Acronym of the proposal	**ESCAPE**		
Title of the proposal in French	Changements environnementaux et sociaux en Afrique: passé, présent et futur.		
Title of the proposal in English	**E**nvironmental and **S**ocial **C**hanges in **A**frica: **P**ast, present and futur**E**		
Total requested funding	1 660 450 €	**Project Duration**	48 months

Abstract

Sub-Saharan Africa (SSA) is known to be particularly vulnerable to climate change due to a combination of naturally high levels of climate variability, high reliance on climate sensitive activities such as rain-fed agriculture and limited economic and institutional capacity to cope with and adapt to climate variability and change. Furthermore, even without climate change, SSA is nowadays facing to recurrent food crises and to water scarcity and stress. The future of this region depends on the capability of the agriculture sector to guarantee food security for the vast majority of the population however while population is growing rapidly, water is becoming scarce, soils are degraded and yields are decreasing. Agricultural systems must therefore change to avoid catastrophe and to escape from the poverty trap. Urgent actions are required to tackle the issues raised by climate change in SSA and these actions need to be supported by the best knowledge available. ESCAPE will revitalize research in SSA in this field through an integrated interdisciplinary framework that will increase our understanding of the problem and support decision making for the future. Two challenges are under way:

- First, we need to provide diagnostic of what has happened, what is happening and what is going to happen to prone economic sectors and to natural resources. It is important to make clear the potential implications of climate variability and change on resources. We need also to understand how the effects of climate change interact with other global changes in Africa (population growth, urbanization, land use changes, poverty...). Human activities and environmental changes have to be viewed together as co-evolutionary and adaptive. The adaptive capacity of the population (means of access, use and manage natural resources, means to adapt to climate variability) needs to be assessed in various sectors and locations by encompassing social, economic, political and technical aspects. By conducting this research, ESCAPE will therefore be in position to assess past and present vulnerability of systems and to point out the most vulnerable sectors and/or to determine regional priorities by economic sector.

- Adaptation will be fundamental in securing the achievement of the UN Millennium Development Goals after 2015 in sub-Saharan Africa. ESCAPE will move beyond the static view of vulnerability assessments and the linear extrapolation of climate scenario impacts to facilitate pro-active adaptation that is scientifically sound and socially acceptable. Once vulnerable sectors and/or people have been targeted, research will be focused on increasing their adaptive capacities by designing new adaptation strategies that would be able to reduce their vulnerability to climate variability and change. This research will consider a user-driven definition and perception of problems and needs, as well as mutual learning by assessing both scientific and local knowledge. A better knowledge of how local actors such as farmers already adapt to climate variability and extreme weather conditions such as droughts and floods is essential to design and propose new adaptation strategies that can be adopted and used.

ESCAPE therefore aims to assess the vulnerability of rural societies in SSA to climate and environmental changes and to explore adaptation pathways to reduce this vulnerability. This will be achieved by fostering interdisciplinary research, through both retrospective and prospective studies, on the evolution of different agricultural, ecological and social systems interacting together under the global environmental changes.

1. CONTEXT AND RELEVANCE TO THE CALL

1.1. CONTEXT, ECONOMIC AND SOCIETAL CHALLENGES

Sub-Saharan Africa (SSA) is the most food-insecure region in the world. At present, a third of the African population faces widespread hunger and chronic malnutrition and is exposed to a constant threat of acute food crisis and famine (Haile 2005). According to the Hunger Task Force of the UN Millennium Project (2005) analysis, the most affected are rural households (80% of the chronically undernourished) whose livelihood is heavily dependent on traditional rainfed agriculture (93% of all agricultural land). Approximately 80% of all cereals consumed in SSA are supplied by domestic production and the agricultural sector employs 70% of the entire work force (FAO 2003). However despite an increased food production in the last decades, the high population growth rate has increased the numbers of malnourished and poor people more rapidly in Africa than in any other region. Comparisons of agricultural production per capita across continents over the past 40 years (Fig.1) reveal the disequilibrium between food production and population growth in SSA. The future of this region depends on the capability of the agriculture sector to face the difficult challenge of feeding a rapidly rising population.

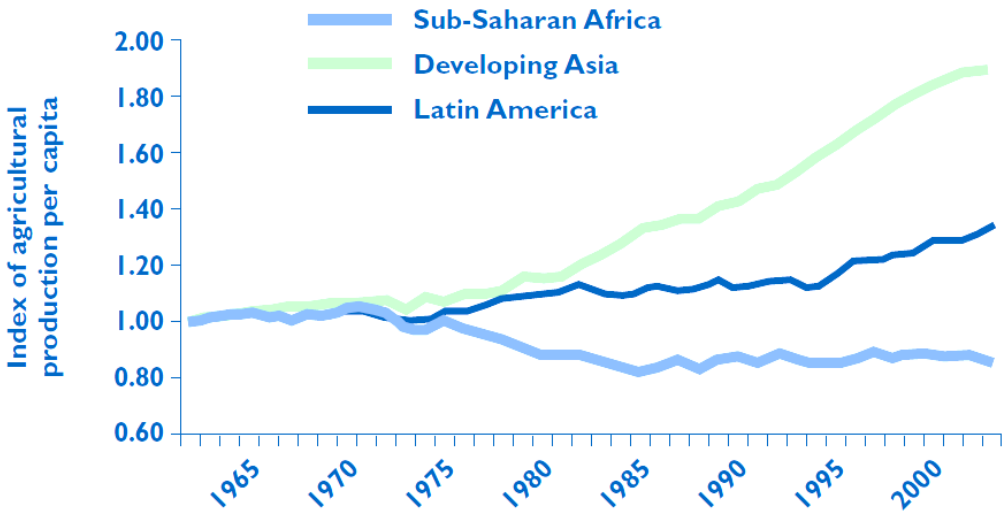


Fig.1: Trends in agricultural production per capita by region 1961-2002 (FAOSTAT data, Haggblade et al. 2004).

But the path ahead to achieve greater food security is strewn by obstacles – one of the most important being climate variability and extreme events such as droughts, excessive rains and floods affecting agricultural productivity and hence rural household food security (Haile 2005). Since the 1970's, the largest food crises in Africa that required large-scale external food aid (1974, 1984/1985, 1992 and 2002) have been attributed fully or partially to extreme weather events (Dilley et al. 2005). A more recent example is the developing food crisis affecting one third of the population in Niger – mainly agro-pastoralists and poor agricultural producers – spreading rapidly to the agro-pastoral and pastoral bands of the entire Sahel according to U.N. aid agencies and FEWS-NET (Fig.2). If the underlying causes of this crisis are multiple (poor water distribution mechanisms, high staple food prices, drop in market prices for cattle), the crisis has been triggered by a food shortage induced by a rainfall deficit in 2009. Indeed, the late onset and the early cessation of rainfall all over the Sahel in 2009 have strongly reduced the food production. However, despite the importance of the onset/end of the rainy season, as well as the distribution of rainfall within the season for crop productivity (Sultan et al. 2005; Ingram et al. 2002), diagnoses and forecasts based on state-of-the-art climate models remain focused on the total amount of seasonal rainfall, disregarding such variability. *ESCAPE will assess the role of climate variations at the various space and time scales on past evolution of water resources and vegetation/crop productivity using both intensive observations and modeling tools.*

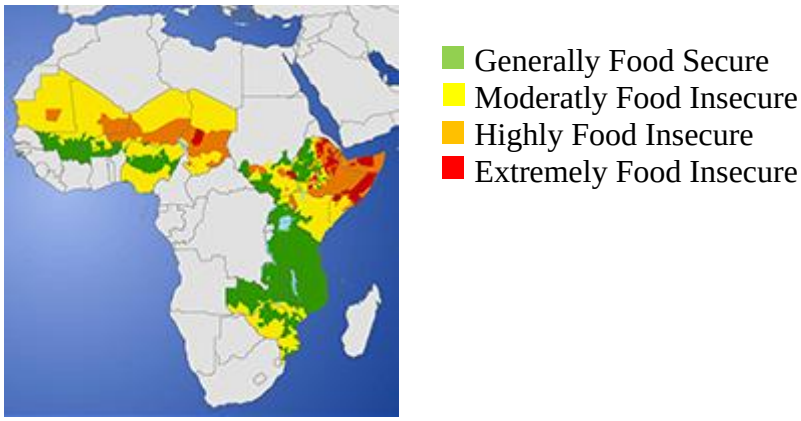


Fig.2: Estimated food security conditions, April-June 2010, Source: FEWS-NET

Climate change could be the additional stress that pushes systems over the edge (CGIAR 2009) in a region where poor people already live on the front lines of pollution, disaster, and the degradation of resources and lands (UNCC 2006). The Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC) has warned the international community on an expected increase in many regions of the world of temperatures and frequency and intensity of major natural hazards such as droughts, highlighting Africa as one of the most vulnerable continent to climate change and variability. There is no doubt that any change in rainfall patterns and variability will affect rainfed croplands and rangelands. Irrigated agriculture, namely rice systems that play a crucial role in feeding African urban populations, is also vulnerable to climate change and variability – not only because it depends on water availability but also due to thermal stresses that can lead to large yield losses (Dingkuhn 1995; Dingkuhn and Miezan 1995; Dingkuhn and al. 1995a). However, the future evolution of climate under the effect of greenhouse gases increase in SSA and its impact on eco-systems and resources is essentially unknown. *ESCAPE will build on the unique African Monsoon Multidisciplinary Analysis (AMMA) observations network and modeling framework to assess the new IPCC Coupled Models Inter-comparison Program (CMIP5) simulations in terms of the representation of the West African monsoon and to derive future trends in vegetation and crop productivity.*

SSA cannot afford to wait forever for more certainty in climate projections – the present climate is already having significant negative impacts on livelihoods of poor people. It is necessary to start now to think about adaptation options that would decrease the vulnerability of SSA populations to climate variability and changes and would increase food production and food security. Adaptation will be fundamental in securing the achievement of the UN Millennium Development Goals after 2015, especially in SSA where it is a matter of survival (EU 2007). However endemic poverty and high climatic variability limit options and force farmers and pastoralists to avert risks keeping them in poverty. *ESCAPE will move beyond the static view of vulnerability assessments and the linear extrapolation of climate scenario impacts to facilitate pro-active adaptation that is scientifically sound and socially acceptable. ESCAPE will investigate the potential of climate information in the design of tactical and strategic options that would be able to reduce the vulnerability of agricultural systems in SSA.*

Human activities and environmental changes should be viewed together as co-evolutionary and adaptive. As the environment and climate change, so do the societies. The adaptive capacity of the population (means of access, use and manage natural resources, means to adapt to climate variability) needs to be assessed in various sectors and locations by encompassing social, economic, political and technical aspects. Drought and extreme weather conditions are not new phenomena in Africa and adaptation is not a new concept. Faced with this unstable environment, rural populations of SSA have throughout history developed specific coping strategies. For instance, farmers can modify their planting dates or adopt different varieties; pastoralists can migrate to new pastures (FAO 2000) or diversify activities. The association of crop, livestock and forestry activities at both, farm and community scales, is the most common indigenous adaptation developed these last 50 years in SSA by rural populations facing climate variations, including major droughts, but also changes in the socio-economic environment such as population density, land tenure, political decentralisation, market opportunities (Ruthemberg, 1980, McIntire et al., 1992). Ample evidences show that interactions between crop, livestock and forestry activities optimise the management efficacy of natural

resources and enhance agriculture productivity and sustainability (e.g., Powell et al., 2004, Herrero et al., 2010). The processes involved are several and interconnected. A better knowledge of how rural communities have already adapted to past environmental changes and present climate variability is essential to design and propose new adaptation strategies that can be adopted and used. *ESCAPE will assess the vulnerability, the resilience and the adaptive capacity of rural communities throughout history in the various target regions, integrating the social and environmental dimensions into a multidisciplinary framework.*

1.2. RELEVANCE OF THE PROPOSAL

CONTEXT AND POSITIONING

ESCAPE in the socio-economic context. SSA, where poor communities critically depend on the direct use of local natural resources and where widespread poverty limits capacity to cope with climate variability and change, is the most prone and vulnerable area to global environmental changes in the world. This vulnerability is likely to increase in the next decades as demands on resources increase with the rapidly growing population. ESCAPE represents a focused and integrated effort by French research and development institutions that aims to *assess this vulnerability and explore adaptation pathways to climate and socio-economical changes* by fostering coordinated research, *both retrospective and prospective*, on the evolution of different agricultural, ecological and social systems interacting under the global environmental changes.

ESCAPE in the research context. ESCAPE will build on progress from the international project AMMA (supported by IRD, INSU, MeteoFrance and CNES in France) in which several of the ESCAPE partners are involved. From the AMMA program, ESCAPE will benefit from the unique environmental monitoring capacity and derived database built in West Africa, as well as from a strengthening partnership between France and Africa and from major progresses in our understanding and prediction of climate and its impacts in West Africa. ESCAPE will also build on and extend the international AMMA-Model Inter-comparison Program (AMMA-MIP) modeling framework which propose homogeneous datasets and diagnoses from a variety of climate models and modeling configurations to evaluate the ability of climate model to represent the West African monsoon and its atmospheric components. But ESCAPE will move beyond the "climate-oriented" vision of the evolution and use of resources in Africa adopted in the AMMA program. By mobilizing new partners from social sciences in the definition of a common research and development challenge, ESCAPE represents *a major evolution of the AMMA program towards the human dimension* of the environmental issues tackled in AMMA. Furthermore, ESCAPE will place *adaptation issues*, neglected during the AMMA program, at the centre of its activities by encompassing social, economic, political and technical aspects.

The new CMIP5 exercise that will serve as the basis for the IPCC Fifth Assessment Report (AR5) is starting now. The results of the new climate simulations have to be made available to the international community at the end of 2010. The scientific teams will then have a little bit more than one year to analyze the simulations and submit papers in order to contribute to the IPCC AR5 report. ESCAPE is a very appropriate framework to evaluate those new simulations in terms of their representation of the West African monsoon, and to make a full exploitation of the huge effort supported in particular by the AMMA-France and AMMA-EU programs, in terms of observations. Furthermore, joint to the CMIP5 exercise, the World Climate Research Program (WCRP) is supporting a coordinated regional climate downscaling experiment (CORDEX) by fostering an international coordinated effort to produce improved multi-model high resolution climate change information over regions worldwide for input to impact/adaptation work and to the IPCC AR5. Since such high resolution simulations are extremely pertinent for impact studies promoted by ESCAPE, the consortium will contribute to the CORDEX exercise in a regional assessment and evaluation of the regional simulations and in their use to derive future resources evolutions.

ESCAPE will also capitalize on previous past and ongoing French research initiatives. The REGYNA project (2008-2010; http://www.gisclimat.fr/projet/regyna), coordinated by partner 1 and funded by the GIS CES (Climate – Environment – Society), has made an important progress in quantifying the hydrological and agronomical impacts of climate changes in vulnerable areas, particularly in SSA. But the project, as several other dealing with climate changes and impacts, totally eludes the human dimension in the past and projected

evolution of water and food resources as well as the crucial question of adaptation to future changes. ESCAPE is designed to fill this lack by *integrating the climate changes and related impacts questions to the social and environmental dimensions into a common interdisciplinary framework*. ESCAPE will also benefit on and extend the work done within the ECLIS project (2009-2011), coordinated by partner LMTG and funded by the ANR VMCS 2008. Whereas the ECLIS project brings a real multidisciplinary perspective of the vulnerability of SSA societies, it remains focused on a single production system in SSA, namely the livestock system, and on past variations of natural resources. The investigation proposed by ESCAPE is *multi-sectoral with applications on agriculture, livestock, food security and water resources* and is both retrospective and prospective, using observed data and simulations to *detect and understand past trends* in climate and resources and to *build scenarios for the future* of these resources.

MEETING THE OBJECTIVES OF THE ANR CEP&S CALL

ESCAPE directly addresses most of the main objectives and priorities of the ANR CEP&S call:

- ESCAPE *brings together a multidisciplinary consortium* encompassing environmental, agronomical, social, economical and political expertise on impacts issues and adaptation pathways to environmental and social changes. Throughout the project, the consortium will contribute to *strengthen the skill of French research and development institutes on the human dimension of vulnerability and adaptive capacity of societies to global environmental changes*;
- ESCAPE will contribute to *build and explore a multidisciplinary database* including vulnerability and socio-economic indicators as well as remotely sensed data and local geophysical in-situ measurements in a vulnerable area, SSA. Furthermore, ESCAPE will contribute to *calibrate, validate and use a large set of state-of-the-art and newly developed modeling tools* such as climate models – able to reproduce past and future trends of climate; impacts models that translate climate observations and forecasts into possible risks for a specific sector and vulnerable populations; and bio-economic models that simulate farmers' decisions and evaluate the economic gains and losses of adaptation strategies;
- Through the course of its activities, ESCAPE will *provide direct support for the French contribution to the Grand Challenges in Sustainability Research*;
- ESCAPE will place *North-South scientific cooperation* at the centre of its activities through collaboration with several African institutes.

ESCAPE address mainly the thematic priority 1 *"Societies and territories under global environmental changes: vulnerability, adaptation and mitigation"*. ESCAPE will explore the vulnerabilities and risks induced by the environmental changes and social transformations in SSA and will investigate past, present and future adaptation pathways to these global constraints. Through observations and modeling studies encompassing environmental, social, economic, political and technical aspects, ESCAPE will increase our knowledge on the vulnerability of SSA populations and their adaptive capacity to environmental changes. By exploring the link between climate variations and renewable resources (water, agriculture, vegetation), ESCAPE also addresses the thematic priority 2: *"Global environmental changes and interactions with ecosystems and biodiversity"*. Finally, ESCAPE meets the thematic priority 3 *"Natural resources and food security in the global environmental change context"* by exploring pathways to increase food production and reduce food insecurity in SSA.

THE EUROPEAN AND INTERNATIONAL CONTEXT

ESCAPE is designed to contribute to the Millennium Development Goals (MDG) for Africa: MGG1 *"Eradicate extreme poverty and hunger"* and MDG7 *"Ensure environmental sustainability"* by providing the scientific knowledge required to build sustainable solutions that might help rural populations to escape from the poverty trap and increase food security by embracing diversity in agricultural systems for sound risk management.

Further, ESCAPE addresses specific key development issues of the joint EU-Africa Strategy (endorsed at the Lisbon summit in 2007), namely improvements in agriculture and food security by promoting risk

management approaches based on weather observations and forecasts and strengthening agricultural research for development.

ESCAPE will promote a strengthen partnership with African institutes and universities of Senegal, Benin, Niger and Mali. Furthermore, ESCAPE will benefit from the African research network building throughout the AMMA program, involving both research institutes and operational agencies such as AGRHYMET, ACMAD and National Meteorological Institutes to promote and disseminate ESCAPE results far beyond the project lifetime and its geographical targets.

1.3. STATE OF THE ART

The interplay between social and environmental dynamics

The project aims at studying how human relationship with environment (i.e. agro-pastoral exploitation) interacts with the broader and complex economic, social and political configurations and dynamics. Social sciences in Africa and the Sahel have widely investigated into the issue, particularly in order to show how the use of natural resources is socially and culturally embedded. Despite Sahelian strong dependence on environment for primary production and food crops, social sciences have tried to avoid natural determinism and over-emphasizing interpretations of environment changes as the sole reason for Sahel social vulnerability.

- From a historical point of view, social sciences have analyzed ecological crisis, such as the 1970-80 droughts (Gallais 1975; Copans 1975), by recasting them into local narratives and memories and considering them as episodes of a long history of environmental variability (Alpha Gado 1993, 2008; de Bruijn & van Dijk 1995). Ecological crisis have also been studied in their relations to contemporary political and social dynamics, such as the economic diversification, the integration into market system and monetization (Bourgeot 1981); urbanization and sedentarization (Salzman 1980); the penetration of State institutions into rural areas (De Bruijn & Van Dijk 1993; Azarya 1996a, b; Klute 1996).

- The small-scale and field analysis of anthropology and other disciplines has allowed to study social actors' coping strategies against ecological variability, uncertainty or crisis. These are not considered as pure rational choices, but rather as a complex output of local cultural understanding of risk and vulnerability (van Dijk 1997; Becerra & Peltier 2009; Ciavolella & Bonnassieux 2009; Becerra, Dia et Gangneron, 2008; de Bruijn & van Dijk, 1999, 2004, Ciavolella, 2010b). Two strategies have drawn scholars' attention: the economic entanglement of primary production and diversification, and mobility. A solidly grounded tradition of economic anthropology (Meillassoux, 1985; Gastellou 1980) has shown how West African production systems must be studied by focusing on kinship social units. But this methodological choice has also allowed following economic diversification strategies inside a single social unit, provoking strong social reconfigurations (Mounkaila 2002, Adjamagbo 1997, Attané, 2008, 2009a, 2009b; Adjamagbo et al., 2006, Cordell et Piché, 1997). Rural communities' economic diversification, especially consists in herding-farming complementarity (Haan, 1997; Turner, 2004) and small-scale trade, but also urban wage labour, civil service, and so on. It is historically bound to environmental crisis and crops production decline, and it is possible only in a context with opportunities for mobility and the building up of translocal social networks. But for social scientists, mobility (pastoral, infra-rural, rural-urban mobilities, and national, sub-regional and international migration) is not only the result of a push and pull mechanism induced by climate change, but integrated into a complex pattern of historically grounded practices (Hahn et Klute, 2007), tranaslocal economic strategies (Bonnassieux 2007, Dougnon 2007, De Haan, 2000, Oumarou 2008; Bonnassieux 2009), social solidarities reconfigurations (Grémont et al. 2004, Grémont 2005) and cultural aspirations (De Bruijn et al. 2001, Ciavolella 2010a).

- Finally, social sciences have particularly stress the political dimension of the human-environment relation by showing how the effects ecological variability or crisis, such as famines and food security in general (Messer, 1996; De Waal, 1997; De Haan, 2001; Janin, 2006), also depends on social conditions of access to natural resources, concrete opportunities of income and food diversification, political distress, processes of political ethnicisation between local groups and governance management of natural resources in the context of local institutional reforms (Geschiere et Gugler, 1998; Cutolo et Geschiere, 2008; Geschiere, 2009, Bierschenk et Olivier De Sardan, 1998; Ribot, 2002; Ribot et Larson, 2005).

The limits of social sciences interpretations are twofold. On one side, the deconstruction of natural determinism has brought to the downplaying of environment changes and production systems in the analysis of Sahelian society, while global governance analysis still insists on the mechanical relation between climate change/environmental decline and local people vulnerability (i.e. Fao, 2008; World Bank, 2008). On the other, the complexity of human-environment relations has been often shown autonomously by single disciplines focusing on a specific social, cultural or political dynamics. *That is why ESCAPE proposes to bring the environment dimension back in, and to offer an integrated and comprehensive analysis of primary production and natural resources role into the global social dynamics through an interdisciplinary reflection.*

Past changes in climate, environment and resources: dangerous liaisons

West-Africa is known as the region of the Earth which suffers from the strongest climate perturbation of the last 40 years. The multi-decadal drought had and still has a major impact on population and their environment. However, the impact of climate perturbation on the natural resources and crops is far from being simple. Two paradoxes clearly illustrate this point.

- The Sahelian paradox: An increase in water table level, surface water area and gullies has been observed in the last 30 years in the Sahel, despite the rainfall amount being lower (Descroix et al. 2009, Favreau et al. 2009 and references therein). The main cause of this paradox was generally attributed to an increase of the cropped area over the same period, leading to increased run-off (Mahé et al. 2005). Recently, Gardelle et al. 2010 demonstrated that increased Sahelian runoff also affects non-cultivated areas. In that case, the long term response of natural rangelands is suspected to be the triggering mechanism. Conversely, in the Soudanian zone south of the Sahel, the multi-decadal drought causes decline in water yields and river runoff (Séguis et al. submitted). Clearly, linking climate variability and water resources deserve expertise and tools able to simulate such effects, otherwise there is a risk that inference of changes in resources following climate change may be at odd with reality.

- The Sahel greening versus desertification paradox. The satellite archive, which now ranges from 1980 to present, has revealed a second paradox. Indeed, whereas the prominent changes of land surface where mostly attributed to desertification (e.g. Dregne and Chou 1992), the satellite observed a 'greening' trend over the last 25 years, leading to headlines like 'the Sahara desert is contracting' (Tucker et al. 1991). There is now a debate on the nature of this trend and an urgent need to reconcile greening and desertification. If one can easily imaging that the strongest drought of the 70' and 80' were followed by a partial recovery of fast response vegetation systems like annual grasses rangelands and annual crops (Hiernaux et al. 2009a, 2009b), the fate of woody vegetation is mostly unknown to date. In addition to climate, the changes in Land Use and Land cover are central to these questions. For instance, the Sahelian greening trend has been tentatively attributed to increased in crop systems management (Olsson 2005), whereas, conversely, crop yield have been said to decreased, due to decrease in soil fertility of crop extension on less suitable land. Attribution of changes in vegetation resource like pastures and crops to different factors is far from being completed. Crop/livestock systems, rain-fed agriculture, intensification experiments need to be documented over the past period (e.g. La Rovere et al. 2008). Again, expertise, long-term datasets and dedicated tools are the requisites to properly link climate variability and resources.

In addition, if climate and societal scenario have to be used to propose projections of resource availability for the next decades, it is important to pinpoint which variables predicted by climate scenarios are critical for resource evolution. Water availability has been an important focus point for past studies in West Africa. There are however a series of open questions: For instance, can we detect the expected intensification of precipitation predicted by global warming? Is the 'more rain in rainy areas' hypothesis sounded in West Africa (IPCC-AR4) and observed so far? In terms of resources, the importance of the length and frequency of intra-seasonal droughts is certainly to investigate further, as well as the occurrence of consecutive dry years which potentially impact human perception and adaptation strategy. Recent studies have pointed temperature as an important factor, for crops because of thermal stress as well as for human health because of mortality linked to pre-monsoon heat waves.

To solve these issues, it is necessary to document the past changes, to attributes these changes to the proper mechanisms, and to use models both for the historical period, as validation, and for the forthcoming decades. The detection of changes is accessible at the regional scale in some respect: Climate regime, broad land use change derived from satellite over the recent past, regional scale inventories (Ramankutty 2004). Most of the mechanisms however are best accessed at the meso-scale, over areas of typical size 50 x 50 km corresponding to 1 or 2 districts in terms of administrative structure. For instance, historical data based on aerial surveys (1954), long term dynamics of eco-agrosystems, past hydrological studies, resource use and societal enquiries are mostly accessible at this smaller scale. The relevant time-series are rare, especially when they combine the different factors (climate, resource and production systems, societies). The strategy of the proposal is therefore to take advantage of meso-scale coordinated sites (Cappelaere et al. 2009, Mougin et al. 2009) and to use them to evaluate and generalize the most important mechanisms, as well as to replace these sites in a broader context. This is a demanding strategy since these sites have to benefit from in-depth surveys of environmental changes, but also from associated changes in human uses, perception of

these changes and plausible scenarios for both aspects. The consortium has been designed to fit this general organization.

