

Contemporary Social Science

Journal of the Academy of Social Sciences



ISSN: 2158-2041 (Print) 2158-205X (Online) Journal homepage: <https://www.tandfonline.com/loi/rsoc21>

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To cite this article: Tora Holmberg (2019): Animal waste work. The case of urban sewage management in Sweden, Contemporary Social Science, DOI: [10.1080/21582041.2019.1630669](https://doi.org/10.1080/21582041.2019.1630669)

To link to this article: <https://doi.org/10.1080/21582041.2019.1630669>



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Published online: 21 Jun 2019.



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Animal waste work. The case of urban sewage management in Sweden

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ABSTRACT

Urban infrastructures such as wastewater services are essential to the functioning of cities. Through waste work, sewage gets transformed and revalued. Non-humans are potentially unruly agents in the transformation of “dirty” sewage into biogas, a “clean” energy resource in environmental terms. But these values are not given or applied in any simple sense. What goes on under the surface, beneath the street or inside a pile of dirt is the invaluable work that constitutes a city’s multispecies waste management. The article argues that rats, worms and microbes perform labour in the urban wastewater economy, as they eat, digest and breed. This article investigates the role of these non-human waste workers and the cultural and economic values they produce in the intersections between the socio-technical infrastructures where the urban and the animal meet. The article makes use of “trash-tracing” as a method and follows the multiple steps taken in the chain of sewage management in the city of Gävle, Sweden. It contributes new knowledge on the waste ecologies of cities by paying close attention to shifting and paradoxical valuations of wastewater, as it is configured through nonhuman work.

ARTICLE HISTORY

Received 8 February 2019

Accepted 2 June 2019

KEYWORDS

Value; rat; infrastructure; bacteria; worm; trash

Introduction

By studying the production of trash and the management of its disposal, we can learn about the essential cornerstones of the culture we wish to study. Such “waste work” includes the upgrading – or downgrading – of stuff, and the actors performing it are assigned value accordingly. Urban animals, who share overlapping lifeworlds in proximity with humans, play visible roles in waste management (e.g. Jerolmack, 2008; Nagy & Johnsson, 2013). Different – or even the same – species are viewed negatively or positively, depending on the spatial and relational context. The rook, *Corvus frugilegus*, provides an illustrative example of such ambiguous valuations in the waste economy. It belongs to the crow family, and as such, it is known to thrive in cities. In Uppsala, Sweden, rooks are ubiquitous to such an extent that they are promoted as a “city bird” (Uppsala Municipality, 2016). They are now close to being endangered and, as reported, should therefore be tolerated and not subject to culling. But they are frequently a source of conflict. In the local newspaper, the

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owner of a grill testifies that, because the birds like to hang out above and around his restaurant to feed on guests' leftovers, he needs to constantly clean up when the "rooks poop on the tables" (Uppsala Nya Tidning, 2016). Not only do the Uppsala rooks disturb the human-centric urban order by making unpleasant sounds, scavenging food waste and defecating in inconvenient places, they are also bad for business.

As a counter-story, international newspapers reported in August 2018 that specially trained rooks were being called in to deal with trash left by visitors to the French national park Puy du Fou. Whenever the rooks delivered, for example, a piece of paper, they were rewarded with bird treats. They quickly learned how to fit the rubbish into the treat machine and to tear bits that were too large into smaller pieces. Rooks are particularly intelligent and communicative, and their waste management skills may even have a pedagogical role, in that "crows could teach us to take care of the environment" (The Guardian, 2018). Stories like these stimulate questions about non-human workers in the urban waste economy and the values they produce. Such stories delve right into the important scope of this special issue, namely the dynamics and potentials of "socio-natural intersections where the animals and the urban meet" (Brighenti & Pavoni, this issue). These intersections will be analysed with a focus on wastewater services and their management, which are at the very heart of the functioning of cities (Lofrano & Brown, 2010).

