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Waste, rodents and integrated pest management at UCT

Nicoli Nattrass

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About the author:

Nicoli Nattrass is a professor in the School of Economics and co-Director of the Institute for Communities and Wildlife (iCWild) at UCT. (ORCID: https://orcid.org/0000-0002-8422-5631).

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Abstract

The University of Cape Town (UCT) has long been committed to 'Integrated Pest Management' (IPM) yet has struggled to implement this. IPM prioritizes prevention over poisoning yet persistent collective action failures within the university – especially over the poor management of waste – and between pest control companies and university managers, have made this difficult to achieve in practice. This paper focusses on the challenge of managing pest rodents at UCT. It provides a brief history and reports on early efforts through the 'Khusela Ikamva Sustainable Campus' initiative to reduce the use of, and need for, rodenticides. This action research suggests that ecological considerations are important in developing pest control protocols (especially given that UCT's upper campus is within a national park) and that adaptive management can assist with institutional learning. Even so, there is a clear need for more widespread engagement with all stakeholders at UCT to achieve IPM in practice.

1. Introduction

The University of Cape Town (UCT) has long been committed to 'Integrated Pest Management' (IPM) yet has struggled to implement this. IPM emphasizes prevention over lethal control, yet persistent collective action failures within the university – especially over the poor management of waste (le Cordier et al, 2022) – and between pest control companies and university managers, have made this difficult to achieve in practice.

IPM is international best practice for the pest control industry. It prioritizes prevention (hygiene, exclusion) and monitoring, the idea being to use poison baits and toxic chemical spray only when necessary – and when there is clear evidence that this is required (Greene & Breisch, 2002). IPM is more intensive of time (because of monitoring and the efforts required to promote hygiene and exclude pests) but is more environmentally sustainable and has been shown to be more efficient and cost effective than prophylactic poisoning (see e.g., Miller and Meek,

2004; Williams et al., 2005; Kass et al., 2009). Ideally, pest management should be rooted in a clear understanding of the ecology of the pest concerned so that interventions can be as targeted and humane as possible.

This paper focusses on the challenge of managing pest rodents at UCT. It provides a brief history and reports on early efforts through the 'Khusela Ikamva Sustainable Campus' initiative to reduce the use of, and need for, rodenticides. This action research suggests that ecological considerations are important in developing pest control protocols (especially given that UCT's upper campus is within a national park) and that adaptive management can assist with institutional learning. Even so, there is a clear need for more widespread engagement with all stakeholders at UCT to achieve IPM in practice.

2. Management of pest rodents

Rodents, especially rats,[1] are seen as 'pest' animals (or 'vermin') globally because of the damage they do to infrastructure (through gnawing and burrowing) and to stored food, and because of the potential health risks they pose to humans (Begon, 2003; Bonnefoy, Kampen & Sweeney, 2008; Taylor et al., 2008; Julius et al., 2012; Himsworth et al., 2013; Archer et al., 2017). Recent research suggests that urban rats are found in clusters of genetically related individuals (Combs et al., 2018) and that this affects patterns of disease, with some populations carrying no diseases at all (Byers et al., 2021). Roads and 'resource deserts' (areas without food or shelter for rodents) act as major barriers to movement (Combs et al., 2018). This implies that managing pest rodents is a highly contextual issue, requiring in-depth knowledge of local conditions and resident rodents.

Rodent populations can grow quickly when conditions are propitious, notably when food supply increases (Singleton et al., 2010). Low-income urban areas are particularly vulnerable to rodent infestation because of their typically dilapidated structures (providing harborage for rats), high housing densities (facilitating easy colonization of adjacent buildings) and inadequate waste management (providing food and shelter) (Himsworth et al., 2013; Jassat et al., 2013; Himsworth et al., 2014). This can prompt apparent waves of infestation as rats can have up to five litters a year, with up to eight young per litter, where conditions are favourable (Feng & Himsworth, 2014: 152-153).

[1] Most members of the broad category 'Rattus' occupy natural habitats, but five are considered true 'commensals' in that they live in close proximity with humans. Two of these, the black rat (*Rattus rattus*) and the Norway rat (*Rattus norvegicus*), are rarely found in the wild (Aplin et al., 2003). Norway rats originated in northern China, and black rats in India and Southern Asia, with both species spreading around the world in association with human transport (Bonnefoy et al., 2008; Feng & Himsworth, 2014). The Norway rat has been especially successful, often displacing the black rat, which in some places has been declared endangered (Feng & Himsworth, 2014: 157).