ESCAPE will build on unique expertise and long term datasets of meso-scale and district-scale environmental changes (resources, climate and societies) to identify the key processes linking environmental changes and societal perception and adaptation. ESCAPE will assess the regional scale (SSA) estimates of these changes to ascertain the relevance of observed and simulated historical changes and projections.

Climate variability and changes

Africa has a long history of rainfall fluctuations and droughts of varying lengths and severity. Recently, the West African Monsoon which contributes to ~90% of the annual rainfall amount in the Sahel (Le Barbé et al. 2002) has experienced from the 1970s to the 1990s a dramatic change, leading to the strongest interdecadal signal of the planet in the 20th century (Redelsperger et al. 2006). A number of studies have highlighted the role of sea surface temperatures (SST) in driving such variability (Folland et al. 1986, Palmer 1986, Giannini et al. 2003). Some studies also suggest that the world-wide warming trend of SSTs, associated with the global warming trend, may be related to the Sahel drying, highlighting the dominant role of the tropical Indian (Bader and Latif 2003, Giannini 2009, Lu and Delworth 2005) and tropical Pacific (Lu and Delworth 2005, Caminade and Terray 2009). Nevertheless, over the whole 20th century, the Sahel precipitation decadal changes cannot be solely explained by the global warming trend of SST. The partial recovery in the 1990s and 2000smay be attributed to the interference of internal multi-decadal variability in the Atlantic Ocean (the AMO, a SST pattern connected to the oceanic thermohaline circulation; Knight et al 2005) with the global warming signal: Atlantic SST strengthened the Sahel drying induced by warming of the oceans when in a phase that favored a southward location of the Intertropical Convergence Zone (ITCZ) in the 1970s and 1980s, but are now in a configuration favorable for Sahel rainfall, hence they are partially counteracting the drying trend associated with global warming (Ting et al 2009, Mohino et al. 2009). Those expectations are not confirmed however by the results of the CMIP3 exercise for the IPCC-AR4 report which essentially show no agreement even on the sign of the rainfall trends over Sahel (Fig 3).

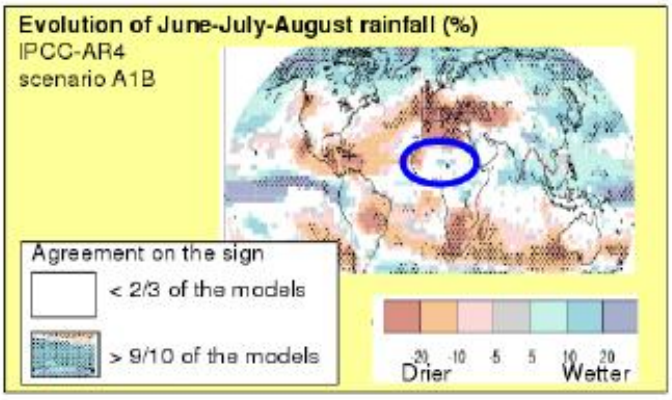


Figure 3: Evolution of the summer rainfall in the IPCC AR4 climate change simulations. There is a very large dispersion in terms of rainfall trends in that region: about the same number of models predicts a drier or a wetter climate in Sahel.
Source: IPCC-AR4

It is presumable that the dispersion of the coming simulations of the next IPCC AR5 report will be as large (or probably larger due to the larger variety of models) than in the previous report. Since the future of rainfall in SSA is of paramount importance for the future of ecosystems and agricultural systems (90% of all water is used by agricultural activities according to Brown and Hansen 2008), producing reliable future scenarios of natural resources and agricultural production depends critically on our capacity to reduce the uncertainties in climate change projections.

ESCAPE will use numerical simulations of climate models, which are a central tool in the understanding of climate variability and mechanisms, to make a major step in assessing for which reason some models predict more rainfall and others less. One important question in that respect is to understand the contribution of natural variability, global warning or other forcing to the recent decadal evolution of rainfall. ESCAPE will perform a hierarchy of sensitivity experiments and will make a real profit of the unique AMMA database to quantify the respective contribution of each driver on this evolution. Therefore ESCAPE will be in position to evaluate the new CMIP5 present and future climate simulations.

Adaptation options for the future

SSA cannot afford to wait forever for more certainty in climate projections – the high climate variability of today is already having a strong impact on the lives and livelihood of poor populations in Africa (Dilley et al. 2005; CGIAR 2009). To cope with the climate risk, rural populations have developed a variety of practices entailing a high degree of risk aversion (Affholder 1997; de Rouw 2004), a basic survival strategy. But such a strategy, if effective to ensure bare survival under adverse conditions, severely impedes development in keeping production potential low in good years and plays a significant role in keeping farmers, and their families, in poverty (CGIAR 2009). Further, changing socio-economic conditions such as the population pressure (Fig.4; Muller et al. 2010) and the threat of an increase of this already high climatic variability under a changing climate can severely aggravate the situation.

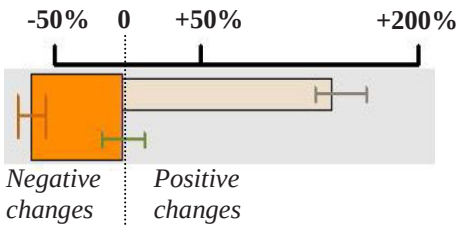


Figure 4: Mean change in crop yields (green bars) and self-sufficiency (orange bars) in SSA from 1996-2005 to 2046-2055 in 30 scenarios defined by Muller et al. (2010). Whiskers indicate the range of impacts. Tan-coloured bars indicated projected changes in population (Nakicenovic and Swart, 2000). Although a large uncertainty in projected future yields (between -7.5% and +7.6%), SSA is likely to experience a significant decrease in self-sufficiency because of population growth (a loss greater than -50%). *After Muller et al. (2010)*

This is where actionable climate knowledge, through Climate Risk Management (CRM), can make a huge difference. CRM is an emerging discipline that advocates the use of climate information in planning and decision making not only offers protection against the impacts of bad weather, but also opportunities to capitalize on favorable weather (CGIAR 2009). CRM can provide a small, first step to escape to poverty trap in improving the resilience of climate-limited livelihood systems. Among the variety of tools of CRM, climate forecasts and weather index-based insurances are particularly suited for better agricultural risk management (Hammer et al. 2000; Skees et al. 1999). While the use of climate forecasts in orienting tactical decision making is not new, it has only recently developed into a serious scientific contribution (Sultan et al. 2010; Hansen et al. 2002; Hammer et al. 2000). Index-based insurance is a newer option that could help transfer the climate risk from vulnerable populations to financial markets (CGIAR 2009) with growing pilot studies and scientific literature (Berg et al. 2009; Collier et al. 2009; Barnett et al. 2008, Barnett et al. 2007). But there is still a poor understanding of how to use climate information for better risk management due to the dominant paradigm for knowledge generation in CRM which begins with climate, remaining focused climate products, rather than with the decisions that can be made based on this climate information. As a consequence, climate information is often ill-suited for decision-making (Ash et al. 2007; Stern and Easterling 1999) and evaluation of its added value, necessary to mobilize funds and to focus on where the benefits are likely to be the greatest, are scarce (Sultan et al. 2010; Meza et al. 2008). But defining an efficient risk management framework is not a trivial task since climate information needs and adaptation options can differ strongly depending on the location, the socio-economic context and the adaptive capacity of rural communities. Most of all, it requires the input and participation of the most affected by climate risk – the African rural poor – to build the necessary bridge between scientists and stakeholders.

ESCAPE will bring together the necessary interdisciplinary expertise in climate science, agronomy science, social science and economics to design and evaluate innovations based on climate knowledge in climate-limited livelihood systems. ESCAPE will adopt a participative approach which places people and livelihood at the centre of the research effort.

1.4. SCIENTIFIC & TECHNICAL OBJECTIVES, INNOVATION CONTENT

The overall objective of ESCAPE is to *assess the vulnerability of rural societies in SSA to climate and environmental changes and to explore adaptation pathways to reduce this vulnerability*. This will be achieved by fostering coordinated research, through *both retrospective and prospective studies*, on the evolution of different agricultural, ecological and social systems interacting together under the global environmental changes. The specific objectives of ESCAPE are:

- **Detect and attribute environmental changes:** ESCAPE will provide new insights into the major environmental changes in Africa over the last fifty years through their different components (water availability, agro-ecosystems production), drivers (climate and land-use changes) and their complex interdependencies;
- **Improve understanding of climate changes:** ESCAPE aims to better understand the contribution of natural variability, global warning or other forcing factors to the recent decadal evolution of rainfall in Africa. ESCAPE will therefore take the necessary steps to reduce the uncertainties in climate change projections;
- **Quantify vulnerabilities and adaptive capacity:** ESCAPE will assess the vulnerability, the resilience and the adaptive capacity of rural communities in various climate-limited livelihood systems by conducting an integrated and comprehensive analysis of the role of primary production and natural resources into the global social dynamics through an interdisciplinary approach;
- **Explore adaptation options for the future:** ESCAPE will move beyond the static view of vulnerability assessments and the linear extrapolation of climate scenario impacts to facilitate pro-active adaptation that is scientifically sound and socially acceptable. ESCAPE will investigate the potential of climate information in the design of tactical and strategic options that would be able to reduce the vulnerability of major climate-limited livelihood systems in SSA;
- **Improve adaptive capacity and decision making:** ESCAPE will create individual, communal and institutional adaptive capacity at case-study locations throughout SSA by converting scientific knowledge into measurable actions within the case study regions (e.g. changes in the cropping management such as crop choice, sowing dates, fertilizer use in response to anticipated climate variability or changes). Stakeholders and users will be fully involved in the design and evaluation of such adaptation options to maximize their efficiency in decision making;
- **Maintain established capacity in Africa:** To ensure that processes and networks established throughout the project can continue after the program and contribute to reinforce research capacity in Africa, ESCAPE will facilitate bilateral scientific exchanges between France and Africa. Specific collaborative actions targeted for African students and confirmed scientists will be developed (organisation of workshops in Africa, sub-contract with several African institutes, funds request for North-South travels and student grants).

This will be achieved by:

- **Conducting a set of case studies** in target countries selected to reflect different climate conditions from humid to nearly arid environment and various socio-economical conditions determining various environmental risks and vulnerabilities;
- **Capitalizing on and completing large existing environmental and socio-economic database** such as the unique AMMA database with an unprecedented data coverage including long-term geophysical regional and local in-situ measurements (Fleury et al. 2009; Lebel et al. 2009), agronomical and ecosystems surveys as well as household vulnerability indicators from socio-economic surveys in several Sahelian countries; the ECLIS project database documenting management of natural resources including the role of public policies in Northern Sahel; the Niakhar database with a long-term assessment (since 1984) of demographic indicators and economic variables describing socio-cultural population characteristics in Senegal. These databases, completed throughout the project lifetime by targeted socio-

economic and demographic surveys, will be merged to build for the first time a multidisciplinary database on long-term environmental, social and ecological monitoring in Africa;

- **Conducting unique model-data comparisons** at time scales ranging from 30 minutes to several years based on state-of-the-art and newly developed climate models. Those comparisons, supported by the AMMA-MIP framework, will allow assessment of the CMIP5 control and climate change simulations in terms of their representation of the African monsoon both for present climate, for the representation of decadal variations and for the representation of surface variables;
- **Deploying an intensive social fieldwork program** encompassing different disciplines such as anthropology, history, sociology, geography and demography within a diachronic and historical perspective to examine how individuals and groups face up to uncertain climate and environmental conditions and changes, particularly their economic activities, social re-organisations and coping strategies;
- **Applying a users and livelihood oriented approach** through the integration of innovative biophysical, economic and climate modeling approaches fitted to decrease perceived climate-induced vulnerabilities within the complex economic, social and political configurations and dynamics;
- **Adopting a participatory approach in the design and evaluation of adaptation options.** Role playing game and participatory modelling will fully involve users and stakeholders to maximize the effectiveness and acceptability of the project outputs;
- **Bringing together a multidisciplinary consortium** with expertise on climate science, hydrology, agronomy, ecology, demography, economy, geography, anthropology and ethnography to tackle a common research issue. All these communities, especially social and geophysical ones, have worked until recently in relative isolation. ESCAPE will integrate expertise and knowledge of the latter communities into a coherent interdisciplinary framework that maximizes utility of these disciplines to tackle the complex transdisciplinary science and development issues raised by environmental and social changes in Africa.

2. PROJECT SCIENTIFIC AND TECHNICAL OBJECTIVES / WORK CONTENT

2.1. SCIENTIFIC CONTENT, PROJECT BREAKDOWN

The workpackages of ESCAPE and their interdependencies

ESCAPE is organized into 6 work packages (WP) outlined in the figure below showing a graphical presentation of the WPs with their main interdependencies.

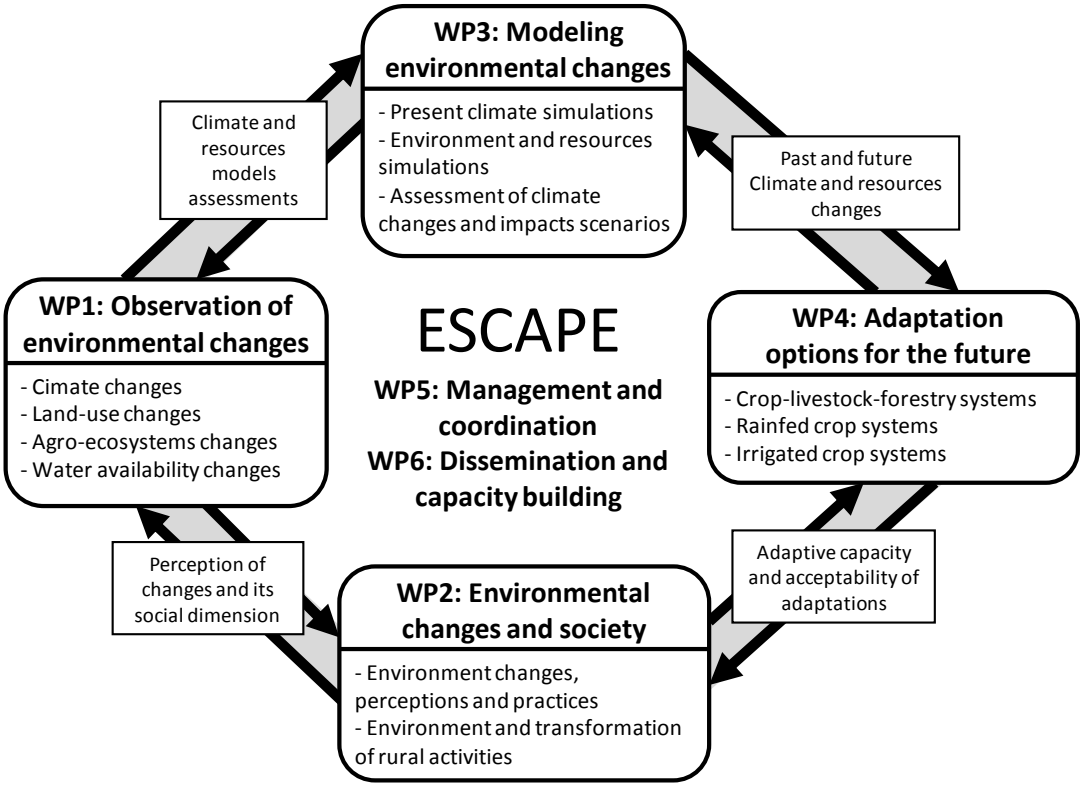


Fig.5: Graphical representation of the ESCAPE workpackages and their interdepedencies

WP1: Observation of environmental changes
The purpose of WP1 is to detect the major past environmental changes impacting societies in West Africa. These issues are addressed at the regional scale when possible through satellite data and the local scale (basin catchments, production systems) where datasets and expertise ranging from climate to production systems and to societal perception and adaptation can be systematically collected and analysed. WP1 will provide the ground truth for assessing climate and resources simulations of WP3.

WP2: Environmental changes and society
The WP2 goal is to evaluate the impact of climatic deterioration and environmental practices on the dynamics of natural resources and agricultural activities in the Sahel and the Sudano-Sahelian region. In a historical perspective, we intend to question the social groups' perceptions of their vulnerabilities and their strategies to cope with it. To do this it is necessary to enshrine this socio-environmental dynamics in the complexity of societal transformations. In this perspective, we propose to: compare data on the dynamics of surface water and primary production (WP1) with local people's perceptions and use practices in the field; and to observe the coping strategies and questioning their possibility of becoming agro-pastoral adaptation options for the future proposed in WP4.

WP3: Modeling environmental changes
The purpose of this task concerns numerical modeling of environmental changes at various places and at various scales over West Africa, using results produced in WP1 and WP2 and also AMMA database. For

this, focus on various actions will be carried out, such as the building and the analyzing of numerical simulations of the climate and environmental changes during the last decades (1950-present) and the assessment of climate change from the forthcoming CMIP5 and CORDEX climate change simulations, with respect to the questions of environmental changes over West Africa. Those simulations will serve as the basis to design adaptation options for the future changes planned in WP4. Indeed, ESCAPE will be in position for the first time to determine what are the key climate determinants for resource productions (e.g. onset of the rainy season, length of the rainy season, dry spells, seasonal rainfall); how these determinants are represented in state-of-the-art climate models simulations; and how they will evolve in future scenarios of climate change.

WP4: Adaptation options for the future
The objective is to design and evaluate various adaptation options to reduce vulnerability in climate-limited livelihood systems. WP4 will cover the main three production systems namely (i) integrated crop-livestock-forestry systems, (ii) rainfed crop production systems and (iii) irrigated crop systems. Constraints and opportunities for the future will be assessed from the climate changes and impacts scenarios of WP3. Through a improved knowledge of adaptive capacities of rural communities from WP2 and a participative approach which places people and livelihood at the centre of the research effort, WP4 aims to facilitate pro-active adaptation that is scientifically sound and socially acceptable.

WP5: Management and coordination
A specific task will be dedicated to scientific and technical management and coordination as well as project monitoring during the 48 months of the project lifetime.

WP6: Dissemination and capacity building
WP6 will propose efficient tools for internal and public communications to insure a large dissemination of project results. Database management, central for WP1, WP2, WP3 and WP4 will be supported by WP6 in close connection with the AMMA database team. WP6 will also fully support the participation of African scientists throughout the project.

Scales and geographical targets

The work of WP1, WP2, WP3 and WP4 will be conducted at both regional scales (WP1 and WP3) and at the local scales of basin catchment, production systems or household scale (WP1, WP2 and WP4). Interactions between scales in the methodological framework of ESCAPE are described in the figure below.

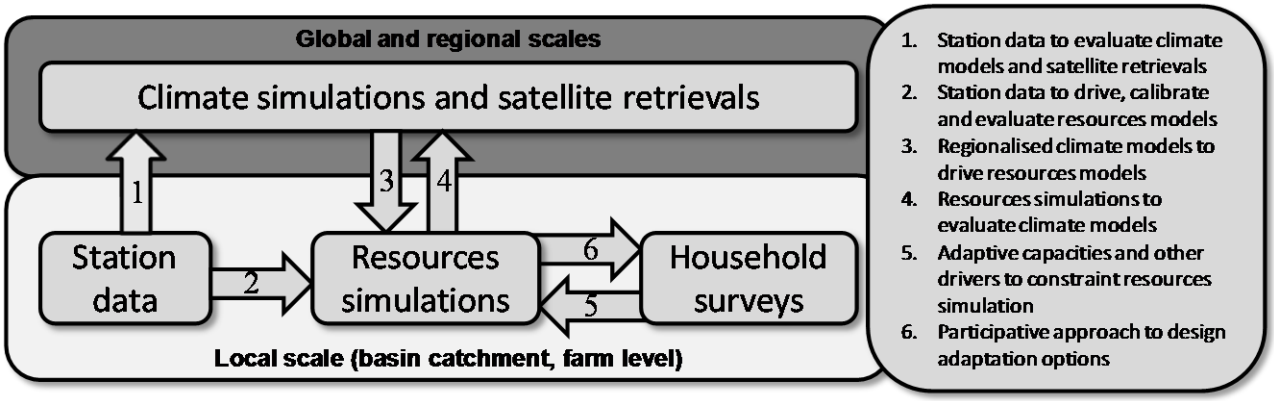


Fig.6: Scales issues in the ESCAPE methodological framework

ESCAPE will conduct a set of case studies in target countries selected to reflect different climate conditions from humid to nearly arid environment and various socio-economical conditions determining various environmental risks and vulnerabilities. Test sites have been chosen (i) to sample this variety of situations (ii) to capitalise on long-term database both for geophysical and socio-economic purposes and (iii) to generate synergic work between the different disciplinary communities involved in ESCAPE.

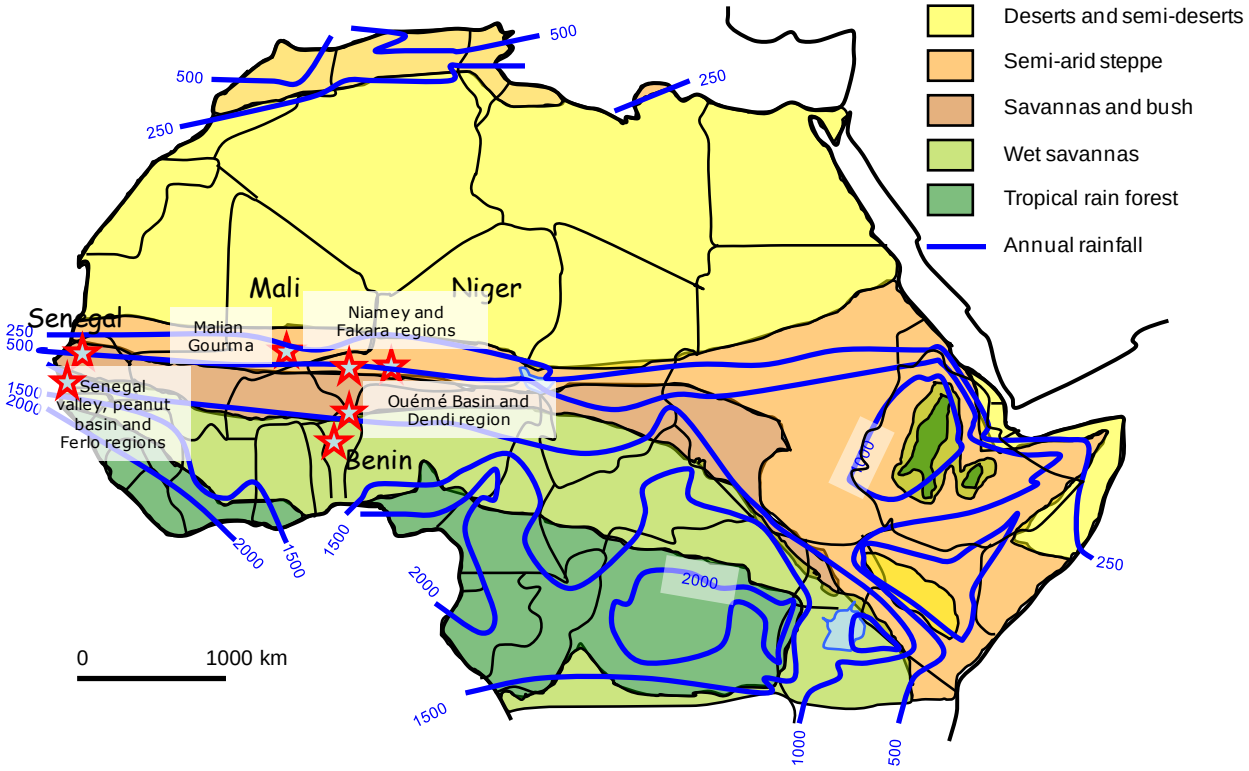


Fig.7: Map of ESCAPE target sites

2.2. PROJECT MANAGEMENT

In addition to the 4 scientific work packages, one work package will be devoted to the project scientific and technical management (WP 5) and one to the promotion and dissemination of results (WP 6). The project will be coordinated by Benjamin Sultan (LOCEAN). Each WP will be assigned a leader who will be in charge of the good achievement of the work and timely delivery of outputs for his/her work package.

Workpackages structure and responsabilities sharing

Number of the workpackage	Name of the workpackage	Lead participant
WP1	Diagnosis and characterisation of environmental changes	L. Kergoat (LMTG)
WP2	Questioning environmental changes impact on local societies. Agrarian production systems and access to natural resources embedded in social dynamics	R. Lalou (LPED)
WP3	Numerical modeling of environmental changes	F. Hourdin (LOCEAN)
WP4	Adaptation options for the future	B. Muller (CIRAD)
WP5	Management and coordination	B. Sultan (LOCEAN)
WP6	Dissemination and capacity building	J-L. Redelsperger (CNRM)

Together with the coordinator, the WP leaders will form an executive committee who will monitor the project, that is ensure that the objectives of the project are properly followed, adjust the strategy if deemed necessary, enhance the links between work packages and maintain adequate links with national and international partner programmes. The project executive committee will meet on a regular (bimonthly) basis through videoconferencing. Besides specific WP meetings, three workshops (kick-off, mid-term, final) will be organized for all the project participants with the purpose to specially emphasize WP interactions. Two of the workshops will be held in Africa. The coordinator will solicit the IRD program for funding international workshops (IRD-DIC) organized by IRD researchers to get extra-funds in order to increase the size of those events and the number of African participants. In general, the project coordination will closely watch the critical participation of Africans in the WP activities and in the project workshops. A specific budget is required to support the latter. Capacity building actions will be developed in WP6 (see section 4.).

The project coordination will be backed by the AMMA International Executive Office for tasks related to technical management and communication. Part of activities of a programme manager and a project assistant based at the AMMA IEO at CNRM (Toulouse) will be dedicated to technical coordination together with the scientific coordinator. A project assistant also based at CNRM will be in charge of web developments. Their tasks will be to:

Task 5.1 Set the project management plan

- schedule meetings
- coordinate reporting process (schedule, forms and support documents)
- set up the project management tools (participant and mailing lists, document sharing, …)

Task 5.2 Monitor the project

- manage budget
- organise meetings
- follow up deliverables
- ensure correct information flow within the project.

