image courtesy of Keith Eppich.

this better into my learning goals for my courses? I would say "yes" to all. Before addressing my approaches to (re)considering course content, I provide some context for the discussion as it relates to teaching about science from my own disciplinary perspective.

A necessary feature for teaching about the basics of climate science (for my instructional purposes, as it relates to anthropological interpretations) is science literacy. In my more recent teaching experiences, I have not encountered significant pushback from students' willingness to accept scientific evidence. What I do sometimes encounter, however, is a degree of fear surrounding science-based courses that appears to be rooted in some degree of misunderstanding about science as a practice and as a way of knowing and measuring the world. I will return to this idea later.

The fact that most of the students I have encountered have not needed to be convinced about the validity of science, combined with the inherently progressive and insular nature of academia had resulted in a degree of naive comfort regarding my own broad assumptions that scientific reasoning was largely unquestioned more generally. The result was that I found the overt politicization of science and reactions to it from the far right of our political spectrum ahead of our recent election to be shocking. Since the events that led to the tumultuous and deeply concerning 2016 election and the March for Science that followed, I have been driven to find ways to instruct my students on how to educate others/peers about basic science literacy. I realized that, though my students might not need convincing, they would certainly encounter others in their worlds who would. I began to note that my mission should be to prepare them to encounter ignorance about science with enough literacy to comfortably engage with such thinking.

In order to more critically consider how my course content could more deliberately address humans' involvement with climate change in terms of a more recent and distinguishable geologic time frame, the term widely known as the "Anthropocene," I began to look at the kind of content I already include which is directly relevant to such discourses. I talk in classes about ancient climate, its fluctuations, and how we reconstruct these without spending as much time on how archaeologists can contribute to current discourses on growing illiteracy about science as process. I had not typically incorporated deliberate class discussions about how scientists could participate in the political conversation about policy and change in regard to climate change. Upon reflection I found this unconscious omission to be inconsistent with my deliberate efforts to talk about other forms of advocacy within academic work such as decolonizing archaeology and what archaeologists could bring to that classroom conversation. As I consider what critical conceptual connections I could cover more thoroughly in teaching on the Anthropocene specifically, and on the importance of science literacy more generally, I think it is important to strike a delicate balance between detailing how archaeology can inform a broader public on *both* (1) how pasts elucidate our present *and* (2) how pasts cannot be directly compared with current circumstances. This seemingly contradictory position presents a subtle dichotomy that must be carefully explained. I am not of the view that we can look to the past to extract seemingly convenient analogues of climate-related social perils and directly compare these with current systemic and global environmental crises. I do not favor using ancient people as examples for how we can and should do better today. I do believe, however, that we can look to the past to retrieve broad trends and explain that over *very* long periods, climate does fluctuate and that such fluctuations cannot be compared with the yearly extreme variances we see today.

In discussions on climate science, I include a cursory review of paleoclimatic reconstruction and its importance for understanding ancient evolutionary changes. I discuss that global climate has undergone numerous drastic changes, that Milankovich cycles have been identified as key to these processes, and that we have been able to reconstruct these changes over periods of deep time that coincide with changes in fossil evolution and structures of migration, adoption of agriculture, and the rise and fall of populations centers throughout the ancient world. It would be entirely appropriate to explain (1) how archaeology permits an understanding of how ancient climate fluctuations across time and space have impacted ancient evolution and history and then segue to (2) what this helps us understand about the far more drastic human-induced causes we see in this Anthropocene era (which would more appropriately be considered the result of global capitalist forces, an idea I return to below). The utility of archaeology here, as I see it, is not in explaining what we might learn from ancient cases of environmental mismanagement (which I believe is itself a deeply flawed notion) but rather that archaeological questions have helped pioneer advances in paleoclimate reconstruction. These efforts permit real advances in climate science. These not only give us clues to the past but help us track the devastating impacts of global capitalism on our climate in real time.

