The Potential for Adaptive Water Governance on the US-Mexico Border: Application of the OECD's Water Governance Indicators to the Rio Grande/Bravo Basin

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Despite decades of political commitments, laws and agreements, and significant policy efforts, existing governance and policy regimes in many transboundary river and lake systems have not been able to cope with the combined impacts of population and economic growth, changing consumption patterns, and climate change. Complex water systems located in arid regions, such as the Rio Grande/Bravo basin, are particularly challenged and the need for better governance system performance is even more acute. The Rio Grande/Bravo basin is one of the fastest-growing regions in the US and Mexico, set to double in population by mid-century, and it is widely acknowledged by officials that the region will not be able to meet the water demands generated by this growth. Long stretches of the river are completely dry for much of the year, and water managers cannot meet full allocations to water users, let alone ensure water releases for environmental services and conservation.

Both academic scholarship and policy analysis attribute failures such as this to the inability of current water governance regimes to respond to rapidly changing circumstances – to 'adapt'. These studies, loosely gathered under the umbrella concept of 'adaptive governance,' call for resource management regimes that are more coordinated, connected and flexible; that promote broader engagement; and that generate and disseminate knowledge as well as stimulate learning in the face of complexity and uncertainty. Alongside a multidisciplinary discussion of adaptability, scholars, practitioners and international organizations have experimented with the use of governance 'indicators', in an effort to create diagnostic tools that can isolate and assess particular governance attributes linked to more effective resource management, especially those relating to adaptability.

Since 2015, the OECD has been working on a framework of twelve water governance principles, with the intent of understanding the high rate of water governance failures, as well as promoting adaptability and sustainability in water resource management. In 2016, the OECD translated these principles for good water governance into 36 water governance "indicators" (WGIs) that would provide a means for directly gauging the efficiency, effectiveness and level of engagement of water governance systems. These indicators were pilot-tested in OECD jurisdictions at various scales, and were deemed helpful in terms of diagnosing gaps in water governance *within* countries. This paper will detail both the OECD's work and the dialogue in the adaptive water governance literature, and then report on the results of empirical research which applies the OECD WGIs to the *transboundary* context in the case of the Rio Grande/Bravo basin. The findings with respect to the Rio Grande/Bravo case are used to reflect both on whether this particular transboundary water governance system exhibits attributes associated with adaptive governance and on the usefulness of the OECD WGIs as a tool for diagnosing water governance strengths and weaknesses in a transboundary context.

The Rio Grande-Bravo: A Complex Water System in Crisis

In 2018, the Rio Grande-Bravo (RGB) was named "one of America's most endangered rivers", an ecological system at a crossroads in terms of its ability to endure increased human demands and an impending border wall.[1] The RGB is the fifth longest river in the United States, and the portion that forms the US-Mexico border from El Paso, Texas to the Gulf of Mexico flows through mountains and desert. The Basin is heavily managed; it has been almost completely

[1] American Rivers (2018), "Lower Rio Grande names one of America's most endangered rivers" Available at: https://www.americanrivers.org/conservation-resource/lower-rio-grande-named-one-of-americas-most-endangered-rivers-of-2018/ Accessed: 04/17/2019

modified by 21 major dams, four of which have capacities of over 1,000 hectometres.[2] These diversions from the RGB have been put in place primarily to regulate the flow of water between the US and Mexico, and to supply farmers. For a century, water in the RGB has been discussed almost exclusively in terms of allocation totals, or how much surface water each country would receive annually from various portions of the river under the *1906 Convention Between the United States and Mexico on the Equitable Distribution of the Water of the Rio Grande* and the *1944 Water Treaty for the Utilization of the Waters of the Colorado and Tijuana Rivers and of the Rio Grande*.

In fact, under the provisions of these treaties, the waters of the Rio Grande are fully-(and actually over-)allocated, either to the U.S. or to Mexico, with large amounts dammed for human use and consumption, leaving 200 miles of the river – often referred to as 'The Forgotten Reach' – completely dry for long periods of time. It is important to recognize that the binational portion of the Rio Grande actually operates as two separate segments in terms of water allocations and sharing (see Figure 1): the first, from south of Elephant Butte Dam past the water withdrawals and return flows of El Paso, TX and Ciudad Juarez, Chihuahua; and the second, from Fort Quitman through to where the Rio Conchos flows into the Rio Grande and down to the Gulf of Mexico.[3] Under the 1906 Convention, in the first segment, the U.S. must deliver 60,000 acre feet (AF) per year to Mexico, but the flows may be proportionately reduced in both countries during periods of drought, without the water having to be "repaid" later. Since 2012, deliveries have been reduced every year, by as much as 70%.[4] For the stretch below Fort Quitman, under the 1944 Treaty Mexico has the right to keep two-thirds of the flows that feed into the Rio Grande

[2] US Fish and Wildlife Service; Mexican Water Atlas 2016.
[3] Congressional Research Service (2017), "U.S.-Mexico Water Sharing: Background and Recent Developments", p.14. Available at: https://fas.org/sgp/crs/row/R43312.pdf
[4] Ibid.

from the six tributaries flowing from Mexico, but must deliver one-third of flows from these sources to the U.S.[5] These water deliveries must average at least 350,000 AF per year, measured in five-year cycles. If Mexico fails to meet this minimum requirement due to conditions of "extraordinary drought" (not defined in the Treaty), as was the case over the 2010-15 cycle, it must make this up during the course of the next five-year cycle (Mexico delivered on its "water debt" in 2016).

The key message here is that, in both 'management segments' on the Rio Grande-Bravo, the water demands regularly exceed supply, which is perhaps not surprising given that the original supply assumptions embedded in treaties were based on periods of relative water abundance many decades ago. This imbalance is greatly exacerbated in periods of drought, yet stakeholders – and particularly farmers – have not lowered their allocation expectations. The RGB complex water system is thus one of scarcity, and users wait year-to-year to see whether they will get their full allocation, with little change in behaviour. If not, as is now regularly the case, they supplement by pumping groundwater.

[5] 1944 Water Treaty, Articles 4(A) and 4(B).

