

Technical Annex for ICART CRARF project:- Development of Ecologically-Based Rodent Management for the SADC Region

Objectives

Overall objectives

- i) To reduce the high level of rural poverty in southern African countries by making agriculture more competitive and to raise poor farmers' incomes by cost beneficially increasing crop yields, reducing storage loss and preventing the transmission of diseases to people and livestock caused by rodent pests.
- ii) To offset the high rate of natural resource degradation particularly small mammal biodiversity through improving the management and invasion of commensal rodents and increasing knowledge about rodent-human interactions and agricultural expansion.
- iii) To develop effective rural policy options with institutions and farmer groups to support rodent pest management actions. Policies will be developed and introduced to ensure the right tools and knowledge are made available to rural farming communities and to inform national regulations regarding rodenticides, research provision and extension staff training.

Specific objective

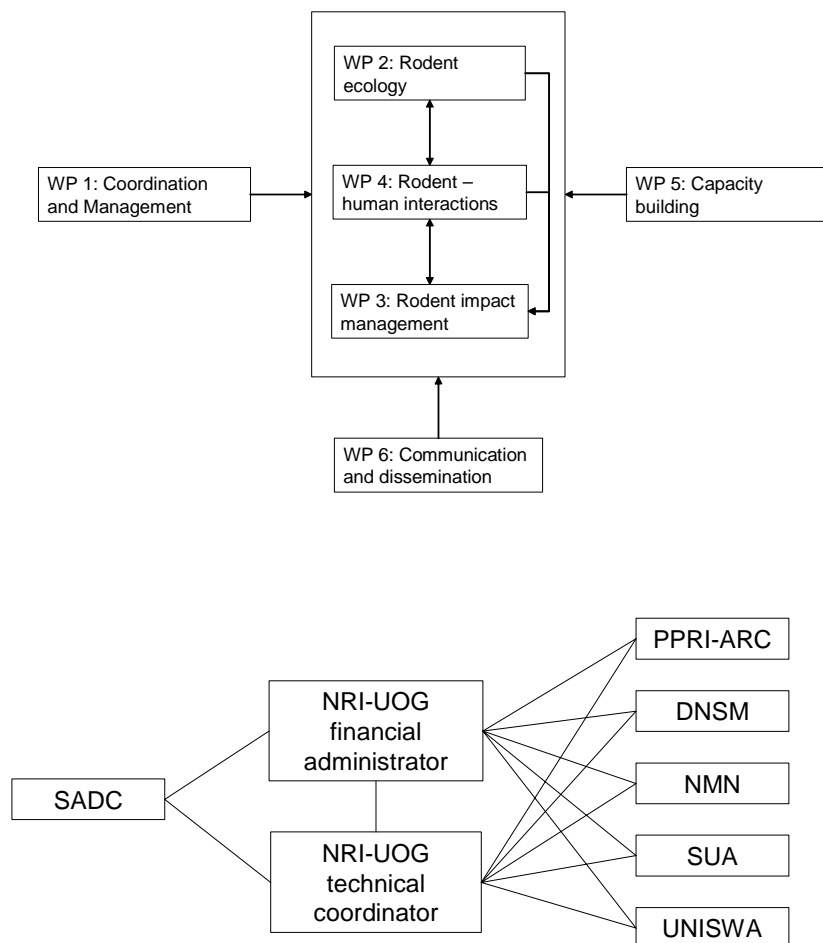
The specific objective of this proposed action is to strengthen the generation of appropriate, cost-effective and sustainable technologies for rodent pest management in small-scale farming for the SADC region. To do this, we will carry out essential ecological research that is required to develop sustainable community-managed rodent pest control strategies. Many farmers will understand that rodents are a problem and damage their crops, stored food and personal possessions. However, awareness among farmers about the level and scope of damage is often underestimated. For example, rodents can transmit more than 60 different diseases, the symptoms of many may be confused with other diseases (e.g. malaria) where awareness is higher. It is, therefore, important to raise awareness and generate accurate information about the multiple damages caused by rodents, producing data that show true levels of loss and contamination, and disease risks. Providing people with the true cost of rodents on their livelihoods allows them to consider how much they can invest (traps, poisons, labour) in controlling rodents. The measurement of success also needs to be reflected through the same rodent damages to livelihoods (as opposed to simply counting the number of dead rodents). The way people interact with rodents can be complex (seeing them as food, pests, or even involved in witchcraft) so capturing people's knowledge, attitudes and practices with regards to rodents will also be essential to improving the way in which rodent pests are managed. The specific objective of this project will be met through:

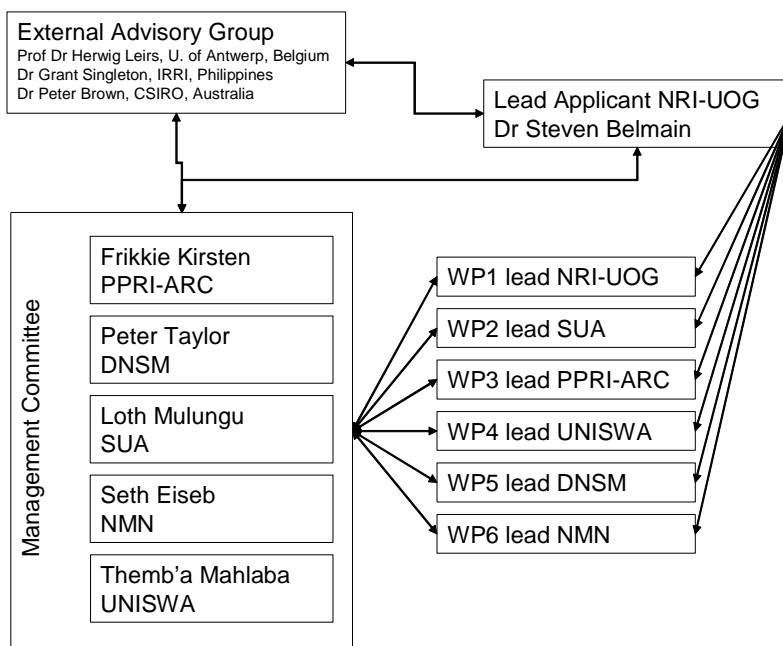
- Carrying out research to identify the rodent species affecting small-scale agricultural communities in Namibia, Swaziland and Tanzania.
- Understanding the population dynamics of the main rodent pest species in targeted regions, including breeding potential, migration patterns, habitat utilisation and behaviour.
- Carrying out research to quantify different rodent damages identified through discussion with small-scale farmers. This is likely to involve developing new methodologies for assessing crop damage, measuring loss, contamination and damage to stored grain within traditional farm granaries, assessing rodent disease risks by determining which diseases and/or parasites are carried by them, and measuring other financial losses incurred by rodents and/or their ineffective control.
- Evaluating the knowledge, attitudes and practice of small-scale farming communities with regards to their current rodent management practice, their understanding of rodent species and behaviours, the problems they face with rodents, and the perceived success of their actions against rodents.
- Comparing available rodent management tools with new technology for controlling rats that is not widely available in Africa. This will involve assessment of efficacy and cost-benefits.
- Carrying out research in collaboration with farmers on trapping and environmental management as sustainable methods of rodent control within small-scale agricultural communities.
- Researching the impact of agricultural expansion on small mammal biodiversity and the risks posed to increased incidence, prevalence and endemicity of zoonosis (such as plague) among human settlements.
- Researching the interactions between rodents and humans and between sylvatic and commensal rodents over resource utilisation and particularly during episodes of land use change (deforestation, bush burning, agricultural expansion).
- Producing policy recommendations regarding the adoption of ecologically-based rodent management strategies for the SADC region adapted for small-scale agricultural communities.
- Ensuring that SADC scientists are capable of generating appropriate research knowledge required to increase the uptake of improved rodent management options.
- Strengthening SADC research institutions to carry on rodent ecology research within an internationally integrated web of expertise.

- Raising public and institutional awareness on the severity and range of rodent damage to people's livelihoods, while showing that rodent pests can be sustainably and cost-beneficially managed.

Detailed description of activities

Activities have been divided into six separate work packages. Each of these work packages will be technically coordinated by one of the project partners, acting as a lead partner who will oversee and manage activities that may involve several of the project partners. Work package leaders will be responsible for summarising and reporting back technical progress to the lead applicant. The management structure for carrying out activities for this project is simple and highlighted in the graphs below. All partners will be in direct contact with the coordinator and the project administrator at NRI-UOG. To optimise concerted actions between the work packages, the project will have a Management Committee consisting of selected representatives from each partner. The role of the Management Committee is to facilitate communication between disciplines (ecology, economics, taxonomy, indigenous knowledge, agronomy, rodent management) and make sure that the different work packages remain complimentary, that communication between work packages is maintained, that compatibility is ensured between work in different WPs, and that activities can be adjusted depending on results of or problems with other work packages. They will also prepare the agenda of the project coordination meetings. The project will also have an External Advisory Group consisting of independent, internationally respected experts who have acquired wide experience in developing ecologically-based rodent management. The main task of the members of the advisory group will be to provide independent evaluation of project progress. They will also be consulted for advice on project questions, invited to share their views on the project progress and generally participate in discussions about project strategies and externalities that affect project priorities. The advisory group will have no formal responsibilities in the project and receive no project budgets but are invited (on the coordination budget) to attend meetings where they participate in an advisory role. The composition of this group may change during the course of the project.





Workpackage	WP 1: Coordination and management
Lead partner	NRI-UOG
Involved partners	UNISWA, NMN, PPRI-ARC, DNSM, SUA
Objectives	<ul style="list-style-type: none"> • Coordinate activities among all partners • Ensure timely reporting to the SADC • Promote synergy among project activities
Justification	Project size, complexity and level of integration/interdependency among different project actions require strict delivery and adherence to project timelines as essential. Partners must often work together achieve specific project outputs.
Description of work	<p>Project inception workshop. A one-week project inception workshop will be held at the beginning of the project to enable all project partners to define the procedures for working together to achieve the project outputs. We will review the contractual arrangements for the financial control of the project and for the assessment of the agreed tasks and deliverables. Work package managers will present strategies and protocols to be accepted after discussion by all partners. The workshop will also include hands-on training where needed, especially for standardised procedures that need to be followed by different partners.</p> <p>Follow-up coordination meetings. Formal meetings will be organised each year with representation from each partner. In order to provide the project with independent evaluation and ensure key stakeholders are informed of progress, experts and end users will be invited to participate. Presentations from each work package leader will summarise achievements. Discussions about progress, potential deviations from the work plan and forward planning will be standing items at each meeting.</p> <p>Activity reporting. Partners will prepare a two-page activity report every six months. The lead applicant and work package managers will use these to assess whether work progresses to plan and take action to minimise the effects of delays on other project activities.</p> <p>Annual progress reports. Annual reports will be made following SADC instructions. Work package managers will be responsible for collating information and making a single WP-report. The lead applicant will be responsible for integrating these into a single full report. A similar approach will be used to prepare the final project report covering information from all project years.</p>
Deliverables	<ul style="list-style-type: none"> • Project reporting delivered on time
Risks	None anticipated

