

Charting a Pathway for Water Security and Resilience

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Abstract

The world is facing an escalating water crisis of quantity, quality, distribution, and allocation. Essential for life and a fundamental engine for economic growth, water is foundational to sustaining the world as we know it. Increasing frequency, magnitude, and extent of water-related natural and human-induced disasters including floods, loss of large freshwater lakes, and oil spills are not only threatening human wellbeing and economic growth, but social development and political stability even in high income countries. Patchwork remediation has failed; business as usual is no longer possible. Successfully addressing sustainable development challenges requires not only resources, but also massive behaviour changes that must occur at the level of governments, economies, and individuals. These changes require resilience on the part of all.

We posit that resilience requires good growth, supportive governance, and community stewardship in order to be sustainable. This can be achieved and maintained through innovative engagement of the private sector in community investment strategies. The key lies in innovating technological and social change while aligning stewardship with the marketplace in order to foster awareness and behavioral change.

Our solution plots a path towards sustainable water security and resilience through the Realising Action for Community Transformations (ReACT) implementation framework that is predicated on assessment, iterative learning, evidence-informed decision making, and an innovative approach to behaviour change - the PathSight Model. This private sector marketing model uses complex, big data sets combined with social sciences and technology to influence behaviour and impact outcomes. Integrating this model into the framework creates an innovative approach to sustainable water development and management through the use of science to inform and framing of causes that inspire, in order to engage the populace in necessary and sufficient behavioral transformations.

Framework application is ongoing in the Lake Winnipeg Basin, Manitoba, Canada, where negative impacts on water resources appear to be occurring at ever increasing rates. Specific water-related threats to environmental, agricultural, political, and economic resilience in the province include floods and large scale eutrophication. Lake Winnipeg is threatened with ecosystem collapse and consecutive billion-dollar, one in 100 year floods have emptied provincial coffers and resulted in unpopular policy decisions that led to resignation of high level politicians and defeat of the longstanding government. Using an integrated PathSight framework the Lake Winnipeg problem is being reframed and re-distributed across a broader group of actors who may not have previously identified with either the problem or the solution(s). In this manner, politicians, private sector, and citizens are starting to articulate what they can do individually and together. In creating and mobilising a trans-sectoral, multi-stakeholder, multi-dimensional entity to bear on solving the Lake Winnipeg challenge, opportunities for shared governance, policy alignment, and grassroots action are emerging.

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Introduction

The idea that humanity has become a force of nature in its own right, capable of disrupting the function of our biodiversity-based planetary life support system, was first put forth by the Nobel Prize-winning atmospheric chemist Paul Crutzen in 2000.¹ Since then, evidence supporting the claim that we are entering a completely new era of human impact on conditions that support life on Earth as we know it is mounting; we are moving towards a consensus that the Anthropocene should be identified as a unique epoch in the history of the Earth. This is when humanity, because of its numbers and needs, began to measurably alter the global climate. Earth system science, a multi-disciplinary research effort that brings together contributions from geochemistry, atmospheric chemistry, global ecology, oceanography, hydrology, glaciology and climatology, and other related fields, provides evidence of Earth system thresholds which we appear to be crossing.² We are no longer talking about the spread of human impacts across “the face of the Earth,” but rather a shift in the way our biodiversity-based planetary life support



Figure 1: Conceptualising water security

system functions. We are quickly entering a world unrecognizable from the one we have known for the past 200,000 years. Indeed, any acknowledgement at all of the Anthropocene turns our world view upside down. Natural and human history, which have been largely taken to be independent from and incommensurate with one another, must now be considered to be one and the same.³ As such, the practices that will preserve the planet must not be considered environmental practices, but rather best practices for the normal conduct of governance, business, and stewardship.

Nowhere is this more apparent than for water security (Figure 14).⁵ The loss of relative global hydro-meteorological stability means that we are no longer able to predict when, where, in what form, and how much water will fall from the sky at any one point in time or space. In turn, this has affected - and will

continue to affect - food security, economic development, political stability, and ultimately, human wellbeing and survival. Floods and storms cost billions in damages and are contributing to de-development even in high income countries. Unfortunately, those most vulnerable to water insecurity are those who are least able to actualise adaptation and resilience. Take, for example, the small island states who are seeing their land masses slowly shrink as sea levels rise, or subsistence farmers in Sub Saharan Africa who can no longer depend on the rainy seasons to grow their food. In 2015 the World Economic

¹ Crutzen, P. J., and E. F. Stoermer. "The "Anthropocene." Global Change Newsletter 41, 17–18." *International Geosphere–Biosphere Programme (IGBP)* (2000).

