Sustainability principles and the future of Phoenix, Arizona: framing the Salt River's urban waterway redevelopment

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Abstract

As urban populations rapidly increase in an era of climate change and multiple social and environmental uncertainties, scientists and governments are cultivating knowledge and solutions for the sustainable growth and maintenance of cities. In this light, our study leverages a qualitative content analysis of news media and interviews to expose if well-established sustainability principles are evoked during the nascent discourse of recently proposed urban waterway developments along forty-five miles of Arizona's Salt River. Possible developments could incorporate the landscape alongside human use, increase residential wellbeing, and provide multiple uses of natural resources. Alternatively, they could cause community, political, and environmental harm in the name of economic development. Therefore, understanding which principles are or are not adopted as these propositions move from ideas to development not only connects theory to practice, but carries powerful implications for Phoenix's future and other cities conducting restorations amidst rapid population growth.

Keywords: community development; riparian restoration; urban waterway development; sustainable urbanism; sustainability principles

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Introduction

As urban populations rapidly increase in an era of climate change and multiple social and environmental uncertainties, scientists and governments are developing knowledge and solutions for the sustainable growth and maintenance of cities (Gleick 2003; Grabowski et al. 2017; Sachs 2008). One key component for sustainable urban futures is the proper management of water resources because water is critical for biological functionality of living beings, production of food and energy, and transportation of human goods and geophysical nutrient loads (Butler 2017; Solomon 2010; Rockström 2009). Acknowledging water's importance, human societies consistently establish themselves alongside waterways (McNeill 2001; Solomon 2010; Khagram 2004) and Phoenix is no exception. As a desert city, Phoenix exhibits a dynamic, multi-scalar, multi-sector relationship with all forms of water resources (Jacobs and Holway 2004; Gober and Trapido-Lurie 2006).

One key water resource in Arizona is the Salt River. The Salt River, or Rio Salado, cuts through the heart of the Phoenix metro area and is an integral part of Phoenix's physical and social geography (Wessells and Lejano 2017; Hirt et al. 2008; Roberge 2002). The river plays a significant role in Phoenix's identity, with an ancient history of Hohokam canals to recent large-scale concerts at Tempe Town Lake. Although much of the Salt River is now dry, there have been multiple attempts over the last 50 years to encourage large scale restoration projects along the river including Tempe Town Lake and the Rio Salado Habitat Restoration Area.

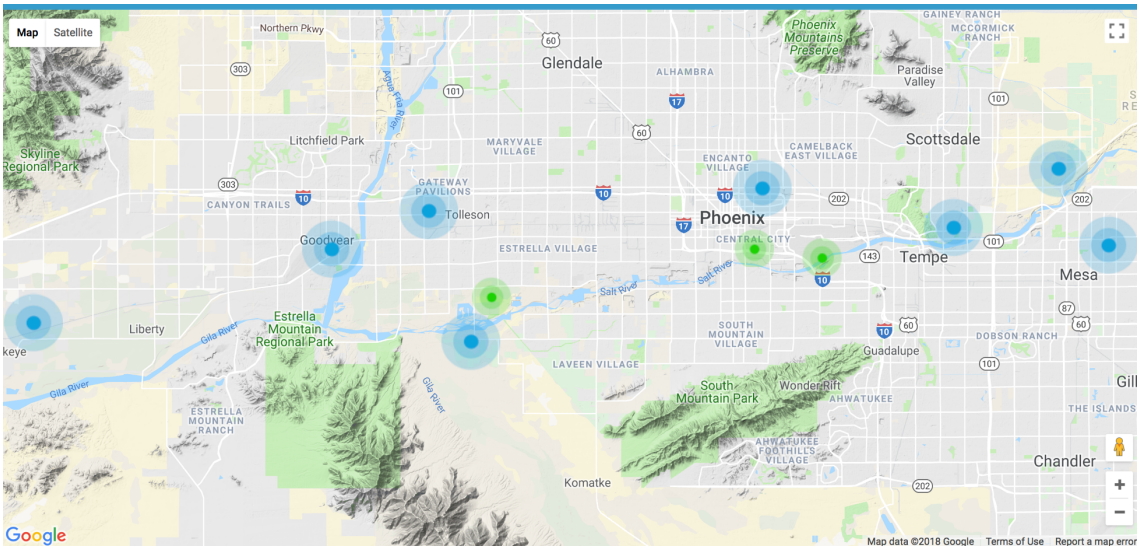


Figure 1. The Salt River, Arizona. Blue dots represent municipalities and tribes that are participating in Rio Reimagined. Green dots represent existing restoration area. (rioreimagined.org, 2018; map data generated by and property of Google).

Recent momentum around redevelopment was sparked by Arizona Senator John McCain with the support of Arizona State University (ASU). This initiative has been deemed "Rio Reimagined" in homage to the successful, multi-decade involvement of the ASU Design School in the development of Tempe Town Lake. Currently, ASU is actively cultivating regional support around the project as a whole and is dedicating an array of resources toward the long-term commitment required for such a large-scale vision. To gather the support of civic leadership, the university and Senator McCain are promoting regional collaboration toward the common goal of long term ecological viability, urban well-being, and economic vitality of the area.

Therefore, this study analyzes the project's emergent framing to determine if well-established sustainability principles are being evoked and ultimately adopted during the planning process via the question:

What sustainability principles do or do not emerge from the media and discourse surrounding Rio Reimagined?

A deductive content analysis is used to address this research question leveraging online news media and interviews of key Arizona State University professors and practitioners who are actively leading the Rio Reimagined project (Bernard et al. 2017; Riffe et al. 2005). Content analysis is used to quantitatively reveal the emergence of (or lack of) sustainability principles in the nascent discussion of Rio Reimagined. The analysis was built from Gibson's (2006) sustainability assessment framework, Larson et al.'s (2013) sustainability principles, Iwaniec and Wiek's (2014) sustainability values, and McPhearson et al.'s (2016) sustainable future visions. Framing codes are built from Benford and Snow's (2000) seminal work on collective action framing and social movement theory.

Literature review

Framing and discourse

In the study of social movements, organizers purposely evoke particular "master frames" to elicit a particular reaction, perception, or meaning of the situation (Benford and Snow 2000). Sociologists, social psychologists, and political theorists have leveraged framing and discourse for decades (Goffman 1974; Van Dijk 1980; Potter 1996; Alvesson and Karreman 2000) to analyze the emergence and life cycles of social movements. For decades, seminal authors Benford and Snow have argued that collective action master frames face certain procedural requirements: diagnostic framing, prognostic framing, and motivational framing (Snow and Benford 1988; Benford and Snow 2000) Diagnostic framing implies that there must be blame or responsibility for the issue at hand, prognostic framing implies the "plan of attack," and motivational framing is the "call to arms" (Benford and Snow 2000).

