1. Title

Prevention of sanitary risks linked to rodents at the rural/peri-urban interface – RATZOOMAN

2. Objectives

This project will investigate the sanitary risks linked to the proximity of rodents in rural and peri-urban areas of south-eastern Africa. Within the proposed project, the disease prevalence and livelihood constraints will be measured for three major diseases, plague, leptospirosis and toxoplasmosis. Ecological and anthropogenic factors responsible for their spread and transmission will be identified and evaluated. Host ranges will be investigated, and the infection dynamics within the host populations and from the hosts to humans will be studied. Section b-ii-2 of the programme objectives on the *rural urban interface sustainability in water management, land use and sanitary risks* will be addressed by developing predictive tools and control strategies which can reduce the risks posed by rodent-borne diseases. The project aims to help SADC countries develop strategies for the *prevention of sanitary risks linked to the proximity of humans and animals* by ensuring that policy makers and extensionists are provided with the appropriate tools and information to manage rodent disease risks using cost-effective, sustainable and ecologically-based strategies. Such predictive tools will help policy makers to support rural and peri-urban communities to handle their natural and social capital in a way that improves people's health as well as their land and water management. The general objective of the project is to provide new insights on the risks to public health caused by rodents living in close association with humans, and apply this information for the development of risk-management strategies. Because of changes in rural ecology, previously rare diseases could become more common. Because of increasing connectivity between rural and urban areas, these diseases could reach cities. Because of deteriorating hygiene and increasing urban rodent pests, these diseases could easily spread and persist in cities. In order to confirm these hypotheses, three rodent-vectored diseases (plague, leptospirosis and toxoplasmosis) will be studied as model systems because of their different clinical manifestations and different transmission routes in relation to designing predictive models. Specific objectives:

To identify and describe the Yersinia, Leptospira and Toxoplasma species prevalence in four geographically clustered southern African countries for both human, rodent and domestic animal populations

- Collect and serologically analyse blood samples from humans and animals and isolate, when appropriate, causative agents from blood, urine, and tissue samples (*report*)
- Conduct longitudinal study of disease infection in rural and peri-urban areas (*report*)
- Survey anthropological and economic impact of diseases upon livelihoods (survey *report*)

To investigate the ecological and epidemiological determinants of rodent borne zoonotic diseases

- Taxonomically identify major rodent species, identify when appropriate other major natural hosts and analyse inter-species transmission routes (*report*)
- Develop a Geographical Information System from existing satellite and database information linked to project collected information on disease prevalence (*GIS database creation*)
- Quantify the impact of anthropogenic factors which affect disease ecology and increase disease transmission risks (*report*)
- Analyse key water management and land use strategies and their impact upon disease ecology (*GIS input*)

To formulate sustainable participatory strategies for major stakeholders (researchers, rural and peri-urban populations, policy makers and health institutions) to bring about awareness of the risk of disease, disease prediction (early warning) and disease management following outbreaks

- Undertake a livelihood constraint analysis of the diseases on humans in targetted areas (*report*)
- Create GIS-based predictive tools that could be used for risk-modelling rodent-borne diseases (*tool kit produced*)
- Develop and test sustainable control strategies that reduce sanitary risks associated with rodent-borne diseases (*tool kit validated*)
- Provide well-grounded information to policy makers in the Southern African Development Community (SADC) countries, the EU and beyond on the impact of anthropogenic and ecological

change factors upon the transmission risks of rodent-vectored diseases (*policy debate document produced and considered by policy makers*)

- A regional dissemination workshop will be held for NGOs, public health staff, extension workers and health and agriculture researchers drawn from targetted SADC countries.

3. Work Plan

a) Introduction

This project is comprised of five main parts:

- **Research on the ecology of rodent-borne zoonoses**
  This section comprises research related to the epidemiology of plague, leptospirosis and toxoplasmosis among rodents, domestic animals and humans, rodent ecology and taxonomy, analysis of anthropogenic factors such as water and land use management, measuring impacts of rodent-borne disease upon sustainable livelihoods, and analysis of disease transmission pathways, which includes when applicable, other natural- and intermediate hosts as well as factors (soil and water pH, water levels, soil moisture in relation to deforestation and changes in precipitation) affecting the survival of causative agents, notably Leptospira serovars, in the environment. Data about past incidence of the respective diseases in man will be obtained by retrospective analysis of available serum banks and the exploration of hospital and public health records. These data are the inputs for tool kit development and validation described below.

- **Development and analysis of Geographic Information System**
  Satellite images and other mapping information are analysed for natural and anthropogenic change factors such as deforestation, erosion, salinisation, impact on habitat diversity, etc. This ecological information is then combined with disease ecology data and interpreted for correlations among factors. In addition, a retrospective study on habitat deforestation and recovery will be performed by interviewing local residents as well as collecting older satellite images of the regions under study from pre-existing satellite image libraries.

- **Testing and validation of predictive and simulation tools for risk-modelling**
  Theoretical models developed based upon main prioritised factors responsible for inducing outbreaks of rodent-borne zoonotic diseases. Models validated through field application.

- **Management of disease transmission risk**
  Community participatory research, using both surveys and social anthropological and PRA methods, will be carried out to identify local livelihood activities which are related to disease transmission, including water-related and food preparation activities, and to identify attitudes and views relating to the perceived threat to disease deriving from rodents. This research will also be intended to identify what kinds of control strategies would be feasible, through an assessment of the contextualisation of potential strategies within livelihood activities. This will include an assessment of social, cultural and economic impacts of potential strategies. A particular focus will be the differential impact on different categories of individual (for example, women might need to devote extra time to activities to reduce disease transmission through food or to reduce transmission of disease to children).

  Following this phase of research, cost-effective and sustainable strategies for reducing the impact of rodent-borne diseases will be identified and tested in selected communities using participatory research methods. Strategies will be monitored for impact upon disease prevalence in the community along the transmission pathway.

- **Dissemination of project outputs**
  Production of a policy discussion document distributed among key stakeholders. Workshop held in the SADC to discuss research findings and issues. Publication of research in peer-reviewed journals as well as in local newsletters read widely among the public health and extension community. To inform the region of project progress, provide for exchange of information on

rodent management, encourage collaboration and promote dissemination to other regions, regular summaries of project activities would be published on the IPME[1] website.

