Modelling and scenarios of biodiversity-2013

Acronym	**CERISE**	Earlier proposal	
Coordinator	GRANJON, Laurent	Affiliation	IRD
English title	SCEnarios of Rodent Invasion in the SahEl: Global change impact on the expansion of the Nigerian Gerbil and the House Mouse in Senegal		
French title	Scénarios d'invasion de rongeurs au Sahel : Impact des changements globaux sur l'expansion de la gerbille nigerianne et la souris domestique au Sénégal		
Project duration (in months)	36	Submission date	2013-06-20

Type of ecosystems studied:
Ecosystème terrestre de la zone sahélienne, incluant habitats d'extérieur et d'intérieur (domestique)

Disciplines / fields of expertise of the participants involved:
Développement rural (KB, BB, AT, SAB, AS)
Ecologie et biologie des rongeurs (KB, CB AD, JMD, LG, AN, MT)
Socio-anthopologie(ON, JL, FD)
Gestion de la faune (SAB, AS)
Modélisation (KK, JLF, SP)

Geographical focus countries and regions (territories, areas, seas) concerned:
La moitié nord du Sénégal, correspondent à la zone bioclimatique sahélienne, en particulier la Vallée du fleuve Sénégal et la région agro-pastorale du Ferlo

Project summary:
The House Mouse (Mus musculus) and the Nigerian Gerbil (Gerbillus nigeriae) are two invasive rodent species in Senegal. The commensal M. musculus has recently spread from West to East following the development of urbanization, infrastructures and transportations. Gerbillus nigeriae, an outdoor species present in N. Senegal since the 90's, is progressing southwards thanks to global changes, becoming the dominant species in rodent communities of the Senegalese Sahel. Both species are confirmed pests as potential vectors of pathogens and predators of stored foodstuffs/crops.

The multidisciplinary project here proposed aims at elucidating the causes and modalities of range expansion of these species in Senegal, in relation to man-induced (for M. musculus) and climatic/environmental (for G. nigeriae) changes experienced by the Sahelian area considered.

Based on data already available from recently invaded areas, we will develop and use a simulation model to analyze the modalities of invasion of these species in Senegal. In particular, we will produce scenarios of evolution of (native and invasive) small mammal diversity in relation to human and environmental factors. We will then test the validity of these scenarios by collecting original data in areas identified as highly likely to experience invasion. Based on these data and projections, information will be forwarded to local populations and counterparts, regarding rodent

identification and monitoring, as well as damage control.

Project summary:

La souris domestique (Mus musculus) et la gerbille nigerianne (Gerbillus nigeriae) sont 2 espèces de rongeurs invasives au Sénégal. M. musculus, commensale, a progressé récemment d'ouest en est en suivant le réseau des agglomérations, infrastructures et transports en développement. Gerbillus nigeriae, espèce non commensale apparue au nord du pays dans les années 90, progresse en nappe vers le sud avec l'aridification du climat, devenant l'espèce dominante des communautés de rongeurs locales. Ces espèces sont nuisibles en tant que vecteurs potentiels de pathogènes, déprédateurs des denrées stockées et des cultures.

La recherche pluridisciplinaire proposée vise à expliciter les causes et modalités de l'expansion de ces espèces, en relation avec les composantes anthropiques (pour M. musculus) et environnementales (pour G. nigeriae) des changements globaux affectant le Sahel.

Sur la base de données acquises en zone envahie, nous mettrons en œuvre un modèle de simulation pour analyser les modalités d'invasion de ces espèces au Sénégal. Des scénarios d'évolution de la diversité de petits mammifères (natifs et invasifs) en relation avec les facteurs humains et environnementaux seront élaborés. La validité des scénarios et modèles sera testée par la collecte de données originales en zones à haut risque d'invasion. Un retour d'information visera alors à sensibiliser les acteurs concernés à l'identification des espèces, au contrôle de leurs populations et à l'atténuation de leurs dégâts.

Indicate how you first heard about this call for proposals:

Par alertes électroniques (FRB, IRD...)

3.   Project description for non-research audience (IN FRENCH).

Les effets de la mondialisation combinés à ceux liés aux changements globaux ont entraîné une multiplication des cas d'espèces invasives à l'échelle de la planète. Les conséquences associées à ces invasions biologiques sont multiples, et touchent des domaines variés. En plus de leurs impacts biologiques, environnementaux et sanitaires (Mooney & Cleland 2001, Clavero & Garcia-Berthou 2005, Pyšek & Richardson 2010), les espèces invasives entraînent des pertes économiques dont les estimations atteignent des valeurs extrêmement élevées (Olson, 2006). Quatre espèces de rongeurs sont parmi les 100 « pires espèces invasives » de la planète (Lowe et al. 2000). La souris domestique (*Mus musculus*) est l'une d'entre elles. Les dégâts économiques associés à cette espèce ne sont pas chiffrés en Afrique mais elle est une des deux principales espèces nuisibles en zone rurale aux Etats-Unis (Pimentel et al. 2005), et elle provoque des dégâts important lors de ses phases de pullulation en Australie (Singleton et al. 2005). En Afrique sahélienne, la gerbille nigérianne (*Gerbillus nigeriae*) est sans conteste l'un des principaux déprédateurs des cultures sèches (Hima 2010). Ces deux espèces sont en pleine expansion au Sénégal, comme le montrent les données recueillies ces 5 dernières années dans la moitié nord du pays. La souris domestique, espèce commensale, progresse d'ouest en est le long de la Vallée du fleuve Sénégal et dans la région du Ferlo (K. Bâ, C. Brouat, A. Dalecky et coll., données non publiées). Cette expansion en réseau apparaît liée au développement des voies de communication, à l'essor démographique des villes et villages et/ou à l'installation des marchés hebdomadaires dans ces régions. La gerbille nigerianne, apparue dans le nord du pays il y a une vingtaine d'années (Bâ et al. 2006) a, elle, progressé en nappe vers le sud pour occuper aujourd'hui l'ensemble du Ferlo jusqu'à moins de 15° de latitude nord (K. Bâ, M. Thiam et coll., données non publiées). Elle y est devenue une des espèces dominantes des communautés de rongeurs des habitats naturels et agricoles en bénéficiant *a priori* des effets de la péjoration climatique de ces dernières décennies (Lebel et Ali 2009), ainsi que de la dégradation et l'anthropisation des habitats (Miehe et al. 2010) dans cette région.

La compréhension et le contrôle de la progression de ces espèces de rongeurs nuisibles sont donc primordiaux en vue de l'atténuation de leurs dégâts aux infrastructures, aux denrées stockées et aux cultures. Ces questions sont d'autant plus cruciales dans le contexte sahélien que cet espace (et de façon générale les zones sèches), est considéré comme particulièrement exposé aux conséquences des changements globaux (van der Geest & Dietz 2004). A travers une collaboration entre des équipes de l'Institut de Recherche pour le Développement (IRD), l'Université Cheikh Anta Diop de Dakar (UCAD), de la Direction des Eaux et Forêts, Chasses et de la Conservation des Sols (DEFCCS) du Ministère de l'Environnement et du Développement Durable du Sénégal et de l'association de développement villageois ADEMBA, ce projet vise, via la mise en place et en œuvre de modèles d'expansion des deux espèces mentionnées ci-dessus, à répondre aux questions suivantes :

- o Quels sont les principaux facteurs responsables de l'invasion des 2 espèces à l'écologie et à l'histoire biogéographique contrastées au Sénégal ?

- o Quelles sont les aires géographiques susceptibles d'être envahies dans un futur proche ?

L'étude des conséquences observées et attendues de ces invasions sur les communautés de rongeurs « natives » représentera une question connexe, quoique non centrale dans ce projet. L'approche utilisée intègrera à la fois des connaissances bio-

écologiques (caractéristiques des espèces et dynamique des populations de rongeurs), socio-anthopologiques (développement urbain et des moyens de communication, structure de l'habitat humain), environnementales (climat, végétation) et agronomiques (utilisation des terres) dans les facteurs potentiellement explicatifs de l'expansion des espèces-cibles. Basés sur des données d'occurrence des rongeurs concernés en cours d'acquisition dans le cadre d'autres programmes, les modèles mis en œuvre viseront en particulier à faire des prévisions spatialisées sur les risques d'invasion des zones urbaines, anthropisées et naturelles de la moitié nord du Sénégal par ces espèces. Une validation-terrain de ces projections sera effectuée en aval, afin de tester les sorties des modèles et confirmer leur pertinence. Cette approche permettra d'agir en amont de l'invasion, en mettant en place des mécanismes de surveillance basés sur la diffusion d'informations spécifiques sur les espèces de rongeurs et leurs dégâts potentiels. Les aspects innovants de ce projet résident dans *i)* la mise en œuvre simultanée d'outils de modélisation différents en vue de la production de scénarios d'expansion d'espèces invasives ; *ii)* l'aspect comparatif de la démarche, menée sur des espèces à histoire évolutive, histoire d'invasion et écologie contrastées (une espèce cosmopolite commensale *vs.* une espèce africaine d'extérieur), le tout sur un terroir commun. Les résultats attendus sont donc de nature à rendre compte d'un ensemble de situations possibles dans le contexte de la zone sahélienne africaine dans un premier temps, avec *in fine* des extrapolations possibles à d'autres situations.

Le retour d'information et la mise en place de cette « veille d'invasion » seront assurés par des acteurs institutionnels (Direction des Eaux et Forêts du Sénégal) et associatifs (Association ADEMBA) locaux, via un certain nombre d'opérations incluant des séminaires d'information (dans les zones d'invasion actuelle et future), la distribution de fascicules de présentation des espèces et des moyens de leur capture et leur identification, et la formation aux méthodes de lutte et de contrôle des populations de rongeurs.

4. Detailed project description (3576 words + illustrations).

- Context of the proposal, problem statement of what is to be done and why it is important; state of the art and links with other projects and programmes

The worldwide intensification of human-associated exchanges is making previous biogeographical barriers meaningless in term of living organism dispersion, which favors the multiplication of invasion processes at various geographical scales (Searle 2008). As a result, invasive species are nowadays of major concern in current biological sciences. They are identified as having a significant impact on evolutionary processes (Mooney & Cleland 2001), represent a major threat to biodiversity (Clavero & Garcia-Berthou 2005), and are also likely to entail new sanitary and health problems (Pyšek & Richardson, 2010). One hundred of these invasive species have been listed as the "World's Worst Invasive Alien Species" (Lowe et al. 2000). The House Mouse, *Mus musculus* is part of this list. This species has been introduced in most parts of the World thanks to human movements and settlements, and it is generally considered as a serious pest species (see for instance Pimentel et al. 2005 for the USA, Singleton et al. 2005 for Australia). Besides, and at a more regional scale, some other rodent species are currently enlarging their geographical distribution range thanks to global change consequences. They become invasive in areas where they were formerly unknown, with, again, various potential impacts on native communities and human activities. In Senegal this is the case of at least five xeric rodent species (Duplantier et al. 1991, Bâ et al 2006, A. Ndiaye et al., unpubl.) since the beginning of the last severe Sahelian drought (1972). The most recent of these invaders, which is also a major pest species, is the Nigerian Gerbil *Gerbillus nigeriae*, a Sahelian species which has only recently colonized Senegal (Bâ et al. 2006).

These two species, *Mus musculus* and *Gerbillus nigeriae*, represent adequate model species for the study of invasion processes and their consequences. Both are experiencing a

significant expansion range in Senegal over a well circumscribed space, each characterized with distinct processes, patterns and effects. The House Mouse is well known for the damages it may cause to infrastructures and stored foodstuffs, and the Nigerian Gerbil is considered as a major predator of dry crops, especially millet which represents one of the key-crops of Sahelian Africa (Nomao 2002, Hima 2010). The control of their populations is thus of prime importance in the Sahel, a region suffering from chronic food shortage related with rainfall deficit (Lebel & Ali 2009) and habitat degradation (Miehe et al. 2010), therefore considered as especially vulnerable to global changes consequences (van der Geest & Dietz 2004). This control has to be based on accurate information concerning the target species distribution and population trends, but also the other species present in local communities. For these purposes, data are being gathered for a few years now on *M. musculus*, *G. nigeriae* and the other small mammal species with which they co-occur in Northern Senegal. This enables a thorough documentation of the current expansion of these two species in the country, as well as the associated changes in native small mammal communities.

As for *Mus musculus*, both Duplantier et al. (1997) and Happold (2013) figured the distribution of the species in Senegal as restricted to the westernmost part of the country. Standardized data on House Mouse and other commensal small mammal species distribution in Northern Senegal are collected since November 2011 in the frame of an ANR-funded program "ENEMI"[1]. They reveal that *Mus musculus* has become the dominant species in most of the localities sampled (Fig.1). Another source of information is the Sahelo-Sudanian Rodent Database which compiles information accumulated from the beginning of the 20th century up to present time (http://simmasto.org/GetInfo.html?id=024). Comparing the two sources of information also shows that the House Mouse has progressed significantly towards the East during the very last years along two major axes: the Senegal River Valley, and the Ferlo central road. There, it has partially ruled out the native species and especially *Mastomys erythroleucus* which used to be the main commensal species in this part of the country (Duplantier et al. 1997). Along these axes, the House Mouse benefited from the increase of human activities and movements, illustrated by the demographic growth and the establishment of weekly markets in a number of villages, and by the development of associated infrastructures (road surfacing, building construction…). As a strictly commensal species in this part of the World, the House Mouse expansion thus follows a human-mediated network where its dispersal is associated with Man and goods transportation.
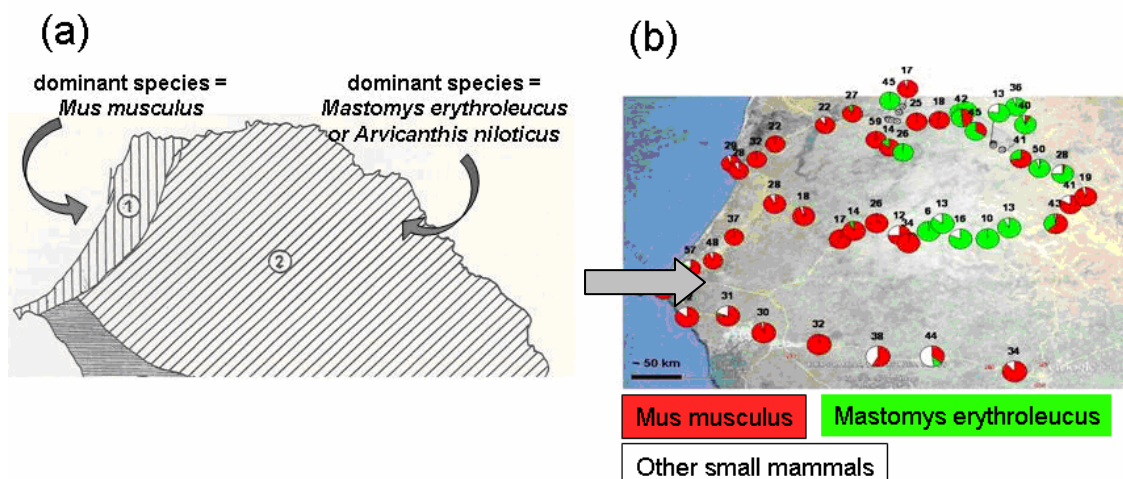

Fig.1: (a) former (modified from Duplantier et al. 1997) and (b) current (Dalecky et al. unpubl.) distribution of *Mus musculus* and native commensal rodents in N. Senegal.