² Rockström, Johan, Will Steffen, Kevin Noone, Åsa Persson, F. Stuart Chapin, Eric F. Lambin, Timothy M. Lenton et al. "A safe operating space for humanity." *Nature* 461, no. 7263 (2009): 472-475.

³ Hamilton, Clive, François Gemenne, and Christophe Bonneuil, eds. *The anthropocene and the global environmental crisis: rethinking modernity in a new epoch*. Routledge, 2015.

⁴ Schuster-Wallace, C. J. and S. Dickson, S. "Pathways to a water secure community." Adeel, Z., R. W. Sandford and D. Devlaeminck (Eds.) *Individuals and communities: The human face of water*. Water Security in a New World book series. Springer. Ch. 11, In Press.

⁵ Schuster-Wallace, C. J. and R. W. Sandford. *Water in the world we want*. United Nations University Institute for Water, Environment and Health and United Nations Office for Sustainable Development, 2015. Available from: <http://inweh.unu.edu/wp-content/uploads/2015/02/Water-in-the-World-We-Want.pdf> (Accessed July 2016).

Forum identified the water crisis as the #1 global risk for societal devastation.⁶ Every year \$260 billion is lost globally due to lack of adequate water⁷; women and children spend 140 million hours a day collecting water⁸; and poor water and sanitation kills children at a rate of one jumbo jet crash every ten hours. Human health and well-being are predicated on planetary health and vice-versa. Water security is a means of achieving climate stability which leads ultimately to planetary health.

Given the many competing roles of water and related wastewater and sanitation, the uneven distribution of the resource over space and time, changes in quantity and quality, and varying government, institutional and financial support across nations, sustainable development and management requires an iterative approach that goes beyond traditional linear and geospecific development processes and boundaries. At the global scale, the United Nations responded to the urgency and the opportunity of sustainable development in September of 2015⁹, just before the Paris climate talks¹⁰. The 2030 Transforming Our World agenda promises to be the most comprehensive and inclusive effort to positively change the world in all of human history. It is nothing less than a charter for people and the planet for the 21st century that raises the ceiling on sustainability. All 17 of the UN's Transforming Our World global sustainable development goals (SDG) can be approached by realizing the link between water security (SDG 6), climate stability (SDG 13), and human and planetary health and well-being. Acting upon this link will demand the creation of new kinds of partnerships and different behaviours.

A New Narrative: Realising Action for Community Transformations (ReACT) Framework

A strongly entrenched narrative has pictured humanity as being above global material and energy cycles with no need to consider the finiteness of the Earth's resources has been proven to be wrong and dangerous. As a society we have to come back down to Earth. All our institutions – history, culture, markets, economy, and political structure – have to be reformed immediately if we do not want global environmental shifts to extend further into the future. As the writer Kittredge once said about the American west “what we need most urgently is a fresh dream of who we are – one which tells us how to act; new stories about taking care of what we have that drive us to take appropriate action. That story, when found, will be a gift, passing from one person to another. And then our institutions will change almost at once.”¹¹

If we are to survive, the new world view will require as fundamental a shift in perspective as occurred when we discovered that the Earth revolves around the sun, not the other way around. Our future will depend on our ability to confront our fate, not with panic, anger, or denial, but with patience, thoughtfulness, and wisdom. Whatever will come to pass will not be the result of intentions but rather of actions. Each generation creates its own narrative about the world. We should not wait for further huge shocks to large numbers of people to move public attitudes. We have transformed the world and the

⁶ World Economic Forum. *Global risks 2015*. 10th Edition. Insight Report, 2015. Available from: http://www3.weforum.org/docs/WEF_Global_Risks_2015_Report15.pdf (Accessed July 2016).

⁷ Hutton, G. *Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage*. World Health Organisation. WHO/HSE/WSH/12.01, 2012. Available from: http://apps.who.int/iris/bitstream/10665/75140/1/WHO_HSE_WSH_12.01_eng.pdf?ua=1 (Accessed July 2016).

⁸ Unilever and WaterAid. *Water for women: Every woman counts; every second counts*, Unilever, VoxPops, Ifeanyi Iloduba, 2015. Available from: http://www.unwater.org/fileadmin/user_upload/worldwaterday2015/docs/Water%20For%20Women.pdf (Accessed July 2016).

⁹ United Nations. *2030 Transforming our world*, United Nations, 2015. Available from: <https://sustainabledevelopment.un.org/post2015/transformingourworld> (Accessed July 2016).

¹⁰ UNFCCC. *Paris accord on climate change*, 2015. Available from: <https://unfccc.int/resource/docs/2015/cop21/eng/109.pdf> (Accessed July 2016).