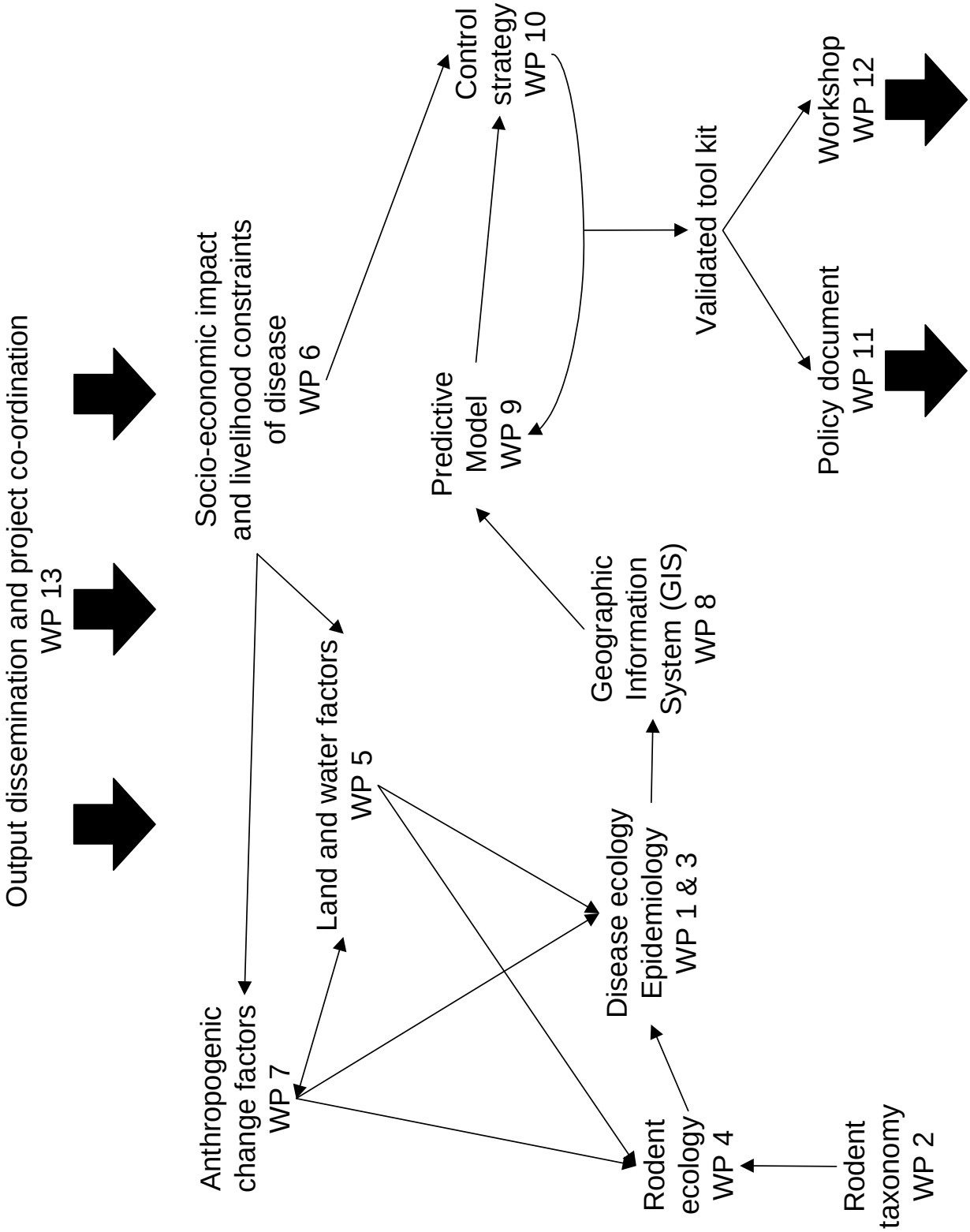
To facilitate appropriate design and encourage participation in the development and eventual use of derived technologies, the research process will involve intended beneficiaries during the design and testing stages (empowerment). Virtually all the research activities will be based in the SADC partner countries, with a few minor exceptions. Rodent and zoonosis identification will be done in collaboration among institutions based in Europe and Africa, and skills and equipment lacking in Africa will require that some samples are taxonomically identified in European-based laboratories. Some elements of clinical epidemiology and analysis of sera will be based in EU laboratories, when they are best equipped for this task. EU-led expertise on GIS will work with collaborating African partners to train and develop GIS skills locally; however, it is expected that some GIS work will occur in the EU where more extensive computer and satellite equipment is based. Analysis of food and environmental samples for zoonotic contamination will occur in both African and EU countries where equipment and expertise are most appropriate. All other activities will, by their focus on ecology, be conducted in SADC countries.

The project takes an interdisciplinary approach, involving the technical inputs of microbiology, social anthropology, economics, pest ecology, taxonomy, GIS and environmental science, clinical epidemiology and public health. Coherence is achieved through the clear focus on the provision of validated tools to rural/peri-urban communities which reduce disease transmission risks associated with rodents and in supporting sustainable small-holder livelihoods in SADC countries. The overall approach is to bring existing European expertise to bear on the generation and testing with SADC collaborators, of predictive tools and management strategies that can be used to reduce the impact of rodent zoonoses on human health. Techniques and approaches will differ according to the objectives of the particular work areas.

[1] IPME, the European Group for Integrated Pest Management in Development Cooperation is a pan-European group which promotes a harmonised European approach to sustainable agriculture. It is co-funded by the Member States of the EU, and the EC.

b) Work packages

Graphical representation of relationship among work packages



Work package timeline of activities

	Year 1												Year 2												Year 3											
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
WP1																																				
WP2																																				
WP3																																				
WP4																																				
WP5																																				
WP6																																				
WP7																																				
WP8																																				
WP9																																				
WP10																																				
WP11																																				
WP12																																				
WP13																																				

Work package list

Work Package No.[1]	Work package title	Lead contractor No.[2]	Persons-Months[3]	Start Month[4]	End Month[5]	Deliverable No.[6]
1	Retrospective and prospective investigation of human sera for zoonotics	3	66	0	23	D1, D2
2	Taxonomic identification of rodent species found in rural and peri-urban habitats	4	53	0	14	D3, D4
3	Isolation and identification of zoonotics from rodents and domestic animals	5	68	0	23	D5, D6, D7
4	Rodent ecology in rural/peri-urban Africa	4	102	0	23	D8, D9, D10
5	Impact of environmental factors, water management and land use strategies upon zoonotics	1	40	0	15	D11, D12, D13, D14, D15
6	Socio-economic impact and livelihood constraints of disease	1	32	0	14	D16
7	Measuring factors of anthropogenic change upon rodent ecology, epidemiology and natural capital	1	38	0	15	D17
8	Geographic Information System	6	44	0	23	D18, D19
9	Predictive modelling tools for assessing zoonotic transmission risks	1	21	20	34	D20, D21
10	Development of sustainable control strategies for the management of rodent-borne disease	2	44	24	34	D22, D23, D24
11	Analysis of policy issues	8	19	26	30	D25
12	Stakeholder workshop	7	11	28	34	D26
13	Output dissemination and project co-ordination	1	27	0	35	D27, D28, D29
	TOTAL		565			

