The Wasteful Potential of Dog Poop

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Introduction

Our research project focuses on the wicked issue of dog poop in Lethbridge with two related problems in resource management that cannot be addressed on their own: dog poop is not being picked up within our community, especially in and around off-leash dog parks; and when dog poop is picked up, it is with single-use plastic bags that are then sent to the landfill. We expand on ways in which these problems affect access to ecosystem services such as regulating services, cultural services, and supporting services.

The average dog generates one kilogram of poop every few days, which is an incredible amount of waste to leave behind (Snow, 2019). Abandoning dog poop on lawns and in parks not only immediately affects the appearance of the grass, but it can continue to decrease vegetation growth in the time it takes to fully decompose. Dog poop can take weeks to months to break down, depending on the temperatures and moisture in the area. On top of these smaller aesthetic issues, leaving dog poop behind increases the exposure of harmful germs and bacteria to people and dogs. Stepping in the neglected dog poop and tracking it into homes is a concern for both us and our pets, as this increases the risk of getting infected with these pathogens. The various infectious matter can cause a variety of health problems in both humans and animals, commonly stomach flu and other gastrointestinal problems.

Plastic dog bags take an exceptionally long time to decompose in landfills due in part to the lack of oxygen supply as well as the fact that plastic can take hundreds of years to break down. An average of 500 million plastic dog poop bags are used annually worldwide (Snow, 2019). Of course, there are alternative bags to plastic, such as paper or those marked as "biodegradable", but these come with their own challenges as well. Paper bags may seem better at first glance, but once more research is done, it is unclear if the increased amount of greenhouse gas emissions during production outweighs their benefits. Many "certified biodegradable or compostable" bags still take hundreds of years to decompose naturally (Snow, 2019).

As far as ecosystem services go, Lethbridge's dog poop problem spans across various categories. The wastewater treatment aspect, as well as the reduction of pathogens in the environment, fall under regulating services. The dog parks being used for recreation causes the issue to also fall under cultural services. Educating dog owners on the issue and getting them to be actively involved in solutions could also be considered a form of cultural service. Ensuring that dog poop does not bring harm to people or other animals in the form of diseases, or the destruction of grass, highlights the supporting services at play here too.

Other cities in Canada have programs in place that allow dog owners to dispose of dog poop in alternative ways. Both Vancouver and Winnipeg's wastewater treatment plants are able to effectively kill the disease-causing pathogens in dog poop, as such, dog owners are able to flush dog poop down their household toilets. Waterloo has installed dog poop specific waste receptacles in order to have less dog poop end up in plastic bags in landfills. In Red Deer, dog owners can compost their dog's poop in specialized bags to decrease the amount of plastic waste in landfills. In Australia, parks provide paper bags and compost bins for users to dispose of dog poop. In England and the United States, temporary anaerobic digesters convert energy locally, while educating users about the fate of their dog's poop.

In Lethbridge, we have access to alternative means of disposal, and we feel that this is an issue within our community that we can bring awareness to. We would like to embrace this opportunity to make a change in our community. Our goal this semester was to provide tangible suggestions and solutions to improve the issues we address in this project, but due to the time constraints of the semester, we are submitting the introduction and preliminary research.

Preliminary Research

In 2019, 9,000 dogs were licensed in Lethbridge, with an estimated 12,000 total (Bradley, 2019). We use these 2019 stats because, although we reached out to several contacts to get stats for 2021, this has been unsuccessful by the time we are handing in this assignment. The most recent census from 2019 indicates Lethbridge's population at 101,482, across 42,022 households (Lethbridge Census Online, 2019). These statistics indicate that pet dogs are found in approximately one in three Lethbridge homes (Bradley, 2019). Because the average dog excretes one kilogram of poop every three days, this could be as high as 3-to-4 thousand kilograms per day; and over 1 million kilograms per year in Lethbridge (Baechler, 2018; Tully, 2018; Bradley, 2019; Clear Choices Clean Water Indiana, 2022). This is clearly a lot of poop in our community.