Workpackage	WP 2: Rodent ecology
Lead partner	SUA
Involved partners	UNISWA, NMN, PPRI-ARC, DNSM, NRI-UOG
Objectives	<ul style="list-style-type: none"> Develop ecological knowledge about the main rodent species found in each country (Tanzania, Swaziland, Namibia) with relevance to their pest status and control in small-scale agriculture.
Justification	<p>The international scientific community and rodent pest control industry increasingly recognise that rodenticide use, alone, is not an appropriate solution for rodent pest problems found in small-scale agricultural communities throughout Africa and Asia. As has occurred with insect management, an integrated approach for rodent pest management is increasingly viewed as more sustainable and cost-beneficial. However, such an approach to rodent management requires a good understanding about the rodent species, their behaviours, breeding potential and habitat use in a given area. Unfortunately, these factors are poorly understood for indigenous African rodent species and habitats throughout Africa. Ecologically-based rodent management can only be developed and applied through the generation of rodent ecology research within relevant contexts.</p>
Description of work	<p>Habitat utilisation and inter-specific interactions. Live and kill trapping of rodents will be carried out in various habitats ranging from bush, fallow, forest, staple crops, vegetable crops, inside houses, outside houses, and around key sites in rural communities (e.g. schools, markets, transport hubs). These trials will use standard methodologies for trapping using lines of traps placed set distances apart with a minimum of 20 traps per transect. Habitats will be replicated a minimum of three times using a mixture of traps designed to capture rodent species with varying levels of neophobia. Replication will involve using different communities in each country with the same habitat types (Namibia, Tanzania, Swaziland) ensuring that data can be assessed for each region as well as across the countries. These habitat trials will be carried out over a minimum of 12 months, trapping in the same places each month for a minimum of 5 consecutive trap nights. Captured rodents will be sacrificed for taxonomic and breeding data, and samples will be identified through morphometrics and molecular typing in the laboratory where necessary. These data will be analysed for temporal and spatial changes, giving an assessment of habitat utilisation over an annual cycle as well as the relative degree of inter-specific competition among the rodent species captured. The methodology may need to be modified based on the trap success rate to ensure that data are representative.</p> <p>Population dynamics. Standard methodologies will be followed to implement studies that will assess population density, seasonality and migration potential for the most abundant rodent species found in a given area. Capture mark release grids of 100 live capture traps will be laid out in a 10 X 10 grid with 10 metres between each trap. Trapping in each grid will be carried out each month over a 12 month period for three consecutive trap nights. Captured animals will be weighed, measured for standard taxonomic indices, externally assessed for breeding, marked through toe clipping and released in the same place of capture. A minimum of two grids will be set up in each target country (Namibia, Swaziland and Tanzania) assessing rodent populations in agricultural field cropping areas. These data will be analysed showing the population dynamics for the major rodent species captured in relation to cropping and climatic factors (e.g. rainfall, temperature).</p> <p>Disease potential. Parasite load can be used as an indicator of rodent biodiversity, ecological health, species interactions as well as potential dangers for the health of humans and livestock that come into contact with rodents. Therefore, rodents captured in the above trials will be assessed for internal and external parasites, collecting parasite samples and rodent tissue samples for laboratory analysis and taxonomic studies.</p> <p>Data from these activities will inform actions described in WPs 3 and 4. The lead partner of this WP, SUA, will provide capacity training to other involved partners, to ensure that all staff are competent in the techniques applied and that comparable methodologies are used in all target countries. This training will involve staff exchange, whereby staff from NMN, UNISWA, PPRI-ARC and DNSM travel to</p>

	Tanzania for practical field training. Taxonomic studies will involve DNSM providing capacity training and technical backstopping to other involved partners.
Deliverables	<ul style="list-style-type: none"> • At least three peer-reviewed scientific publications on rodent population dynamics, habitat utilisation, biodiversity and parasitology. • Ecological data that can be used to develop appropriate rodent management strategies for the pest problems experienced by small-scale agricultural communities in the SADC region following the principles of ecologically-based rodent management.
Risks	<p>If experienced, adverse ecological conditions (drought, floods) may influence data collected.</p> <p>Capture-mark-release studies require the release of animals, so it will be necessary to ensure communities are aware and understand the purpose of these trials</p>

Workpackage	WP 3: Rodent impact management
Lead partner	PPRI-ARC
Involved partners	SUA, UNISWA, NMN, NRI-UOG, DNSM
Objectives	<ul style="list-style-type: none"> • Increase knowledge about the multiple impacts of rodents on people's livelihoods. • Involve small-scale farmers in the assessment of rodent damage and rodent management. • Increase awareness about the types of damage caused by rodents among farmers and agricultural research and extension institutions. • Evaluate different rodent management strategies in collaboration with small-scale farming communities for impact on rodent populations and reduced damage levels.
Justification	<p>Although effective rodent control methods exist, their poor application and adaptation to particular situations often results in treatment failures, leading to apathy and widespread acceptance of rodent pests in the environment. Generally, there is a poor perception about the impact of rodents on people's livelihoods which is partly due to their multiple impacts (agriculture and health), the difficulty to assess some of the problems (e.g. crop loss) and low public awareness (e.g. disease transmission) about the damage caused by rodents.</p> <p>Current rodent control practices are often based on the use of rodenticides. Misuse of these poisons is unfortunately common in many SADC countries, which poses a threat to human health and environmental contamination by killing non-target species such as predatory birds and using highly dangerous poisons which are often banned. More importantly, misused rodenticides may not significantly reduce the rodent population, therefore having little impact on reducing the damage caused by rodents. When correctly used, rodenticides can be a highly effective tool, but they are most appropriate in large-scale, intensive, high-value situations where safety and accuracy can be assured. The success of anticoagulant rodenticide baits in controlling rodents in developed countries has inadvertently stifled research on other aspects of rodent behaviour and ecology that could help develop more sustainable methods of control in the small-scale agricultural situations found in Africa. Because rodenticides can be expensive and difficult to use safely, other rodent management methods involving trapping and environmental management are more appropriate for the rural agricultural situations found in Africa. However, there has been insufficient research to develop appropriate tools and strategies for rodent pest management for different agro-ecological conditions, particularly targeting small-scale farming.</p>
Description of work	<p>Pre-harvest damage. Methods for measuring rodent damage often involve straight line transects through crops. These methods are laborious and often not effective in capturing the patchy clumped distribution of rodent damage typically experienced. Rodent damage is not always indicative through damage assessments near the time of crop harvest as damage may occur to seedlings, transplanting, flowering and fruiting stages. It is therefore necessary to carry out research on methods of damage assessment that are relatively easy and representative of rodent damage levels to different crops. Methods such as Adaptive Sampling have not been widely used in</p>

Africa and may prove more effective in measuring rodent damage to a number of different crops. Damage assessment using three statistically accepted methodologies will be trialled and compared for their interpretation of rodent damage. Rodent damage can also be closely linked to key geographic features (e.g. rivers, forests) and these will be assessed in collaboration with small-scale farming communities. Through discussion with farmers, areas which are perceived to be at higher risk of rodent damage will be compared with areas which are perceived to be at lower risk to confirm potential trends and identify sources that can explain the variation. This research will help the development of guidelines which can be used to help target rodent management activities where they are most needed by small-scale agricultural communities.