1. Work package number: WP 1 – WP n.
2. Participant number of the leader of the work in this work package (as used in Part A).
3. The total number of person-months allocated to each work package.
4. Start date of work in the specific work package, month 0 being the start of the project and all other start dates being relative to this.
5. End date, months from start of project.
6. Deliverable number: Number for deliverable(s)/result(s) as mentioned in the work package description: D1 to Dn

List of deliverables

Deliverable No.[1]	Deliverable title	Delivery date[2]
D1	Prevalence and incidence of three rodent-borne zoonotic diseases in humans evaluated among rural and peri-urban areas in SADC partner countries	23
D2	Impact of agro-ecological and socio-economic factors upon disease prevalence understood.	23
D3	Rodents and insectivores living in rural and peri-urban areas of southern Africa taxonomically identified	14
D4	A taxonomic rodent species reference collection for each SADC partner country (or existing reference collections expanded with specimens from peri-urban habitats)	14
D5	Disease ecology for three zoonotic diseases understood among rodent, insectivore and domestic animal reservoir populations in SADC partner countries	23
D6	Potential carriers and/or transmitters of zoonotic disease identified.	23
D7	Impact of climate and agro-ecological zone upon disease prevalence understood	23
D8	Prevalence ratios of small mammal species among different habitats established	23
D9	Factors affecting species demography identified	23
D10	Movement patterns between habitats established	23
D11	GIS database created based on readily available geographic information.	15
D12	Patterns in land and water use established	15
D13	Impact of anthropogenic factors upon land and water resource management understood	15
D14	Natural resource criteria prioritised for potential effects on persistence and spread of zoonotics	15
D15	Disease transmission pathways through food and environment identified	15
D16	Zoonotic disease factors which impact upon sustainable livelihoods determined and reported	14
D17	Sociological and anthropogenic change factors identified and analysed for potential impacts upon zoonotic transmission risks	15
D18	Geographic Information System database created and maintained within the SADC for the analysis of rodent-borne zoonotic disease	23
D19	Principle natural and social factors affecting the persistence and prevalence of rodent zoonotics identified	23
D20	A set of quantitative models established which can be used for probabilistic prediction of disease transmission risks	34
D21	A quantitative model that will facilitate decision making about strategies to be followed, and through a population dynamics approach, the consequences of management on disease transmission and its socio-economic impact	34
D22	Atleast one risk reduction strategy tested through application for each model disease: plague, leptospirosis and toxoplasmosis	34
D23	Efficacy of risk reduction strategies monitored and confirmed	34
D24	Predictive modelling tool validated and input factors refined	34
D25	Policy discussion document produced and circulated among policy makers in the SADC and the EU.	30
D26	Two-day workshop, inviting approximately 100 stakeholders from the SADC	34
D27	RATZOOMAN reporting delivered on time	35
D28	Atleast three publications in peer-reviewed journals submitted by end of project	35
D29	Atleast three articles published in the popular press and local newsletters by end of project	35

1. Deliverable numbers in order of delivery dates: D1 – Dn
2. Month in which the deliverables will be available. Month 0 being the start of the project and delivery dates being relative to this.

Work package description: Retrospective and prospective investigation of human sera for the presence of antibodies against Leptospira, Toxoplasma, and Yersinia antigens

Work package number :	1						
Relative start month [1] :	0						
Participant number:	3	7	6	5	8		Total
Person-months per participant:	18	12	12	12	12		66

[1]Month 0 being the start of the project.

Objectives

- To ascertain the history and current status of sero-prevalence of three rodent-borne zoonotic diseases across age, sex, socio-economic, geographic and rural/peri-urban boundaries among human communities in SADC partner countries.

Description of work

Serum banks and hospital/public health records in the targetted localities of the project will be used to screen for historical incidence of rodent zoonotics. New samples of human blood will be collected for disease screening according to criteria which may affect the presence and prevalence of zoonotic disease. In order to limit sample size, prevalence data will be strictly interpreted within pre-defined community boundaries. These communities will be selected as being representative of larger agro-ecological zones with respect to their rural/peri-urban context. Blood samples will be collected by qualified personnel, observing all local and national ethics and guidelines. Samples will prepared and stored for future analysis according to standard protocols. Personal information collected from sampled individuals will be anonymously maintained. Samples will need to be collected over two annual cycles to account for climatic and agro-ecological changes that may impact upon disease ecology. The timing and frequency of sample collection will vary among areas with respect to local conditions, but will roughly follow: commencement of rainy season, near end of rainy season, post-harvest and mid to late dry season.

Samples will be screened for the general presence of anti-Leptospira IgG and IgM antibodies and investigated for agglutinating antibodies against Leptospira interrogans s.l., notably serogroup Icterohaemorrhagiae. Samples will be similarly screened for the presence of IgG and IgM antigens specific to *Toxoplasma gondii* and *Yersinia pestis*. Molecular techniques such as PCR will be used as necessary to identify isolates for typing.

Deliverables

D1 Prevalence and incidence of three rodent-borne zoonotic diseases in humans evaluated among rural and peri-urban areas in SADC partner countries.

D2 Impact of agro-ecological and socio-economic factors upon disease prevalence understood.

Milestones and expected results

Years 1 & 2

- Samples of human sera collected from at least one rural, one peri-urban community and nearby serum banks from four different countries
- Samples serologically analysed for leptospirosis, toxoplasmosis and plague.

Year 2

- Data set analysed for influence of socio-economic and agro-ecological factors
- Results summarised and conclusions reported

Work package description: Taxonomic identification of rodent species found in rural and peri-urban habitats

Work package number :	2						
Relative start month [1] :	0						
Participant number:	4	5	6	7	8		Total
Person-months per participant:	13	10	10	10	10		53

[1]Month 0 being the start of the project.

Objectives

- To ascertain the rodent and insectivore species found among different habitats in SADC communities

Description of work

Particularly in urban areas, many of the major species of rodents found in southern Africa are easily recognised. However, in rural and peri-urban areas, several indigenous species of rodent can be found, some of them very hard to identify. It is important to know which species are prevalent as their susceptibility to zoonoses and ability to act as carriers of disease will vary. Taxonomic identification can also help establish important differences in behaviour and physiology related to a species' pre-disposal to neophobia and commensality.