I talk about paleoclimate reconstruction in my archaeology introductory courses and in my physical anthropology courses. My goals, in both instances, are to provide context. The context varies with the details of the courses. For example, in archaeology class I focus on how paleoclimate reconstruction allowed archaeologists to reconstruct the peopling of the Americas. In the physical anthropology class, paleoclimate reconstruction plays a much more central role throughout the course. Specifically, it permits reconstruction of the changing climatic and environmental circumstances which shaped and conditioned fossil hominin and primate evolutionary processes through natural selection adaptations. In terms of the impacts of climate change on research, I discuss certain examples, such as permafrost thawing and the emergence of evidence from Arctic conditions (one example is the naturally mummified remains of a man dating to between 3400 and 3100 B.C.E. discovered in the Otztal Alps known popularly as Otzi) as well as how submerged coastlines and coastal sites makes research on Paleoindian coastal route migrations challenging. In my upper division Archaeological Method and Theory course, we discuss partnerships between ecologists and archaeologists with cases from the Andes and the American Southwest, detailing how a closer collaboration between archaeologists and ecologists can provide important avenues for reintroducing ancient and highly sustainable agricultural practices.

One topic I also cover in both my Introductory Archaeology and in my First Year Seminar course deals with human-induced climate change and the "collapse" of the Maya. Though I handle this issue in both classes, I treat it in far greater detail in my First Year Seminar course, titled "Ancient and Modern Maya Worlds." In that class, we discuss how the Maya are conveyed to publics through five primary and popular discourses. These include the film *Apocalypto*, the Maya "collapse," the 2012 phenomenon, tourism, and museums and looted ancient Maya art. Good, bad, or indifferent, these discourses tend to frame most modern (Western) publics' knowledge of these complex people. The problem arises when dominant voices in those discourses (commanding the most attention and incurring the greatest profits) are people with actually limited knowledge of the ancient and modern Maya. One of those discourses we discuss and challenge, drawing on archaeological responses (see McAnany and Yoffee 2010) is that presented by UCLA Professor of Geography Jared Diamond (2005) through his book, *Collapse: How Societies Choose to Fail or Succeed*. Diamond devotes a chapter to the ancient Maya collapse as

Dr. Matt Ricker, North Carolina State University, doing a soil core in the northeast tank at the site of El Perú-Waka'. Image courtesy of Damien Marken.

a result of environmental degradation and therefore as a warning narrative about how societal failure resulted from long-term environmental mismanagement. The balance here is explaining the importance of understanding human influences in delicately balanced ecologies and biotopes while also struggling against Diamond's far-reaching and influential voice as his discourse appears to fault ancient peoples (the Maya, the ancestral Puebloans, etc.) for their own demise. Emphasizing the latter is problematic because it reads to wider audiences as blame of ancient Indigenous peoples for past societal demise rather than focusing on resiliency, long-term success, and the achievement of balance in an otherwise challenging environment over millennia. The ancient episodes of societal shifts which Diamond characterizes in the title of his book as "failure" are complex and deserve nuanced consideration. They can hardly be used to contextualize or be compared with circumstances which frame contemporary challenges, including modern post–industrial capitalist zeal for the bottom line and fossil fuel industry at the cost of humanity and, in particular, at greatest cost to those most on the margins of our globalized world. Current reliance on fossil-fuel capitalism endangers greater scales of planetary systems, both social and biophysical.

Therefore, my response to this problematic discourse is not to suggest that the Maya or any other ancient or indeed modern people do not modify their environment, nor do I suggest that such modifications won't be potentially detrimental in the longer term. What I do suggest is that the discourse comes across as blaming the ancient Maya and using a poorly understood narrative about their cultural demise as a lesson for contemporary Westerners about how to avoid perils we face today. The problems of this approach are directly analogous with those that uncritically blame humans for modern environmental degradation. We know this to be a supremely complex process, though the term "Anthropocene" would seem to suggest it can rather simply be attributed broadly to humans, rather than more rightly blaming structures of modern capitalism for their role in perpetuating these troubling patterns. Following scholars such as Jason Moore (2016, 2017), a more appropriate (though far less utilized) term would be the Capitalocene. The blaming of humanity without looking to the capitalist structures that create our circumstances is just as irresponsible as painting the ancient Maya collapse as an environmental disaster narrative (rather than as that of a political institution), and comparing the consequences of it with the extravagances of our modern post-industrial capitalist system. The material I teach aims to draw students' attention to these complexities and questions; part of that critical inquiry is using scientific reason to contest narratives which can do real damage to Indigenous and descendant communities.