Post-harvest damage. Until recently, methods for measuring losses to commodity during storage by rodents have been theoretically based on the number of rodents potentially feeding in a grain store and their daily food intake requirements. Although this theoretical model may be partially justified for use in a large grain warehouse with a resident rodent population, it is less appropriate for the on-farm storage situations found in small-scale farming communities. In these situations many different rodent species may be feeding from a grain store as well as other food sources, making it virtually impossible to know how many rodents are feeding from a small grain store and the percentage of their daily intake derived from the food store. Recent trials in South Africa and Bangladesh have proposed a new methodology for measuring the impact of rodents on grain stored on-farm in traditional storage structures. This methodology involves placing known quantities within farmers' own stores, and with the participation of farm households, measuring loss, damage and contamination by rodents to the known quantity of commodity. These replicated measurements can be analysed to calculate total losses experienced to the entire farm store over a given period of time, and it is proposed to assess and adapt this method to different commodity types (maize, sorghum, millet, legumes) and storage structures used by small-scale farmers in the target countries (Namibia, Swaziland, Tanzania). This research will give accurate measurements of post-harvest rodent damage and, for the first time, allow cost-beneficial strategies to be developed that can prevent rodent damage based on real economic costs to farm households.

Knowledge, attitude and practice survey. Sustainable rodent management must be based on what farmers currently try to do to control rodents, their financial and labour expenditure, and their perceptions on the effectiveness of their control, and perceptions about rodents and the management tools they have at their disposal. For example, few small-scale farmers understand the difference between acute and chronic rodent poisons and their differing modes of action. Most farmers will choose acute poisons as they see dead bodies in the morning which they never see when using chronic poisons. Although acute poisons cause significant bait avoidance and do not achieve the high percentage kills seen with chronic poisons, human perceptions can lead to wrong choices. It is, therefore, crucial to understand people's existing knowledge, attitudes and practice before proposing changes to their behaviour and practice as the success of any new rodent management strategy will need a strong educational foundation. The KAP survey will be carried out through a standard questionnaire delivered to a minimum of 50 individual households in two different communities per target country (Tanzania, Swaziland, Namibia), giving a total of 300 questionnaires. Households will be chosen randomly from a community; however, there will be a necessity to ensure certain categories are stratified particularly when there is significant variation within a community (e.g. sex, age, farm size, ethnic group). Collected data will be incorporated into an electronic database and analysed for trends among responses. These individual questionnaires will be supplemented with group meetings to collect similar KAP information.

Damage to personal property. Although economically important, damage to personal belongings (buildings, clothes, wires, fishing nets, utensils) is usually overlooked by rodent management specialists. Damage can be sporadic and varied; however, such damage has clear financial implications for small-scale farming households (e.g. damage to a shirt or book which was recently purchased). Measuring such losses in a meaningful way can only occur through the cooperation of communities. Relevant data can be collected through additional questions added to the KAP survey summarised above. However, discussions with communities will explore other potential methods for collecting such information over a period of time, for example, through standing items at regular community meetings or the keeping of

individual diaries. Information collected over the life of the project will provide quantifiable data.

Public health. Current rodent management strategies used in small-scale agriculture may have serious public health impacts. For example, the nematicide, Aldicarb (carbamoyloxime), is not licensed for use as a rodenticide but is illegally sold throughout the SADC for killing rats, dogs and even people. In addition to their agricultural impact, rodents are also a serious public health issue and are known transmitters of more than 60 different diseases that can affect people and livestock. Socio-economic research will, therefore, be carried out to quantify the existing public health constraints and damage posed by current management strategies and the presence of rodents causing damage to human health (disease transmission, both zoonoses such as bubonic plague and enteric diseases such as salmonella). This socio-economic research will use a variety of quantitative and qualitative assessment methods to capture information from different stakeholders involved (market traders, shops, food vendors, farm households) in rodent management actions or disease transmission pathways. The analysed data will provide a prioritised list of risks and potential risk reduction strategies, highlighting the damage rodents cause to human and environmental health through existing management strategies (or lack thereof).

Trapping. Intensive or sustained trapping has not often been considered as a primary method of rodent control. Commonly cited reasons include 1) a belief that rats will become 'trap-shy' and thus increasingly difficult to catch; and 2) an expectation that the population will compensate for the mortality by various means including earlier onset of breeding, a higher rate of survival of young animals and an increased rate of emigration from 'uncontrolled' habitats. However, these reasons would also apply to the use of rodenticides, and trapping probably has not been seriously researched as an effective tool because it is relatively labour intensive. As rodent management research has been largely driven by developed country constraints (high labour costs relative to rodenticide costs), there is a need to carry out new research within the constraints found in developing countries (low labour costs relative to rodenticide costs). Previous research in South Africa and Bangladesh suggests that trapping can be an effective and sustainable rodent management tool for small-scale agricultural communities, and it is proposed to develop this research through expansion throughout the SADC. The efficacy of different traps commonly available will be compared against new technology designs that are less commonly available through action research trials taking place in a minimum of three agricultural communities in each target country (Tanzania, Swaziland, Namibia). An evaluation of trap efficacy, its effect under different situations, impact on rodent population dynamics and abundance, and rodent damage levels will be analysed over a 12 month period to assess temporal and spatial changes caused through continuous intensive trapping regimes.