Many studies have leveraged framing for environmental issues, such as Barthel et al. (2015), which focuses on food and green spaces, Hall and White (2008), which focuses on fisheries

management; McGrail et al (2015), which focuses on carbon emission reduction; Hagerman (2007), which addresses neighborhoods and waterways; and White et al. (2015) which focuses on environmental decision making and water sustainability. Furthermore, key authors such as Dryzek (2013) and Hajer (1995) highlight the relevance of discourse analysis for environmental movements. As such, the redevelopment of the Salt River and the current momentum of "Rio Reimagined" is situated as a relevant social-ecological case to apply framing and social movement theory.

Urban sustainability and water management

In respect to long-term urban planning, multiple definitions of sustainability across various literatures can be evoked. For example, social-ecological systems (SES) theory recommends including a balance of social, economic, and ecological concerns (Ostrom 2009; Andereis et al. 2004; Gunderson and Holling 2002; Rockstrom et al. 2009; Wu 2014). Additionally, multiple frameworks for urban sustainability analysis emerge from resilience and socio-technical literatures (including SES theory). These frameworks emphasize varying approaches to sustainability, but each contain at a minimum an acknowledgment that successful urban systems rely on balancing social and ecological components (Grabowski et al. 2017; Wiek et al. 2012; Larson et al. 2013; Brown et al. 2008; Gober et al 2013; Ahern 2011; Andereis et al. 2004). Therefore, for the scope of this study, an SES approach is adopted.

Sustainability principles

Defining specific sustainability criteria for urban management is a growing area of research across disciplines (Gibson et al. 2006; Wiek and Larson 2012; Sachs 2012; Sarewitz et al. 2012) and is being widely developed as urban densities increase across the globe (Iwaniec and Wiek 2014; Sheppard et al. 2011; Ahern 2011). For this study, sustainability principles are defined via Larson et al. (2013) and Gibson (2006) as:

(1) social ecological system integrity
(2) resource efficiency and maintenance
(3) livelihood sufficiency
(4) civil engagement democratic governance
(5) intergenerational and intragenerational equity
(6) interconnectivity from local to global scales
(7) precaution and adaptability

These criteria are founded upon Gibson's (2006) sustainability assessment framework and Larson et al.'s (2013) sustainability principles for water governance and can be applied to water sustainability as well as broader urban sustainability goals. Using these principles as the theoretical foundation through which Rio Reimagined is analyzed will demonstrate if these principles are operationalized (or not) beyond theory and academic literature.

The components of sustainability as listed above have specific operational definitions, but the language encompasses a broad range of issues. These principles do not claim to be a panacea, but rather a holistic and inclusive framework through which significant sustainability issues can be categorized and ultimately addressed. The categories' holistic nature and moderate flexibility allow for a dynamic approach to analyze the emerging discourse addressed in this study, rather than strictly prescribing a checklist-type framework. This tangible, but holistic approach is particularly relevant due to the project's broad scope in time (historic and future); suite of cultural and political implications, and range across physical geography.

Future visioning and moving from theory to action

Scenario development and future visioning projects are important contributions for planning and bridging academic-policy boundaries. Knowledge-action system analysis (Munoz-Erickson et al. 2017; vanKerkhoff and Lebel 2006), and narrative network analysis (Wessells and Lejano 2017; Ingram et al. 2015) Therefore, in the development of this study, content analysis codes were also developed from sustainability visioning projects as related to the Phoenix area. Within the context of Rio Reimagined, investigating the presence and absence of sustainability

visions could either support or diverge from what had already been seen from workshops with Phoenix-area municipal leaders. Many values may be the same, and it could be expected that similar needs and concerns may be invoked during the development of Rio Reimagined.

The specific future visioning concepts that are leveraged in this study are Iwaniec and Wiek's (2014) sustainability vision elements for Phoenix 2050 and McPhearson et al.'s (2016) positive visions for sustainable futures. Both of these works emerge from research that engaged with local Phoenix metro area urban planners and civic leaders. Below are the specific visions from those studies drawn upon in this study.

(A) Iwaniec and Wiek's Sustainability Vision Elements, Phoenix's Plan for 2050 (2014):

(1) Responsible water use
(2) Lots of open space
(3) Dense urban cores
(4) Abundant vegetation
(5) Transportation (originally: comprehensive mass transit and enhanced roads/highways)

(B) McPhearson et al.'s Positive Visions for Sustainable Futures (2016):

(1) Visionary
(2) Motivational
(3) Relevant
(4) Shared

Water resource governance

Integral to the conversation about Rio Reimagined, and even embedded in the name itself, is the river. The physical waterway has a long and contentious history. Situated as the historic lifeblood of the region via Hohokam canals and irrigation, then in the 19th century developments and then the post-World War II boom into the Phoenix metropolitan area, water has always been a salient and relevant concern in the area. Because Phoenix is an arid geophysical space, water management has been a strong priority over the decades. Over the years, the river has been diverted, terraformed, and dammed. Alongside rapid urban development, parts of the river have

endured multiple eras of grey infrastructure changes, flood mitigation projects, mining, and industrial pollution. Some have called these areas "scars" which Rio Reimagined will provide the opportunity to restore and heal, ideally giving "life back to" the "urban spine" that connects the Phoenix area from west to east.

Urban social-ecological infrastructure

In recent years, the perception of infrastructure as SETS (social-ecological-technical systems) has emerged (Ahern 2011; Grabowski et al. 2017) and therefore can inform future development of Rio Reimagined, namely because the exact plans and visions of what the waterway redevelopments are yet to be determined. As the project progresses, multiple points of research as related to modular, resilient, and adaptable infrastructures may prove relevant. However, particular infrastructures related to Rio Reimagined are not addressed in this study and are a point of future analysis.

Ecological concerns are captured within the chosen principles, but specific recipes for restoring environmental health or cultivating biological conservation are not addressed. As plans come into play, a critical analysis of what types of environmental restoration is needed, desired, and possible. Phoenix, as a younger and growing city is poised with a great opportunity to merge ecological infrastructure with traditional grey infrastructure and pioneer innovative forms of development.

Methods

Online news media and promotional sources

News media sources were collected via google internet search for articles directly related to Rio Salado. Searches were conducted iteratively until April 15th, 2018 and include articles beginning in August 2017. Prior to March 30th, 2018, the project was labeled as "Rio Salado 2.0," and thus searches represent both titles for the initiative ("Rio Reimagined" and "Rio Salado 2.0").

Seven news media articles, one promotional video, and one radio interview were used for this study. Due to the limited volume of content available as the time of study, random sampling of the available data was not conducted. After the public launch and civic leader commitment signing on March 30th, 2018, there has been an increase in Rio Reimagined talks and workshops, so more data is emerging rapidly.

Leveraging web-published media sources removes a variety of issues such as researcher effect that can occur in interviews. However, the target audience and motivation behind an online news article can vary. Furthermore, it is possible that many of the journalists received their information from the same primary source, meaning the rhetoric present could be unrepresentatively amplified or absent for both the sustainability principles and framing tools. To mitigate the possibility of false amplification or absence due to limited data origins and gain additional perspectives, the data set was bolstered via semi-structured interviews.