In addition, the project coordination will support the coordination with international and French programmes. The ESCAPE project will contribute to the objectives of the AMMA programme. Thus collaboration and coordination will be fostered with the other research or observation projects carried out in this context. The WP0, WP1 and WP3 leaders are members of the scientific committee of AMMA France chaired by Serge Janicot (LOCEAN) also a member of the AMMA France executive group, and many other members of

ESCAPE are involved in AMMA-related activities. ESCAPE will benefit the background of AMMA in terms of data and experience. In particular, the AMMA-MIP web site and its architecture will be used to make model runs available. The AMMA database and data will be accessible to all the project participants, who will be able to contribute new data (see section 4.). This partnership will also open the international range and the large scientific community of AMMA to our studies while ESCAPE will bring a new dimension by mobilizing new partners from social sciences.
The coordinator and executive committee will pay particular attention to the good insertion and contribution of ESCAPE to the IPCC-AR5, and the COordinated Regional climate Downscaling Experiment (CORDEX). The LOCEAN team will contribute actively in providing climate change scenarios simulations for the IPCC and CORDEX exercises. Furthermore, the coordinator B. Sultan has been nominated by the French focal point of the IPCC as a candidate author to contribute to the next IPCC AR5 report.

2.3. WORK PROGRAM & TASKS DESCRIPTION

WORKPACKAGE 1: DIAGNOSIS AND CHARACTERISATION OF ENVIRONMENTAL CHANGES

The purpose of this task is to detect the major environmental changes which have impacted societies in West Africa in the recent past or susceptible of having an increasing impact in the near future. As highlighted in the previous sections, these issues are addressed at the regional scale when possible, for instance when large-scale patterns of environmental changes can be detected at this scale and at the scale of a number of sites where datasets and expertise ranging from climate to production systems and to societal perception and adaptation can be systematically collected and analysed.

Task 1.1: Detection and patterns of climate change

In view of the recent results identifying the most critical variables in terms of impact on resources, including outputs of the AMMA program (ASL special issue), the focus is put on the patterns of drought, especially in terms of dry spells occurrence, floods and heat waves, which impact rain-fed agriculture for instance and multi-year phenomena which impact production systems and may drive societal changes.

Different datasets will be scrutinized: this includes regional scale historical daily SYNOP data (AMMA database), the CILS (1950-present) through collaboration with AGRHYMET, GISS and CRU datasets, as well as NWP re-analyses (ERA40, ERA-Interim, NCEP), satellite estimates (EPSAT, TRMM, Megha-Tropiques) and meso-scale high resolution and dense networks of the AMMA-CATCH S.O. that provides up to twenty years of 5-minute rainfall densely spread over three sites of roughly 10000 km² surface in Mali, Niger and Benin.

Rainfall characteristics over the past decades will be analysed as well as their links to changes in larger scale features such as the monsoon flow and the inter-tropical front In addition to drought. The characteristics of rain systems will be analysed, with a focus on the evolution of their occurrence rate, intensity and the spatial extension, by merging CILSS, AMMA-CATCH and satellite datasets. Geo-statistical models, fed with climatological information. With the objective of feeding environmental and resource models (agriculture, rangeland models, water availability simulations) to be used in WP3, rain fields will be produced at meso and regional scale.

This task will also address a less studied phenomenon, namely rainfall intensification: is there a trend towards global warming triggered intensification in rainfall and floods? High time-resolution datasets from AMMA-CATCH will be compared to regional scale daily rainfall fields and trends or absence of trend will be analysed.

Besides, it is also important to detect warming trends and heat wave occurrence. It is especially critical in the pre-monsoon season, which is the hottest and more humid season and which provokes important mortality and during the growing season, when it combines with drought occurrence to provoke crop heat stress. Changes observed in surface air temperature, diurnal temperature range and rainfall over the past decades will be analysed as well as the links between thermodynamics, rainfall and surface fluxes. While Summer temperature are expected to be linked to monsoon rainfall on inter-annual time scales, other balances and trends may prevail at larger time scales in Spring when temperature reaches its yearly large maximum, prior to rainfall. Variations in the duration, mean properties and spatial coherency of this phase of the year will be analysed as well as the variations in the diurnal temperature range. Whether such changes in Spring are associated with a delay, shift and shortening of the rainy season will be studied.

Task 1.2: Detection and attribution of land use change

Land use and land use changes (LULC) reveal the changes in production systems driven by societal changes and adaptation and it is also an active player in the resource production changes, and even to some extend in climate changes. As such, important efforts will be devoted to detect LULC and the drivers of it.

- *Detection and attribution at the district (meso-scale) scale*

LULC will be derived from historical remote sensing data over three well documented sites from the AMMA-CATCH Observation System (S.O.) spanning latitude gradient in West Africa (Ouémé in Bénin, Fakara in Niger and Gourma in Mali). Classification of land units from CORONA images (1965), aerial photographs (1949 to 1954) and SPOT/LANDSAT data (present) will be produce for the three sites. Features like crop/pasture/fallow/secondary forest/primary forest will be diagnosed. Diagnostics of the drivers of these changes will be collected (within WP2).

- Detection of LULC at the regional scale
This task aims at evaluating the existing LULC products with the objective of assessing the generality of the district scale features and to assess the LULC datasets used in climate simulations.

Task 1.3: Detection and attribution of ecosystems and agrosystems changes from long term series
As soon as trends and decadal variability are addressed, it is critical to analyse the long term datasets, which are unfortunately extremely rare. ESCAPE has a unique opportunity of accessing two long term dataset, from which the dynamics of rangeland ecosystems: rapid and lagged response to drought, dynamics of the different Plant Functional Types, coupled water/plant systems, coupled plants/LULC systems. Similarly, for crop/livestock production systems: trends in yields, trends in livestock inventories, coupled production/LULC systems, coupled production/societies systems will be analysed. These datasets will be used for the validation of resource simulations over 1950-present.

The large scale trends and patterns, (satellite greening trends, desertification areas) will be assessed in view of the previous analyses, with the objective of rejecting or reconciling these theories. Satellite signal will be carefully analysed in terms of vegetation and surface properties changes over time (AVHRR LTDRv3 and VGT dataset).

Task 1.4: Detection and attribution of surface water and run-off changes over 1950-present
This task aims at diagnosing the long term changes in surface water availability and at attributing these changes to either climate or man-made LULC, or presumably to a combination of these factors. It requires an assessment of surface water (ponds, wetland) and run-off (gullies, erosion patterns) systems derived over the Fakara and Gourma sites as well as corresponding eco-hydrological and LULC changes.

Links with other WPs
Task 1.1 is mirrored in WP3 for the climate model counterpart. Tasks 1.2 to 1.4 will feed the simulations of WP3. Tasks 1.1 to 1.4 will be completed with parallel effort over the same sites in WP2.

Deliverables

D1.1a: Report and article on the assessment of changes in the seasonal cycle of temperature at multi-decadal scales across West Africa in observations and in re-analyses data. **M12 (CNRM)**

D1.1b: Report on the signature of climatic changes in surface thermodynamic and energetic couplings. **M12 (CNRM)**

D1.2a: Report on drought patterns inter-annual variability, intra-seasonal dry spell, intensification. **M18 (LTHE)**

D1.2b: Report on the generation of rainfall fields from climatological information and techniques to be applied in WP3 simulations. **M18 (LTHE)**

D.1.3a: Report on land use maps series from 1950s to present and corresponding digital maps for the Gourma (Mali) site. **M12 (LMTG)**

D.1.3b: Report on land use maps series from 1950s to present and corresponding digital maps for the Niger site. **M12 (LTHE)**

D.1.3c: Report on land use maps series from 1950s to present and corresponding digital maps for the Ouémé (Bénin) site. **M12 (HSM)**

D.1.4: Assessment of LULC historical datasets: consistency at the regional scale, accuracy from comparison at the district scale. **M18 (LTHE)**

D1.5: Report on Multi-decadal dynamics of ecosystems and crop/livestock production systems at the district scale in Gourma (Mali) and Fakara (Niger). **M18 (LMTG)**

D1.6: Report and article on the assessment of the greening and desertification theories. **M36 (LMTG)**

D1.7a: Report on the evolution of surface water and run-off systems at the district scale for the Mali site. **M18 (LMTG)**

D1.7b: Report on the evolution of surface water and run-off systems at the district scale for the Niger site. **M18 (LTHE)**

WORKPACKAGE 2 : QUESTIONING ENVIRONMENTAL CHANGES IMPACT ON LOCAL SOCIETIES. AGRARIAN PRODUCTION SYSTEMS AND ACCESS TO NATURAL RESOURCES EMBEDDED IN SOCIAL DYNAMICS

This task aims at evaluating the impact of climate and environmental changes on agro-pastoral practices and, more broadly, on social and kinship relationships over time. Involving different disciplines, such as anthropology, history, sociology, geography and demography, this project stems from a diachronic and historical perspective. It examines how individuals and groups face up to uncertain climate and environmental conditions, particularly their economic activities, social re-organisations and coping strategies. This objective demands not to consider the climate and environmental conditions as the sole reason of local societies' vulnerability in the Sahel. This is why the project aims at studying how human relationships with environment interact with the broader and complex economic, social and political configurations and dynamics.

Field researches will be carried on in four sites:

- Two main sites: Hombori region in Mali and Fakara region in Niger. Fieldworks will allow a crosscutting research with the other WP, as they are common to the whole project, and benefit from the AMMA and ECLIS research experience.
- Two secondary sites: the region between the Senegal River Valley, Sine Saloum and the Ferlo (Senegal) and the Dendi area in northern Benin. Their environmental and social characteristics will bolster a comparison with the 2 main sites with specifically focused social surveys.

Field-sites must be considered as poles of possible reticular extensions for research in order to follow social actors' translocal dynamics (urban settings, areas of migration…). On all these sites, the research tackles two main issues, presented here as two tasks T2.1 and T2.2.

Both tasks employ different methodological techniques in accordance with participants' disciplinary specialisation and research experiences and with the specific research goals:

- Free and semi-directive interviews for collecting single or collective social actors' representations and practices, with individuals or focus groups
- Ethnographic participant observation for collecting and analyzing discourses, daily social practices, social organisation , socio-political dynamics
- Geographic Informatic System (GIS) data collection and treatment, combining and comparing social perspectives and scientific land uses characterisation (WP1), techniques for representing geographical perception / representation of space, developed by Saqali (2009)
- Quantitative socio-demographic surveys based on 500 to 1000 households' samples and statistical data treatment and analysis.

To save space in the WP2 description, a table summarizing the methodological framework of WP2 is given in the annex section (see table section 6.4).

Research will stem from socio-economic data and evidences previously gathered and produced by:

- The AMMA program on agriculture and livestock with group interviews for 1354 households in 16 sites in Senegal, Mali, Burkina Faso, Niger and Nigeria distributed across a rainfall gradient divided into three zones: 400-500 mm, 500-700 mm, and 700-900 mm.
- The ECLiS project documenting 3 sahelian communities, Dantiandou in Niger, Téssékré in Senegal, Hombori in Mali and a sudanian site, Djougou in the Benin. The human sciences team works on the concrete management of natural resources including the role of public policies in two different cases, years with normal rainfall and years with rainfall deficit. The team has already collected 600 interviews, 600 socio-economic questionnaires, 10 reports and an important cartographic database.
- The Niakhar project with a long-term assessment (since 1984) of demographic indicators and economic variables describing socio-cultural population characteristics in 30 villages covering 230 km² in Senegal.

Task 2.1: Perceptions of environment and agro-pastoral practices over time

Observations and reflections will focus on the relationships between local people and their natural environment. Field researches and surveys will grasp:

- local populations' memory and representations of environmental change: narratives of climate and landscape changes; mental geographies; perceptions of quantity and quality of natural resources (water, pasture land, wild grass...); cultural representations of nature, risk and uncertainty.
- local populations' practices and knowledge related to natural resources (water resources and primary production) : their spatial distribution and social redistribution accordingly to economic and social units; seasonal and social conditions of access; land tenure; contrasting/complementary relationships between herding and agricultural activities.

Production systems, both in their technical and "cultural" dimensions, are at the core of this sub-task research, constantly privileging a diachronic approach. This will lead to a comprehensive analysis of socio-economic and technical strategies for coping with uncertainty, and adapting to climate hazards.

Task 2.2: Economic diversification strategies and social reconfigurations

The main concern of task 2.2 is to examine the role of climatic and environmental changes in the transformation and development of rural societies. It will focus on:

- the diversification of economic activities (trade, wage labour, civil service, informal activities, traffics, transport...) in relation to the constraints of the rural world (demographic pressure, land scarcity, declining soil fertility, diseases and mortality of livestock, work difficulty, lack of opportunities ...).
- the complexity of mobility practices as strategies for coping and adapting to environmental changes or for diversifying socio-economic activities : pathways, circulations and movements, migration flows within countries and the sub-region, multi-territoriality, home-destination links…
- Ongoing socio-political dynamics: the reshaping of social relationships, i.e. their "ethnicisation"; power struggles within and between groups; new territorial and institutional dynamics in the framework of decentralization.
- Family reconfigurations: their possible dependence on environmental change and resource depletion; the evolution of gender and generation relations within families; the impact of the monetization of trade exchanges and of new cultural and materialistic aspirations...

Collaboration and joint analysis of research evidence with the other WP

Tasks 2.1 and 2.2 strongly allow a joint analysis with the other WP, and more particularly:

- a comparison between WP1 data and WP2 field evidence about perceptions and modes of exploitation of surface waters and primary productions.
- a contribution to the modeling and forecasting of future strategies options (WP3 and WP4) by presenting effective locally, socially and historically grounded coping strategies.

Deliverables

D2.1: Joint meeting with WP4 and WP1 for integrating adaptive capacities from household surveys into the farm model to be build in WP4 and for combining social perspectives and land uses characterization into a common GIS. **M18 (LPED)**

D2.2: Provisional version of the GIS data collection and treatment, combining and comparing social perspectives and scientific land uses characterisation (WP1), techniques for representing geographical perception / representation of space for Mali and Niger. **M24 (LMTG)**

D2.3: Report on local history of environmental and climate change. **M36 (LPED)**

D2.4: Report on local practices and perceptions of natural resources. **M36 (LMTG)**

D2.5: Report on the evolution of primary production systems as a coping strategy. **M36 (LMTG)**

D2.6: Report on economic diversification and rural constraints. **M36 (LPED)**

D2.7: Report on mobility practices as coping strategies. **M36 (LPED)**

D2.8: Report on political dimension of resources management. **M36 (LMTG)**

D2.9: Final version of the GIS. **M36 (LMTG)**

D2.10: Collective book on climate and environmental changes and socioeconomic in African rural societies (integrating WP2 results as well as those from WP1, WP3 and WP4). **M42 (LPED)**

WORKPACKAGE 3: NUMERICAL MODELING OF ENVIRONMENTAL CHANGES

This task relies on numerical modeling of environmental changes at various places and at various scales over West Africa, using results produced in WP1 and WP2 and also AMMA database. Hydrological, crop and biomass models will be run using both observed meteorological fields and outputs from climate simulations of the last decades (1950-present). This approach will then be extended to the assessment of climate change from the forthcoming CMIP5 and Cordex climate change simulations, with respect to the questions of environmental changes over West Africa. These actions are described in the following tasks.

Task 3.1: Climate simulations of the last decades
The climate of the last decades will be reconstructed with various configurations using a state-of-the-art climate model, coupling the LMDZ atmospheric model (Hourdin et al. 2006) with ORCHIDEE, a model which includes a representation of hydrology as well as a dynamic vegetation model (Krinner et al., 2005). The LMDZ-ORCHIDEE model will be run with imposed sea surface temperatures. A hierarchy of model configurations will be used in order to attribute particular aspects of the observed climate and environmental changes over West Africa to the various components of anthropic forcing and climate natural variability. The model will be run considering or not seasonal leaf growth or considering or not vegetation dynamics in order to assess the part of the decadal variations which may be related to coupling with vegetation, an important issue for future scenarios. The climate model will also be run with: 1) observed sea surface temperature ; 2) sea surface temperature issued from a coupled ocean-atmosphere simulation of the XXth century ; 3) sea surface temperature issued from the same coupled model but without evolution of greenhouse gases (control simulation). Comparisons of such a simulation set with the analysis performed in the frame of task T1.1 will allow characterizing the part of the climate variations due to global warming, and the part related to various aspect of the climate internal variability.

Task 3.2: Simulations of the related changes of environment and resources
Hydrological, vegetation and crop models will be used to assess the effect of past climate variations on water availability, vegetation biomass and yields. These models will be run using observed climate variations and state of the art simulations of the last decades, both with the simulations of task 3.1 and with the control simulations of the Cordex and CMIP5 programs. Those simulations will be used to identify key factors affecting water resources, biomass and yields: annual cumulated rainfall, intraseasonal distribution (onset, long breaks), mean and extreme temperatures, radiation. The historical framework of this task will also allow defining strategies to make the meteorological data issued from the climate models amenable to realistic simulations by hydrological, vegetation and crop models. The possible strategies include dynamical (from Cordex runs) and statistical down-scaling, bias correction (Michelangeli et al. 2009 used in the REGYNA project) and latitude correction, in order to obtain a more realistic climate regime. Millet and sorghum will be considered as reference crops. Simulations will be performed using SARRAH crop model developed by CIRAD, considering few varieties and intensification levels, for Senegal and Niger. Those simulations will then be used in task 4.2 of WP4 to explore the potential of intensification options. Regarding water resources, the focus will be on the changes in the water balance induced by the important human and climatic changes that occurred through the last decades. The climate simulations will provide a first estimate of these changes based on the ORCHIDEE model, embedded in the climate simulations. Specific model, calibrated for the various AMMA-catch supersites will also be tested and compared to observed data of WP1. Specific hydrological modeling studies will be carried out over the AMMA-Catch-Niger site using a Land Surface Model (LSM) with hydrological components tailored to the specifics of the Sahelian environment. This work will benefit from previous modeling works led both at local and meso scales for the AMMA experiment, in particular calibration and validation of LSMs over typical natural and agricultural Sahelian ecosystems, and the intercomparison exercise conducted within the starting ALMIP 2 project (Boone et al., GEWEX).

Task 3.3: Assessment of climate change scenario and projection of future environmental changes
The final objective of WP3 is to provide assessment of the climate change scenarios of IPCC CMIP5 and Cordex exercises in terms of relevance for the modification of crop potential, vegetation biomass and hydrological resources. Evaluation of the climate simulations will rely on the results of the above work. In particular, the simulations will be qualified in view of their ability to reproduce: 1) internal climate decadal variability; 2) the trend linked to global warming; 3) the climate characteristics important to produce good

predictions of water resources and yields. The latter point is particularly important and innovative. Indeed, through the interdisciplinary framework of WP3, combining expertise on agriculture, hydrology and climate modeling, ESCAPE will be in position for the first time to determine what are the key climate determinants for resource productions (e.g. onset of the rainy season, length of the rainy season, dry spells, seasonal rainfall); how these determinants are represented in state-of-the-art climate models simulations; and how they will evolve in future scenarios of climate change. Furthermore, this analysis will benefit from the framework of the AMMA-Model Intercomparison Project (AMMA-MIP, Hourdin et al., 2010, amma-mip.lmd.jussieu.fr). This project was at first centered on the detailed and "process-oriented" evaluation of climate atmospheric models involved in the AMMA program, with a focus on the years of the campaign. The framework will be extended to the evaluation of the ability of CMIP5 and Cordex simulations to reproduce the observed climate variations over West Africa during the historical period according to the above mentioned criteria. Strategies consisting in re-running one atmospheric model (the version of LMDZ which will have been optimized for West Africa) on a series of SST changes issued from the various global coupled models available through CMIP5 will be envisaged. Finally, the crop and hydrological models will be used to: 1) explore the dispersion of possible responses to global warming and internal climate variability; 2) propose most likely scenarios and estimate the uncertainty around this and 3) explore extreme and hypothetical scenarios constructed by adding for instance constant trends to temperatures or rainfall to historical records, or by considering possible or extreme changes of land use in order to identify possible breakdown points in yields and their likelihood in climate change scenarios. These scenarios will then be used to evaluate the potential of adaptation strategies in WP4.

Deliverables

D3.1: Multi-configuration simulations with LMDZ-ORCHIDEE of the West African past climate variations (1950-2010). **M12 (LOCEAN)**

D3.2: Evaluation of the simulations and attribution of changes to global warming, changes in land use and internal variability. **M18 (LOCEAN)**

D3.3: Characterization of the observed and simulated historical climate variations at dekadal scales in terms of surface thermodynamic variables (rainfall, air temperature and humidity) and interpretation in link with recent observations of the surface energy and water balance **M24 (CNRM)**

D3.4: Identification of the key factors controlling the yields, and identification of related key diagnostics relevant for the assessment of climate model simulations. **M24 (CIRAD)**

D3.5: Evaluation of control simulations of Cordex and CMIP5 exercises. New diagnostics and assessment results made available through AMMA-MIP. **M24 (LOCEAN)**

D3.6: Simulation of pond regime in Gourma driven by observed metorological forcings. **M24 (LMTG)**

D3.7: Simulation of Land Surface Model (SURFEX, Sethys-Savannah) driven by historical observed climate and land use over the CATCH-Niger mesosite (including part of the Fakara). **M36 (HSM)**

D3.8: Exploration of future likely scenarios for resources under climate changes. **M36 (LOCEAN)**

D3.9: Simulations with the STEP rangeland (water balance, productivity, feeding, tentative livestock estimates) driven by observed meteorological fields over the Gourma and Fakara sites. **M36 (LMTG)**

D3.10: Exploration of future likely scenarios for crop yield under climate changes with the SARRAH crop model. **M36 (LOCEAN)**

D3.11: Simulation with the STEP rangeland (water balance, productivity, livestock estimates) driven by predicted meteorological fields and land use scenarios over the Gourma and Fakara sites. **M36 (LMTG)**

D3.12: Simulation of Land Surface Model (SURFEX, Sethys-Savannah) driven by climate and land use scenario over the CATCH-Niger mesosite (including part of the Fakara) **M36 (HSM)**

WORKPACKAGE 4: ADAPTATION OPTIONS FOR THE FUTURE

The objective is to evaluate various scenarios of evolution of some of the main agricultural systems of the Sudano-Sahelian areas of West Africa. Studies will concern (i) productivity of integrated crop-livestock-forestry systems, (ii) rainfed productions intensification with the help of climate forecast and agricultural insurances, (iii) climate related risk assessment for irrigated rice.

Task 4.1: Options to enhance productivity of integrated crop-livestock-forestry systems

A set of options to increase agriculture productivity through further integration of crop, livestock and forestry activities will be evaluated under the climatic and impacts scenarii provided by WP3.

- The dairy and weight performance of animals will be modelled based on hypotheses for the access to resources and existing animal nutrition models. Resources availability will be predicted from vegetation production (WP3) under a range of grazing pressure depending on socio-economic options fully documented by WP2.
- Herd production will be derived from individual production and herd composition based on initial situation (farm types, WP1) and dynamics over time as resulting from reproduction parameters and rate of exploitation. Dynamics will be fitted according to predicted resource data and socio-economic options.
- The impact of associated crop and livestock options at farm scale will be assessed for selected farm types using the Nutmon calculator. Modeling crop-livestock mixed farm systems to predict the viability of socio-economic options will be tested for different societal situations derived from surveys and analyses performed by WP2.

LMTG scientist will seek collaboration (ILRI, CIRAD) to adapt existing ruminant nutrition and herd population models. The adaptation of the Nutmon calculator to Fakara and Gourma farm data will be done in collaboration with University of Wageningen.

Task 4.2: Opportunities for intensifying rainfed productions through climate risk management

This task aims to evaluate the potential of climate risk management (seasonal forecasts and weather index-based insurances) for intensifying rainfed production. Economical risks implied by intensification will be first assessed. Then potential roles of climate forecasts and insurances to minimize and mitigate risks will be explored. Work will concern several exploitations in Senegal.

- A farm model able to simulate technical and economic operations and yields (through crop model coupling) of rainfed farms will be developed using GAMS programming software and adapted to 3 standard farms of Senegal on a North-South gradient. It will simulate economic indicators and choices of farmers in relation to climate and economic environment (prices, market, external incomes). Information and parameters will be mainly found in literature. Surveys conducted in WP2 and participative modeling workshop will allow to assess farmers risk aversion, adaptation options and to better fit the model to reality. The model will be validated with information coming from surveys, literature (WP2) and data.

- Climatic constraints to intensification will be assessed by SarraH simulations for different cereals genotypes, sowing criteria and intensification levels, working on historical and future climate data (provided by WP3). The possible uses of climate forecasts to guide decisions before and during cropping season will be listed. Then the interest of forecasts will be assessed in terms of productions and incomes gains or losses using the farm model (following the method of Sultan et al. 2010), considering different assumptions for forecasts accuracy and farmers aversion to risk. Incomes variations at both field and farm levels will be analysed in order to assess insurances needs. Then weather indices based insurances impacts will be assessed working on historical and future climate data (provided by WP3). Various weather indices will be tested. Studies will also concern impacts of combination of climate forecasts and insurances. Hypotheses on risk aversion will be derived from surveys conducted in WP2.

- Results will be submitted to farmers in participative modeling workshop in close connection with WP2. Participative Scenario Modeling will be used to allow farmers to validate, and enrich, the prior agro-economic modeling. This participatory method first helps to formalize with stakeholders the different economic factors influencing farmers' strategies to enhance grain productivity, from internal farmers' constraints (competition between different farmer's crops and activities) to local (collective organization of harvesting, of inputs purchase…) and more global factors (land tenure systems, products and inputs prices…). Then, this method allows formalizing the different strategies farmers implement, or could implement, to deal with different socioeconomic scenarios of constraints. The Companion Modeling

approach (http//www.commod.org) will be used to design these workshops and their participatory modeling supports. These different socioeconomic constraints will be introduced in role playing games based on the prior agro-economic modeling and new participants' proposals. In these workshops, local stakeholders enrich and validate the prior modeling then react to different socioeconomic scenarios by implementing different individual and collective practices to deal with these constraints. The role playing game and participatory modeling support will present indicators to allow "players" to follow effects of their practices on grain productivity, sustainability of natural resources and farmers' economic growth. Workshops involve farmers but also the others local relevant stakeholders. In a second phase, this participative modeling support will integrate outputs of WP2 in order to take account the interactions between the different uses and activities and their impact on grain productivity.

Task 4.3: Irrigated rice climate related risk assessment

The objective is to assess climate related risk for irrigated rice areas of Senegal River and Niger River in Mali. Risks related to temperatures, early and late rains will be considered and optimal sowing windows defined. Birds' damages, one of the most important constraints for rice production (De Mey et al. 2010), and their links with climate will also be addressed. Those assessments are necessary step to explore insurances options for irrigated rice areas.