In municipal as well as commercial promotion of sustainable futures, sewage management is often represented as a straightforward cycle: from worthless dirt flushed down toilets to economic and ecological valuables, such as bio-fertilisers, back to food production and new consumption. Questioning these neat processes, the theoretical figure of "urban metabolism" points at some related messiness (e.g. Gandy, 2004; Kaika, 2005). Infrastructures are made of assemblages of technological and natural agents that transform rather than simply transport matter such as for example water. Non-humans are essential but potentially unruly agents in such transformations of "dirty" sewage into biogas, which is considered a "clean" energy resource in environmental terms (Lepawsky & McNabb, 2010). Scholars in urban science and technology studies (STS) have long studied the city through the lens of human and non-human networks (e.g. Farias & Bender, 2011; Guzman & De Souza, 2018; McFarlane, 2014). For the present article, I start at the micro-level, following the trash in an attempt to get a grip on urban waste management. This is akin to how Kopytoff (1986) argued for investigating the "cultural biography of things" to examine the trajectories of objects as they are transformed when they pass through different settings. The present article makes use of "trash-tracing" as a method and follows the multiple steps taken in the chain of sewage management. It contributes new knowledge on the waste ecologies of cities by paying close attention to shifting and paradoxical valuations of wastewater, as it is configured through non-human work.

Urban waste work

Water is filled with cultural meaning, ranging from symbols of creation and sustainer of life to – when flushed away – symbols of dirt, decay, contagion and even death. In his classical *History of Shit* (1978), Dominic Laporte examines the Western genealogy of sanitisation, showing how the purification process that led up to today's infrastructures is in fact a prerequisite for urbanisation as such. Along with scholars such as Norbert Elias (2000) and Richard Sennett (1994), Laporte (1978) argues, from a psychoanalytical perspective, that

the exclusion of excrement from urban display was central to the formation of the modern individual. The privatisation of water use, in turn, pushed the “hydrological reconstruction of the modern city” (Gandy, 2004, p. 5). Moreover, as a consequence of the installation of water-borne waste removal systems in the nineteenth century, individuals also became increasingly dependent on the collective authorities – the municipality (Benidickson, 2007, p. 97). The city authority was, and still is, the principal body, in that it executes governance through provision, regulation, screening and taxation of water flows.

Up until the final few decades of the twentieth century, water management was a public affair. But with leakages creating health hazards, environmental scandals and the more recent climate change awareness and resilience discourses, a green economy involving a plethora of public and private actors has arisen (Swyngedouw, Kaika, & Castro, 2002, p. 8). Similarly, the rationales for handling wastewater in Western societies have changed greatly. From being a necessary and symbolically dirty affair, its’ management has become a potentially profitable business involving not only public actors, but also transnational corporations, implying a shift in “waste regimes” (Gille, 2010).

As the production, circulation and transformation of waste become increasingly complex, neither a social nor a technological perspective on waste management is sufficient (Gille, 2010, p. 1054). A research focus on the intertwinement of the social and the material, technology and nature, is particularly important when studying urban water flow management. Water is omnipresent and malleable matter; it is a cultivated natural resource that assembles architectural, animal, technological, legal, and organisational actors. These assemblages, in turn, are spatially anchored and take place through the urban metabolism (Gandy, 2004; Kaika, 2005; Swyngedouw, 2006). It is far from being as self-generated or contained as the term might imply (Gandy, 2004). On the contrary, the urban metabolism – conceived of as the transformative flow of water, waste and energy in/through urban infrastructures – is a messy affair. As Gay Hawkins writes, “the infrastructural logic of sanitation is not just technical but cultural” (2006, p. 46). Most of all, sewers literally mediate between the private sphere of the home/body and the public/municipal sphere. These mediations and transformations of values ultimately depend on the work of non-human animals, because valuation is part of that work activity itself (cf. Vatin, 2013, p. 16).

