

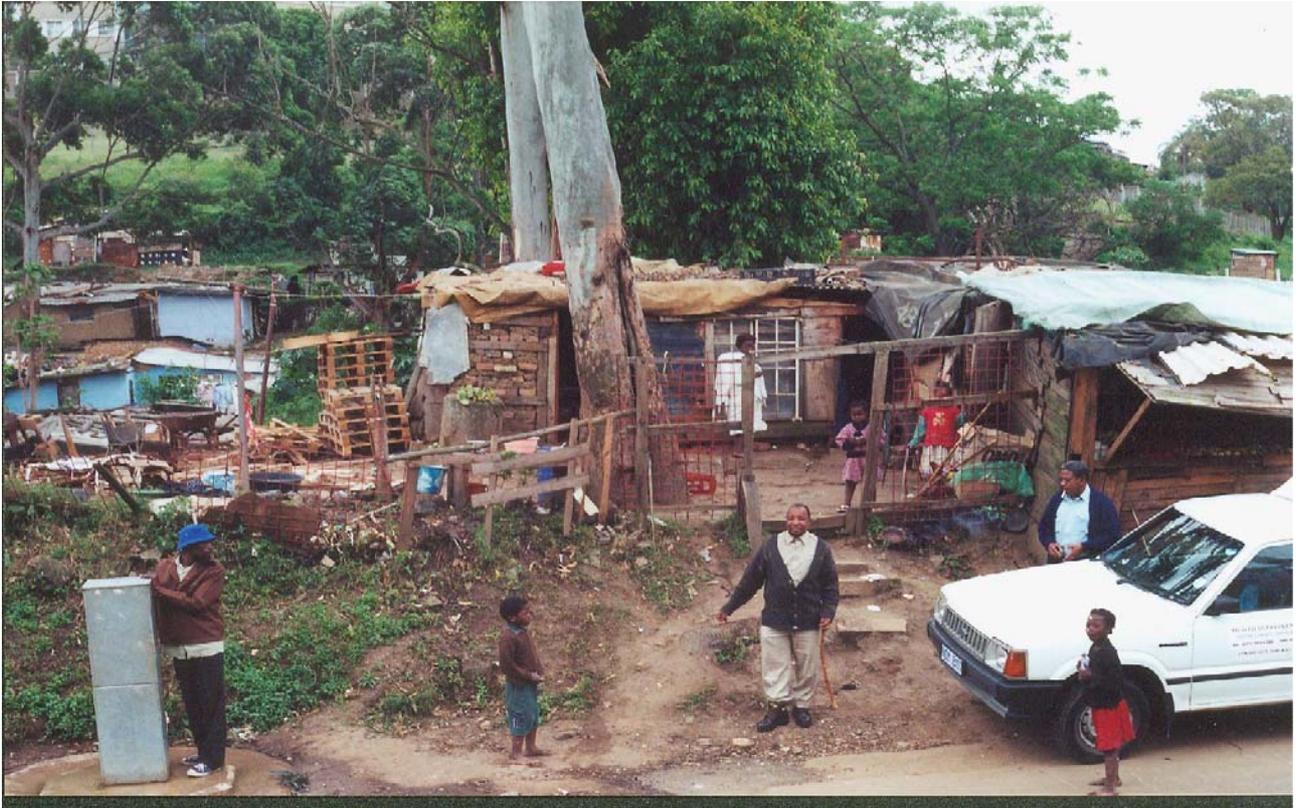
Recommendations for rodent management interventions in the Republic of South Africa

By

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Two study sites were chosen in South Africa; Cato Crest an urban settlement in the Durban area in the KwaZulu Natal Province and Mapate, a rural settlement in the Limpopo Province. Investigation on socio-economic aspects (Malcolm Iles NRI Report: 2782, 2006) was carried out in the two areas where 120 and 90 households were interviewed in Mapate and Cato Crest, respectively. The socio-economic reports were followed by anthropological studies describing the habits and doing in the two settlements (Leclerc-Madlala & Janowski NRI Report: 2781, 2004; Janowski & Matshidze NRI Report 2780, 2004). Surveys of prevalence of the diseases; plague, toxoplasmosis and leptospirosis in rodents and humans was carried out.