- Optimal irrigated rice sowing windows allowing avoiding thermal stresses will be actualised and determined for the future according to climatic scenario (provided by WP3). The work will be based on simulations performed by RIDEV and SarraH crop models (Dingkuhn and al. 1995b; Dingkuhn 1997; Struif Bontkes and Wopereis 2003) for different genotypes. For Senegal River the analysis will also take in account rains of June and July which can be synonymous of constraints. Results will be compared with information existing in AfricaRice and Office du Niger databases, and obtained from farmers through surveys concerning cropping calendars and their evolutions.
- We will also investigate if late rains of September and October may have negative impacts on yields when occurring at flowering. This will be done by yield-gaps analysis. That will allow assessing exceptional climatic risk associated to optimal sowing windows.
- Information about birds' damages will be collected in Senegal and Mali in official database and reports of local institutions (importance, year, period, sites, local features, etc.). Farmers will be questioned too. Damages will be correlated to climate and vegetation development and previous hypotheses (damages are smaller for high rainfall year as shown by Bruggers; 1980) will be assessed and transcended.
- According to results recommendations concerning insurances could be elaborated.

Irrigated rice issues will be managed by CIRAD and AfricaRice. Analysis concerning risks related to temperatures and rains and sowing windows will be performed by a postdoc student of AfricaRice under CIRAD/AfricaRice coordination. Surveys and information collects will be managed by AfricaRice in Senegal and by Office du Niger in Mali.

Deliverables

D.4.1: Calibration in Gourma (Mali) and Fakara (Niger) zones of existing ruminant nutrition models to fit the seasonal needs of sahelian zebu, sheep and goat breeds depending on the target production and forages. **M24 (LMTG)**

D.4.2: Calibration in Gourma (Mali) and Fakara (Niger) zones of existing livestock population models to cattle, sheep and goat herd dynamics depending on farm types and economic scenario. **M36 (LMTG)**

D.4.3: Soil fertility, yields, labour and income trends predictions for Gourma and Fakara farm types under climate and economic scenario. **M42 (LMTG)**

D.4.4: Farm model able to simulate choices of crop management options, cereal yields and farm income validated for 3 typical farms in Senegal. **M24 (CIRAD)**

D.4.5: Potential benefit of climatic forecast and weather index-based insurance on cereal yields and farm incomes in typical farms of Senegal under current climate and under socioeconomic potential contexts. **M36 (LOCEAN)**

D4.6: Potential benefit of climatic forecast and weather index-based insurance on cereal yields and farm incomes in typical farms of Senegal under future climate scenarios. **M42 (LOCEAN)**

D.4.7: Birds' damages assessment in Senegal River and Niger River and their link to climate. **M36 (CIRAD)**

D.4.8: Optimal sowing windows for irrigated rice and associated risks in Senegal River and Niger River, for present and future. **M42 (CIRAD)**

WORKPACKAGE 5: COORDINATION AND MANAGEMENT

The project coordination is described in section (2.2). The main tasks are to:

Task 5.1 Set the project management plan

- schedule meetings
- coordinate reporting process (schedule, forms and support documents)
- set up the project management tools (participant and mailing lists, document sharing, …)

Task 5.2 Monitor the project

- manage budget
- organise meetings
- follow up deliverables
- ensure correct information flow within the project.

Deliverables

D5.1: Management plan. **M2 (CNRM)**

D5.2: Kick-off meeting. **M2 (CNRM)**

D5.3: Progress report_M6. **M6 (LOCEAN)**

D5.4: Progress report_M12 + Financial statement. **M12 (LOCEAN)**

D5.5: Progress report_M18. **M18 (LOCEAN)**

D5.6: Mid-term workshop. **M22 (CNRM)**

D5.7: Progress report_M24+ Financial statement. **M24 (LOCEAN)**

D5.8: Progress report_M30. **M30 (LOCEAN)**

D5.9: Progress report_M36+ Financial statement. **M36 (LOCEAN)**

D5.10: Progress report_M42. **M42 (LOCEAN)**

D5.11: Third workshop. **M46 (CNRM)**

D5.12: Progress report_M48+ Financial statement. **M48 (LOCEAN)**

D5.13: Final report + Financial synthesis. **M48 (LOCEAN)**

WORKPACKAGE 6: DISSEMINATION AND CAPACITY BUILDING

WP6 will propose efficient tools for internal and public communications to insure a large dissemination of project results. Database management, central for WP1, WP2, WP3 and WP4 will be supported by WP6 in close connection with the AMMA database team. WP6 will also fully support the participation of African scientists throughout the project.

Task 6.1: Creation of tools for internal and external communication on the project
Communication actions developed in ESCAPE will not be limited to give a visibility on the project but will also participate to the "conception and implementation of pluridisciplinarity information systems dedicate to environmental changes". Indeed one of the aims of the proposal is to increase "the fundamental research to innovation towards finalised environmental services answering to the users' needs". It is fundamental to communicate to the right public on these new services.

Thus, following the ESCAPE research topics, its communication is designed along three paths:

- The scientific communication on the project with the valorisation of the obtained results
- The specific diffusion of scientific services towards the large public with a priority for the decision makers and end-users
- The sharing of the AMMA communication tools and tasks

Communication on the project: external and internal.
WP6 will develop tools to facilitate the communication of information about the project. It will follow a communication strategy elaborated on the project duration. The aim of the external communication is to broadcast objectives and activities and to valorize results of the project. The internal communication allows the information distribution between project actors and partners. Several supports will be developed (see table) with specific targets.

Specific diffusion
The ESCAPE communication for a large public has to take in account the specific targets that the project has to reach and to give awareness in priority. Consequences on society as adaptation solutions to the climatic variability have to be transmitted first to the decision makers and to the intermediaries working with end-users, and second to a large public. Each actor will be able to carry out its responsibilities and to put in place the mitigation actions.
This communication will be active principally in the research field of ESCAPE, West Africa.
(i) Decision makers include project officers and program managers in government departments; members of state and federal parliament and local government; national weather service direction. They have to be informed essentially on the results about adaptation options in front of climatic change (evaluation of environmental politics, interactions climate-ecosystems-resources…)
(ii) To reach end users, the communication will be targeted towards associations and NGO networks linked with users, in the framework of ESCAPE, mainly rural actors.
(iii) The large public will be targeted through broads in exhibition and conferences to diffuse pedagogical scientific information about stakes and impacts of climate change.

ESCAPE and AMMA communication sharing
In taking advantage of the communication actions of AMMA programme, ESCAPE will beneficiate of a large international visibility. ESCAPE and AMMA can put in place an inter-exchange of their communication to share both experiences and societal application information. AMMA is working today with a network of 2000 journalists and in a closed link with African journalist networks specialised on climate change (Reseau Africain pour l'Information Climatique, Union Internationale de la Presse Francophone…) and the AMMA internal community gathers more than 2500 people.

Task 6.2: Dissemination through workshops, conferences and publications
Three workshops will be organized throughout the project to insure full interactive work and results sharing within the projects and to disseminate the project goals and achievements to relevant scientific and actors community. The two events will be held in Africa to maximise the local impacts in Africa. In addition, partners will be encouraged to publish their results in scientific journals and share their results within the

international scientific community through the participations to international conferences. They will be also encouraged to publish in both French and English journals and in open source journals for a better dissemination of the results in Africa.

Task 6.3: Capacity building, training and scientific exchange visits

ESCAPE aims to insure a strong partnership with African partners by involving both African confirmed scientists and PhD students. To achieve this goal, two workshops will be held in Africa and special travel costs are asked to insure a large African participation to these workshops. Many of the ESCAPE consortium members have a long and successful experience of working in partnership with African researchers, indeed forming and supporting such partnerships form an integral part of IRD and CIRAD's mandates. Those two institutes have existing exchange programmes for junior and senior researchers, and also a sandwich programme for African PhD students. These programmes fund repeated visits of three month durations by developing country scientists to CIRAD and IRD and are widely known throughout African research institutes. CIRAD and IRD will take advantage of these programmes to facilitate researcher exchange, thus reducing the recourse to ESCAPE funds, and also ensuring that research partnerships can continue after the project end. WP6 will publish in the newsletter and intranet funding opportunities for bilateral North-South scientific exchanges and will encourage and coordinate ESCAPE partners' proposals. Communication reports and synthesis report will point out the main actions of the French-African partnership and bilateral work throughout the project.

Task 6.4: Database management

Data exchange is a crucial issue in multidisciplinary program. A precise description of the information (metadata), data standardization (format, units…) and user friendly online tools help data use by non specialist users and intensify cross-disciplinary collaborations. AMMA database has been developed in the framework of the AMMA multidisciplinary international programme and comply with such requirements. The database constitutes a programme legacy to the scientific community and aims to be further used and developed by forthcoming projects, in particular the ESCAPE project. AMMA database contains indeed a great amount and a large variety of data that may be relevant in the framework of ESCAPE. It includes about 150 past and recent in situ observation datasets, 60 satellite products, 20 model output sets as well as human sciences field surveys and value-added products.

AMMA database and the associated online tools have been fully developed and are managed by two teams in France (IPSL Database Centre, Palaiseau and OMP Database Centre, Toulouse). The complete system is duplicated at AGHRYMET Regional Centre (CRA) in Niamey, Niger. Both systems are automatically synchronized (datasets, user directory…). Contents of the two systems are synchronized and CRA database is particularly devoted to data dissemination to the African scientific community. The different data centres will provide an intensive user support to ESCAPE participants. They will be in charge of the management of new datasets used or produced by the project. That involves meteorological measurements and rainfall during the past decades, land use classes maps, socio-economics surveys, scenario simulation outputs… A detailed list of data used and produced by the project to be stored in AMMA database will be established within the first six months of the project, together with the ESCAPE scientists. A specific data policy may be needed during the project period in order to favour early data exchange. The data produced by the project will be disseminated to the whole AMMA database user community at the end of the project.

Deliverables

D6.1: Proposition for ESCAPE data policy. **M6 (OMP)**

D6.2: Web site of the project. **M6 (CNRM)**

D6.3: Production and distribution of the project description brochure. **M8 (CNRM)**

D6.4: Report about AMMA database tasks in the framework of ESCAPE (user statistics, request statistics, specific datasets, tools development if needed…). **M24 (OMP)**

D6.5: Report about the AMMA database tasks in the framework of ESCAPE (user statistics, request statistics, specific datasets). **M48 (OMP)**

D6.6: Report of the African participation throughout the ESCAPE program. **M48 (LOCEAN)**

D6.7: Production and distribution of the project results synthesis brochure. **M48 (CNRM)**

2.4. PLANNING, DELIVERABLES AND MILESTONES

THE TIMING OF THE DIFFERENT WPS AND THEIR COMPONENTS (GANTT CHART OR SIMILAR)

Month	1	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48
WP1 Observed major environmental changes					■		■						■				
T1.1: Climate changes					1.1		1.2										
T1.2: Land use changes					1.3		1.4										
T1.3: Agro-ecosystems changes							1.5						1.6				
T1.4: Water availability changes							1.7										
WP2 Environmental changes and societies					■				■				■		■		
T2.1: Perceptions and practices					2.1				2.2				2.4; 2.5; 2.9		2.10		
T2.2: Transformations of rural activities													2.3; 2.6; 2.7; 2.8		2.10		
WP3 Modeling environmental changes					■		■		■				■				
T3.1: Climate simulations of the last decades					3.1		3.2		3.3								
T3.2: Environment and resources simulations									3.4; 3.6				3.7; 3.9				
T3.3: Climate change and impacts scenarios									3.5				3.8; 3.10; 3.11; 3.12				
WP4 Adapting for the future global changes									■				■		■		
T4.1: Opportunities for diversified systems									4.1				4.2		4.3		
T4.2: Intensifying rainfed productions									4.4				4.5		4.6		
T4.3: Opportunities for irrigated crops													4.7		4.8		
WP5 Management		■						■								■	■
T7.1: Scientific and technical management		5.1			5.4		5.5		5.7		5.8		5.9		5.10		5.12
T7.2: Project monitoring		5.2	5.3		5.4		5.5	5.6	5.7		5.8		5.9		5.10	5.11	5.13
WP6 Dissemination and capacity building		■	■		■				■				■				■
T6.1: Tools for public communication			6.2	6.3													6.6
T6.2: Workshops and conference		5.2						5.6								5.11	
T6.2: Capacity building																	6.7
T6.3: Database management and policy			6.1						6.4								6.5

Duration of task Deliverables Milestones

LIST OF DELIVERABLES

Del. no.	Deliverable name	WP no.	Nature	Responsible partner	Delivery date
D1.1	D1.1a: Report and article on the assessment of changes in the seasonal cycle of temperature at multi-decadal scales across West Africa in observations and in re-analyses data D1.1b: Report on the signature of climatic changes in surface thermodynamic and energetic couplings	WP1	Report	CNRM	Month 12
D1.2	D1.2a: Report on drought patterns inter-annual variability, intra-seasonal dry spell, intensification D1.2b: Report on the generation of rainfall fields from climatological information and techniques to be applied in WP3 simulations	WP1	Report	LTHE	Month 18
D1.3	D.1.3a: Report on land use maps series from 1950s to present and corresponding digital maps for the Gourma (Mali) site (resp: LMTG) D.1.3b: Report on land use maps series from 1950s to present and corresponding digital maps for the Niger site (resp: LTHE) D.1.3c: Report on land use maps series from 1950s to present and corresponding digital maps for the Ouémé (Bénin) site (resp: HSM)	WP1	Report	HSM	Month 12
D1.4	Assessment of LULC historical datasets: consistency at the regional scale, accuracy from comparison at the district scale	WP1	Report	LTHE	Month 18
D1.5	Report on Multi-decadal dynamics of ecosystems and crop/livestock production systems at the district scale in Gourma (Mali) and Fakara (Niger)	WP1	Report	LMTG	Month 18
D1.6	Report and article on the assessment of the greening and desertification theories	WP1	Report	LMTG	Month 36
D1.7	D1.7a: Report on the evolution of surface water and run-off systems at the district scale for the Mali site (resp: LMTG) D1.7b: Report on the evolution of surface water and run-off systems at the district scale for the Niger site (resp: LTHE)	WP1	Report	LMTG	Month 18
D2.1	Joint meeting with WP4 and WP1 for integrating adaptive capacities from	WP2	Report	LPED	Month 18

	household surveys into the farm model to be build in WP4 and for combining social perspectives and land uses characterization into a common GIS				
D2.2	Provisional version of the GIS data collection and treatment, combining and comparing social perspectives and scientific land uses characterisation (WP1), techniques for representing geographical perception / representation of space for Mali and Niger.	WP2	Report	LMTG	Month 24
D2.3	Report on local history of environmental and climate change	WP2	Report	LPED	Month 36
D2.4	Report on local practices and perceptions of natural resources	WP2	Report	LMTG	Month 36
D2.5	Report on the evolution of primary production systems as a coping strategy	WP2	Report	LMTG	Month 36
D2.6	Report on economic diversification and rural constraints	WP2	Report	LPED	Month 36
D2.7	Report on mobility practices as coping strategies	WP2	Report	LPED	Month 36
D2.8	Report on political dimension of resources management	WP2	Report	LMTG	Month 36
D2.9	Final version of the GIS	WP2	Report	LMTG	Month 36
D2.10	Collective book on climate and environmental changes and socioeconomic in African rural societies (integrating WP2 results as well as those from WP1, WP3 and WP4)	WP2	Report	LPED	Month 42
D3.1	Multi-configuration simulations with LMDZ-ORCHIDEE of the West African past climate variations (1950-2010)	WP3	Data production	LOCEAN	Month 12
D3.2	Evaluation of the simulations and attribution of changes to global warming, changes in land use and internal variability	WP3	Report	LOCEAN	Month 18
D3.3	Characterization of the observed and simulated historical climate variations at dekadal scales in terms of surface thermodynamic variables (rainfall, air temperature and humidity) and interpretation in link with recent observations of the surface energy and water balance	WP3	Report	CNRM	Month 24
D3.4	Identification of the key factors controlling the yields, and identification of related key diagnostics relevant for the assessment of climate model simulations	WP3	Report	CIRAD	Month 24
D3.5	Evaluation of control simulations of Cordex and CMIP5 exercises. New diagnostics and	WP3	Report	LOCEAN	Month 24

	assessment results made available through AMMA-MIP.				
D3.6	Simple simulation of pond regime in Gourma driven by observed meteorological forcings	WP3	Report	LMTG	Month 24
D3.7	Simulation of Land Surface Model (SURFEX, Sethys-Savannah) driven by historical observed climate and land use over the CATCH-Niger mesosite (including part of the Fakara)	WP3	Report	HSM	Month 36
D3.8	Exploration of future likely scenarios for resources under climate changes	WP3	Report	LOCEAN	Month 36
D3.9	Reference simulations with the STEP rangeland (water balance, productivity, feeding, tentative livestock estimates) drivent by observed meteorological fields over the Gourma and Fakara network sites	WP3	Report	LMTG	Month 36
D3.10	Exploration of future likely scenarios for crop yields under climate changes with the SARRAH model	WP3	Report	LOCEAN	Month 36
D3.11	Simulation with the STEP rangeland (water balance, productivity, livestock estimates) driven by predicted meteorological fields and land use scenarios over the Gourma and Fakara network sites	WP3	Report	LMTG	Month 36
D3.12	Simulation of Land Surface Model (SURFEX, Sethys-Savannah) driven by climate and land use scenario over the CATCH-Niger mesosite (including part of the Fakara)	WP3	Report	HSM	Month 36
D4.1	Calibration in Gourma (Mali) and Fakara (Niger) zones of existing ruminant nutrition models to fit the seasonal needs of sahelian zebu, sheep and goat breeds depending on the target production and forages	WP4	Report	LMTG	Month 24
D4.2	Calibration in Gourma (Mali) and Fakara (Niger) zones of existing livestock population models to cattle, sheep and goat herd dynamics depending on farm types and economic scenario	WP4	Report	LMTG	Month 36
D4.3	Soil fertility, yields, labour and income trends predictions for Gourma and Fakara farm types under climate and economic scenario	WP4	Report	LMTG	Month 42
D4.4	Farm model able to simulate choices of crop management options, cereal yields and farm income validated for 3 typical farms in Senegal	WP4	Report	CIRAD	Month 24
D4.5	Potential benefit of climatic forecast and weather index-based insurance on cereal	WP4	Report	LOCEAN	Month 36

	yields and farm incomes in typical farms of Senegal under current climate				
D4.6	Potential benefit of climatic forecast and weather index-based insurance on cereal yields and farm incomes in typical farms of Senegal under future climate scenarios	WP4	Report	LOCEAN	Month 42
D4.7	Birds' damages assessment in Senegal River and Niger River and their link to climate	WP4	Report	CIRAD	Month 36
D4.8	Optimal sowing windows for irrigated rice and associated risks in Senegal River and Niger River, for present and future	WP4	Report	CIRAD	Month 42
D5.1	Management plan	WP5	Report	CNRM	Month 2
D5.2	Kick-off meeting	WP5	Report	CNRM	Month 2
D5.3	Progress report	WP5	Report	LOCEAN	Month 6
D5.4	Progress report and Financial statement	WP5	Report	LOCEAN	Month 12
D5.5	Progress report	WP5	Report	LOCEAN	Month 18
D5.6	Mid-term workshop	WP5	Report	CNRM	Month 22
D5.7	Progress report and Financial statement	WP5	Report	LOCEAN	Month 24
D5.8	Progress report	WP5	Report	LOCEAN	Month 30
D5.9	Progress report and Financial statement	WP5	Report	LOCEAN	Month 36
D5.10	Progress report	WP5	Report	LOCEAN	Month 42
D5.11	Third workshop	WP5	Report	CNRM	Month 46
D5.12	Progress report and Financial statement	WP5	Report	LOCEAN	Month 48
D5.13	Final report and Financial synthesis	WP5	Report	LOCEAN	Month 48
D6.1	Proposition for ESCAPE data policy	WP6	Report	OMP	Month 6
D6.2	Web site of the project	WP6	Web site	CNRM	Month 6
D6.3	Production and distribution of the project description brochure	WP6	Brochure	CNRM	Month 8
D6.4	Report about AMMA database tasks in the framework of ESCAPE (user statistics, request statistics, specific datasets, tools development if needed…)	WP6	Report	OMP	Month 24
D6.5	Report about the AMMA database tasks in the framework of ESCAPE (user statistics, request statistics, specific datasets, tools development)	WP6	Report	OMP	Month 48
D6.6	Production and distribution of the project description brochure	WP6	Brochure	CNRM	Month 48
D6.7	Report of the African participation throughout the ESCAPE program	WP6	Report	LOCEAN	Month 48

LIST OF MILESTONES

Miles. no.	Milestones name	Work package(s) involved	Expected date	Means of verification
M1.1	Collection of land-use maps series and corresponding digital maps	WP1	Month 12	Data are available for partners
M1.2	Rainfall fields generated for WP3 use	WP1	Month 18	Data are available for partners
M1.3	Improved knowledge on greening and desertification	WP1	Month 36	Report validated by the WP leader
M2.1	Joint meeting with WP1 and WP4 completed	WP2	Month 18	Minutes of the meeting
M2.2	First phase of fieldwork program completed	WP2	Month 24	Data are available for partners in the database
M2.3	Second phase of fieldwork program completed	WP2	Month 36	Data are available for partners in the database
M2.4	Socio-economic data analysis completed	WP2	Month 42	Report validated by the WP leader
M3.1	Completion of climate simulations	WP3	Month 12	Data are available for partners through AMMA-MIP
M3.2	Climate simulations assessed	WP3	Month 18	Report validated by the WP leader
M3.3	Control simulations of CORDEX and CMIP5 evaluated	WP1	Month 24	Diagnostics and assessment results made available through AMMA-MIP
M3.4	Improved knowledge on future scenarios	WP3	Month 36	Report validated by the WP leader
M4.1	Crop, ruminant nutrition and farm models calibrated	WP4	Month 24	Models ready to use for sensitivity experiments
M4.2	Potential of climate risk management for rainfed crop systems assessed	WP4	Month 36	Participative evaluation with stakeholders
M4.3	Constraints and opportunities for present and future in irrigated and mixed crop systems assessed	WP4	Month 42	Report validated by the WP leader and participative evaluation with stakeholders
M5.1	First workshop completed	WP5	Month 2	Report of the workshop
M5.2	Mid-term workshop completed	WP5	Month 22	Report of the workshop
M5.3	Final workshop completed	WP5	Month 46	Report of the workshop
M5.4	Final report achieved	WP5	Month 48	Report validated by the WP leader
M6.1	First newsletter distributed for the kick-off (the next ones every three months)	WP6	Month 2	Newsletter distributed electronically with a

				mailing list and some in paper copies for key bodies
M6.2	First informative mail with web links (the next ones every 6 months)	WP6	Month 6	Archives are available on-line on the web site
M6.3	First completion of AMMA database including ESCAPE products	WP6	Month 12	List of data stored in the database
M6.4	Second completion of AMMA database including ESCAPE products	WP6	Month 24	List of data stored in the database
M6.5	Third completion of AMMA database including ESCAPE products	WP6	Month 36	List of data stored in the database
M6.6	Final completion of AMMA database including ESCAPE products	WP6	Month 48	List of data stored in the database

RISKS AND CONTINGENCY PLAN

ESCAPE will involve both French and African partners conducting high level research activities and capacity building in five African countries. One ESCAPE strength is that many of its consortium members have a long and successful experience of working in partnership with African researchers, indeed forming and supporting such partnerships forms an integral part of IRD and CIRAD's mandates. The opportunity of building on AMMA experience and partnerships reduces the risks related to the effective participation of partners in the project activities. Furthermore the long-established extensive engagement of ESCAPE partners in Africa with the associated existing exchange and interaction mechanisms will enable the prompt start of the ESCAPE project implementation. Major risks in the project implementation derive from exogenous sources, in particular from the potential political instability of countries in the region. It is especially true in northern Mali and northern Niger affected by insecurity problems since the resumption of rebellions in 2007. However until now, the southern strip of the region where ESCAPE will focus on (including the Gourma in Mali and the Niamey and Keita area in Niger) is still safe for travel. No such a risk is reported in Senegal, Benin or Niger. The choice of several test sites in different countries and the existing database from ECLIS and AMMA projects should minimize the impact of increasing or emerging security problems, which will be closely monitored throughout the project duration, and therefore, if necessary, an appropriate contingency plan will be put in place to move core activities to alternative test sites.

Specific risk identification throughout the project and associated contingency plan and milestones are listed in the table below:

Activity	Risk description	Contingency plan	Milestones
Observation of environmental changes	*Environmental data are not available in due time*	A large part of data to be used in ESCAPE (both field data and satellite products) is already available in the AMMA database. Many of the Satellite products are freely available. Furthermore, the consortium involves several African partners (as sub-contracting partners) who have volunteered data.	M1.1 (month 12) and M1.2 (month 18)
Observation of	*Socio-*	The choice of several test sites in different	M2.2 (month

demographic and socioeconomic changes	*demographic data are not available in due time because of political instabilities*	countries and the existing database from ECLIS and AMMA projects should minimize the impact of increasing or emerging security problems, which will be closely monitored throughout the project duration, and therefore, if necessary, an appropriate contingency plan will be put in place to move core activities to alternative test sites.	24) and M2.3 (month 36)
Producing and assessing climate simulations	*Simulations are not available in due time for assessment or for impacts modeling*	ESCAPE contains partners with extensive experience developing and using global climate models. The processing of climate changes simulations will already be carried out prior to the start of ESCAPE through the IPCC AR5 and CORDEX exercises with the contribution of partner LOCEAN.	M3.1 (month 12), M3.2 (month 18) and M3.3 (month 24)
Reducing uncertainties in climate change scenarios	*The future climate scenarios are still uncertain*	Assessing the current limit of these models is a central goal of ESCAPE. A better understanding of how climate models represent past trends from the model-observation comparisons intended within ESCAPE will provide the basis to go beyond this limit.	M3.4 (month 36)
Assessing and improving climate related impacts quantification	*The hydrological, vegetation or crop models are not able to capture the impacts of past climate changes*	ESCAPE will not use a single impact models but a variety of impact models for each application with different levels of complexity. Evidence for the inability of some models to capture past environmental changes would be an important result from the project (especially for models already implemented for operational applications) and would fully justify the needs from improvements intended within ESCAPE.	M4.1 (month 24)
Assessing the impact of climate changes on resources	*Climate models are not accurate enough (coarse resolution, strongly biased) to drive impact models*	ESCAPE contains partners (LOCEAN and LTHE) with extensive experience developing and using downscaling and/or bias reduction techniques applied to climate simulations. The REGYNA project, coordinated by partner LOCEAN, has already showed successful achievements in coupling climate and crop models in Africa. Furthermore, the CORDEX exercise will provide high-resolution climate simulations suited for impact studies.	M4.2 (month 36) and M4.3 (month 42)
Designing adaptation options for the future	*The adaptation options are disconnected from the users' reality*	The participative and people-centered approach promoted by ESCAPE will insure that adaptation options investigated within the project are both scientifically sound and socially acceptable. Furthermore, a complete description of the environmental, social, political and technical context in place in targeted sites will drive the design and the evaluation of the adaptation options.	M4.2 (month 36) and M4.3 (month 42)
Disseminating the project outputs and capacity building	*Inappropriate or insufficient dissemination of project results at national and international level*	ESCAPE will benefit from the communication tools and networks from the AMMA program. It will ensure high chance of success in the dissemination of the project outputs to decision makers and the wider public beyond the lifetime of ESCAPE and its geographical boundaries. Furthermore, many of the ESCAPE consortium members have a long and successful experience of working in partnership with African researchers,	Project lifetime and beyond

	indeed forming and supporting such partnerships form an integral part of IRD and CIRAD's mandates.