Rodenticides can reduce urban rat populations significantly, but only when sustained and well targeted (Buckle & Smith, 2015). Rat populations recover quickly, however, to fill the vacuum left by such culling – especially if the underlying attractions of food and shelter remain unchanged (Easterbrook et al., 2005; Singleton et al., 2010; Gras, Patergnani & Farina 2012). Rodent populations can also become resistant to rodenticides, either evolving a tolerance for it or learning to avoid poison bait (McGee et al., 2020). This is further reason to prioritize dealing with the underlying causes of the infestation rather than relying on sporadic and prophylactic lethal control. Rodenticide use has been growing in Africa but has proved costly and ineffective at helping farmers protect their crops against rodents, prompting 'ecologically-based' rodent management programs to seek locally acceptable alternatives (Belmain et al., 2008; Makundi & Massawe, 2011).

There is emerging evidence that rodents exposed to anticoagulant rodenticides are more likely to carry diseases potentially harmful to humans such as Leptospira infection, implying there may well be further unanticipated negative implications for human health from the use of anticoagulant rodenticides (Murray & Sánchez, 2021). A study in Vancouver found that the prevalence of *Leptospira interrogans* in a rat population subject to lethal pest management went up relative to areas where no such culling took place. The authors hypothesized that the social disruption caused by culling might have resulted in greater contact between rodents as they sought to re-establish social hierarchies (Lee et al., 2018).

There is also increasing concern over the impact of rodenticides on non-target animals, especially on wild animals and birds that prey on rodents (Eason & Spurr, 1995; Thorsen et al., 2000; Brakes & Smith, 2005; Serieys et al., 2019; Rattner & Mastrota, 2018; van den Brink et al., 2018). The rise of the animal welfare movement has also meant growing attention is being paid to the rat itself, notably the humaneness of rodent control. Rodenticides cause painful, and often protracted, death and thus kill traps are considered preferable from an animal welfare point of view (Ludders et al., 1999; Edelman, 2002; Mason & Littin, 2003; Littin et al., 2004; Meerburg, Brom & Kijlstra, 2008; Yeates, 2010; Littin et al., 2014; Hadidian, 2015).

More attention is being paid to territorial behaviour and social dynamics within rodent populations, with some suggestive findings. Studies of the four-stripe mouse (a wild field mouse that can also be found in urban areas) in South Africa is revealing of social hierarchies and communal breeding strategies in which juvenile mice, which are physically capable of breeding, do not do so during the first breeding season, but rather stay on as 'helpers' in the parental nest (Schradin & Pillay, 2004). This suggests that killing the dominant female could increase rodent populations as these juveniles start breeding, and as other rodents enter her

previously defended territory,[2] which, if so, is yet a further cautionary tale against using rodenticides prophylactically against rodents.

3. A recent history of rodenticides at UCT

Rodent control in Cape Town has long been a political issue bound up with racial oppression and socio-economic inequality (du Plessis, 2019). When the third great pandemic of bubonic plague reached Cape Town in 1900, fear of disease intersected with colonial racist ideology to prompt and justify racial segregation (Swanson, 1977; Poleykett, 2017). However, neither the oppressive translocation of people, nor the large scale killing of rats, prevented these commensal rodents from retaining a firm foothold in the city. In the early 2010s, a wave of rodent infestation appears to have occurred in Cape Town, resulting in complaints across the city, especially in low-income areas (du Plessis, 2019). Officials in the local African township, who had been attempting to reduce the use of rodenticide in the area because of poisoning of children, sought to address the wave of infestation by hiring previously unemployed people to trap and drown rodents. This innovative strategy, however, was halted after the Society for the Prevention of Cruelty to Animals (SPCA) objected to drowning caged rats (Nattrass et al., 2019). Even though the Society also regarded poisoning as inhumane, their actions forced the local officials to rely primarily on rodenticides.

Images from: https://www.news.uct.ac.za/article/-2020-09-02-uct-retains-top-spot-in-africa-in-the-world-rankings; https://www.news.uct.ac.za/article/-2010-03-29-connecting-the-campuses

Figure 1: UCT

UCT has also historically relied on rodenticides, despite being located on the urban edge of Cape Town, with its main 'upper campus' jutting into Table Mountain National Park (Figures 1 and 4). Upper campus is above the M3 highway. Middle campus, student residences and the Medical campus are below

[2] Such dynamics have been recorded for other mammals. One of the mechanisms by which culling jackals is thought to increase the population of jackals is through the disruption to social hierarchies caused by killing the dominant pair. Populations can increase as helper females start breeding, and as dispersing jackals from other territories enter the area (see review in Nattrass et al., 2020).

the highway. The Hiddingh Hall campus (not shown on the map in Figure 1) is in the Cape Town city centre, adjacent to the old Company gardens. Pest control on all campuses is conducted by private contractors, whose composition has changed over the years in response to regular tender processes.

