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On the limitation of evidence-based policy: Regulatory narratives and land application of biosolids/sewage sludge in BC, Canada and Sweden

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ABSTRACT

Sewage management exhibits all characteristics of a 'wicked' problem: it is framed as a technical problem even though it is surrounded by scientific uncertainties, and the framing hides both value-frameworks and the unequal distribution of risks and benefits. In this study, we analyze how uncertainties and the limits of scientific knowledge are approached and communicated in two jurisdictions that presently are in the process of revising their regulatory frameworks pertaining to land application of the residuals remaining after sewage treatment: Sweden, which is governed by the EU Directive 86/278/EEG, and the Canadian province of British Columbia, which draws heavily on the US EPA503 Rule. We find that the two jurisdictions take very different approaches to uncertainty and ignorance: The BC framing rests on the presumption that no evidence of harm can be taken as evidence that the practice is safe and draws on a persuasive narrative to that end. In contrast, the Swedish narrative rests on the presumption that absence of evidence cannot be taken as evidence of absence and that it therefore is better to hark on the safe side, when it is technically possible. The BC framing is indicative of a classic risk assessment approach and public acceptance is addressed as a knowledge deficit problem. The pursuasive tone and lack of transparency appears to negatively impact residents' trust in regulatory agencies. The Swedish framework takes a more precautionary approach, combining risk assessment with hazard determination and uses a deliberative and transparent approach, seemingly producing more socially 'robust' knowledge. Even though Sweden pays considerable attention to the challenges involved in making assessments based on limited data, the limits of science-based knowledge is not touched upon. In fact, Sweden and BC signal a similar view on humanities' ability to create reliable knowldge: given sufficient time, it will eveutally be possible to close the knowledge gaps and develop reliable (technical) solutions. We argue that treating the problem as if it is a technical challenge at its heart hides social aspects and forward that the value-judgements that underlie hazard determinantions and risk assessments must be transparently identified and communicated, including the assessment of uncertainty and the limits of science, to avoid increased polarization and thus hardened conflicts.

1. Introduction

Sewage management systems are expected to be functional, efficient and, perhaps most importantly, invisible (George, 2014). While the actors are limited to a small group of professionals, the stakeholders are many and the sectors' invisibility hides the fact that risks and benefits are unequally distributed. This is not least seen in the management of the semi-solid residue, which is a bi-product of waste-water treatment called 'biosolids' in North American legislatures CCME (2012); (US EPA, 1994) and 'sewage sludge' in Europe (Erhardt and Prüeß, 2001). Many jurisdictions encourage land-application with reference to the positive effects on soil health. The residue contains nutrients such as phosphorus and nitrogen and has a high organic matter content, which can improve the quality of the soil by enhancing the water holding capacity, physical structure etc. In addition to the direct effects, land-application of the residue also carries indirect benefits as it for example reduces the dependence on mined phosphorous (Cordell and White, 2011), and the alternatives (such as ocean dumping, landfill disposal, or incineration) are costlier and/or are deemed worse for both human and environmental health (Harrison et al., 1999; Leschber, 2002). The problem is that many of the pollutants that originally were present in the wastewater are concentrated in the residue, including pathogens, heavy metals and organic pollutants. The potential to environmental harm includes reduced soil productivity and eutrophication. Human health risks include spread of diseases (via virus, prions, or bacteria), cognitive impairment (for example caused by lead) and effects on the hormone system (for example caused by endocrine disrupting chemicals).

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The practice carries all the characteristics of a 'wicked' problem, for one it has both 'winners' and 'losers' (Head, 2008; Rittel and Webber, 1973). Among the winners are the collective urban population, as they are ridded of their waste in a cost-efficient manner, polluters as they do not carry the cost of handling their discharge once it has entered the waste stream, sewage treatment plants, who receive reduced storage and disposal costs, and farmers, who benefit from reduced fertilizer costs (Laha and Parker, 2003; Leschber, 2002; Mason et al., 2014; Ochsenhirt, 2012). Among the losers we find the collective rural populations as they face fears of odour, reduced property value, and perceived risks related to potential negative health and environmental impacts of land application. They are also exposed to a number of other risk factors and liabilities such as increased truck traffic, which brings increased risks of spills and traffic accidents, and increased road maintenance. Stakeholder categories are not so simple though, and rural populations also include winners: the local economy generally benefits from land application through the creation of job opportunities (Mason et al., 2014). The alternatives to land-application are incineration, land-filling and discharge at sea or in local water courses. These 'solutions' do also infer risks and benefits that are unequally distributed. As for all complex and multifaceted problems, the majority of the potential winners and losers are future generations, whether it is a question of negative health/environmental effects caused by chosen management option or by problems that weren't mitigated because another option was not chosen (Öberg and del Carmen Morales, 2016). Hence, management of the semi-solid residue carries all the characteristics of a wicked problem, meaning that there are no 'solutions' as all options have unintended consequences thus causing other problems, and an unequal distribution of risks and benefits (Andersson et al., 2014; Rittel and Webber, 1984; Turnpenny et al., 2009).

