

Assessing Flood Risk Awareness Contributes to Environmental Policy Formation

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ECONOMIC



HEALTH



SOCIAL



POLITICAL

SUMMARY

Due to climate change, there has been an increase in the frequency of exceptional heavy rainfall leading to flooding. This poses problems for people living or working near water courses and it can also increase the risk of poorly performing Domestic Waste Water Treatment Systems (DWWTs) and the risk of contamination of well water for people living in rural areas. But how well do such people really understand these risks and to what extent has their understanding prompted them to take appropriate steps to protect themselves? Dr Eoin O'Neill has sought to identify the answers to these questions through a series of research studies. The information gleaned has contributed to the development of environmental policies by government and agencies at both national and European levels.

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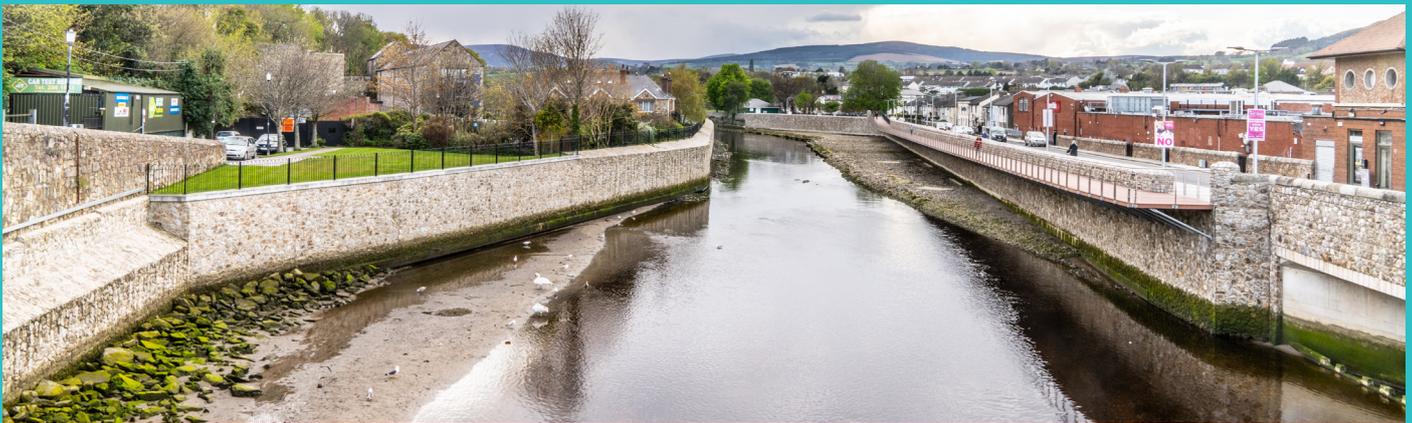
Climate Change Drives Dual Approach

At an early stage in his career Dr Eoin O'Neill, worked with the UK's Environment Agency on flood risk management in the Thames Region of England. “There had been a shift in thinking away from building structural defences to a risk-based model,” he recalls.

“Even at that stage it had been recognised that because of climate change it simply would not be possible to prevent all flooding and that this was going to be an increasing problem in the future. So the focus had already switched to a dual approach of reducing exposure and reducing consequences. That means encouraging people to make their own preparations as well as doing other things to reduce the impact of flooding.” That work sparked what was to become an enduring interest in environmental policy matters related to flooding.

Once recent example of his work in this area was a multidisciplinary research project which provided the ideal opportunity to evaluate people's sense of risk “before” and “after” a significant intervention. In this instance it was a flood relief scheme for the River Dargle where it runs through the town of Bray, Co Wicklow. Undertaken in conjunction with social scientists and funded by UCD and Irish Research Council, the project assessed the levels of anxiety of people exposed to flooding before the work went ahead. This was followed up with further research after heavy rainfall events that would previously have triggered severe flooding concerns.





River Dargle, Bray post-construction of the River Dargle Flood Relief Scheme

The initial phase of the research found that people living near the river judged their homes to be further away from the area at risk of flooding than they actually were. According to Dr Eoin O'Neill "This is important, as people who do not perceive themselves to be exposed to flood risk are less likely to undertake preventive actions that will reduce the harmful impacts of flooding on them. It is important that these complex issues are understood, as future awareness-raising activities will be required to help people adapt to the inevitable impacts of climate change."

Irish Well-Water Prone to Contamination

This was followed up with two related, but more rurally-focused studies. One, funded by the Environmental Protection Agency, explored householders' perceptions of the risks associated with poorly performing Domestic Waste Water Treatment Systems (Septic Tank Systems) and identified elements required for effective risk communication.

The other examined people's perceptions of flooding and risk with regard to drinking water supplies. Again involving a multidisciplinary team, this time including planners, environmental scientists, epidemiologists and hydrogeologists from UCD, Technological University Dublin and University College Cork, the work was funded by the Irish Research Council and Geological Survey Ireland.