Cato Crest, South Africa



The area known as Cato Crest is one of six ‘informal’ urban settlements that comprise the community of Cato Manor. Cato Crest is located along the ridge of Cato Manor, approximately seven kilometres to the west of the Durban central business district. The area is densely populated and characterized by poverty and high unemployment rate (Malcolm Iles, NRI Report: 2782, 2006).

The area is populated with mostly African people of Zulu, Xhosa and Sotho origin, but the settlement also serve as a temporary place for immigrants and refugees. This makes this community different from the other study areas, as the individual inhabitants do not necessarily consider the other inhabitants as fellow citizens, but as strangers.

Most dwellings in Cato Crest are built with recycled materials, but bricks and concrete are used in some areas (Figure 1). Recycled materials are mainly wattle, daub, wood and plastic.

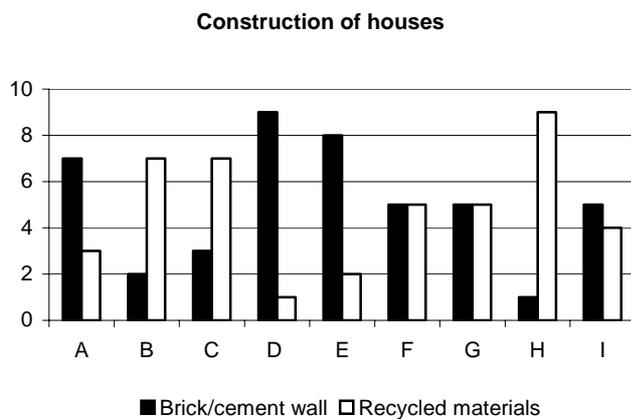


Figure 1. Construction of houses in the different study areas of Cato Crest.

There is a newly developed area, known as the ‘Smartie Houses’, which consists of solid concrete/brick 3-room houses (Transect D and E). Otherwise most of the houses in Cato Crest can be characterized as small ‘informal’ dwellings, with few (one or two) rooms serving a multipurpose function. In a 2-room dwelling the room used for food preparation is normally separated from the one used for sitting/entertaining visitors/sleeping. In most houses ‘windows’ and door-ways are in such bad shape that they offer little or no protection against intruding rats.

Food and Storing

Crops are not grown in the area, but food items like maize may in most houses be stored for later use. The majority store maize or the like in open containers (drums). Meat is expensive and prestigious food and is seldom eaten. When eaten the most common is beef followed by chicken. Another source of protein is game meat but is not very common in Cato Crest.

Electricity has become available in recent years, but only few residents of Cato Crest have refrigerators. Thus the general custom of keeping and storing food, leftovers and water for drinking is in sealed containers.