Environmental management. The carrying capacity of the environment to sustain large numbers of rodents can be changed through often simple changes to hygiene and reducing rodent access to food, shelter and water. Demonstration trials will be carried out in collaboration with farming communities to show how identified rodent damage can be reduced through permanent changes to the environment. This may involve better waste management, or proofing food stores. The costs of making such changes will be assessed against the multiple damages caused by rodents in order to ensure a favourable cost-benefit ratio. As environmental management requires anthropogenic change, it will be important to base this research on the results of the KAP survey summarised above and raising the awareness of rural communities about rodent damage and management strategies. New technology (traps or proofing) will only be taken up when end users directly observe the costs and benefits which accrue to their family, and these trials will necessarily involve farming communities to assess their overall acceptance and likelihood of being carried out in the future.

Rodenticides. Commercially available rodenticides are usually evaluated against the Norway rat, *Rattus norvegicus*, the main pest species in Europe and North America. Previous research indicates that many other rodent species are less susceptible to anticoagulant poisons, and to date, few African rodent species such as *Mastomys natalensis*, have been assessed for their susceptibility to rodenticides. Poison use in Africa is also confused by the widespread use of acute poisons. These poisons are typified by killing quickly and painfully and, therefore, encourage bait shyness and behavioural resistance. It is therefore necessary to carry out controlled research under African conditions to evaluate the impact of acute and chronic poisons on

African rodent populations. Controlled trials with different poison formulations will be carried out following standard protocols. Estimates of rodent populations before and after treatment will be assessed through trapping transects and activity monitoring (tracking tiles). The data collected will show the comparative effects of different poisons against indigenous species under practical field conditions found in small-scale agricultural villages.

Monitoring and evaluation. The effects of rodent management can only be known through measuring changes to the rodent population and the levels of the different rodent damages experienced by farmers. This is important for assessing efficacy as well as measuring the costs and benefits of the intervention. If input costs exceed the perceived benefits, then farmers will not adopt an intervention. Previous research in Bangladesh has shown that rural farming communities are able to observe real improvements in their livelihoods with minimal individual cost when adopting appropriate and informed rodent management strategies. Changes in rodent populations can be measured through passive monitoring, such as tracking tiles that record rodent footprints. Monitoring with tracking tiles can help prevent the trap-shy dogma from gaining ground within a community as it shows changes in rodent activity over time. Trials using soot-covered tiles will be carried out in the same farming communities participating in the research summarised above. Tiles will be replicated in sets of 30, measuring activity with a grid system over three nights to build up a picture of rodent activity patterns during the period of rodent population reduction interventions.

The lead partner of this workpackage, PPRI-ARC, has acquired significant research knowledge on actions described in the WP and is, therefore, best placed to train other involved partners in Tanzania, Swaziland and Namibia so that all staff are competent in the techniques applied and that comparable methodologies are used in all target countries. This training will involve staff exchange, whereby staff from NMN, UNISWA, and SUA will receive field training visits from staff based at PPRI-ARC and NRI-UOG.

Deliverables	<ul style="list-style-type: none"> Quantitative data on the multiple impacts of rodents experienced by small-scale farming communities New rodent damage assessment methodologies Report on socio-economic and anthropological parameters affecting rodent management strategies in rural SADC farming communities. Quantitative data on impact of ecologically-based rodent management interventions within small-scale farming communities. Policy report on the cost-benefits achieved for small-scale farmers using an ecologically-based rodent management strategy Prioritised list of recommendations for improving rodent management for SADC farmers, researchers and policy makers.
Risks	<p>If experienced, adverse ecological conditions (drought, floods) may influence data collected.</p> <p>Reliability of data collected in farmer participatory trials can make it difficult to publish in peer-reviewed journals.</p>

Workpackage	WP 4: Rodent – human interactions
Lead partner	UNISWA
Involved partners	NMN, SUA, PPRI-ARC, DNSM, NRI-UOG
Objectives	<ul style="list-style-type: none"> Understand the impact of agricultural expansion and intensification on rodent populations Determine the dynamics between sylvatic and commensal rodent species in small-scale agricultural communities Assess habitat utilisation and overlapping resource uses between rodents and humans
Justification	Sylvatic rodents species do not generally come into contact with people and are generally not considered to be pests. Many of these species serve important

ecological purposes (seed dispersal, predation) and may act as reservoirs for various zoonotic diseases. Agricultural expansion often disrupts and fragments wild habitats, causing increased competition over resources and increasing interaction with commensal rodents that migrate with expanding human-influenced habitats. Sylvatic species may, therefore, pass disease to commensal rodent species or come into increasing contact with humans by foraging in and around human settlements. The impact of agricultural expansion can have two major effects: 1) it puts people at greater risk of contracting zoonoses such as bubonic plague 2) it can drive sylvatic species locally extinct, replacing them with invasive commensal rodents such as *Rattus rattus*, thereby reducing biodiversity and ecological health. Evidence suggests endemic diseases such as plague are spreading, and there is global concern about new zoonoses emerging and expanding endemicity. However, little research to understand these processes in Africa has been carried out, particularly with regard to the role of agriculture in facilitating zoonosis.

Description of work **Radio telemetry and spooling.** These are techniques for tracking animal movements. Telemetry involves attaching small radio collars to animals and monitoring their movements with a handheld receiver. Spooling involves attaching a spool of thread to an animal's back, the thread trailing behind as the animal moves about. These methods will be used to monitor the movements of different rodent species captured in different environments. This research will help establish the degree to which different rodent species come into contact with areas of human settlement and the potential interaction between different rodent species utilising the same habitat.

Land use change. Areas which are currently and/or have recently undergone conversion (e.g. deforestation, bush clearing through fire) will be surveyed for rodent species diversity in comparison to undisturbed habitats nearby. These longitudinal habitat surveys will be carried out through using a mixture of live capture traps placed through a demarcated area over 5 trap nights and repeated seasonally over one year. This research will help assess the degree to which biodiversity is compromised by anthropogenic changes to the environment, whether and which rodent species are able to adapt to these changes and how emigration and immigration are affected by land use changes.

The lead partner of this workpackage, UNISWA, has considerable expertise on tracking small mammals and has carried out small mammal biodiversity research which it will share with the other involved partners. Training will be provided on the different techniques and survey methods to other involved partners so that all staff are competent in the techniques applied and that comparable methodologies are used in all target countries.