All risks are estimated to be low but are surrounded by large uncertainties. This is because the residue commonly contains thousands of chemicals (e.g. pharmaceuticals, personal care-products, pesticides, flame-retardants, solvents) of which only a few have been thoroughly tested and very little is known about potential synergistic effects. Also, most tests are based on the effect of single compounds on single-organisms and very little is known about potential effects on the complex soil-plant system (Clarke and Cummins, 2014). Land-application of the residual after sewage treatment is thus surrounded by both known unknowns and unknown unknowns (Hoffmann-Riem and Wynne, 2002; Wynne, 1992).

Mary Douglas (2002) highlights that when dealing with complex questions that are surrounded by uncertainty and rely heavily on expert knowledge, the central question is 'how safe is safe enough'. Also, awareness is needed that there is not one unambiguous answer to that question because people have different interests and thereby also different preferences and perceptions of acceptable risks and the value of potential benefits (Beecher et al., 2005; Harrison et al., 1999; Lowman et al., 2013; Mason et al., 2014; Ormerod, 2016).

When conflicts erupt in areas that rely heavily on scientific and technical knowledge, governments commonly respond by advocating for more science (see for example: CCME, 2012; Iranpour et al., 2004). Calls for more science are commonly grounded in the so-called information deficit model, which assumes that the root of the conflict is due to insufficient scientific information that is not well communicated (Douglas, 2017; Fernández, 2016). Such an approach is efficient when disputes are mainly technical in nature, but not for handling complex problems where all solutions are problematic for one reason another (Andersson et al., 2014). It is held that such conflicts require a transparent identification of objectives, explication of underlying trade-off decisions, predicted outcomes, including how risks and benefits are distributed, and, not least importantly, uncovering uncertainties and the limits of knowledge (Hoffmann-Riem and Wynne, 2002).

Several authors call attention to how the framing of a problem guides the process that results in tradeoffs between competing objectives, including ethical aspects of management decisions (e.g. who reaps the benefits and who carries the risks; Andersson et al., 2014; Benessia et al., 2016; Brown et al., 2010; Saltelli and Giampietro, 2016). Elliott (2011) outlines how the use of terminology and categorization can have far reaching impacts on the future course of scientific research, the publics' awareness or attention to particular scientific phenomena, the viewpoints and behaviour of key decision-makers, as well as altering the burden of proof required to take policy action. This is further echoed by scholars such as Larson (2011) and Nisbet and Mooney (2009) who call for careful attention to be paid to value-laden terminology and the ways research is framed for the public.

To better understand how the uncertainties surrounding risks and benefits related to land-application of the residual remaining after sewage treatment and how the framing of risks and benefits might impact policy, we comparatively examine documents from two jurisdictions that are in the process of revising their regulatory framework surrounding land-application. As the first case, we choose our own jurisdiction: the Canadian province of British Columbia (BC), as we have specialized knowledge about this province. As the second case, we choose Sweden as it is widely recognized as a leader in many areas of environmental regulation. We choose to compare these two jurisdictions because of their many similarities (e.g. wealthy, industrialized in the northern hemisphere, perceived as environmental leaders with a strogn rule of law; Boyd, 2011). Yet, BC is a laggard when it comes to sewage management, with several treatment plants yet to be upgraded to secondary level (Öberg et al., 2014) and the Capital Regional District still discharging to the ocean without treatment (Ellis, 2015). Another reason for choosing these cases is that most jurisdictions in the world that land apply sewage sludge draw heavily on either the EU-framework (EC Directive 86/278/EEC) or the US EPA Part 503 Rule, and while Sweden is governed by the EU directive, BC draws heavily on the 503 Rule. Furthermore, both jurisdictions are presently in the process of revising their regulatory frameworks pertaining to the land application of sewage sludge. Finally, we have specialized knowledge about both cases, for example as the lead author has direct experience of living in and working in both locations thus being familiar with the scientific, legal, political, and cultural environments.

1.1. Regulating to prevent harm under scientific uncertainty

There are numerous studies that address potential risks and benefits associated with land application but as it is a question of applying a complex mixture to a complex system there are many uncertainties and much that simply is unknown. It is, for example, well documented that many chemicals are present in the residue, but their potential impact on human and environmental health is poorly understood (Naidu et al., 2016; Noguera-Oviedo and Aga, 2016; Snyder and Anumol, 2015). In situations where knowledge is lacking, it is not possible to determine probabilities and it is then a question of determining how to handle absence of evidence, which neither is evidence of absence nor of the opposite (Altman and Bland, 1995). Wynne and others have repeatedly pointed out that it is deeply problematic when uncertainty (known unknowns) is not distinguished from ignorance (unknown unknowns) (Hoffmann-Riem and Wynne, 2002; Wynne, 1992) as the extent of the former can be estimated with statistics, whereas the latter cannot.

When assessing risk in a complex policy context and determining whether potential risks merit action, there is a need to consider how to handle things where data or knowledge is lacking or non-existent (Altman and Bland, 1995; Benessia and Funtowicz, 2016; Hoffmann-Riem and Wynne, 2002; Wynne, 1992). As elaborated by Ragnar Lofstedt (2011), it is in regulatory circles debated when it is appropriate to use hazard classification (the potential for something to cause harm) vs risk assessment (a combination of hazard and the probability of that hazard happening). Hazard classification is for example the guiding principle for the 1973 Swedish Act on hazardous chemical products and also for Health Canada's 2008 bisphenol A (BPA) ban in baby-bottles. The Canadian Environmental Protection Act uses both approaches by