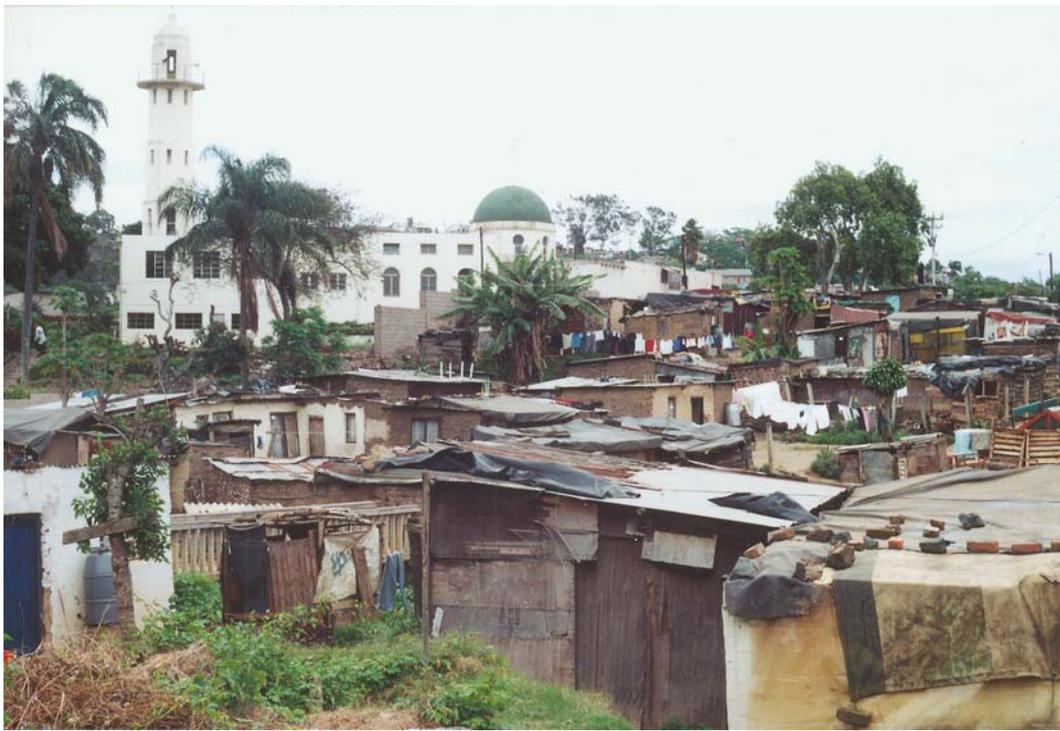
Water

In all Cato Crest water is available and free from piped stands located around the area, with only a few households having water within the houses. As clean water is offered for free, river water is not used for household purpose in general. But the river and pools/streams of water is used by children for playing.

With the exception of dwellings in the newly developed ‘Smartie’ area, piped drainage/sewerage does not exist. Drainage around piped tap-water is also lacking which leaves the area with pools and steams of water or damp soil. This leaves pools of stagnated water around the stands and between houses as waste water from the households is thrown outside the houses. As the women are collecting water and children playing barefooted in the pools of water this makes them especially exposed to leptospira infections.

Storing

Water is stored in the 58 % of the households. Of those storing water most of the households are aware of keeping the drinking water covered (87 %) and keep the cover on except when being used (88 %). There are generally few (9 %) that cover water meant for washing purpose.



Dwellings in Cato Crest. Showing the proximity of the buildings (shacks) to each other (about one to two meters apart). In the background the ' Ahmedia Mosque '.

Sanitation

Toilets

Most households have their own toilets in close proximity to the house. The toilets are in the form of pit-latrines that are encased by large pieces of wood and corrugated iron. The latrines themselves may serve as an ideal site for rats to find “food”. The latrines often leave the ground moist. Latrines may be attractive to rodents as rodents may use human faeces as a source of food. Indeed rats are seen coming from the latrines. When people are infected with parasites, which are excreted with faeces, further transmission of parasites back to humans most likely will go via rodents, as they become infected by eating and being in contact with the infected faeces.

Waste

Collection of refuse is carried out by the municipality one to twice a week. It is however noticed that this is more carefully done in the ‘Smartie’ house area than in the informal area leading to numerous unsightly and unhealthy garbage heaps remaining. Furthermore piles of household refuse, broken cars, beds, buckets, pots, furniture, pieces of wood, iron, plastic etc, can be found in the surrounding areas. Refuse sites are an ideal place for rodents to hide, breed and building nests.



Private pit-latrine in Cato Crest. Notice the piles of garbage

Personal hygiene

Inhabitants in Cato Crest are generally very aware of personal hygiene. There is generally awareness of the importance to wash hands before preparing, cooking and eating the food, but otherwise hand washing is seldom done. This may be a source for infectious diseases, as *e.g.* petting animals (cats) may increase transmission of toxoplasma.

Animal keeping

Cato Crest is an urban settlement with no farming and cattle. Cats are however numerous in Cato Crest and some of them are claimed as pets, but most roam freely, coming and going between households, looking for food. The attitude of cats being present is mixed as a persistent association between cats and witchcraft exists among inhabitants in Cato Crest. The general attitude is that cats may serve as means of rat control, though not believed to be effective. Physical contact with cats is mainly seen with children as they typically are the ones that will cuddle and play with cats, and thus especially children are exposed to a possible toxoplasma infection. But as cat faeces can contain infectious toxoplasma other household members are also exposed as cats roaming around households leave faeces behind. Generally cat faeces are swept away when seen in and around houses, but may still be considered a potential source for toxoplasma transmission to humans.

Rodent species in Cato Crest

The commensal species like brown rat (*Rattus norvegicus*) and house mouse (*Mus musculus*) are the main rodent species observed in the area of Cato Crest. *Rattus rattus* (the black rat) are presumed also to be present but are believed in most places to be out-competed by the larger brown rat. *Mastomys sp.* is more prevalent in field-areas outside Cato Crest and seldom encountered in the houses (*pers com.* Peter Taylor).