3. EXPLOITATION & DISSEMINATION. MANAGEMENT OF INTELLECTUAL PROPERTY

3.1. DATA MANAGEMENT AND POLICY

AMMA database has been developed in the framework of the AMMA multidisciplinary international programme. The database constitutes a programme legacy to the scientific community and aims to be further used and developed by forthcoming projects, in particular the ESCAPE project. AMMA database contains indeed a great amount and a large variety of data that may be relevant in the framework of ESCAPE. It includes about 150 past and recent in situ observation datasets, 60 satellite products, 20 model output sets as well as human sciences field surveys and value-added products. In order to stimulate the exchange of information and collaboration between researchers from different disciplines or using different tools, a detailed description of the products is provided, standardized formats are used and a user friendly data request interface in online.

AMMA database and the associated online tools have been fully developed and are managed by two teams in France (IPSL Database Centre, Palaiseau and OMP Database Centre, Toulouse). The complete system is duplicated at AGHRYMET Regional Centre (CRA) in Niamey, Niger. Both systems are automatically synchronized (datasets, user directory…) The different data centres will provide an intensive user support to ESCAPE participants. They will be in charge of the management of new datasets used or produced by the project. That involves meteorological measurements and rainfall during the past decades, land use classes maps, socio-economics surveys, scenario simulation outputs… A detailed list of data used and produced by the project to be stored in AMMA database will be established within the first six months of the project, together with the ESCAPE scientists. A specific data policy may be needed during the project period in order to favour early data exchange. The data produced by the project will be disseminated to the whole AMMA database user community at the end of the project.

3.2. DISSEMINATION STRATEGY

ESCAPE will develop an ambitious communication strategy described in WP6. The main tools are shown in the table below:

Communication medium	Target	Periodicity	Editors	Diffusion	Deliverable	Results
Internal Communication						
Newsletter	Scientific community, institutions and scientific partners	First one for the kick-off and every three months	Coordinators, communication officer and scientists	List of scientific community and institutions	Distribution electronically with a mailing list and some in paper copies for key bodies	The internal newsletter is distributed to scientists and institutional partners directly involved in the project. It is a tool of information between different actors of the project, that facilitates coordination of activities. It highlights the major themes of the project; information on the timeliness of the project gives visibility to key players and teams involved.
Intranet Website	Scientific community	Creation at the beginning of the project and regular updating	Webmaster + editors and participation of the researchers and project coordinators	1. Address of the website in all communication documents	intranet	Information about the project as description of objectives, planned activities, calls for proposals, studies, research in course, teams involved, training activities implemented under the project, meeting reports, submitted publications, etc..
Informative mail with web links	Scientific community, institutions and scientific partners	Every month	Communication officer	2. Mailing list	Archiving of the resources available on-line	Easier access to website data and regularly information of ESCAPE to animate the community
External communication						
Website	scientists, institutions, agencies, decision makers, journalists and large public	Creation at the beginning of the project and regular updating	Webmaster + editors and participation of the researchers and coordinators	Address of the website in all communication documents	website	Centre of general information and resources for everybody interested in the project.

Brochure	Institutions, decision makers and press	At the beginning and at the end of the project	Coordinators and communicators	3. Large distribution in events	Brochure	Intended to give visibility to the project, it is distributed to the scientific community, development actors, policymakers, the media. So attractive, accessible and consistent, it presents the framework of the project, its objectives and expected, the main activities planned and the partners involved.
Press information	Journalists (Radio, TV, newspapers and magazines)	When noteworthy event (seminars, workshops) and result (publication of research results): first press release at the opening of the project	Communication officer and scientist (scientific results) or coordinator (events)	Press list	Press release and press pack,	Increase the project visibility and participate to the general public information. Information on the project's progress regularly broadcast media in the countries of West Africa and France concerned (especially scientific press and news dedicated to Africa) and with some websites of scientific information.
Specific diffusion						
Decision Makers	Project officers and program managers in government departments; members of state and federal parliament and local government; meteorological direction, French Minister of Foreign Affairs…)	One publication after two years and one at the end of project	Scientist and communication officer	List of decision makers by country	Publication of result synthesis redacted specifically for these targets	Information about societal problematic linked to the climate change and about results for adaptation and mitigation
Intermediaries to target end-users	NGO, Associations, National weather services… to increase end-users (specifically	One publication after two years and one at the end of project	scientist and communication officer	List of targets by country	Synthesis of scientific results redacted specifically to	4. Relevant information for organisation able to transmit it to the end-users

	farmers) awareness of results useful form ESCAPE science.				these target	
Large public	Citizens, young people, university, schools…	Start one year after the beginning	Animation by researchers/ PhD students and organisation by coordinators and communication officer	5. Participation to scientific culture events	Itinerating exhibition (Three new boards joined to the existing AMMA exhibition) and conferences.	Scientific culture to informed the large public about scientific overhang

4. CONSORTIUM OVERVIEW

4.1. PARTNERS DESCRIPTION & RELEVANCE, COMPLEMENTARITY

PARTNERS DESCRIPTION

Partner 1: The LOCEAN team

LOCEAN will coordinate the project. Its team regroups people with three different skills and expertises:

Climate modeling and diagnostics
Fréderic Hourdin (CNRS-LMD) is a key people in the development of one of the two French models contributing to the IPCC exercise, namely LMDZ. He was the coordinator of the evaluation and improvements of climate models within the French and European AMMA project. Ionela Musat (CNRS-LMD) was in charge of the building of the AMMA-MIP web site and database. Serge Janicot (IRD-LOCEAN) is more a specialist of the analysis of the climate variability. He was the coordinator in the AMMA project of all the questions concerning the monsoon system and its variability. He is also the leader of the AMMA-LEFE project. Those three people will be involved in WP3. Fréderic Hourdin will coordinate WP3.

Climate impacts
Benjamin Sultan (IRD-LOCEAN) has an extensive experience in quantifying climate impacts on agriculture in West Africa through biophysical modeling (see coordinator description). Agnès Ducharne coordinates the team HYDRO of the UMR Sisyphe (UPMC/CNRS), which is specialized in the modeling of water fluxes in river basins (hydrogeology, hydrology, land surface fluxes), with numerous applications to assess the impacts of environmental changes at the regional scale (climate change, land use change, nitrate pollution, etc.). She will bring her expertise to Workpackage 3 regarding downscaling, attribution of driving factors, uncertainty assessment. Benjamin Sultan will coordinate the project.

Economic modeling
Philippe Quirion (CNRS-CIRED) is an economist working both on the economic analysis of environmental policies (especially climate change mitigation policies) and, more recently, on the impact of climate variability and change on agriculture in West Africa. With two PhD students (Philippe Roudier and Antoine Leblois), he is currently working on two topics: (i) economic modeling of weather-index insurances. This includes a submitted review of the literature, an analysis of the feasibility of such insurances in Burkina Faso, published in *Weather, Climate and Society*, and an ongoing work on the feasibility of such insurances in Niger. (ii) Economic modeling of seasonal climate forecasting, with an application on Niger. (iii). Analysis of the impact of climate change on West-African agriculture. Those people will be involved in WP4.

Partner 2: The LMTG team

LMTG is a joint lab of CNRS, Université Pau Sabatier Toulouse III and IRD. LMTG has developed important activities in the domain of environmental sciences, from hydrology, hydro-geochemistry to social sciences. As such, LMTG is involved in both the study of Global Environment Changes and also Societies Changes and adaptation. Therefore, LMTG will contribute to the Work Packages 1, 2, 3 and 4 as well as coordinating task 1.

With the recent arrival of a former CESBIO team (Mougin and collaborators), LMTG addresses ecology and vegetation issues, and is now in charge of one of the 3 sites of the AMMA-Catch Observation System (labelled by INSU and IRD). This site, in the Malian Gourma, consists of a long term survey (1984-present) for rangeland functioning and productivity and it has been considerably strengthened during AMMA-1 in both the land-atmosphere exchanges and the social sciences. LMTG includes facilities for remote sensing shared between solid earth sciences and environmental sciences as well as a strong involvement of IRD staff in several tropical terrains.

The LMTG group mostly involved in environmental studies in ESCAPE (Kergoat, Mougin, Grippa, Timouk, Hiernaux) has an expertise in ecosystem survey, remote sensing applications such as trend detection, land use changes and land in the climate system (e.g. surface fluxes and radiation balance). This expertise is translated into modeling activities (e;g; the STEP model for Sahelian rangelands).Hiernaux brings not only a long term expertise of Sahelian livestock/crop production system in the Gourma, but also in the Fakara. Marielle Gosset has an expertise in precipitation (remotee sensing, radar, characteristics of rainfields). Efforts of these sub-group will be concentrated in WP1, 3 and 4.

The human sciences team of the LMTG is specialized on natural resources, intra-African migrations, pastorals motilities, political marginality in different countries of the sahelian region (Mali, Mauritania, Niger, Benin and so on). All these topics are always thought as socio-environmental systems. So, the human sciences team has already built strong links with the other searchers of the LMTG involved in the AMMA and ECLIS programs and now in this project. Thus the main effort will be done specially into the WP2 but our challenge is to continue to work closely with them (specially but not only with WP1) to compare the dynamics of natural resources, water resources with the actor's perceptions of the changes and the them coping strategies. We will also work with the WP4 in charge of the scenarios. Actually our general goal is to understand how climate changes contribute to the vulnerably of sahelian people in a dynamic societal pattern (political, economical, demographical and social changes).

Key staff people
-Dr Laurent Kergoat has an expertise in long term remote sensing of land surface, measurements and modeling of land in the climate system. He will coordinate WP1.
-Dr Eric Mougin has an expertise in Sahelian ecology, modeling and remotes sensing. He is in charge of the Mali site of the AMMA-Catch S.O. He will supervise the modeling activities of LMTG (WP3) and the WP4 studies of livestovk/crop system in the Sahel.
-F. Gangneron has expertise in social sciences, more specifically social perception of resource use and reuce use policy.
- Dr Alain. Bonnassieux has expertise is social adaptation to environmental and political constraints
-Dr Manuela Grippa has an expertise in remote sensing and modeling (WP1 and 3). She is a the CNAP member affected to the AMMA-Catch S.O.
-F. Timouk is in charge of the instrumental setup in the Gourma. He is involved in data processing and has expertise in very high resolution remote sening.
- Dr Marielle Gosset has an expertise in RADAR and estimation of precipitation.

Partner 3: The CIRAD team

CIRAD staff will contribute to WP3 and WP4. Team is composed of 5 scientists, specialists of (i) crop model adaptation, validation and use, including biophysical-socio-economical tools coupling process, and (ii) participative processes such as "Participative Scenario Modeling workshop".
- Dr Michael Dingkuhn (HDR) is agronomist, specialist in plant phenology and physiology, and crop modeling, having developed crop models such as RIDEV and SarraH. He published more than 70 publications in international reviewed journals. He has been worked in several tropical countries

including Senegal, as AfricaRice scientist. He is actually involved in different collaborations with AfricaRice.
- Dr François Affholder is agronomist, and consulting professor at Supagro (Montpellier) for crop modeling. He is specialist in crop model development, calibration/adaptation and use for agronomical diagnosis and risk assessment. He worked in several tropical countries including Senegal. He participated in researches aiming at defining insurances systems and others aiming at coupling biophysical and socio-economical tools.
- Dr Bertrand Muller is agronomist, specialist in crop model calibration/adaptation and use for agronomical diagnosis and risk assessment. He was posted in CERAAS from 2005 to 2009 and now in AfricaRice at Sahel Research Station of Ndiaye. He participated to AMMA project as CIRAD and CERAAS staff. He also recently contributed to the first index based insurance study developed in West Africa by World Bank.
Dr Michael Dingkuhn, Dr François Affholder and Dr Bertrand Muller will bring their expertise on irrigated rice and rainfed cereals (millet, sorghum and maize) modeling, risk assessment, and linkage between biophysical and socio-economical tools. They will also contribute to good partnership with local institutions such as CERAAS and AfricaRice.
- Dr Patrick d' Aquino (HDR) has carried out since twenty years in Sahel different research-action programs with farmers to improve their agropastoral resources management, at different scales.
- Dr Sigrid Aubert is specialized in regulation modes for renewable resources exploitation and the participative modeling supports allowing to analyze them with the actors (in particular playing-game).
Patrick d'Aquino and Sigrid Aubert will bring their specific knowledge of the context and competences on participative processes such as "Participative Scenario Modeling workshop" that will be used, following "Companion Modeling approach" (http//:commod.org) to allow farmers to validate, and enrich, the farm agro-economic modeling.

Partner 4: The HSM team

HSM will participate in WPs 1 and 3, bringing substantial contributions to the evaluation and the modeling of environmental changes and their impacts on resources, as they relate to the terrestrial water cycle. HSM possesses a recognized expertise in this field for Sub-Saharan Africa, especially so over the two AMMA meso-sites of South-West Niger (Niamey area / Fakara) and Central Benin (Ouémé catchment) on which HSM's contribution will focus. This contribution will essentially deal with (i) the evaluation of historical changes in environment (land use/land cover, ecosystems) at the Benin site (WP1.2), (ii) the modeling of the hydrological cycle's response to the past changes in the climate and environment (WP3.2) and (iii) the simulation of this response to scenarios of future climate and land use and their consequences for resources (WP3.3) over the Niger site.
From the inception of the AMMA programme (Redelsperger et al., 2006), HSM has been a major participant in many continental aspects of the underlying international and national projects. HSM is one of the three labs that created and have been operating the AMMA-CATCH long-term hydro-environmental observatory (SOERE) in Sub-Saharan Africa (Lebel et al., 2009). HSM's research on Sub-Saharan hydrology produced over 50 international peer-reviewed publications for the past five years.

Key staff members:
Jerome Demarty joined HSM as an eco-hydrology researcher in 2008 to work in the framework of the AMMA programme. He is a specialist in the modeling of soil-vegetation-atmosphere interactions, with a focus in semiarid environments.
Bernard Cappelaere is a senior research engineer, with over 15 years of experience in Sahelian hydrology. He is the coordinator of the AMMA-CATCH observatory for the Nigerian site in the Niamey-Fakara area.

Christophe Peugeot is a senior researcher in West African hydrology. Since 2003, he has been leading the AMMA programme for the Ouémé watershed in Central Benin. He is a member of the Executive Board of the AMMA-CATCH observatory.
Luc Séguis is a senior researcher in West African hydrology, with special expertise in the effects of land use and land management on hydrological processes and the water balance. Within the AMMA programme, he has been working on the Ouémé catchment since 2003.
Nathalie Benarrosh is a hydrological engineer, with several years of experience in West Africa.

Partner 5: The LTHE team

The LTHE is a joint lab of CNRS (the French Scientific Centre), IRD (the French research Institute dedicated to tropical areas), University Grenoble 1-Joseph Fourier and G-INP, the National Polytechnical Institute of Grenoble). The research areas of the lab are mainly hydrology and climatology. Soil sciences and Atmosphere physics are our instruments in order to advance in processes knowledge, prevision and modeling of climate and water resources. The LTHE lab includes 120 peoples from whom 50 permanent researchers and 25 to 30 PhD students. Notable equipment and facilities can be dedicated to the project and mainly the existing implementation of instruments in West Africa.

Key staff members:

Thierry Lebel heads LTHE since 2008. He devoted most of its career to studying climate variability in Africa and its impact on the water cycle and the water resources. From 2004 to 2008, he was the chair of the International Coordination and Implementation Group of AMMA. Dr. Lebel has published six dozen international peered reviewed papers in various hydrological and climate journals, focusing more recently on the dynamics of the West African Monsoon.
Theo Vischel is lecturer at Université Joseph Fourier since November 2007. He is based at LTHE where he works on the modeling of rainfall variability and its impact on tropical catchments. He especially focuses on the scale issues associated with the mismatch between the resolutions of the hydrological models used to document the variability of the surface processes and the resolutions of the hydrological data available to force and validate these models.
Luc Descroix joined the LTHE in 1998 as a hydrologist and he studies particularly the hydrological consequences of land use changes in tropical areas. He is working in AMMA program since 2003.
Gérémy Panthou is a PhD student of the LTHE

Main tasks:

Mainly involved in WP1, LTHE will:

- provide rainfall fields through West Africa, using instruments networks and specific
- map and spatialize land cover and the factors of the water resources regional evolution.

Experience relevant to the task:

The experience and qualification of IRD researchers relevant to the project comprises a unique expertise in spatial analysis of soil moisture, rain field generation and interpolation, rainfall satellite product validation as well as in hydrological modeling.

Partner 6: The LPED team

The Laboratoire Population Environnement Développement (LPED, UMR 151 University of Provence-IRD, www.lped.org) has been carrying out studies on interrelationships between man and its environment for 25 years. LPED has developed an interdisciplinay approach mainly **in the** mediterranean and sub–Saharan regions. Reaserach performed at LPED deals with the diversity **of the social-environmental interactions within the development paradigm.** LPED examines environmental perceptions and practices as an interface between knowledge and technical, ecological, economic and social rationalities. **LPED works on the following issues:** Governance of natural resources (forests, pasturelands, water, etc.) and of urban and rural areas, biodiversity management in regions enduring demographic and ecological pressure.

Today the LPED members include 36 teacher-researchers and researchers from the University of Provence and IRD as well as about 30 Ph.D. students belonging to different disciplines : Demography, Ecology, Sociology, Economy, Geography, Agronomy. The LPED members involved in the ESCAPE project have a considerable experience of carrying out general population questionnaire surveys in Africa and have highly contributed to the development of the population observatory in Niakhar (Senegal). Finally a geomatic platform is made available for the project.

Key staff members:
Richard Lalou heads LPED since 2008. He devoted most of his career to studying environment and health relationships, especially from vector-borne diseases. He has published many international peer-reviewed papers and book chapters on malaria and health-seeking behaviour in West Africa. Recently, he has collaborated to a project on demographic and ecological dynamics in Niakhar (Senegal).
Agnès Adjamagbo heads POPSANTE team since 2008. She has extensively worked on changes of family composition and organization and rural economic and ecological crisis in Ivory Coast plantations.
Valérie Delaunay joined the LPED in 1999 as a demographer and she has mostly carried out research on demographic and social dynamics in Niakhar, one of the study sites in the ESCAPE project.

Main tasks:
Mainly involved in WP2, LPED will:
- Provide demographic data on population dynamics (growth, migration, household economic organization, population density)
- Provide qualitative and quantitative data on natural threath perceptions and on environmental and agricultural practices.
- Examine the history of natural risk perceptions and natural ressources management.

Experiences relevant to the task:
The skills of LPED researchers associated to the project include a great expertise in qualitative and quantitative surveys in Africa, in-depth knowledge of the Niakhar site and a good research experience on environmental and population issues.

Associated partners in the South:
The Geography Department of the Faculté des Lettres et Sciences Humaines de l'UCAD (Cheikh Anta Diop University, Senegal) includes teacher-researchers that work in Physical Geography (Geomorphology, Hydrology, Climatology, Biogeography) and Human Geography (analysis of relationships between man and urban/rural areas). In view of the 21st century new environmental challenges, the « Ecole Doctorale Eau et Qualité de l'Eau (EDEQE , Ph.D. program on water and water quality) » has been set up to promote training and research on water-related issues aiming at identifying and analysing the linkages of these issues with environmental dynamics and human data. At the University level, the ESCAPE project could be linked to ETHOS (Studies on Man and Society),

Partner 7: The CNRM/GAME team

The CNRM-GAME is a joint lab of CNRS and Meteo-France. The team involved in ESCAPE is composed of specialists of (1) atmospheric processes and (2) project coordination and communication who are all strongly involved in the AMMA programme.

F. Guichard and JL Redelsperger have a long-standing expertise in atmospheric physical processes, including their modeling and parameterization, and has also acquired experience in the analysis of observational datasets. They have published around 80 international peered reviewed papers. Collaborations already exist with other teams involved in ESCAPE. Finally and regarding

observational datasets, the present project will benefit from collaborations with other researchers in Météo-France, which have strong expertise to analyse long term series of climate variables.

The team has also an established experience in coordination and dissemination. Since 2002, the French and international coordination of the AMMA programme has been largely steered by J.-L. Redelsperger. The AMMA International Executive Office (IEO) is hosted by CNRM-GAME. With their specific skills, permanent people of IEO (O. Roussot, A Sonneville, JL Redelsperger) allow for coordination and communication actions including executive tasks in support to governing bodies, scientific coordination, organization of meetings and international conferences, targeted dissemination of science results and press relation. Other national and international projects or programmes, are also coordinated at CNRM-GAME, providing a favorable environment to enrich this experience through knowledge exchange.

Partner 8: the OMP team

The SEDOO (Service Données à l'OMP) team is a service of OMP, UMS 831 in Toulouse. It composed of 4 permanent persons:

- Laurence Fleury : coordinator, data policy expert, interface between scientists and informaticians;
- Laurence Mastrorillo : engineer, metadata expert and involved in human sciences datasets processing;
- Guillaume Brissebrat : engineer in development, involved in in situ datasets processing and user management, web interface expert;
- Jean-Luc Boichard: web, database and system expert. Design and maintenance of the systems.

This team is in charge of in situ datasets, user interface and user management of the AMMA database. It works together with ESPRI, IPSL team:

- Karim Ramage: satellite database, satellite products processing;
- Sophies Cloché: model database, model outputs processing;

and CRA team, in charge of the AMMA database system in Niger:

- Oumarou Moulaye: system engineer, database expert;
- Hadiza Aboubakar: technician, user support and datasets management.

Three persons of SEDOO were previously located in MEDIAS-France where more than 100 applications (database, web sites…) have been developed. Now SEDOO maintains more than 10 applications and is strongly involved in the MISTRALS programme. The eight persons listed above will devote 5 to 10% of their work time to the ESCAPE project.

More information of the AMMA database can be found in:
Fleury L., J.-L. Boichard, G. Brissebrat, S. Cloché, L. Eymard, L. Mastrorillo, M. Oumarou and K. Ramage (2010) A user friendly distributed database for the African Monsoon Multidisciplinary Analyses programme. In: Curdt, C. & Bareth, G. (eds.): Proceedings of the Data Management Workshop, University of Cologne, Germany, 29.-30.10.2009, *Kölner Geographische Arbeiten*, issue 90, 8pp.

CONSORTIUM AS A WHOLE

The consortium is formed by 8 partners with an extensive experience in academic research covering the required expertise for carrying out the transdisciplinary objectives of the program. As described in section 2.2, to accomplish its objectives, ESCAPE brings together a critical mass of scientific French leading institutions in the field of climatology, hydrology, agronomy, ecology, demography, economy, geography, anthropology and ethnography. All these communities, especially social and geophysical communities, have worked until recently in relative isolation. ESCAPE offers a unique opportunity to combine all these expertises to bring a new insight on the interactions between societies and environmental changes in Africa. It should be highlighted that even the work on the ESCAPE proposal has led to the formation of new working collaborations between social and environmental researchers.

	Climate models and diagnostics	Environment survey and field data	Resources models	Economic models	Social survey and human dimension	Management and communication tools	Database management
LOCEAN	•		•	•			
LMTG		•	•		•		
CIRAD		•	•	•			
HSM		•	•				
LTHE		•					
LPED					•		
CNRM	•	•				•	
OMP							•

One ESCAPE' strength is that all consortium members have a long and successful experience of working in partnership with African researchers, indeed forming and supporting such partnerships form an integral part of IRD and CIRAD's mandates. This partnership is central for the success of ESCAPE. Thus ESCAPE will support scientific collaborative actions between France and Africa. The two tables above summarize the implications of African institutes within ESCAPE and the contribution of partners to training activities in Africa.