Semi-structured interviews

From August 2017 to May 2018, ASU has served as the primary convener and valley-wide support system for the Rio Reimagined project. To complement online news media sources and track emergent narratives in real-time, semi-structured interviews were conducted. The interview protocol and procedure were ASU Internal Review Board approved prior to conducting interviews. Interviewees were purposively sampled because of their direct and engaged involvement with the Rio Reimagined project. All interviewees are employees of ASU and include both practitioners and professors. All interviewees are involved with developing the project within and beyond the university.

Interviews were conducted in person between April 2nd and 6th, 2018. The interviews lasted 30-40 minutes, were audio recorded and partially transcribed. For analysis purposes, one of five interviews only includes 15-minutes of data due to audio-recording failure but was still included

at this stage of analysis due to limited existing relevant data. The interview protocol (Figure 2) is based on the discussed sustainability visions and principles was designed with open ended questions to allow for a range of responses, with specific cues and probes designed to keep the interview on track. Notes were taken while interviewing, but only transcriptions of the interviews were quantitatively coded. Fine-scale conversation analysis was not necessary due to the meta-level theme analysis for this study and thus false starts and utterances were excluded from transcription and therefore analysis (Bernard et al. 2017).

Exposing the meta themes and framing of Rio Reimagined in early 2018 is relevant so that additional interviews can be conducted throughout 2018 with different communities, such as active volunteers on the Rio Salado, civic leaders, and ASU graduate students involved in Rio Reimagined projects. Other relevant interviewees also include local residents within walking or public transportation distance of the river, tribal communities, business owners, and marginalized populations using the river for refuge.

Interviews provide important data that both contrast and complement the news media sources. These narratives are also dynamic and emergent, like the media sources. Future iterations of interviews will likely see changing narratives as the project's salience, credibility, and traction ebbs and flows within and beyond the ASU and municipal leadership communities in 2018 and beyond. Overall, semi-structured interviews are key to gaining an individual insight on the project scope, plan, and themes from those who are initiating the regional conversation around Rio Reimagined.

Interview Protocol
1. What is Rio Salado 2.0 and how did you first hear about the project? a. What is your involvement with Rio Salado 2.0?
2. From your perspective, what are the main motivations behind Rio Salado 2.0?
3. What will Rio Salado 2.0 bring to the region? For instance, Tempe Town Lake is often looked to as a vibrant economic benefit and environmental amenity as well as the Rio Salado Audubon Habitat Restoration Area as an ecological restoration and environmental amenity.
4. Who should participate in the planning process of Rio Salado 2.0? Who should not participate?
5. Do you believe that there is a shared vision from leaders across the river for Rio Salado 2.0?
6. Do you believe that it will be possible to balance human needs (including uses of water and other natural resources) with ecosystem needs by restoring and protecting the life supporting functions of the river?
7. Do you believe that the current discussion of the project aims to provide equitable access and provision of economic and natural resources across all communities along the river? (Now and into the future?)
8. Development on the Salt River has a rich and dynamic history in the Phoenix area. To what extent to you believe Rio Salado 2.0 stands apart or within prior Salt River development visions? a. What values remain the same? b. What values might be different moving forward?

Figure 2: Theory-based interview protocol

Deductive content analysis

The codebook was generated using well-established theoretical foundations and data were analyzed using MAXQDA 2018 software. The unit of analysis was no less than a sentence and no greater than a paragraph. The format of some news articles did not follow true paragraph form, but the broadest level of analysis did not exceed a traditional paragraph's three to five sentences unless a clear turn was present (e.g. interview quotes to article author or long, contiguous semi-structured interview responses).

After the preliminary codebook was tested on six sample articles, non-salient codes were removed from future analysis and some codes were broken into more specific meanings of the code via sub-codes. For example, seeing the river an environmental amenity is distinct from the concept of ecological well-being, although the two concepts are not necessarily mutually exclusive. Both concepts emerged as two separate codes underneath the parent code Social-Ecological System Integrity.

After interviews were conducted, it became clear that certain codes needed to be replaced and additional sub-codes were necessary. Therefore, relevant codes were iteratively replaced or modified, and all data were re-coded with the final codebook. Ideally, initial code testing would have included a sample interview, but the project's expedited timeline for data collection and analysis prevented that option. Additionally, inter-coder reliability was not conducted for this stage of the project.

Results

Occurrence of sustainability principles

The Gibson (2006) and the Larson et al. (2013) principles were present a total of 336 times for the total data set (Figures 4 and 5). There were some notable absences, such as precaution and adaptability and low frequency of local to global and resource efficiency. Social-ecological system integrity, livelihood sufficiency, and civil engagement and democratic governance were very common in both online news media

and interviews. In general, there was a more even spread of the principles in the interviews, with a lesser focus on inter- and intragenerational equity than in the online news media sources (Figures 4 and 5). Figure 6 shows the distribution of all parent and sub codes across data types (not within), with increasing frequency indicated by increasing circle size.

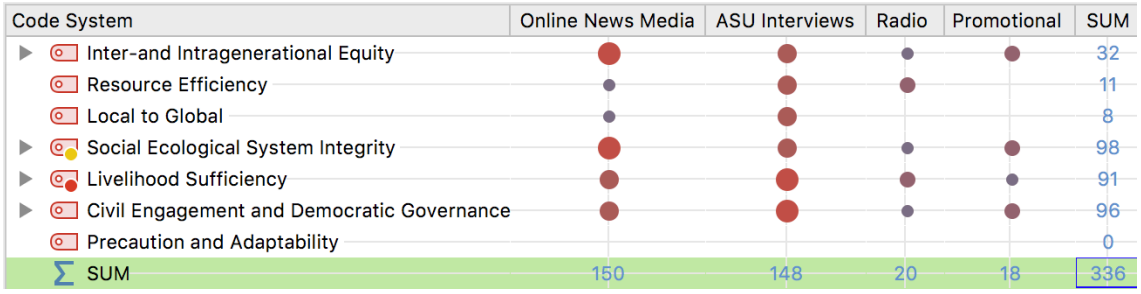


Figure 4: Frequency of Sustainability Principles **across** data type, read by row. Image output from MAXQDA (2018) Software. Circle size represents greater frequency of occurrence. Sum for data type in bottom row, sum for code type on right column.