Trapping success varied depending on which area rats were tried to be trapped, suggesting that rats may be more numerous in certain areas than in others. Generally fewer rats were trapped in the Smartie-house area and those areas with generally higher building standards. Most rats were trapped in those areas with the shaggiest dwellings in Cato Crest. However from questionnaires daily rodent sightings was common in all areas both inside houses and in the surrounding area (Data provided by Peter Taylor), indicating that rats are present even in those areas where no rats were trapped.

Rats were not considered a serious problem indoor in the 'Smartie'-houses, instead mice were found indoor and could be abundant (Peter Taylor *pers com.*), indicating a greater acceptance of mice. In the 'Smartie'-house area more vegetation surrounded the area. From observations by the researchers, presence of rats was notified as holes in gardens and shrubbery.

Perception of rats as pest

Generally people are not aware of the disease-carrying potential of rats as only 33 % of the interviewed households knew rats to be carriers of diseases. Rats are seen as a problem (76 % of the interviewed households) because they are perceived as competitors as they eat their food, nibble their clothes, and gnaw at their furniture. From the socio-economic study in Cato Crest the major concerns are of material kind, see table 1 (from Malcolm Iles, NRI Report: 2782, 2006).

Table 1

Problem rats cause	In Cato Crest (number of responses)
<i>Eat food</i>	30
<i>Eat clothes</i>	21
<i>Make mess/dirty/holes</i>	6
<i>Destroy furniture/other</i>	6
<i>Destroy everything/ belongings</i>	5
<i>Noise/disturbing</i>	4
<i>Flies/health</i>	2

Prevalence of rodent-born diseases in Cato Crest

Rodents sampled from the Cato Crest and the Durban area was tested for plague, leptospirosis and toxoplasmosis. No rodents were tested positive for plague.

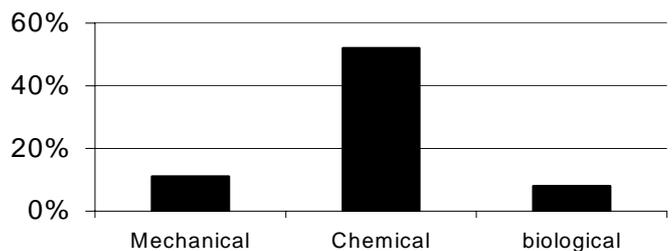
Leptospira was found to be prevalent in the tested rodents, with 10.3 % of the 185 rodents tested being positive. The brown rat (*Rattus norvegicus*) was the only species found to be infected, with varying infection rates in the different areas. Especially transect A and B seemed to be hotspot for leptospira, as 39 % of the tested rodents were infected. Besides having pools of water from the water stands, which may act as a perfect transmission medium there is also a river, where especially children play around.

Infection rate in rodents by toxoplasma was low (2.5 %), as only five brown rats out of 203 tested rodents were infected. As for leptospira the distribution was not random but concentrated at transect A and B where the infection rate was 8 %. Cats are the main host for toxoplasma and shed in the faeces. Rats becoming infected with *toxoplasma gondii* have an altered behaviour as they become less neophobic and more trappable (Webster *et al.* 1994). This might have affected the trapping success in that particular area as toxoplasmosis infection in transect A and B was equally higher (8 %) compared to average infection rate (2.5 %).

Rodent Control

From the socio-economic survey a positive correlation was found in Cato Crest between seeing rats and undertaking rodent control. Twenty-one percent of the households in Cato Crest undertook rat control. However there seemed to be a tendency that the level of rat control was high in those areas where many rats were seen more (figure 3). The means of control are primarily chemical (52 %).

Figure 3 Rat control undertaken in Cato Crest



Chemical control is the primary way of dealing with rat control (52 %). Rat control is mainly undertaken by women in Cato Crest, as this is considered as part of the tasks in housekeeping. Women preferred poison (Rattex) to traps as they do not have to face and kill the rats. However, use of Rattex poison is often found ineffective and unable to kill the rats. The ineffective rat control using poison may well be due to the fact that Rattex is 'expensive' and thus women tend not to use enough poison to be able to control a rat population at an acceptable level. Also the fact that poison by inexperienced people often place the poison non-strategically. A professional rat control program was undertaken in transect A and B during this period rat infestation was reduced (Peter Taylor *pers com*). Stressing the need for educated rat controllers to deal with rat control.