As stated earlier, though I do emphasize issues concerning climate science in various classes, I have more recently paid greatest attention to emphasizing a deeper understanding of science as process and science literacy in nearly all the classes that I offer to anthropology, sociology, and archaeology students. Central to my efforts is gaining a better understanding of how my students react to this information. This work has yielded some interesting insights. In my physical anthropology class, I've focused most intently on instilling a focus on science literacy precisely because this course fulfills science credit requirements. My sense is that this course may be deemed less daunting than other "hard science" courses (such as chemistry or biology) and thus more amenable to social science students who have some trepidation about those other fields. This class is therefore an important "gateway" science course and may be one of the few such courses the social science and/or humanities-centered students take during their four years. From that perspective, this presents a real opportunity to educate an audience with mixed feelings about hard science classes. In the first two weeks, I

focus on how we define and understand science. I begin on our first day by distributing a PBS-based science survey form available through their program on evolution distributed by NOVA. After that first day, we go on to discuss why science matters for social policy and review an historical lesson on science in politics through the PBS documentary "Judgement Day: Intelligent Design on Trial." This documentary reviews the case of *Kitzmiller v. Dover Area School District* of Dover, Pennsylvania, which evaluated whether or not intelligent design could be considered science and therefore included in school science class discussions as an alternative to Darwinian evolutionary theory. We then talk about what science is and why that question matters. We follow that conversation with the results of the science survey. The survey has the advantage of being short and straightforward. Students must survey at least four individuals of varied ages and backgrounds with the list of questions provided. I have never crunched the numbers on these data because I pass work back during the semester, so I don't have responses in my possession. What I *can* present here are my impressions of some of the qualitative responses that students have talked about in our class discussions, which are telling. The two survey questions which yield the most interesting and widely discussed responses in our classes are as follows: (1) What is science? (2) Do you like science? Why or why not? Many of the students find their respondents have a wider-ranging understanding of science than they might express. Many who have ill-formed ideas about science express a decided fear about science. Specifically, our educational predilection for grades has left many with a fear that science is out of reach or simply too labyrinthine to achieve a satisfactory grade. Those who may not see themselves performing well, academically speaking, in science are those who tend to express that they do not like science. I've used the exercise to start a conversation on how misunderstanding and/or fear of science may lead to rejection of it—though science need not be an endeavor that is out of reach. Rather, given the fact that many of my students are in the social science fields, I attempt to speak to them as scientists in training and instill an understanding that science as process is a clear path to critical thinking. We work on unpacking terminology—exploring complex words like empiricism (the idea that all knowledge derives from sensory, and therefore independently verifiable, observation) and falsifiability (a test of science which is that scientific questions must be disprovable or falsifiable). These terms can be confusing if not spelled out specifically in terms of how they are meaningful within scientific understanding. As with these complex concepts, even far simpler terms, because of their colloquial familiarity, can be profoundly misunderstood in scientific contexts. A major example is the term "theory" which is frequently synonymized with terms such as "hunch." We talk about how "theories" in science are not mere hunches or untested ideas based on one's "gut feeling." But, because of this unfortunate conflation, scientific theories can be questioned in popular discourse precisely because of the frequent association of "theory" with the idea of a "hunch" which may result in its being easily dismissed by popular audiences who are unfamiliar with the definition of the word "theory" in a scientific context. We who teach may assume the word "theory" is understood in a scientific context—but if it is not, the results can be disastrous. That entire process of unpacking terminology is the basis for scientific literacy; however, I would not have understood that I should probe students on these and other assumptions had I not introduced the aforementioned short survey which revealed this pattern to me. When we discuss our survey results, the students are always entirely engaged and really enjoy talking about what they've learned from their results about how people think of science. We also talk about how scientific opinion is not shaped by the opinions of people on the street. Science is not a democracy of ideas, but a competitive arena for seeking solutions to challenging problems. It is driven by skepticism, empiricism, and replicability through experimentation.