Figure 2: Rubbish piled up at UCT Residences and food litter on upper campus probably blown out of overfull bins (photos taken in 2021).

Rodents can be controlled in non-lethal ways that are consistent with humane treatment and IPM by reducing their access to food and shelter. Given UCT's putative commitment to IPM, pest control contractors at UCT are required to bring to the attention of university managers structural problems (such as holes in buildings) that provide access into buildings for rodents, or problems with waste management. It is unclear how often such reports are made, but there is evidence that managers have been slow (or even totally reluctant) to act on the information when it is provided. Pest control contractors have pointed to persistent problems with UCT's unhygienic waste management collection areas (Figure 2), but as these appear to fall into a managerial black hole (le Cordier et al., 2022), pest control companies have been forced to respond by increasing the number of bait stations in these areas.

The prophylactic use of pesticides and rodenticides has been implicated in the global collapse of insects, birds and mammals (Intergovernmental Science-Policy Platform, 2019; Sánchez-Bayo, F. & Wyckhuys, 2019). That these were routinely used on upper campus, close to the boundary with a national park is nothing short of scandalous from an environmental perspective. A recent iCWild study showed that rodenticides in Cape Town find their way into otters, genets and owls (Serieys et al., 2019). Given UCT's unique location and role as one of the premier educational institutions in Africa, one might reasonably expect the institution to recognize that it has a special duty to ensure environmentally sound waste management and pest control – and to ensure that staff and students become environmentally responsible citizens. It has only recently paid serious attention to

the issue, and it remains to be seen whether this attention will result in real, sustained change (le Cordier et al., 2022).

Figure 3: Eagle Owl in the tree (Educare Centre), Caracal, Cape Grey Mongoose, Spotted Genet, and information (courtesy of Justin O'Riain) pertaining to an exploratory student survey of wildlife behind upper campus, 2013.

Hundreds of rodent bait stations can be found outside UCT buildings. Until recently, this included buildings close to UCT's boundaries with Table Mountain National Park, posing clear dangers to predators and scavengers that might feed on a poisoned small mammal. There have been no surveys of wildlife on campus, but it is known that Eagle Owls nest in the big fig tree next to the Educare Centre on upper campus, and a student-run pilot camera trap survey behind UCT captured images of genets, caracals and Cape grey mongooses, all of which eat rodents and have tested positive to rodenticides (Figure 3).

The Urban Caracal Project has radio-collared many of Cape Town's caracals. Figure 4 shows that several of them (most of which are now unfortunately dead) visited UCT. 'Jasper' and 'Laduma' explored the ring road and the natural areas around UCT.

The most lethal rodenticides are the highly toxic 'second-generation' anticoagulants such as Brodifacoum and Difenacoum which kill animals that feed on the poisoned rodents (Rattner & Mastrota, 2018). First generation anti-coagulants such as Coumatretralyl (known in South Africa as Racumin) are thought to be less toxic to owls (Fischer et al., 2003) than second generation anti-coagulants, although the long-term impact is not known. Cape sparrows have been known to die from exposure to Coumatretralyl, and mongooses, cats and dogs and other wildlife have died after eating Coumatretralyl-poisoned rodents (Rattner & Mastrota, 2018: 60; O'Connor et al., 2003). Some formulations of Difenacoum, such as 'Ridak' which requires rodents to feed more than once on the bait before

they die, are thought to be less toxic to owls than single feed formulations but remain toxic for mammals (such as caracal, domestic cats, genets and mongooses) which might ingest a poisoned rodent.[3] Anti-coagulant rodenticides have been found to undermine the immune systems of bobcats in the United States (Serieys et al., 2015; Serieys et al., 2018) and the Urban Caracal Project has found caracals in Cape Town both weakened immunologically and killed by these rodenticides (www.urbancaracal.org/). Alternative products like Solentra, which kills rodents by blocking their guts with calcium, are less dangerous to wildlife, but likely inhumane.