Data on *Gerbillus nigeriae* in Northern Senegal are being gathered since the first evidence of the species in the country, at the end of the 90's (Bâ et al. 2006). The species was then recorded from Richard-Toll, at the border between Senegal and Mauritania, where it was supposed to come from. Later, Thiam et al. (2008) showed the species to be present along the Linguere – Louga road in 2003, i.e. ca. 100km south of the Mauritania-Senegal border. In Barn Owl's pellets collected between 2003 and 2006, the Nigerian gerbil was found as the main prey species as far south as 15°N (Fig. 2). More recently, thanks to various projects funded by the CNRS program "Observatoire Homme-Milieu de Tessekere" (coord. M. Thiam), the species has proved to become one of the dominant species of the rodent communities in the Ferlo area (Thiam et al. 2012), and to be present in fair numbers between 14°30'N and 15°N in various localities (Tal-Tal, Tiel, Velingara-Ferlo, M. Thiam & K. Bâ, unpubl. data).
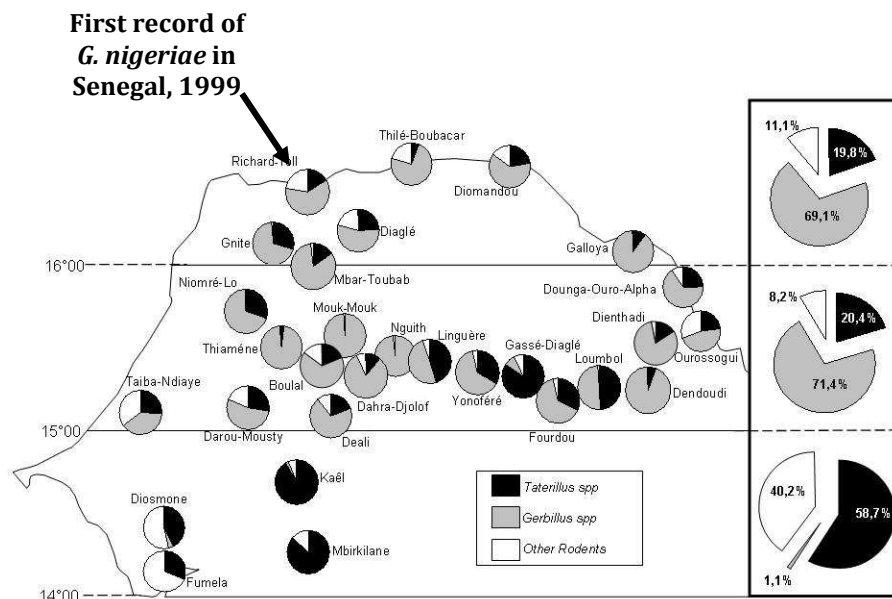

Fig.2 – Proportion of the main 2 genera of rodents of the Gerbillinae subfamilly, *Gerbillus* and *Taterillus*, in samples of Barn Owl's pellets collected in 2003 - 2006, in various localities of N. Senegal (Thiam et al. 2008 and unpubl. data)

Interpreted as the result of the establishment of arid conditions due to the aridification of the Sahel following rainfall shortage of the 70's and 80's (Bâ et al. 2006, Thiam et al. 2008), the initial colonization of the founder populations have clearly been followed by population increase in what appear as environmentally favorable areas for *G. nigeriae*. Indeed, the physiological and behavioral adaptations of *G. nigeriae* to the new Sahelian eco-climatic conditions were considered by Thiam et al. (2011) as prominent in this success. Moreover, it has to be underlined that this spectacular southward progression can here only be linked with natural dispersal, as the species is an exclusive outdoor one. At the community level, the successful installation of *G. nigeriae* in the Sahelian area of Senegal has been accompanied by a decrease of abundance of the native species of the Gerbillinae subfamily, namely those of the genus *Taterillus* (*T. gracilis* and *T. pygargus*; Thiam et al. 2011; Fig.2).

Our project thus appears tightly linked with the current ENEMI[1] project (2011→2015) project, and the recent OHM-Tessekere projects (2010, 2011, 2013) that focus on the same geographic area, and in which *Mus musculus* and *Gerbillus nigeriae*, respectively, are among the main species under focus. It will also benefit from the current development of model-based analyses of the invasion by another rodent species, namely the Black Rat *Rattus*

rattus, of Southeastern Senegal and nearby Western Mali, implemented within the ANR funded program CHANCIRA[2]. It also falls within the fields of interest of the SREC[3] pluridisciplinary regional platform created and funded by the IRD, and to which the IRD participants of the present project are affiliated.

- Objectives, in relation with the themes and criteria of the call, and working hypotheses

Based on this information, the objectives of the present project are:

- To develop models of the expansion of *Mus musculus* and *Gerbillus nigeriae* in Northern Senegal. Using occurrence data gathered along the years and showing the current trend of geographic expansion of the two target species, these spatially explicit models will use *i)* for *M. musculus*, data on urban and infrastructure development (see next part for details); *ii)* for *G. nigeriae*, climatic and environmental data (see next part for details)

- To elaborate predictions on the forthcoming expansion range of both *M. musculus* and *G. gerbillus* at several temporal horizons.

- To realize a field validation of the models projections in areas not invaded today but likely to become invaded in the mid-term

- To implement a composite information scheme directed toward the local populations and stakeholders. The principal aims of this action will be to *i)* disseminate knowledge about the species under concern, their characteristics and the potential damages they may cause where they are / will become installed, and *ii)* train local actors to control the rodent populations and mitigate their potential negative effects.

- Description of methods and proposed activities

The project will develop in 4 steps:

1- The first one will consist in **gathering information** in two distinct fields:

❖ Rodent data: Data on the occurrence of the two target species and the other species of small mammals (mainly rodents) co-occurring with them will be collated for the last 50 years, at the scale of the whole Northern half Senegal (i.e. North of 14°N). During this time frame, trapping campaigns have regularly been performed by various research teams and successive programs in Senegal. Most of this information has already been compiled in the "Sahelo-Sudanian Rodent Database" (Duplantier et al. 2009). This information will represent the basic source of knowledge to document the spatio-temporal progression of both *Mus musculus* and *Gerbillus nigeriae* in Senegal over recent years, and the concomitant evolution in presence/abundance of co-occurring (native) small mammal species.

❖ Environmental (*sensu lato*) data: Within the same area and the same time frame as for rodent data, a number of environmental parameters and variables will be gathered. In relation with the House Mouse distribution, information on human settlements (villages, cities), trade routes and intensity, communications and traffic… will be collected, corresponding to different periods of the time window considered (every 10 years for instance). Associated with Nigerian Gerbil data, information on climate, vegetation cover and land use changes will be gathered with the same decadal periodicity, whenever possible. These environmental data will be used as models variables to try understand which of them are the most meaningful in the explanation of rodent expansion in Northern Senegal. Multivariate analyses will be used to build a typology of the environment on the basis of

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[2] Project ANR-11-CEPL-010: CHANgements environnementaux, CIrculation de biens et de personnes : de l'invasion de réservoirs à l'apparition d'anthropozoonoses. le cas du RAt noir dans l'espace sénégalo-malien. 2012-2014, Coord. P.Handschumacher.

[3] PPR-SREC : Plateforme Pluridisciplinaire Régionale - Sociétés Rurales, Environnement et Climat en Afrique de l'Ouest" – Institut de Recherche pour le Développement

statistical individuals corresponding to the selected elementary mesh. The relations between these various environmental types and the characteristics of presence/absence of the concerned species at different space-time steps will be defined starting from the observation. The dynamics of the processes of invasion in the future will then be considered according to scenarios of environment evolution. Logistic regressions, ANOVAs and alternative statistics will be used. A spatialized database will be built using the ArcGis software which will make it possible to incorporate the diagnosed and considered changes.

2-   The second step will consist in **model development and implementation**:

Two modeling approaches, namely correlative/statistical and mechanistic, viz. computer simulations, will be explored to translate the knowledge gathered during the project into projections building. These approaches will be jointly developed and compared so as to permit a mutual enrichment of the respective models.

The computer simulation models will use an individual based formalism (Ferber 1999, De Angelis & Mooij 2005) of the "mechanistically rich" model type (De Angelis & Mooij 2003) that encompass the multi-factorial processes into spatially realistic dynamics. Moreover, the approach will follow the pattern oriented approach (Grimm et al. 2005), a rigorous method where individualized processes scale into global observable pattern of the phenomena under concern, viz. the mutual effect of natural and anthropogenic drives. This approach has been already successfully applied in another context to both socio-economic (Le Fur 2005) and bio-ecological (Le Fur & Simon 2009) questions. Within this scheme, rodents' population will be formalized at the individual level. Demographic, behavioral and ecological processes will be considered to express the population dynamics *per se*. Upon this description, the anthropogenic and natural context within which the simulated populations are embedded will be formalized and related to.

As previously mentioned, the House Mouse and Gerbil have distinct means of dispersion and these will be considered in separate specific modeling approaches: The House Mouse spreads using human transportation whereas Gerbil population develops in layer. The first species dynamics will be formalized using a model of human transportation evolution within the Senegal roads and tracks. Modeling this complex process will benefit from the formal framework currently developed in the Chancira[2] project to study the Black Rat population spread in Senegal. It will be adapted to the House Mouse based on expertise of the project scientists and experts. Conversely, Gerbil spread will be formalized as constrained by the bio-climatic dynamics description of the study area and the dependency of this species to changes in these environmental constraints. This last approach will be specifically developed within the project. Both models will finally join by mean of a shared set of output indicators. These indicators will encompass the rodents' dynamics as well as their effect on human activity (threats on crops, stored food, infrastructure, health…). The indicator set will be jointly established by the projects participants, following tested approaches (Rey et al. 2007), so as to properly describe the fate and effect of the target species colonization. Knowledge used to formalize both models will cover the past 20 years. Accordingly, the temporal horizon selected for projections will be decennial, i.e. from 10 to 20 years in the future.

The second approach is based on statistical modeling of rodents' occurrence data using site occupancy models (MacKenzie et al. 2003). The recent extension of occupancy models, incorporating a component accounting for spatial autocorrelation allows for the modeling of a contagious-type process, such as in the case of the expansion of invasive species (Bled et al. 2010, Yackulic et al. 2012). This approach aims at estimating probabilities of local colonization and persistence and testing the relative impacts of anthropogenic and climatic factors on the spatial and temporal variation of these probabilities (MacKenzie 2003). The factors tested will be quantified and incorporated into the models as a set of predictors and probabilities of local colonization and persistence. These will be modeled as a function of the different predictors. Model selection using Akaike Information Criterion (Akaike 1974) will be performed to compare and select the factors involved in the colonization process. Finally, the

estimated parameters describing the relationship between the species dynamics and the selected factors will be used to build predictive models. These will be used to predict the future range expansion under different scenarios of climatic and anthropogenic conditions.

The models validation will take three forms. Expert criticism of the dynamics simulated, confrontation of the model indicators outputs to field reality, and sensitivity analysis of the model outputs to its parameters. The use of the models will be of the type "what if…?" where various factors and environmental drives will be modified through formalized scenarios and their effect investigated.

3- The third step will consist in **field-checking the model outputs and scenarios**. The areas recently colonized and likely to become colonized by both *Mus musculus* and *Gerbillus nigeriae* will be visited, and control trapping will be performed according to standard procedures: Inside villages/cities (for *Mus musculus* and coexisting commensal small mammals), traps will be set inside houses (two traps per room: one Sherman and one wire-meshed) for 2-3 nights, for an overall trapping effort of >200 trapnights. Outdoor trapping (for *Gerbillus nigeriae* and associated species) will be conducted according to trap.lines run in various habitats, as in Thiam et al. (2012). Barn owl pellets will also be collected, as they are likely to bring additional information on local small mammal communities (Granjon & Traoré 2007, Thiam et al. 2008). As far as possible, sites (villages or outdoor locations) that have already been sampled in recent years will be chosen, to check for i) recent evolution in the respective importance of the invasive species and coexisting native ones in formerly colonized areas (comparisons of the relative abundances of the different species, and of their spatial distribution / habitat preference), and ii) recent arrival of invasive species in areas that were not formerly colonized. Biological samples will be taken from the rodents caught in this phase that will be used in various genetic analyses aimed at characterizing these invasive species colonizing propagules. In *G. nigeriae*, cytogenetic analyses will also be conducted on a selected sample of specimens, to go on with the documentation of chromosomal polymorphism in this species (Hima et al. 2011).

4- The fourth step, **information and training** will be engaged from the beginning of the project and will be dedicated to the dissemination of the knowledge gathered. This will mainly regard *i)* the rodents communities present in the study area, their current evolution in terms of specific composition, overall abundance and spatial characteristics; *ii)* the interactions between rodents and human activities, with special emphasis on potential damages to crops, stored stuff and infrastructure on the one hand, and sanitary / health problems to cattle or Man on the other hand; *iii)* the methods to control rodent populations. Part of this information is already available (see Granjon & Duplantier 2009 and references therein), and it will be completed *in situ* during step 3 of the present project. The regular presence of research teams involved in rodent-oriented research in the target area over the last years (see above), as well as the implication of partners (DEFCCS, Ademba) well installed in the rural and urban community network of this part of Senegal will maximize the efficacy of these actions. Local agents of the DEFCCS and members of the Ademba association, with the help of academic scientific participants of the project, will serve as go-between who will disseminate the information obtained in an easy-to-understand and practical way within local communities. Various documentary media (posters, brochures…) as well as local conferences (including in schools) will be specifically elaborated to reach the maximum amount of people. Training of previously identified people from a sample of villages and rural communities will be performed, with as main objectives the acquisition of expertise in the capture and identification of the main rodent species, and the learning of knowledge and techniques on how to check and control rodent population in an environment-friendly manner (see for instance Taylor et al. 2012).