It explored the impact of flooding on people's drinking water and whether their health had been affected by contamination. Most importantly, it delved into people's levels of perceived risk vs actual risk and the extent, if any, to which they had taken preventative actions that aligned with the true level of risk.

"In general," Dr O'Neill explains, "The research shows that unless there's an obvious issue with regard to water, if people are actually getting sick, for example, the majority of people will assume there is no problem."

However, this is far from the reality, particularly in rural Ireland. In the country as a whole private wells are the primary source of drinking water for 15.5% of the population. But Ireland also has the highest crude rate of VTEC gastroenteritis - a particularly virulent strain of E.coli which in certain circumstances can lead to kidney failure. In Ireland, furthermore, an increase in the number of documented illnesses often follows flooding events, especially in areas

with high densities of private well-water usage.

This is exacerbated by Irish rural settlement patterns with each one-off dwelling having its own septic tank. This is unlike England, for example, where rural populations tend to live in well-defined villages. Irish homes in rural settings also often adjoin fields that may be used for cattle grazing and/or on which slurry is spread regularly, as well as close to other residential properties with septic tanks, some of which may not be adequately maintained. All these factors increase the risk of contamination of well-water, especially at times of flooding. The problem has also been exacerbated in recent years by the increasing size of cattle herds and the growth in rural populations, as well as climate change.

This body of work has identified, the underlying high levels of contamination risk to well-water supplies, especially at times of flood, and quantified the low levels of awareness of this risk by users, and the need for policy changes to rectify the situation.

Significant Potential Impacts

Dr O'Neill believes passionately in the important role that research can - and should - play in driving environmental policy. The study on the Bray Flood Relief Scheme resulted in the publication of a number of papers, both qualitative and quantitative. Informed by the findings, a number of submissions and policy proposals were made subsequently to national planning frameworks, an EU Climate Adaptation Review, the National Climate Adaptation Framework and the Citizen's Assembly meeting on Climate Change. This research has been heavily cited, for example in the National Climate Adaptation Framework and internationally, in respective reports by the Intergovernmental Panel on Climate Change, the Global Commission on Adaptation, the US Geological Survey and the UK Climate Change Committee.

The subsequent research, FloodRisk2WellWater, again resulted in a number of publications and submissions to public consultations, and is cited in the Climate Change Adaptation Plan for the Health Sector.

Furthermore, the Environmental Protection Agency now uses risk guidelines developed by Dr O'Neill and his team for their public engagement as part the implementation of the National Inspection Plan 2018-2021 (DWWTS).



River Dargle, Bray pre-construction of the River Dargle Flood Relief Scheme

This research has also informed the National Risk Assessments of 2018 and 2019. More recently, Dr O'Neill has been commissioned with colleague Prof. Mark Scott to prepare a report for the Irish Climate Change Advisory Council on "Opportunities for individual, household and community level resilience in Ireland".

In relation to rural well-water, Dr O'Neill hopes that the research will also lead to an annual risk assessment being provided each year for every well, and ideally a free well-water quality test, too. "With the arrival of COVID the concept of free testing for public health has certainly become established in Ireland," he points out.

"In Ontario (Canada) everyone with a private well is entitled to free well water testing by the public health authority. But in Ireland there is, as yet, essentially no systematic approach to testing. Water is an essential for everybody and a lot of people here don't have clean water - they just don't know it. "We've a much high reliance on individual household supply versus public supply compared to other European countries and while wells may have been tested at the point of installation they may not have been tested since then, despite the increased intensity of agriculture or the arrival of new neighbours. So I do think voluntary free water testing should be more widely accessible. It's certainly an environmental and public health policy issue that needs to be addressed and hopefully our work will help to inform policy in this area."

Research References

O'Neill, E., Brereton, F., Shahumyan, H. and Clinch, J.P., 2016. The impact of perceived flood exposure on flood risk perception: The role of distance. *Risk Analysis*, 36(11), pp.2158-2186.

O'Neill, E., Brennan, M., Brereton, F. and Shahumyan, H., 2015. Exploring a spatial statistical approach to quantify flood risk perception using cognitive maps. *Natural Hazards*, 76(3), pp.1573-1601.

Brennan, M., O'Neill, E., Brereton, F., Dreoni, I. and Shahumyan, H., 2016. Exploring the spatial dimension of community-level flood risk perception: A cognitive mapping approach. *Environmental hazards*, 15(4), pp.279-310.

Fox-Rogers, L., Devitt, C., O'Neill, E., Brereton, F., and Clinch, J.P., 2016. Is there really "nothing you can do"? Pathways to enhanced flood-risk preparedness: *Journal of Hydrology*, v. 543, p. 330-343.

Devitt, C., O'Neill, E. and Waldron, R., 2016. Drivers and barriers among householders to managing domestic wastewater treatment systems in the Republic of Ireland; implications for risk prevention behaviour. *Journal of Hydrology*, 535, pp.534-546.