Deliverables

- At least two peer-reviewed scientific publications on rodent habitat use and biodiversity in SADC countries
- Ecological data that quantifies the potential risk of zoonosis transmission from wild rodents to humans
- Report on the impact of agricultural expansion and intensification on small mammal biodiversity

Risks

If experienced, adverse ecological conditions (drought, floods) may influence data collected.

Rodents may need to be tracked through village environments, including people's houses so it will be necessary to ensure understanding and consent is given prior to trial commencement.

Workpackage **WP 5: Capacity building**

Lead partner DNSM

Involved partners NRI-UOG, PPRI-ARC, NMN, SUA, UNISWA

Objectives

- Ensure that SADC research on rodents is improved and informed by the rodent pest management constraints experienced in small-scale agriculture.
- Integrate rodent researchers and raise the awareness on the importance of rodent

	<p>research among SADC agricultural research institutions.</p> <ul style="list-style-type: none"> • Form effective collaborative alliances among rodent researchers in the SADC.
Justification	<p>Research on rodents remains a marginal concern in most countries. The advent of anticoagulant rodenticides in the 1950's could be argued to have stifled further research in developed countries, and pest management became simply one of applying rodenticides in the correct fashion. Rodent ecology research in the developed world tends to focus on wildlife conservation and non-pest species. Despite this, developed and developing countries continue to face growing rodent pest problems, and there are signs that research institutions are beginning to address growing rodent pest problems.</p>
Description of work	<p>Workpackage leadership. Each involved partner is leading one of the workpackages proposed within this project. Workpackage leaders will be required to organise and monitor activities taking place within their WP. They will also be required to summarise and analyse results generated, making presentations on progress at regular coordination meetings and producing reports for incorporation into annual project reports. This gives each partner a significant administrative and managerial role, ensuring that activities take place as proposed and helping to address potential problems that arise during the course of the work.</p> <p>Staff exchange. WPs 2, 3, and 4 all involve significant staff exchange among involved partners. Lead partners for these WPs were chosen because they have significant experience in the particular research fields indicated. However, other partners also possess relevant knowledge, particularly the project lead partner, NRI-UOG, and the South African partners, DNSM and PPRI-ARC, are expected to provide training and capacity building to the other involved partners as one of their main functions within the project. These training programmes in different techniques will generally proceed whereby partners spend short periods of time at each others' institutions to learn techniques and adopt standard methodologies to apply the actions back in their home country. Where possible these training sessions for different techniques will be combined to coincide with each other and with the project coordination meetings planned within WP1, as a way of reducing international travel budget requirements.</p> <p>Project management committee. Each partner will ensure staff representation on the project management committee. This committee will jointly make decisions regarding project decisions affecting various activities and ensure that research and data are managed effectively and transparently. The management committee will also be responsible for delivering annual reports and other reports and papers generated for specific activities.</p> <p>The lead partner of this workpackage, DNSM, has worked with a range of different stakeholders involved in rodent research and advising rodent management actions. They are well-placed to lead this WP and ensure that research staff gain the competence in both research techniques as well as managerial techniques required to run a successful rodent research department.</p>
Deliverables	<ul style="list-style-type: none"> • An effective regional rodent research team operating within the SADC.
Risks	None anticipated
Workpackage	WP 6: Communication and dissemination
Lead partner	NMN
Involved partners	NRI-UOG, PPRI-ARC, DNSM, SUA, UNISWA
Objectives	<ul style="list-style-type: none"> • Produce research outputs that are relevant to end users suffering from rodent pest problems, particularly small-scale agricultural communities • Raise awareness with the general public, policy makers and agricultural research institutions on the damage caused by rodents to people's livelihoods and about ecologically-based rodent management as an effective tool for reducing rodent damage
Justification	Rodent research and pest management do not register as high priority issues among

SADC member governments, and there are few dedicated rodent research departments within agricultural research institutions. As experienced by people trying to control rodent pest problems, there can be a degree of frustration and apathy among institutions, and existing poor levels of rodent pest control can reinforce beliefs that rodents can not be effectively controlled, thereby curtailing further investment. This project action can help reverse this trend by presenting clear evidence of the impact of rodents on agriculture, human health and livelihoods which have been traditionally understated with little evidence to back up policy statements. The project can also present evidence of how rodent researchers can work together with affected communities and produce rodent management results that are sustainable and cost beneficial.

Description of work	<p>International peer-reviewed publications. These are an internationally accepted measure of research excellence and an essential component of information dissemination and building scientific research capacity. The basic research actions proposed in this project lend themselves well to producing high quality scientific publications, and the project can easily ensure a minimum of six multi-authored publications submitted to high quality journals by the end of the project.</p> <p>Radio programmes and public awareness. Outputs can not be limited to scientific peer-reviewed publications which are not easily accessible or understood by the general public. The project will, therefore, produce press releases for the mass media and work closely with key journalists to prepare newspaper articles and assist in the production of radio programmes that target farmer education. The lead applicant has previously produced radio programmes on rats¹ and can use this experience within the proposed project to develop appropriate material in local language broadcasts.</p> <p>Project website. An open access website will be created as a deposit for project data, reports and information to be shared among project partners <www.nri.org/ecorat>. It will also provide links to other electronic sources of rodent management information and act as a public knowledge resource on rodents for the SADC region.</p> <p>International conferences. Attendance at international conferences is an important aspect of communication and capacity building for SADC research staff. Conferences are one of the main training grounds for research active staff and platforms for disseminating research findings. Relevant conferences, such as the International Conference on Rodent Biology and Management and the African Small Mammal Symposia will be targeted for staff involved in the action to attend and present their findings.</p> <p>Final workshop. A final project workshop will be organised and widely advertised among scientific and extension staff (targeting both NGO and government staff involved in agricultural extension and policy making), highlighting key research findings, their practical implications and recommendations for future research and policies related to rodent pest management in the SADC region.</p> <p>Community uptake. Agricultural communities will be directly involved in research actions described in WP 3 and indirectly involved in WPs 2 and 4. This form of dissemination is limited within this project, but we expect community involvement to act as a platform for further dissemination of appropriate knowledge through farmer field schools and extension programmes operated by NGO and government extension programmes.</p> <p>The lead partner of this WP, NMN, is strongly involved in public awareness campaigns, and public education is one of its core activities. NMN will use this expertise to ensure partners can work together to achieve the project's dissemination goals. It will act as the main instigator of communication with media sources and be largely responsible for organising the final workshop.</p>
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Deliverables	<ul style="list-style-type: none"> • At least six peer-reviewed publications • A series of radio programmes in local languages discussing problems with rodents and effective management strategies • Newspaper and other media articles about the project actions
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¹ Links to BBC World Service programmes on rats