- Anticipated results and benefits

The data gathered during the project will enable to build a complete database covering the Northern half of Senegal and comprising detailed information on indoor and outdoor rodent

distribution (i.e. biological information, with special focus on the invasive species *Mus musculus* and *Gerbillus nigeriae*), as well as data pertaining to a number of different fields (i.e. environmental information) likely to play a role in the observed invasive processes.

The expected outcome of the models is an insight on what and how factors driving the two rodent species will impact the future of invasion processes in Senegal area. From there, the scenarios produced as result of the modeling phase will serve as tools for anticipating possible outcomes of the processes at work in rodent communities of Northern Senegal, under the current trends of global changes. The field-checking operations planned to test the scenarios produced will serve as a validation step of the best models implemented, and enable an update of the invasion situation. At this stage, precise maps of distribution range of the two target species (but also of the co-existing ones) will be produced, based on contemporary data. Moreover, thanks to the interdisciplinary approach of this project, we will be able to identify the determinants leading to the transformation of spaces in a direction favoring the spread of the invasive species. After this diagnosis step, operational proposals will possibly be made to mitigate the negative impacts of these invasions, in relation with the actors involved in these diffusion processes.

In this last respect, one expected outcome of the communication step is to establish a two-way relationship between research and all the components of the sector, so as to go on with the acquisition and transfer of useable knowledge after the project completion.

- Method for involvement of stakeholders, dissemination strategy for results, tools and perspectives for policy and practice (be specific!)

Transferring scientific knowledge in developing countries is a complex question (Le Fur 2007) involving multiple stakeholders, types of media and communication channels dedicated to various type of information (data, knowledge, expertise, recommendations). Indeed, the scope of the project implies accounting for a diversity of stakeholders, ranging from farmers or village dwellers to NGO and government institutions. One key point in transferring acquired knowledge is to adapt to this diverse set of beneficiaries. Accordingly, the project aims to develop a set of specific media to enable access to the knowledge acquired. Given the size and duration of the project two principal directions will be considered. The first one is dedicated to local populations, the other targets the institutions and policy makers. The general communication scheme will be organized in two related steps. The first step will consist in stepwise collating of available and acquired knowledge during all the duration of the project. One characteristic of this knowledge is the diverse forms into which it is expressed: biological data, socio-economic information, model output or qualitative expertise. A specific information system dedicated to this multi-disciplinary, multi-formal context has been already developed (Le Fur & Fofana 2002) and formerly applied to several other fields of knowledge (see http://www.mpl.ird.fr/ci/). It will be used during the whole duration of the project to compile and articulate in one unique system the multi-disciplinary nature of the knowledge acquired. The information collected will be then formatted on several media and communicated using several channels in order to reach the different types of populations (see 'deliverables relevant for stakeholders' below).

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6. Timetable of activities (Gantt chart or similar presentation)

	year 1												year 2												year 3											
months	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	36
Database completion (step 1)																																				
Rodent data gathering	1	1	1	1	1	1	1	1	1																											
Environnmental data gathering	1	1	1	1	1	1	1	1	1																											
Cross-analysis of rodent/environment data							1	1	1	1																										
Common database building							1	1	1	1	1	1																								
Model development (step 2)																																				
Transportation model (A) adaptation				1	1	1	1	1	1	1	1	1																								
Sensitivity analysis of model A													1	1	1	1																				
Development of diffusion model (B)							1	1	1	1	1	1				1	1	1	1																	
Sensitivity analysis of model B												1	1	1						1	1	1														
Input data formatting models A & B		1	1	1							1	1				1	1	1																		
Scenario definition models A & B													1	1						1	1	1	1	1												
Projections models A & B																1									1	1	1			1	1	1	1			
Implementation of statistical model (C)													1	1	1																					
Exploration of model C															1	1																				
Communication & publication																1		1													1			1	1	1
Field validation of models (step 3)																																				
Model-based choice of areas to sample																						1	1	1												
Logistic preparation of field sessions																						1	1	1												
House Mouse-focused field sessions (villages)																									1		1		1		1		1			
Gerbil-focused field sessions (outdoor)																										1		1		1		1		1		
Model validation based on field data																									1	1	1	1	1	1	1	1	1	1	1	1
Communication and transfer (step 4)																																				
Information system (IS) software adaptation			1	1	1	1	1																													
IS procedural organization							1	1																												
IS incremental feeding								1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Information retrieving and media formatting														1	1					1	1	1	1	1												
Building itinerant exhibition / other media																									1	1	1	1	1	1						
Communication with stakeholders							1	1	1										1	1					1			1			1					1

7. List of scientific deliverables and expected date of completion

The first scientific product of this project will be a database gathering all the information needed for the following steps. It will include, for all geo-referenced sites in which data are and will become available, information on small mammal presence and abundance (as expressed by number of captures weighted by sampling effort), and information on environmental *sensu lato* variables (i.e. taking into account that human-related data are here considered as part of the environmental context in which rodent populations evolve). This database will be built within the first year of the project. Its "small mammal" component will heavily rely on data currently accumulated in the "Sahelo-Sudanian Rodent DataBase" (BDRSS, Duplantier et al. 2009).

This database will be the primary source of knowledge on which modeling activities will take place. Model construction will start as soon as possible within the first year of the project, and model implementation using the information compiled in the project database will represent the main task of the second year of the project. From there, the scenarios of House Mouse and Nigerian Gerbil expansion in Northern Senegal should be produced by the end of the 2nd year of the project.

Field validation of the models outputs will then start, mainly based on rodent sampling in areas of predicted colonization by the two rodent invasive species. This step will be performed during the 3rd year of the project. A number of field trips will be planned for that purpose, during which both the trapping operations and the exchange and dissemination of information, experience and good practice can be conducted (see part 8 hereunder).

The project will be the occasion to involve students of various levels. These will be mainly be from the University Cheikh Anta Diop, Dakar. Master 2 students of the scientific department "Mathématique et Informatique" and "Biologie Animale", both involved in the project, will be given practical subjects in the frame of their final training session.

During the last year of the project, scientific papers will be prepared for submission in high-standard journals, and oral communications to ad hoc symposiums and conference will also be scheduled.

8. List of deliverables relevant for stakeholders

- Identify the application and the target(s), i.e. the stakeholder(s)/policy-makers

The main institutional stakeholder partner is the "Directions des Eaux et Forêts, Chasses et de la Conservation des Sols" (hereafter DEF). Their agents will be involved in the field steps 3 and 4 of the projects, namely "field-checking the model outputs and scenarios" and "information and training". This step will rely heavily on the network of DEF squads present in various localities of Northern Senegal (as for instance Ross-Bethio, Ranerou, Bambey…), the members of which will participate to various field sessions planned during year 3 of the project. Members of the ADEMBA will play the same role, especially as far as commensal rodent sampling and information dissemination is concerned, in the Senegal River Valley region where the association is installed, but also in the Ferlo region where its members used to work at various occasions (see CV's). Locally, we will identify members of rural community and village councils who may serve, on a voluntary basis, as go-between for information transfer to local population.

- Explain how the deliverables will be transferred to them

As previously described, two major communication channels will be considered within the project with dedicated popularization media dedicated to each type of stakeholders:

1- An interactive CD-ROM and/or brochure (following the advices of the addressee) giving access to the information gathered to the institutional policy makers and established NGOs as well as identified local actors involved in urban and rural management in all the localities surveyed.

2- An all-terrain itinerant exhibition including information and training directed towards local populations and actors. The exhibition will be practically constructed following previous experience of the project's participants (see Le Fur, 2004, p.32-33). The sessions will be particularly organized in those localities where DEF squads are installed. Training sessions will be organized locally by the IRD and UCAD biologists of the project, to teach DEF agents and local (communal) actors on rodent knowledge (determination, capture, control). During these sessions, batches of locally-made traps will be made available to local communities in view of regular or opportunistic trapping sessions.

The popularization media will concern the rodent species involved, their distribution range and habitat requirements, and the methods available for controlling their populations and mitigating their damages. These media will be formatted thanks to a communication expert engaged for this purpose in the project under the supervision of the ADEMBA NGO in order to best conform to the cultural and specific nature of the stakeholders targeted. The expert will closely connect to the various project participants so as to best fit the resulting media to the project development and outcomes.

Doing so, we hope to implement a network of actors able to monitor, and hopefully control, the invasion process of the rodent species here concerned, in relation with DEF agents and academic researchers installed in Senegal.

9.   Consortium description

Overall description:

Number of partners (institutions) involved: **6**

Research partners: **4**   Non-academic partners: **2**

Financial coordination by: **UMR 22 IRD - CBGP (PARTNER 1)**

List of academic partner institutions

- **PARTNER 1 : UMR 22 IRD – Centre de Biologie pour la Gestion des Populations (CBGP)**

Team leader: Laurent GRANJON

Other participants: Carine BROUAT, Ambroise DALECKY, Jean-Marc DUPLANTIER, Jean LE FUR, Post-Doc (France, 6 months), Post-Doc (Senegal, 6 months).

Note that Pascal HANDSCHUMACHER (Researcher, IRD, UMR SESSTIM) and Heloïse LUCACCIONI (PhD), both engaged in the ANR-CEPS-funded CHANCIRA project, will punctually bring their expertise on geographical and socio-anthropological aspects (step 1).

Requested budget: 70406€

Briefly describe the team's role in the project: The IRD-CBGP team will be involved in all phases of the project, from (rodent) data gathering and database building to information dissemination and capacity transfer (AD, CB, JMD, LG) via modeling (JLF, SV) and field validation of models outputs (JMD, LG, AN). Note that CB is leader (and AD one of the main participants) of the ANR-JCJC "ENEMI" project which will furnish most of *Mus musculus* recent distribution data that will be used to feed the models focused on this species.

Briefly explain how the requested budget will be used by the team: The requested budget will include 2 important chapters: i) Fees for a 6 months post-doctoral contract to SV (implementation of the statistical models), and ii) an important "travel and subsistence" chapter for field work (*in situ* validation of model scenarios and local information / training). Additional expenses will include computer materials for modeling, and small equipments for field studies.

- **PARTNER 2: UCAD/ IFAN - Laboratoire Zoologie des Vertébrés Terrestres (LZVT)**

Team leader: Massamba THIAM

Other participants: 1 temporary contractor

Requested budget: 12840€

Briefly describe the team's role in the project: The IFAN-LZVT team will participate to (rodent) data gathering and database building, then to field validation of models outputs (including taxonomic validation and collection constitution). Note that MT has been the coordinator of "OHM-Tessekere"-funded projects in 2010, 2011 and 2013, which will furnish a significant part of *Gerbillus nigeriae* recent distribution data of that will be used to feed the models focused on this species.

Briefly explain how the requested budget will be used by the team: The requested budget will be used i) to complete small equipments needed for field and laboratory work associated with the project (the latter including some routine biometric / cytogenetic taxonomic analyses), and ii) as fees for a temporary assistant who will help with data gathering and processing (step 1 of the project), and for a Master 2 student of the UCAD Zoology

Department, who will participate to the collection and treatment of field data (step 3 of the project).

- **PARTNER 3: UMR 215 IRD - Pôle de recherche pour l'organisation et la diffusion de l'information géographique (PRODIG)**

Team leader: Olivier NINOT

Other participants: Jérôme LOMBARD, Françoise DURAFFOUR

Requested budget: 20651€

Briefly describe the team's role in the project: The IRD-PRODIG team will be mainly involved in the first step of the project, namely environmental data gathering in view of the global database completion. Note that the same team is currently engaged in the same type of activity in the frame of the ANR-CEPS-funded "CHANCIRA" program focusing on the expansion of another commensal rodent species in Southeastern Senegal and Western Mali, the Black rat (*Rattus rattus*).

Briefly explain how the requested budget will be used by the team: The requested budget will mainly be devoted to i) travel and subsistence costs in Senegal for the IRD-PRODIG team participants who will come and collect relevant data in central and local Senegalese administrations, and ii) pay fees for Master 2 students in geography who will be involved during this phase.

- **PARTNER 4: UCAD – Département de Mathématique et Informatique (MATHINFO)**

Team leader: Karim KONATE

Other participants: Pape Adama MBOUP (PHD)

Requested budget: 3424€

Briefly describe the team's role in the project: The UCAD-MATHINFO team will be involved in computer modeling activities, in collaboration with JLF (IRD-CBGP). Note that these two participants are currently collaborating in the frame of the ANR-CEPS-funded "CHANCIRA", via the co-supervision of a PhD student (Pape Adama Mboup) whose expertise will be solicited as well.

Briefly explain how the requested budget will be used by the team: The requested budget will be devoted to computer equipment and fees for 2 Master2 students from the MathInfo Department of UCAD

List of non-academic partners

- **PARTNER A : Direction des Eaux et Forêts, Chasses et de la Conservation des sols du Sénégal (DEFCCS)**

Team leader: Abba SONKO

Other participants: Seydi Ababacar BEYE

Requested budget: 12626€

Briefly present the organization (status, location, date of creation, activities, main partners…): The "Direction des Eaux, Forêts, Chasse et de la Conservation des Sols" (DEFCCS) is one of the main Offices of the Ministry of Environment and Sustainable Development of Senegal. Created in 1935, it is one of the most ancient services of the country. Its headquarters are situated in Dakar-Hann. Its staff, mainly comprising technicians and engineers of various specialties, represents 71% of the total Ministry personnel. These officers are involved in a number of tasks, in the fields of i) technical conception and implementation; ii) environmental awareness; iii) hunting, forest and border controls.

The DEFCCS manages a number of programs (see list at http://www.environnement.gouv.sn/rubrique.php3?id_rubrique=10) dealing with forest resources, natural and traditional resources, agricultural projects… in collaboration and with the financial support of various governmental and non-governmental organizations. Some of these programs are centred on the Northern regions of Senegal (Senegal River Valley and Ferlo) where the DEFCCS benefits from a dense network of regional and local bureaux, at various administrative levels (region, department, district and rural community).