Figure 3. Rio Grande Basin

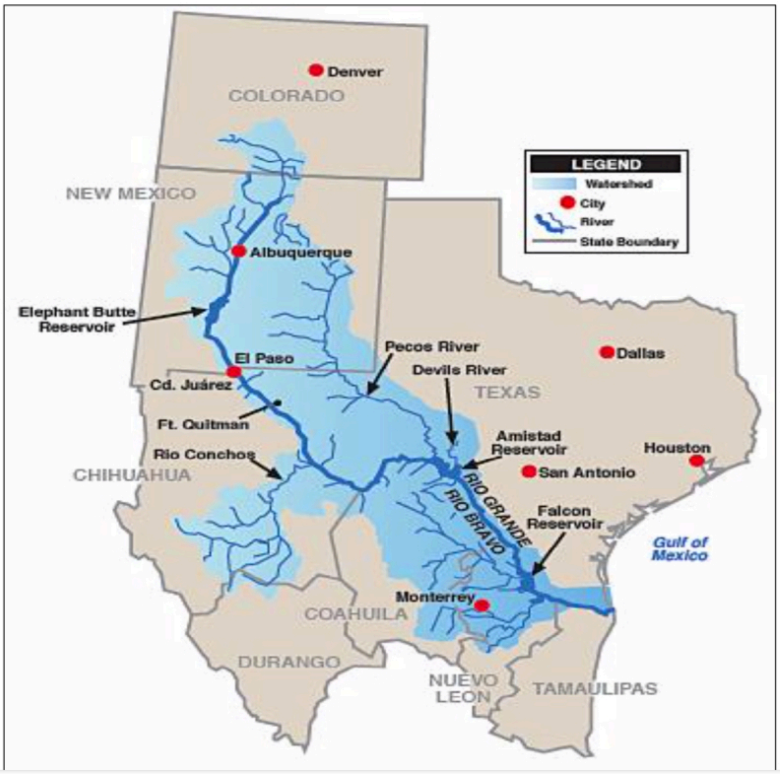

Figure 1: Rio Grande-Bravo Basin showing major reservoirs
Source: Congressional Research Service (2017), U.S.-Mexican Water Sharing: Background and Recent Developments. Available at: https://fas.org/sgp/crs/row/R43312.pdf

Correspondingly, the formal transboundary governance regime is also focused on the allocation of surface water. The 1944 Treaty expanded the role of the International Boundary and Water Commission (IBWC)/la Comisión Internacional de Límites y Aguas (CILA), which has separate US and Mexican sections that work collaboratively to enforce the rules and regulations of the water-related treaties and agreements signed by the two countries. The IBWC is also tasked with monitoring the water's conditions, and issuing reports on these conditions. Under the Treaty, the IBWC can issue a "Minute", which is the official, binding documentation of decisions made by the Commission at binational meetings to respond to particular situations that may arise. While most Minutes respond to particular problems (e.g., how water is shared during periods of drought), Minute 308, entitled "United States Allocation of Rio Grande Waters

During the last Year of the Current Cycle" and issued in 2002, represented an initial attempt to promote a more sustainable approach to water management in the Rio Grande-Bravo basin. It outlined a course of action whereby stakeholder participation, information exchange and funding for conservation, especially for the modernization of irrigation, were prioritized.[6] Several Minutes since then have included measures to promote conservation and improved water quality in river basins.

Both in conjunction with, and separately from, these Minutes, which attempt to push the governance regime incrementally toward greater consideration of water quality, ecological services and conservation, as well as bring a broader range of communities into discussions about how to manage the region's water, a host of other initiatives are being under taken all over the basin. For example, an initiative aimed at creating and operationalizing a binational watershed approach to managing water on the Lower Rio Grande has been in place for almost a decade, and involves stakeholders from all levels of government, nongovernmental organizations, scientists and water users.

However, attempts to allocate water for ecological or conservation purposes is constrained by the hierarchy of uses established in the 1944 Water Treaty, which is as follows: 1) domestic and municipal uses; 2) agriculture and stock-raising; 3) electric power; 4) other industrial uses; 5) navigation; 6) fishing and hunting; and 7) other beneficial uses as determined by the Commission.[7] There is no mention of ecological water uses or water conservation. And, other than the treaty framework and legacy of Minutes, there is no formal transboundary agreement which specifically addresses water quality or ecological degradation in the Rio

[6] International Boundary and Water Commission (2002), Minute 308: "United States Allocation of Rio Grande Water During the Last Year of the Current Cycle" June 28. Available at: https://www.ibwc.gov/Files/Minutes/min308.pdf

[7] 1944 Water Treaty, Article 3.

Grande-Bravo, or that addresses the use or quality of groundwater sources that are shared between the two countries.

It is also worth noting that differences in domestic water management approaches add an additional layer of complexity to the transboundary relationship. Mexico manages the Rio Grande/Bravo from the national level with some engagement by states, while the U.S. manages the basin primarily at the state and irrigation district levels, with some national engagement, which makes transboundary governance difficult.[8] Mexico's federal and regulatory system – particularly for water policy-making – is highly centralized and very bureaucratic. The federal water agency, CONAGUA, controls water allocations and water quality standards, even at the state and regional levels. By contrast, the American system is quite decentralized; water use (after the broader allocations have been made by the IBWC) is managed primarily at the state level, which allows Colorado, New Mexico, and Texas to have differing legislation, water uses, and rights structures.[9] The U.S. does have a national set of environmental water quality standards that apply across the individual states; the *Clean Water Act*, which was established in 1972, regulates water pollution and permits in addition to creating water quality criteria for all water resources across the country. And these political realities of managing shared water resources are coloured by the difficult legacy of relations along the border. The history of annexation, wars fought over the international boundary and continued tensions with respect to water shortages arising from high levels of irrigation, withdrawals and reduced river flow have made joint water management difficult, [10] to say the least.

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[8] Mumme, S.P. (2016), "Scarcity and Power in US-Mexico Transboundary Water Governance: Has the Architecture Changed since NAFTA?" *Globalizations* 13 no.6, p.703

[9] Mumme, S.P. and O. Ibanez (2013), "Power and Cooperation in US-Mexico Water Management Since NAFTA" in P. Gilles, H. Koff, C. Maganda and C. Schultz, eds., *Theorizing Borders Through Analysis of Power Relationships*. pp.151-176. Brussels: P.I.E. Peter Lang.

[10] Mumme and Ibanez (2013)

As implied above, the largest user in the Rio Grande-Bravo is – overwhelmingly – agriculture[11]; more than 85% of water is diverted for the purposes of irrigation.[12] Consistent access to water is critical for a $1 billion agricultural sector[13] that is particularly water-thirsty; popular crops in the area such as alfalfa and pecans require larger quantities of irrigation water when compared to other, more water-efficient crops. On the Mexican side, these highly water-intensive crops are grown because more traditional crops such as corn or sorghum could not compete with those from U.S. producers.[14] As farmers are required to rely heavily upon crops that use large quantities of water to maintain a competitive advantage, the agricultural sector contributes mightily to the water shortages in the basin.

However, growing urban areas are demanding an ever increasing proportion of water, now at least 14% of allocations on both sides of the US-Mexico border. And also with population growth on both sides of the border, urban water use is forecast to increase. Along the Rio Grande-Bravo transboundary mainstem, there are only four major cities, but the urban population is growing at a rapid rate of 2-4% per annum.[15] On the Mexican side of the southern border, the population has increased more quickly, as the region draws economic migrants from poorer parts of Mexico, and increasingly Central America. The US-Mexico cross-border region is also a centre of industrial activity; there are currently over 1 400 industrial plants in the Rio Grande region, most of them located in the basin's largest cities, that require significant

[11] Dagnino, M. and F.A. Ward (2012), "Economics of Agricultural Water Conservation: Empirical Analysis and Policy Implications" *International Journal of Water Resources Development* 28 no.4 (December), pp.1-24.
[12] Rister, M.E., A.W. Sturdivant, R.D. Lacewell and A.M. Michelsen (2011), "Challenges and Opportunities for Water of the Rio Grande" *Journal of Agricultural and Applied Economics* 43 no.3 (August), pp.367-378.
[13] Texas Water Resources Institute (2012), "Rio Grande Basin Initiative Fact Sheet" Texas A & M, College Station, TX, Retrieved from: http://riogrande.tamu.edu/media/278362/rio_grande_basin_initiative_4.2012.pdf
[14] Hernandez et al. 2004
[15] World Wildlife Fund (2018), Retrieved from: https://wwf.panda.org/our_work/water/freshwater_problems/.../rio_grande_bravo/

quantities of water.[16] The North American Free Trade Agreement has resulted in a significant intertwining of the U.S. and Mexican economies along the border, and the Rio Grande region is essential to this economic partnership, acting as the hub of binational trade via export-based industrial plants or maquiladoras.