Although cats are seen as a potential means of controlling rats (biological), many people commented that cats are quite unable to catch and kill the big rats. In general, cats and/or dogs are perhaps most effective at preventing an infestation than eliminating a current population. Cats may be seen as effective predators of mice, but usually will not attack an adult rat mainly due to the size.

Recommendations for future rodent control and avoidance of disease transmission from rodents

Individual level	Community level	Governmental level
<i>Preventative measures in rodent control</i>		
Improve housing quality and limit rodent access. Better fitting doors, avoid smaller openings at the ground, roof and windows	Education/information on the importance of good renovation and daily waste handling	Education of good waste handling. Why it is important
Better garbage and waste handling; garbage around houses should be removed and deposit at central garbage stations.	Establishment of an official place/station for collection of garbage like wood, plastic, furniture etc. Separation of garbage into burning and non-burning garbage.	Establishment of an official place for garbage.
Keep area around houses and toilets clean; free of garbage and vegetation	Centre for disposal of waste in those areas where it is difficult to reach the individual households for collection of waste. Using chemicals for rodent control should only be carried out by authorized persons. In 'hot spot' areas of toxoplasma and leptospira infected rodents. Control should be especially intensified.	Collection of garbage (wood, furniture etc.) like once a month. Collection of waste Using chemicals for rodent control should only be carried out by authorized persons.
<i>Measures to avoid rodent-born disease transmission to man</i>		
Food always be well-cooked	Education on aspects of rodents and diseases.	
Wash all fruit and vegetables before consumption	Drainage around areas with water stands	Drainage around areas with water stands
Better personal hygiene as washing hands before and after eating, handling animals (petting cats), visit to toilets.	Establishment of proper condition for laundry-doing. Concrete 'floor' (avoid moist soil) with proper drainage for waste water	Establishment of proper condition for laundry-doing. Concrete 'floor' (avoid moist soil) with proper drainage for waste water.
Bring awareness of where to throw the waste water (preferably one place) to keep it away from where the people usually go/walk about.	Establishment of drainage around the individual households	
Establishment of drainage around the individual households	Information on water as a transmission source. Bathing in rivers (especially children) can be connected to <i>e.g.</i> leptospira infection. <i>E.g.</i> monitoring level of leptospira infected rodents in the river area.	Establishment of drainage around the individual households

Education

Organized information meetings that may help to increase the understanding of rodent and rodent born diseases. In a community like Cato Crest with high degree of poverty, unemployment and other serious illness like HIV/AIDS, tuberculosis, diarrhoea and malnutrition rodents are considered less of a problem and that rats are a nuisance you have to live with. But as especially HIV/AIDS are prevalent but also the high degree of malnutrition among especially children may weaken their immune response to these diseases. Therefore it is important to stress that what might seem unimportant may improve generally living.

Professional rodent control

Use of Rattex is common in Cato Crest. However used by the individual households proven not to be effective enough. It is recommended that control is carried out by trained persons. Control of rodent should be carried out as follows: the area is investigated thoroughly to delimit the infestation. Poison is put at strategically places and amount of poison measured after the estimated size of infestation and ensure enough poison especially in those places where poison intakes are high. This mean that control is continued until population density declines to an acceptable level. It is important to stress in a community like Cato Crest (inhabitants with different backgrounds, inhabitants only being there for limited time) that rodent control is done on joint basis.

However, essential for all rodent control is proper renovation. Refuse and food leftovers can be regarded as competitive to poison, and may limit intake of poisonous bait and thus insufficient to kill the rat.

Mapate, South Africa



Mapate is a peri-urban area of the town of Thohoyandou in the Limpopo province. Mapate is a rural settlement with farming activities. The housing density is low and with most houses located on the hill site (67 %) and the remaining 33 % in the valley of Mapate. Bricks and concrete are commonly used as building materials (44 % of the housing) of the traditional housing (55 %) only few (13 %) did not have any kind of improvement. As Mapate is a rural settlement large parts of the surroundings are either cultivated or bush-land. Farming is considered as women task and do in most cases not involve the men of Mapate is high and unemployment rate amongst “heads of households” (mostly men) high as well with only a few employed (25 %).

Traditional (improved)

Staples and storing

Maize is the most important crop and grown by most households. The average distances to maize and uncultivated fields are 75 and 114 metres, respectively. Vegetables and fruit are also grown but are in close proximity (an average distance of 9 metres) to the houses.

Staples are stored in 86 % of the interviewed households, with the typically storing being sacks (62 %). Sleeping in the same room as where staples are stored is common (42 %).