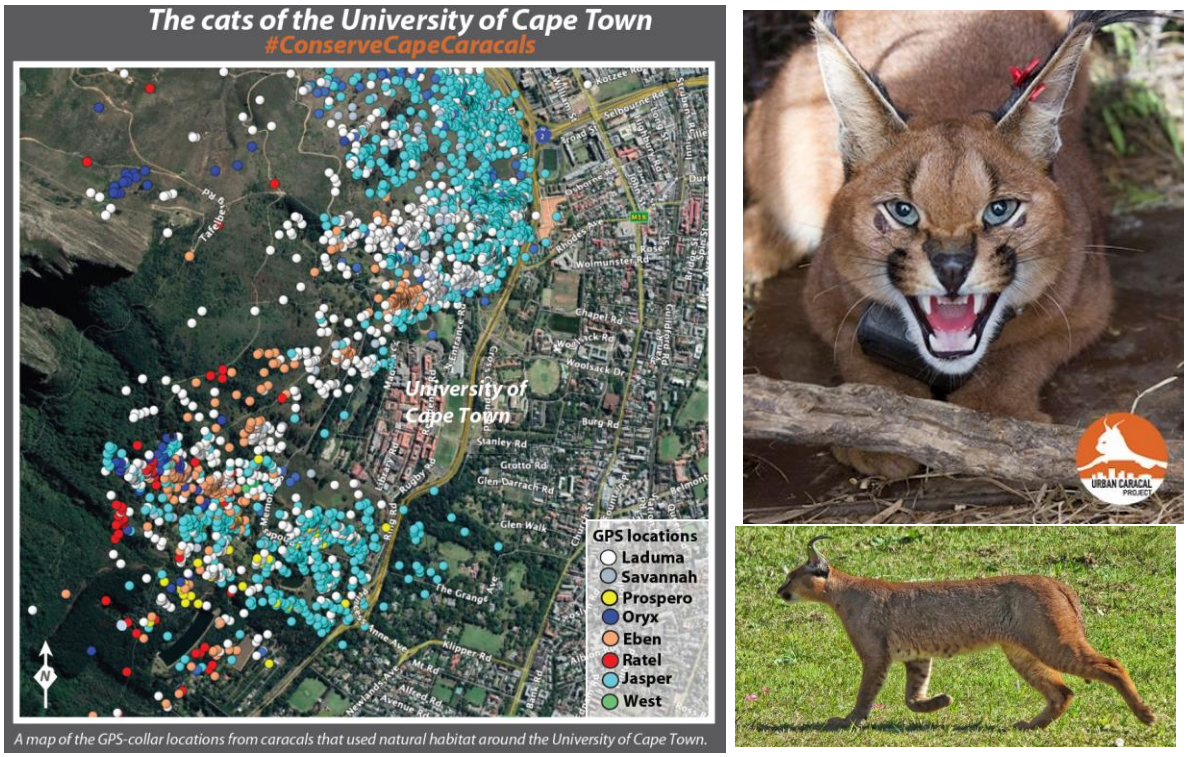

Figure 4: GPS locations of individual collared caracal (see figure legend for names and insert photographs are of 'Laduma', top right, 'Jasper', bottom) reveal a high presence of many caracal in the immediate vicinity of campus and occasionally on upper campus. Data and images courtesy of the Urban Caracal Project.

Up until recently, UCT pest control contractors used highly toxic anti-coagulant rodenticides – in one case a few years ago even doing so despite claiming to be using non-toxic monitoring in bait stations on upper campus (personal observation and evidence from a pest control company). Given UCT's poor waste control and

[3] Gerhard Verdoorn, the Director of the so-called 'Griffon Poison Information Centre' has 'endorsed' Ridak as an owl-friendly product, but warns it remains toxic for mammals. It is unclear what information Verdoorn has taken into account in making this assessment beyond the fact that Ridak is a multiple feed formulation. The Griffon Poison Centre is not located in any university and does not have a website.

unhygienic waste collection areas, pest control companies face strong incentives to use poison as a way of dealing with a problem beyond their control. Attempts were made to reframe and alter pest control contracts, but this process was contested, not only through bureaucratic inertia, but because of anxieties about moving towards a more innovative approach when conventional pest control contracts emphasized the prophylactic use of poison. An alternative adaptive managerial approach of learning by doing seemed appropriate.