Given the current demands on the Basin's water as a result of intensive agricultural operations, growing urban populations and industrial activities, not to mention a rigid binational water-allocation regime, the Basin is clearly over-utilized. Attempts to ameliorate water quality and quantity stresses are being undertaken at various points in the basin, but the status of many are unclear vis-à-vis the treaty regime. And predictions for the future are even more dire. According to the US Bureau of Reclamation, climate change is likely to strain water availability even further. With temperatures increasing in the region "by roughly 5-6°F during the 21st century", various impacts are expected, including with respect to the sources of the Rio Grande water, as snowpack is replaced by rainfall; in terms of the continued unpredictability of rainfall and decreased early season run-off impacting irrigation, hydropower operations and flood control; and with respect to increased stress on aquatic life, plants and wildlife.[17] In a noteworthy article that garnered considerable interest by communities along the Rio Grande/Bravo, a 2018 scientific study indicated that more than 90% of snowpack monitoring sites across all western US states, during all months and in all climates, had shown signs of significant decline over the past 14 years.[18] For the Rio Grande, which relies – as do many rivers in the US – on snowpack from headwaters in Colorado for spring flows, the outlook is grim. Warmer conditions are also

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[16] Texas Commission on Environmental Quality

[17] United State Department of the Interior - Bureau of Reclamation (n.d.), "Managing Water in the West. Basin Report: Rio Grande". Available at: https://www.usbr.gov/climate/secure/docs/2016secure/factsheet/RioGrandeBasinFactSheet.pdf.

[18] P.W. Mote, S. Li, D.P. Lettenmaier, M. Xiao and R. Engel (2018), "Dramatic declines in snowpack in the western U.S." *Climate and Atmospheric Science* (Nature Partner Journal) 1. Available at: https://www.nature.com/articles/s41612-018-0012-1

likely to lessen natural groundwater recharge, yet further incentivize increased groundwater pumping. Given this very challenging and constrained context, what is the capacity of the transboundary water governance architecture to adapt and respond?

Adaptive Governance and the OECD Water Governance Initiative

The Rio Grande-Bravo basin seems, then, to be a "hard case" in terms of the ability of a water governance system, whose management provisions and stakeholder relationships were established many decades ago, to respond to multi-faceted conditions and rapidly changing circumstances. It is hard to escape the contention of Olssen et al. that we are in a period of "abrupt change or turbulence" in which "previous rules and social mechanisms don't apply."[19] The mismatch between, the one hand, the scientific data on water scarcity and precipitous snowpack decline and, on the other, the continued adherence to water allocations in the Rio Grande region provides a dramatic example of turbulence and change meeting outmoded governance modes.

As natural science scholarship highlights these environmental developments, scholars from a range of fields in the social sciences have been sounding their own alarm, on the urgent need to redesign institutions involved in transboundary water governance to become more adaptive, particularly as climate change accelerates and exacerbates water scarcities. The term 'adaptive governance' (AG) is perhaps most accurately described as an umbrella concept under which scholars from a variety of disciplines and using different analytical approaches attempt to puzzle through the challenge of moving current management regimes to governance modes that

[19] Olsson, P., L.H. Gunderson, S.R. Carpenter, P. Ryan, L. Lebel, C. Folke and C.S. Holling (2006), "Shooting the Rapids: Navigating Transitions to Adaptive Governance of Social-Ecological Systems" *Ecology and Society* 11:18.

more fully recognize and internalize the interdependence of social and ecological systems. [20] This is seen as key to better understanding and diagnoses of problems and better decision-taking that are more likely to respond effectively to rapidly changing conditions.

The adaptive governance literature provides insights into the attributes that can improve a governance system's performance in this regard. We view AG through the lens of Chaffin et al., whose analytical focus is trained on the ability/capacity of formal and informal institutions and networks, as well as actors, to pursue "a desired state for social-ecological systems."[21] A successful AG system must be able to recognize and diagnose deteriorating conditions, and then be able to undertake changes in paradigms, structures and processes in order to transition towards a governance system that responds to these altered conditions. Certainly, a key feature in terms of moving in this direction is the ability of the system to generate and apply knowledge, or to 'learn.'[22] This, in turn, requires the ability to monitor key drivers of change and engage in scenario planning – both of which are forward-looking learning processes – yet also take into account past experiences.[23] This information then needs to be structured into decision processes. Here social networks "can be key mechanisms for drawing on social memory at critical times and enhance information flow and collaboration across scales."[24]

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[20] Dietz, T., E. Ostrom and P. Stern (2003), "The struggle to govern the commons" Science 302, pp.1907-1912; Folke, C., T Hahn, P. Olsson, & J. Norberg. (2005). Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources*, 441-473.

[21] Chaffin, B.C., H. Gosnell and B.A. Cosens (2014), "A decade of adaptive governance scholarship: synthesis and future directions" *Ecology and Society* 19(3): 56.

[22] Hill, M. and N.L. Engle (2013), "Adaptive Capacity: Tensions across Scales" *Environmental Policy and Governanc*e, 23(3), 177-92; Milman, A. et.al. 2013. Assessment of Institutional Capacity to adapt to Climate Change in Transboundary River Basins, *Climate Change*, 121: 775-770; Pahl-Wostl, C., L.Lebel, C. Knieper and E.Nikitina, 2012. *From Applying Panaceas to Mastering Complexity: Toward Adaptive Water Governance in River Basins*, *Environmental Science and Policy*, 23, 24-34.