One big issue with dog poop is the "ick" factor, especially when it is abandoned in public areas. It is gross, smelly, and not at all pleasant to step in. Then comes the issue of having to worry about cleaning it off ourselves or our dogs. Although there have been developments in excrement management in terms of human and other animal waste since the medieval times, this has not necessarily been the case with dog poop (Gross, 2015). Regardless of the displeasing visual component of leaving dog waste on sidewalks, streets, and grass, there is the added issue of infectious material that could be present as well. One gram of poop can house up to 23 million fecal coliform bacteria (Siler, 2018). It is estimated that household dogs can transmit over 30 different diseases, whether they be bacterial, viral, parasitic, or fungal. Protozoa such as *Cryptosporidiosis* and *Giardiasis*, cestodes like *Echinococcosis* and *Dipylidiasis*, nematodes including *Toxocariasis,* and hookworms are all parasites with the potential to be transmitted through dog poop when it is just left out in the open. These parasites can cause a myriad of health problems in humans ranging from gastrointestinal issues and malabsorption of vitamins and nutrients, to cyst growth and liver enlargement, to fevers, coughs, and headaches (Kumar & Smith, 2000). In addition to the possible presence of parasites, bacteria carried in dog poop poses another threat to human health; "*Salmonella spp., Escherichia coli*, *Yersinia spp*., and *Campylobacter spp*." are all bacteria that have been previously discovered in dog feces that could easily cause public health problems in large amounts (Toledo et. al, 2015). *Campylobacter spp*. and *E. coli* are thought to be the single most common bacterial cause of gastroenteritis (stomach flu) in industrialized countries, and the second most common cause in developing countries (Toledo et. al, 2015).

The threat of these diseases and illnesses only increases when the concentration of waste in an area increases, so it is especially important to keep areas with high rates of dog traffic clean, such as dog parks (Bradley, 2019). Choosing to not pick up after one's dog increases the likelihood that someone else (or their dog) could step in the dog waste and track it into their homes. The simplest way to persuade people into cleaning up after their dogs is to make it as

easy as possible and ensure there is adequate infrastructure in place to handle the dog poop disposal. Having enough garbage cans and dog poop bag dispensers in a given area can achieve this (Siler, 2018). On a more local note, it is clear that issues could potentially arise in such expansive areas with only a handful of garbage cans spaced around the dog parks in Lethbridge (Table 1). Three of the popular off-leash dog parks in Lethbridge (Popson Park, Peenaquim Park, and Scenic Drive Dog Run) are located near the Oldman River, which is the source of drinking water for Lethbridge and nearby communities (Bradley, 2019). Typical wastewater in Lethbridge undergoes several treatment and disinfection steps; however, dog waste running directly into the river means that it bypasses all the steps necessary for proper disinfection as it is carried downstream (Figure 1) (City of Lethbridge, 2022c). This increases the chances that the aforementioned bacteria can infect people and their pets either by entering household water supplies downstream from the treatment facility, or for those who swim in the Oldman River.