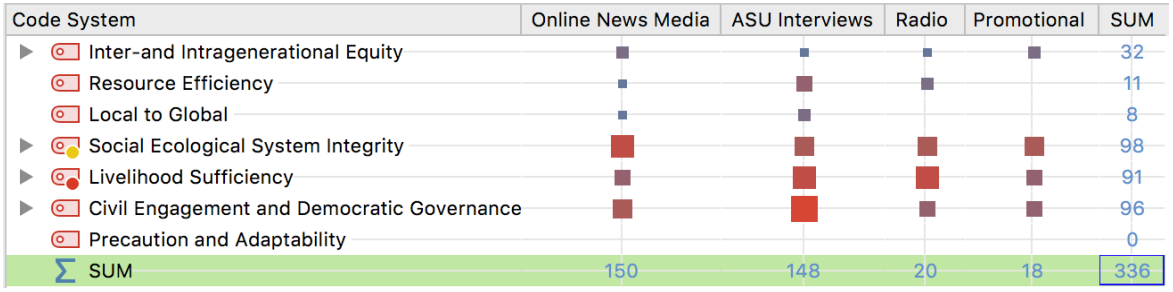


Figure 5: Frequency of Sustainability Principles **within** data type, read by column. Image output from MAXQDA (2018) Software. Square size represents greater frequency of occurrence. Sum for data type in bottom row, sum for code type on right column

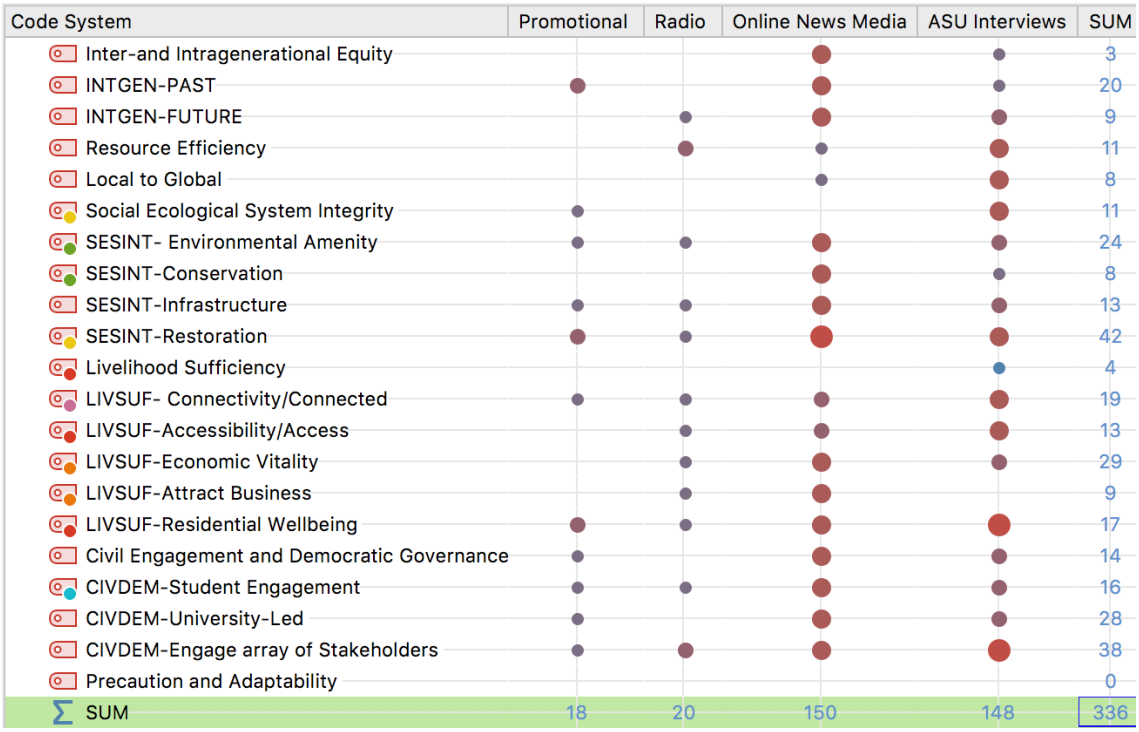


Figure 6: Frequency of Sustainability Principles **across** data type, read by row. Image output from MAXQDA (2018) Software. Circle size represents greater frequency of occurrence. Sum for data type in bottom row, sum for code type on right column. Graph expanded to show parent and sub-codes.

Occurrence of sustainability visions

Overall, there were fewer sustainability visions that were evoked (n= 78) than sustainability principles (n= 336). Concepts such as responsible water use, open space, and improved transportation were discussed more often in interviews than in news media. The concepts motivational and visionary were evoked more commonly than shared or relevant in all data types. The concept of shared was frequently elicited, with a common theme of shared barriers to project planning and development.

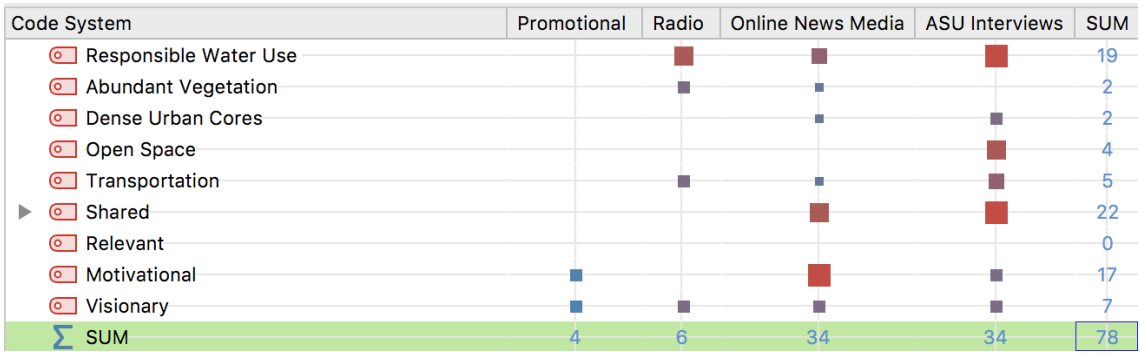


Figure 7: Frequency of Sustainability Visions **within** data type, read by column. Image output from MAXQDA (2018) Software. Square size represents greater frequency of occurrence. Sum for data type in bottom row, sum for code type on right column.

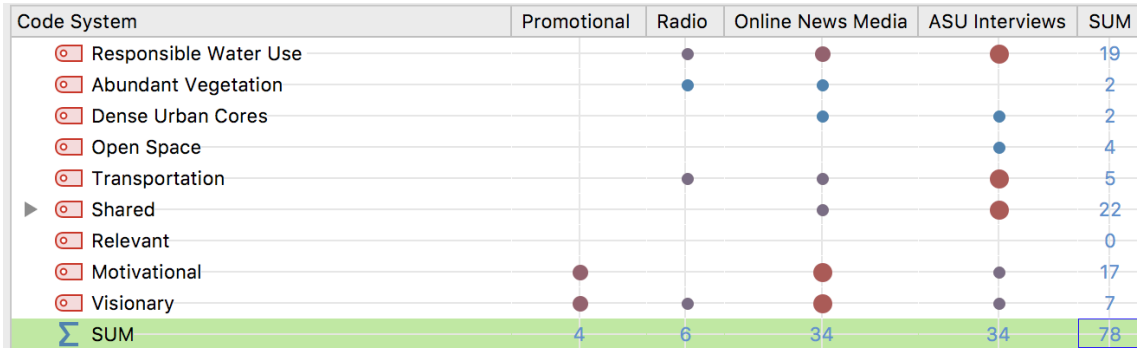


Figure 8: Frequency of Sustainability Visions **across** data type, read by row. Image output from MAXQDA (2018) Software. Circle size represents greater frequency of occurrence. Sum for data type in bottom row, sum for code type on right column.