Animals perform labour everywhere and are often heavily exploited for their reproductive, bodily capacity (Shukin, 2009). Within the urban waste economy, the work of non-humans is central, but their place in the apparatus of production does not easily accord with the sociology of work framework, e.g. a Marxist understanding of wage workers producing surplus capital. Thinking beyond the framework of commodities, Donna Haraway envisions commercial dog breeding as “biotechnologies” (cf. Haraway, 2008, p. 56; Russell, 2004). In the regimes of lively capital, non-human co-workers become subjects with agency as well as objects in multispecies encounters (Haraway, 2008, p. 45 ff.). Moreover, non-human bodies can be produced, traded, or reproduced to create economic value without being trained or bred, as in the dairy or the dog breeding industry. Anna Tsing, a cultural historian of mushrooms, asks how extra-capitalist work can be turned into capitalist wealth. Her answer is “salvage accumulation”, where multispecies bodies are converted and appropriated, arguably outside capitalist modes of production (Tsing, 2015). Attending to non-human work in the urban waste economy is critical in our attempts to understand the actors, policies, symbols, social relations, material factors and economic

resources that form and govern the water infrastructure system. And waste is certainly not value neutral.

Trash tracing

The project *Waste Work in the Sustainability Economy: Transforming Values of Biological Waste* studies two Swedish cities in detail, following flows of water and food waste through various transformation processes. As stated above, it makes use of the method of “trash tracing”, piggy-backing such waste along metabolic pathways, e.g. from sewage circuits, through treatment plants, to bio-fuel production and deposits of residual waste. Special attention is paid to the varied valuation practices mobilised in these settings: how they are performed, by whom and to what effects. A panoply of human and non-human actors is involved in the transformation of values. The present article focuses principally on the wastewater transformation process in one of these cities – Gävle.

Gävle is located on the east coast by the Baltic Sea, two hours north of Stockholm, connecting northern and central Sweden. Historically, it was a typical commercial town, and it still benefits from the traffic in and out of the harbour. It is the capital of the Gästrik-Hälsingland county region, with a population of 100,000 inhabitants. The municipality is rapidly growing in population and is planning for a 20% increase in less than 10 years. Naturally, these plans impact the water and waste management infrastructure, putting pressure on a sewage treatment facility that is already pushing the limits of its authorised operations and scope.

The data for the present article consist of 120 archival documents: e.g. municipal directives, annual plans and sustainability policies. Moreover, the study includes several site visits at Gävle’s main treatment plant, the biogas centre owned by a consortium of municipal corporations and the commercially driven city recycling centre. Finally, the article is based on interviews with 16 key actors working along the sewage flow.¹ Although a limited number of quotes are presented below, the analysis as a whole is based on the full set of data sources.

Making sludge

In general, people do not think much about the afterlife of their bodily leavings after flushing the toilet or rinsing the bathroom sink. Some might know that wastewater goes through purification processes at the sewage treatment facility before exiting into recipient waters. Even fewer are aware of the subsequent processes that take place: from making sludge through aerobic, anaerobic and chemical treatment and refinement, to biogas and further to deposits. One could say that the flows are more or less hidden from public consciousness. Jamie Benidickson, author of *The Culture of Flushing*, states, “the human contribution to the water cycle [...] has never seemed particularly riveting or worthy of attention” (2007, p. 5).

Contributing to this lack of attention – beside the smooth operation of wastewater infrastructures – is the spatial separation. Most of the Swedish sewage treatment plants were built in the 1950s and 60s, and at that point they were located outside the city centre, with deposits being placed even further away. The effort to avoid smells and other nuisances is one reason for keeping plants at a distance from residential areas.

Another reason is that a recipient is needed for the refined water deposit; for safety reasons, this recipient should be well separated from the city's water supply. However, because cities are growing, densification is the name of the game. The industrial districts where sewage plants often are located are becoming gentrified. Thus, we can predict that as hidden water infrastructures and treatment become more visible, future city inhabitants will become increasingly aware of what is made from the things they flush away. Closer attachment between the consumer and the discarded may increase public awareness of unsustainable practices. When what otherwise would be private "shit" is brought to the fore, it may "energize our ethical imagination" with regard to urban waste ecologies (Hawkins, 2006, p. 48). The end product of the various processes of purification of wastewater is sludge. Sludge is simultaneously dirty – a condensed form of human excrement – and pure. Massive amounts of environmentally hazardous contents – mainly phosphor and nitrogen – have been filtered out along the way. Notably, sludge mediates between the "dead" decay of the human body and the "living" – the lively capital that is used as energy and fertilisers. Producing sludge and making the necessary transformations of values is hard work.