Partnerships with Africa within ESCAPE

Institute	Country	Nature of the involvement	WP	Nature of partnership
Université Abdou Moumouni	Niger	Land use land cover determination, field validation	WP1	Scientific collaboration
ICRISAT	Niger	Expertise, data collection	WP2, WP4	Sub-contracting
Université Zinguinchore	Senegal	Expertise in public policies for resources management and resource use and perception.	WP2	Sub-contracting
IER, DNPIA	Mali	Livestock data	WP2, WP4	Sub-contracting
University Cheikh Anta Diop, department of geography	Senegal	Expertise in land policies and land uses. Collaboration to data collecting	WP2	Sub-contracting
Université d'Abomey-Calavi	Benin	Support to fieldwork	WP2	Sub-contracting

CERAAS	Senegal	Database providing, Data collecting, Farm and crop models development	WP3, WP4	Sub-contracting
AfricaRice Senegal	CGIAR Benin	Data collecting, Database providing, Rice constraints and modeling expertise	WP4	Sub-contracting
Office du Niger	Mali	Data collecting, Database providing, Rice constraints expertise	WP4	Sub-contracting
AGRHYMET	Niger	Mirror of the database for an easy use and access in Africa	WP6	Scientific and technical collaboration
Media	Senegal, Burkina Faso, Niger, Benin	Exhibition for large public, diffusion thanks to teachers association and scientific French cooperation;	WP6	Cooperation
Media	Senegal	African network for climate information	WP6	Support of the journalist responsible for West Africa
Media	Nigeria, Benin, Niger, Senegal, Ivory Coast	Support to dissemination activities	WP6	Support of journalists to participate to conferences and meetings

Involvement of ESCAPE partners in African training

Institute	Country	Training purpose	WP	Added value to the consortium	Added value of the project to the student
ICRISAT	Mali	PhD on the response of livestock/crop systems to climate variability	WP1 and WP3	Experience in livestock/crop system in the Sahel	Experience gained in rangeland monitoring (including long term network and remote sensing)
Université Abdou Moumouni	Niger	PhD on hydrologic consequences of land use changes in South West Niger	WP1	Determination of land cover	Comparing methods of land cover determination
CERAAS	Senegal	PhD Climate and crop model coupling to assess climate model outputs (thesis funded by CERAAS)	WP3	Expertise on climate modeling	Travels for scientific exchanges
AfricaRice Senegal	CGIAR Benin	Master on rice constraints and cycles analysis	WP4	Data collecting, agronomic skill	Scientific environment
Office du Niger	Mali	Master on rice constraints and cycles analysis	WP4	Data collecting, agronomic skill	Scientific environment
CERAAS	Senegal	PhD on Farm modeling development and use for	WP4	Local data Farm model	Travels for scientific

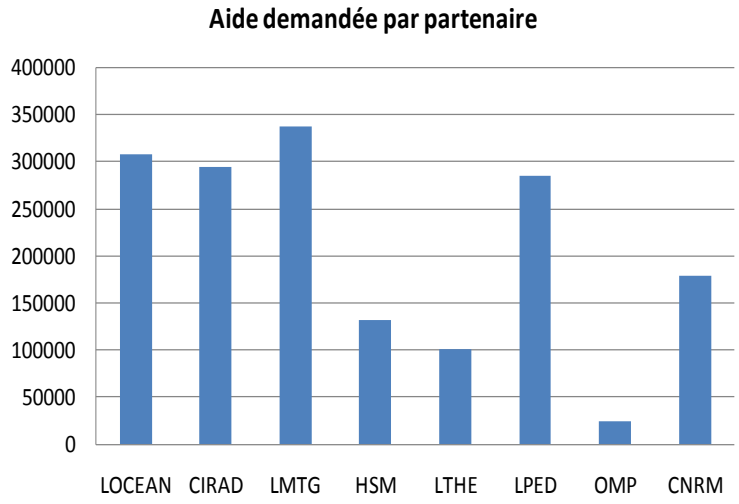
		insurances issues (thesis funded by CERAAS)		development and validation	exchanges
To be defined	Senegal, Burkina Faso, Niger, Benin	Training students to present exhibitions	WP6	Information on project diffused to Large Public	Skill in scientific communication More knowledge on ESCAPE topics

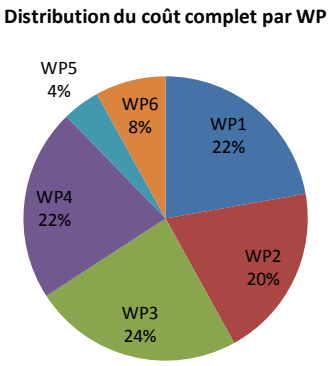
4.2. RELEVANT EXPERIENCE OF THE PROJECT COORDINATOR

Dr. Benjamin Sultan is an IRD researcher based in LOCEAN. His background by Ph.D. is environmental sciences. For 10 years, he has worked on the African climate and its impact on societies (agriculture, health) and has published nearly 30 international peered reviewed papers in various agronomical, medicine and climate journals, focusing on the dynamics of the West African Monsoon and its impacts on agriculture and health. Since 2008, Dr Benjamin Sultan heads a team involving 14 researchers in LOCEAN dedicated on interactions between climate and society. He has actively contributed to past EU projects (FP4 WAMP, FP5 PROMISE) dedicated to predictability and variability of monsoons, and the agricultural and hydrological impacts of climate change. He has been recently strongly involved in the FP6 AMMA project both on climate and impacts dedicated workpackages (including coordination of tasks, writing of deliverables, implication on the field experiment in Africa). This gave him the opportunity to develop strong ties with the West African scientific community, whether by contributing to the training of PhD students or by setting up a sustainable partnership with African institutions and Universities. He is PI of REGYNA, a French project funded by GIS-CES (CNRS, CEA, ADEME) between 2008 and 2010, which aims to quantify the impact of climate change on agriculture and hydrology in Africa and South America. He also coordinates the agricultural impact group of the French AMMA-LEFE program. He is implied in the PICREVAT program (ANR VMCS 2008), leading a workpackage on agricultural production and climate variability. Dr Benjamin Sultan has been nominated by the French focal point of the IPCC as a candidate author to contribute to the next IPCC AR5 report.

5. DESCRIPTION OF PROJECT RESOURCES

Financial Synthesis





5.1. PARTNER 1 : LOCEAN

- *Equipment*

Two laptops (2k€)

- *Personnal costs*

Financial support is required for two postdoctoral positions:

Postdoc (18 months)
The post-doc will work on the analysis of the decadal variability in the climate simulations and in the intermediate-complexity simulations. The post-doc of would be at the heart of WP3. He will in particular realize the intermediate complexity simulations and analyze the decadal variations in those simulations as well as in the CMIP simulations. He will also contribute to the evaluation of the representation of the seasonal evolution of the West African climate in those simulations.

Postdoc (24 months)
The post-doc will be involved both in WP3 and WP4 in charge of coupling climate models with the crop model SARRAH under present and future scenarios (WP3). He will explore several methods for this coupling and will analyze the results by comparing with observed yield data. He will contribute to study the potential different adaptation options (climate forecasts, insurances) by using the farm model developed in WP4.

- *Travels*

As coordinator of the project, LOCEAN ask for a significant budget for travels. It includes 12k€ for frequent meetings in France (Toulouse, Marseille, Montpellier), 14k€ to attend to workshops in Africa, 12k€ to participate to international conferences (EGU, AGU…).
A specific budget dedicated to the organization (including travel costs for African partners) of 3 workshops (two in Africa) is requested (52.90k€) from the following cost model:

Workshop organisation costs				
	Pax.	No.	Unit price	
room renting		1	200	200
coffee break	60	2	5	600
lunch	60	1	12	720
dinner	60	1	22	1320
				2840
Mean participation expenses				
	Pax.	No.	Unit price	
travel	10	1	1000	10000
per diem	10	4	120	4800
				14800
Estimate for 3 x one day workshops during the project with 10 invited African participants				**52920**

- *Other working costs*

Gratifications for master students (9.6k€)
Publication charges (8k€)

5.2. PARTNER 2 : LMTG

- *Equipment*

Un poste de travail est demandé pour chacun des 3 post-docs pour un coût unitaire de 1000 euros. Il est aussi prévu d'acheter deux versions d'un logiciel de SIG (Système d'Information Géographique) au tarif Education (soit 500 euros au total).
Le travail prévu sur l'occupation du sol nécessitera l'achat d'images satellitaires qui viendront compléter la base de données existante développée dans le cadre du projet AMMA (1500 euros pour le site du Gourma).

- *Personnal costs*

Le personnel non permanent financé par le projet compte un chercheur en CDD pour 31mois sur les WP 1, 2 et 3, un ingénieur pour 5 mois pour assurer les simulations à l'aide du modèle Nutmon (WP4.2), et un chercheur pour 21 mois sur le WP2 (voir les termes de références ci-dessous).

Type de personnel	Tâches	Nombre	Durée en mois	Cout annuel	Montant Total
				Euros	Euros
Chercheur (CDD)	WP 1, 2, 3, 4	1	31	49 000	126 583
Ingénieur (CDD)	WP4.2	1	5	40 000	16 667
Chercheur (CDD)	WP2	1	21	49 000	85 750
Total LMTG					**229 000**

Termes de référence de 3 contrats CDD au LMTG

Post-doctoral researchers' profile
At the overlap of the four tasks, the project needs three different post-doctoral researchers. Common required research capacities and experience:

- a fieldwork experience in the Sahel (possibly in one of the project countries or sites)
- a high score of publication in high standard journals or books
- a proven capacity to work within an interdisciplinary framework of research, including biophysical, agronomic and social sciences.

Specific required research interests and skills:

- An agronomist and ecologist (PhD), with a relevant research experience on natural resource assessment and monitoring, including soils, surface water and vegetation. Some experience in biological modeling (e.g. primary production models) will be helpful. Moreover, experience in multidisciplinary studies of agricultural systems, including livestock husbandry and animal production modeling.
- A geographer (Engineer) with a solid fieldwork experience on farming system in Africa, and experience in system modeling and geographic information systems. Skills in economy will be appreciated. Candidates with skills to integrate data from biophysical sciences with data from social sciences on a geographic basis will be particularly appreciated.
- A cultural and political anthropologist (PhD), with fieldwork experience on issues such as political relationships between groups in the context of institutional decentralization; cultural perceptions and representations of risk and nature; mobility as a coping strategy against vulnerability and local communities orientations between primary production intensification and economic diversification.

Une demande de thèse pour un étudiant malien sera déposée à la mi-juillet auprès de l'IRD dans le cadre de leur deuxième appel à candidature. Le financement sollicité auprès de l'IRD

est de 100%. Aucune demande de financement de thèse auprès de l'ANR n'est faite dans le cadre de cette proposition.

- *Subcontracting*

Deux prestations de service sont prévues au titre des WP2 et des WP1, 3 et 4. Ceci couvrira les frais de collecte de données complémentaires (réactualisation des bases de données d'occupation du sol, végétation, ménages ruraux et cheptel au Niger ; base de données cheptel au Mali) et de données d'archive (recensement de population et de cheptel au Mali).

. WP2 : avec l'Université de Ziguinchor qui réalisera au Sénégal des enquêtes qualitatives concernant les impacts des politiques publiques agricoles, pastorales et environnementales sur la disponibilité des ressources naturelles et les conditions sociales d'accès.

. WP 4 (collaboration 3 et 1) : avec l'ICRISAT et le LASDEL au Niger et l'Institut d'Economie Rurale au Mali et la DNPIA (Direction Nationale des Productions Animales) au Mali.

- *Travels*

Les déplacements prévus en France sont au nombre de 3 par an (soit 12 sur l'ensemble du projet). Le budget demandé servira à financer les voyages (avion ou train) et des frais d'hébergement des participants. Ce budget couvrira aussi les voyages qu'il pourrait être utile de faire pour assurer la coordination en particulier pour assurer les rapports semestriels scientifiques et financiers.

Des missions au Mali, Niger et Bénin auprès des partenaires africains et sur le terrain seront régulièrement prévues tout au long du projet. Le budget mission couvre le coût du voyage en avion de la France vers ces 3 pays et celui des missions de terrain sur les trois sites. 4 missions sont demandées au titre du WP2 et 6 pour les WP 1, 3 et 4 (soit 10 au total pour un coût unitaire de 3000 euros).

Trois participations à des colloques internationaux (2000 euros / colloque).

- *Expenses for inward billing (Costs justified by internal procedures of invoicing)*

Néant

- *Other working costs*

Les autres dépenses de fonctionnement à facturation externe couvrent les coûts de publication dans des revues internationales et diffusion des documents techniques et rapports de projet (6 pour un montant total de 9 000 euros.
Il est prévu d'accueillir 2 stagiaires de niveau Master 2 par an sur les WP 1, 3 et 4 (soit 8 sur 4 ans) et 1 stagiaire tous les deux ans pour le WP2. La gratification de stage est de 400 euros/mois soit 1600 euros pour un stage d'une durée de 4 mois.

5.3. PARTNER 3 : CIRAD

- *Equipment*

1 laptop computer for the CIRAD postdoc. Cost: 600 €.

- *Personnel costs*

1 postdoc during 18 months. Cost: 73.920 € (49.280 €/year).

Note 1: Two African PhD students of CERAAS, with fees fully funded by CERAAS, will also participate to the project, for WP3 and WP4 activities.
Note 2: AfricaRice will also contract a postdoc. See "Subcontracting".

Postdoc CIRAD profil:
He/she will be located in CIRAD, Montpellier, France and will participate with task 4.2 (WP4), under management of CIRAD, CIRED and LOCEAN scientists.
He will first contribute to the farm model building and validation, helping to improve integration of necessaries issues such as farmers risk aversion and livestock integration, linkage with crop model and to define agronomical options to be considered.
In a second time he will work on climatic forecasts and insurance potential interest assessment.
He will have to list the possible uses of climatic forecasts to guide decisions before and during cropping season. Then he will perform sets of simulations considering different assumptions for forecasts accuracy and farmers aversion to risk, in order to explore and assess the potential interest of forecasts in terms of productions and incomes.
Considering insurance issues he will contribute to farmers incomes variations at both field and farm levels in order to assess insurances needs. Then he will work on selection of a set of weather indices to be considered and integrated in simulations for insurance impacts assessment. If possible he will also contribute to assess impacts of combination of climatic forecasts and insurances.
Postdoc candidate must be already experimented in complex integrating modeling in agronomical and/or environmental areas.

- *Subcontracting*

Total : 130.100 €

AfricaRice
Description of partner:
Africa Rice Center (AfricaRice) is a leading pan-African research organization with a mission to contribute to poverty alleviation and food security in Africa through research, development and partnership activities. It is at same time an autonomous intergovernmental research association of African member countries and one of the 15 international agricultural research centers supported by the Consultative Group on International Agricultural Research (CGIAR). AfricaRice is working since decades on rice in Africa, having developing world famous NERICAS varieties (New Rice for Africa). AfricaRice have several research stations, including the Sahel Research Station of Ndiaye, in Senegal River valley, close to Saint Louis, Senegal. AfricaRice is developing many research and development programs in partnership with African NARS and other institutions like Office du Niger for instance.
Activities and collaboration within project:
AfricaRice will contribute to task 4.3 (WP4), providing all the experience and knowledge on rice of AfricaRice scientists, and data and information, and helping for local and regional contacts. Note that a CIRAD staff, responsible for WP4, is actually posted at Ndiaye Sahel Research Station (Senegal). AfricaRice will recruit and manage, in collaboration with CIRAD, a postdoc (2 years) to develop activities of task 4.3. He will work on sowing windows assessment, using RIDEV and SarraH models,

integrating recent results on varieties features obtained in projects developed by AfricaRice and CIRAD such as RISOCAS and Orytage. Postdoc, with the help of Master students (during training periods), will collect and manage information and data from AfricaRice and Office du Niger databases, and then performs risks analysis related to early and late rains. Postdoc will also work on birds' damages issues, in collaboration with AfricaRice agroeconomic staff, collecting relevant information in database and from local institutions and farmers (surveys) in order to analyse and confront them to climate features. Postdoc will collaborate with Office du Niger and local institutions.
Requested funding: total : 110.900 €
Postdoc 2 years: 80.000 €
Equipment: 2 laptops: for the postdoc and the Master students. Cost: 600x2 = 1.200 €
Fees for 2 Masters students during their training period. Cost: 1.200x2 = 2.400 €
Travels: for the postdoc
3 short missions to Mali (3x2.100 €); 2 participations to International Conferences (2x2.500 €);
2 long missions to France (2x5.500 €); total = 22.300 €.
Local functioning cost, mainly for local missions (data collecting) and farmers surveys of Master students, postdoc and staff: 5.000 €.

Office du Niger
L'Office du Niger est une organisation malienne charge de gérer les grands périmètres rizicoles irrigués développés autour du fleuve Niger et ses affluents au Mali. Il gère actuellement environ 100.000 Ha. Son siège est à Ségou. C'est un organisme stratégique pour la gestion de la sécurité alimentaire du Mali et de la région. Il possède des enregistrements historiques des productions rizicoles.
Activities and collaboration within project:
Office du Niger will facilitate data providing from its database. Office du Niger will collaborate in data collecting and processing, managing 2 Master student training periods.
Requested funding: total : 8.100 €
Equipment: 1 laptop: for the Master student for their training period. Cost: 600 €
Fees for 2 Masters students during their training period. Cost: 1.200x2 = 2.400 €
Travels: one short mission to Senegal. Cost: 2.100 €
Local functioning cost, mainly for local missions (data collecting) and farmers surveys of Master students: 3.000 €.

CERAAS
CERAAS (Centre d'Etudes Régionales pour l'Amélioration de l'Adaptation à la Sécheresse ; "regional center for studies on the improvement of plants adaptation to drough") is a regional research center focusing on crop water deficit adaptation, located in Thiès, Senegal. It is an ISRA (Senegalese Institute of Agronomy Research) research center and a regional reference research center of the West and Central African Council for Agricultural Research and Development (CORAF / WECARD), and thus has a regional status. It is an historical close partner of CIRAD, and has participated to AMMA program. CERAAS strongly collaborates with CIRAD since many years in SarraH model improvement and adaptation to African genotypes (millet, sorghum, maize).
Activities and collaboration within project:
CERAAS will collaborate mainly with 2 African PhD students (fees fully funded by CERAAS) who will contribute to WP3 and WP4. One (Seyni Salack, from Niger) already started his PhD work, working with CERAAS, CIRAD, LPA (Atmospheric Physic Laboratory of Dakar UCAD University) and LOCEAN. His PhD deals with climate model assessment through coupling with crop models. The second PhD will be a Senegalese economist or agroeconomist recruited and founded by CERAAS to develop a farm model and researches on insurances. The farm model will be used for WP4 activities. PhD works will be founded by CERAAS within a project developed by CERAAS and CIRAD. ESCAPE will contribute to reinforce PhD works by providing larger scientific assistance. Note that CERAAS is developing other activities on crop model adaptation and improvement and farmers yields monitoring that will provide data to the project.

Requested funding: total : 11.100 €
Equipment: 1 laptop: for the agroeconomist PhD student. Cost: 600 €.
Travels: mainly for the agroeconomist PhD student who will collaborate with WP4.
1 long mission to France (5.500 €) for PhD; 1 participation to International Conferences (2.500 €) for PhD; and 1 short mission to France for local PhD supervisor/professor (2.500 €) ; total = 10.500 €.
Note: local functioning of the PhD are funded by CERAAS.

- *Travels and Missions*

Total : 67.000 €
Participations to meetings in France: 8x600 = 4.800 € (including 3 for CIRAD postdoc).
Short missions to Africa: 5x2.000 = 10.000 € (including 3 for participation of CIRAD staff to Participative modeling workshops).
Short missions to France: 3x2.500 = 7.500 € (for CIRAD staff posted in Africa).
Long missions (1 month) to Africa: 2x4.000 = 8.000 € (for CIRAD postdoc).
Short missions to Mali: 2x2.100 = 4.200 € (for CIRAD staff posted in AfricaRice).
Participation to International Conferences: 5x2.500 = 12.500 € (including 2 for CIRAD postdoc).
Access costs to experimental fields in Africa : 20.000 Euro

- *Other working costs*

Total : 11.400 €
Fees for 2 African sociologist Masters students during their training period. They will participate to Participative modeling workshop preparations and management. Cost: 1.200x2 = 2.400 €.
Local functioning / travel cost for Master training periods and general local management/coordination with partners: 3.000 €.
Organisation of 4 Participative modeling workshop with farmers: 4x1500 = 6.000 €.

5.4. PARTNER 4 : HSM

- *Equipment*

To analyse the land cover changes over the Oueme site, aerial photographs (for the 1950s and 70s) are required. Due to the fine scale of aerial photographs and the extent of the Upper Oueme (12 000 km²), this approach will be undertaken on 2 specific sites (2 x 1000 km²), one with a high degree of cropping today and the other where the forest cover is dominant. SPOT images will be used for the recent period since the 80s. Two dates will be selected. A total cost of 2500€ is planned for this work. The equipment includes also 2 computers for each of the 2 post-doctoral researchers (1500€/computer).

- *Personnal costs*

24 months, splitted into two post-doctoral positions, are required for HydroSciences Montpellier. These months will be spent in WP1 (Tasks 1.2 and 1.3) and WP 3 (Tasks 3.2 and 3.3). The total cost for 24 months will be of 98.560 € (49.280 €/year).

Post-doctoral researcher profile 1 (WP1, 6 months)

A geographer (PhD) with an expertise in farming systems of wet West Africa, remote sensing and LULC retrieving from different sources (aerial photographs and satellite images) is required. As the recent history of forest land-clearing seems to be due to a positive net migration from people from northern regions (Benin and Burkina Faso) affected by the droughts, an applicant with the ability to discuss with demographs will be particularly appreciated.

Post-doctoral researcher profile 2 (WP3, 18 months)

The post-doctoral researcher will focus on hydrologic modeling at the AMMA Catch Niger site (WP3, Tasks 3.2 and 3.3). A hydrologist or an ecologist, with a great experience in environmental sciences and surface modeling, including soils, surface water and vegetation is absolutely required to provide scientific results in 18 months. A fieldwork experience in the Sahel will be also very helpful.

- *Travels*

The implication of HSM will be on the two AMMA-Catch sites of Niger and Benin. For this purpose, 4 short specific missions at these sites are planned in the framework of the project, considering a mean cost estimated at 3000€ including plane ticket and 2 weeks of local expenses. Concerning WP1, 2 missions are planned towards the main goal of validating the land occupation derived form satellite data analyses. Concerning WP3, a thorough knowledge of the AMMA-Catch field site in Niger is definitely required by the post-doctoral researcher involved in the hydrological modeling aspect. Moreover, a number of meetings in France are planned during the project life (total of 7 meetings, 500€ by meeting), and participation to two international conferences is also planned (1 for the post-doctoral researcher and 1 for the PHD student who are implied in WP3, total cost 4000€).

- *Other working costs*

Costs of publications in international journals are accounted for (2 publications, total 2000€). Gratifications for Master students (2 students for 5 months each, 420€ by month) are also requested (total of 4200€).

5.5. PARTNER 5 : LTHE

- *Equipment*

The equipment includes :

- the total computation equipment of the post doctorant; as the lab really needs the post doc (see the following item), it also needs its equipment;
- a lap top for field measurements; this is needed to monitor the field network and to have satellite images at screen during validation field works, as well as at the stage of geometrical images correction.

- *Personnal costs*

This is the main need of the LTHE team, because there is a lack of one person carrying out the task of studying the regional climatology and the integration of MCS series in the historical monitored context.

The post doc "Rainfall climatology at mesoscale in West Africa since the 1950s" is needed in order to better document the climatology of the rainy systems in West Africa, particularly the evolution of their occurrence rate, intensity and the spatial extension. This post doc will use the climatological information to improve the generation of rain fields that could be used for hydrological and agricultural modeling applications, at the meso and the regional scales. 15 months is a convenient duration to achieve this task.

- *Travels*

Missions in Africa ;
Some of them are short ones (estimated cost 2000€ including plane ticket and 1 week or 1 week and half of local staying) ; this is the regular commission duration in order to work with our local partners in Niger (mostly UAM and Agrhymet) .
Some other commission are more expensive (2500 €) due to the need of validating satellite data, during fields trips which can last one week or more. These commissions are planned to last 2 to 4 weeks, which justify their higher costs. The purpose of these missions is to validate the satellite data classification on different seasons: at the end of the dry season, at the beginning and the end of the rainy season, and finally, just after the last rain event at the beginning of October; we need 6 "long" missions (2500 € each) but 4 will be funded by other programmes.
Some meetings in France are planned during the life of the project, justifying their funding.
At least, we hope to obtain relevant results to present in any international conferences, justifying the need of this particular funding.

- *Other working costs*

Planned costs in international revues publications are required, as well as trainers grants in the field as well as at the lab.

5.6. PARTNER 6 : LPED

- *Personnal costs*

The short-term contracted researchers meet the required competencies, which are not available at LPED. These two researchers have a background in anthropology and history. These humans resources will enable the project to carry out historical and anthropological analyses on agropastoral practices and on natural resource uses and its representations.

Two postdoctoral researchers are required:

Common required research capacities and experience:

- a fieldwork experience in the Sahel (possibly in one of the project countries or sites)
- a high score of publication in high standard journals or books
- a proved capacity to work within an interdisciplinary framework of research, especially with other social sciences and with ecology, agronomic studies and geophysics.

Specific required research interests and skills:

- A social anthropologist (PhD), with a relevant research experience on the issue of family reconfigurations. He/She will study social relationships between sexes and generations and fitting it into the French and Anglo-Saxon gender studies debate. We really appreciate candidates with skills for developing an economic anthropology analysis and integrating it into a collaboration with social and economic demographers. Anne Attané (CV enclosed) who has already contributed strongly to the writing of this proposal is a very strong candidate for this profile.

- A historian (PhD) with a solid fieldwork experience and knowledge of oral surveys methods. He/She will have a good knowledge of agrarian history issues (territory practices and representations, conditions of access to natural resources, land tenure, coping strategies against climate changes), their political, social, economic contexts, and their transformations over time. Charles Grémont (CV enclosed) who has already contributed strongly to the writing of this proposal is a very strong candidate for this profile.

- *Subcontracting*

Data collection and data processing require subcontracted services. LPED will recruit a great deal of fieldworkers, supervisors and data entry employees in the four study countries. Local partners (Cheikh Anta Diop University in Senegal, Université d'Abomey-Calavi in Benin) will collaborate with LPED in these field operations.

- *Travels*

Travelling costs for missions constitute an important part of the team budget. These are mainly due to the collection of life histories and interviews carried out by five anthropologists, historians and geographers across four countries. The quantitative survey operations will benefit from four IRD expatriate appointments (Senegal, Benin).

5.7. PARTNER 7 : CNRM/GAME

- *Personnal costs*

AI/T Communication
The communication assistant is responsible for the design, development and maintenance of Internet and Intranet websites. He formats the content, maintains the technical platform and handles the referencing. He will also be in charge, under the responsibility of the communication responsible, of the realization of internal and external communication tools, from preparation of documents to the editorial proofreading. He will ensure the tasks of maintaining and updating of operational tools of communication, mailing list, press file, upload ... In addition to web development, he must be expert in the informatics tools and desktop publishing software.

Post-Doctorant
Financial support is asked for a 18-month post-doctoral position. The work will focus on the analysis of observational datasets (historical SYNOP and rainfall data, CRU anf GISS datasets) with the aim (1) to assess changes observed in surface air temperature, diurnal temperature range and rainfall over the past decades and (2) to analyse how they are linked to changes in larger scale features such as the monsoon flow and the inter-tropical front.
The primary task will be to characterize the seasonal cycle of these parameters, their changes and climatic sensitivities. The question addressed here concerns changes and trends in the main features of the seasonal cycle of temperature and rainfall in terms of amplitude and shape (e.g. lengthening, warming of the hot moist pre-monsoon period, delay, shortening or shift in the rain season, intensification of rainfall events). These analyses will be further used to evaluate climate models.
The candidate is expected to have robust bases in meteorology and atmospheric physics, and some experience with the manipulation of observational and NWP datasets including statistics.

- *Travels*

A contribution is requested for missions of coordination in France, for result dissemination, general management and collaborative WP1 works with WP3

- *Expenses for inward billing (Costs justified by internal procedures of invoicing)*

The request corresponds to a contribution for printing of brochures, exhibitions and newsletter, together with scientific peer review publications

5.8. PARTNER 8 : OMP

- *Personnal costs*

The mean time required to homogenize and convert datasets in AMMA database format is as long as two weeks per dataset. Inserting new datasets used or produced by the project would probably need about 6 person months more than the available manpower. The non permanent person (CDD, AI or IE level) should be hired at OMP but will be able to process satelite or model products if needed. The selected person wil be a developer with good knowledge of the languages, softwares and tools used in the AMMA database system (UniX, Apache/Tomcat, Java, PostgreSQL…) If this extra-manpower is not funded by the project, the products will be only made available in the original delivery format, which enable data exchange but not multi-criteria data request and homogenized format dataset extraction.