Modern housing

Water source and storage

Piped water exists and is available from stand pipes situated several places in Mapate. Other water source is stream or river water. The stand pipes were told occasionally to dry out and thus all inhabitants in Mapate use stream or river water. Water for drinking is seldom treated, as many can not afford to buy bleach, which is the typically way of treating water in Mapate. The socio-economic report lists, that only 38 % use piped water as drinking source and 7 % for other purposes (washing), leaving the open water sources as river water the most commonly used source for both drinking and washing.



There is awareness of the importance of protecting the stored water, thus when asked 78 % of the interviewed households had some kind of protected storage for drinking water, but only 23 % protected the water mend for dish washing and personal hygiene. Though 78 % covered their drinking water only 17 % kept it covered at all times (when not in use).

Sanitation

Toilets

Most households (83 %) have their own toilet. Toilets are placed away from the general housing (on average 17 metres). Half of the toilets are improved traditional toilets (49 %) and 34 % of the toilets are located in separate ‘houses’ made from bricks. However the surrounding bush-land is presumably also frequently used (NRI report: 2780, Janowski & Matshidze 2004).

Waste

There is no coordinated collection of waste etc. Each household has responsibility to get rid of their own wastes. There are two ways practised in Mapate; burning (48 %) and collection of waste in pits (29 %). The waste typically thrown into pits, which occasionally are uncovered (half of the pit are not covered), are mainly food waste, as much of it can not burn.

Personal hygiene

Washing hands are known by some of the interviewed to be important for limiting disease transmission, but is not commonly practised.

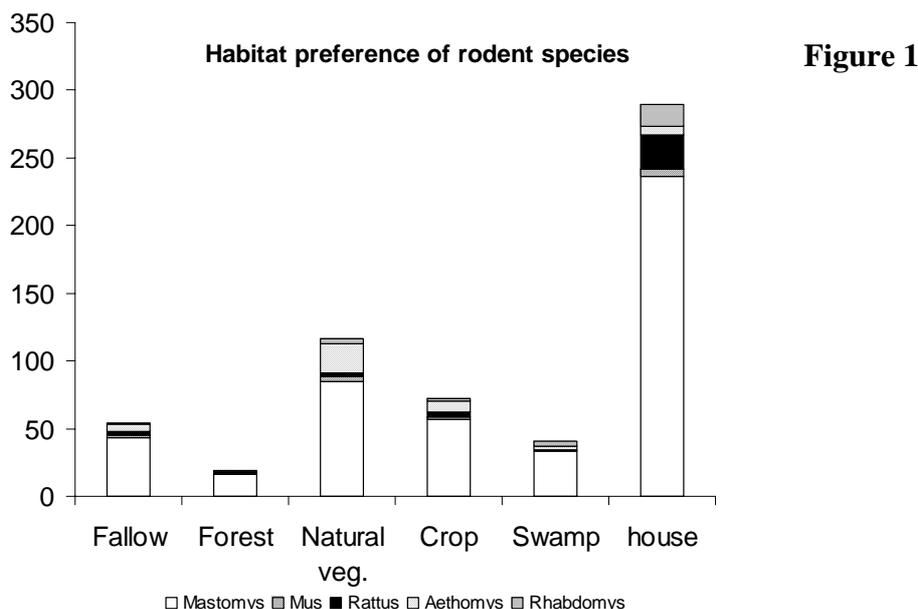
Animal keeping and domestic animals

Only few households had either/and cattle, goats and pigs. No household members did sleep in the same room with the animals.

Dogs seem to be numerous in Mapate with 33 % of the interviewed households having dogs with an average of 2.8 dogs per household. From the socio-economic questionnaire only two households had cats (2.5 per household), but from the anthropologically report (NRI report: 2780, Janowski & Matshidze 2004) cats seems to be common in Mapate, but presumably they are “stray” cats. Generally cats and dogs are not allowed sleeping in the houses.

Rodent species in Mapate

Rodents were sampled within Mapate during trapping sessions carried out from September 2003 until September 2005. each trapping session was carried out every three months for four consecutive trapping nights. *Mastomys natalensis* were the most prevalent species found in all trapping sessions. The commensally species like *Rattus rattus* and *Mus musculus* also occurred, but not as numerous as *M. natalensis*. Population density of *M. natalensis* peaks June-August in the dry period. Population of *M. natalensis* was seen to increase at the end of the rainy season. But already in January, before the population increase, high proportions of reproductive active females occurred in the samples. Rodents were sampled in different type of habitat and in all samples *Mastomys* prevailed (Figure 1).