Down the drain

As stated above, Gävle has grown substantially in population and is expected to continue to do so at an increased pace. The water supply infrastructure is constantly being renovated so as to reduce risks such as pollution, clogging and leakage. However, the wastewater infrastructure is vulnerable while under renovation. Large portions of the existing sewage system are from the 1950s or earlier. These pipes are made from concrete, material that gradually crumbles, allowing for inflows of storm water – and of non-human animals, such as rats. These rodents are pervasive in the drains, where they live off household leftovers. Rats mainly enter the system through open pipes, old drains and wells. As one informant, who works with monitoring, maintenance and renovation of the sewer network in Gävle, explains: Rats are present, "they are there", because they "are good at chewing their way in" (Interview G15). When I insist on finding out how they get in, he again affirms that "they live there [...] many of them live entirely in the drain system". My questions disclose a rather naïve but probably common image of the wastewater network as closed and contained. But urban infrastructures are far from straightforward. The sewers mediate not only between the private and the public, but the pipes also allow for flows between the inside and the outside (Gandy, 2004).

What is it then that rats find so appealing? One important factor is the food waste and the growing amount of fat that people flush down their drains – an increase that is mainly due to changing consumption habits. Supernatant oil may create fat blobs and ultimately lead to what can be called an "arrhythmic urban metabolism" (Dijst et al., 2018, p. 15). Extreme amounts of fat threaten the city's sewage flow and thus become, in addition to a nuisance and a hygiene issue, a security risk. But what are considered risks for some constitute positive values for others: Rats thrive on the food waste and frying oil (Figure 1).

Rats have always followed human populations, and there are at least as many rats in a Swedish city as there are people. The subspecies brown rat, *Rattus norvegicus*, most often live hidden from human sight, and they prefer sewers. Rats do not always stay below



Figure 1. Standing rat (Photo: Reg Mckenna, Wikimedia, <https://commons.wikimedia.org/w/index.php?curid=3875136>).

ground, but occasionally emerge in gardens, basements and, in some cases, via toilets. When they transgress spatial-temporal boundaries and become visible, they appear as a threat, and as such, their existence is violently enforced.

In the city of Gävle, the above-ground emergence of rats is reported to the authorities. Some rats are trapped and killed and the places “sanitized”, in this particular case by the Sweden-based, internationally active company Anticimex. When interviewed in a local newspaper, an Anticimex representative states:

Using heat sensors, the trap senses when a rat comes running and snaps in one-tenth of a second. - There are barbs, that is spikes, coming down and crushing the rat and then it is washed away (Gävle Dagblad, 2014).

Being closely connected to waste in the cultural imagery, urban animals that feed on garbage may themselves be regarded and treated as trash (Jerolmack, 2008). Rats are despised as destroyers of property and unjustly feared as spreaders of disease and

urban infestations (Burt, 2005). Symbolically described as hidden, destructive, intrusive – in the economy of waste, these rodents produce negative cultural and economic values. However, brown rats may well be viewed as waste workers, because their livelihood depends on the stuff humans throw away. Indeed, as illegitimate but invisible waste workers, they collect and transform the unwanted remains of human consumption. Notably, their presence also produces work for others, because they are fought using architectural constructions and pest control. As dirty and worthless “trash animals”, they are considered disposable outlaws (Nagy & Johnsson, 2013, p. 4). Rat bodies emplace spaces such as pipes, cloaks, and, further downstream, they get caught up in nets and are mashed in pumping stations. But even the dead bodies work (cf. Laqueur, 2015), because they cause clogging, which in turn calls for sanitisation. Pest control firms make sure rats do not enter the purification process. Thus, the separation and dissolution of their bodies from the water flow constitute but one step in the production of sludge.