¹¹ Kittredge, W. "Doing Good Works Together." In Smiley, Jane, and Kurt Brown. *The True Subject: Writers on Life and Craft*. Graywolf Pr, 1993.

world is now about to transform us. The status quo is the enemy of survival. Change requires technical, human, institutional, and financial resources, along with the recognition that massive behaviour change must occur at the level of governments, economies, and most importantly the general populace. As Rolling Stone journalist Scranton has pointed out, if we want to survive in the Anthropocene we can't just see the light, we have to *be* the light.¹² To be that light, we need a new narrative.

It is within this context that the ReACT (Realising Action for Community Transformations) Framework was developed. While technological solutions exist to capture, conserve, protect, store, and treat water, these solutions will not work unless implemented sustainably¹³. For this to occur, it is essential to

understand context (physical, social, environmental, economic, cultural, political, legal), resources (financial, institutional, human), and values to empower change in the behaviour of institutions, communities, families, and individuals so that not only is the physical infrastructure (hardware) in place, but also the supporting infrastructure (software) for sustained change (Figure 2¹⁴). Behaviour is often habituated, and changing those behaviours “is not so much about getting people to make different choices or decisions so much as, more fundamentally, getting them to see their actions in terms of choice and decision-making... through a process of recognition, re-valuation, and re-orientation to self and behaviour”[p.30].¹⁵ Before people can be expected to change their behaviours, they need to be made aware of the context in which those behaviours need to change, why, and what is in it for them (everyone has a currency in which they are willing to trade, be it the health and safety of their children, protection on the world’s vulnerable, self-preservation, personal gain, status, or financial savings). This is not always easy to do, as a study examining climate change mitigation in the United Kingdom identified. It found that people were not interested in implementing actions to mitigate climate change simply in response to campaigns requesting such mitigation. Instead, people were more likely to act in order to achieve a lower carbon future (no matter that this also helps to mitigate climate

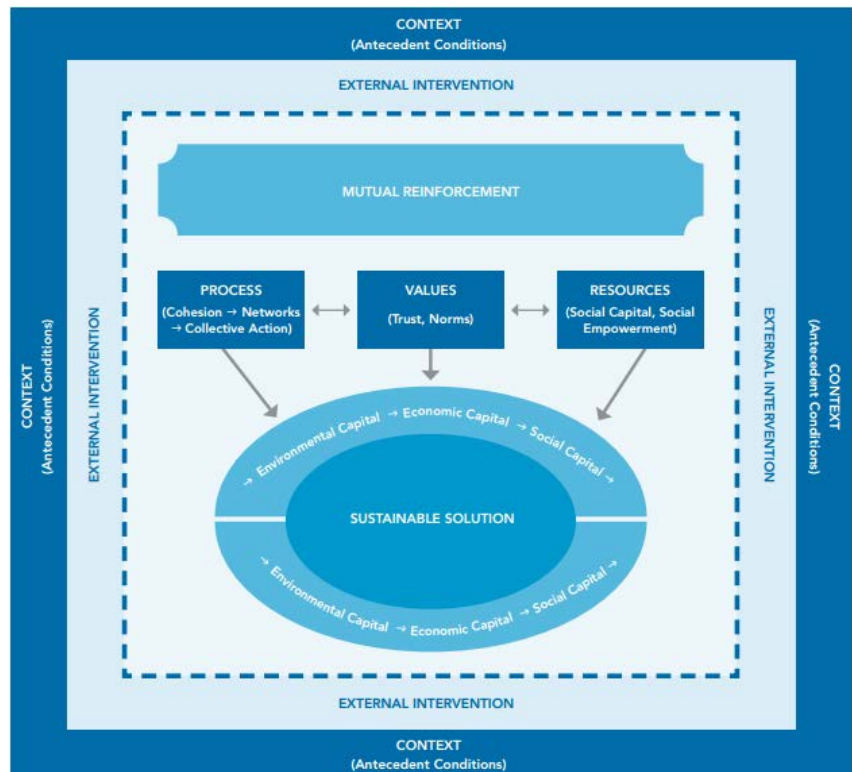


Figure 2: Empowering change

change, why, and what is in it for them (everyone has a currency in which they are willing to trade, be it the health and safety of their children, protection on the world’s vulnerable, self-preservation, personal gain, status, or financial savings). This is not always easy to do, as a study examining climate change mitigation in the United Kingdom identified. It found that people were not interested in implementing actions to mitigate climate change simply in response to campaigns requesting such mitigation. Instead, people were more likely to act in order to achieve a lower carbon future (no matter that this also helps to mitigate climate

¹² Scranton, Roy. *Learning to Die in the Anthropocene: Reflections on the End of a Civilization*. City Lights Publishers, 2015.