[23] Peterson et al. 2003

[24] Folke C., and T. Hahn (2005), "Adaptive Governance of Social-Ecological Systems" *Annual Review of Environment and Resources* November, p.453

Another critical attribute of adaptive governance, one which builds on several decades of insights and experience with integrated water resources management, is the ability to engage a broad range of decision-makers and stakeholders meaningfully in governance.[25] Scholarship on water governance universally points to the engagement of water users and stakeholders as important in terms of increasing both the legitimacy of decision-making within these governance systems as well as the quality of decisions made.[26] There is clear evidence that governance and policy systems that engage key water users and stakeholders are more successful, particularly at local and watershed scales.[27] Adaptive governance is thus in line with the emergence of new modes of governing in which multiple actors are involved, interactions within and across state, private sector and civil society are key, and decisions require action across multiple scales and levels.[28]

Other studies have laid out additional institutional and network attributes that are argued to support the ability of a governance system to respond and adjust to increasingly uncertain ecological conditions in a forward-looking fashion.[29] A number of scholars have, for example,

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[25] deBoer et.al. 2013, 2016; Ostrom, E. 2007. "The Governance Challenge: Matching Institutions to the Structure of Social Ecological Systems", in S. Levin (ed) *The Princeton Guide to Ecology*. Princeton, NJ; Princeton UP; von der Porten and deLoe 2014; Debora VanNijnatten, Carolyn Johns, Kathryn Friedman, Gail Krantzberg (2016), "Assessing Adaptive Transboundary Governance Capacity in the Great Lakes Basin: The Role of Institutions and Networks" *International Journal of Water Governance* Special issue on "Assessing Adaptive Transboundary Governance Capacity in the Great Lakes Basin": 7-32.

[26] Huitema et al. 2009. Adaptive water governance: Assessing the institutional prescriptions of adaptive (co) management from a governance perspective. *Ecology and Society 14* (1), 26.

[27] Ostrom (2007).

[28] C.J.A.M. Termeer, A. Dewulf, M.V.Lieshout (2010), Disentangling scale approaches in governance research: comparing monocentric, multilevel, and adaptive governance Ecology and Society, p. 15; J. Vogler, A. Jordan (2003), "Governance and the environment" in F. Berkhout, M. Leach, I. Scoones (Eds.), Negotiating Environmental Change: New Perspectives from Social Science, Edward Elgar, Cheltenham, UK (2003), pp. 77-108.

[29] Betinni et.al. 2015; Edelenbos and van Meerkerk 2015; Garrick 2015; Garrick and DeStefano 2017; Hill and Engle 2013; Knieper and Pahl-Wostl 2016; Pahl-Wostl, C. 2009. A conceptual framework for analyzing adaptive capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change 19*, 354-365; Pahl-Wostl, C., G. Holtz, B. Kastens, & C. Kneiper. 2010. Analyzing complex water governance regimes: the Management and Transition Framework. *Environmental Science ad Policy 13*, 571-581; Pahl-Wostl 2012.

embraced the concept of 'polycentricity' from the work of Ostrom[30], whereby multiple arenas of policy actors are coordinated under an overarching set of formal and informal institutional rules and arrangements, and where institutional arrangements and the multi-scale dimensions of water governance are seen as important in analyzing adaptability.[31] However, understanding the connective tissue that supports and links these arrangements across scales is also important for understanding how governance resources across institutions and actors are mobilized and directed at emerging problems.

The assumption in this literature is that, if these attributes are present in the water management regime – governance that is more coordinated, connected and flexible; that promotes broader engagement; and that generates and disseminates knowledge as well as stimulates learning – that a 'desired end state' will be achieved, namely better governance exhibiting a higher level of adaptability and resulting in a more sustainable social-ecological system (VanNijnatten & Johns, *under review*). But how do we determine the presence and/or strength of these governance attributes? Alongside the multidisciplinary discussion of adaptability, scholars, practitioners and international organizations have experimented with the use of governance 'indicators', in an effort to create diagnostic tools that can isolate and assess particular governance attributes linked to more effective resource management, especially those

[30] Ostrom (2007); Ostrom, E. (2009), "The contribution of community institutions to environmental problem-solving," in A. Breton, G. Brosio, S. Dalmazzone, G. Garrone, eds., *Governing the Environment*, Edward Elgar.

[31] Pahl-Wostl 2009; Pahl-Wostl et.al. 2010, 2012; Hill and Engle 2013; Garrick, D. (2015), *Water Allocation in Rivers Under Pressure: Water Trading, Transaction Costs and Transboundary Governance in the Western US and Australia*. Cheltenham, UK: Edward Elgar Publishing; Betinni, Y., R. Brown and F. de Hann (2015), 'Exploring Institutional Adaptive Capacity in Practice: examining water governance adaptation in Australia', *Ecology and Society***, 20(1), 47-**; Knieper, C. and C. Pahl-Wostl (2016), 'A Comparative Analysis of Water Governance, Water Management, and Environmental Performance', *Water Resources Management*, 30: 2161-2177; Garrick, D. and L. De Stefano (2016), 'Institutional Attributes for Adaptive Capacity in Federal Rivers: Moving from Principles to Indicators' *Current Opinion on Environmental Sustainability* 21:78-85.

relating to adaptability.[32] Governance indicators are understood as comprising "a variable or some aggregation of variables" describing "a system or process such that it has significance beyond the face value of its components."[33] Ostrom's (1990) eight design principles for managing a commons are one of the most widely tested sets of governance indicators in policy research (though they are expressed in the language of principles rather than as testable indicators).

Governance indicators are different from "outcome" indicators, which focus on measuring the state of ecosystem/water quality.[34] Instead, governance indicators provide an understanding of the factors that might contribute to implementation deficiencies across programs, across sectors and across systems – including key adaptive governance attributes such as levels of public engagement, linkages among decision-makers and communities across scales, and the presence of consistent and predictive information. Governance indicators provide us with "horizontal" knowledge about the transboundary capacity to support the general aims and objectives for a shared water basin. They are a powerful way to focus data collection and connect scholarly research to real-world governance challenges, as they can contribute to continuous diagnosis, reflection and improvement, when designed and used appropriately.[35] Significantly, governance indicators can provide a means of connecting outcomes with social and human behavioural change; this connection is widely recognized as critical in any complex

[32] Bennett, F. and C. Roche (2000), "Developing indicators: The scope for participatory approaches" *New Economy, Juncture* (March), 24

[33] Lorenz, C.M., A.J. Gilbert and W.P. Cofino (2001), "Environmental Auditing: Indicators for Transboundary River Management" *Environmental Management* Vol. 28, No. 1, p.117.

[34] Outcome indicators related to water have been developed as part of broader environmental indicators of water quality/quantity (Yale EPI 2016); for water security (Dunn and Bakker 2009; Norman et.al. 2013; Garrick and Hall 2014); for water stress (TWAP 2016); for water poverty (Sullivan 2002; Garriga and Foguet 2015); and for international assessments and comparisons (DeStefano 2010; OECD 2011).

[35] Langhans, S.D., P. Reichert and N. Schuwirth (2014), 'The Method Matters: A Guide for Indicators Aggregation in Ecological Assessments', *Ecological Indicators*, 45: 494-507; Muriithi, K.J. Margarita, N. Jannin, N.Sajid, S. Sahibjeet, S. Sudhanshu (2015), *Quantifying Governance: An Indicators Approach,* London School of Economics.

environmental governance system and is particularly relevant in meeting the goals of transboundary agreements.