Occurrence of framing

The framing layer of analysis addressed the diagnostic (What is the problem? Who is to blame?), prognostic (What tools do we need? What are the solutions to the problem?), and motivational (call to arms) frames. Framing tools occurred 180 times across data types, with an inversion of prognostic and motivational frames being elicited in the interviews and news media. There were many more prognostic frames in the interviews and more motivational frames in the media. Diagnostic frames were more present in the interviews.

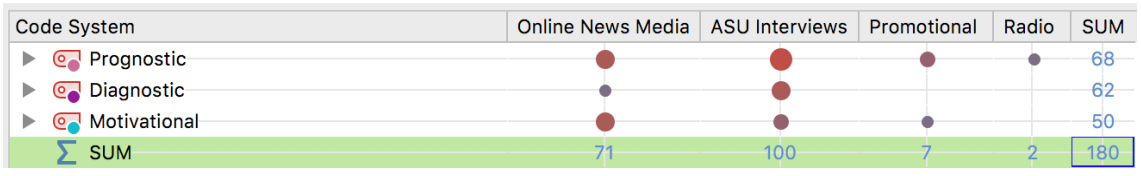
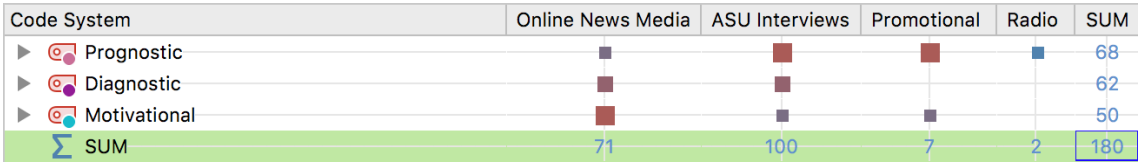
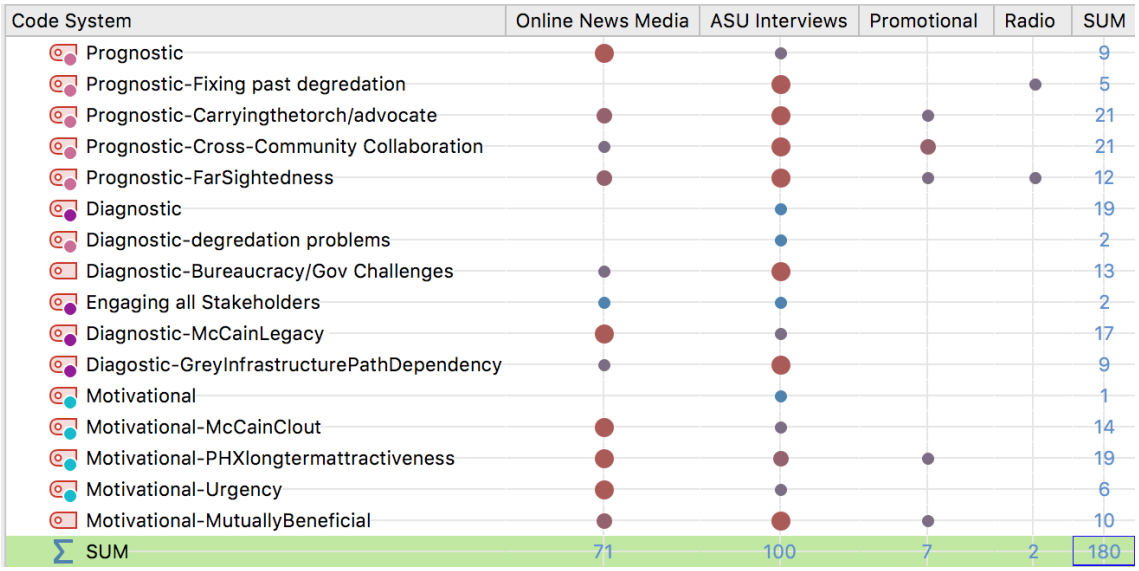


Figure 9. Frequency of framing tools **across** data type, read by row. Image output from MAXQDA (2018) Software. Circle size represents greater frequency of occurrence. Sum for data type in bottom row, sum for code type on right column.



Code System	Online News Media	ASU Interviews	Promotional	Radio	SUM
Prognostic					68
Diagnostic					62
Motivational					50
SUM	71	100	7	2	180

Figure 10: Frequency of framing tools **within** data type, read by column. Image output from MAXQDA (2018) Software. Square size represents greater frequency of occurrence. Sum for data type in bottom row, sum for code type on right column.



Code System	Online News Media	ASU Interviews	Promotional	Radio	SUM
Prognostic					9
Prognostic-Fixing past degredation					5
Prognostic-Carryingthetorch/advocate					21
Prognostic-Cross-Community Collaboration					21
Prognostic-FarSightedness					12
Diagnostic					19
Diagnostic-degredation problems					2
Diagnostic-Bureaucracy/Gov Challenges					13
Engaging all Stakeholders					2
Diagnostic-McCainLegacy					17
Diagostic-GreyInfrastructurePathDependency					9
Motivational					1
Motivational-McCainClout					14
Motivational-PHXlongtermattractiveness					19
Motivational-Urgency					6
Motivational-MutuallyBeneficial					10
SUM	71	100	7	2	180

Figure 11. Frequency of framing tools **across** data type, read by row. Image output from MAXQDA (2018) Software. Circle size represents greater frequency of occurrence. Sum for data type in bottom row, sum for code type on right column. Graph expanded to show parent and sub-codes.

Notable co-occurrences

Livelihood sufficiency with social ecological integrity

The concepts of livelihood sufficiency and social ecological system integrity overlapped strongly (n=37). This is attributable to the nested concepts of community, residential, and human well-being as part of both the concepts of SES integrity and livelihood sufficiency. The most common sub code occurrence between those two codes was the concept of the restoration as an environmental amenity (under social ecological system integrity) and the concept of economic development benefitting the community (underneath livelihood sufficiency), which happened 19 times. For example, one news article states: “McCain stressed it won’t be an office park on a riverbank. If amenities like

bike trails and picnic areas aren't there, business won't follow." This overlap demonstrates that people believe that ecological development not only increases residential use of recreation and natural areas, but subsequent economic development is related in a feedback loop.

Prognostic framing with civil engagement and democratic governance

Additionally, there was a strong overlap between civil engagement and democratic governance with prognostic framing (n=27), particularly the sub-code encompassing future advocacy and "carrying the torch" (n=10). For example, one interviewee highlighted the need for new leadership to carry through the longevity of the project to ensure true community advocacy: "I've distilled the engagement of the community down to its essence, which was, I think, the establishment of a new leadership class in this area. Can, through this project, new leaders, new voices, come to the fore and demand, or properly articulate what their communities want? And how do we get that into the plan?"