Rodents and other small mammals will be trapped in a variety of peri-urban habitats across SADC partner countries in correlation with activities outlined in WP 1. As many species seasonally vary in prevalence, collections will be undertaken periodically over an annual cycle. Based upon initial observations, representative samples of the species caught will be taken for taxonomic identification in laboratories based in Europe and Africa. Taxonomic identification will be based on morphology, craniometry, karyology and for some species molecular techniques. In each region, reference collections of karyologically confirmed museum specimens will be made.

All animals trapped during the project will be taxonomically identified as part of this work package. Where the results of the first year indicate that this cannot be done reliably based on morphological characteristics, the specimens will continue to be sent to the partner 4 reference laboratory in year 2 for identification.

Deliverables

D3 Rodents and insectivores living in rural and peri-urban areas of southern Africa taxonomically identified

D4 A taxonomic rodent species reference collection for each SADC partner country (or existing reference collections expanded with specimens from peri-urban habitats)

Milestones and expected results

- Year 1
- Rodents trapped and specimens prepared
- Specimens taxonomically identified
- Taxa compared between localities

Year 2

- Results reported

Work package description: Isolation and identification of zoonotics from rodents, insectivores and domestic animals

Work package number :	3						
Relative start month [1] :	0						
Participant number:	5	3	7	6	8		Total
Person-months per participant:	18	16	18	10	6		68

[1]Month 0 being the start of the project.

Objectives

- To ascertain the prevalence of three rodent-borne zoonotic diseases among different rodent, insectivore and domestic animal species across temporal and spatial boundaries.

Description of work

Rodents and small mammals will trapped and blood samples taken for serological analysis. Kidneys will be used for culturing leptospires, and obtained isolates will be characterised by serological and molecular methods. Trapping will be conducted in the same areas as research conducted within WPs 1 and 2. Trapping will be conducted using recognised standard protocols over two annual cycles. All animals will be taxonomically identified as part of WP1. Blood samples from domestic animals (dogs, cats, cattle, goats) will be collected, and samples will be screened for the general presence of agglutinating antibodies against *Leptospira* notably those against serovars of the Icterohaemorrhagiae group. Samples will also be screened for the presence of IgG and IgM antigens specific to *Toxoplasma gondii* and *Yersinia pestis*. Fleas found on rodents will be collected for the presence of plague bacillus. Culturing and PCR techniques will be used to type isolates.

Deliverables

D5 Disease ecology for three zoonotic diseases understood among rodent, insectivore and domestic animal reservoir populations in SADC partner countries
D6 Potential carriers and/or transmitters of zoonotic disease identified.
D7 Impact of climate and agro-ecological zone upon disease prevalence understood

Milestones and expected results

Years 1 & 2

- Samples of rodent, insectivore and domestic animal sera collected from atleast one rural and one peri-urban zone from four different countries
- Samples analysed serologically for the presence of leptospires, toxoplasma and plague antigens and by culturing and PCR

Year 2

- Data set analysed for influence of animal species, seasonal and agro-ecological factors
- Results summarised and conclusions reported

Work package description: Rodent ecology in rural/peri-urban Africa

Work package number :	4						
Relative start month [1] :	0						
Participant number:	4	5	3	6	7	8	Total
Person-months per participant:	18	24	6	18	18	18	102

[1]Month 0 being the start of the project.

Objectives

- To establish rodent population dynamics for the major rodent and small mammal species identified in targetted areas of the SADC
- To understand the interactions among different small mammal communities in these areas
- To analyse the roles of the different species identified in WP 2 in relation to human populations and zoonosis
- To discover potential factors influencing small mammal species prevalence

Description of work

Mark and recapture experiments will be implemented using standard protocols with grids or lines of Sherman live traps within the selected community locations in each of the four SADC countries. This research will be conducted over two annual cycles using sites that account for differences among three habitats: wild vegetation, agricultural and human habitation. Demographic analysis of the study populations will be conducted to determine the survival characteristics of each identified species, noting reproduction and maturation differences among species. Ectoparasites will be collected and identified. Intrinsic and extrinsic factors affecting population dynamics will be analysed using standard statistical software.

Using radiotelemetry and work with marked baits, movements of rodents between the three habitats will be investigated at the individual and population level over different seasons, in two or three sites. This information is particularly relevant since it provides information about possible mechanisms for carry-over of pathogens between habitats.

Deliverables

D8 Prevalence ratios of small mammal species among different habitats established
D9 Factors affecting species demography identified
D10 Movement patterns between habitats established

Milestones and expected results

Year 1

- Mark and recapture experiments started

Year 2

- Mark and recapture experiments complete
- Demographics of predominant small mammal species established
- Habitat parameters of predominant species identified

Work package description: Impact of environmental factors, water management and land use strategies upon zoonotics

Work package number :	5						
Relative start month [1] :	0						
Participant number:	1	3	5	6	7	8	Total
Person-months per participant:	8	4	10	6	6	6	40

[1]Month 0 being the start of the project.

Objectives

- To determine characteristics of key water resources and their usage in targetted rural and peri-urban communities
- To analyse principle agricultural, livestock, transport and market demands upon land management among rural and peri-urban communities
- To discover potential effects of anthropogenic change upon water and land resources
- To discover effects of deforestation and precipitation changes on disease transmission risk
- To provide prioritised criteria that could affect the persistence and spread of rodent zoonotics
- To assess food and environmental samples for the presence of Toxoplasma, Yersinia, Leptospira and other rodent contaminants

Description of work

Readily available satellite information will be captured for the selected rural and peri-urban areas in SADC partner countries. A geographic information system (GIS) will be developed using commercial software to interpret and analyse these data within the wider natural resource context. Historical satellite information will be used to determine agro-ecological and seasonal change factors. Where necessary, these data may be supplemented by ordinance survey and locally gathered information, for example, on location of wells and other micro-habitats present in targetted areas. Additional information about past land use changes will be obtained by interviewing local inhabitants.

In conjunction with Work Package 6, in-depth studies will be conducted with a sub-sample of selected households to assess the anthropogenic factors impacting upon water and land management. In order to provide accurate representation, these studies will be designed to reflect potential differences across gender, ethnic and socio-economic parameters using standard techniques for working with small groups and individuals. Data will be collated and analysed to determine the predominant factors influencing how people use their available water and land resources.