Present the organization's biodiversity or environmental policy/strategy: Sustainable development and biodiversity conservation are among the keywords of DEFCCS policy, through the following actions:

- Forest management and production as a means for struggling against rural poverty;

- Reforestation and soil conservation

- Protection and management of wildlife, habitats and biodiversity

- Fight against bushfires for the protection of forests

- Information, education and training of populations

Briefly recount the history of the collaboration between your team and the consortium's research teams if any: The DEFCCS renews on a yearly basis the small mammal capture authorization granted to IRD teams that have succeeded in Senegal for more than 40 years now, based on the evaluation of regular accounts of the activities of these teams. UCAD / IRD and DEFCCS have recently interacted during field sessions organized in the "Great Green Wall" area of central Ferlo in the frame of the "OHM-Tessekere"-funded programs: The field sites where various UCAD / IRD research teams conducted their studies (including those on mammals coordinated by M. Thiam of UCAD/IFAN, partner 2 of the present proposal) are managed by the DEFCCS local squads. The ADEMBA and the regional DEFCCS team of Saint Louis also recently collaborated in reforestation programs initiated in and around the village of Mbarigo.

Briefly describe the team's role in the project: Taking advantage of its implantation in the regions concerned (Senegal River Valley and Ferlo), the DEFCCS role in the project will be central in step 4, i.e. communication, knowledge transfer, training and support of local population. The DEFCCS participants of the project will participate to the production of information media and to the field campaigns organized during the 3rd tear of the project.

Briefly explain how the requested budget will be used by the team: The requested budget will cover expenses associated with the activities scheduled in project step 4, namely production of communication supports and participation to field campaigns organized during the 3rd tear of the project (logistics and per diems).

- **PARTNER B: Association pour le développement de Mbarigo (ADEMBA)**

Team leader: Khalilou BA

Other participants: Boubacar BA, Arona TOURE, Local Contractor (1 year)

Requested budget: 39055€

Briefly present the organization: ADEMBA (http://adembasen.free.fr) was created in July 2001, as a Senegalese association devoted to the development of the village of Mbarigo. It includes a profit-seeking "Groupement d'Intérêt Economique" (GIE) acting for the benefit of the population of MBarigo. The head of village and other members of village council are members of ADEMBA, which is run by an executive bureau of 10 members elected for a renewable 3-year period. The association includes all the inhabitants and sympathizers of the village. It develops actions aimed at improving local everyday life conditions in the

respect of the environment, via different sub-structures: pupils association, sport and culture association, association for the promotion of women…

Partners with which Ademba develop current projects are:

- Senegalese public services (Council of the Rural Community of Gandon, Sub-prefecture of Rao, Prefecture of Saint-Louis, Direction of the DEFCCS of Saint-Louis, Medical District of Saint-Louis, Academic Inspection of Saint-Louis…), for various educational, environmental and infrastructure projects;

- Twinning Comitee "Viens à MBarigo", between Viens (village of Vaucluse, France) and Mbarigo, for cultural, agricultural, school and environmental projects;

- The association "Heaven On Earth (HOE)", Paris (France) for cultural, school and environmental projects;

- The observatory "Saly Carrefour" (Saly Portudal, Senegal) for experience exchange projects and local production exchanges;

The "Institut de Recherche pour le Développement" (IRD, Sénégal) for training, information, scientific popularization projects

Present the organization's biodiversity or environmental policy/strategy: In the articles of the association, the following is explicitly mentioned : *« L'objectif général de cette association est de relever le niveau de vie des habitants du village, afin d'accroître la rentabilité des exploitations et d'améliorer les conditions de vie de tous les résidents à Mbarigo, dans un environnement amélioré. »*

Various actions have been performed to reach this goal, including the installation of garbage cans in the village, information on plastic bags use… ADEMBA current concern in biodiversity/environment conservation is exemplified by a project run in collaboration with the IRD and DEFCCS regional services, which includes i) tree-planting in a 2ha-protected perimeters, of local or acclimated species of potential economic/medical use such as *Acacia senegal, Guiera senegalensis, Combretum glutinosum, Acacia nilotica, Balanites aegyptiaca, Acacia radiana, Acacia seyal, Ficus natalensis, Tamarindus indica, Adansonia digitata, Albizzia adianthifolia, Calotropis procera, Euphorbia balsamifera, Faidherbia albida, Combretum micranthum, Parkinsonia aculeathum, Amaranthus viridis…*ii) the installation of windbreak tree edges with *Eucaleuptus camaldulensis, Casuarina equisetifolia, Eucalyptus alba, Prosopis chilensis…*and iii) the building of a "Nature house" for awareness-raising activities about local natural heritage and environment protection.

Briefly recount the history of the collaboration between your team and the consortium's research teams if any: The connections of ADEMBA and IRD are ensured by one of the founders of the association, its current president Khalilou Bâ, who is also for more than 35 years now working as Research Technician, then Engineer in Biology at the IRD. In the frame of these professional activities, K. Bâ has interacted with most of the IRD and UCAD (Université Cherikh Anta Diop, Dakar) participants of the current project (see his CV). He has participated to most of the recent field sessions that have gathered data on the distribution of the two target species of the project, i.e. *Mus musculus* and *Gerbillus nigeriae*. Moreover, the environment-oriented activities of ADEMBA (see above) are also conducted in connection with both the IRD and the "Eaux & Forêts" services in Saint-Louis.

Briefly describe the team's role in the project: The ADEMBA role in the project will be of transferring the research results into information that will be communicated to local populations, especially in the Senegal River Valley. The association is now well-known within this region, especially in the villages and cities between Saint-Louis and Podor. As such, its main role will be to disseminate information on commensal rodents among villages of the Senegal River Valley, and to inform about the current invasion process by *Mus musculus*. ADEMBA will also organize training sessions devoted to rodent identification, capture and control methods implementation.

Briefly explain how the requested budget will be used by the team: The requested budget will be used for three main purposes, especially linked with step 4 of the project:

- to set up a local contract for a skilled candidate having experience in document production and dissemination / popularization of scientific knowledge in relation with the results obtained in steps 1-3 of the project.

- to organize / participate to the information campaigns that will be co-organized with the IRD and DEFCCS participants, along the Senegal River Valley as well as within the Ferlo region, which will require vehicle-related expenses, fees for the participants

- to buy / build traps that will be used (rather than chemical items) to catch rodents in villages chosen for the training sessions

Stakeholders not included within consortium

- Identify the stakeholders who will be associated with the project, but not included as partners within the project consortium (will not receive a budget):

- Briefly present the concerned organizations (status, location, date of creation, activities, main partners…)

- Present their biodiversity or environmental policy/strategy

- Briefly recount the history of the collaboration between them and the project teams

- Explain at what stage (objectives definition, protocol elaboration, date production and sharing, design of deliverables,…) and how they will be involved in the project, and how results will be transferred to them

At the highest level, these stakeholders mainly include representatives of the most concerned ministries (Agriculture and Rural Equipment; Land Settlement and Local Collectivities; Trade, Industry and Informal Sector; Infrastructures and Transportations; Health and Social Action), to which relevant documentation will be transferred at the end of the project. At the local scale, we will identify members of rural communities and villages councils who will serve as go-between in the information transfer operations that will be one of the main tasks of the field campaigns organized during the 3rd year of the project. In villages of some importance, one member of the village council is generally attached to environmental questions. Such people are always involved in field activities of the academic research teams of the present project. They are generally identified by the village chiefs who therefore are responsible for their activity within this collaborative partnership.

Here, they will be identified either via "Eaux & Forêts" local squads upstream of the filed campaigns planned during the 3rd year of the project, or during these field trips. They will be given special responsibilities as to i) knowledge acquisition and training on the invasive rodent problems, ii) maintenance and distribution of communication media and traps at the local scale, and iii) link with the different (academic and non-academic) partners of the project. They will be paid for their activity during the field campaigns, and will remain focal contacts of the research teams whenever special action has to be taken in relation with rodent problems.

10. Follow up of the project activities

10.1 Follow up of the scientific activities

Follow up of the modeling activity, further development or update of the biodiversity scenarios, continuation of scientific communication and of the networking among partners, etc.

Follow up of the modeling activity will be made possible via a methodology and competence transfer to the UCAD-MATHINFO department, via the participants of the project (K. Konaté and the M2 students who will be involved). The current collaboration of this UCAD Department with the IRD-CBGP researchers involved in the modeling part of the project will enable further potential update/development of the models implemented, and production of updated scenarios in the future. Scientific communication between most members of the project is already at a high level (see CV of participants, and § "Other sources of funding" hereunder), and will be maintained thanks to various tools. These include the "Centre d'Information SimMasto" (http://simmasto.org) developed and managed by J. Le Fur, where rodent-oriented information is publicly made available. Specific information on the "CERISE" project will be produced and regularly updated following the SimMasto protocol, so that networking is maintained lively and pro-active between partners of the project. At the end of the project, the accumulated information will be gathered by the communication expert in the form of a "mini-encyclopedia" which will remain as permanent information publicly accessible both on the internet and a distributable standalone CD-ROM.

10.2 Follow up of project activities relevant for stakeholders and policy-makers

- What are the needs of the identified stakeholders or policy makers and what use will they make of the tools developed through the project ?

The major needs of the stakeholders / policy makers identified and involved in the project concern communication media and support, and regular access to updated information. These will be furnished, as described in § 8 "List of deliverables relevant for stakeholders" and 10.1 "Follow up of the scientific activities" here above. Communication media will be used along the field sessions that will be conducted during the 3rd year of the project (activities of step 4). Part of them (brochures, posters…) will be disseminated in the villages and rural communities visited, others (poster exhibition after the itinerant phase, CDs…) will be deposited in regional/local "Direction des Eaux & Forêts" bureaux as well as at the head office of the ADEMBA association, in Mbarigo (Saint Louis region). Access to information and update facility will be made available through the SimMasto website.

- Plans for the follow-up activities (1 to 2 years): training and support for stakeholders to promote the use (and adaptation if needed) of the tools and new knowledge developed. What activities are planed? What human and financial resources will be dedicated to these activities by the research partners and by the stakeholders?

Partner stakeholders involved in the project already have skills and experience in communication and popularization of scientific information in various contexts (see CVs): Both the "Eaux & Forêts" services and the ADEMBA have conducted various actions related to environmental awareness, and the IRD-CBGP and UCAD-IFAN researchers will mainly have to feed this line with (invasive) rodent-oriented materials and information. This transfer of knowledge will start during the 2nd year of the project. It will continue *in situ*, during the 3rd year campaigns aimed at field-checking the model outputs and disseminating the information gathered to local actors and populations. As far as possible, these field trips will involve participants from the IRD-CBGP and UCAD-IFAN academic research teams and participants from the "Eaux & Forêts" and ADEMBA partners. Representing a major involvement in time, logistic and human resources, these field campaigns will concern at least 10 of the participants of the 4 partners listed here above. Together with the salary of the communication expert who will be engaged for 1 year, these communication / training activities will represent an important part of the total budget requested.

- Medium and long term follow-up of the project: What activities could be planed to ensure i) the continuation of the link between the research partners and the stakeholders and ii) the durability of the project's results? What human and financial resources could be dedicated to these activities by the research partners and by the stakeholders?

In the longer term, formalized continuation of the link between the research partners and the stakeholders will partly depend on setting-up new projects. However, the CERISE project will undoubtedly reinforce the links between the IRD and UCAD teams on the one hand, and the "Eaux & Forêts" and ADEMBA partners on the other hand. The current scientific concern on the invasive species problem (exemplified by the two ANR programs currently run on invasive commensal species in Senegal, repeatedly mentioned here) will create further opportunities for research project funding in the future, and both academic and stakeholder partners will take advantage of this collaboration to go ahead on this theme.

11. Budget

Budget breakdown per cost category

	Total Cost	Requested Budget
Permanent Staff	431,818.00€	
Temporary Staff	49,800.00€	48,800.00€
Equipment	13,200.00€	13,200.00€
Travel & subsistance	92,300.00€	78,300.00€
Consumables	5,800.00€	5,800.00€
Provision of services	2,500.00€	2,500.00€
Indirect costs (max 7% of requested budget)	10,451.00€	10,402.00€
TOTAL	605,869.00€	159,002.00€

Breakdown of total cost per year

	Year 1	Year 2	Year 3
Permanent Staff	154,337.00€	146,233.00€	131,248.00€
Temporary Staff	4,500.00€	42,500.00€	2,800.00€
Equipment	7,000.00€	6,200.00€	0.00€
Travel & subsistance	32,300.00€	6,000.00€	54,000.00€
Consumables	1,400.00€	800.00€	3,600.00€
Provision of services	0.00€	2,000.00€	500.00€
Indirect costs (max 7% of requested budget)	0.00€	0.00€	0.00€
TOTAL	199,537.00€	203,733.00€	192,148.00€

Budget breakdown by partner

		Total Cost	Requested Budget
Partner 1	UMR22 IRD CBGP	409,199.00€	70,406.00€
Partner 2	UCAD-IFAN (LVT)	24,840.00€	12,840.00€
Partner 3	UMR 215 IRD - PRODIG	93,763.00€	20,651.00€
Partner 4	UCAD - MATHINFO	16,424.00€	3,424.00€
Partner A	DEFCCS	22,588.00€	12,626.00€
Partner B	ADEMBA	39,055.00€	39,055.00€
TOTAL		605,869.00€	159,002.00€

Other sources of funding

A great part of the information that will be used to build the rodent-environment database (step 1) are being gathered since 2010 in the frame of two projects: The "OHM-Tessekere" funded projects contracted in 2010, 2011 and 2013 by M. Thiam and his collaborators (among whom K. Bâ and L. Granjon also involved in the current project) have enabled to significantly update *Gerbillus nigeriae* distribution data, following the PhD work of M. Thiam (*Thiam, M., 2007. Les changements climatiques et l'invasion des Gerbilles (Rongeurs, Muridae) au Sénégal: importance et causes du phénomène, compétition avec les espèces résidentes. Ph.D. Thesis, University of Dakar*). Similarly, in the frame of the ANR-JCJC 4-year "ENEMI" project (2011-2015) coordinated by C. Brouat (and which also includes K. Bâ and A. Dalecky as participants), an important sampling effort is currently being made to complete *Mus musculus* distribution data over a vast geographic area (see map of Fig.1). Environmental data related to urban development, trade and traffic (here useful to explain *Mus musculus* distribution), as well as elements of computer simulation modelling, are currently being accumulated and developed in the frame of the 3-year ANR-CEPS "CHANCIRA" project (2011-2014) coordinated by P. Handschumacher (and which also includes A. Dalecky, J.-M. Duplantier, L. Granjon and K. Bâ as participants).