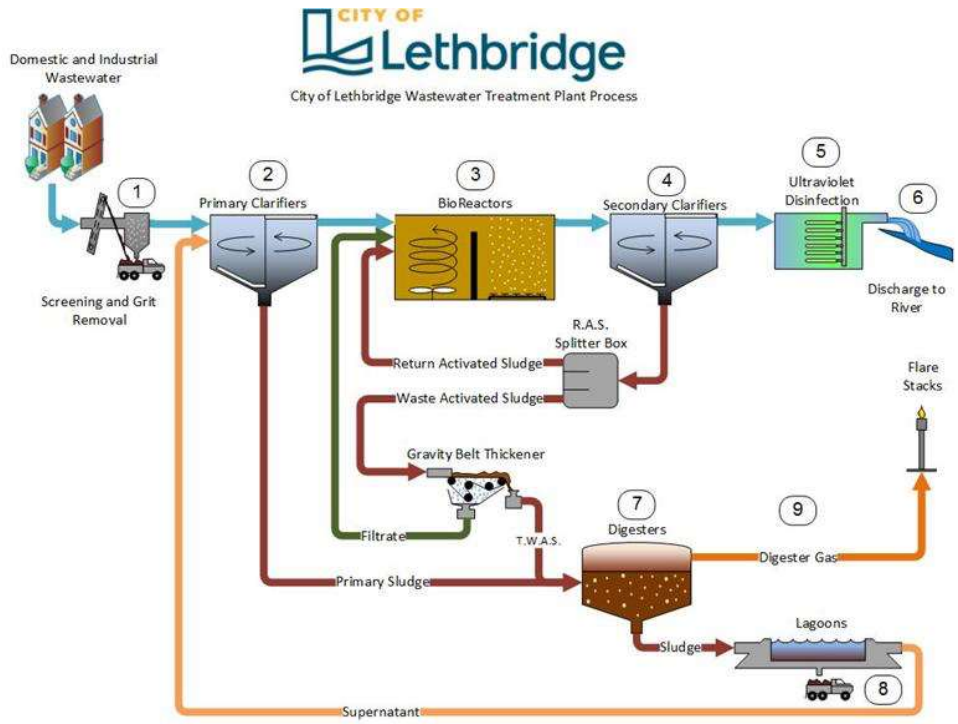

Figure 1. Process by which wastewater is treated in the City of Lethbridge's wastewater treatment plant (City of Lethbridge, 2022c).

In both Canada and the US, it is the responsibility of the wastewater treatment plant managers and municipalities to decide whether to flush or treat dog poop in their facilities (EPWN, 2022). Lethbridge has an "unflushables" list that focuses on clogged plumbing concerns; however, it is unclear as to whether dog poop is specifically encouraged or discouraged (City of Lethbridge, 2019; City of Lethbridge, 2022b; personal communication, April 14, 2022). This is not the case in all cities though, as both Waterloo and Vancouver encourage flushing, because these wastewater treatment plants are designed to treat that kind of waste (City of Vancouver, 2022; Region of Waterloo, 2022). It is important to acknowledge that dog poop bags are not to be flushed; only the contents within are accepted. We will discuss more on the topic of bags later on.

Unlike other animal waste, such as cattle and swine manure, dog poop does not act as a good fertilizer for grass and plants. Due to most dog's high protein diet, their poop becomes very acidic and is damaging to lawns and grass (Poop 911, 2022). Because cows and pigs eat a mainly vegetation-based diet to begin with, their waste is broken down easily and the decomposition returns essential nutrients such as phosphorus and nitrogen to the soil. This is not the case with dogs because most dog foods are made up of chicken, beef, and pork by-products that do not provide benefits to grass (Poop 911, 2022).

Regulating services are processes that manage and balance vital ecosystem activities. These services may go mostly unnoticed when they are working well, but when there is a problem, it can be tough to restore balance. For our focus on dog poop in Lethbridge, wastewater treatment and the reduction of harmful pathogens are the two main regulating services that affect the health and wellness of people. The wastewater treatment plant in Lethbridge works to keep the Oldman River safe for plants, animals, and people, and ensure contaminants are thoroughly removed from the water before it is released back out for natural uses.

The four dog parks that we discuss in this assignment have opportunities for cultural services, in the form of recreational use, spiritual enrichment, and education, and these services are threatened when dog poop is left behind. In 2018, Scenic Drive Dog Run was at risk of closing, because of this problem. In October 2017, volunteers collected 150 pounds of poop across a 300-metre section of the park, with a rate of seven pounds per hour; in May 2018, volunteers collected 40 pounds of poop over that same stretch of park, with a rate of five pounds per hour (Bradley, 2019). The City of Lethbridge's idea to mitigate this problem ranges from threatening to close parks, to threatening fines, to providing plastic bags at parks (as well as in residential communities). There are 200 dispensers around the city, providing about 600,000 single-use plastic bags per year (Bradley, 2019). However, these are proving to be ineffective measures because, based on our personal experiences walking in these parks, this is still a significant issue. We can see that mass amounts of dog poop are abandoned, and despite the 190 pounds of poop collected between 2017-2018, only eight fines were issued between 2016-2019 (Bradley, 2019). Scenic Drive remained open in 2018, but it is clear that both enforcement and motivation to pick up after dogs in our community is low.