Feeding bacteria

Further down the drain, water, human excrement, toilet paper, oil (and dissolved rat bodies) flow through the nets that make up the obligatory passage point between sewers and the treatment plant. The plant is a place where what got flushed away is further transformed in its process of becoming sludge. Entering the unit, a mechanical sorting out of the undifferentiated mass of wastewater takes place. First, there is separation of non-biological waste from the undissolved, such as plastic and paper. Second, liquid is pressed out, shrinking the volume of sludge before entering the next phase: purification through the reduction of phosphorus. At the main treatment plant in Gävle, this is principally done through a biological process called Bio-P. The leading actors in this process are Phosphor Accumulating Organisms (PAOs) (Figure 2).

These microbes – the PAOs – have qualities that make them exceptionally well suited to digesting phosphor. The process is well described in the following quote from the industry organisation *Svenskt vatten* (Swedish Water):

The microorganisms that enable bio-P also have the capacity necessary for the process, in that they can aerobically take up more phosphorus than is required for growth. This phosphor is stored in the cell structure for later needs. In order for a net uptake of phosphorus to take place, an initial anaerobic environment is required where the bacteria first release phosphorus and absorb organic carbon. The energy from the absorbed carbon is then utilized by the microorganisms for uptake of phosphorus in the aerobic stage. [...] When the microorganisms accumulate enough phosphorus, the sludge is separated from the water stream, which is thus purified from phosphorus (Svenskt vatten, 2018 [translated by author]).

Like other bacteria, PAOs are sensitive to their environment. In order to function well, they need a certain amount and quality of nutrition for the first – anaerobic – stage of the process. Nutrition is provided in the form of carbon, which is provided in generous amounts by the sludge. In the next aerobic stage, the microorganisms, if fed well, ingest more phosphor than they actually need for their livelihood. As “bio-technologies” (Russell, 2004), their work creates a material, bio-chemical surplus value.

In addition to the right amounts of carbon, they need a certain temperature interval and pH level, which are meticulously monitored. Water flows should be as constant as possible. However, the flow of wastewater cannot be fully controlled. The above-



Figure 2. Duvbacken sewage plant, Gävle (Photo: [author] 2018).

mentioned fat release creates problems for the bacteria. One interviewee who works at the sewage treatment facility discusses the consequences, here with regard to work shop oil:

Not really aware of what you can release, some small industries and garages perhaps don't know about oil, about separating and emptying. Fat separations that need to be taken care of, cleaning of brushes, this disturbs my bugs because they are sensitive as individuals, right (Interview G1).

Fat residue disturbs the PAOs' working environment. But the primary interruptions come from the above-mentioned variation in water flows. The strains on the sewage treatment facility vary over the year, but also over weeks, days and hours. Weekends and rush hours mean increased flows, but the more acute problems are presented by melting snow and excessive rain fall, which create a threat to these microorganisms' lifeworld. It may take weeks for the "bugs", as the interviewee calls them, to recover, and meanwhile the purification process has been severely disturbed, providing an example of urban infrastructures' "precarious achievements" (Graham, 2010, p. 9).

After being drained and processed, the sludge enters the biogas chambers where the digestion process takes place. Here, an oxygen-free environment requires anaerobic bacteria that can produce methane. But to work well, these bugs also need the right conditions. At the ideal temperature of 37 degrees Celsius, they produce biogas. Apart from temperature, the right amount and composition of microbes are essential. And of course, the quality of their feed – the sludge. These conditions are continuously monitored, maintained and fixed so as to prevent any interruptions.

The words swelling, digesting, feeding, and thriving all connote vital, bodily activities. Phosphor-digesting bacteria as well as methane-producing ones are indeed precarious organisms, and plenty of human labour goes into managing them. These microbes and their working environment need continuous tinkering to ensure their wellbeing (e.g. Balmer & Molyneux-Hodgson, 2013). This precariousness points to the inherent sensitivity of water infrastructures. Disruptions are always lurking around the corner, and constant repair work is needed to prevent them. This requires expertise and is time consuming – cultivating, monitoring, and feeding the others as co-workers, while building of microbes and cities.

Depositing digestates

Wastewater sludge may – after proper pre-treatment and quality certification – be distributed to farms and used as bio-fertilisers. This is the case in, for example, the city of Malmö in southern Sweden. Given the considerable amount of agriculture in the region, there is a market for such certified products. However, this procedure is currently being called into question at the national level, and the future of wastewater-based sludge management is unclear (SOU, 2019). In Gävle, the residue from bio-gas production is transported to the recycling facility outside the city and deposited as land fill. And because the sludge from Gävle contains high levels of zinc, it needs to be handled separately from deposits from the surrounding municipalities. At the facility, trucks place the sludge in neat rows for further processing (Figure 3).