PROJECT PARTICIPANTS:

<table>
<tr><td colspan="4" align="center">Coordinator</td></tr>
<tr><td colspan="2">GRANJON, Laurent</td><td>Status</td><td>DR Directeur de recherche</td></tr>
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<tr><td>Address</td><td>IRD, BP1386, Dakar CP18524, Senegal</td><td>Country</td><td>France</td></tr>
<tr><td>Affiliation</td><td colspan="3">Institut de Recherche pour le Développement - IRD</td></tr>
<tr><td>Laboratory</td><td colspan="3">Centre de Biologie pour la Gestion des Populations - CBGP</td></tr>
<tr><td>Equipe de recherche</td><td colspan="3"></td></tr>
<tr><td>Main research interests</td><td colspan="3">Evolutionary systematics and ecology of tropical (mainly African) rodents: Taxonomy, phylogeny, phylogeography, community ecology, population biology
Comparative evolutionary biology of mainland vs. island tropical and temperate rodent populations</td></tr>
<tr><td>Position</td><td colspan="3">Responsable de l'impantation 2ndaire CBGP au Sénégal</td></tr>
<tr><td>Former positions</td><td colspan="3">Since Sept. 2008:Researcher (DR2), IRD, CBGP, Dakar, Senegal
2007-2008:Researcher (DR2), IRD, CBGP, Montpellier, France
2000-2006:Researcher (CR1) IRD, CBGP, Bamako, Mali
1991-1999: Lecturer, Muséum National d'Histoire Naturelle, Paris, France</td></tr>
<tr><td>Education</td><td colspan="3">1984-1987:PhD Thesis in Population and Ecosystem Biology, Montpellier 2 Univ., France
1983-1984:Master II in Evolutionary Sciences, Montpellier 2 Univ., France
1982-1983:Master I in Organismal and Population Biology, Lyon 1 Univ., France</td></tr>
<tr><td>Scientific responsabilities</td><td colspan="3">- Since August 2008: Head of IRD-CBGP Laboratory, Dakar, Senegal
- 2009-2012- Member of IRD Dakar Scientific Council
- 2004-2010: Member of the Research Unit (CBGP) committee
- PhD dissertation (co)supervision (6), Master 2 supervision (20)
- Editor/Associate editor of the International Journal of Mammalogy Mammalia (since 1991)
- Co-Organizer of the 8th African Small Mammal Symposium, July 1999, MNHN, Paris.
- Referee for more than 20 scientific journals
- Teaching and tutoring (Fr, Mali, Sen)</td></tr>
<tr><td>Projects (in the last 5 years)</td><td colspan="3">- ANR-CEPS, CHANCIRA "CHANgements environnementaux, CIrculation de biens et de personnes : de l'invasion de réservoirs à l'apparition d'anthropozoonoses. Le cas du RAt noir dans l'espace sénégalo-malien" (2011-2014, participant)
- OHM-Tessekere, Great Green Wall programme in Senegal, projects funded in 2010, 2011 and 2013 (participant)
- Ecofor, MEDD programme, "Forêts de failles et forêts galeries au sud du Mali : deux voies pour la pérennité des refuges guinéens en zone soudanienne" (co-coordinator, 2006-2010)
- SRK Consulting – IRD partnership convention for the Mammal part of the "Environmental and Social Impact Assessment", Sabodala mine project (coordinator, 2009-2010)</td></tr>
<tr><td rowspan="2">Publications</td><td colspan="3">Total number of publications: 110
Number of articles in peer-reviewed journals: 95
Number of book chapters: 3
Number of book written or edited: 2
Number of citations (Web of Science [WoS] or Google Scholar Citations [GSC]): 1200 (WoS)
H-index factor (Specify WoS and/or GSC): 19 (WoS)</td></tr>
<tr><td colspan="3">Granjon, L. & Duplantier, J.M., 2009 - Les Rongeurs de l'Afrique sahélo-soudanienne. Editions de l'IRD (Collection Faune et Flore tropicales), Marseille, 216p.
Granjon, L. & Duplantier, J.M., 2011 - Guinean biodiversity at the edge: Rodents in Southern Mali forest fragments. Mamm. Biol., 76: 583-591.
Hima, K., Thiam, M., Catalan, J., Gauthier, P., Duplantier, J.M., Piry, S., Sembène, M., Britton-Davidian, J., Granjon, L., & Dobigny, G., 2011 - Extensive Robertsonian polymorphism in the African rodent Gerbillus nigeriae: geographic aspects and preliminary meiotic data. J. Zool., 284: 276–285.
Ndiaye, A., Bâ, K., Aniskin V., Benazzou, T., Chevret, P., Konecny, A., Sembène, M., Tatard, C., Kergoat, G. & Granjon, L., 2012 - Evolutionary systematics and biogeography of endemic gerbils from Morocco: An integrative taxonomy approach. Zool. Scripta, 41: 11-28.
Colangelo, P., Verheyen, E., Leirs, H., Tatard, C., Denys, C., Dobigny, G., Duplantier, J.M., Brouat, C., Granjon, L. & Lecompte, E., 2013 - A mitochondrial phylogeographic scenario for the most widespread African rodent species, Mastomys natalensis. Biol. J. Linn. Soc., 108: 901-916.</td></tr>
</table>

Participant 2

MBOUP, Pape Adama		Status	Doctorant
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Address	IRD, BP1386, Dakar, CP18524 Senegal	**Country**	Senegal
Affiliation	Université Cheikh Anta Diop de Dakar - UCAD		
Laboratory	Département de Mathématiques et Informatique - MATHINFO		
Equipe de recherche			
Main research interests	Développement (langage C, JAVA, PHP, XHTML, HTML5, CSS3, JAVASCRIPT) Webmaster Administration de Bases de Données Algorithmique Data Mining Traitement numérique d'image Modélisation Statistique Modélisation de système dynamique (Mathématiques) Modélisation informatique (systèmes multi-agents et UML) Modélisation 3D (structures de protéines) Enseignement		
Position	Doctorant boursier SCAC		
Former positions			
Education	2011-2012 : MASTER2 de BIOINFORMATIQUE mention TRES BIEN		
Scientific responsabilities			
Projects (in the last 5 years)			
Publications	**Total number of publications:** **Number of articles in peer-reviewed journals:** **Number of book chapters:** **Number of book written or edited:** **Number of citations (Web of Science [WoS] or Google Scholar Citations [GSC]):** **H-index factor (Specify WoS and/or GSC):**		

Participant 3

DURAFFOUR, Françoise		**Status**	Ingénieur de recherche
Email	Francoise.Duraffour@univ-paris1.fr	**Tel**	(33) 1 44 07 75 73
Address	PRODIG, 2 rue Valette, 75005 Paris France	**Country**	France
Affiliation	Centre National de la Recherche Scientifique - CNRS		
Laboratory	Pôle de Recherche pour l'Organisation et la Diffusion de l'Information Géographique - PRODIG		
Equipe de recherche			
Main research interests	- Focus on the "mba" approach (modelling and experimenting with agent-based simulation)		
Position	Ingénieur CNRS		
Former positions	- 2010-2013: Research engineer CNRS - PRODIG research unit, Paris, France - 1996-2010 : Studies engineer CNRS – PRODIG, France - 1986-1996 : Computer engineer – Organisation of information system unit, CNRS, France		
Education	- 1993: PhD Thesis, University Paris IX, France		
Scientific responsabilities	- Since 2010: Member of the "MAPS" group. The MAPS group members' objective is to provide spatialized agent-based models, through the geographical lens as well as the other human sciences disciplines - Teaching: GIS-conceptual models, agent-based simulation, within the Doctoral School of Geography Paris XII--Val de Marne (Master 2 "Bioressources en régions tropicales et méditérranéennes"		
Projects (in the last 5 years)	- 2013-2015: Programme PERIMARGE, (Périphéries, marges : interpréter les relations aux centres dans la mondialisation), ANR « Métamorphoses des sociétés - inégalité - inégalités » (participant) - 2012-2014: Programme SAVARID - Changements Environnementaux Planétaires et Sociétés (CEP&S 2011) : Effet de l'augmentation de l'aridité et de la fréquence des sécheresses sur les systèmes socio-écologiques de savane dépendant de la biodiversité (participant) - 2008-2012: Programme PERISUD (Dynamiques territoriales à la périphérie des métropoles des Suds), ANR « les Suds, aujourd'hui » (participant) 2010-2013: ANR TOLIMMUNPAL « Study of environmental determinants, biological and genetic involved in the development of immune tolerance associated with malaria » -an example of modelling and experimenting with agent-based simulation (participant)		
Publications	**Total number of publications:** **Number of articles in peer-reviewed journals:** **Number of book chapters:** **Number of book written or edited:** **Number of citations (Web of Science [WoS] or Google Scholar Citations [GSC]):** **H-index factor (Specify WoS and/or GSC):**		
	- ARCHAMBEAU O., DURAFFOUR F., 2001. Cd-Rom " Campagne d'exploration géo-photographique à bord de la Boudeuse - Expédition Singapour, Jakarta, Iles Mentawaï " - THEODAT J.M, DURAFFOUR F., 2007 " Boc Banic - Banica : : une mésopotamie transfrontalière " - application multi-média - DURAFFOUR F., 2007 Une expérience d'application multimédia appliquée à un bassin versant, Revue Echogéo, n°2 - EUZEN A., DURAFFOUR F., 2007. Application " Le Suzon, les hommes et la ville de Dijon : usages, gestion et protection d'un cours d'eau à travers le temps ". application multi-média consultable à l'UMR - Collectif, 2011. « L'élevage au Sénégal ». Site internet.		

Participant 4			
BA, Boubacar		**Status**	AA Autre acteur
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Address	HLM Grand Médine, Villa N° 758, Dakar, Senegal	**Country**	Senegal
Affiliation	Association pour le Développement de Mbarigo - Ademba		
Laboratory	not applicable - N/A		
Equipe de recherche			
Main research interests	- Marketing - Agriculture practice		
Position	Agriculture Technician		
Former positions	- 11/2011 - 04/2012 : Stage d'étude des rongeurs nuisibles aux cultures, IRD (CBGP), Dakar, Sénégal - Mai 2011 : séminaire en télémarketing à l'agence de télécommunication en haute définition, Dakar, Sénégal - 2007 - 2011 : techniques de cultures irriguées pendant les vacances scolaires		
Education	2010 – 2011 : BT Commerce International Marketing IPG / ISTI, Sacré Cœur, Dakar, Sénégal		
Scientific responsabilities			
Projects (in the last 5 years)			
Publications	**Total number of publications:** **Number of articles in peer-reviewed journals:** **Number of book chapters:** **Number of book written or edited:** **Number of citations (Web of Science [WoS] or Google Scholar Citations [GSC]):** **H-index factor (Specify WoS and/or GSC):**		

Participant 5

TOURÉ, Arona		**Status**	AA Autre acteur
Email	aronatoure@hotmail.com	**Tel**	(221) 77 556 24 86
Address	Mbarigo, Communauté rurale de Gandon, département de Saint-Louis	**Country**	Senegal
Affiliation	Association pour le Développement de Mbarigo - Ademba		
Laboratory			
Equipe de recherche			
Main research interests	•Agriculture irriguée •Développement rural •Vulgarisation agricole		
Position	Chargé d'opération à la SAED		
Former positions	•2012 à nos jours : Chargé d'opération du PDMAS à la SAED (Société Nationale d'Aménagement et d'Exploitation des Terres du Delta du fleuve Sénégal et des Vallées du fleuve Sénégal et de la Falémé) •1997 à 2012 : Responsable aménagement et gestion de l'eau dans le Secteur Bas Delta à la SAED •1994-1997 : Chef de zone à Thiagar (SAED) •1983-1985 : Chef de colonne labour à la SAED •1974-1983 : Encadreur des producteurs à la SAED		
Education	1968-1973Cycle secondaire CEG Gazeilles et lycée Charles de Gaulle de Saint Louis, Sénégal (BFEM)		
Scientific responsabilities	•Depuis 2001 : Secrétaire Général de l'Association pour le Développement de Mbarigo (ADEMBA)		
Projects (in the last 5 years)	•Mai 2007 : Atelier sous régional sur la maitrise de l'eau à la parcelle organisé à Niamey au Niger par Agrymet (CILSS) •Mars 2000 : Stage sur la réhabilitation des périmètres irrigués au Burkina fasso/CEFOC/Ethsher/EIR/Ouagadougou •Novembre 1998 : Stage intensif sur la qualité et le traitement des eaux usées domestiques et agricoles organisé par l'Institut des Sciences de l' Environnement de l'université de Dakar •Mars 1998 : Formation en gestion de l'eau par l'université Kleuwein/Belgique au CIFA de Ndiaye •Juillet-Aout 1996 : Stage de formation en Israel (méthodes d'irrigation et de vulgarisation agricole) par le Centre de coopération international pour le développement agricole (CINADCO) •Juillet 1994 : Stage agronomique du riz à Bouaké au Cote d'Ivoire organisé par l'Association pour le développement de la riziculture en Afrique de l'Ouest (ADRAO) •Juin 1990 : Stage sur les pratiques de cultures maraichères au Centre de Développement Horticole (CDH) de Dakar		
Publications	**Total number of publications:** **Number of articles in peer-reviewed journals:** **Number of book chapters:** **Number of book written or edited:** **Number of citations (Web of Science [WoS] or Google Scholar Citations [GSC]):** **H-index factor (Specify WoS and/or GSC):**		