The City of Lethbridge records the frequency of garbage collections (Table 1), but not the amount of waste collected (Bradley, 2019; Bradley, Racz & Richter, 2022). To give some context for residential black carts since curbside recycling was implemented, Table 2 shows the totals that came from residential black carts since curbside recycling was implemented, along with the total percentage of all pet waste (Bradley, Racz, & Richter, 2022). It is difficult for the City of Lethbridge to measure pet waste; therefore, these statistics include more than just dog poop (for example, it may also include kitty litter, rodent bedding, etc.). Employees typically empty garbages around the city when they are one third full, or fuller, have heavy items, or emit a foul odour; however, at dog runs, all garbages are emptied at each visit, no matter how full they are (S. Ackroyd, Parks Operations Coordinator, Parks & Cemeteries, City of Lethbridge, personal communication, March 2022).

Table 1. Dog Park Collections from 2021 (Bradley, 2019; Bradley, Racz & Richter, 2022).

Park	Approx Size (ha)	# of Garbage Cans	Average # of Times Collected	Total # of Collections
Popson	20	5	38	189
Riverstone	1	6	42	254
Scenic	45	4	105	418
Peenaquim	20	6	52	312
Total	86	21	237	1173

Table 2. Total pet waste in Lethbridge between 2019-2021 (Bradley, Racz & Richter, 2022).

Year	Total (Tonnes)	Pet Waste (%)	Pet Waste (Tonnes)	Pet Waste (Pounds)
2019	22,052.77	8.53%	1,881.10	4,147,113.51
2020	22,483.14	6.42%	1,443.42	3,182,187.28
2021	21,629.78	7.21%	1,559.51	3,438,120.63

Those who pick up after their dog are considered "responsible pet owners" (City of Lethbridge, 2022a). Removing dog poop from parks and sidewalks could be considered a form of "detoxification", but that is really only focused at that specific site. Collecting and moving the waste essentially moves the problem, and the waste accumulates somewhere else. The waste would actually decompose at a quicker rate if it were left exposed to natural elements, as the decomposition cycle can begin much earlier. However, we have already addressed this as being problematic. Instead, the City of Lethbridge recommends owners tightly tie the dog poop in a plastic bag and toss it into the garbage; this is problematic too because this significantly lengthens the time it would take the poop inside to break down (City of Lethbridge, 2022a). For example, it takes an average of 9 weeks to decompose when exposed to the elements, depending on moisture and temperatures in the environment (Aaron, 2022). Contrast this with the ten years, and up to one thousand years, it takes plastic poop bags to fully break down in a municipal landfill; this is the case even for bags termed "biodegradable" (Vallery, 2015). This dramatic time difference occurs because neither the contents within the tied bags, nor the bags that are buried in the landfill, receive oxygen, which is needed to decompose.

Decomposing dog poop has its own set of challenges whether it is left on the ground, sent to a landfill in a bag, or composted with, or without, a bag. We consider whether plastic or paper bags decompose faster in various circumstances, and which produces and distributes less greenhouse gases. Some evidence shows paper to be less durable than plastic, thereby decomposing faster (Edgington, 2019). However, in Lethbridge, bags of any kind will not decompose in a landfill because it is necessary for these bags to have access to oxygen to break down, and this is not possible when they are buried (personal communication, February, 2022). The City of Lethbridge also does not yet accept compostable bags in the city compost, because the knots are problematic for the machinery; they do not break down with the rest of the bag and get stuck in the machines during the process (personal communication, February, 2022). We have yet to find evidence about the efficiency and success of paper decomposing in a buried landfill and identify this as an area to continue our research.