Samples of food and water will be collected along the supply chain using well-documented sampling protocols. Samples will be analysed in the laboratory for the presence of rodent hairs, faecal material, urine, general bacteria and other etiologic agents including Leptospira, Yersinia and Toxoplasma species. PCR techniques will be required to identify disease causing agents from saprophytic bacteria. Samples will be collected over an annual cycle accounting for both socio-economic and agro-ecological differences. Tracing transmission pathways will require that laboratory analysis techniques are sufficiently specific and sensitive to determine zoonotic contamination, and standard methodologies may need to be optimised through research and development. We will investigate pH of surface waters and soils, water levels and soil moisture to asses their impact upon disease prevalence.

Deliverables

D11 GIS database created based on readily available geographic information.
D12 Patterns in land and water use established.
D13 Impact of anthropogenic factors upon land and water resource management understood.
D14 Natural resource criteria prioritised for potential effects on persistence and spread of zoonotics
D15 Disease transmission pathways through food and environment identified

Milestones and expected results

Year 1

- Satellite information acquired and interpreted for rural and peri-urban communities within the SADC partner countries
- Participatory appraisal surveys conducted and assessments made on human management of natural capital in targetted areas

Year 2

- Analysis of food and water samples for zoonotics complete
- Combined data set of anthropogenic and agro-ecological factors analysed and reported
- Factors that may impact upon the persistence and spread zoonotic diseases identified

Work package description: Socio-economic impact and livelihood constraints of disease

Work package number :	6						
Relative start month [1] :	0						
Participant number:	1	5	6	7	8		Total
Person-months per participant:	8	6	6	6	6		32

[1]Month 0 being the start of the project.

Objectives

- To assess the impact of zoonotic disease on the health and nutrition of African communities

Description of work

Surveys will be conducted with local communities using standard participatory protocols to determine what sorts of health problems are faced in communities by rat-borne diseases and how these can affect productivity. For example, through individual discussions, the frequency of rat bites and subsequent secondary infections will be recorded across gender, age and socio-economic brackets. Detailed methodology planning will undertake a review of secondary information and a methodology workshop conducted with intended beneficiaries, in conjunction with WP 5. The process is expected to involve a sequence of methodologies: rural appraisal, to provide a brief overview of the factors of disease and guide data collection; short formal survey, to derive statistically valid quantitative estimates representative of the target population, and in-depth sub-sample study of households, to provide details. A further supplementary survey could be considered if these latter methods were applied concurrently.

Hospital and clinic-based studies will be performed to assess incidence related with clinical personnel and epidemiological data. Symptomatic diagnosis will also lead to estimates on, for example, the number of working days lost to sickness, costs associated with preventative or curative treatments and deaths. Surveys in rural and peri-urban areas will be conducted over one annual cycle to determine seasonal fluctuations in disease incidence and impacts upon changing work priorities.

Deliverables

D16 Zoonotic disease factors which impact upon sustainable livelihoods determined and reported

Milestones and expected results

Year 1

- Surveys conducted in atleast one rural and one peri-urban community from four different countries

Year 2

- Report produced on zoonotic disease factors which impact upon sustainable livelihoods

Work package description: Measuring factors of anthropogenic change upon rodent ecology, epidemiology and natural capital

Work package number :	7						
Relative start month [1] :	0						
Participant number:	1	5	6	7	8		Total
Person-months per participant:	8	12	6	6	6		38

[1]Month 0 being the start of the project.

Objectives

- To assess the impact of social capital upon natural capital with regard to zoonotic disease transmission risks.
- To determine anthropogenic factors which promote or reduce the likelihood of contracting zoonotic diseases

Description of work

Members of farming households in rural and peri-urban areas of Africa carry out a number of tasks during the day. Some of these activities are related to land and water resource management which are addressed in WP 5. However, other activities such as food preparation, sanitation, household construction, food storage practices, and other indigenous activities could have important roles in promoting disease transmission from rodents to people. Participatory appraisals will be conducted using a variety of participatory and social anthropological techniques to break down routine activities according to gender, age, ethnic and income groups. While the methods used WP5 will be primarily quantitative surveys, the participatory and social anthropological methods used in this work package will be one-to-one and group discussion based, and will incorporate observation of activities and discussion around topics as well as direct questions. Although general information about different groups and their activities in African societies are well-documented, specific information is often lacking. For example, in areas where people eat rats, rat meat preparation methods could impact upon disease transmission pathways. This research will be conducted in close parallel to activities in WP 5, particularly in reference to the analysis of food and water samples. This research will pay particular attention to determining potential changes in daily practice that have occurred in the recent and distant past. It will also assess the potential livelihood impact on different groups of changes in activities which are found to impact negatively on health by encouraging transmission of disease from rodents to humans, and thus help to identify which strategies for control are feasible to introduce.

Deliverables

D17 Sociological and anthropogenic change factors identified and analysed for potential impacts upon zoonotic transmission risks

Milestones and expected results

Year 1

- Research conducted within targetted areas of SADC partner countries on anthropogenic factors

Year 2

- Factors which potentially impact upon disease transmission pathways prioritised and reported
- Aspects of livelihoods which potentially affect the feasibility of potential control strategies identified

Work package description: Geographic Information System

Work package number :	8						
Relative start month [1] :	0						
Participant number:	6	1	5	7	8	4	Total
Person-months per participant:	24	8	3	3	3	3	44

[1]Month 0 being the start of the project.

Objectives

- To develop a Geographic Information System (GIS) capable of combining natural and social capital factors related to the epidemiology of rodent-borne diseases

Description of work

A GIS based on that initially developed in WP 5 will become the central feature of the project collating information acquired from WPs 1 to 7. Data will be linked to the rural and peri-urban areas chosen among the four SADC partner countries. The GIS system will be based at DC partner 6. As data sets are overlaid, the GIS will be used to investigate time and spatial inter-relationships between outbreaks, disease foci, geography and rodent populations. Climatic and geographic data are readily available through the Southern Africa Development Community and the LandSat system. Potential correlations between land use changes, climatic and seasonal fluctuations and disease outbreaks will be analysed. The GIS database will be used to pinpoint potential disease foci, overlaps and relationships between diseases and the rodent vectors. Potential correlations among or within diseases across habitats and climates as well as static or changing patterns in disease transmission could point to areas or situations that would help identify the primary factors involved in promoting rodent-borne diseases. The GIS will also assist in interpreting correlations between natural and social factors and lead to identifying the primary factors which influence zoonotic prevalence and persistence in the environment. Environmental or social change which has contributed to the re-emergence of rodent-borne disease will be identified, offering potential avenues which can be explored in the development of transmission risk reduction strategies.