Further, we consider the difference between thinking of science as a subject in school versus as a way to understand the world; we also consider the importance of scientific literacy in the twenty-first century, a time when science influences every aspect of our lives from shopping at the grocery store (genetically modified food), to choosing a car (environmental implications), to voting on political issues (global climate change and increased frequency of extreme weather events, health, habitat conservation, and technology). The nexus of these ideas with the results of their surveys always provides an important starting point for grasping why science literacy is so fundamental to critical thinking.

Increased deliberate engagement of science literacy with students and teaching them to be advocates for science is also relevant in view of the discussions we are currently having on our campus as we look to broader curricular changes. These changes include questions about how to more effectively bring the sciences and the humanities together on concerns about social justice, and how to combat perceptions that antagonism exists between STEM (science, technology, engineering, and math) fields and the humanities. As an archaeologist of the ancient Americas, I see myself straddling these perceived gulfs almost daily. Regarding the importance of social justice issues with respect to science and/or STEM specific fields, I argue that a focus on global climate change and its impacts (including but not limited to unsustainable levels of energy use, the impacts of the green revolution, invasive species, the fossil fuel industry, and unchecked corporate interests that exploit sacred and protected landscapes home to diverse habitats and species) are inherent to issues of social justice. At greatest risk in our inexorable move beyond sustainability and a point of no return are those at the margins of our global communities—those who have long been exploited most vigorously and whose practices have been undermined and rendered obsolete by industrial scale agriculture and monocropping. These communities will be affected most severely by our inaction. We have seen the vulnerable Caribbean islands, including our own people of Puerto Rico, destroyed by a string of devastating hurricanes made deadlier by ever warmer sea temperatures. Our global economic policies have long exploited Puerto Ricans, rendering them colonized peoples without even the ability to represent themselves in our national government. Since that devastation I have seen museum experts and archaeologists scrambling to protect those at-risk cultural resources while people remain for months afterwards without basic utilities. As I see it, if I am to do better, and if I am to connect science discourse with social change, it is on behalf of those most vulnerable to these exploitative practices that I should be raising my voice while continuing to draw my students' attention to those disparities.

Acknowledgements:

I wish to thank Phyllis and Skip Messenger for their invitation to participate in the session on "Integrating Climate Change into Archaeological Curricula" at the Society for American Archaeology in Washington, DC. I would also like to thank Brent Woodfill, Laurie Moberg, and another anonymous reviewer for their feedback on this paper. I am grateful to my colleagues within the Departments of Sociology and Anthropology and the Program in Archaeology at the College of Wooster for fostering a positive mentoring environment in which I have been thoroughly supported in my efforts to grow as a teacher and a scholar. I am also grateful to the College Administration, the Office of the Dean for

Faculty Development, the Office of the Provost, the Office of the President, my faculty colleagues of color, members of the Educational Policy Committee, and colleagues across campus for pushing to enrich our curricular thinking in meaningful ways. Finally, most importantly, I wish to thank all the students I've had the pleasure of working with who have consistently challenged me to consider new and innovative ways to approach pedagogy, social justice, and critical thinking in my classes; it is for them that I do this work.

References

Diamond, Jared. 2005. *Collapse: How Societies Choose to Fail or Succeed*. New York: Viking Press.

McAnany, Patricia and Norman Yoffee, eds. 2010. *Questioning Collapse: Human Resilience, Ecological Vulnerability, and the Aftermath of Empire*. Cambridge: Cambridge University Press.

Moore, Jason W., ed. 2016. *Anthropocene or Capitalocene?: Nature, History, and the Crisis of Capitalism*. Oakland: PM Press.

———. 2017. "The Capitalocene, Part I: On the Nature and Origins of our Ecological Crisis." *The Journal of Peasant Studies* 44 (3): 594-630.

Recommended Citation

Navarro-Farr, Olivia. 2020. "Science 101: Teaching Scientific Anthropology in the Age of 'Alternative' Facts." *Open Rivers: Rethinking Water, Place & Community,* no. 16. https://editions.lib.umn.edu/openrivers/article/science-101/.