Participant 6

THIAM, Massamba		Status	IE Ingénieur d'étude
Email	thiam.massamba@gmail.com	**Tel**	(+221) 77 130 10 10
Address	Zoologie des Vertebrés Terrestres (ZVT) Institut Fondamental d'Afrique Noire (IFAN) Université Cheikh Anta Diop de Dakar (UCAD) BP 206, Dakar, Senegal	**Country**	Senegal
Affiliation	Institut Fondamental d'Afrique Noire/Université Cheikh Anta DIOP - IFAN-UCAD		
Laboratory	Laboratoire de Zoologie des Vertébrés Terrestres - LZVT		
Equipe de recherche			
Main research interests	- Ecology and ecophysiology of rodents - Population genetics - Community ecology - Collection curator		
Position	Chercheur IFAN		
Former positions	- Since October 2011: Research Assistant at the "Zoologie des Vertébrés Terrestres" laboratory, and curator of mammal collections, "Institut Fondamental d'Afrique Noire", Cheikh Anta Diop University (IFAN-CAD), Dakar, Senegal		
Education	2004-2007: Ph.D. Thesis in Animal Biology, Cheikh Anta Diop University of Dakar (UCAD), Faculty of Science and Technology (FST) - 2002-2004: Master 2, Dept of Animal Biology, UCAD, Dakar - 2001- 2002: Master 1, Natural Sciences, Dept of Animal Biology, UCAD, Dakar		
Scientific responsabilities	- Curator of Terrestrial Vertebrate collections at IFAN-CAD, Dakar, Senegal		
Projects (in the last 5 years)	2012 – 2013 : Coordinator of the project: "Genetical study of a polymorphic and invasive rodent species in Senegal (Gerbillus nigeriae), in the Great Green Wall area: Population analyses by means of microsatellite merkers", funded by the "Observatoire Homme-Milieu – OHM - Tessekere" on the impact of the Great Green Wall installation in central Ferlo, Senegal. 2009 – 2011: Coordinator of the project: "Impact of the location of the Great Green Wall (GMV) on mammals and their parasites in the Ferlo (Senegalese Sahel) funded by the "OHM Tessekere".		
Publications	**Total number of publications: 8** **Number of articles in peer-reviewed journals: 5** **Number of book chapters:** **Number of book written or edited:** **Number of citations (Web of Science [WoS] or Google Scholar Citations [GSC]): 16 (WoS)** **H-index factor (Specify WoS and/or GSC): 3 (WoS)**		
	Bâ K., Thiam M., Dobigny G., Granjon L., Mané Y., Volobouev V. & Duplantier J.M., 2006. Hypothesis on the origin of the invasion of Senegal by Gerbillus nigeriae based on chromosomal data. Mammalia, 72: 303-305. Thiam M., Bâ K. & Duplantier J.M., 2008. Impact of climatic changes on small mammal communities in the Sahel (West Africa) as evidenced by owl pellet analysis. African Zoology, 43: 135 - 143. Thiam M., Ag'Atteynine S., Traoré S., Duplantier J.M., Maurel D. & Sicard B., 2011. Capacity for water conservation in invasive (Gerbillus nigeriae) and declining rodents (Taterillus pygargus and Taterillus gracilis) that exhibit climate-induced distribution changes in Senegal. Journal of Arid Environment, 75: 998 – 1007 M. Thiam, K. Hima, P. Gauthier, C. Tatard, J.M. Duplantier, G. Dobigny, L. Granjon, A. Dalecky, K. Ba, M. Sembene and C. Brouat, 2010. Isolation and characterization of polymorphic microsatellites in the rodent Gerbillus nigeriae. Molecular Ecology Ressources, 11: 418- 421. Hima K, Thiam M, Catalan J, Gauthier P, Duplantier JM, Piry S, Sembène M, Britton-Davidian J, Granjon L & Dobigny G. 2011- Extensive Robertsonian polymorphism in the African rodent Gerbillus nigeriae: geographic aspects and meiotic data. Journal of Zoology, 284: 276-285.		

Participant 7

SONKO, Abba		**Status**	AA Autre acteur
Email	abbasonko@hotmail.com	**Tel**	(221) 33 831 01 01
Address	Direction des Eaux et Forêts, Chasses et de la Conservation des sols, BP 1831, dakar, Sénégal	**Country**	Senegal
Affiliation	Ministère de l'Environnement et du Développement Durable, Sénégal - MEDD		
Laboratory	Direction des Eaux, Forêts, Chasses et de la Conservation des Sols -		
Equipe de recherche	Division Gestion de la Faune		
Main research interests	- Forest management (inventories, reforestation...) - Wildlife management - CITES expertise		
Position	Chef de Division Gestion de la Faune		
Former positions	- Since 2010: Head of Section "Gestion de la Faune" - 2005-2007: Deputy head of Section "Gestion de la Faune", Direction Nationale des Eaux, Forêts et Chasses, Dakar, Senegal - 2004-2005: Head of Section "Gestion de la Faune", Inspection régionale des Eaux, Forêts et Chasses », Kaolack, Senegal - 2003-2004: Expert in wildlife management, "Société des réserves animalières de Kagne /Thiès", Senegal		
Education	- 2010: Master II in Forest Sciences, Environment and Sustainable Management of Natural Resources, ENSA, Thiès University, Senegal - 2003: Higher degree (B) of Wildlife Specialist, Wildlife School of Garoua (EFG), Cameroon		
Scientific responsabilities	- 2009-2010: Forest and wildlife inventories, classified forest of Kousmar, Kaolack region (Master 2 practical session) - 2006: Management plan elaboration of the community forest of Sambandé, Keur Socé, Kaolack region, Senegal, (funded by GTZ) - 2005: Forest and wildlife inventories, and management plan elaboration of the classified forest of Bandia, Thiès region, Senegal - 1988-2000: Participative approach methodology development in the Classified Forest Restoring Project (PROWALO), Northern Senegal (funded by FAO)		
Projects (in the last 5 years)	- Since 2010: Focal point CITES Senegal, Direction Nationale des Eaux, Forêts et Chasses, Dakar, Senegal - Since 2010: Suivi et conservation du dortoir de rapaces insectivores (Faucon Crécerellette Falco naumanni et Elanion naucler Clelictinia riocorii) de île de Kousmar (Kaolack/Sénégal) - 2009-2010: Etat actuel de la biodiversité ligneuse et aviaire de la forêt classée de kousmar, site dortoir de deux rapaces migrateurs (Faucon Crécerellette Falco naumanni et Elanion naucler Clelictinia riocorii), mémoire de fin d'études Master II, 2010;		
Publications	**Total number of publications: 2** **Number of articles in peer-reviewed journals: 1** **Number of book chapters:** **Number of book written or edited:** **Number of citations (Web of Science [WoS] or Google Scholar Citations [GSC]):** **H-index factor (Specify WoS and/or GSC):**		
	Pilard, P., Lelong, V., Sonko, A. & Riols, C., 2011. Suivi et conservation du dortoir des rapaces insectivores Faucon Crécerellettes Falco naumanni et Elanion naucler Chelictinia riocourii). Alauda, 79 : 295-312. Sonko A., 2010. État actuel de la biodiversité ligneuse et aviaire de la forêt classée de Kousmar, région de Kaolack, Sénégal, Journées Régionales de l'IRD 11-12 mai 2010, Université Ckeick Anta Diop (UCAD2), Dakar, Sénégal (oral communication).		

Participant 8

NINOT, Olivier		**Status**	CR Chargé de recherche
Email	olivier.ninot@univ-paris1.fr	**Tel**	33 (0)1 44 07 75 79
Address	IRD UMR Prodig, Centre France Nord, 32 avenue Henri Varagnat, 93143 Bondy Cedex, France	**Country**	France
Affiliation	Institut de Recherche pour le Développement - IRD		
Laboratory	Pôle de Recherche pour l'organisation et la Diffusion de l'Information Géographique - PRODIG		
Equipe de recherche			
Main research interests	Key words: Rural-urban relations; transports; trade; local dynamics and global forces; Sub-Saharan Africa Main topics: 1/ Transport systems and circulations of goods and persons in western Africa (particularly in Senegal) at different scales: from local (small rural areas) to regional (ECOWAS). 2/ Spatial dimensions of trade and retail in Western Africa with a special focus on cattle and small commodities. 3/ Urban transport system evolution in South Africa (City of Cape town)		
Position	Directeur adjoint de l'Unité		
Former positions	2010-2013　Deputy director of research unit 8586 PRODIG, Paris Since 2006Research engineer, research unit 8586 Prodig 2005-2006Engineer, University of Lille 1		
Education	2004post-doctoral researcher, ISRA Senegal 2003PhD Thesis, Geography, University of Rouen (Dir. M. Lesourd et J. Lombard) 2001-2003Associate lecturer, University of Poitiers		
Scientific responsabilities	- deputy director of joint unit Prodig (2010-2013) - member of the editorial board of Echogeo (echogeo.revues.org) since 2007 - co-publication manager of Grafigéo collection since 2011 - reviewer for WCTR (world conf on transport research) and Cybergéo - Since 2010: member of 4 thesis committees - Since 2007: supervisor of more than 12 master students (M1 and M2)		
Projects (in the last 5 years)	CHANCIRA : ANR CEP&S 2011-2014 ; Dir. P. Handschumacher. Environmental changes, goods and people movements: from invasion of reservoirs to emergence of human diseases. Case study of the black rat in the Senegal-Mali boundaries (participant) MARGEM : ANR 2013-2016; Dir. E. Mesclier. Marginal territories in the globalisation (participant) PERISUD : ANR-07-Suds-010 ; Dir. J.L. Chaléard ; 2008-2012. Territorial dynamics of the urban peripheries in 6 global cities of the South (participant) ICARE : CIRAD. Dir. G. Duteurtre. 2007-2009. Livestock breeding, trade and territory in Senegal and Mali (participant)		
Publications	**Total number of publications: 24** **Number of articles in peer-reviewed journals: 15** **Number of book chapters: 9** **Number of book written or edited: 2** **Number of citations (Web of Science [WoS] or Google Scholar Citations [GSC]):** **H-index factor (Specify WoS and/or GSC):** LOMBARD J., NINOT O., 2012, (eds). « Des mobilités aux transports. Regards croisés en Afrique de l'ouest ». Echogéo n°20. MAGRIN G., NINOT O., CESARO J.D., 2011. « L'élevage pastoral au Sénégal : entre pressions spatiales et mutations commerciales ». Mappemonde, n°101, 2011-1, 17 p. LOMBARD J., NINOT O. (eds), 2011. Nouvelles mobilités dans les Suds. Espace, Populations, Sociétés, n°2010-2-3. LOMBARD J., NINOT O., 2010. « Connecter et intégrer : les territoires et les mutations des transports en Afrique » Bulletin de l'Association des Géographes Français, n°2010-1, pp. 69-86 NINOT O., 2010. « Des moutons pour la fête : l'approvisionnement de Dakar en moutons de Tabaski » Les Cahiers d'Outre Mer, n°249, pp141-164.		

Participant 9

		Status	CR Chargé de recherche
LOMBARD, Jérôme			
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Address	IRD UMR Prodig, Centre France Nord, 32 avenue Henri Varagnat, 93143 Bondy Cedex, France	**Country**	France
Affiliation	Institut de Recherche pour le Développement - IRD		
Laboratory	Pôle de Recherche pour l'organisation et la Diffusion de l'Information Géographique - PRODIG		
Equipe de recherche			
Main research interests	Focus on the mutations of transport systems in Western Africa, the access to urban markets and the links between villages and cities, especially in Senegal and in Mali.		
Position	Directeur adjoint de l'Unité		
Former positions	2010-2013: Researcher at PRODIG Bondy, France 2005-2009: Researcher at LPED Marseille, France 2000-2004: Researcher at IRD Dakar, Senegal 1991-1999: Program "Research on transport system in the north of France", Lille, France 1989-1990: Program "Agriculture and trade in Central Senegal" at IRAM consultants, Paris, France		
Education	1984-1988: PhD Thesis, IRD Dakar, Senegal		
Scientific responsabilities	- 2014-2018: Deputy Director of PRODIG research unit, Paris, France - 2013: Member of the Scientific Consultation on road transport of goods, Senegal/European Union. - Member of Scientific comittee, Space Populations Societies Journal		
Projects (in the last 5 years)	- ANR CEPS "Environmental changes, goods and people movements: from invasion of reservoirs to emergence of human diseases. Case study of the black rat in the Senegal-Mali boundaries". 2011-1014 (task leader) - Contract with Ministry of Foreign Affairs, France: « International migration and territory evolutions in Western Africa and Central Sahara », 2005-2009 (task leader)		
Publications	**Total number of publications:** **Number of articles in peer-reviewed journals: 25** **Number of book chapters: 20** **Number of book written or edited: 8** **Number of citations (Web of Science [WoS] or Google Scholar Citations [GSC]):** **H-index factor (Specify WoS and/or GSC):** CHOPLIN A., LOMBARD J., 2013, "When the Sea is Closed: From Transit to Post-Transit Migration in Mauritania", in Triulzi A. and McKenzie R. (ed.), Long Journeys: Lives and Voices of African Migrants on the Road, Londres, Brill. LOMBARD J., NINOT O. (eds), 2012, "From mobility to transport. Diverse outlooks on Western Africa". EchoGéo 20 [http://echogeo.revues.org/13127]. LOMBARD J., NINOT O., 2010. Connecter et intégrer : les territoires et les mutations des transports en Afrique. Bulletin de l'Association des Géographes Français, n°1, p. 69-86. LOMBARD J., STECK B. (éds), 2004. « Transports au Sud : pouvoirs, lieux et liens ». Autrepart, 32(4). NINOT O., LOMBARD J., LESOURD M. 2002 « Nouveaux espaces, nouvelles centralités. Echanges et réseaux en milieu rural sénégalais ». Historiens et géographes. pp 141-152.		