- *Travels*

A total amount of 2 k€ by year would allow to organize coordination missions between the three centres, to participate in the project workshops when needed, and to buy disks and other small computer equipment.

6. ANNEXES

6.1. REFERENCES

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Sultan B., C. Baron, M. Dingkuhn, B. Saar et S. Janicot (2005). Agricultural impacts of large-scale variability of the West African monsoon, *Agricultural and Forest Meteorology*, 128 (1-2), 93-110.

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Van den Bosch, H., A. De Jager and J. Vlaming. 1998a. Monitoring nutrient flows and economic

Van den Bosch, H., J.N. Gitari, V.N. Ogaro, S. Maobe and J. Vlaming. 1998b. Monitoring nutrient flows

Van Dijk, H. (1997). « Risk, Agro-Pastoral Decision-Making and Natural Resource Management in Fulbe Society, Central Mali », NOMADIC PEOPLES, 1(1), pp. 109.

Williams T O, Tarawali S, Hiernaux P and Fernández-Rivera S (eds.) 2004.Sustainable crop-livestock production for improved livelihoods and natural resource management in West Africa. Proceedings of a workshop held at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, 19-22 November 2001. CTA, Wageningen, The Netherlands and ILRI, Nairobi, Kenya.

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6.2. SHORT BIOGRAPHIES / CV, RESUME

Partner 1: LOCEAN

Benjamin SULTAN, 31 years

Current Situation
- Senior Research (CR1) at IRD LOCEAN

Other functions performed
- 2003-2004 Post-doctorate at CIRAD (Montpellier)
- 2001-2003 Temporary Lecturer of Geography, Univ. Paris 7, Denis Diderot

Relevant publications

Berg A., B. Sultan and N. De Noblet (2010) Including Tropical Croplands in a Terrestrial Biosphere Model: Application to West Africa, *Climatic Change*, in press.

Berg A., B. Sultan and N. De Noblet (2010) What are the dominant features of rainfall leading to realistic large-scale crop yield simulations in West Africa?, *Geophysical Research Letters*, doi:10.1029/2009GL041923, in press.

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Berg A., P. Quirion and B. Sultan (2009) Can weather index drought insurance benefit to Least Developed Countries' farmers? A case study on Burkina Faso, *Weather, Climate and Society*, 1, 71–84.

Sultan B., M. Bella-Medjo, A. Berg, P. Quirion and S. Janicot (2009) Multi-scales and multi-sites analysis of the role of climate in cotton yields in West Africa, *International Journal of Climatology*, DOI 10.1002/joc.1872.

Frédéric Hourdin

1966 : born in Paris, France

1989-1992 : PhD, University Paris 7, Astrophysique et techniques spatiales.

1994 : Permanent position at CNRS

2005 : “habilitation à diriger des recherches”

2009 : “directeur scientific adjoint” at LMD

Expertise:

- Study and numerical modeling of the general circulation of planetary atmosphere (the Earth, Mars, Titan, Venus).
- Numerical modeling of the Earth climate and climate change.
- Numerical modeling of the advection of atmospheric trace species and inversion of atmospheric transport.
- Parameterization of the atmospheric boundary layer.
- West African climate.
- In charge of the development LMDZ global climate model.

Publications available at : http://www.lmd.jussieu.fr/~hourdin/publis.html

5 most significative publications in the 5 last years:

1. Hourdin, F., O. Talagrand, and A. Idelkadi, 2006*b*, Eulerian backtracking of atmospheric tracers. II: Numerical aspects, *Q. J. R. Meteorol. Soc.*, *132*, 585–603, 2006*b*.

2. Hourdin, F., I. Musat, S. Bony, P. Braconnot, F. Codron, J.-L. Dufresne, L. Fairhead, M.-A. Filiberti, P. Friedlingstein, J.-Y. Grandpeix, G. Krinner, P. Levan, Z.-X. Li, and F. Lott, 2006*a*, The LMDZ4 general circulation model: climate performance and sensitivity to parametrized physics with emphasis on tropical convection, *Climate Dynamics*, *27*, 787–813, 2006*a*.

3. Rannou, P., F. Montmessin, F. Hourdin, and S. Lebonnois, 2006, The Latitudinal Distribution of Clouds on Titan, *Science*, *311*, 201–205, 2006.

4. Rio, C., et F. Hourdin, A thermal plume model for the convective boundary layer : Representation of cumulus clouds, *J. of Atmosph. Sci.*, *65*, 407–425, 2008.

5. Rio, C., F. Hourdin, J.-Y. Grandpeix, and J.-P. Lafore, 2009, Shifting the diurnal cycle of parameterized deep convection over land,*Geophys. Res. Lett.*, *36*, 7809-+ 2009

Philippe ROUDIER, roudier@centre-cired.fr

Education

2008 - present: PhD student at Centre International de Recherche sur l'Environnement et le développement (CIRED), working on the value of seasonal forecasting in West Africa.
2008: Double grade, both with honors : M.Sc. '*Natural hazards'* at University of Strasbourg, and M.Sc at the Ecole Nationale du Génie de l'Eau et de l'Environnement de Strasbourg (ENGEES), National school of water and environmental engineering, Strasbourg, France.

Work experience

2010: teaching at Paris Pantheon Sorbonne, master IEDES. How could NGOs deal with climate change in West Africa?
2009: report for the NGO Action Against Hunger about past and future climate changes in Mali.
Feb-July 2008: Internship at the Institute for Research of Development (IRD, Montpellier, France) working on *Vulnerability of water resources to climate changes in the Bani watershed (Mali): study with indicators*

Publications, Talks and awards

Roudier P, Mahé G. (2010). Calculation of design rainfall and runoff on the Bani basin (Mali): a study of the vulnerability of hydraulic structures and of the population since the drought. *Hydrological Sciences Journal* **55** (3), 351-363
Roudier P, Quirion P, Sultan B. (2009). How can seasonal forecasts change agricultural decisions? A case study on millet producers in Niger.Talk at AMMA international conference, Ouagadougou
Roudier P, Mahé G. (2009). Study of water stress and droughts with indicators using daily data on the Bani river (Niger basin, Mali). *Int. J. Climatol*
2009: award of the Académie d'agriculture de France (French academy of agriculture)

Philippe Quirion

Economist, PhD, chargé de recherches CNRS, CIRED, since October 2004. Philippe Quirion works both on the economic analysis of environmental policies (especially climate change mitigation policies) and, more recently, on the impact of climate variability and change on agriculture in West Africa. He has published 19 papers on the first topic in peer-reviewed journals, and 3 on the second topic. His works on the second topic include 4 work streams. 1). Analyses of the influence of climate on cotton yields, through statistical models, published in *Agricultural and Forest Meteorology* and in the *International Journal of Climatology*. 2). Economic modeling of weather-index insurances. This includes a submitted review of the literature, an analysis of the feasibility of such insurances in Burkina Faso, published in *Weather, Climate and Society*, and an ongoing work on the feasibility of such insurances in Niger. 3). Economic modeling of seasonal climate forecasting, with an application on Niger. 4). Analysis of the impact of climate change on West-African agriculture.

Antoine Leblois
PhD candidate in economics at "Centre International de Recherches sur l'Environnement et le Dévelopement" (CIRED).

Training
- Master's degrees in Macroeconomics at *La Sorbonne* (Research post graduate certificate, Paris I) and in Sustainable Development at Sciences Po.
- Master in Management at ENS Cachan and Créteil University (Paris XII, Ecole Supérieure des Affaires).

Teaching experiences
2009-2011:
- teaching at Paris I University (*La Sorbonne*): Macroeconomics and Development Economics at 'Institut d'Etude du Développement Economique et Social' (master).
- Insuring against Meteorological Risks in Agriculture (master) at AgroParisTech.

2009-2010: Statistics at Paris I, economics bachelor degree.
2007-2008:
- T.A. at Science Po. in international economic relations and implementation of the 'Global Classroom in sustainable development', joint lecture of Columbia University and other international universities including IDDRI).

Other work experience
- Research assistant at DIAL (a development economics laboratory attached to IRD and INSEE) for a paper on migrations and Diasporas for the European Institute of and redaction of a paper on endogenous returns of professional training in Senegal and Kenya.

Conferences' presentations
EAAE PhD workshop: September 2009, in Giessen (Germany).
AMMA (African Monsoon Multidisciplinary Analysis) conference: July 2009 in Ouagadougou (Burkina Faso).

Partner 2: LMTG

Yves Auda
Courriel : yves.Auda@lmtg.obs-mip.fr

Curent situation
- engineer CNRS, biology and statistics

studies
- Thèse de doctorat de 3ème cycle, 1984, Rôle des méthodes graphiques en analyse des données : application au dépouillement des enquêtes écologiques,
- Habilitation à diriger des recherches, 1997, Une expérience de l'analyse des données dans un laboratoire d'archéologie

Relevant publications
- Laffite Olano A., **Y. Auda**, V. Trichon, J. Majerowicz, L. Simon et B. Tamru 2005, Une classification dirigée fondée sur les spectres de texture : application à l'étude des paysages de la montagne de Lure (Alpes, France). Télédétection, vol. 4 n°4, 373-380
- **Auda Y.**, C. Déchamp, G. Dedieu, F. Blasco, D. Duisit et J.-L. Pontier 2008. Détection des plantes envahissantes par télédétection : un cas d'étude, l'ambroisie en région Rhône-Alpes, France, Int. J. Remote Sensing, 29, 4, 1109-1124
- Jomaa I., **Auda Y**., Abi Saleh B., Hamze M., Safi S. 2008. Landscape spatial dynamics over 38 years under natural and anthropogenic pressures in Mount Lebanon. Landscape and Urban Planning, 87, 67-75
- **Auda Y.**, Dejoux J.-F., Ducrot D., Gouaux D., Hagolle O., Lepage M., Suere C., Dedieu G. 2009. Utilisation d'un SIG nomade couplé à un GPS pour cartographier les paysages du Sud-Ouest toulousain, Revue XYZ, N° 118, 47-50

- Jomaa I**., Auda Y**., Hamze M., Abi Saleh B. and Safi S., 2009. Analysis of Eastern Mediterranean oak forests over the period 1965-2003 using landscape indices on a patch basis. Landscape Research, 34(1), 2009, 105-124

Bonnassieux Alain , Sociologue LMTG et UMR Dynamiques rurales Université Toulouse 2
alain.bonnassieux@univ-tlse2.fr

Curent situation

- Chargé de recherche UMR Dynamiques Rurales et collaboration avec le LMTG

studies : de sociologie Université de Paris (1983), Institut d'Etudes Politiques Paris

other fonctions performed

- Participation à des programmes de recherche au Burkina Faso, Mali, Niger, Bénin : Corus Eau, Ecosystèmes sous les tropiques, 2004-2008, AMMA, Analyse Multidisciplinaire de la Mousson Africaines, 2008-2009 , ECLIS, 2009-2011 (Elevage Climat et Société)
- De 1973 à 1999, en poste en Côte d'Ivoire, Niger et Burkina Faso : enseignant en socio-économie et réalisation de recherches sur la précarité en milieu urbain (L'Autre Abidjan, 1987, Ed Karthala), les migrations, les dynamiques associatives et la formation en milieu rural

Publications et travaux récents

- **Bonnassieux A**, 2010, Evolution des migrations et diversification des activités de subsistance dans la région de Hombori (Mali), AMMA – Programme GT3.3, 67 pages
- **Bonnassieux A,** 2010, Enjeux autour de l'accès à l'eau et diversification des modes de gouvernance des infrastructures hydrauliques au Burkina Faso, Géodoc n° 57, Université Toulouse 2, pp 185-2005
- **Bonnassieux A,** 2009, L'évolution des stratégies migratoires des Burkinabé en Côte d'Ivoire et le rôle des réseaux communautaires, in Migrants des Suds, Editions IRD et PUM, pp 279-289
- **Bonnassieux A,** 2007, Dynamiques migratoires et transgressions des frontières urbain-rural au Niger, in C - Bouquet et H Velasco Regards Géopolitiques sur les frontières, L'Harmattan, pp 159-169

Riccardo CIAVOLELLA, Anthropologist (PhD, EHESS/University of Milan Bicocca, 2008)

Courriel : riccardo.ciavolella@lmtg.obs-mip.fr

Current Situation

- CNRS Post-doc fellow (Chargé de recherche CDD) at LMTG-Toulouse, in the framework of the ECLIS project
- Lecturer (time contract) in "Cultural Anthropology" (University of Teramo, I)

Other functions performed

- 2008-2009 Post-doctoral fellow at African Studies Centre, Milan and University of Milan Bicocca
- 2008-2009 Lecturer (time contract) in "Non-European Cultures and Politics" (University of Teramo, I) and "History of Africa" (University of Milan Bicocca)
- 2004-2008 Teaching Assistant in Anthropology, University of Milan Bicocca
- 2006 Research Associate on decentralisation and local development, Groupe de Recherches et Réalisations dans le Développement Rural (GRDR), Mauritania

Relevant publications

- Ciavolella, R. (2010). Les Peuls et l'Etat en Mauritanie. Une anthropologie des marges, Karthala, Paris.
- Ciavolella, R. (2010). "Frontiers of Mobility, Limits of Citizenship: Political Meanings of Immobility for some Fulani groups of Mauritania", in Gratz, T. (dir.), Transnationalism and Migration in Africa, Cambridge Publishers, Cambridge.
- Ciavolella, R. (2010 forth.). "Soli davanti al mondo. Responsabilità individuale ed etica del lavoro di fronte alla vulnerabilità climatica e alimentare nel Sahel", in Vignato, S. (dir.), Soggetti al lavoro, UTET, Roma.
- Ciavolella, R. (2010 forth.). "Ripoliticizzare la vulnerabilità. I Peuls del Sahel di fronte al cambiamento climatico, alla crisi alimentare e all'instabilità politica", L'Uomo, n. 1.
- Ciavolella, R. (2009). "Entre démocratisations et coups d'état. Hégémonie et subalternité en Mauritanie", in **Ciavolella, R. & Fresia, M.** (dir.). La Mauritanie au coup par coup, Politique Africaine, 114 : 3-21.

Gangneron Fabrice

Courriel : fabrice.gangneron@lmtg.obs-mip.fr

Current Situation

- engineer CNRS, sociology and human geography

Studies
- DEA de géographie de l'environnement
- maîtrise de sociologie rurale

Relevant publications
- **Gangneron F., Becerra S., Dia A. H.**,(2010a, sous presse), L'étonnante diversité des ressources en eau à Hombori : entre contrastes environnementaux, pratiques locales et technologies extérieures, Tiers Monde
- **Gangneron F., Becerra S., Dia A. H.**, (2010b, sous presse), Les pompes à motricité humaine : état des lieux dans une commune du Gourma malien, Autrepart
- **Becerra S, Dia A. H., Gangneron F., Saqali M.**, (2010, sous presse) « Hey Mrs Jerrycan » Vulnerabilities and everyday life adaptations to water crises. The case of Hombori in the malian Gourma, World Development
- **Mougin E., Hiernaux P., Kergoat L., Grippa M. et al. (including Gangneron F)**, 2009, The AMMA Gourma observatory site in Mali: Relating climatic variations to changes in vegetation, surface hydrology, fluxes and natural resources. J. Hydrol., AMMA, 375(1-2), 14-33.
- **Dia A. H., Becerra S., Gangneron F.,** 2008, Crises climatiques, ruptures politiques et transformations de l'action publique environnementale au Mali, VertigO

Manuela Grippa
Born 28 March 1972, Italian.
Education
- Ph.D. (July 2001) in Physics on atmospheric remote sounding at the Physics Department, Heriot-Watt University, Edinburgh, UK
- Physics degree (Master equivalent, July 1997) at the University of Milan, Italy.

Work experience
- Postdoctoral fellow at CESBIO (Nov 2002 -Aout 2007). Main research on remote sensing of snow, surface water and vegetation indicators, data analysis and integration in dynamic vegetation models.
- Postdoctoral fellow at University of Edinburgh, Department of Geography (Nov 2002 -Aout 2007). Research on radar remote sensing applications for deriving surface roughness, soil moisture and vegetation parameters.

Current position, since September 2007; Physicien adjoint (CNAP) at the Observatoire Mydi- Pyrénées (LMTG), within the « service d'observation » AMMA-CATCH.
Expertise: Analysis and long term evolution of the Sahelian ecosystems (vegetation, surface hydrology and surface radiative balance) by combining in-situ observation , remote sensing and land surface modelling.
5 most significative publications in the 5 last years:
1- Grippa M, Kergoat L, Frappart F, Araud Q, Boone A, de Rosnay P, Lemoine JM, Gascoin S, Balsamo G, Ottlé C, Decharme B and Saux-Picart S, Land water storage changes over West Africa estimated by GRACE and land surface models *Water Resource Research, accepted with revision, 2010*
2- Gardelle J, Hiernaux P, Kergoat L, and **Grippa M**, Less rain, more water in ponds : a remote sensing study of the dynamics of surface waters from 1950 to present in pastoral Sahel (Gourma region, Mali), *Hydrol. Earth Syst. Sci.*, 14, 309–324, 2010
3- Boone A, et al. (including **Grippa M**), 2009, The AMMA Land surface Model Intercomparison Project (ALMIP), *BAMS*, 90 1865-1880
4- Hiernaux P, Ayantunde A, Kalilou A, Mougin E, Gerard B, Baup F, **Grippa M**, Djaby B, Trends in productivity of crops, fallow and rangelands in Southwest Niger: Impact of land use, management and variable rainfall, J. Hydrol., 375 (1-2) , 65-77
5- **M. Grippa**, N. M. Mognard, T. Le Toan, S. Biancamaria, 2007, Observation of changes in surface water over the Western Siberia Lowland », *Geophy. Res. Letter*, 34, L15403

Kergoat Laurent
Born 9 June 1964
Education
1992-1995 PhD University Paul Sabatier Toulouse
1996 Permanent position with CNRS
Current position: Research scientist with CNRS (CR1), has joined LMTG in January 2010.
Expertise
Land-atmosphere gas and energy exchange in Africa through surface flux and remote sensing data, long term changes in ecosystems, surface water and soil, and links to surface energy balance (past focus on global scale, boreal zones and since 2003 on West Africa). Coordinator or the "Remote sensing WP" of AMMA-IP,
5 most significative publications in the 5 last years (full list http://kergoat.laurent.free.fr/publications.html)

1- Gardelle J, Hiernaux P, **Kergoat L**, and Grippa M, Less rain, more water in ponds : a remote sensing study of the dynamics of surface waters from 1950 to present in pastoral Sahel (Gourma region, Mali), *Hydrol. Earth Syst. Sci.*, 14, 309–324, 2010
2- Timouk F, **Kergoat L**, Mougin E, Lloyd CR, Ceschia E, Cohard JM, de Rosnay P, Hiernaux P, Demarez V, C.M. Taylor, 2009, Response of surface energy balance to water regime and vegetation development in a Sahelian landscape, *J. of Hydrol.* 375 (1-2),178-189
3- Samain O, **Kergoat L**, Hiernaux H, Guichard F, Mougin E, Timouk F, Lavenu F, 2008, Analysis of the in situ and MODIS albedo variability at multiple time-scales in the Sahel, *J. of Geophys. Res.*, 113, D14119
4- Kergoat L, Lafont S, Arneth A, Le Dantec V, Saugier B, 2008, Nitrogen controls plant canopy Light-Use-Efficiency in temperate and boreal ecosystems, *J. Geophys.l Res., biogeosciences, 113, G04017*
5- Delbart N, Picard G, Le Toan T, **Kergoat L**, Quegan S, Woodward I, V Fedotova, 2008, Spring phenology in boreal Eurasia over a nearly century time-scale, Global Change Biology, 14, 603–614

Mougin Eric
51 years old, agronomist, received the Ph.D in remote sensing from the Institut National Polytechnique, Toulouse, (1989). He moved to LMTG in January 2010, working on the modelling of land surface processes, satellite remote sensing of vegetation and soils, and the coupling between vegetation models and satellite observations. He has been PI of several national and international projects in remote sensing, natural resources monitoring and land surface processes. From 1999, he has been in charge of the long term observation program of the AMMA-CATCH site in Mali and was the coordinator of the 'Physical and Biological process' studies during AMMA. He is in charge of the ECLIS project. He has published about 65 papers in international peer-review journals.
5 most significative publications in the 5 last years:
1-Mougin E., Hiernaux P., Kergoat L., Grippa M. et al., 2009, The AMMA Gourma observatory site in Mali: Relating climatic variations to changes in vegetation, surface hydrology, fluxes and natural resources. *J. Hydrol.*, AMMA, 375(1-2), 14-33.
2-Frappart F., Hiernaux P., Guichard F., **Mougin E.**, Kergoat L., Arjounin M., Lavenu F., Koité M., Paturel J.E., Lebel T., 2009, Rainfall regime over the Sahelian climate gradient in the Gourma, Mali. *J. Hydrol.*, 375(1-2), 128-142.
3-Jarlan L, Balsamo G, Lafont S, Beljaars A , Calvet JC, **Mougin E**, 2008, Analysis of leaf area index in the ECMWF land surface model and impact on latent heat and carbon fluxes: Application to West Africa *J. Geophys.-Atmosphere*, 113, D24117
4-Philippon N., Jarlan L., N. Martiny, P. Camberlin, **Mougin E.**, 2007, Characterization of the interannual and intraseasonal variability of West African vegetation between 1982-2002 by means of NOAA-AVHRR NDVI data. *Journal of Climate*, 20, 1202–1218.
5-Tracol Y., **Mougin E.**, Jarlan L., Hiernaux P., 2006, Testing a sahelian grassland functioning model against herbage mass measurements, *Ecological modelling*, 193, 437-446.

Timouk Franck
45 ans,
Education
DEA ATEG, Modélisation Spatiale. Univ. Paris I. 1995
*Pilote privé avion & ULM, 1993 (licence à renouveler)
*First Certificat of Cambridge in English, Westminster college,
Londres, 1985
Current position, IE IRD
Expertise : Experimental design and setup, in bioclimatology, hydrology and soil science; Spatial analysis, high and very high resolution remote sensing in the solar domain, large-field of view sensors in the thermal infrared.
Current position (IRD Bamako, Mali, since 2005): In charge of the instrumental setup, data collection, quality-check and processing for the AMMA-Catch site in Mali.
PI of the eddy covariance flux stations and the full automatic weather stations; Co-I of the soil moisture sensor network, of the sap-flow station network, and of the soil CO2 concentration network; Technical support for AERONET-PHOTON (Univ. Lille) and CarboAfrica networks (Univ Viterbo).
5 most significative publications in the 5 last years:
1- Gruhier C, de Rosnay P, Hasenauer S, Holmes T, de Jeu R, Kerr Y, Mougin E, Njoku E, **Timouk F**, Wagner W, Zribi M, 2010, Soil moisture active and passive microwave products: intercomparison and evaluation over a Sahelian site, *Hydrol. Earth Sci. Sys.*, 14, 141-156,
2-Timouk F, Kergoat L, Mougin E, et al., 2009, Response of surface energy balance to water regime and vegetation development in a Sahelian landscape, *J. of Hydrol.* 375 (1-2),178-189.

3- de Rosnay P, Gruhier C, **Timouk F**, Baup F, Mougin E, Hiernaux P, Kergoat L, LeDantec V, 2009, Multi-scale soil moisture measurements at the Gourma meso-scale site in Mali, J. Hydrol., 375, (1-2), 241-252
4-Mougin E., Hiernaux P., Kergoat L. et al. (including **Timouk F**), 2009, The AMMA Gourma observatory site in Mali: Relating climatic variations to changes in vegetation, surface hydrology, fluxes and natural resources. *J. Hydrol.*, 375(1-2), 14-33.
5-Boulain N, et al. (including **Timouk F**), 2009, Towards an understanding of coupled physical and biological processes in the cultivated Sahel-2. Vegetation and carbon dynamics, *J. Hydrol.*, 375 (1-2), 190-203

Partner 3: CIRAD

Bertrand MULLER, Ph. D., 47 years

Current Situation
Agronomist, CIRAD scientist posted since July 2009 with AfricaRice at Sahel Regional Station of Ndiaye, Senegal.

Other functions performed
- 2005-2009 : scientist CIRAD posted with CERAAS (Centre d'Etude Régional pour l'Amélioration de l'Adaptation à la Sécheresse), in Senegal. Researches on crop (millet, sorghum, maize) modeling and on yields forecasting within AMMA project. Collaborating with World Bank "insurance for the poor" program and participation to index based insurance study for Senegal developed by World Bank.
- 2001-2004 : scientist CIRAD posted with FOFIFA in Malagasy : working on zero tillage (direct seeding) mulch-based cropping systems: runoff, water balance, erosion and crop (mainly upland rainfed rice) development studies.

Recent relevant publications
- **Muller B.**, Baron C., Traore S., Alhassane A., Kouressy M., Vaksmann M., Diop M., Somé L., Sanon M., Sultan B., Siene A., Kouakou P., Oumarou S., Sarr A., Ouatara B., Salack S., Faye A., Dingkuhn M. 2009. Assessing climate impact on West African non-intensified crops : a captivating challenge for agro-modelers. In : Marie-Pierre Devic, Odile Roussot, Serge Janicot and Chris Thorncroft (Editors). African Monsoon Multidisciplinary Analyses (AMMA) 3rd International Conference, Ouagadougou, 20-24 July 2009. pp. 601.
- Sultan B., Alhassane A., Traore S., Baron C., **Muller B.**, Roudier P., Marteau R., Descroix L., Chaffard V., Boubkraoui S., Dingkuhn M. 2009. A multiscale observation and modelling study in the millet zone in Niger : the role of intraseasonal variability of rainfall on yields. In : Marie-Pierre Devic, Odile Roussot, Serge Janicot and Chris Thorncroft (Editors). African Monsoon Multidisciplinary Analyses (AMMA) 3rd International Conference, Ouagadougou, 20-24 July 2009. pp. 601.
- Sultan B., Janicot S., Baron C., Dingkuhn M., **Muller B.,** Traoré S., Sarr B. 2008. Les impacts agronomiques du climat en Afrique de l'Ouest : une illustration des problèmes majeurs. Sécheresse, 19 (1) : 29-37.
- Chopart J.L., Sine B., Dao A., **Muller B**. 2008. Root orientation of four sorghum cultivars: application to estimate root length density from root counts in soil profiles. Plant root, 2 : 67-75.
- **Muller B.**, Dusserre J., Douzet J.M., Rakotoarisoa J. 2007. Bilan hydrique de systèmes de culture en riz pluvial traditionnels et sans labour avec couverture végétale sur les Hautes Terres malgaches. In : Les sols tropicaux en semis-direct sous couvertures végétales : Séminaire international, Antananarivo, 3-8 décembre 2007.
- Participation to World Bank, 2009. Index-based Crop Insurance in Senegal : Promoting Access to Agricultural Insurance for Small Farmers. The World Bank, Sustainable Development, Africa Region, Finance and Private Sector Development. April 2009. p.89 and annexes.