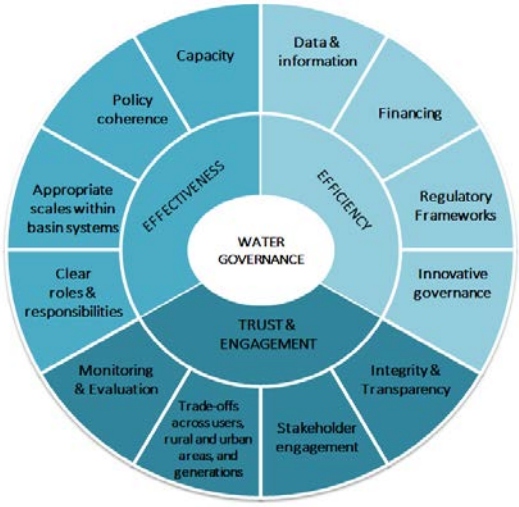
However, operationalizing this connection between how human and social behaviour is connected to environmental outcomes through management institutions and networks, and then characterizing these interactions through the use of governance indicators is a challenging task; certainly, the complexities of context and interactions through institutions and networks are difficult to reduce to a 'proxy' measure. Nevertheless, the development and use of indicators in water governance has exploded; indicators related to water have been developed as part of broader environmental indicators of water quality/quantity (Yale EPI 2016); for water security (Dunn and Bakker 2009; Norman et.al. 2013; Garrick and Hall 2014); for water stress (TWAP 2016); for water poverty (Sullivan 2002; Garriga and Foguet 2015); and for international assessments and comparisons (DeStefano 2010, OECD 2011).

The Organization for Economic Cooperation and Development (OECD) Water Governance Programme has waded into these waters, attempting to provide tools for water managers to self-diagnose their governance system's strengths and weaknesses. The OECD considers 'water governance' to be the range of political, institutional and administrative rules, practices and processes (formal and informal) through which decisions are taken and implemented, stakeholders can articulate their interests and have their concerns considered, and decision-makers are held accountable for water management.[36] In 2015, the OECD conducted a comprehensive inventory of water governance indicators and developed 12 Water Governance Principles that were endorsed by OECD member countries (see Figure 2).[37] The Principles provide a framework for understanding and assessing water governance systems, and they help

[36] OECD, 2011. *Water Governance in OECD Countries: A Multi-level Approach*, OECD Water Programme, Paris.
[37] OECD 2015, *Principles on Water Governance* https://www.oecd.org/cfe/regional-policy/OECD-Principles-on-Water-Governance.pdf

to generate dialogue on how to improve water governance. The 12 Principles focus on three main dimensions (effectiveness; efficiency; trust and engagement) and apply to all levels of government, all water management functions, and all water uses.

Figure 2: OECD Principles on Water Governance



Although the 12 principles have been applied in some jurisdictions,[38] to further develop and support the implementation of the Principles the OECD developed 36 indicators in 2016-17, three for each of the 12 water governance principles.[39] In 2017-18, the OECD pilot-tested the 36 indicators in 12 OECD jurisdictions at various scales: basin, national, regional, and local. The approach to applying the indicators is based on a voluntary self-assessment framework and multi-stakeholder dialogue to assess how water governance systems are performing at a given moment (static) or expected to perform over time (dynamic). The OECD's water governance indicators are *perception-based*, involving the view of experts or various types of stakeholders, and *fact-based*, involving available/objective data. In applying the OECD's water governance indicators, both approaches should be used and data collected through a mix of methods

[38] See, for example, Chris Seijger et.al. 2018. "Functions of OECD Water Governance Principles in assessing water governance practices: assessing the Dutch Flood Protection Programme", *Water International*, 43:1, 90-108.
[39] OECD 2018, *Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices*, OECD Studies on Water, OECD Publishing, Paris, https://doi.org/10.1787/9789264292659-en.

including questionnaires, interviews, workshops, and available data sources to build consensus over subjective judgments within multi-stakeholder settings.

At the World Water Forum in March 2018 the full list of water governance indicators and methodology options were publicly released in the report *Water Governance at a Glance*.[40] Findings from the first round of applications in pilot jurisdictions were also presented and many jurisdictions and organizations pledged to implement the OECD Principles on Water Governance and indicator framework.[41]

OECD Indicator Application to the Rio Grande/Bravo Case

To date, applications of the WGIs have been *within* various OECD member countries at various scales.[42] However, there have been no applications in the US, Mexico or Canada, and there have been no applications in *transboundary* water basins. As part of our project on water governance in the shared, binational Great Lakes and the Rio Grande/Rio Bravo regions, funded by the Social Sciences and Humanities Council of Canada, we have adopted and modified the OECD's WGIs to apply them to these two transboundary cases.

Methodology

In the summer of 2018, our research team reviewed the OECD's water governance indicators and methodology options related to applications in transboundary cases. We then adopted the 36

[40] OECD 2018. *OECD Water Governance Indicator Framework*, http://www.oecd.org/regional/OECD-Water-Governance-Indicator-Framework.pdf

[41] OECD. 2018. *Brasilia Multi-stakeholder Pledge to Implement the OECD Principles on Water Governance* http://www.oecd.org/cfe/regional-policy/Brasilia-Multi-stakeholder-Pledge.pdf

[42] OECD 2018. *Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices*, OECD Studies on Water, OECD Publishing, Paris, https://doi.org/10.1787/9789264292659-en.

indicators and modified the perception-based methodology for application at the transboundary scale in the Great Lakes and Rio Grande/Bravo regions. We designed a worksheet containing all 36 of the OECD's water governance indicators (Appendix A) as well as a short questionnaire (Appendix B), which would allow participants to provide assessments of the indicators as well as their applicability and value vis-à-vis their region, and asked participants whether they wished to provide additional feedback or comments in a short follow-up interview. A pre-test was conducted with six experts, after which the methodology was modified for clarification and to incorporate an iterative component. In the fall of 2018, we then applied and tested the OECD water governance indicators in the Great Lakes region.

Application of the OECD water governance indicators to the Rio Grande/Bravo case began in January 2019, with invitations being sent out to key stakeholders involved in basin water management. All materials were provided in English and Spanish. However, given the US federal government shutdown in early 2019, some invitations – and responses – were considerably delayed. A total of 33 stakeholders were invited to participate, and 16 responses have been received (with more promised). This paper provides preliminary findings on the responses submitted thus far in the Rio Grande/Bravo case, on the understanding that responses continue to be submitted and will be integrated into the next version of this paper.

Preliminary Findings – OECD Indicator Worksheet

The worksheet containing all 36 of the OECD's water governance indicators asks respondents to choose whether each indicator is "in place, functioning", "in place, partly implemented", "in

place, not implemented", "under development", "not in place" or "not applicable" (See Appendix A). As can be seen in the summary table below (Figure 3), the "not applicable" option was rarely chosen, and only reached two responses for 9c. "mechanisms to identify corruption." In addition, respondents also rarely opted for 'in place, not implemented.'