4. Action research and evidence-lead adaptive management: A new approach?

In 2021, UCT launched the 'Khusela Ikamva Sustainable Campus' initiative to encourage 'stakeholders' to come together in the co-production of knowledge and practice to improve sustainability on campus. This initiative included a component aimed at eliminating the use of rodenticides and making IPM more efficient and humane. The strategy adopted was to engage in problem-driven research and adaptive management through engagement between researchers, pest control companies and university managers.

The strategy entailed 'research for action' through a collective effort to obtain a common understanding on which to base practical change (Drèze, 2017: 4-8). Such strategies are consistent with the co-production of knowledge to assist with adaptive management (Drèze, 2017; McNiff, 2017). Rather than research being a spectator activity conducted 'on people', action research entails the 'participatory assessment' of problems and their solutions (McNiff, 2017). It accepts that values inevitably guide research (and influence even the most 'scientific' designs), and that systematic research twinned with action to improve the world is community building and contributes not only to knowledge but also to understanding and transformation (Drèze, 2017).

4.1 Adaptive, poison-free management of rodents in buildings near natural areas

As a first step, the contractor for pest control on upper campus since 2020 – Mike Schrieff who owns and runs 'Coltech Environmental Solutions', a family-run small business, was invited to talk about the challenges he faced in doing his job, and about his preferences for different control methods. Fortunately, Coltech was already using the most wild-life friendly rodenticides and was keen to assist with efforts to improve the environmental sustainability and humaneness of rodent control. Mike Schrieff initiated an informal 'trial' by removing the poison bait stations on all buildings adjacent to the national park (many of which had been installed by the previous contractor). He started with the Educare Centre, the Tennis Court and the Earth Pump house (in the green area to the left of Figure 5).

He initially replaced the bait stations with kill traps – see location in Figure 6 – in which the rodent was trapped and killed instantly inside a box. Mike visited the traps regularly and kept a log of kills and rodent complaints.

https://www.uct.ac.za/sites/default/files/image_tool/images/328/contacts/maps/uctuppercampus.jpg

Figure 5: Buildings on Upper Campus

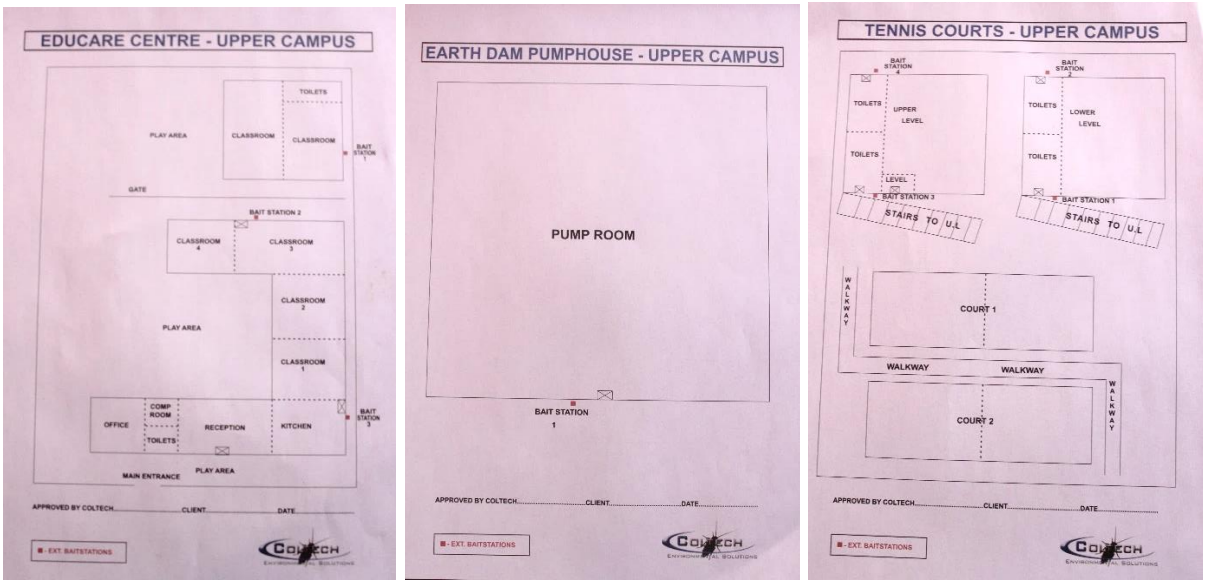

Figure 6: location of kill traps in Educare, The Pump House and the Tennis Courts

Table 1 summarizes the results of this informal trial (up until 17 September 2021). It shows that no complaints were recorded. No rodents were killed except for a four-stripe mouse at the Earth dam Pump house.