Paper bags release more emissions during production than plastic, due to the rigorous processes involved in the forestry industry (Cho, 2020; Californians Against Waste, 2016). For

example, trees are harvested, transported, milled, stripped, transported again, etc. On the other hand, paper bags impact solid waste less than plastic bags (California Against Waste, 2016). Do these 'overhead costs' of paper products offset paper's ability to decompose faster? Does it matter if paper bags are incapable of decomposing in a landfill anyway?

Using single-use bags of any kind is problematic, whether they are paper or plastic, and we are curious about the ways that paper products, such as newspapers, can be recycled into a bag. As Canada strives towards a goal of contributing less plastic waste by 2030, we are interested in the ways we can utilize existing products more efficiently, rather than making new products, to pick up poop (Crosswhite, 2021). Lethbridge is in a unique situation, because our city has access to various facilities with potential to handle dog poop, albeit with some improvements and commitment from our community; we can curate a plan that builds off other successful programs.

For example, the City of Red Deer compost program accepts dog poop in certified compostable bags. Their green cart program started with a small pilot project in 2015, and the entire city was engaged in this program by 2018. Before starting this program, they had a backyard composting program in 2013, where Red Deerians signed up for a 2.5-hour seminar to learn about composting in one's backyard. This seminar also included a starter kit to encourage less waste sent to the Red Deer landfill. The original composting program is still in place, but they saw limitations to the items one could compost within one's yard, unlike the green cart program. Within the city of Red Deer's master plan of the green cart program, they had provided a chart describing the cost and likelihood of implementation of green initiatives (Figure 2) (City of Red Deer, 2013).

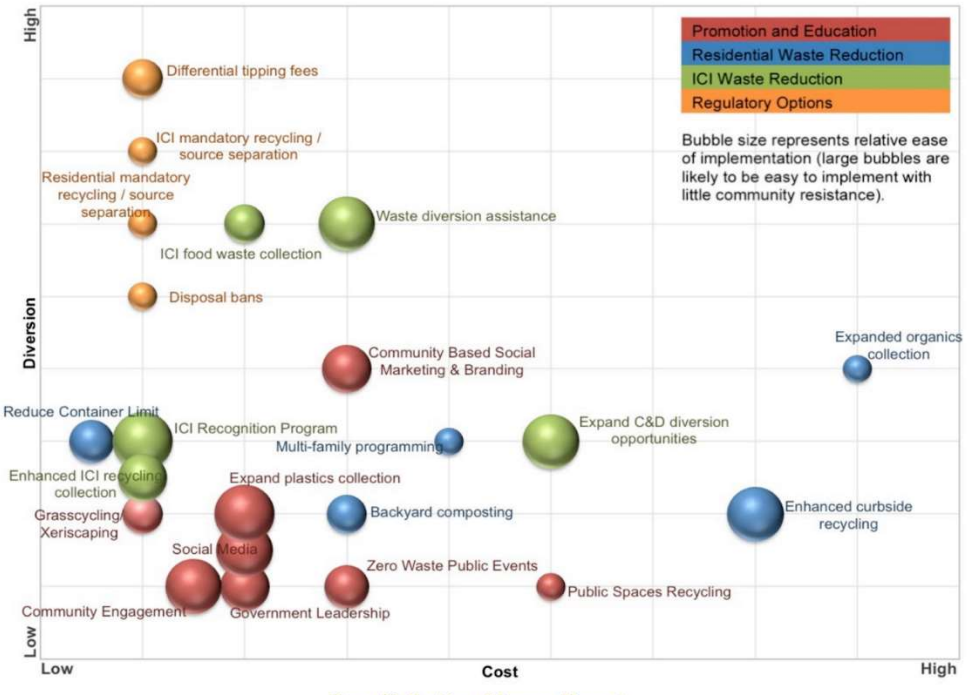

Figure 2. Cost benefit analysis of City of Red Deer introducing green initiatives (City of Red Deer, 2013).