What is striking about the results in the RGB case is the lack of consensus reflected across the responses and the high number of split responses on most indicators. Responses on 11 out of the 36 indicators are split largely between two options and an additional 16 responses are split between three or more options. This means that responses on fully 27 out of the 36 indicators show a clear lack of agreement on the existence/implementation/functioning of the attributes described in the indicators on the part of respondents. On only nine indicators were there a clear majority of responses favouring a specific option. In terms of where these majorities appear, there is consensus on the *presence* of agreements and institutions in place for water management and cooperation, along with designated lead agencies, agencies with regulatory functions and cooperative mechanisms more generally, as 'in place and functioning'. Consensus also exists on the *absence* ('not in place') of transboundary education/training, frameworks for revenue collection, mechanisms to identify corruption and ombuds-institutions. In addition, a strong majority of respondents also agreed that the transboundary incentives for innovation are 'not in place'.

But there the agreement ends. There is a diversity of opinion on whether the transboundary institutions, agreements, cooperative and associated mechanisms actually foster cooperation across water users (2c.), address capacity gaps (4b.), encourage bottom-up initiatives/dialogue/learning (8b.), foster knowledge and experience sharing (8c.) or cross-sectoral (horizontal) coordination and policy coherence (3a., 3b.). Further, no agreement exists

on whether the governance regime possesses domestic revenues and allocations for water (6b.), sound water management regulatory frameworks (7a.), regulatory tools for both water quality and quantity (7c.), legal and institutional frameworks to promote integrity and transparency (9a.), transboundary legal frameworks to engage stakeholders (10a.), mechanisms to diagnose/review stakeholder agreement (10c.), formal provisions/legal frameworks for fostering equity across water users (11a.), regular transboundary monitoring and evaluation of water policy and governance (12a.) or transboundary monitoring and evaluation to assess water policies and practices (12b.)

OECD Water Governance Indicators Worksheet: Summary of Submissions

Indicator	In place, functioning	In place, partly implemented	In place, not implemented	Under development	Not in place	Not applicable	No Response Don't Know	tage Split
1a. existence of water agreement/law								clear majority
1b. designated lead agencies								clear majority
1c. formal review mechanisms								clear majority
2a. cooperative mechanisms								53 - 40%
2b. institutions at basin-wide scale								46-20%
2c. cooperation across all water users								20%
3a. cross-sector approach/policies								40%
3b. transboundary horizontal coordination								40-40%
3c. mechanisms to review cross-sector barriers and policy coherence								26-40%
4a. merit based independent implementers								33-33%
4b. mechanisms to identify and address capacity gaps								26-20-26-20%
4c. transboundary/domestic education and training programmes for water professionals								clear majority
5a. transboundary water information systems								26%
5b. standardized, harmonized, official, basin-wide water-related statistics								40%
5c. mechanisms to identify data gaps								26-46%
6a. frameworks to collect necessary revenues to meet mandates								clear majority
6b. domestic revenues and allocations related to water								33%
6c. mechanisms to assess short, medium and long-term investment needs								33-40%
7a. sound water management regulatory frameworks								20%
7b. dedicated public institutions with key regulatory functions								clear majority
7c. regulatory tools for both water quality and quantity								40-26-13-13-13%
8a. transboundary policy framework/incentives to foster innovation								clear majority
8b. transboundary institutions encouraging bottom up initiatives, dialogue and learning								13-20-6-33-20%
8c. transboundary knowledge and experience sharing mechanisms								13-4-0-26-20%
9a. legal and institutional frameworks on integrity and transparency								13-26-6-13-40%
9b. independent audit/adjudication to investigate and safeguard public interest								clear majority
9c. mechanisms to identify corruption								clear majority
10a. transboundary legal frameworks to engage stakeholders								40%
10b. structures to engage stakeholders								26-46%
10c. mechanisms to diagnose/review stakeholder engagement								46%
11a. formal provisions/legal frameworks fostering equity across water users								46%
11b. transboundary ombuds/institution to protect water users including vulnerable groups								clear majority
11c. mechanisms to manage trade-offs across users								40-46%
12a. regular transboundary monitoring and evaluation of water policy/governance								33%
12b. transboundary monitoring and evaluation to assess policies/practices and help adjust								13-46-13-26%
12c. transboundary monitoring and evaluation mechanisms to measure extent to which water policy fulfils intended outcomes and water governance framework fits is								26-40%

*all responses may not total to the total 'n' as some participants did not respond to all 36 indicators indicating a 'don't know' or unsure '?' response

NOTES

Corresponding colour indicates clear majority of responses (51% and above = 8 and above)
Two colours indicate split in responses (two cells representing values of between 4 and 7)
Purple indicates distribution of responses across more than two response categories (cells representing value of 1-7);
In a few cases respondents included checked two cells in a particular indicator - we have included both

Notable in this regard is that responses tend not to cluster at one side of the spectrum among more closely related options (e.g., 'in place, functioning' and 'in place, partly implemented'). There are arguably only three cases of clustering: 2a. where respondents agree that cooperative mechanisms are in place, but disagree on whether they are functioning or partly implemented; 10b. where respondents agree that structures for engaging stakeholders are in place, but disagree on whether they are functioning or partly implemented; and 5c. where respondents believe that mechanisms to identify data gaps are either 'not in place' or 'under development.' In all other cases of split responses, respondents were very likely to disagree on whether particular attributes were 'in place, functioning', under development' or 'not in place' at all. To provide one illustration of this tendency, respondents were just as likely to believe that transboundary legal frameworks for engaging stakeholders were in place (whether 'functioning' or 'partly implemented') as to believe such frameworks were 'not in place'. Interesting also is the observation that some responses seem to indicate an awareness that some of the mechanisms to address these gaps are 'under development', while others did not.

It is important to reflect on what might explain the lack of agreement among respondents on the presence of the 36 OECD indicators. While the number of respondents (16) is too small to provide any definitive answers to this and follow-up interviews would be needed to get more detail as to the roots of this disconnect, there are two hypotheses that might be worth pursuing in future work on water governance in the Rio Grande/Bravo. First, it may be that answers are influenced by the respondent's location in the basin. As noted above, the basin is managed as two separate segments in terms of water allocations and sharing (see Figure 1) and under two separate treaties: the first, from south of Elephant Butte Dam past the water withdrawals and return flows of El Paso, TX and Ciudad Juarez, Chihuahua; and the second, from Fort Quitman

through to where the Rio Conchos flows into the Rio Grande and down to the Gulf of Mexico.[43] As was noted by more than one respondent, the two segments "are really two separate rivers, that are managed in different ways," due to varying ecological and river conditions, different stakeholder composition, networks and power structures, and diverse modes of interaction across the border. Anecdotal evidence suggests that there are a variety of initiatives being undertaken in different parts of the basin, which may influence how respondents see governance in their part of the basin. Secondly, responses may differ based on respondents' status as water user, i.e., where are they positioned in the hierarchy of water allocations, if at all? Indeed, positionality as a feature of context figured into respondents' comments; as one respondent explained, "I see two different categories of respondents: i) those who have water rights or concessions …; and (ii) those with insufficient water rights. …Those in the first category may respond more positively than those in the second…"