Hynds, P., Naughton, O., O'Neill, E. and Mooney, S., 2018. Efficacy of a national hydrological risk communication strategy: Domestic wastewater treatment systems in the Republic of Ireland. *Journal of Hydrology*, 558, pp.205-213.

O'Neill, E. et al (2016) Relay Risk: Guidelines for effective risk communication. (2016). Environmental Protection Agency: Johnstown Castle, Wexford.

O'Neill, E. et al. (2016) Relay Risk: Examining the communication of environmental risk through a case study of domestic wastewater treatment systems in the Republic of Ireland. EPA Research Report 167. Environmental Protection Agency: Wexford, Ireland.

Andrade, L., O'Dwyer, J., O'Neill, E. and Hynds, P., 2018. Surface water flooding, groundwater contamination, and enteric disease in developed countries: A scoping review of connections and consequences. *Environmental pollution*, 236, pp.540-549.

Andrade, L., O'Malley, K., Hynds, P., O'Neill, E. and O'Dwyer, J., 2019. Assessment of two behavioural models (HBM and RANAS) for predicting health behaviours in response to environmental threats: Surface water flooding as a source of groundwater contamination and subsequent waterborne infection in the Republic of Ireland. *Science of the Total Environment*, 685, pp.1019-1029.

McDowell, C.P., Andrade, L., O'Neill, E., O'Malley, K., O'Dwyer, J. and Hynds, P.D., 2020. Gender-related differences in flood risk perception and behaviours among private groundwater users in the Republic of Ireland. *International journal of environmental research and public health*, 17(6), p.2072.

Musacchio, A., Andrade, L., O'Neill, E., Re, V., O'Dwyer, J. and Hynds, P.D., 2021. Planning for the health impacts of



climate change: Flooding, private groundwater contamination and waterborne infection—A cross-sectional study of risk perception, experience and behaviours in the Republic of Ireland. *Environmental Research*, 194, p.110707.

Hynds, P., O'Dwyer, J., Andrade, L., Mooney, S. and O'Neill, E., 2018, April. Putting the "socio" in socio-hydro (geo)logy via existing psychological models: Health-related flood risk perception in the Republic of Ireland. In *EGU General Assembly Conference Abstracts* (p. 15558).

Media and Social Media

<https://www.independent.ie/regionals/braypeople/news/locals-underestimate-flood-risk-near-homes-35375442.html>

<https://www.irishtimes.com/news/environment/many-overestimate-distance-of-homes-from-flood-zones-1.2919301>

<https://www.independent.ie/regionals/braypeople/news/locals-underestimate-flood-risk-near-homes-35375442.html>

https://www.ucd.ie/t4cms/UCD_Flooding_Seminar.pdf

<https://www.irishtimes.com/opinion/ireland-s-flood-problem-is-small-but-a-rethink-is-required-1.2497083>

<https://www.irishexaminer.com/news/arid-20385474.html>

<https://nfgws.ie/wp-content/uploads/2018/10/Summer-2015-final-web.pdf>

<https://greennews.ie/new-project-launched-study-links-flooding-waterborne-disease-outbreaks/>

<https://nfgws.ie/wp-content/uploads/2018/10/Autumn-2017-web.pdf>

Key Policy Citations

National Climate Adaptation Framework, DCCAE 2018.

National Climate Adaptation Framework. Department of Communications, Climate Action and Environment: Dublin.

IPCC (Intergovernmental Panel on Climate Change) Special Report, Oppenheimer, M., B.C. Glavovic, J. Hinkel, R. van de Wal, A.K. Magnan, A. Abd-Elgawad, R. Cai, M. Cifuentes-Jara, R.M. DeConto, T. Ghosh, J. Hay, F. Isla, B. Marzeion, B. Meyssignac, and Z. Sebesvari, 2019: Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities. In: *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate* [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. In press

van Valkengoed, A.M., and Steg, L. 2019. Climate change adaptation by individuals and households: A psychological perspective. *Global Commission on Adaptation Background Paper*. Available online: www.gca.org.

Milch, K.F., Perry, S.C., and Bruce, J.L., 2019, Communicating hazards—A social science review to meet U.S. Geological Survey needs: U.S. Geological Survey Circular 1449, 67 p., <https://doi.org/10.3133/cir1449>.

Power, K., Lang, A., Wood, J., Gubbels, F., McCullough, J., Carr, A., England, K., Guida, K. (2020) Understanding how

behaviour can influence climate change risks, AECOM and Sniffer. UK Committee on Climate Change: London. Available online: www.ukclimaterisk.org

New York State Department of Environmental Conservation. (2019). *Using Natural Resilience Measures to Reduce Risk of Flooding and Erosion in New York State*. Available online: www.dec.ny.gov

EPA 2018. *National Inspection Plan 2018 - 2021 Domestic Waste Water Treatment Systems*. EPA: Wexford