LE FUR, Jean		**Status**	CR Chargé de recherche
Email	jean.lefur@ird.fr	**Tel**	04.99.62.33.02
Address	Centre for biology and population management (CBGP), Campus International de Baillarguet, CS 30016 34988 Montferrier-sur-Lez, France	**Country**	France
Affiliation	Institut de Recherche pour le Développement - IRD		
Laboratory	Centre de Biologie pour la Gestion des Populations - CBGP		
Equipe de recherche			
Main research interests	Computer Modelling, Complex Living Systems Currently: modelling of pluridisciplinary knowledge on rodents dynamics (http://simmasto.org)		
Position	Chercheur IRD		
Former positions	2007-2013-Centre de Biologie et de Gestion des Populations, Montferrier-sur-Lez, France 2004-2006-Centre de Recherches Halieutiques Méditerranéennes et Tropicales, Sète, France 1999-2003-Centre National des Sciences Halieutiques de Boussoura, Rep. of Guinea 1996-1998-Laboratoire Halieutique et Ecosystèmes Aquatiques, Montpellier, France 1991-1995-Centre de Recherche Océanographique de Dakar-Thiaroye, Senegal 1990-1991-Bureau d'Etude Gestion Environnement et Aménagement du Territoire,		
Education	1989 PhD from the University of Lyon I. 1985 Master of molecular biology, biometry and applied mathematics to biology (Univ. Lyon I).		
Scientific responsabilities	- 8 Web sites - Participation / coordination of 9 research projects including 7 completed or underway including 6 on external financing - Supervision of 16 students including 9 Master 2 - Realization of 1 film, 1 travelling exhibition, 1 research open day.		
Projects (in the last 5 years)	ANR CEPS "Environmental changes, goods and people movements: from invasion of reservoirs to emergence of human diseases. Case study of the black rat in the Senegal-Mali boundaries". 2011-1014 (participant)		
	Total number of publications: 20 **Number of articles in peer-reviewed journals: 20** **Number of book chapters: 1** **Number of book written or edited:** **Number of citations (Web of Science [WoS] or Google Scholar Citations [GSC]):** **H-index factor (Specify WoS and/or GSC):**		
Publications	-Le Fur J. & Simon P. 2009. A new hypothesis concerning the nature of small pelagic fish clusters. An individual-based modelling study of Sardinella aurita dynamics off West Africa. Ecological Modelling, 220: 1291-1304. -Le Fur J. 2005. Emergence of a self-organized dynamic fishery sector: Application to simulation of the small-scale fresh fish supply chain in Senegal. In: Mathieu, P., Beaufils, B. & O. Brandouy (Sci. Eds) Artificial Economics: Agent-based Methods in Finance, Game Theory and Their Applications, Springer Ed.: Lecture Notes in Economics and Mathematical Systems, 564: 79-89. -Le Fur J. 2007. Communicating scientific knowledge to actors: how do indicators respond to stakes in relation to the development of the fishery sector in the Guinea Republic? Int. J. Sustainable Development, 10: 73-92. -Le Fur J. 2013. Extending life concepts to complex systems. Interdisciplinary Description of Complex Systems 11: 37-50. -Le Fur J., Guilavogui A. & Teitelbaum A.2011. Contribution of local fishermen to improving knowledge of the marine ecosystem and resources in the Republic of Guinea, West Africa. Can. J. Fish. Aquat. Sci., 68: 1454-1469. -Rey-Valette H., Laloë F. & Le Fur J. 2007. Introduction to the key issue concerning the use of sustainable development indicators. Int. J. Sustainable Development, 10: 4-13.		

Participant 11

KONATÉ, Karim		Status	IE Ingénieur d'étude
Email	kkonate911@yahoo.fr	**Tel**	(221) 77 635 56 66
Address	Département Mathématique et Informatique, Université Cheikh Anta Diop, Dakar, Senegal	**Country**	Senegal
Affiliation	Université Cheikh Anta Diop de Dakar - UCAD		
Laboratory	Département de Mathématiques et Informatique - MATHINFO		
Equipe de recherche			
Main research interests	Systèmes d'exploitation; Programmation; Electronique; Systémique; Réseaux et télécommunications; Supports de transmission; Interconnexion de sites distants par l'intermédiaire de réseaux WAN; Technologie Internet et Intranet; Administration réseau; Planification d'une architecture d'interconnexion de réseaux TCP/IP		
Position	Enseignant-Chercheur, Chef de la section Informatique		
Former positions	- Since 2001: Maître de Conférences en Informatique, Université Cheikh Anta Diop, Dakar - 1999 - 2000: Responsable réseau et télécommunications, Fondation Trade Point, Sénégal - 1993-1995 : Assistant vacataire Université Cheikh Anta Diop, Dakar - 1990- 1992 : Ingénieur concepteur laboratoire « Fibonacci Computers », Institut Polytechnique de Vinnitsa, Ukraine		
Education	1996: Thèse de 3ème cycle (Ph.D.) Université Cheikh Anta Diop, Dakar		
Scientific responsabilities	Chef de la section Informatique du Département Mathématique et Informatique, Université Cheikh Anta Diop, Dakar, Senegal		
Projects (in the last 5 years)	- Since 2003: Instructeur Cisco, Académie Régionale Cisco, Université Cheikh Anta Diop, Dakar, Sénégal		
Publications	**Total number of publications:** **Number of articles in peer-reviewed journals:** **Number of book chapters:** **Number of book written or edited:** **Number of citations (Web of Science [WoS] or Google Scholar Citations [GSC]):** **H-index factor (Specify WoS and/or GSC):** Bykov N.M., Raimy A., Konaté K., Segeda A.E., 2011. The method of a fast filtering for noise reduction in automatic recognition systems, Advances in Computer Science and Engineering, 7: 91-97. Bykov, N.M., Raimy A., Konaté K., 2011. The Development of Effective Decision Making Strategy in Intelligent Computer Systems, Applied Mathematical Sciences, 5 (80): 4045 – 4055. Diop, C., Ndiaye Seck, M., Adj, M., Konaté, K., OuldH'medy, I., Gaye Seye, M.D., Coly, A., Tine, A., 2010. Study by Modelling the Scenarios of CO2 Emissions Mitigation Related to Households Energy Demand in Dakar, J. Int. Environmental Application & Science, 5: 225-234. Konaté K., Gaye A., 2011. Modelling of a Secure Mecanism in Routing Protocol of Manets: Application of theory of Games. International Journal of Distributed and Parallel Systems (IJDPS), 2: 335-346		

Participant 12

DUPLANTIER, Jean-Marc		**Status**	CR Chargé de recherche
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Address	CBGP, Campus de Baillarguet, CS 30016, 34988 Montferrier-sur-Lez cedex, France	**Country**	France
Affiliation	Institut de Recherche pour le Développement - IRD		
Laboratory	Centre de Biologie pour la Gestion des Populations - CBGP		
Equipe de recherche			
Main research interests	Invasive rodent species: consequences on biodiversity, agriculture and human health Study sites: Sahelian countries, Madagascar and Gabon.		
Position	Chercheur, Directeur adjoint de l'Unité		
Former positions	Since 2007: Deputy Director of CBGP research unit, Montpellier, France 2002-2006: Head of CBGP laboratory, IRD Dakar, Senegal 2000-2002: Researcher at CBGP Montpellier, France 1996-2000: Program "Research on Health and the Environment", Madagascar 1994-1996: Institute of Evolutionary Sciences (ISEM), Montpellier University, France 1988-1994: Program "Water and Health in the Senegal River Valley", Senegal 1986-1988: ISEM, Montpellier University 1983-1986: Head of Applied Zoology Lab. Dakar		
Education	1988: PhD Thesis, Institute of Evolutionary Sciences (ISEM), Montpellier University (Thèse d'Etat) 1982: PhD Thesis, Institute of Evolutionary Sciences (ISEM), Montpellier University (Thèse de 3ème cycle)		
Scientific responsabilities	2006 : membre du groupe d'experts OMS « Prevention and control of plague », Antananari 1996?2000 : Commission Technique de lutte contre la Peste, Ministère Santé, Madagascar 1995 : Expertise pour la Banque Mondiale du projet CRESAN ?Appui à la lutte contre la peste à Madagascar? 1988-1993: Member of the Scientific Committee of the National Parks of Senegal 1992 : Member of OMS expert group ?Rodent Ecology, Population Dynamics and Surveillance Technology in Mediterranean Countries?, Genève		
Projects (in the last 5 years)	- ANR SEST "Environmental factors involved in distribution and incidence of tick-borne relapsing fever in West and North Africa", 2005-2008, team leader - ANR SEST « Plague spread in Madagascar: importance of rats and men movements from the habitat to the landscape scales; risk factors evaluation", 2006-2010, project leader - ANR CEPS "Environmental changes, goods and people movements: from invasion of reservoirs to emergence of human diseases. Case study of the black rat in the Senegal-Mali boundaries".2011-1014, team leader		
Publications	**Total number of publications: 108** **Number of articles in peer-reviewed journals: 94** **Number of book chapters: 9** **Number of book written or edited: 4** **Number of citations (Web of Science [WoS] or Google Scholar Citations [GSC]): 1335 (WoS)** **H-index factor (Specify WoS and/or GSC): 21 (WoS)**		
	Konecny A., Estoup A., Duplantier J.M., Bryja J., Bâ K., Galan M., Tatard C. & Cosson J.F. 2013. Invasion genetics of the introduced black rat (Rattus rattus) in Senegal, West Africa. Molecular Ecology 22: 286-300. Thiam M., Ag Atteynine S., Traoré S., Duplantier J.M., Maurel D. & Sicard B. 2011. Water-economy capacity in invasive (Gerbillus nigeriae) and declining rodents Taterillus pygargus and Taterillus gracilis) that exhibit climate-induced distribution changes in Senegal. Journal of Arid Environments, 75: 998-1007. Tollenaere C., Brouat C., JM Duplantier, Rahalison L., Rahelinirina S., Pascal M., Moné H., Mouahid G., Leirs H. & Cosson J.F. 2010. Phylogeography of the introduced species Rattus rattus in the western Indian Ocean, with special emphasis on the colonization history of Madagascar. Journal of Biogeography, 37: 398-410. Granjon L. & Duplantier J.M. 2009. Les rongeurs de l'Afrique Sahélo-Soudanienne. Ed. IRD / MNHN, Collection Faune et Flore Tropicale, Marseille, 215p. Thiam M., Bâ K. & Duplantier, J.M. 2008. Consequences of climatic changes on rodent communities in the Sahel (West Africa) as evidenced by owl pellet analysis. African Zoology 43(2): 135-143.		

Participant 13

DALECKY, Ambroise		**Status**	CR Chargé de recherche
Email	ambroise.dalecky@ird.fr	**Tel**	33 (0)4 99 62 33 09
Address	Centre de Biologie pour la Gestion des Populations (UMR CBGP) Campus International de Baillarguet, CS 30016, 34988 Montferrier-sur-Lez cedex, France	**Country**	France
Affiliation	Institut de Recherche pour le Développement - IRD		
Laboratory	Centre de Biologie pour la Gestion des Populations - CBGP		
Equipe de recherche			
Main research interests	- Metacommunity ecology of rodents in villages and agro-ecosystems of Western Africa. – Rodent invasion in Western Africa. - Dispersal and local adaptation of European corn borer's (Ostrinia nubilalis) host races. - Test for the validity of multiple bio-indicators for the management of nature reserves. - Impact of forest fragmentation on mammal communities in a Neotropical rainforest		
Position	Chercheur IRD		
Former positions	Since 2010 Researcher CR1, IRD, CBGP, Montpellier. 2007-2010 Researcher CR2, IRD, CBGP, Montpellier. 2004-2006 Post-doctorate, INRA; Funding: European Union, IFB, CNRS, French Gov. 1999-2003 PhD studies, CEFE-CNRS, Montpellier. 1998-1999 Volunteer Scientific Service (VSS), Madagascar; Funding: State Univ. of New York at Stony Brook. 1997-1998 Member of research staff on Environmental Impact Assessment, MNHN, French Guiana; Funding: MNHN/EDF.		
Education	2003 PhD thesis, CEFE-CNRS, Montpellier; Funding: French Gov. fellowship, IFB, National Geographic Society.		
Scientific responsabilities	- 2010 Member of Master-1 Jury (Univ. Montpellier). - Since 2010 Co-organizer of scientific meetings in population and community ecology, CBGP. - 2010-2011 Supervision of 1 Master-2 student, and 2 Master-1 student. - 2010 Teaching in Master-2 Animal Biology at Univ. Cheikh Anta Diop, Dakar.		
Projects (in the last 5 years)			
Publications	**Total number of publications: 23** **Number of articles in peer-reviewed journals: 23** **Number of book chapters: 2** **Number of book written or edited:** **Number of citations (Web of Science [WoS] or Google Scholar Citations [GSC]): 232 (WoS)** **H-index factor (Specify WoS and/or GSC): 9 (WoS)**		
	. [Mouquet N., Devictor V., Meynard C.N., Munoz F.]*, Bersier L.F., Chave J., Couteron P., Dalecky A. et al. 2012. Ecophylogenetics: advances and perspectives. Biological Reviews 87: 769-785. . Debout G, Dalecky A, Ngomi Ngomi A, McKey DB (2009) Dynamics of species coexistence: maintenance of a plant-ant competitive metacommunity. Oikos, 118: 873-884. . Léotard G*, Debout G*, Dalecky A*, Guillot S, Gaume L, McKey D, Kjellberg F (2009) Range expansion drives dispersal evolution in an Equatorial three-species symbiosis. PLoS ONE, 4: e5377 (doi:10.1371/journal.pone.0005377). . Dalecky A, Debout G, Estoup A, McKey D, Kjellberg F (2007) Changes in mating system and social structure the ant Petalomyrmex phylax are associated with range expansion in Cameroon. Evolution 61:579-595. . McKey D, Gaume L, Brouat C, Di Giusto B, Pascal L, Debout G, Dalecky A, Heil M (2005) The trophic structure of tropical ant-plant-herbivore interactions: community consequences and coevolutionary dynamics. In Biotic Interactions in the Tropics. Their role in the maintenance of species diversity, D. Burslem, M. Pinard, and S. Hartley (eds.). Cambridge University Press, Cambridge, pp. 386-413.		