We are shown around the plant, starting at a purification bed for water flows in the area, then to the site for handling household garbage. Large wheel loaders work on sorting garbage. The whole plant is shadowed by seagulls and crows. This is a perfect smorgasbord for the birds! (The gulls are also waste workers of a kind). Then we come to the collection point for sludge. Striking how a giant area is used for strings of sludge that occupy a fraction of the surface. The *Duvbacken* sludge lies in its own pile where it is placed before being deposited on its own place, up on the hill (Fieldnotes, 21 September 2018 [translated by author]).

The pile that to us appeared to be a temporary, transitory deposit site, is actually a place where myriad activities are going on. Instead of a dead pile of sludge, it is an active transformative processing machine: an open-air compost (B according to Swedish standardisation). Here, the sludge from the treatment plant is mixed with organic material such as chipped garden waste, which is added as fuel. The initial composting continues for six months, and the post-composting, where the last maceration is carried out, adds an additional three months to the process (Interview, G6). Composting is a slow biological process through which the deposited matter is reduced to nutritional soil.

Besides being a time-consuming process, composting does not occur automatically. It is a careful, laborious process, and decomposing agents are needed to get the work done. As stated above, numerous microorganisms are enrolled upstream and contribute to the composting process. But anyone who has ever had a garden compost knows that where there is manure, there are earthworms, larvae and other critters. They thrive on the high nutrient content, the moisture and the temperature, while transforming sludge. But the process is fragile. As pointed out by Sebastian Abrahamsson and Filippo Bertoni, composing wormy relations “takes work, and it can always produce friction, and lead to failure” (2014, p. 140).

Earthworms are culturally interesting because they add positive value to the deposit, making life out of the drained sludge and, in the end, creating soil. Worms slowly eat their way through it, as they chew, digest, and renew. Like rats and bacteria, they work in the dark, hidden and partly uncontrolled; it is no accident they are called “night crawlers”. Like rats but unlike phosphor-eating organisms, they are not contained. On the contrary, while the architecture of the dump actively strives to keep the sludge contained, worms are unruly because they escape and transcend those barriers. In contrast to the idea of “salvage accumulation” (Tsing, 2015), worms are hardly a harvested resource. But they give the economy of waste a bonus, as the work they do adds value to the sludge production apparatus. They produce good things without intending to (Hawkins, 2006, p. 124).

The last step, or at least the point where I leave the wastewater flow, is the final deposit. The composted sludge is now placed at the top of a hill, left here to rest for eternity. Eventually, bushes, trees and other vegetation will become established. And the worms will continue doing their maintenance work (Figure 4).

Concluding discussion

As I have argued above, multispecies waste work builds the city – “that fascinating, unearthly region where trash flourishes and thrives” (Kennedy, 2007, p. 88). The city is undoubtedly the soil for wastewater and its various kinds of workers. It is the soil from



Figure 3. Forsbacka Suez (Photo: [author] 2018).



Figure 4. Forsbacka Suez (Photo: [author] 2018).

which the multiplicity of feeding/eating activities derives. Urban infrastructures are vehicles of distribution and provide “spaces of mobilities and flows for some”, while they are “barriers for others” (Graham, 2010, p. 12). Rats, worms and microbes perform labour in urban wastewater management, producing sludge and its byproducts. While typically not “big like us” (Hird, 2012), these under-recognized nonhuman actors perform work that risks flying below the sociological radar. These creatures create economic and cultural values from waste while they eat, digest and breed. What goes on under the surface, beneath the street or inside a pile of dirt is the invaluable work that constitutes a city’s multi-species waste management. Myra Hird has discussed what she calls waste-build-worlds, devoid of human presence (2016). To push the argument further, without this infrastructural work providing water and waste disposal, *there would be no cities* as we know them.