Perception of rats as pest

There is a general perception of rats as a problem (84 %). But only less than half (43 %) are aware of rodent as potential carrier of diseases. When asked how often rats are seen in the housing area, crops or bush, many of the interviewed does not have this as a daily experience, but a common sighting though.

Rodent control

74 % of the interviewed households undertook rodent control. The preferred method is chemicals (34 %) followed by mechanic controlling methods (13 %). There was considerably less rodents (N=94) caught in those households where rodent control had been carried out than in households with no rodent control (N=204).

Prevalence of rodent-born diseases in Mapate

Rodent sera samples were tested for plague, *Leptospira* and *Toxoplasma*. None of the samples were positive for plague (178 samples tested) but *Toxoplasma* infection was high (18.4 %) in the examined samples (201 samples examined). *Leptospira* was found in 6.7 % of the samples (193 samples tested).

Infections were mainly found in *Mastomys*, but a few infected *Rattus* and *Rhabdomys* was also found (Figure 2 and 3). Approximately 20 % of the *Mastomys* caught in and around houses was found to be infected with *Leptospira* and *Toxoplasma* (Figure 4 and 5).

Figure 2.a

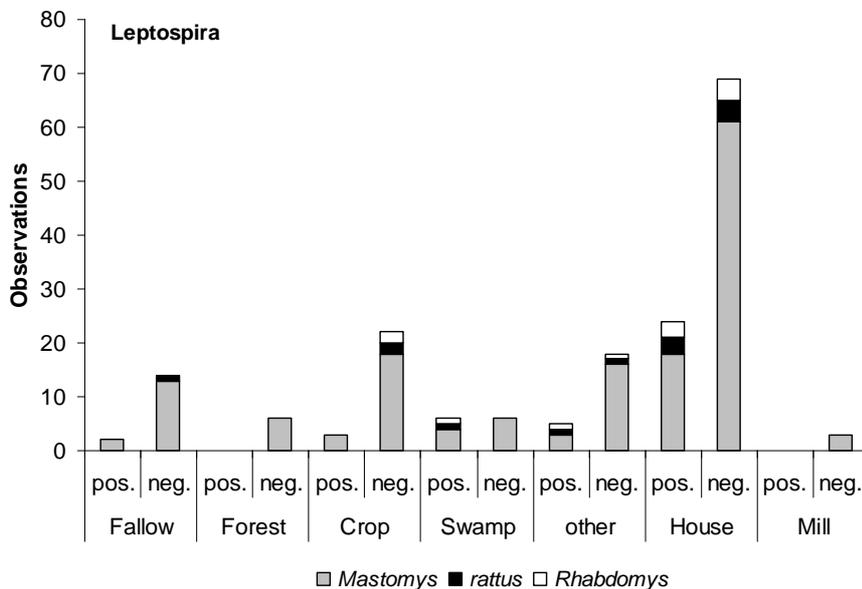


Figure 2.b

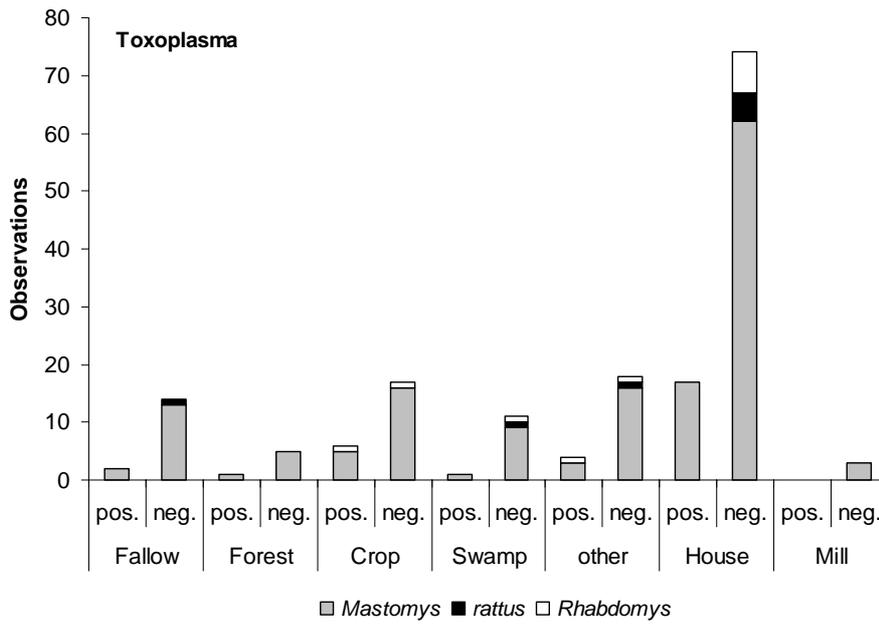


Figure 3.a

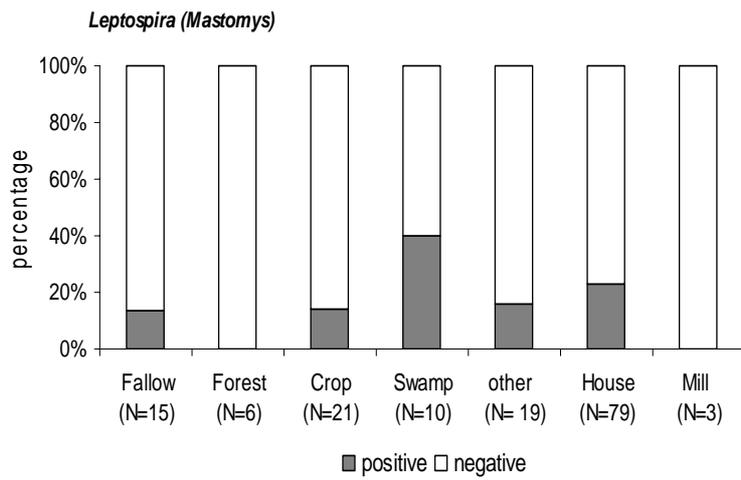
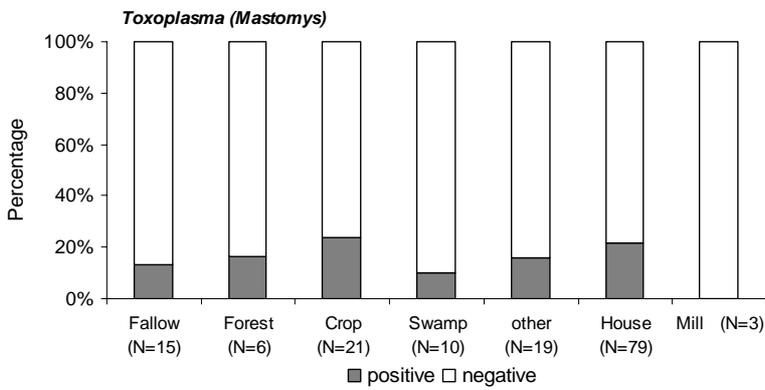


Figure 3.b



Recommendations for future rodent control and avoidance of disease transmission from rodents

Individual level	Community level	Governmental level
<u>Preventative measures in rodent control</u>		