http://news.bbc.co.uk/2/hi/programmes/documentary_archive/4600185.stm

http://www.nri.org/ratzooman/docs/BBC_World_Service_One_Planet_Rats_Africa_with_music.mp3

http://www.nri.org/InTheField/mozambique_rats.htm

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| <ul style="list-style-type: none"> • Open access project website • Final workshop attended by research and extension staff from the SADC region. |
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Risks	None anticipated
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Publications and other outputs

Training

- Staff exchange visits between consortium partners consisting of a minimum of six weeks training in various techniques and skills relevant to the project action.
- Small-scale farming community training in a minimum of nine different communities, providing key people with skills in trapping, handling rodents and collecting data
- A final workshop to disseminate project results to policy, extension and research institutions throughout the SADC.

Reports and documents

- At least four popular press releases with articles targeted at newspapers, radio and TV.
- At least six peer-reviewed international journal publications.
- A publicity and training brochure aimed at the general public and summarising the project.
- At least one presentation at a relevant international conference summarising the project activities and results.
- Annual and final reports to the SADC.
- A policy document on the impact of agricultural expansion and intensification on small mammal biodiversity and threats of zoonosis.
- Report on socio-economic and anthropological parameters affecting rodent management strategies in rural SADC farming communities.
- Policy report on the cost-benefits achieved for small-scale farmers using an ecologically-based rodent management strategy.
- Prioritised list of recommendations for improving rodent management for SADC farmers, researchers and policy makers.

Tools

- An interactive public access web-based knowledge dissemination centre
- A series of radio programmes in local languages on rodent pests aiming to raise awareness of pest problems and appropriate control solutions.
- New rodent damage assessment methodologies.
- Ecological data set to develop appropriate rodent management strategies.
- Data set on the multiple impacts of rodents experienced by small-scale farming communities.
- Data set on impact of ecologically-based rodent management interventions within small-scale farming communities.
- Data set that quantifies the potential risk of zoonosis transmission from wild rodents to humans.
- An effective regional rodent research team operating within the SADC.

Timeline of activities

Year 1													
Activity	Semester 1						Semester 2						Implementing body
	1	2	3	4	5	6	7	8	9	10	11	12	
1 Coordination and management													Lead by Natural Resources Institute Involving all partners in all activities
1.1 Project inception workshop													
1.2 coordination meetings													
1.3 Activity reporting													
1.4 Annual progress reports													
2 Rodent ecology													Lead by Sokoine University of Agriculture Involving all partners in all activities
2.1 Habitat utilisation													
2.2 Population dynamics													
2.3 Disease potential													
3 Rodent impact management													Lead by Plant Protection Research Institute Involving all partners in all activities
3.1 Pre-harvest damage													
3.2 Post-harvest damage													
3.3 Knowledge, attitude and practice survey													
3.4 Damage to personal property													
3.5 Public health													
3.6 Trapping													
3.7 Environmental management													
3.8 Rodenticides													
3.9 Monitoring and evaluation													
4 Rodent – human interactions													Lead by University of Swaziland Involving all partners in all activities
4.1 Radio telemetry and spooling													
4.2 Land use change													
5 Capacity building													Lead by Durban Natural Science Museum Involving all partners in all activities
5.1 Work package leadership													
5.2 Staff exchange													
5.3 Project management committee													
6 Communication and dissemination													Lead by National Museum of Namibia Involving all partners in all activities
6.1 International peer-reviewed publications													
6.2 Radio programmes and public awareness													
6.3 Project website													
6.4 International conferences													
6.5 Final workshop													
6.6 Community uptake													

Year 2 to 3					
Activity	Semester 3	Semester 4	Semester 5	Semester 6	Implementing body
1 Coordination and management					Lead by Natural Resources Institute Involving all partners in all activities
1.1 Project inception workshop					
1.2 coordination meetings					
1.3 Activity reporting					
1.4 Annual progress reports					
2 Rodent ecology					Lead by Sokoine University of Agriculture Involving all partners in all activities
2.1 Habitat utilisation					
2.2 Population dynamics					
2.3 Disease potential					
3 Rodent impact management					Lead by Plant Protection Research Institute Involving all partners in all activities
3.1 Pre-harvest damage					
3.2 Post-harvest damage					
3.3 Knowledge, attitude and practice survey					
3.4 Damage to personal property					
3.5 Public health					
3.6 Trapping					
3.7 Environmental management					
3.8 Rodenticides					
3.9 Monitoring and evaluation					
4 Rodent – human interactions					Lead by University of Swaziland Involving all partners in all activities
4.1 Radio telemetry and spooling					
4.2 Land use change					
5 Capacity building					Lead by Durban Natural Science Museum Involving all partners in all activities
5.1 Work package leadership					
5.2 Staff exchange					
5.3 Project management committee					
6 Communication and dissemination					Lead by National Museum of Namibia Involving all partners in all activities
6.1 International peer-reviewed publications					
6.2 Radio programmes and public awareness					
6.3 Project website					
6.4 International conferences					
6.5 Final workshop					
6.6 Community uptake					