The fact that one person’s trash is another person’s treasure points at unstable ontologies, “waste matter is ambiguously located between categories” (Kennedy, 2007, p. 30). The meaning of disposable objects depends on the social, material, economic and cultural systems of valuation through which they flow. Thus, studying waste values directs our focus to the social relations that produce this ambiguous category (Hawkins, 2006, p. IX). As pointed out by Johan Hultman and Hervé Corvellec: “For whom is this a problem, and for whom is it a resource?” (2012, p. 302; Drackner, 2005). For example, fat may be regarded as a problem for the water-borne waste systems, while the cloak rats truly appreciate it. Likewise, non-humans may be negatively valuated as vermin, or

positively, as a resource, depending on their positions in the flow of waste. Zooming in on the digestive assemblages – where some feed and others eat – allows us to question the inherent, and perhaps unavoidable, anthropocentric heritage of the trash/treasure binary (Hird, 2016).

Waste workers, although associated with dirt and low status, are invaluable actors in their roles as intermediaries of significant relations. But playing these roles in the apparatus of sludge production is not something they have been trained to do. Instead, their work can be interpreted in terms of “salvage accumulation”, as “the process that brings [their] skill into the factory to the benefit of owners” (Tsing, 2015, p. 57). Such a Marxist interpretation might shed light on the fact that rat waste work is valued negatively, whereas bacteria that serve as purifiers seem to gain status through the work performed. Bacteria have moved from being viewed solely as disease-generating enemies that need to be combatted to create and keep a healthy population, to being positioned as friendly allies that help human – and animal – bodies function (e.g. Gröndal, 2018). Microbe/human ecosystems have even been elevated to a kind of role model for how humans should involve in ecological relations (Paxson & Helmreich, 2014). This discursive shift has been conceptualised as “microbiopolitics” (Paxson, 2013), implying a kind of microbial work-force. A related perspective is that of “domestication”. The term normally refers to historical relations based on human control over animal movement and reproduction. Moreover, domestication is spatially determined, as it implies proximity to home and household. It is worth noting that domestication is a relational category of co-habiting, involving multiple dependencies and agencies (Haraway, 2003, p. 30; Holmberg, 2015). Rats, worms and microbes and the work they perform may be viewed in terms of the times/spaces of domestication.

Rats live close to human settlements where they are (unintentionally) fed; their reproduction is controlled through ruthless culling, and they are tolerated only when hidden. Their waste work is not acknowledged, on the contrary. To continue, microorganisms are not typically viewed in terms of domestication. However, the PAOs are certainly appreciated when they are in place at the treatment plant. They are bred, contained, fed, monitored and cared for. Outside the plant, they would not be considered feral or wild, but simply valued as worthless. In contrast, compost worms working at the deposit site are in a sense uncontrolled, in that they enter the piles uninvited. Their compostation work is mainly appreciated in the food waste assembly of the green economy. Not typically fitting into the binaries of wild/domesticated, free ranging/contained, they confirm that the taxonomy of domestication is “constantly challenged by the messiness of life” (Brighenti & Pavoni, 2018, p. 577). Savages, salvaged, servants, or co-habitants in multispecies cityscapes, these waste workers mess around with such binaries.

Instead of being the unwanted byproduct of sanitisation processes, non-humans are truly “harbingers of urbanisation” (Brighenti and Pavoni, this issue), not only always already present and shaping the city as such, but also increasingly brought into the urban waste economy. As the rooks in the introduction exemplify, their performances are legitimate or illegitimate, public or hidden, historically established or recently involved. I have argued that non-humans handle and transform sludge as their livelihood and are thereby essential agents in the sewage metabolism. Animal and microbial labour is indispensable to building worlds in the urban waste economy. Follow the waste workers, and you will find the city.

Note

1. The interviewees signed informed consent forms, and their identities have been anonymized.

Acknowledgements

The project group consists of Tora Holmberg (PI), Malin Ideland, Claes Fredrik Helgesson and Sebastian Abrahamsson.

Disclosure statement

No potential conflict of interest was reported by the author.

Funding

The project is funded by the Swedish Research Council 2018-2020 (reg. no. 2017-02142).

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