DOI: https://doi.org/10.24926/2471190X.7156

About the Author

Olivia C. Navarro-Farr is associate professor of anthropology and archaeology in the Department of Sociology and Anthropology and Chair of the Program in Archaeology at the College of Wooster in Wooster, Ohio. She has worked in the Maya area since 1997 on projects in Belize, Mexico, and Guatemala and she currently directs research at the Proyecto Arqueológico Waka' (PAW) with Juan Carlos Pérez Calderón. She has published selections in various edited volumes as well as a co-edited book (with Michelle Rich) *Archaeology at El Perú -Waka': Performances of Ritual, Memory, and Power* detailing research at ancient El Perú -Waka'. She has directed investigations at Waka's primary civic-ceremonial structure (M13-1) since 2003. Her interests include the archaeology of ritual, monumental architecture, site abandonment processes, and the role of royal women in Classic Maya statecraft.

EDITORIAL

THANK YOU

By *Open Rivers* Editorial Staff

After 16 issues and over four years of publication, *Open Rivers: Rethinking Water, Place & Community* continues both to expand the range of conversations to which we contribute and to connect with new contributors, readers, and communities. Issues 13–16 encourage our audience to explore how water is implicated in questions of injustice and inequality, how the ancient past might inform responses to climate change, how story might reconfigure how we engage with water and each other, and how fluctuations in water quantity (and quality) shape our social worlds. These questions push us to reach across difference, across communities, across professional sectors, and across disciplines, and in doing so, they represent *Open Rivers* at its best.

This work has been made possible through the support and collaboration of our editorial board members, guest editors, writers, and reviewers. The editorial team, on behalf of the University of Minnesota Institute for Advanced Study and our partners at the University of Minnesota Libraries Publishing Services Division, is grateful to our extensive editorial community for contributing to the ongoing quality and success of this journal.

Bridge over rapids. Image courtesy of Fabian Schneiter.

Contributors

- Mary Jane Acuña
- Debika Banerji
- Karen Bauer
- Hannah Baxter
- Jay Bell
- Rebecca Bria
- Lisa Marie Brimmer
- adrienne maree brown
- Kate Brauman
- Juliet Burba
- Kate Carlson
- Carlos R. Chiriboga
- Christina Collins
- Craig E. Colten
- Jaskiran Dhillon
- Caroline Fidan Tyler Doenmez
- Greg Donofrio
- Bree Duever
- Jayeesha Dutta
- Tracy Fallon
- Tom Fisher
- Britt Gangeness
- Tia-Simone Gardner
- Merle Geode
- Lewis E. Gilbert
- Mark Gorman
- Emily Green
- Jennifer Gunn
- Mahin Hamilton
- Katherine Hayes
- Sarah Holger
- Ashley Ignatius
- Jennifer L. Immich
- Siddharth Iyengar
- Leslie Johnson
- Simi Kang
- Linda Kingery
- Karen Kinoshita
- Douglas Klimbal
- Steve Kosiba
- Kevin Kuehner
- David Todd Lawrence
- Kimberly Long
- Nenette Luarca-Shoaf
- Adriel Luis
- Paula Maday
- Charlotte Melin
- Brianna Menning
- Lewis C. Messenger Jr.
- Phyllis Mauch Messenger
- Melissa Miller
- David Morrison
- Olivia Navarro-Farr
- Tianna M. Odegard
- William G. B. Odum
- David Naguib Pellow
- Amit Pradhananga
- Alexander E. Rivas
- Jessica Rossi-Mastracci
- Tim Ruzek
- Laura Salveson
- Jen Schaust
- Yvonne P. Sherwood
- Jae Hyun Shim
- Sun Yung Shin
- Mona Smith
- Susannah L. Smith
- Jennifer Tonko
- Abby Travis
- Margaret Wagner
- Doris Walter
- Lark Weller
- Brent K. S. Woodfill
- Travis Zimmerman

DOI: https://doi.org/10.24926/2471190X.7222