Motivational framing with phoenix's long-term attractiveness and liveability

A common theme emerged regarding Phoenix's need to develop in such a fashion that it becomes an unprecedentedly beautiful and attractive place to live, work, and conduct business. Such an appeal, in many ways, motivates Rio Reimagined and is therefore an appealing frame through which to attract consensus and momentum for the initiative. Therefore, it was not surprising to find that increased livelihood sufficiency overlapped with motivational framing fifteen times. For example, an early 2018 Arizona Central Op-Ed captured this concept well: "Phoenix is a city whose inhabitants crave a sense of place, and if John McCain is successful, he will help us understand our connection to the past, its influence on our urban character and its possibilities for a brighter future."

Discussion

Coding

Coder bias and reliability

For the scope of this study, multiple coder reliability was not conducted. However, the primary coder did conduct iterative code generation and improvement. As such, there is a degree of bias and subjectivity involved in the code implementation. For instance, within the Sustainability Principles, concepts of social justice and equity are common in multiple principles. To address this concern, specific sub-codes were created. For example, equitable access to the river and its resources were categorized as a sub-header of Livelihood Sufficiency, because the parent category is defined as "ensur[ing] that everyone and every community has enough for a decent life and that everyone has opportunities to seek improvements in ways that do not compromise future generations' possibilities for sufficiency and opportunity" (Gibson 2006, p 270). This definition of livelihood sufficiency overlaps heavily with the concept of inter and intragenerational equity: "Ensure that sufficiency and effective choices for all are pursued in ways that reduce dangerous gaps in sufficiency and opportunity (and health, security, social recognition, political influence, etc.) between the rich and poor" (Gibson 2006, p 270). Therefore, multiple, specific sub-codes within livelihood sufficiency and civil engagement and democratic governance were generated to capture concepts of equity and the code for inter and intragenerational equity focused on intergenerational equity. For future analyses, tighter definitions clarifying these overlaps should be addressed.

When further research is conducted, inter-coder reliability will be established, and some codes will be reassessed. For example, the sustainability principle of "precaution and adaptability" and the sustainability vision "relevant" did not appear in the coding results. While this could partially be attributed to coder bias or unreliability, it is also strongly attributable to the particularity of the code definitions.

Latent and Implicit Codes:

Future analysis or re-coding of this dataset should address latent codes within the framing tools (Bernard et al. 2017). There were many factors regarding the diagnostic framing (What is the problem? Who/What is to blame?), which became clearer during the interview process because a variety of more explicit pathways or solutions (prognostic framing) were discussed, which illuminated components of the problems that need to be addressed. Therefore, it would seem that there are latent diagnostic frames regarding bureaucratic conflict, tension, or lag-time embedded within many of the prognostic frames which should be addressed prior to giving tangible strategy or policy recommendations.

Sustainability visions- why so few evoked?

One unexpected result from this study was that the sustainability visioning principles were not as salient as the sustainability principles. For instance, a handful of codes from both Iwaniec and Wiek (2014) and McPhearson et al.'s (2016) sustainability visions did not make the first cut of codebook testing (e.g. Systemic and Coherent, Figure 12).

Key features of the quality criteria for sustainability visions (modified from Ref. [21])

Quality criterion	Key features
Visionary	Desirable future state; with elements of (aspirational) surprise, utopian thought, far-sightedness, and holistic perspective
Sustainable	In compliance with sustainability principles; featuring radically transformed structures and processes
Systemic	Holistic representation; linkages between vision elements; complex structure
Coherent	Composed of compatible goals (free of irreconcilable contradictions)
Plausible	Evidence-based—informed by empirical examples, theoretical models, and pilot projects
Tangible	Composed of clearly articulated and detailed goals
Relevant	Composed of salient goals that focus on people, their roles, and responsibilities
Nuanced	Detailed priorities (desirability)
Motivational	Inspire and motivate towards the envisioned change
Shared	Display a critical degree of convergence, agreement, and support by relevant stakeholder

Figure 12. McPhearson et al.'s (2016) Sustainability Visions

Another contributing factor could be the operationalization of these concepts. Unlike the sustainability principles, both sets of sustainability visions lacked highly

detailed definitions and examples of the concepts. Furthermore, the sustainability visions criteria were derived from focus groups and workshops with local practitioners, which implies a particular lens or bias within such results. One possible explanation is that due to the current nascent stage of Rio Reimagined, these sustainability visions were either too specific (e.g. "Composed of salient goals that focus on people, their roles, and responsibilities") or too nuanced for the current level of discussion.

However, one interviewee heavily discussed the linkage between connectivity, accessibility, and transportation as a necessary social equity concern for the city's well-being if any restoration is going to be done under the assumption of sustainability (Figure 13). The same interviewee also tended to address many concepts from the sustainability visions codes more than other data sources, which indicates a possible need for increased and diversified data sampling.

"I think we have the ability to think about our response to urban planning and urban design. I think there are issues around thinking about what natural assets and resources can play a larger role in this project. I think there are initiatives around transportation. So, whether that means the future of autonomous vehicles here, or the future of building stronger transportation systems for ourselves and taking less importance on the independent vehicle. And I think, because of our unique position, geographic position, being at a crossroads between the Los Angeles cargo and shipping industry, and also distribution as it comes across the US ... Not as well optimized right now by rail. Heavily optimized through our region by trucking. And so, is there a way for us to think differently about that and change that?"

Figure 13. ASU interview discussion of city and regional transportation concerns alongside natural resources for Rio Reimagined.

Call to Action Frames, Future Visions, Motivation, and Relevance

From the results of this project, it would appear that the collective action framing is directed toward the political leadership in the valley. The diagnostic framing is not necessarily directed toward one party, group of people, or a specific event, but more the idea that civic leaders carry an obligation to leave the region better off than when they came into office. Therefore, the current prognosis (solution) is to agree to the overall sentiment that redeveloping the Salt River is a critical communal need for the area under the pretense that development will bring mutually beneficial economic, ecological, and social improvements. It would seem that failure to support this iteration of Salt River redevelopment, in honor of long standing public figures such as Senator John McCain and ex-Congressman Ed Pastor, would be choosing to leave "a scar" in the area and proactively forego the bountiful opportunities for beautification, community connectedness, and increased ecological vitality.

However, time will tell if this movement gains tangible adherence through the next series of torchbearers, possibly seen with the creation of a 501 c(3), the generation and acquisition of funding, and iterations of possible developments. The opportunities appear boundless, but barriers remain. As one news article mentioned: "Rio Salado is about remembering. But it needed a jolt. It needed somebody to swing some clout" (AZ Central Op Ed 01/03/18).

Connectedness: Community, Transportation, and Adaptation

An additional thread of the Rio Reimagined discourse is deeply rooted in the region's history. Situated within the fastest growing county in the nation for 2016 and 2017, the Phoenix metro area is transitioning from a majority car-centric culture to become more connected and alternative transportation friendly. Tempe, Mesa, and Phoenix have led the way with the light rail and proposed extensions and the strong bicycle culture in Tempe and areas serviced by circulator buses. However, a long history

of the car-centric and fast, but scattered growth that has occurred in Phoenix poses a series of challenges, as one interviewee captures:

> "When a child can't walk to school, or can't choose to ride their bike or walk, then that becomes an issue. An issue that supports things like health and wellness too. The same thing about access to food. There's fundamental needs of a community that you have to think about when you think about social impact. Where is my ability to access my basic needs within a five to ten-minute walk?"