Preliminary Findings – Open-ended Questions

Responses on the open-ended questions (Appendix B) yielded further insights into perceptions of the water governance regime in the Rio Grande/Bravo. In terms of the first question asking for respondents' general assessment of the applicability of the OECD WGIs to the Rio Grande/Bravo basin, a majority all respondents noted that the WGIs were applicable. For example, one respondent noted with regard to the WGIs that "most are applicable to the Rio Grande/Bravo region", while another stated that "the indicators make sense" and a third provided a similar assessment: "they are common sense indicators of the effectiveness, efficiency and transparency of the institutional arrangements designed to safeguard the sustainability of the

[43] Congressional Research Service (2017), "U.S.-Mexico Water Sharing: Background and Recent Developments", p.14. Available at: https://fas.org/sgp/crs/row/R43312.pdf

basin." It should also be noted however that one respondent believed that the WGIs were "not very relevant" to the Rio Grande/Bravo, while a second indicated that "most are related, some are not quite related or not applicable" and a third noted that "[t]he indicators reflect the general aspects of the governance of the Rio grande Basin. They do not demonstrate specific characteristics."[44]

A recurring theme in the open-ended responses was that the OECD WGIs were a useful toolset, in a theoretical sense, for thinking about how to better manage the shared water basin, as well as for highlighting gaps in the governance regime – regardless of whether indicators were deemed to be in place and functioning in the basin at the present time, or not. One respondent commented that "these indicators are a weather vane for sustainability of any water resource" while another noted that "they are helpful tools to assess the current state, but also a good way to see what may still be needed. … These indicators are a great way to track what's being done, who's doing it, what's needed, etc." Another believed that the WGIs provide "[v]aluable guidance that could be a shared goal and process for a multi-jurisdictional approach."
As one respondent explained, the WGIs "do a good job of capturing strengths and weakness" (in the water governance regime); another felt that "these indicators could be a tool to better manage the basin. It provides all the elements necessary for smart planning and operations."

A majority of respondents also agreed on the value of applying the WGIs, in light of charting future directions. As noted by one respondent, the exercise "shows the heavy weight of past institutions and directions that we need to innovate to be adaptable in the future." Another commented that "[i]f OECD indicators can be used as a tool to help RGB water governance respond to future water-related challenges, that would be of value." A third explained that "[t]here is value in applying the OECD water governance indicators in identifying current

[44] Response translated from original in Spanish.

settings and exploring opportunities for improvement/innovation in water operations with new frameworks." Respondents variously referred to the WGIs as a "checklist", "roadmap" and, as noted above, "a weather vane". The WGIs were also described as "helpful tools to assess the current state but also a good way to see what may still be needed."

However, there were three significant weaknesses with respect to the indicators that were noted across respondents. Perhaps most significantly, it was felt by many of the respondents that the application of the OECD indicators do not allow for proper consideration of surface-groundwater interactions. Several respondents noted the difficulty of applying the WGIs as it was not clear to them how such interactions could be taken into account given the nature of the indicators. Several respondents echoed the view of one respondent who explained that "my answers are limited only to surface water, since basically all my answers would have been 'not in place' for groundwater." In fact, a number of respondents sought counsel from the investigator when completing the worksheet and questionnaire, asking whether they should view the exercise as being primarily about surface water or subsurface, implying that there are two different regimes. Two respondents even filled out the sheet with separate answers for the surface and subsurface regimes. One respondent was quite direct in their assessment of this challenge in approaching the WGIs: "The indicators are only capable of reflecting the topic concerning superficial water and nothing else."[45] As another respondent concluded, "[w]e need to make sure that (1) water quality (esp. salinity) and (2) subsurface water also are considered matters of governance," implying that they are not, at present.

Second, respondents felt that the indicators were not likely to apply equally well across scales and jurisdictions. As one respondent noted "[t]he multi-jurisdictional issue on a regional, state and country basis makes a few of the indicators difficult to address – policy coherence, data

[45] Response translated from the original in Spanish.

and information, regulatory frameworks, monitoring and evaluation all seem like areas that would be extremely challenging to implement on such a large scale." Another noted that, in filling out the worksheet, "the indicators labelled as 'not applicable' were labelled as such because at a national level there is no regulatory framework that applies to water issues. Likewise, the indicators of equity, ombudsman and compensation do not exist within the laws of water and the treaty, much less in the political constitution as an obligation to observe."[46] In fact, several respondents noted feeling overwhelmed by myriad activities at different scales, the sheer complexity of water management in the basin and the lack of coordination among them. One explained that "[m]any people are doing really good things in their respective areas but have capacity and scale issues in thinking and reaching out beyond their areas." Another noted that "[s]everal NGOs and planning groups are actively engaged and there are so many levels of projects/planning activities underway that many agencies are feeling overwhelmed and unable to commit to additional efforts." The impression given by such sentiments are of a multiscalar and fragmented reality, complicating how the WGIs can be applied.

Third, several respondents noted that the application of the WGIs needed to be contextualized, both in terms of how they applied to a given water management case but also in terms of the normative rationale for why they are being used in the first place. One respondent explained that, "I do believe there is value (to applying the OECD WGIs), particularly if greater context can be provided as to why using the OECD's governance indicators may be of value…" As one respondent noted, "it would be valuable for the investigators to offer greater detail as to why the assessment is being conducted in the first place. My assumption is that this is being done to gauge how well transboundary water institutions in the RGH may be able to address growing disparities between water demand and water availability. But, that is my assumption. All to say

[46] Response translated from the original in Spanish.

that, in my mind, context is everything as to how respondents answer the questions." Further, several respondents noted that the OECD WGIs could not show how things were changing in response to context, and were not themselves dynamic enough. As one respondent explained, "I feel like the diagram is too neat. I do not believe the world falls into a perfect 3X4 pie chart. I'd like it to look more adaptive."

Observations on the Application of the OECD Water Governance Indicators at the Transboundary Scale in Rio Grande/Bravo Basin

This paper began with a discussion of the challenges facing those managing water in the Rio Grande/Bravo basin; the RGB is portrayed as a "hard case" in terms of the ability of a water governance system, whose management provisions and stakeholder relationships were established many decades ago, to respond to multi-faceted conditions and rapidly changing circumstances. If we reflect on the preliminary findings of application of the WGIs in the Rio Grande/Bravo case, does this exercise tell us what we need to know with respect to how adaptive the governance regime is, where the gaps are and, at the same time, where energy might be focused in terms of moving the governance system toward higher levels of adaptability? Also, in the process of actually using the OECD indicators, what lessons have we learned in terms of their usefulness as a tool for assessing the adaptability of water governance regimes in a transboundary context?