Deliverables

D18 Geographic Information System database created and maintained within the SADC for the analysis of rodent-borne zoonotic disease

D19 Principle natural and social factors affecting the persistence and prevalence of rodent zoonotics identified

Milestones and expected results

Year 1

- GIS system created and training in its operation to SADC partner country staff given

Year 2

- Data from WPs 1 to 7 input according to deliverable schedule
- Database analysed and factors correlated to determine key elements involved in epidemiology of leptospirosis, plague and toxoplasmosis

Work package description: Predictive and simulative modelling tools for assessing zoonotic transmission risks in rural and peri-urban areas of Africa

Work package number :	9						
Relative start month [1] :	20						
Participant number:	1	5	2				Total
Person-months per participant:	8	3	10				21

[1]Month 0 being the start of the project.

Objectives

- To develop modelling tools that are capable of providing accurate simulations and predictions of when zoonotic diseases may outbreak and to determine particular areas that are or will become increasingly susceptible to zoonosis.

Description of work

Temporal and spatial models based upon trends and correlations in the data set developed in WP 8 will be linked with bio-economic factors which had been overlaid in the GIS. Using optimal and sub-optimal points identified among the conditions measured in WPs 1 to 7, factors will be prioritised and represented with numeric weightings that allows the impacts of varying particular parameters to be measured. Dynamic and mechanistic epidemiological models will be initially based upon the GIS system and the zoonoses infection dynamics, using parameters identified from earlier work packages. This process-based tool kit will be used to understand the extent to which human infection would be expected to decrease if, for example, rat populations were halved. The validity of the model outputs will be tested in WP 10 which will allow for criteria to be modified, if required.

Deliverables

D20 A set of quantitative models established which can be used for probabilistic prediction and simulation of disease transmission risks

D21 A quantitative model that will facilitate decision making about strategies to be followed, and through a population dynamics approach, the consequences of management on disease transmission and its socio-economic impact

Milestones and expected results

Year 2

- Zoonotic disease transmission risk tool kit produced for predicting areas vulnerable to outbreaks

Year 3

- Tool kit predictions tested

Work package description: Development of sustainable control strategies for the management of rodent-borne disease in rural and peri-urban areas of the SADC

Work package number :	10						
Relative start month [1] :	24						
Participant number:	2	1	5	6	7	8	Total
Person-months per participant:	12	8	6	6	6	6	44

[1]Month 0 being the start of the project.

Objectives

- To test management strategies that could reduce the impact of zoonotic disease upon human health and sustainable livelihoods
- To verify and improve predictive modelling tools

Description of work

Strategies to control rodents using ecologically-based management systems are increasingly documented and verified through their application within a range of agricultural programmes. However, integrated disease-vector management is only one strand of potential methodologies that can be used to reduce zoonotic disease transmission risks. As has been highlighted within this proposal, anthropogenic factors of how human populations interact with rodents will have a considerable impact upon disease transmission. Therefore, many strategies may involve modifying human behaviour and action, for example, ensuring that drinking water vessels within the home are adequately covered at all times as a means of preventing water contamination. The risk management strategies developed will focus upon disrupting the transmission pathway of each of the diseases researched: plague, leptospirosis and toxoplasmosis.

For each disease, it is proposed that atleast one strategy is implemented within selected rural and peri-urban communities where disease prevalence has been noted. The effectiveness of the strategy will be monitored through analysis for the presence of the etiologic agent along the transmission pathway, e.g. antigenic presence in blood or disease presence in food samples. The strategy will be implemented over an annual cycle, and results will be compared against a control community nearby where no strategy has been implemented. Feedback from community members will be recorded through participatory appraisals as a means of determining improvements in overall health and nutrition through relative changes to levels of sickness and productivity.

The results on the effectiveness of the risk reduction strategies will provide feedback to WP 9, allowing factors within the predictive model to be further refined.

Deliverables

D22 Atleast one risk reduction strategy tested through application for each model disease: plague, leptospirosis and toxoplasmosis
D23 Efficacy of risk reduction strategies monitored and confirmed
D24 Predictive modelling tool validated and input factors refined

Milestones and expected results

Year 3

- Risk reduction strategies developed
- Strategies applied in rural and peri-urban communities within SADC partner countries
- Strategies evaluated

Work package description: Analysis of policy issues

Work package number :	11						
Relative start month [1] :	26						
Participant number:	8	1	2 to 7				Total
Person-months per participant:	3	4	2 each				19

[1]Month 0 being the start of the project.

Objectives

- To contribute to the policy debate related to public health priorities in the Southern African Development Community
- To highlight the impacts which rodent-borne diseases have upon human livelihoods with cost-effective disease management strategies identified
- To facilitate consideration of the project findings by policy makers in the SADC and the EU

Description of work

Current knowledge about the impacts of zoonotic disease upon sustainable livelihoods are so poor that the issue barely registers on the policy agenda in afflicted countries or among donor organisations. Most activity regarding zoonosis occurs post-outbreak with often large sums of money spent on damage limitation and clean up. Not only is the cost-effectiveness of this 'crisis management' approach highly debatable, this ad-hoc approach contributes little to prevention of outbreaks or the understanding of why outbreaks occur. Proverbial sayings such as "a stitch in time saves nine" or "an ounce of prevention is worth a pound of cure" are all too relevant with regard to the current public health situation on rodent-borne diseases.

Extensive risk assessment, prediction modelling and disease prevention strategies should provide the cornerstone of any public health programme. The range of activities undertaken by this project will make a significant contribution in this field by assessing disease impacts and providing tools for ongoing monitoring and evaluation of zoonotic disease.

Project research findings will be synthesised throughout the course of the project, and in the latter stages of the project activities, final results will be analysed in terms of their implications for policy making. A discussion document will be produced which identifies key areas of interest in relation to the factors to be taken into account when deciding disease reduction strategies. The project will provide a summary document of the project findings for policy context relating to public health programmes.

Deliverables

D25 Policy discussion document produced and circulated among policy makers in the SADC and the EU.

Milestones and expected results

Year 3

- Final results summarised and formulated within public health policy
- Policy document distributed to public health stakeholders and policy makers

Work package description: Stakeholder workshop

Work package number :	12						
Relative start month [1] :	28						
Participant number:	7	1	5	6	8		Total
Person-months per participant:	6	2	1	1	1		11

[1]Month 0 being the start of the project.