Figure 14. ASU interview discussion on social equity and access concerns related to connectivity, health and well-being.

Local and regional connectivity was a major theme for the project in news articles as well: **"**Wouldn't it be great if the cities came together and say, 'Let's have a project ... that sort of makes us look a bit more like a coherent metro area than just something that's sort of all over the landscape'" (Boehm 12/24/17).

Social Justice and Intergenerational Equity

Acknowledging the Voices of those often unsolicited or unheard

One of the greatest sustainability challenges that emerged during interviews and not during formal presentations and discussions is in regard to the homeless population that often uses the riparian habitat and public space for homesteading (Figure 15). Although this is a known issue and there are non-governmental organizations that are aimed to assist this population, homelessness and poverty along the Salt River is still a concern that must be addressed if the Rio Reimagined serves to be considered sustainable and adhere to the suite of principles this study relies upon (Palta et al. 2016). Therefore, one strong area of focus moving forward should be on how to properly mobilize resources to create alternative affordable housing options along the river and generate a sense of inclusivity alongside safety within any new developments.

"I'll give an example, and that's homeless advocacy. I know for many years that the riverbed, good or bad, becomes a residential living quarters for homeless populations because they can be hidden, and they're in those areas. Certainly, that is part of the non-invested stakeholder. It will need to be dealt with, and just pushing them back into the neighborhoods or up into areas where they're not going to be wanted."

Figure 15. Exemplar quote discussing social equity concerns as related to development and habitat changes.

Water as the thread that connects us all

Although the possible future developments around Rio Reimagined are not fully established to integrate additional water flow, in the emergent discourse around the proposal, the cultural and almost mystical value of water was frequently elicited as seen in Figure 16:

(1) "Rio Reimagined will be the thread that connects us all, honoring and intertwining the individual cultures and communities it touches as it meanders through the desert."

(2) "Do we have enough water? And that's actually a really poor way to put the question. It's not about quantity, it's about quality and access to it. What kind of water, for what kind of use, under what circumstances, and have you thought through, as a region, what that would take. And have you been really judicious about how you deploy it."

(3) "When you talk about water in the desert, there's something historical and spiritual in the mix. Something that speaks of the soul of this community – a soul that folks with a shallow understanding of our history mistakenly say doesn't exist."

Figure 16: Exemplar quotes highlighting the significance of water to Rio Reimagined and Phoenix's sense of place.

Final considerations

As this project moved forward, there has been a clear call for leadership and advocates beyond the university. Whomever seeks to take on the project will likely face many challenges related to sensitive political concerns related to a suite of stakeholders and financial investment in a post-federal works era. Furthermore, any new leaders will be required to also approach the project with an understanding of the multi-scalar and regional concerns associated with such a large scale and ambitious undertaking.

What remains clear is that, as a rapidly growing city, Phoenix is presented with an opportunity to act as a steward for social and ecological sustainability. Rio Reimagined can serve as a focal point to bring Phoenix to the forefront of innovation, not only for its own environmental and residential wellbeing, but for other places conducting urban waterway restoration. If balancing human and ecological long-term needs is genuinely the goal, then implementing the sustainability principles that have seen to be so widely discussed around Rio Reimagined will require all hands-on deck for some time to come.

Disclosure Statement

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Appendix 1: News Media List

News Media:

AZ Central Op ED: January 3rd, 2018
https://www.azcentral.com/story/opinion/editorial/2018/01/03/john-mccain-rio-salado-salt-river-support/997912001/

Boehm, AZ Central December 24th, 2017:
https://www.azcentral.com/story/news/local/phoenix/2017/12/24/john-mccain-legacy-project-develop-45-miles-rio-salado-arizona-state-university-phoenix-tempe-mesa/915158001/

ASU: Nov 17th 2017: ASU Convenes Leaders for Rio Salado Project
https://asunow.asu.edu/20171117-arizona-impact-asu-takes-lead-rio-salado-project

Mendoza, Angel, State Press Article on 08/25/2017
http://www.statepress.com/article/2017/08/arizona-senator-unveils-new-asu-project

A River in the Desert: ASU helps McCain with Rio Salado Effort Mike Sunnucks – Senior Reporter, Phoenix Business Journal, Oct 26, 2017, 6:46am.
https://www.bizjournals.com/phoenix/news/2017/10/26/a-river-in-the-desert-asu-helps-mccain-with-rio.html

Phoenix Business Journal, 10/1/2017, Mike Sunnucks, John McCain's legacy: a flowing river for economic development
https://www.bizjournals.com/phoenix/news/2017/10/01/john-mccain-s-legacy-a-flowing-river-for-economic.html

Video (note, only the first of the below videos were transcribed for this study).
Promotional Video from http://rioreimagined.org/

AZ Central:
https://www.azcentral.com/videos/news/local/phoenix/2017/12/23/rio-salado-2.0/108876408/

ASU: August 25th 2017
https://asunow.asu.edu/20170825-arizona-impact-asu-mccain-team-transform-phoenix-riverbed

Full presentation for Civic Leaders meeting Link to the recent November 2017 Rio Salado Event full presentation – 57 mins: https://vimeo.com/244479461

McCain, J. (2017, August 25). Rio Salado 2.0; A Conversation with U.S. Senator John McCain [Video] Retrieved from: https://vimeo.com/231776994

References

1. Ahern, J. (2011). From fail-safe to safe-to-fail: Sustainability and resilience in the new urban world. *Landscape and Urban Planning, 100*(4), 341-343.
2. Alvesson, M. and D. Karreman. 2000. Varieties of discourse: On the study of organizations through discourse analysis. Human Relations 53, 1125-1149
3. Anderies, J., Janssen, M. A., & Ostrom, E. (2004). A framework to analyze the robustness of social-ecological systems from an institutional perspective. *Ecology and Society, 9*(1).
4. Barthel, S., Parker, J., & Ernstson, H. (2015). Food and green space in cities: A resilience lens on gardens and urban environmental movements. *Urban studies*, *52*(7), 1321-1338.
5. Benford, R. D., & Snow, D. A. (2000). Framing processes and social movements: An overview and assessment. *Annual review of sociology*, *26*(1), 611-639.
6. Bernard, H. R., Wutich, A., & Ryan, G. W. (2017). *Analyzing qualitative data: Systematic approaches* SAGE publications.
7. Brown, R., Keath, N., & Wong, T. (2008). Transitioning to water sensitive cities: Historical, current and future transition states. *11th International Conference on Urban Drainage, 10*
8. Butler, D. (2017). Global Challenges: Water. *Global Challenges*, *1*(1), 61-62.
9. Dryzek, J. S. (2013). *The politics of the earth: Environmental discourses*. Oxford university press.