Participant 14

BROUAT, Carine		**Status**	CR Chargé de recherche
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Affiliation	Institut de Recherche pour le Développement - IRD		
Laboratory	Centre de Biologie pour la Gestion des Populations - CBGP		
Equipe de recherche			
Main research interests	- Evolutionary ecology of rodent-parasites interactions: population genetics and phylogeography, community ecology, immunogenomics, invasion biology - Population genetics in a carabid community. - Origin and evolution of plant-ant mutualisms		
Position	Chercheuse IRD		
Former positions	Since 2008Researcher CR1, IRD, CBGP, Montpellier. 2003-2007Researcher CR2, IRD, CBGP, Montpellier. 2000-2003Post-doctorate, INRA, CBGP, Montpellier.		
Education	1996-1999PhD, UMII, CEFE-CNRS, Montpellier ;Financial support: French Gov. fellowship 1995-1996Master (DEA) in Evolutionary Biology and Ecology, University of Montpellier. 1993-1995Forestry Engineer Course, ENGREF Nancy.		
Scientific responsabilities	Member of Master Jury (3) and PhD dissertation committee (2) Referee for scientific journals (Mol. Ecol, Ecography, Heredity…) Teaching and tutoring of post-graduate/undergraduate students (Univ. of Montpellier II- France, UCAD-Senegal, Univ. of Niamey-Niger, Univ. Paris XI-France) and of permanent staffs. 2007-2010: Elected member of the laboratory committee 2005-2010: Scientific board member of the "Écosystèmes Tropicaux" program (GIP ECOFOR), and the "Réseau des interactions durables (REID)		
Projects (in the last 5 years)			
Publications	**Total number of publications: 40** **Number of articles in peer-reviewed journals: 38** **Number of book chapters: 1** **Number of book written or edited:** **Number of citations (Web of Science [WoS] or Google Scholar Citations [GSC]): 498 (WoS)** **H-index factor (Specify WoS and/or GSC): 13 (WoS)**		
	1- Brouat C, Rahelinirina S, Loiseau A et al. (2013) Plague circulation and population genetics of the reservoir Rattus rattus: the influence of topographic relief on the distribution of the disease within the Madagascan plague focus. Plos Neglected Tropical Diseases in press. 2- Brouat C, Tatard C, Machin A et al. (2011) Comparative population genetics of a parasitic nematode and its host community: the trichonstrongylid Neoheligmonella granjoni and Mastomys rodents in southeastern Senegal. International Journal for Parasitology 41, 1301-1309. 3- Gascuel F, Choisy M, Duplantier J-M, Débarre F and Brouat C (2013) Host Resistance, Population Structure and the Long-Term Persistence of Bubonic Plague: Contributions of a Modelling Approach in the Malagasy Focus. Plos Computational Biology 9, e1003039. 4- Tollenaere C, Brouat C, Duplantier J-M et al. (2010a) Phylogeography of the invasive species Rattus rattus in the western Indian Ocean, with special emphasis on the colonization history of Madagascar. Journal of Biogeography 37, 398-410. 5- Tollenaere C, Jacquet S, Ivanova S et al. (2013) Beyond an AFLP genome scan towards the identification of immune genes involved in plague resistance in Rattus rattus from Madagascar. Molecular Ecology 22, 354–367.		

Participant 15

BEYE, Seydi Ababacar		**Status**	AA Autre acteur
Email	khafbeye@hotmail.com	**Tel**	(+221) 77.539.02.85
Address	Centre Forestier de Recyclage à Thiès (Centre FoReT), BP 115, Thiès, Senegal	**Country**	Senegal
Affiliation	Ministère de l'Environnement et du Développement Durable, Sénégal - MEDD		
Laboratory	Direction des Eaux, Forêts, Casses et de la Conservation des Sols -		
Equipe de recherche			
Main research interests	- Forestry - Agriculture - Rural planification		
Position	Chef de Secteur forestier		
Former positions	- Since 21/03/2013: Head of Forest Sector of Bambey (Diourbel Region), "Direction des Eaux et Forêts (DEFCCS)" - Jan. 2012 – March 2013: Made available to the Director of the DEFCCS - Dec. 2006 – Dec. 2008: Deputy Director and Head of Division "Etudes et Planification /Centre FoReT (Thiès)", Senegal - Nov. 2003 – Oct. 2006: Head of Forest Sector of the Kanel Department (Matam Region), Senegal - Dec. 1991 – Nov. 2003: Heaf of Regional Division / IREF Kaolack (91/99) and IREF St-Louis (99/2003)		
Education	- Dec. 2011: Master 2 degree at "Ecole Nationale Supérieure d'Agriculture" (ENSA), Thiès, Senegal - Nov. 1989 : Master I Pro degree, Ingénieur des Travaux des Eaux et Forêts / - Ecole Nationale des Cadres Ruraux (ENCR), Bambey, Senegal		
Scientific responsabilities	- Member of the Trainer Pool of the «Direction Eaux & Forêts" and "Wetlands International (Africa)"		
Projects (in the last 5 years)	- 2010: AICAD (Nairobi / Kenya: Humid Zones and Climate Change (15 days) - Dec. 2006 – Dec. 2008: Humid zone participative management, Wetlands International Africa ; "Gestion cycle de projet (GCP) et renforcement de capacité des organisations de développement local au niveau national", ADG – Gembloux (Belgian NGO)		
Publications	**Total number of publications:** **Number of articles in peer-reviewed journals:** **Number of book chapters:** **Number of book written or edited:** **Number of citations (Web of Science [WoS] or Google Scholar Citations [GSC]):** **H-index factor (Specify WoS and/or GSC):** - 2011: Mémoire de Fin d'études Master (ENSA de Thies) : « Analyse Coût-Avantage de processus de mise en aménagement participatif d'espace sylvopastoral intervillageois (ESPIV) : Cas de Keur Niene et Ndock Saré (Bassin arachidier du Sénégal) »; - 2007: Articles publiés au journal « Echo » du Centre FoReT (en 2007) : a) Chronique d'une battue administrative – b) Gestion des zones humides : Enjeux de développement durable. c) Gestion participative des Ressources Naturelles : Montage d'un comité intervillageois (CIV) dans le Damga. - 1989: Mémoire de Fin d'études Licence Pro (ENCR de Bambey) : « Rôle de la chasse dans l'économie sénégalaise »		

Participant 16

BÂ, Khalilou		Status	Ingénieur de recherche
Email	khalilou.ba@ird.fr	**Tel**	(221) 33 957 10 44
Address	IRD (UMR 022, CBGP) BP 50, MBour, Sénégal	**Country**	France
Affiliation	Institut de Recherche pour le Développement - IRD		
Laboratory	Centre de Biologie pour la Gestion des Populations - CBGP		
Equipe de recherche			
Main research interests	- Systematics and ecology of Sahelian rodents – Ecology and virology of rodent reservoirs: hosts of pathogens		
Position	Ingénieur biologiste IRD		
Former positions	- Since November 2011: Biological Research Engineer, UMR CBGP, Mbour, Senegal - August 2002 – October 2011: Biological Research Engineer, UMR CBGP, Dakar, Sénégal - 1994-2002, Biological technician, laboratory of Medical Zoology IRD, detached at the Pasteur Institute, Dakar, Senegal (Responsible of the "Rodent" section, in relation with the Virological Laboratory) - 1977-1993, Biological technician, Zoology Laboratory, ORSTOM, Dakar, Senegal		
Education	- 2002 : Diploma from the "Ecole Pratique des Hautes Etudes", Paris 4 July 2002 - 2000 : Capacity Certificate (Life & Earth Sciences), Ecole Pratique des Hautes Etudes, Paris, 17/01/2000		
Scientific responsabilities	- 2001: Founder (and current president) of "ADEMBA" (Association pour le Développement de Mbarigo), development association including a "Groupement d'Intérêt Economique" (GIE) aimed at improving life conditions of the inhabitants of Mbarigo, a village belonging to the region of Saint-Louis.		
Projects (in the last 5 years)	- ANR CEPS "Environmental changes, goods and people movements: from invasion of reservoirs to emergence of human diseases. Case study of the black rat in the Senegal-Mali boundaries"; 2011-1014, participant) - Observatoire Homme-Milieu de Tessekere projects on the impact of the Great Green Wall on mammal communities in central Ferlo, Senegal (2010, 2011, and 2013; participant) - SRK Consulting – IRD partnership convention for the Mammal part of the "Environmental and Social Impact Assessment", Sabodala mine project, Senegal (2009-2010; co-leader)		
Publications	**Total number of publications: 35** **Number of articles in peer-reviewed journals: 27** **Number of book chapters:** **Number of book written or edited:** **Number of citations (Web of Science [WoS] or Google Scholar Citations [GSC]): 249 (WoS)** **H-index factor (Specify WoS and/or GSC): 9 (WoS)** Bâ, K., Thiam, M., Dobigny, G., Granjon, L., Mané, Y., Volobouev, V. & Duplantier, J.-M., 2006. Hypothesis on the origin of the invasion of Senegal by Gerbillus nigeriae based on chromosomal data. Mammalia, 72 : 303-305. Bâ, K., Kane M., Gauthier P. & Granjon L, 2013. Ecology for a typical west African Sudanian Savannah rodent community. African Journal of Ecology (in press) Kone?ný A., Estoup A., Duplantier J.M., Bryja J., Bâ K., Galan M., Tatard C. & Cosson J.F., 2013. Invasion genetics of the introduced black rat (Rattus rattus) in Senegal, West Africa. Molecular Ecology 22: 286–300 Thiam M., Bâ K., Ndiaye A., Diouf M., Ndour R. & Granjon L. 2012. Evolution des communautés de petits mammifères et leurs parasites intestinaux dans le sahel sénégalais dans le contexte de la mise en place de la Grande muraille Verte. Ed. Les cahiers de l'Observatoire International «Homme-Milieux» Tessekere. Volume 1 : 75-85. Thiam M., Bâ K. & Duplantier J.M., 2008 - Consequences of climatic changes on rodent communities in the Sahel (West Africa) as evidenced by owl pellet analysis. African Zoology, 43: 135 - 143.		

Participant 17

PIRY, Sylvain		Status	AA Autre acteur
Email	piry@supagro.inra.fr	**Tel**	04 99 62 33 37
Address	CBGP, UMR 22, IRD Campus de Baillarguet CS 30016 34988 Montferrier sur Lez cedex, France	**Country**	France
Affiliation	Institut National de la Recherche Agronomique - INRA		
Laboratory	Centre de Biologie pour la Gestion des Populations - CBGP		
Equipe de recherche			
Main research interests	Application of computer sciences and software development for biology, genetics and ecology		
Position	Ingénieur INRA		
Former positions	- 1995-present: Ingeneer INRA - CBGP. Softwares developement in population genetics (Bottleneck, GeneClass), NGS amplicons analysis (SESAME and |SE|S|AM|E| Barcode), databases developement for the lab teams, computer support for scientific processings, Geographical Information Systems. - 1993-1995: Ingeneer in bioinformatics for INRA (French National Institute for Agricultural Resaerch),Versailles, mainly in modelisation and databases		
Education	- 1992: Master in bioinformatics		
Scientific responsabilities	- Manager of several databases housed at http://www1.montpellier.inra.fr/CBGP/ - designer of various softwares for population genetics		
Projects (in the last 5 years)	- ANR - JCJC - SVSE 7 2011: Biodiversité, évolution, écologie et agronomie : projet ENEMI : Conséquences évolutives des ennemis naturels dans des invasions biologiques majeures : le rôle des parasites dans le succès de l'invasion de deux rongeurs commensaux. Coord. C.Brouat, 2011-2015, participant - ANR-11-CEPL-010: CHANgements environnementaux, CIrculation de biens et de personnes : de l'invasion de réservoirs à l'apparition d'anthropozoonoses. le cas du RAt noir dans l'espace sénégalo-malien. 2012-2014, Coord. P.Handschumacher, 2011-2014, participant.		
Publications	**Total number of publications:** **Number of articles in peer-reviewed journals: 17** **Number of book chapters:** **Number of book written or edited:** **Number of citations (Web of Science [WoS] or Google Scholar Citations [GSC]): 2609 (WoS)** **H-index factor (Specify WoS and/or GSC): 9 (WoS)** Piry, S., Guivier, E., Realini, A. & Martin, J.F., 2012. |SE|S|AM|E| Barcode: NGS-oriented software for amplicon characterization – application to species and environmental barcoding. Molecular Ecology Resources: no–no. doi:10.1111/j.1755-0998.2012.03171.x. Emese, M., Piry, S., Desmarais, E., Galan, M., Gilles, A., Guivier, E., Pech, N. & Martin, J.F., 2010. SESAME (SEquence Sorter & AMplicon Explorer): Genotyping based on high-throughput multiplex amplicon sequencing ». Bioinformatics 27 (5). doi:10.1093/bioinformatics/btq641. Fontaine, M., Baird, S., Piry, S., Ray, N., Tolley, K., Duke, S., Birkun, A. et al., 2007. Rise of oceanographic barriers in continuous populations of a cetacean: the genetic structure of harbour porpoises in Old World waters. BMC Biology 5 (1): 30. Piry, S., Alapetite, A., Cornuet, J.M., Paetkau, D., Baudouin, L. & Estoup, A. 2004. GENECLASS2: A Software for Genetic Assignment and First-Generation Migrant Detection. Journal of Heredity 95: 536 539. doi:10.1093/jhered/esh074. Piry, S., Luikart, G. & Cornuet, J.M., 1999. Computer note. BOTTLENECK: a computer program for detecting recent reductions in the effective size using allele frequency data ». Journal of Heredity 90: 502 503.		

Budget breakdown per cost category:

	Total Cost	Requested Budget
Permanent Staff	431 818,00 €	
Temporary Staff	49 800,00 €	48 800,00 €
Equipment	13 200,00 €	13 200,00 €
Travel & subsistance	92 300,00 €	78 300,00 €
Consumables	5 800,00 €	5 800,00 €
Provision of services	2 500,00 €	2 500,00 €
Indirect costs (max 7% of requested budget)	10 451,00 €	10 402,00 €
TOTAL	605 869,00 €	159 002,00 €

Budget breakdown per partner:

	Year 1	Year 2	Year 3
Permanent Staff	154 337,00 €	146 233,00 €	131 248,00 €
Temporary Staff	4 500,00 €	42 500,00 €	2 800,00 €
Equipment	7 000,00 €	6 200,00 €	0,00 €
Travel & subsistance	32 300,00 €	6 000,00 €	54 000,00 €
Consumables	1 400,00 €	800,00 €	3 600,00 €
Provision of services	0,00 €	2 000,00 €	500,00 €
Indirect costs (max 7% of requested budget)	0,00 €	0,00 €	0,00 €
TOTAL	199 537,00 €	203 733,00 €	192 148,00 €

Budget breakdown per year:

		Total Cost	Requested Budget
Partner 1	UMR22 IRD CBGP	409 199,00 €	70 406,00 €
Partner 2	UCAD-IFAN (LVT)	24 840,00 €	12 840,00 €
Partner 3	UMR 215 IRD - PRODIG	93 763,00 €	20 651,00 €
Partner 4	UCAD - MATHINFO	16 424,00 €	3 424,00 €
Partner A	DEFCCS	22 588,00 €	12 626,00 €
Partner B	ADEMBA	39 055,00 €	39 055,00 €
TOTAL		605 869,00 €	159 002,00 €