Table 1: Coltech's informal adaptive management trial (August and September, 2021): Building in natural areas.

	Educare	Earth dam Pumphouse	Tennis courts
August	Traps checked 8 times, no complaints, no kills	Trap checked 8 times. No complaints, no kills	Traps checked 8 times, no complaints, no kills
September (up to 17th)	Traps checked 6 times, no complaints, no kills	Trap checked 6 times. No complaints. One four-striped mouse killed, 17/09/21	Traps checked 6 times, no complaints, no kills

Source: Treatment and activity reports, Coltech

The case of the Earth dam Pump House is an instructive one for IPM. The Pump House is in a green area, below UCT's Earth dam and is surrounded by grass, trees and shrubs (Figure 7). Rodent control is required here, despite the absence of human-inhabited buildings in the immediate vicinity, apparently to protect pipes and electrics from rodent damage.

As can be seen in Figure 7, the pipes enter the Pump House from the rear. As of July 2021, the area of entry was not rodent proof and rodents could enter via gaps in the masonry. Coltech had brought this to the attention of UCT's Properties and Services on several occasions, but no action was taken. Mike Schrieff decided to fix the problem himself (using an industrial sealant) before replacing the poison bait station with a kill trap. As noted above, this trap was responsible for the only kill during this trial period – a four-striped mouse.

Four-striped mice (*Rhabdomys*) are field mice that are widely distributed in South Africa (du Toit et al., 2012). The sub-species *R. pumilio* is common in the Western Cape (Ganem et al., 2020) and has been found in the fynbos biome (Rymer et al., 2013) and amongst alien vegetation on the Cape Flats (David & Jarvis, 1985). They feed on succulent shrubs and annuals (Schradin & Pillay, 2006) and appear to have a dietary preference for fruit and seeds (Curtis & Perrin, 1979). They are territorial and social, with group size and home range varying according to food availability (Schradin & Pillay, 2004, 2006). Four-stripe mice are preyed upon by raptors, felines, and snakes – and show aversive behaviour in the presence of predatory snake feces (Pillay et al., 2003).

Images courtesy of N. Nattrass and Mike Schrieff

Figure 7: UCT's Earth Dam Pumphouse. Top right: location; top left: back of Pumphouse; bottom left, old poison bait station at front (July 2021); bottom right, opened new kill trap with a dead 4-striped mouse, 17 September 2021.

From the perspective of humane IPM and adaptive management, the killing of the four-striped mouse raises the question as to whether it makes sense to place traps on the outside of the Pumphouse. If access to the Pumphouse had by then been prevented (through the sealing up of holes), then the need to place a kill trap outside a door that is rarely used (and firmly secured) surely falls away. One could certainly question the practice of *attracting* rodents (via the bait on the kill trap) away from the natural area they live in, to their deaths. Yes, the kill trap is humane because it causes a quick and painless death. But was the death of the rodent in Figure 7 necessary? After joint discussion, it was resolved to remove the kill trap and replace it with non-lethal monitoring bait and to keep an eye on whether any rodent damage to the pump house become evident.

4.2 Further steps

Ideally, rodent bait stations should only contain non-toxic monitoring blocks that record rodent activity, and all reasonable effort should be made to understand which rodents are in the vicinity. There should be a zero-tolerance policy for rats on campus (neither *Rattus rattus* nor *Rattus norvegicus* are indigenous, and they both pose risks to humans and other rodent species). The house mouse (*Mus musculus*) can also pose major problems, and should be dealt with swiftly in buildings, or if they are discovered close to buildings. However, a more considered approach should be adopted towards the four-striped mouse. Their presence outside of buildings should not trigger eradication efforts: these should be limited to individuals who might enter buildings, perhaps in search of shelter.

Standard operating practice in the South African pest control industry is to place bait stations on external walls near doors as a means of controlling potential entry into the building by rodents. The problem with this, however, is that it may target rodents whose home ranges are only outside buildings and hence result in unnecessary killing of these rodents and perhaps also aid the development of rodent strains that are resistant to the poison baits. If external bait stations are to be used it makes more sense to restrict them to areas of high risk, such as doors into kitchens or food storage areas, or in external waste collection sites – but even in these places, there are strong arguments for the use of kill traps rather than poison baits. If the rodents are identified as field mice, then innovative strategies such as using custom-made deterrents (for example, placing snake feces in nearby stations) might be worth exploring, perhaps as a student research project.