¹³ Schuster-Wallace, C. J., K. Cave, H. McCormick, M. S. Watt and S. E. Dickson, S. *WaSH: Integrated social empowerment toolkit for community WaSH and wellbeing - W:ISE toolkit handbook*. United Nations University Institute for Water, Environment and Health (UNU-INWEH), 2015. Available from: http://inweh.unu.edu/wp-content/uploads/2016/04/WISE-Toolkit-Manual_web.pdf (Accessed July 2016).

¹⁴ Schuster-Wallace, C.J. et al. (2015). *Ibid.*

¹⁵ Schuster-Wallace, C.J. et al. (2015). *Ibid.*

change) or for social justice reasons as these were seen to provide tangible and intangible benefits, as opposed to sacrifices in lifestyle.¹⁶

Identifying a single “hook” for capturing people’s attention is the dream of private sector marketing firms and social marketing organisations everywhere. Messages already target people based on age, gender, and culture. However, emotional life – memories and emotional judgements - is largely housed in the limbic system. The limbic system supports a variety of functions including adrenaline flow, emotion, behaviour, motivation, long-term memory, and olfaction. These nonverbal characteristics are what provides one’s instinctive, unlearned reactions as human beings seek to make sense of an array of (often competing) instincts. They develop as children and mature through adolescence. However, behavioural models rarely account for the role that instinctive characteristics play in decision-making. As a result, while it is possible to appeal to an individual's public character, behaviour and choices can differ as a result of conflict at the instinctual level. It is essential that these instinctive profiles be accounted for to understand how people conceive of and understand the whole concept of environmental dynamics. Once this is embedded into the understanding of people, we can personalize the strategies to engage and influence behavior with optimal impact (Figure 3).



Figure 3: A person-centric approach to behaviour change

Over the past three years PathSight has constructed a science-to-cause-to-populace model that can segment any population by differentiating between their instinctive, nonverbal reactions to the world and the verbal, higher functioning narratives that represent how one aspires to live. PathSight has surveyed, interviewed, and observed tens of thousands of people in pursuit of understanding these dynamics. The data collected have revealed recurring patterns or clusters (Figure 4) that reflect unique instinctive profiles, based on the biologic instincts that inform the attitudes, values, and behaviours associated with personal narratives. These clusters are defined by two intersecting axes. The x-axis expresses the differences between individuation and social binding. The domains measured include

¹⁶ Howell, R.A. It’s not (just) ‘the environment, stupid!’ Values, motivations, and routes to engagement of people adopting lower-carbon lifestyles. *Global Environmental Change* 23 (2013): 281–290.

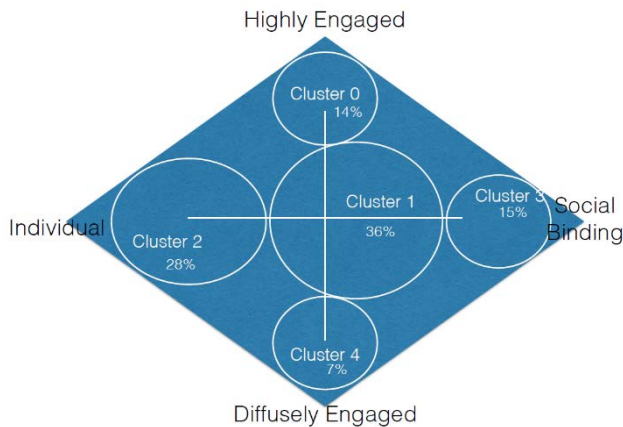


Figure 4: PathSight Continuum and Location of Clusters

care, fairness, loyalty, and purity.¹⁷ The findings have been globally validated across age, gender, ethnicity, and cultural groupings and the outputs subjected to functional magnetic resonance imaging (fMRI) testing.¹⁸ The y-axis differentiates along the concept of boundaries between one's group of origin and others. The results demonstrate that the domains that are identified in the PathSight model register broadly in various parts of the limbic system. Once identified, customised engagement strategies can be developed for each cluster to maximise message resonance and behaviour change uptake. Because the model is rooted in biologically defined traits that are not learned, there is confidence that these clusters will also serve as a means of enhancing the understanding of population risk. Knowledge of one's membership in any cluster will prove to be a

meaningful input as one characterizes risk and the potential impact of direct interventions. Early indicators seem to confirm this. The five clusters are:

- Balanced (Cluster 0)* - universal donor; appeal crosses all 5 domains; very engaged and self-aware;
- Balanced Centrist (Cluster 1)* - centrist with a lean toward binding; supporters of the status quo; compassion tempered by traditions;
- Individualist (Cluster 2)* - a world of individuals; compassion and fairness for individuals; lots of tolerance for differences and intolerance for conformity;
- Authoritative (Cluster 3)* - very real boundary between us and them; traditions, conformity, and security; and,
- Centrist (Cluster 4)* - detached, hard to reach; self-directed with a personal focus and low need to judge.