10. Gibson, R. B., S. Hassan, S. Holtz, J. Tansey, and G. Whitelaw. (2006). Sustainability assessment: Criteria and processes. London, UK: Earthscan.
11. Gleick, P. (2003). Global freshwater resources: Soft-path solutions for the 21st century. *Science (New York, N.Y.), 302*(5650), 1524-8.
12. Gober, P., & Trapido-Lurie, B. (2006). *Metropolitan Phoenix: Place making and community building in the desert*. University of Pennsylvania Press.
13. Gober, P., Larson, K., Quay, R., Polsky, C., Chang, H., & Shandas, V. (2013). Why land planners and water managers don't talk to one another and why they should! *Society & Natural Resources, 26*(3), 356-364.
14. Goffman, Erving. (1974). Frame Analysis. New York: Harper Colphon.
15. Grabowski, Z., Matsler, A.M, Thiel, C., Mcphillips, L., Hum, R., Bradshaw, A., MIller, T., Redman, C. (2017). Infrastructures as Socio-Eco-Technical Systems: Five Considerations for Interdisciplinary Dialogue. *Journal of Infrastructure Systems, 23*(4), Journal of Infrastructure Systems, 01 December 2017, Vol.23(4).
16. Gunderson, L. H., & Holling, C. S. (2002). *Panarchy : Understanding transformations in human and natural systems*. Washington, DC ; London: Washington, DC ; London : Island Press.
17. Hagerman, C. (2007). Shaping neighborhoods and nature: Urban political ecologies of urban waterfront transformations in Portland, Oregon. Cities, 24(4), 285–297.
18. Hajer, M. A. (1995). *The politics of environmental discourse: ecological modernization and the policy process* (p. 40). Oxford: Clarendon Press.
19. Hall, T. E., & White, D. D. (2008). Representing recovery: science and local control in the framing of US Pacific Northwest salmon policy. *Human Ecology Review*, 32-45.

20. Hirt, P., Gustafson, A., & Larson, K. (2008). The mirage in the Valley of the Sun. *Environmental History*, *13*(3), 482-514.
21. Ingram, M., Ingram, H., & Lejano, R. (2015). Environmental action in the Anthropocene: The power of narrative networks. Journal of Environmental Policy & Planning, online advance, DOI: 10.1080/1523908X.2015.1113513.
22. Iwaniec, D., & Wiek, A. (2014). Advancing sustainability visioning practice in planning—The general plan update in Phoenix, Arizona. *Planning Practice & Research*, *29*(5), 543-568.
23. Jacobs, K. L., & Holway, J. M. (2004). Managing for sustainability in an arid climate: lessons learned from 20 years of groundwater management in Arizona, USA. *Hydrogeology Journal*, *12*(1), 52-65.
24. Khagram, S. (2004). *Dams and development: Transnational struggles for water and power*. Cornell University Press.
25. Larson, K. L., Wiek, A., & Withycombe-Keeler, L. (2013). A comprehensive sustainability appraisal of water governance activities and principles in phoenix, AZ. *Journal of Environmental Management*
26. McNeill, J. R. (2001). *Something new under the sun: An environmental history of the twentieth-century world (the global century series)*. WW Norton & Company.
27. McPhearson, T., Iwaniec, D. M., & Bai, X. (2016). Positive visions for guiding urban transformations toward sustainable futures. *Current opinion in environmental sustainability*, *22*, 33-40.
28. Muñoz-Erickson, T. A., Miller, C. A., & Miller, T. R. (2017). How Cities Think: Knowledge Co-Production for Urban Sustainability and Resilience. *Forests*, *8*(6), 203.

29. Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. *Science*, *325*(5939), 419-422.
30. Palta, M., Du Bray, M. V., Stotts, R., Wolf, A., & Wutich, A. (2016). Ecosystem services and disservices for a vulnerable population: findings from urban waterways and wetlands in an American Desert City. *Human ecology*, *44*(4), 463-478.
31. Potter, J. (1996). Representing reality: Discourse, Rhetoric and Social Construction. Thousand Oaks, CA: Sage
32. Riffe, D., Lacy, S., & Fico, F. (2005). *Analyzing media messages: Using quantitative content analysis in research*. Routledge.
33. Roberge, M. (2002). Human modification of the geomorphically unstable Salt River in metropolitan Phoenix. *The Professional Geographer*, *54*(2), 175-189.
34. Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin III, F. S., Lambin, E. F., ... & Nykvist, B. (2009). A safe operating space for humanity. *nature*, *461*(7263), 472
35. Sachs, J. D. (2012). From millennium development goals to sustainable development goals. *The Lancet*, *379*(9832), 2206-2211.
36. Sachs, J. (2008). *Common wealth: Economics for a crowded planet*. Penguin.
37. Sarewitz, D., Clapp, R., Crumbley, C., Kriebel, D., & Tickner, J. (2012). The sustainability solutions agenda. *New Solut, 22*(2), 139-151. doi:10.2190/NS.22.2.c
38. Sheppard, S. R., Shaw, A., Flanders, D., Burch, S., Wiek, A., Carmichael, J., ... & Cohen, S. (2011). Future visioning of local climate change: a framework for community engagement and planning with scenarios and visualisation. *Futures*, *43*(4), 400-412

39. Snow, D. A., & Benford, R. D. (1988). Ideology, frame resonance, and participant mobilization. *International social movement research*, *1*(1), 197-217.
40. Solomon, S. (2010). *Water: The epic struggle for wealth, power, and civilization*. Harper Collins.
41. Van Dijk, T. A. (1980). Text and context: Explorations in the semantics and pragmatics of discourse. The Hague, the Netherlands: Mouton Publishers.
42. van Kerkhoff, L., & Lebel, L. (2006). Linking knowledge and action for sustainable development. *Annual Review of Environment and Resources, 31*(1), 445-477.
43. Wessells, A. T., & Lejano, R. P. (2017). Urban Waterways and Waterfront Spaces: Social Construction of a Common Good. *Journal of the Southwest*, *59*(1), 106-132.
44. White, D. D., Corley, E. A., & White, M. S. (2008). Water managers' perceptions of the Science–Policy interface in Phoenix, Arizona: Implications for an emerging boundary organization. *Society & Natural Resources, 21*(3), 230-243.
45. White, D. D., Withycombe Keeler, L., Wiek, A., & Larson, K. L. (2015). Envisioning the future of water governance: A survey of central Arizona water decision makers. *17*(1), 25-35.
46. Wiek, A., & Larson, K. (2012). Water, people, and Sustainability—A systems framework for analyzing and assessing water governance regimes. *Water Resources Management, 26*(11), 3153-3171. doi:10.1007/s11269-012-0065-6
47. Wiek, A., & Iwaniec, D. (2014). Quality criteria for visions and visioning in sustainability science. *Sustainability Science*, *9*(4), 497-512.
48. Wu, J. (2014). *Urban ecology and sustainability: The state-of-the-science and future directions* doi: https://doi.org/10.1016/j.landurbplan.2014.01.018