One of the ideas considered at the end of 2021, when the pest control contracts were under consideration, was to use an 'Ecomille trap' in selected areas. The Ecomille trap is an Italian product, imported by PestFreeSA, which attracts rodents into a container (with food bait) and then tips them into a solution. Being 80% alcohol, this solution supposedly 'stuns' them and the rodent drowns shortly thereafter.[4] Whether this trap always works as humanely as intended remains unclear (stories circulate within the pest control industry of people complaining about rats swimming around in the liquid (especially after the alcohol evaporates), desperately trying to get out) and the SPCA in South Africa is apparently still investigating the trap (personal communication with the SPCA). In principle, however, if managed properly and regularly serviced, the trap should result in rodents losing consciousness in seconds (personal communication with the supplier). It is possible that the Ecomille trap could be piloted in areas with a high risk of rodent infestation, such as the waste collection areas outside of residence kitchens (see further discussion below), though improving the hygiene of the waste collection areas would be first prize in terms of IPM.

[4] Details of the trap can be found here: https://www.ekomille.co.za/

Rodent ecology should be front and central in decisions about the pest management of rodents. As is evident from the earlier literature review, the science is clear that rodent population size is linked fundamentally to food supply and to a lesser extent also to shelter. Fixing waste and access to buildings has to be the priority. Ideally, pest control contractors should, through their contracts, be incentivized and required to report any problems with regard to potential rodent food supply and opportunities to access buildings – and University managers should be obliged to act quickly in response to such reports. If a problem of major infestation arises, then it makes sense to contract the supplier of the Ecomille trap (PestFreeSA) to operate the trap in the area on a case-by-case basis. The Ecomille trap is currently very expensive.[5] It may well make more sense for UCT to hire the trap (and its management)[6] when necessary, and to monitor the results.

Kill traps should continue to be used in strategic places, such as the Educare building where Coltech kill traps have currently been placed – see Figure 6. Baited kill traps, however, should be used with caution because we do not want rodents to extend their territories towards buildings because they are lured there by the prospect of food (the bait). As discussed earlier, this is one of the reasons not to use kill traps outside the Pumphouse.

Finally, it is important to emphasize that a poison-free, monitoring-heavy approach will result in more sightings of rodents. It will also probably result in more complaints. At present, university managers and pest control companies see complaints as evidence of failure. From an IPM perspective, complaints should rather be framed as sources of information to be used in the design of targeted intervention – either to deal with the specific problem or to educate those that the rodent they are seeing is not a threat. Notably, if people are concerned about the presence of four-stiped mice in the garden, efforts should be made to educate people about urban ecology. Four-striped mice are important for seeding indigenous plants and providing (poison-free) food for owls.

Complaints can also provide an opportunity for management reforms. For example, if there are complaints from a residence kitchen about rodents, then this could also provide an opportunity for engagement over cleaning practices, the storage of food, the management of waste, the integrity of the building, and whether doors need to be kept shut in strategic places.

[5] The Ekomille trap currently costs R17,500 Rand per unit, and there are additional costs associated with the liquid solution and the bait. These costs have been inflated recently due to the weakness of the Rand (relative to the Euro) and shipping costs which have sky-rocketed under COVID-19 (information from the supplier).

[6] Conversations with PestFreeSA indicate that the trap and its management can currently be hired for R1,000 a month.

5. Towards collective management

Poison-free IPM will only work if there is institutional will to implement it. In the case of UCT, the heart of the problem is ensuring that there is no food waste available for rodents. At the most fundamental level, this means clear management rules, clear job descriptions, and supervisory and monitoring systems to ensure that waste areas are kept clean. Ensuring that staff and students do not litter is a further issue.

The management of cleaning staff at UCT has been a challenge both during times when cleaning was 'outsourced' to contract cleaning companies, and after workers were once again 'in-sourced' following student protests in 2015/16 (le Cordier et al., 2022). Assisted by UCT's Khusela Ikamva initiative, steps have been taken to strengthen the management of UCT's waste and recycling system, although as of May 2022, this process was in its infancy.