Thus, choice architecture¹⁹ can be designed to appeal to or resonate with specific instinctive groups and provide another layer of design when considering how to structure and present choices, including the design of "nudges" to enhance uptake of a desired behaviour.²⁰

Building on the innovation of the Pathsight approach to behaviour change, the ReACT Framework is a roadmap to move us from dialogue to practice as expeditiously as possible. As an implementation framework, ReACT is intended to be systematic, structural, measurable, transferable, and scalable to aid national and sub national governments in implementation of water-related actions which contribute to achieving the Sustainable Development Goals. Specifically, ReACT incorporates assessment, evidence-informed decision making, the PathSight model, and iterative learning into a process that accounts for the need to develop variations upon core behaviour change messages to reach an entire community as

¹⁷ Haidt, Jonathan, Jesse Graham, and Craig Joseph. "Above and below left-right: Ideological narratives and moral foundations." *Psychological Inquiry* 20, no. 2-3 (2009): 110-119.

Haidt, Jonathan. *The righteous mind: Why good people are divided by politics and religion*. Vintage, 2012.

¹⁸ Eden, A. L. The influence of moral behaviors on person perception processes: An fMRI Investigation. Doctoral Dissertation, Michigan State University, 2011.

¹⁹ Thaler, Richard H., Cass R. Sunstein, and John P. Balz. "Choice architecture." *The behavioral foundations of public policy* (2014).

²⁰ Johnson, Eric J., Suzanne B. Shu, Benedict GC Dellaert, Craig Fox, Daniel G. Goldstein, Gerald Häubl, Richard P. Larrick et al. "Beyond nudges: Tools of a choice architecture." *Marketing Letters* 23, no. 2 (2012): 487-504.

well as ensuring that the supporting infrastructure is in place before calling upon individuals to implement new behaviours (Figure 5).

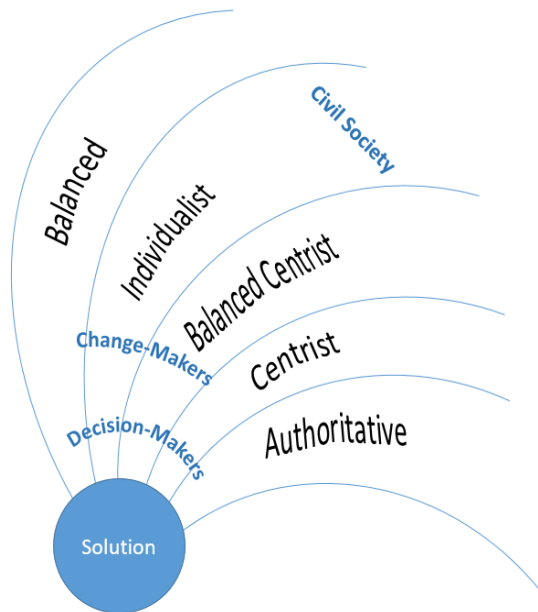


Figure 5: ReACT pathway to sustainable behaviour change

ReACT in Action: Restoring, Reclaiming, and Recognising Lake Winnipeg

At 25,514 km², Lake Winnipeg is the sixth-largest lake in Canada. Its watershed is a basin that straddles four Canadian provinces and two US states. While not a transboundary water body in its own right, the Lake's major tributary is the Red River, which flows northward out of the United States. Inhabitants of the basin rely on it for economic activity (agriculture, fishing), drinking water, food security, recreation, and aesthetics.

The urgency of meaningful action to address the deteriorating ecological condition of Lake Winnipeg, and the threat it poses to the economic health of surrounding communities, is accelerating. The scale of the problem appears to be growing both in extent and complexity. Algal blooms as large as 17,000 km² are now appearing in the lake. Some algal blooms are toxic to wildlife, pets, and humans. Zebra mussels have been

discovered in both Lake Winnipeg and the Red River. It did not help the reputation of the province when an international fisheries watchdog agency proclaimed that, because of what it perceived as poor fisheries management, consumers should not buy fish from Manitoba's three largest lakes, claiming that they were the worst managed fisheries in the world.²¹ This is a damning statement for an industry with CAD 30 million in annual sales.²²

Renowned scientists such as University of Alberta's David Schindler and the University of Saskatchewan's John Pomeroy have demonstrated that the basin has in fact crossed an invisible hydro-climatic threshold into a new hydro-meteorological regime²³. While the western part of the basin is becoming drier and delivering less water and nutrients to the Lake, the eastern part is doing the reverse. In this part of the basin it appears that we can expect more frequent large-scale flooding that will mobilize more nutrients not just into Lake Winnipeg but also into all of Manitoba's water bodies. This is echoed on a global scale, with a survey of hundreds of the Earth's lakes revealing that climate change is causing lakes to warm faster than the oceans or the air around them.²⁴ One reason is that warmer winter temperatures are producing less ice on lakes that normally freeze over. Reduced ice coverage in turn increases the amount of sunlight lakes absorb. These rising temperatures will not only exacerbate problems associated with eutrophication, but also may speed the conversion of carbon-rich organic matter in lake sediments into methane and carbon dioxide, gases that once released into the atmosphere exacerbate global warming.