Increase rodent proofing to minimum category 3	Education/information on how to improve housing quality/rodent proofing	
Clean up inside and outside to minimum cat. 3	Education/information on the importance of waste handling	
Separate storing houses for staples		
Avoid sleeping in the same room as where staples are stored.		
Storing of staples in closed containers made of e.g. hard plastic – avoid sacks.		
Avoid spillage of staples around the storing area		
Keep area around house and toilets free from garbage and vegetation		
Proper storing of food and left-over in sealed containers	Rodent control by traps or chemicals.	Rodent control by traps or chemicals.
Good waste handling, burning and covered pits	Rodent control intensified from January until April/May. Should be preferred though rodents may not appear as a problem in that period. Rodent control in the dry season will only serve as an instant population reduction, with little effect, due to the population increase finding place in dry season and thus not recommend.	
<u>Measures to avoid rodent-born disease transmission to man</u>		
When using open water source boil or treat (filter or bleach)	increase safe piped water supply	
Wash hands before and after preparing, eating food	Good drainage around water stands	
Wash hands after petting animals, especially cats	Education/information on transmission of diseases from rodents	Education/information on transmission of diseases from rodents
Covering of stored water both drinking and washing water	Education/information in basic hygiene, personal and food preparation	Education/information in basic hygiene, personal and food preparation