Objectives

- To debate project research with public health policy makers, researchers, NGOs, extension agents and community representatives
- To disseminate project findings with key stakeholders in the SADC

Description of work

Following on from WP 11, a 2-day workshop will be organised in SADC partner 7 inviting members from public health laboratories, policy makers, extensionists, researchers and community representatives. The workshop's objectives will be met by opening up direct channels of communication with those directly involved in health care provision. The workshop will also allow other issues affecting public health to be put in context allowing rational debate to occur on the priorities of countries facing a barrage of livelihood issues and constraints. It is envisaged that the workshop will increase the attention given to zoonotic disease through providing, for the first time, research showing the impacts of zoonotic disease and offering tools which can help cost-effectively reduce the risks of zoonotic disease transmission. It is expected that organisation of the workshop will take approximately six months, and the workshop will be planned to take place shortly before the completion of the project so that its conclusions can be incorporated into the final report.

Deliverables

D26 Two-day workshop, inviting approximately 100 stakeholders from the SADC

Milestones and expected results

Year 3

- Workshop organised
- Invitations to workshop sent out
- Workshop held

Work package description: Output dissemination and project co-ordination

Work package number :	13						
Relative start month [1] :	0						
Participant number:	1	2 to 8					Total
Person-months per participant:	6	3 each					27

[1]Month 0 being the start of the project.

Objectives

- To co-ordinate activities among European and African partners
- To ensure timely reporting of activities to the EU
- To promote synergy among research activities and the drafting of research-related publications

Description of work

NRI (partner 1) has a long history of co-ordinating various complex projects with several partners. This includes a number of EU-supported projects within the various programme frameworks. Apart from its activity in international research, NRI is also involved in the planning, implementation and evaluation of projects and programmes. Thus partner 1 is well placed to plan and co-ordinate research activities that are geared towards extension and implementation. The partners are aware that strict management of this project will be essential for successful completion of the proposed work programmes. Most of the research partners have previous experience of working with each other. All have been chosen for their proven research record in epidemiology and ecological research. Their ability to deliver results and reports to strict deadlines has been taken into account.

Day to day communication between partners will be by e-mail, telephone and fax. As the lead agency, NRI will co-ordinate the inputs that are provided by the partners. It will be involved in the critical stages of planning, design and analysis, guard the course of the project and the achievements of the objectives, and will have a main role in decision making about adapting strategies and time schedules. Overall project co-ordination will ensure that reporting to the EU is carried out in a timely and accurate manner.

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 RATZOOMAN outputs. The initial project workshop will be held at Partner1, but after that, co-ordination meetings will be rotated around the consortium, with a total of seven meetings occurring, one approximately every six months. The launch meeting will be held to review the contractual arrangements for the financial control of the project and for the assessment of the achievement of the agreed research tasks, milestones and technical deliverables. Reports by the participants will not be needed in this initial meeting but partners will be required to present strategies that they intend to follow. Discussion will permit optimisation of the strategies. A Scientific Management Group (SMG), chaired by the co-ordinator, will be created in which representatives from each partner will have a seat. Partners will nominate their representatives immediately upon the start of the project. The SMG will assess the scientific progress of the project against the tasks and milestones set for each work package. Where necessary, short- and medium-term objectives will be redefined and agreed by the SMG. The SMG will meet at least once per year. Co-ordination meetings for managing work packages between the work package leader and other relevant partners will occur alternately with SMG meetings. For the interim meetings, each partner will provide an output form for each meeting. This will be submitted to reach the co-ordinator two weeks prior to each meeting. The co-ordinator will copy the written reports to all partners one week prior to each meeting. Each partner will be required to make a presentation on the achievements of the milestones, research tasks and technical deliveries during the appropriate reporting period.

A draft consortium agreement will be drawn up by the co-ordinator and following scrutiny, amendment and agreement, it will be signed by all partners at the start of the contract. Intellectual property rights will be addressed within this agreement in line with EU regulations. In order to provide RATZOOMAN with independent evaluation and to ensure that key stakeholders are informed of progress, technical experts and potential users of the outputs will be invited to participate in, or to provide inputs to, co-ordination meetings. The technical co-ordination of each

work package will be given to a single project partner, i.e. the lead work package co-ordinator. Participants involved in each work package will keep the package manager informed of progress through informal but scheduled reporting. The work package manager will inform the project co-ordinator about potential problems as they develop. Work package managers are responsible for technical aspects, while the co-ordinator will verify that planned project milestones and deliverables are achieved as scheduled.

Work package managers and the project co-ordinator will work together to ensure that research outputs from technical reports are drafted into manuscripts appropriate for publication in peer reviewed journals as deliverables are completed. Appropriate avenues for publicising research findings in the popular press and local newsletters will be the responsibility of all participants within their host countries with co-ordinator support. The internet will act as a central focus for dissemination of the project activities to inform the region of project progress, provide for exchange of information on rodent management, encourage collaboration and promote dissemination to other regions. This will be achieved via the IPM Europe website, the European Group for Integrated Pest Management in Development Cooperation which is a pan-European group that promotes a harmonised European approach to sustainable agriculture. It is co-funded by the Member States of the EU, and the EC.

Deliverables
D27 RATZOOMAN reporting delivered on time
D28 Atleast three publications in peer-reviewed journals submitted by end of project
D29 Atleast three articles published in the popular press and local newsletters by end of project

Milestones and expected results
Year 1
- Project inception workshop held. Detailed work plan established.
- First co-ordination meeting held.

Year 2
- Scientific Management Group meeting. Annual progress report and budget statement issued Dissemination outputs in peer-reviewed journals, public health newsletters and articles in popular press formulated.
- Second co-ordination meeting held.

Year 3
- Scientific Management Group meeting. Annual progress report and budget statement issued Dissemination outputs in peer-reviewed journals, public health newsletters and articles in popular press formulated.
- Third co-ordination meeting held.
- Final project workshop. Final reports and budget statements issued.

4. Role of Participants

EU Partners

Partner 1 (NRI)
Natural Resources Institute
University of Greenwich
United Kingdom

Partner 2 (DPIL)
Danish Pest Infestation Laboratory
Denmark

Partner 3 (KIT)
KIT Biomedical Research
Royal Tropical Institute
The Netherlands

Partner 4 (RUCA)
Department of Biology
University of Antwerp
Belgium

SADC Partners

Partner 5 (SPMC) formerly SUA
Pest Management Centre
Sokoine University of Agriculture
Tanzania

Partner 6 (INS)
National Institute of Health
Mozambique

Partner 7 (NHLS) formerly SAIMR
Bacterial Pathogens Unit
National Institute for Communicable Diseases
National Health Laboratory Service (formerly South African Institute for Medical Research)
South Africa

Partner 8 (SZ)
Syngenta/Zeneca
Zimbabwe

Partner I, The NRI will have overall responsibility for project management and co-ordination. This will include the preparation of documents mandating the responsibilities of each partner, disbursing funds to partners through a formalised system, collating financial returns and ensuring reports are accurately prepared to time and in line with INCO-DEV requirements. In addition to its co-ordination role, the NRI will provide technical inputs to WP 5 to 13, leading 5 of the 13 work packages. In both its co-ordination and technical role, the NRI will interact with all consortium partners.