Figure 8: A Waste collection site near a residence kitchen experiencing rodent problems (March 2022)

A key managerial challenge is that waste falls under different line management systems, causing confusion over accountability. For example, in March 2022 one of the university residences called in Mike Schrieff because of rodent problems in and around the kitchen. A site inspection revealed that the adjacent waste refuse

collection site was in a terrible state and was clearly a major source of food for rodents (see Figure 8). The kitchen staff reported that cleaning the outside waste site was not their responsibility and that they did not want to get into an argument with the building cleaners who they believed should be doing the job. The building cleaners regarded the waste management area as outside their area of responsibility. Residence management could not resolve the problem (as neither the internal cleaners nor the kitchen staff fell under the direct control of residence managers). The easiest solution, under the circumstances, was to call in pest control – which is precisely what IPM is supposed to avoid.

This problem was on full display when I, a university professor with no authority regarding waste management, visited the residence on 24 March 2022. My objective was two-fold: to conduct some action research (see what was actually happening on the ground and interview workers and managers); and to start engaging as an active member of the academic community to solve our collective waste management crisis. The experience was eye-opening.

The manager at the residence in charge of operations said that there had been a 'roster' in place in 2021 where cleaning staff and kitchen staff took turns to clean the outside waste area, but it appeared to have broken down – and no one seemed to know whose responsibility it was to fix it. The manager suggested that responsibility lay with additional managerial silos to do with residence-wide management of cleaners and residence-wide management of catering. None of the cleaners in the residence was keen to talk about the problem. When I asked where the cleaning equipment was kept for the outside area, no one knew – and the cleaners inside the building appeared to resent even being asked about this.

A site inspection of the waste collection area conducted together with the residence manager revealed a continued presence of eggshells and other food waste on the floor of the waste area. While we were there, a kitchen staffer came out and threw additional eggshells onto a pile of cardboard that was clearly for recycling. When challenged, he became surly – even after it was pointed out to him that he should be placing the eggshells in a dedicated wet waste bin in the kitchen. His supervisor came over, seemingly annoyed by my intrusion, saying that the problem would be dealt with.

I subsequently took the matter up with the manager of residence-wide catering services who told me that as far as she was concerned, there *was* a cleaning roster for the outside space. She also insisted that the kitchen worker I had confronted should have known better and should have followed the waste protocols. She was unaware that waste management systems were being routinely violated or that the pest control contractor had previously raised the issue. I was reassured by her that the problem would be addressed and the next day the waste area outside the

residence was appreciably cleaner. I checked again on 31 March and the area was clean, but there was a pile of cardboard that had not been picked up (apparently it did not fit into the recycling truck). A large rat scuttled into the pile when I looked into the area. I was unfortunately too startled to take a photograph before the rat disappeared, but it looked like a prime specimen of *Rattus norvegicus*.

5.1 It takes a village

It may well have been inappropriate for me, as a university professor, to be chiding cleaners, confronting kitchen staff and complaining to their managers, but this is what is needed for a large diverse institution like UCT to take genuine collective responsibility for successful IPM. As the saying goes, it takes a village to raise a child: it also takes a village like UCT to implement IPM. Simply escalating issues up complex lines of management – especially where it appears mid-level managers have little power or incentive to confront managers in other silos – can be pointless. It is unsurprising that the history of waste management and recycling has been such a sorry tale of failed attempts at environmental sustainability (le Cordier et al., 2022).

Not only is it unclear who, precisely, is responsible for supervising cleaners, there is no transparency about what cleaners are responsible for. This creates a situation where cleaners and their supervisors can, *de facto*, adjust (and perhaps even invent) what is and is not part of their job description. Workers inside buildings tell me that external waste collection sites are not their responsibility – and workers in the grounds and gardens also deny it has anything to do with them.

The university is in the process of improving job descriptions and hopefully also improving line management of waste. A new senior operations manager in charge of waste was appointed in April 2022 in the Estates and Custodial Services division of Properties and Services. The new manager has been engaging with the various managerial silos and with people involved in the Khusela Ikamva initiative. Hopefully this appointment will help improve and finalise the job descriptions of cleaning staff and create a line manager to which complaints about poor IPM and waste management can be reported.

But we need to go beyond this. More effort must be made to involve the entire institution in holding those responsible for waste management to account. For example, information posters should be available in all buildings – and especially at waste collection sites – as to who is responsible for supervising cleaners. The posters should contain email addresses and phone numbers and encourage anyone to send a message if the area is in a mess. The entire university community needs to know that hygiene and rodent control is a collective responsibility and that it is everyone’s duty to call a supervisor or manager when a problem is detected.

Posters can and should also contain information about IPM and the adaptive management processes involved. These should include information about different types of rodents, notably the difference between field mice (four-striped mice) which are to be tolerated, and the more invasive house mice and rats.

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