²¹ Monterey Bay Aquarium. *Seafood watch*, 2015. Available from: http://www.seachoice.org/wp-content/uploads/2015/11/MBA_SeafoodWatch_Manitoba_freshwater_lakes_Report.pdf (Accessed July 2016).

²² <https://www.gov.mb.ca/waterstewardship/fisheries/commercial/commercial.html>

²³ Dumanski, Stacey, John W. Pomeroy, and Cherie J. Westbrook. "Hydrological regime changes in a Canadian Prairie basin." *Hydrological Processes* 29, no. 18 (2015): 3893-3904.

²⁴ Kintisch, E. "Earth's lakes are warming faster than its air." *Science Magazine*. Dec. 16, 2015. Available from: <http://www.sciencemag.org/news/2015/12/earth-s-lakes-are-warming-faster-its-air> (Accessed July 2016).

Assessment: Some of the policies implemented over the past years were aimed at addressing the problem through regulation focused primarily on agriculture. However well-intentioned, these policies did little to correct the situation related to nutrient contributions from livestock and, in fact, some could argue that its enforcement has significantly crippled small producers in favour of large industrial producers. This transition from small to large scale agriculture will have implications on food security and on the economy in the long run.

The Lake Friendly Alliance was formed to serve a coordinating function and to align the various disparate stewardship activities across government, business, industry, and environmental groups being undertaken across the watershed while finding a meaningful way to engage the populace. Members of Manitoba's Lake Friendly Alliance have been tracking what has happened to Lake Winnipeg in the barely two years since the Alliance was formed to address eutrophication and other threats to lakes, streams and rivers in Manitoba. This initiative has been combined with significant research that has been undertaken on the Lake and within its basin over the past several decades including hydroclimatic studies²⁵, university research, and federal and provincial government gauging stations.

Evidence-informed Decision-making: While commercial agriculture in the basin represents 90% of the economic sector on the Prairies²⁶ the environmental problems in Lake Winnipeg are not simply a consequence of poor agricultural practices. Development on the shores of the lake, poor municipal wastewater treatment and septic system maintenance, and land use practices that have significantly reduced wetland habitats have played an important role in terms of disruption of riparian habitats and organic pollution. Until the implementation of the ReACT Framework, non-governmental organizations focused on environmental stewardship messages (Lake Winnipeg Action Plan) to reduce pollution into the Lake from schools, farms, cottages, and businesses.

The PathSight research was commissioned by the South Basin Mayors and Reeves (local leaders from lakeshore communities). Results revealed the complexity of this landscape. Each of the PathSight Clusters was shown to have individual judgement as to trusted sources of information and affinity with commercial entities. In general, only 20% of the community was instinctively receptive to traditional environmental messages. As such, progress being made was a result of just a single cluster of people; institutions were preaching to the converted who were a minority in the community. This is not surprising, given that in Winnipeg, where residents have experienced two catastrophic floods in a period of four years, people believed that they were more likely to be murdered than to experience an interruption in their access to clean water. The same report indicated that nationally, 51% of Canadians

do not think that the country experiences any environmental problems and only 25% see the environment as one of three most important issues facing Canadians; this falls to 5% for water quality and/or quantity.²⁷ However, 81% of the sample population living in Winnipeg were very concerned or somewhat concerned about the quality of water in their lakes and rivers.²⁸ While climate change was identified as the greatest threat to water resources across Canada, in Winnipeg, the greatest threats were identified as illegal dumping of toxins and runoff of land-based pollutants.²⁹ This situation is emblematic of the

²⁵ Manitoba Hydro. *Lake Winnipeg watershed hydroclimatic study*, Water Resources Engineering Department Power Planning Division (2015). Available from: https://www.hydro.mb.ca/corporate/water_regimes/lake_wpg_regulation/Appendix_7_Lake_Winnipeg_Watershed_Hydroclimatic_Study.pdf (Accessed July 2016).

²⁶ www.parl.gc.ca/Content/HOC/Committee/411/FINA/WebDoc/WD5138047/411_FINA_PBC2011_Briefs%5CSouth%20Basin%20Mayors%20and%20Reeves%20Inc%20E.html

²⁷ Royal Bank of Canada. *RBC Canadian Water Attitudes Study*. RBC BlueWater Project, 2016. Available from: <http://www.rbc.com/community-sustainability/assets-custom/pdf/CWAS-2016-report.pdf> (Accessed July 2016).