Partner 2, The DPIL will use the expertise of its Mammal Department and involvement in rodent ecology research to lead WP 10. In its leadership role, interactions will be with partners 3, 5, 6, 7, and 8. There will be considerable collaboration with partners 1 and 5 in WP 9. Although not directly involved in WP 2, its synergy with partner 4 will ensure close co-ordination between ecological and taxonomic research.

Partner 3, The epidemiological expertise of KIT on leptospirosis and other zoonotics will lead WP 1 with significant inputs to WP 3, 4, 5 and 11. KIT will have strong interactions with partners 6 and 7, which together will provide the core epidemiological research on disease prevalence, ecology and transmission routes.

Partner 4, The RUCA will lead WP 2 and 4, interacting with DC partners to establish taxonomic reference collections in each DC, building their expertise in ecology and increasing the role of partner 5 to act as a regional centre in Africa for pest management research.

Partner 5, The SPMC will use its international reputation in pest ecology to lead WP 3 with significant contributions to all other work packages. The SPMC has strong ties to partners 2, 3 and 4, and its involvement in the proposed project will deepen its regional influence within the SADC through collaboration with other DC countries.

Partner 6, The INS will lead WP 8. Its national role for research on infectious diseases, zoonoses, and health improvement programmes will be strengthened through strong collaboration with partners 7 and 3. Its previous experience in using GIS for the study of landscape ecology and epidemiology of vector-borne diseases as methods for assessing public health vulnerability will position the INS to act as a regional centre for GIS expertise and strengthen this role through collaboration with partner 1.

Partner 7, The NHLS will use its existing role as a regional reference centre for zoonotic diseases to lead WP 12, providing significant inputs to WP 1 and 3 with involvement in nearly all other work packages. The NHLS will host the stakeholder workshop to take place near the end of the project,

strongly interacting with partners 5, 6 and 8. Its international and regional reputation will be strengthened through collaboration with partners 3 and 6.

Partner 8, The SZ provides a unique role to the project through its commercial involvement in the provision of health, sanitation and pest management research. This perspective will be crucial to the long-term sustainability of the project outputs, making the SZ most suited to lead WP 11. The expertise of SZ in commercial development research and its involvement in other work packages will assist the company to expand its existing services and products while increasing their ability to meet stakeholder requirements.

5. Training and exchanges of scientists

Training is an important part of the project, and it is expected that scientific exchanges will occur throughout the project. A scientist from partner 6 will spend time at partner 1 to learn about GIS tools software and analysis, and this will be used to increase capacity of partner 6 in this field. Similar exchanges regarding specific work packages are expected between partners 3, 6 and 7, partners 2, 4 and 5, partners 1 and 2 and partners 5, 6 and 8. Training will also be provided by partners 5 and 3 to other DC partners on standard methods of collecting ecological data. Partners 4, 5 and 6 will be engaging graduate students who will assist in project activities as part of their degree courses and thesis project work, which are specified under the relevant A7.2 forms.

6. Dissemination activities

Work package 11 specifically deals with the analysis and dissemination of policy issues affecting the prevention of sanitary risks linked to rodents. Current knowledge about the impacts of zoonotic disease upon sustainable livelihoods are so poor that the issue barely registers on the policy agenda in afflicted countries or among donor organisations. In the latter stages of RATZOOMAN, results will be analysed in terms of their implications for policy making. Drawing on appropriate outputs from other work packages, a discussion document will be produced which identifies key areas of interest in relation to the factors to be taken into account when deciding disease reduction strategies. The project will provide a summary document of the project findings for policy context relating to public health programmes.

Work package 12 will contribute towards widening the debate through a workshop to open up direct channels of communication with those directly involved in health care provision. The workshop will also allow other issues affecting public health to be put in context allowing rational debate to occur on the priorities of countries facing a barrage of livelihood issues and constraints. It is envisaged that the workshop will increase the attention given to zoonotic disease through providing, for the first time, research showing the impacts of zoonotic disease and offering tools which can help cost-effectively reduce the risks of zoonotic disease transmission.

Within WP 13 (and an element of all work packages), dissemination of knowledge through the internet, peer reviewed journals and the popular press will promote further understanding about zoonotic disease and its control. Clearly identified gaps in scientific knowledge will allow targetted studies to continue which could help further reduce sanitary risks from zoonosis.

By the end of the project, a number of tools will exist for understanding and reducing the impact of zoonotic disease. Predictive and simulation modelling tools can provide invaluable support to rural/urban planning, health provision and pest management programmes. Such tools are of potential commercial interest as well as to humanitarian organisations and government departments involved in improving sustainable livelihoods. Models will be available to consortium partners, that with further development, could be of value in a number of situations and regions where the threats of zoonotic disease are increasing. Equipment based at partner 6 for remote sensing and analysis of landscape ecology and epidemiology of vector-borne diseases will assist in the formation of a regional GIS centre for assessing public health risks from zoonosis and infectious diseases. The creation and strengthening of regional centres of expertise provides scientific staff with the knowledge, expertise and incentives to attract further external funding for research.

Concluding remarks

NRI (partner 1) has a long history of co-ordinating various complex projects with several partners. This includes a number of EU-supported projects within the various programme frameworks. Apart from its activity in international research, NRI is also involved in the planning, implementation and evaluation of projects and programmes. Thus partner 1 is well placed to plan and co-ordinate research activities that are geared towards extension and implementation. The partners are aware that strict management of this project will be essential for successful completion of the proposed work programmes. Many of the research partners have previous experience of working with each other. All have been chosen for their proven research record in epidemiology and ecological research. Their ability to deliver results and reports to strict deadlines has been taken into account.

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In order to provide RATZOOMAN with independent evaluation and to ensure that key stakeholders are informed of progress, technical experts and potential users of the outputs will be invited to participate in, or to provide inputs to, co-ordination meetings. The technical co-ordination of each work package will be given to a single project partner, i.e. the lead work package co-ordinator. Participants involved in each work package will keep the package manager informed of progress through informal but scheduled reporting. The work package manager will inform the project co-ordinator about potential problems as they develop. Work package managers are responsible for technical aspects, while the co-ordinator will verify that planned project milestones and deliverables are achieved as scheduled.