At this point, it is helpful to look at the findings of this study alongside the advice provided by the adaptive governance literature, namely that governance that is more coordinated, connected and flexible; that promotes broader engagement; and that generates and disseminates knowledge as well as stimulates learning is also more likely to be adaptive. The picture that Rio Grande/Bravo case respondents shared with us was of a governance architecture that is

coordinated and connected only in the most basic sense of water allocations under the treaty by institutions, agreements and cooperative mechanisms. At the same time, respondents' comments in the open-ended questions suggested that there are actually many initiatives being undertaken in the basin, outside of formal structures and with the intent to shift the focus of the regime in more sustainable directions. This mass of activity, however, does not seem to be firmly connected to the formal regime, though this needs to be much more closely investigated. Thus, it is not clear whether the regime is developing in a polycentric direction, whereby multiple arenas of activity operating closer to the grassroots are connected by overarching rules and structures. The problem here is that any initiatives that might be successfully experimenting with, for example, joint knowledge-gathering and assessment or bringing additional interests in deliberations on water governance are also likely to be unconnected or not well-connected to the formal transboundary regime.

Moreover, tools that might be regarded as critical to the knowledge and learning function of an adaptive governance system – including mechanisms to identity and address capacity and data gaps, transboundary water information systems and standardized water statistics, as well as transboundary monitoring and evaluation to assess policies and practices – are all the subject of disagreement among respondents as to whether they are in place and functioning, in place and partly implemented, under development or not in place at all. Perhaps most striking in this respect was that the indicator with the highest level of agreement among respondents as being 'not in place' was transboundary policy frameworks/incentives to encourage innovation. One might question, then, whether the transboundary Rio Grande/Bravo system can encourage basic elements of knowledge production, dissemination and discussion, given current structures.

In addition, the concern expressed through the worksheet responses about the lack of legal frameworks and structures for engaging stakeholders and bringing about equity among water users is of concern, and merits further study as another focus for enhancing the adaptability of the governance system. We know from academic scholarship and case study analysis that broadening the range of voices included can change the nature of discourse, heighten levels of reciprocity and trust in a governance regime, leading to a greater likelihood of constructive trade-offs (critical to water governance in the region), and promote more sustainable outcomes. In this respect, it is important to note that very few respondents considered frameworks and structures for engaging stakeholders to be 'under development', which might be regarded as a surprising finding given the variety of initiatives which are being undertaken at various locations around the basin and which seem to be engaging additional communities and organizations.

Applying the OECD WGIs to a transboundary context with a multi-scalar reality is clearly challenging. Biswas and Tortajada have articulated a serious concern about water governance indicators, namely that "it may … not be possible to develop an all purpose water governance indicator even for one country. … because governance requirements for different types of water uses are likely to be different."[47] This problem is magnified in a transboundary context. It both limits what we might be able to conclude from the results and highlights a key weakness of the indicator set. The original intent of the OECD is that the WGIs could be applied at various scales: basin, national, regional and local. The pilot tests for applying the WGIs were carried out at various scales – but individually, to one scale at time, e.g., local or regional, not both at once. Attempts to the apply the OECD WGIs to the transboundary context runs up against a reality whereby some functions in the basin are carried out by binational authorities,

[47] Biswas and Tortajada (2010, p. 136).

other functions by national or subfederal authorities, or at the local level. In the Rio Grande/Bravo basin case, respondents made it clear that it was difficult to fill out the indicator worksheet, given that functions such as water regulation might be carried out at the state level while water allocation was implemented by binational authorities along with local irrigation districts. In this context, the analytical problem of what constitutes "the transboundary governance regime" which we encouraged respondents to focus on, requires a higher level of problematizing, at the very least, and almost certainly limits what the OECD indicators can tell us.

The need for more adaptive governance in the case of the Rio Grande-Bravo, where the system's rigidities are legion and users are closely tied to outdated and uncertain surface water allocations, while at the same time ecological conditions worsen rapidly, is obvious. The analysis here provides some suggestions, based on application of the OECD WGIs, as to where one might focus efforts to improve the adaptability of the governance regimes, namely with knowledge-gathering mechanisms and tools for learning and engaging stakeholders. The exercise also provides insights into pitfalls that need to be approached carefully, such as sorting out multi-scalar interactions. Critically, these reflections have direct bearing on how to address the almost complete lack of governance with regard to shared sub-surface water resources, as our respondents have pointed out. In this case, insights into weaknesses in the transboundary surface water regime can chart future directions for shared governance in the Rio Grande/Bravo.

APPENDIX A: OECD Indicator Worksheet

OECD Water Governance Indicators Worksheet: Application at Transboundary Scale in Rio Grande Region

Indicator	In place, functioning	In place, partly implemented	In place, not implemented	Under development	Not in place	Not applicable
1a. existence of water agreement/law						
1b. designated lead agencies						

1c. formal review mechanisms						
2a. cooperative mechanisms						
2b. institutions at basin-wide scale						
2c. cooperation across all water users						
3a. cross-issue/cross-sector approach/policies						
3b. transboundary horizontal/cross-sector coordination						
3c. mechanisms to review cross-sector barriers and policy coherence						
4a. merit-based independent implementers/bureaucratic officials						
4b. mechanisms to identify and address capacity gaps						
4c. transboundary education and training programmes for water professionals						
5a. transboundary water information systems						
5b. standardized, harmonized, official, basin-wide water-related statistics						
5c. mechanisms to identify data gaps						
6a. frameworks to collect necessary revenues to meet mandates						
6b. domestic revenues and allocations related to water/basin						
6c. mechanisms to assess short, medium and long-term investment needs						
7a. water management regulatory frameworks						
7b. dedicated public institutions with key regulatory functions						
7c. regulatory tools for both water quality and quantity						
8a. transboundary policy framework/incentives to foster innovation						
8b. transboundary institutions encouraging bottom up initiatives, dialogue and learning						
8c. transboundary knowledge and experience sharing mechanisms						
9a. legal and institutional frameworks on integrity and transparency						
9b. independent audit/adjudication to investigate and safeguard public interest						
9c. mechanisms to identify corruption						
10a. transboundary legal frameworks to engage stakeholders						
10b. structures and mechanisms to engage stakeholders						
10c. mechanisms to diagnose/review stakeholder engagement						
11a. formal provisions/legal frameworks fostering equity across water users						
11b. transboundary ombuds/institution to protect water users including vulnerable groups						
11c. mechanisms to manage trade-offs across users						
12a. regular transboundary monitoring and evaluation of water policy/governance						
12b. transboundary monitoring and evaluation to assess and adjust policies/practices						
12c. transboundary monitoring and evaluation mechanisms to measure extent to which existing policy fulfils intended outcomes and water governance framework fits its purpose						

Please indicate with an 'X' your assessment for each indicator

APPENDIX B: Open-ended Questions

OECD Water Governance Indicators

Questions Related to the Rio Grande-Rio Bravo Case

1) Based on reviewing the OECD water governance indicators and completing the worksheet, what is your general assessment of the OECD's water governance indicators and their applicability in the Rio Grande-Rio Bravo transboundary region?

2) Were any of the indicators not applicable to the Rio Grande-Rio Bravo region? Why?

3) Do you think there is value in applying the OECD water governance indicators in the Rio Grande-Rio Bravo region? Why? Why not?

4) Do you have any other comments about the OECD water governance indicators?

5) Would you be interested in providing additional feedback on the OECD water governance indicators, or the use of water governance indicators more generally in the region, by participating in a short 20-30 minute online interview?

YES NO