²⁸ RBC. (2016). *Ibid.*

²⁹ RBC. (2016). *Ibid.*

complexity that exists within any successful engagement architecture. It is clear from this analysis that every community must organize its efforts from the perspective of a unifying umbrella of principles to which all constituents can subscribe. From this point of view, personalized cluster perspectives can be used to engage each target optimally.

Behaviour Change: Key questions asked during this phase include: What are the behaviours we need to change? What are the behaviours we want to change? What language do we need to use to get everyone to act? What are the messages needed to communicate this to all water partners? The answers to these questions created an alliance for a co-ordinated strategy across NGOs for engaging the public and activating change across the spectrum. While the behaviours were not much different than previously identified, the communication of these behaviours to different groups is where the change became important. It was also identified that this quest for behaviour change was set against a backdrop where the majority of Canadians believe that industry and government should be investing in water improvements and not the general public.³⁰ In Manitoba, Supportive Governance, Good Growth, and Community Stewardship provide these organizing principles that are then customized for each group to operationalize the outreach.

The first audience targeted in the basin was leaders – Mayors, Reeves, provincial politicians, and business leaders. These are the individuals with decision-making authority for policy change and/or financial investments. Leaders in the basin were identified as predominantly belonging to the *balanced centrist* category. These individuals tend to be fairly conservative and prefer traditional approaches. As such, language that resonates with politicians and community leaders does not refer to change, but to “the logical next step” in a “tradition of protection”. The currency being traded is that of re-election, so other messages include “doing the right thing” and “seeing economic benefit” that can form a platform for demonstrating action.

Iterative Learning: The goal for the Winnipeg Basin is not simply to restore its environment, but to rebuild the associated reputation and economy, and re-establish relationships. This is undertaken through constant evaluation of progress and adjustments to enhance interventions wherever possible. Within this climate of iterative and continuous learning, it is possible to identify potential failures quickly and address them before lasting damage occurs. One such example occurred when a municipality decided to raise taxes to finance a wastewater treatment plant. For lake shore homeowners, when faced with a property tax levy to support construction of a wastewater treatment plant, initial messages linking the investment to aesthetic and environmental benefits did not produce desired results. Bringing in a realtor to discuss the tax increase in relation to the tangible returns on investment through increases in property values as a result of the

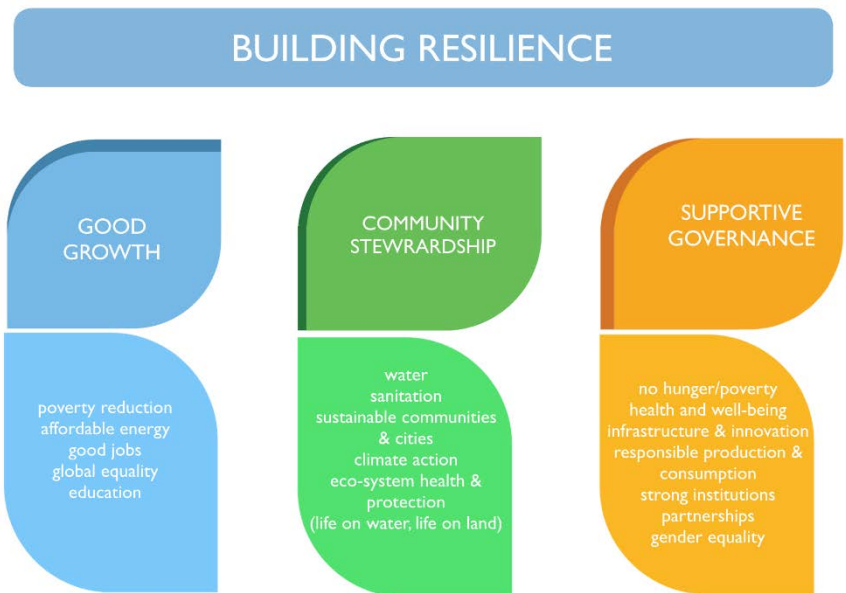


Figure 6: Lake Winnipeg Regional Growth Strategy and the Sustainable Development Goals

³⁰ RBC. (2016). *Ibid.*

improved environment and aesthetics would have been a more successful tactic as the currency of trade for lakeshore property holders is related to property values and protecting their investments.

Successes and Challenges: While still a social experiment, there have been some early successes in Lake Winnipeg with the application of the ReACT framework. Sustainable Development Goals have been integrated into the regional growth strategy for the next 25 years. Goals have been divided under headings of “Good Stewardship”, “Good Governance”, and “Good Growth”; headings that have been identified as resonating across clusters to catalyse behaviour change and water quality improvements in the Lake (Figure 6). While each message does not have to reach every cluster group, it is important that no single cluster is annoyed or offended by any single message, as this will complicate their responses to messages targeted to them. However, the campaigns to apply these approaches have not yet been rolled out. Challenges include financing the campaigns (crowdsourcing is seen as a mechanism to demonstrate buy-in across a range of stakeholders) and getting all of the actors to play together.