This example of composting has strong ties to the cultural services involved in our project, especially as Lethbridge is currently unveiling a new composting service. We see these services in the form of engagement, understanding, buy-in, and commitment from community members. Figure 2 provides some evidence that it can be low cost and easily implemented. There are also strong ties to regulating services, as composting controls the spread of unwanted pathogens due to organic waste and improves water quality. A connection can also be seen between ecosystem services since the recycling process of our organic waste can provide benefits to us for generations to come by eliminating unnecessary waste in the landfill. Supporting services are shown in the practice of composting as it encourages the community to support ecological processes involved in nurturing soil formation. These effects can be far more significant if our community diverts our annual three million pounds of poop away from the landfill into the new composting program.

Another example is that the city of Waterloo installed in-ground dog poop containers at three parks in May 2017. The goal of these containers is to divert waste from the landfill. Pet owners collect their dog waste in whatever bag they have, then it is shipped to a local bio-digester. The poop is separated from the bags and converted into nutrient-dense fertilizer, electricity, and heat (City of Waterloo, 2018). It is not explicitly stated what happens to the bags, but because any bag type is accepted, we assume that these are sent to the landfill. This program had great success, so they installed more in-ground dog waste containers at more local parks around Waterloo in 2019. Recently we reached out to the city of Waterloo to ask for updated statistics on their program to see if it continued to be successful, although we have not received a response to our inquiry by the time of this submission.

The City of Vancouver provides another example of a dog poop program, where an estimated twenty bins are located across the city, eight of which are in parks. These bins are easy to spot as they are red-orange and have a dog figure on the front (Khvorostukhina, 2021). These bins are emptied every week by a third-party contractor, and the material is sent to a facility in Surrey to be processed (City of Vancouver, 2022). The poop is separated from the bags and loaded into 10,000 litre tanks, where water and enzymes get mixed with the dog poop, and then agitated by air bubbles for a week. After that process, it gets pumped into a vacuum truck to be taken to its final destination at the Iona Island Wastewater Treatment Plant in Richmond, where it creates a soil fertilizer, and the methane emitted is turned into biogas that powers the plant (Khvorostukhina, 2021). Similar to Waterloo, we assume that the bags are sent to landfills, which is an area for improvement.

In Australia, local governments have tested out multiple methods for controlling their dog poop issues in parks. One most noteworthy method is their addition of compost bins around public parks with paper bags to collect the waste; this proved successful, although the financial cost was high (Jackson, 2000). This would be an interesting area to conduct a cost/benefit analysis.

There have also been a few temporary projects in Cambridge, Massachusetts (2010), and Malvern Hills, England (2018), that harness energy from dog poop by converting ‘donations’ of poop directly into methane gas, bag and all, that burn as a flame lamp (Crosswhite, 2021). These installations were temporary, with very little information about the successes and challenges of

these projects. This is another area to investigate further when considering solutions for this assignment.

All of these examples illustrate ways that these cultural service issues can be converted into cultural service solutions. For example, dog owners are involved in the process, gaining knowledge and experience in improving this wicked problem. These examples also convert cultural service issues into regulating service solutions, where pests and diseases are being mitigated, water quality is being maintained, and waste products are being processed. Supporting services issues are also addressed through the above examples, as supporting services encompass the basic functioning of ecosystems at their core. Keeping parks clean from abandoned dog poop and reducing the amount of plastic dog bags that end up in local landfills are both ways these issues can become solutions.

Overall, we have found that when most cities implement solutions for dog poop, many focus only on the collection, recycling, or energy extraction of waste, and fail to address the issue of single-use plastic bags. However, we need more holistic education, accountability, and action for both. For lasting change to come, the public must follow new government initiatives and believe that the effort in alternative disposal practices is worth the costs to further drive lasting change. The most effective way to create lasting change is to reinforce and educate the public in order to change their behaviour (Jackson, 2000).

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