Logical Framework

Intervention logic	Objectively verifiable indicators of achievement	Sources and means of verification	Assumptions
<p>OVERALL OBJECTIVES</p> <p>1. To reduce the high level of rural poverty in southern African countries by making agriculture more competitive and to raise poor farmers' incomes by cost beneficially increasing crop yields, reducing storage loss and preventing the transmission of diseases to people and livestock caused by rodent pests.</p> <p>2. To offset the high rate of natural resource degradation particularly small mammal biodiversity through improving the management and invasion of commensal rodents and increasing knowledge about rodent-human interactions and agricultural expansion.</p> <p>3. To develop effective rural policy options with institutions and farmer groups to support rodent pest management actions. Policies will be developed and introduced to ensure the right tools and knowledge are made available to rural farming communities and to inform national regulations regarding rodenticides, research provision and extension staff training.</p>	<p>1.1 Yield increase of all crops grown by small-scale farmers through reduced rodent damage</p> <p>1.2 On-farm stored staple crops protected from rodent loss, damage and contamination</p> <p>1.3 Improved marketability of fruits and vegetables that have not been partially eaten by rodents</p> <p>2.1 Impact of agricultural expansion and spread of commensal rodents on small mammal biodiversity is minimised</p> <p>2.2 Zoonoses carried within rodent reservoirs do not expand their prevalence</p> <p>3.1 Policies recommended to address research constraints on rodent ecology, particularly with regard to zoonosis and pest management</p> <p>3.2 Policies developed to improve delivery of agricultural extension education on rodent management</p> <p>3.2 Policies on rodenticide regulation modified to increase safe and affordable use</p>	<p>Government statistics in partner countries</p> <p>Project reports</p>	<p>These objectives can only be achieved in a stable political and economic environment</p>

<p>SPECIFIC OBJECTIVE</p> <p>To strengthen the generation of appropriate, cost-effective and sustainable technologies for rodent pest management in small-scale farming for the SADC region.</p>	<ol style="list-style-type: none"> 1. Cost-beneficial rodent management strategy developed for small-scale farming communities 2. Extension programmes beginning to adopt rodent intervention programmes by end of project 3. At least 8 scientists trained from Namibia, Tanzania and Swaziland on rodent research for the development of ecologically-based rodent management 4. SADC research institutions pro-actively supporting rodent research activities 	<p>Project reports Reports of partner institutions Reports of extension agencies and programmes Peer-reviewed publications Publicity articles and programmes generated Project website access records</p>	<p>Rodent ecology and species vary among agro-ecological habitats. It is not known to what extent the outputs and recommendations of this project will be widely transferrable and accessible to conditions outside of those investigated within the selected small-scale farming communities. Representative agro-ecologies and communities will be chosen to ensure wide application of project outputs</p>
<p>EXPECTED RESULTS</p> <ol style="list-style-type: none"> 1. Project effectively managed. 2. Increased knowledge of rodent ecology, population dynamics and habitat utilisation. 3. Impacts of rodents on people's livelihoods understood and effectively reduced. 4. Interactions between rodents and humans and the proximity of rodents to people understood in context of zoonosis, agricultural expansion and small mammal conservation. 5. Abilities of scientific research staff working on rodent pest ecology and management increased within the SADC region. 	<ol style="list-style-type: none"> 1. Project produces expected outputs within agreed budget and timeframe. 2. Database of ecological trials carried out on rodent breeding, abundance and prevalence. 3. Database of rodent damage to people's livelihoods, monitoring and evaluation data from community-based rodent management interventions, changes in involved farmer knowledge, attitudes, practice. 4. Interventions for reducing the spread of rodent-zoonoses and effects of agricultural expansion on small mammal diversity understood 5. Rodent research scientists across the SADC working as a team on identified knowledge gaps and research constraints 	<p>Annual reports delivered on time.</p> <p>Project reports Peer-reviewed publications</p> <p>Project reports Peer-reviewed publications Newspaper and radio articles</p> <p>Project reports Peer-reviewed publications Newspaper and radio articles</p> <p>Project reports Peer-reviewed publications Project website</p>	<p>Environmental factors such as drought may affect relevance of outputs.</p> <p>Political factors in one or more of the partner countries could make achievement of project outputs difficult.</p> <p>Involved communities remain committed to the project action and assist in the collection of data</p> <p>Habitats undergoing anthropogenic change can be identified and used for project actions.</p> <p>Rodent research scientists remain in post</p>

<p>6. Research knowledge effectively disseminated to stakeholders and policy recommendations formulated.</p>	<p>6. At least two peer-reviewed journals published and a further four submitted before end of project, project website, final workshop, policy documents and media reporting on project through radio and print articles.</p>	<p>Project reports Peer-reviewed publications Newspaper and radio articles Project website Final workshop Reports by government departments and non-government institutions</p>	<p>Assistance of governments and organisations outside the project are required to achieve this objective</p>
<p>ACTIVITIES</p> <ul style="list-style-type: none"> 1.1 Project inception workshop 1.2 coordination meetings 1.3 Activity reporting 1.4 Annual progress reports 2.1 Habitat utilisation 2.2 Population dynamics 2.3 Disease potential 3.1 Pre-harvest damage 3.2 Post-harvest damage 3.3 Knowledge, attitude and practice survey 3.4 Damage to personal property 3.5 Public health 3.6 Trapping 3.7 Environmental management 3.8 Rodenticides 3.9 Monitoring and evaluation 4.1 Radio telemetry and spooling 4.2 Land use change 5.1 Work package leadership 5.2 Staff exchange 5.3 Project management committee 6.1 International peer-reviewed publications 6.2 Radio programmes and public awareness 6.3 Project website 6.4 International conferences 6.5 Final workshop 6.6 Community uptake 	<p>Personnel - research staff from the UK, South Africa, Tanzania, Swaziland and Namibia Travel - flights between partners to coordinate activities, develop common methodologies and discuss progress. Local travel to carry out research activities with farming communities, set up and collect data from field trials and monitor research progress Equipment - rodent traps, sample collection and analytical supplies Training - research staff training through work exchange visits, farmer education by research staff to collect data and to oversee rodent management trials in their villages</p>	<p>BUDGET FOR THE ACTION (€) Human resources 426,725 Travel 108,500 Equipment and supplies 74,580 Other costs/services 1,000 Administrative costs 42,756 TOTAL 653,561</p>	<p>There are no preconditions for the start of this action. All the partners are known to each other and have relevant experience in this area.</p>