Implications

Far too often a narrow view of a problem is held. To change policy, practice, and buy-in towards ultimate behaviour change we must ensure that actions are collaboratively envisioned and ground-truthed for unintended consequences. This further supports the theory of the need to ensure government, business, industry, and environmental interests are all at the table as equal contributors

in a solution focused approach that moves away from the blame game towards tangible action. Successful solutions will have to be adopted and embraced that require changes in behavior and impact attitudes and practice. The processes for bringing about behavior changes are complex because, as individuals, we are shaped by systemic (our nature and our experiences), biologic (human nature), and individual differences (personal traits). Behaviour change reflects complex interactions of instincts, cultural differences, and individual values. Given system complexity, competing roles, uneven resource distribution, changes in quantity and quality, and varying government, institutional and financial support, sustainable development and management of water requires an iterative

approach. This iterative approach must go beyond traditional development processes and boundaries. The sciences (natural, social, health) must be the defining pillar and inform behaviour changes. Physical and social infrastructure must be identified that can inspire and engage the populace and its institutions to action that is meaningful, impactful and measurable. In turn, the infrastructure must be given the tools and expertise to successfully engage the population in a way that is meaningful, impactful, and measurable. The broader social culture will benefit through this coordinated, sophisticated, and broad-based effort (Figure 7).

The ReACT Framework begins with an assessment of the issues and the solutions required, through an understanding of the instinctive behaviours of the people who need to embrace behaviour change, to develop the messages and a multi-faceted behaviour change campaign. It recognises the importance of speaking in multiple voices around common messages of action. In this manner, it is possible to move beyond disagreements over the science, blame, and rhetoric in order to focus on actions (solutions) that

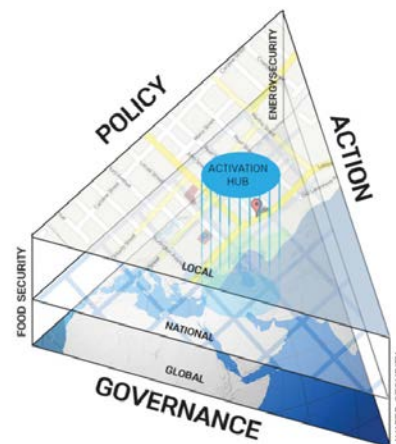


Figure 7: ReACT – synthesizing across scales, actors, and sectors

everyone can stand behind. Once these solutions have been identified, messages that appeal to instinctual groupings can be used to campaign for sustainable behaviour changes. Critically, the approach recognizes that the problems we are facing globally through the escalating crises of water quantity, quality, distribution, and allocation will require a united front and cannot be left to NGOs and environmental interests alone.

In the case of Lake Winnipeg, the analysis of the general awareness and attitudes of the population using the ReACT framework was described initially as “disheartening”. Core groups of people in the basin had committed themselves, their time, and resources to attempting to change behaviours that would improve water quality in Lake Winnipeg, with no chance of broad success. It became evident that no one group, sector, or solution could address the issues at hand and that the real work required in order to succeed given compelling evidence that time is running out, was to build an approach for participation and engagement of all aligning governance process, business, industry, and environmental interests behind science, actions, and targeted communication toward real behaviour change. Once it was realized that the core groups were actually part of the problem, enlightenment invigorated their activities and provided a new, if different, momentum for effecting change across the basin.

Conclusions

In conclusion, the application of the Pathsight model in Winnipeg allowed for development of the ReACT framework to move from analysis to action in resolving a critical issue of water insecurity. Experiences to date demonstrate a positive and measurable response to solving water insecurity issues in the Lake Winnipeg basin. This provides evidence for further application of the ReACT framework as a mechanism to move from dialogue to analysis to action on water insecurities in other parts of the world. This is driven, in part, by PathSight’s capability to capture probabilistic and deterministic data for cluster segmentation purposes by harnessing big data management platform architectures.

The bottom line is that we need to define a safe place in terms of water security to which all of humanity must aim. While not explicitly stated, this is congruent with the Sustainable Development Goals and becomes an added imperative. Our wish to ensure our own intergenerational health by restoring planetary health could be part of the new narrative which humanity must create for itself if it is to get through this dangerous bottleneck in the history of our species. By restoring planetary health we make a meaningful level of sustainability possible thereby bringing prolonged human presence on this planet – and gender equity, equality, and true social justice into the realm of possibility.