François AFFHOLDER, Ph.D., 47 years

Current Situation
- Agronomist, Principal Scientist at CIRAD, Montpellier and Consulting professor at Supagro, Montpellier.

Other functions performed
- 1989-1993: research fellow at CIRAD, posted in Senegal (ISRA), researches on climatic risk for millet production
- 1994-2000: scientist at CIRAD, head of research project "Hydrosystems of the *Cerrados*". Posted in Brazil (EMBRAPA), researches on crop intensification in small scale farms exposed to market and climatic risks,.

- 2001-2006 senior scientist at CIRAD, seconded to IRRI (International Rice Research Institute), posted in Vietnam (Vietnam Academy of Agricultural Science). Head of project "Systèmes Agraires de Montagne"
- 2007-2009 senior scientist at CIRAD, Unité Mixte de Recherché CIRAD/INRA/SUPAGRO "SYSTEM", head of research team "Systèmes de Cultures Multi-Espèces à base d'Annuelles"

Relevant publications

Affholder, F., 1995. Effect of organic matter input on the water balance and yield of millet under tropical dryland condition. Field Crop Res. 41, 109-121.
Affholder, F., 1997. Empirically modelling the interaction between intensification and climatic risk in semiarid regions. Field Crops Research 52, 79-93.
Affholder, F., Assad, E.D., Bonnal, P., Macena da Silva, F.A., Forest, F., Madeira Netto, J., Scopel, E., Corbeels, M., 2006. Risques de stress hydrique sur les cultures dans les Cerrados Brésiliens. Du zonage régional à l'analyse des risques à l'échelle des exploitations familiales. Cahiers Agricultures 15, 433-439.
Affholder, F., Bonnal, P., Scopel, E., 1996. Analyse des interactions entre risques climatiques et risques économiques dans les choix techniques des agriculteurs. In: Reyniers, F.N., Benoit-Cattin, M. (Eds.), Couplage de modèles en agriculture. Colloques, CIRAD, Montpellier, pp. 101-108.
Affholder, F., Jourdain, D., Quang, D.D., Tuong, T.P., Morize, M., Ricome, A., 2010. Constraints to farmers' adoption of direct-seeding mulch-based cropping systems: A farm scale modeling approach applied to the mountainous slopes of Vietnam. Agricultural Systems 103, 51-62.
Affholder, F., Jourdain, D., Scopel, E., 2007. Bio-economic modeling: lessons learned on obstacles towards interdisciplinarity. In: Donatelli, M., Hatfield, J., Rizzoli, A. (Eds.), Farming Systems Design 2007. Int. Symposium on Methodologies on Integrated Analysis on Farm Production Systems., Catania (Italy), pp. 91-92.
Affholder, F., Scopel, E., Madeira Neto, J., Capillon, A., 2003. Diagnosis of the productivity gap using a crop model. Methodology and case study of small-scale maize production in central Brazil. Agronomie 23, 305-325.
Bainville, S., Affholder, F., Figuié, M., Madeira Neto, J., 2005. Les transformations de l'agriculture familiale de la commune de Silvânia : une petite révolution agricole dans les Cerrados brésiliens. Cahiers Agricultures 14, 103-110.

Partner 4: HSM

DEMARTY Jérôme
38 ans

Cursus
2001 Docteur de l'Université Paris Diderot
1998 Master Université Toulouse

Situation actuelle
Chargé de recherche IRD, UMR HydroSciences Montpellier

Principaux thèmes de recherche
Cycle de l'eau en région sahélienne
Modélisation éco-hydrologique
Assimilation de données de télédétection

Liste de 5 publications récentes

Maignan F., F.M. Bréon, C. Bacour , J. Demarty & A. Poirson
Interannual vegetation phenology estimates from global AVHRR measurements. Comparison with in situ data and applications, Remote Sensing of Environment,112, doi 10.1016/j.rse.2007.05.011, 2008
Piao S., P. Friedlingstein, P. Ciais, N. Viovy & J. Demarty, Growing season extension and its effects on terrestrial carbon flux over the last two decades: a process model simulation, Global Biogeochemical Sciences, 21(3), GB3018, 2008
Demarty J., F. Chevallier, A.D. Friend, N. Viovy, S. Piao & P. Ciais, Assimilation of global MODIS leaf area index retrievals within a terrestrial biosphere model, Geophysical Research Letters, 34, L15402, doi:10.1029/2007GL030014, 2007
Demarty J., C. Ottlé, I. Braud, A. Olioso, J.-P. Frangi, H.V. Gupta & L.A. Bastidas

Constraining a physically based SVAT model with surface water content and thermal infrared brightness temperature measurements using a multiobjective approach, Water Resources Research, 41, W01011, doi:10.1029/2004WR003695, 2005
Demarty J., C. Ottlé, I. Braud, A. Olioso, J.-P. Frangi, L.A. Bastidas & H. Gupta, Using a multiobjective approach to retrieve information on surface properties used in a SVAT model, Journal of Hydrology, 287, 1-4, 214-236, 2004

CAPPELAERE Bernard
56 ans

Cursus
2007 Docteur de l'Université Montpellier 2
1990 Ingénieur Informatique ENSEEITH Toulouse
1978 M.A.Sc. Univ. of British Columbia (Canada)
1975 Ingénieur Ecole Centrale de Paris

Situation actuelle
Ingénieur de recherche IRD, UMR HydroSciences Montpellier

Principaux thèmes de recherche
Cycle de l'eau en région sahélienne
Modélisation hydrologique distribuée
Aspects méthodologiques de la modélisation hydrologique et hydrodynamique

Autres expériences professionnelles
Ingénieur R&D, BCEOM Ingénierie (1980-1990)
Ingénieur Informatique Scientifique, IBM-France (1990-1993)

Liste de 5 publications
Boulain N., Cappelaere B., Séguis L., Favreau G., Gignoux J. (2009). Water balance and vegetation change in the Sahel: a case study at the watershed scale with an ecohydrological model. Journal of Arid Environments, 73, 1125-1135.
Cappelaere B., Descroix L., Lebel T., et al. (2009). The AMMA-Catch experiment in the cultivated Sahelian area of south-west Niger - Strategy, implementation, site description, main results. Journal of Hydrology, 375, 34-51.
Cappelaere B., Vieux B., Peugeot C., Maia-Bresson A., Séguis L. (2003). Hydrologic process simulation of a semiarid, endorheic catchment in Sahelian West Niger. 2. Model calibration and uncertainty characterization. Journal of Hydrology, 279: 244-261.
Guinot V., Cappelaere B. (2009). Sensitivity analysis of 2D steady-state shallow water flow - Application to free surface flow model calibration. Advances in Water Resources. 32(4): 540-560.
Favreau G., Cappelaere B., Massuel S., Leblanc M., Boucher M., Boulain N., Leduc C. (2009). Land clearing, climate variability and water resources increase in semiarid southwest Niger: a review. Water Resources Research, 45, W00A16.

Partner 5: LTHE

Luc Descroix

Né le 10/08/1960
Hydrologist,
luc.descroix@ird.fr

HDR in 2003
Domains of interest : hydrology, land use change, tropical areas, processes, spatialisation and regionalisation.

Recent publications:

Descroix, L., Gonzalez Barrios, J.L., Viramontes, D., Poulenard, J., Anaya, E., Esteves, M., Estrada, J., 2008. Gully and sheet erosion on subtropical mountainous slopes: Their respective roles and the scale effect. . Catena, 72:325-339.
Descroix, L., Mahé, G., Lebel, T., G., Favreau, G., Galle, S., Gautier, E., Olivry, J-C., Albergel, J., Amogu, O., Cappelaere, B., Dessouassi, R., Diedhiou, A., Le Breton, E., Mamadou, I. Sighomnou, D., 2009. Spatio-Temporal Variability of Hydrological Regimes Around the Boundaries between Sahelian and Sudanian Areas of West Africa: A Synthesis. Journal of Hydrology, AMMA special issue, 375, 90-102.
Amogu O., Descroix L., Yéro K.S., Le Breton E., Mamadou I., Ali A., Vischel T., Bader J.-C., Moussa I.B., Gautier E., Boubkraoui S., Belleudy P., 2010. Increasing River Flows in the Sahel?. Water. 2(2):170-199.
Lasserre F. and Descroix., L., 2010. Eaux et Territoires. PUQ, Quebac, Canada, 530 p.

Théo VISCHEL
Maître de conférence à l'université Joseph Fourier rattaché au LTHE
Né le 13/03/1979 - 30 ans

Activités de recherche

- Modélisation de la variabilité de la pluie et son impact sur la réponse des systèmes hydrologiques tropicaux.
- Etude des problèmes d'échelle associés aux discordances de résolution entre modèle hydrologique et données de forçage et validation.
- Utilisation combinée de données mesurées au sol, des données télédétectées, de la modélisation stochastique et physiques (modèles hydrologiques et climatique)

Publications

Pellarin T., Tran T., Cohard J.M., Galle, S., Laurent J.P., de Rosnay P., **Vischel T.**, 2009 : Hourly soil moisture mapping over West Africa using AMSR-E observations and a satellite-based rainfall product Hydrology and Earth System Sciences Discussion , 6 ( ): 4035-4064 .
Vischel, T. , T. Lebel, S. Massuel, B. Cappelaere 2009. Conditional simulation schemes of rain fields and their application to rainfall runoff modeling studies in the Sahel. Journal of Hydrology , 90, 90-99.
Vischel T., G. Pegram, S. Sinclair, M. Parak, 2008. Implementation of the TOPKAPI model in South Africa. First results on the Liebenbergsvlei catchment. Water SA 34(3), 331-342.
Vischel T., G. Pegram, S. Sinclair, W. Wagner, A. Bartsch, 2008. Comparison of soil moisture fields estimated by catchment modelling and remote sensing: a case study in South Africa. Hydrologic and Earth Science System 12, 1-17 .
Vischel, T. and T. Lebel, 2007. Assessing the water balance in the Sahel: Impact of small scale rainfall variability on runoff. Part 2: Idealized modelling of runoff sensitivity. Journal of hydrology, 333(2-4), 340-355.
Balme, M., **T.Vischel**, T. Lebel, C. Peugeot, S. Galle, 2006. Assessing the water balance in the Sahel: Impact of small scale rainfall variability on runoff. Part 1: Rainfall variability analysis. Journal of hydrology, 331(1-2), 336-348.
Lebel, T. and **T. Vischel**, 2005. Climat et cycle de l'eau en zone tropicale : un problème d'échelle. C. R. Géosciences 337(1-2), 29-38.

SOULEY YERO Kadidiatou
Date et lieu de naissance : Née le 06/08/1978 à Niamey
Nationalité : Nigérienne
Niveau de formation : Doctorante en géographie
yero_kadidia@yahoo.fr

2008-2012
PhD in geography : "Hydrological consequences of land use changes in the Sahel"
2007-2008
Master of geography, Option : «aménagement et gestion des ressources naturelles»
Département de géographie, Faculté des Lettres et Sciences Humaines, Université Abdou Moumouni

Expertise in remote sensing

Panthou Gérémy
panthhou@hmg.inpg.fr

Formation
Avril 2010-2013 : Thèse en hydrologie / télédétection
Sujet : « Analyse et modélisation de la variabilité hydro-climatique au sein du bassin du fleuve Niger: apport des données satellitaires de pluie. »
SOFRECO (92) –LTHE (38)
2009 : Master professionnel eau et environnement (mention B)
Université Joseph Fourrier Grenoble (38)
2007 : Licence Terre Et Eau
Université d'Avignon (84)
2006 : BTS Gestion Et Maîtrise de l'EAU (mention AB)
Lycée les établières (85)

Partner 6: LPED

Richard LALOU
richard.lalou@ird.fr ou richard.lalou@univ-provence.fr
47 ans, Socio-démographe, diplômé de l'Université de Montréal, (1990), chargé de recherche (CR1) à l'IRD, recruté en décembre 1994.
Directeur de l'UMR 151 IRD/Université de Provence, Laboratoire Population – Environnement - Développement. 33 chercheurs et enseignants-chercheurs, 4 ITA, 35 doctorants.

Thèmes de recherche
Démographie de la santé: comportements sanitaires (recours aux soins, médicaments, comportements de prévention), perception des risques individuels et collectifs, diffusion des pratiques, réseaux, logiques sociales, cognitives et sanitaires, paludisme, VIH/SIDA, Afrique subsaharienne
Expérience des 5 dernières années
Responsable du programme ACTUPALU, 2008 – 2010 : « Paludisme et diversité de l'environnement urbain africain. Un enjeu majeur pour la mise en place des thérapies à base d'artémisinine (ACT) ». Financement : ANR n°07-SEST-001 Responsable de projet. Partenaires : IRD, CNRS, CERDI/Université d'Auvergne, INSERM, Université Cheikh Anta Diop (Sénégal), Institut d'Hygiène Sociale (IHS) de Dakar (Sénégal).
Programme MEDPAL, 2004 - 2007 : « L'observance au nouveau traitement combiné antipaludique au Sénégal et au Cameroun. Facteurs médicaux, cognitifs et environnement social ». Financement : Ministère de la Recherche – Programme PAL+. Partenariat : CNRS, IRD, IMTSSA, Université Cheikh Anta Diop (Sénégal), Université Catholique d'Afrique Centrale (Cameroun). Terrains au Sénégal

Relevant publications
SOUARES A., LALOU R, SENGHOR P., LE HESRAN J.Y. [article accepté]. Child age or weight: difficulties related to the prescription of the right dosage of antimalarial combinations to treat children in Senegal, Transactions of the Royal Society of Tropical Medicine and Hygiene . [IF = 2,06]
SOUARES A., LALOU R., SENE I., SOW D. et LE HESRAN JY 2009. Factors related to compliance to anti-malarial drug combination : example of amodiaquine/sulphadoxine-pyrimethamine among children in rural Senegal. Malaria Journal, 8:108, doi:10.1186/1475-2875-8-118. [IF = 2,92]
FRANCKEL A. et R. LALOU 2009. Health-seeking behaviour for childhood malaria : The household dynamics in rural Senegal. Journal of Biosocial Science, 41(1) : 1-19, Cambridge University Press. doi:10.1017/S0021932008002885. [IF = 1,52]
GARDELLA F., ASSI S., SIMON F., BOGREAU H., EGGELTE T, BA F., FOUMANE V, HENRY MC, TRAORE KIENTEGA P, BASCO L, TRAPE JF, LALOU R, MARTELLONI M, DESBORDES M, BARAGATTI M, BRIOLANT S, ALMERAS L, PRADINES B, FUSAI T et ROGIER C. 2008. Antimalarial drug use in general populations of tropical Africa. Malaria Journal, 7, pp. 124-136,

doi:10.1186/1475-2875-7-124. [IF = 2,92]
SOUARES A., LALOU R., SENE I., SOW D., SENGHOR P., LE HESRAN J.Y. 2008. Adherence and effectiveness of drug combination in curative treatment among children suffering uncomplicated malaria in rural Senegal, Transactions of the Royal Society of Tropical Medicine and Hygiene, 102, pp.751-758. [IF = 2,06]
FRANCKEL A. et R. LALOU 2008. Village Context and Health-Seeking Behaviour in the Fatick Region of Senegal, Population-E, 63 (3), pp. 441-462.
---- 2008. L'impact du contexte villageois sur le recours aux soins. Analyses exploratoires dans la région de Fatick au Sénégal. Population-F, 63 (3), pp. 531-553.
SOUARES, A, R. LALOU, I. SENE, D. SOW et LE HESRAN JY, 2006. Nouvelle thérapie pour les accès simples de paludisme au Sénégal : bilan un an après sa mise en place, Revue d'Epidémiologie et de Santé Publique, 2, pp. 299-310

Agnès ADJAMAGBO, 45 ans
Agnes.Adjamagbo@univ.provence.fr
Current Situation: Chargée de recherche en démographie à l'IRD
Parcours professionnel : 2005 à 2009 : coordination scientifique des activités au Sénégal du programme européen Emergency Contraception in Africa – ECAF, 6ème PCRD)
Août 1999 à octobre 2003 : Recrutement à l'IRD en tant que cr2 : Affectation au centre IRD de Dakar ; participation à divers programmes de recherche sur fécondité, itinéraires féminins et contraception (CODESRIA, AUF, IRD).
Janvier 1998 à juillet 1999 : Chercheure Post-doctorale au Département de démographie de l'Université de Montréal. (Fondation Andrew W. Mellon)
Janvier 1994 à mars 1997 : Allocataire de recherche à l'ORSTOM. Accueil au centre ORSTOM d'Abidjan Petit Bassam. Terrain de thèse sur les pratiques de fécondité des populations de planteurs de café et de cacao du sud ouest de la Côte d'Ivoire.
Thèmes de recherche : Étude des changements socio-économiques et logiques de fécondité dans les sociétés paysannes d'économie de plantation (Côte d'Ivoire) et agropastoral (Sénégal) ; organisation de la production et logiques de survie dans les ménages ruraux ; analyse des itinéraires professionnels et matrimoniaux de femmes en milieu urbain ; études des relations de genre au sein des couples et enjeux sociaux liés à la maîtrise de la fécondité ;
Activité d'enseignement : Depuis 2008 : Module « Analyse des Populations » du Master MASS (mathématiques appliquées aux Sciences Sociales) de l'Université de Provence dispensé aux niveaux master 1 master 2 (deux fois 24 H, répartis entre 6 intervenants membres du LPED).
Relevant publications

Adjamagbo A, Antoine P. 2009. « Être femme autonome dans une capitale Africaine : les cas de Dakar et Lomé », in J. Vallin (dir.) Du genre et de l'Afrique, ouvrage en hommage à Thérèse Locoh, chapitre 20, Paris, Éditions de l'INED, pp 305-318.
Adjamagbo A, Delaunay V et Mondain N. 2009. "Maternité prénuptiale en milieu rural Sénégalais. Quelles conséquences pour les enfants ?" in Marcoux R et Dion J (eds). *Mémoires et démographie : Regards croisés au Sud et au Nord*, Presses de l'Université Laval: pp 232-235.
Adjamagbo A., Antoine P, Beguy, D. Dial F.B., 2009, Comment les femmes concilient-elles mariage et travail à Dakar et à Lomé ? in Amadou Sanni M. Klissou P., Marcoux R. Tabutin D. (dir.) *Villes du Sud, Dynamiques, diversités et enjeux démographiques et sociaux*, Agence Universitaire de la Francophonie, Éditions des archives contemporaines, Paris, pp. 103-124.
Adjamagbo A., Delaunay V., Lévi P. ; Ndiaye O. 2006, Comment les ménages d'une zone rurale du Sénégal gèrent-ils leurs ressources ?, *Études Rurales*, janvier-juin 2006, n°177, pp.71-90.
Adjamagbo A., Antoine P, Delaunay V., 2004 « Naissances prémaritales au Sénégal : confrontation de modèles urbain et rural », *Cahiers québécois de démographie*, Vol. 33, N°2, automne 2004, p.239-272.

Anne ATTANÉ, Anthropologue, contractuel à l'Institut de Recherche pour le Développement, IRD (UMR 912)
dans le cadre d'un projet ANRS 12 181 (2008-2010)
Anne.Attane@ird.fr
Expériences de recherche

2008-2010 (ANRS/IRD) : conception et réalisation d'une recherche sur les relations intrafamiliales et la décentralisation des soins dans le contexte du VIH dans deux régions du Burkina Faso (Bobo Dioulasso, Orodara, Ouagadougou, Ouahigouya, Yako). Recherche dirigée par Fatoumata Ouattara (IRD) et Gabin Korbéogo (GRIL)

2006-2008 Post-doctorante ANRS accueillie à l'Institut de Recherche pour le Développement, IRD (UR002 Acteurs et systèmes de santé en Afrique) dans le cadre d'un programme de recherche ANRS 12 123 « Femmes, sida, relations de genre et structures de santé au Burkina Faso (Ouagadougou, Yako et Ouahigouya) »,
2004-2005, chargée de cours à l'EHESS
2004 ATER d'anthropologie à l'Université de Provence
2003 Obtention d'une bourse post-doctorale de l'Université de Laval (CANADA) : bourse de dix mois attribuée par la chaire d'histoire comparée de la mémoire et le CELAT (Université de Laval, Québec, Canada).
2003 Doctorat, Anthropologie sociale et ethnologie
Titre : « *Cérémonies familiales et mutations des rapports sociaux de sexe, d'âge et de génération. Ouahigouya et sa région. Burkina Faso* » sous la direction de Jean-Pierre Olivier de Sardan. École des Hautes Etudes en Sciences Sociales, Marseille. Mention Très Honorable avec les félicitations du Jury.
1992-2010 Recherches de terrain d'un total de 36 mois au Burkina Faso

Relevant publications
2007, "Les défis de l'incohérence ou comment penser la pluralité sociale ? L'exemple des cérémonies de funérailles, Ouahigouya et sa région", Burkina Faso. In : Bierschenk T., Blundo G., Jaffré Y. & M. Tidjani Alou, *Une anthropologie entre rigueur et engagement. Essais autour de l'œuvre de Jean-Pierre Olivier de Sardan*, Paris, Karthala, pp. 507-526.
2008, "Choix matrimoniaux : le poids des générations. L'exemple du Burkina Faso" in Philippe Antoine (éd.) *Les relations intergénérationnelles en Afrique. Approche plurielle*, Paris, Ceped, pp.167-195.
2008, "Le caractère électif de l'entraide intrafamiliale dans le contexte de l'infection à VIH", *Sciences et techniques, sciences de la santé*, spécial hors-série n°1, dirigé par Alice Desclaux, Blandine Bila et Séni Kouanda, pp. 101-106. Avec Ramatou Ouédraogo
2009a, "Se marier à Ouahigouya : Argent et mutations des rapports sociaux de sexe, d'âge et de génération au Burkina Faso". In Agnès Martial, *La valeur des liens. Hommes, femmes et transactions familiales*, Toulouse, Editions des Presses Universitaires du Mirail, collection Les anthropologiques.
2009b, "Quand la circulation de l'argent façonne les relations conjugales. L'exemple des milieux urbains au Burkina Faso", *Autrepart*, numéro thématique dirigé par Fred Eboko et Christophe Broqua intitulé *La fabrique des identités sexuelles*, 2009-49 : pp. 151-169.

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Formation
Doctorat de démographie, Université de Paris X – Nanterre, 1994
Master de démographie, Institut de démographie de l'Université Catholique de Louvain-la-neuve, Belgique, 1990
Expérience professionnelle
Depuis décembre 2007 : Chargée de recherche, accueillie à l'Institut Catholique de Madagascar, Antananarivo.
2002-2007 : Chargée de recherche, Laboratoire Population-Environnement-Développement, UMR 151 IRD/UP, Université de Provence, Marseille, France, responsable de l'équipe *Population-Santé*.
2000-2002 : Chargée de recherche, visiting scholar, accueillie au Harvard Centre for Population and Development Studies, Cambridge, MA, USA.
1995-2000 : Chargée de recherche, Laboratoire Population et Santé, IRD, Dakar, Sénégal. Programme "Santé de la reproduction et changements socio-économique en milieu rural Sénégalais".
Domaines de recherche
Mortalité des enfants (Sénégal rural) ;Questions méthodologiques autour des Systèmes de Suivi Démographiques : analyse démographique, considérations éthiques, mesure des réseaux sociaux ; Fécondité, sexualité et prévention parmi les jeunes en Afrique ; Naissances du célibat (Sénégal rural) ; Santé reproductive et environnement (Sénégal rural) ; Dons, abandons et prise en charge des enfants (Madagascar) ; Evolution de la famille (Madagascar)

Publications : revues a comite de lecture et chapitres d'ouvrage
Delaunay, V. 2009. "Abandon et prise en charge des enfants en Afrique : une problématique centrale pour la protection de l'enfant." *Mondes en Développement* 37(146):33-46
Delaunay V, Adjamagbo A, Lalou R, 2006 "Questionner la transition de la fécondité en milieu rural africain : les apports d'une démarche longitudinale et institutionnelle", *Cahiers Québécois de Démographie*, 35,1 : 27-50.
Delaunay V, Marra A, Lévi P, 2007. *Analysing Fertility from Demographic Surveillance System Data. Application to the Niakhar site, Senegal*. Nogent sur Marne: Ceped, Les clés pour: 87 p.
Adjamagbo A, Antoine P, Delaunay V, 2005. Naissances prémaritales au Sénégal : confrontation de modèles urbain et rural, *Cahiers Québécois de Démographie*, Montréal, 33 (2) : 239-272.

Delaunay V, Etard JF, Preziosi MP, Marra A, Simondon F, 2001. "Decline of infant and child mortality rates in rural Senegal over a 37-year period (1963-1999)", *Int J Epidemiol*, 30: 1286-1293.

Bénédicte GASTINEAU, Démographe, Chargée de recherche à IRD **LPED**
36 ans

Expérience professionnelle
Depuis septembre 2002 : Chargée de recherche à l'IRD
2002-2007 : accueil à l'Université catholique de Madagascar
2000- 2001 : Attachée d'enseignement et de recherche en démographie, Université Paris X
1999 : Attachée d'enseignement et de recherche en sociologie, Université de Lille 1
1997 – 1999 : Allocataire de recherche de l'Université de Paris X – Nanterre
Mars 1997 – Juin 1999 : accueil au Centre tunisien de recherche et de documentation et d'Information sur la Femme (CREDIF) (Tunisie)
Domaines de recherche
Sexualité, fécondité et avortement chez les adolescentes à Madagascar ; Violence conjugale et relations de genre à Madagascar ; Lien entre fécondité et économie des ménages ruraux en Tunisie et à Madagascar
Relevant publications
Gastineau B. 2005.Devenir parents en milieu rural malgache. Evolutions dans la province d'Antananarivo. *Revue Tiers-Monde*, n°182, pp.307-328
Gastineau B., Sandron F. 2006. Démographie et environnement à Madagascar. *Economie Rurale*, n°294- 295, pp.41-56.
Binet C., Gastineau B., 2008. Mariage, fécondité et autonomie conjugale à Madagascar. *Revue Autrepart*, n°47, pp.43-56
Gastineau B., Hanitriniaina O. 2008. Connaissance de la contraception et sexualité à risque chez les jeunes à Antananarivo (Madagascar) », *Médecine d'Afrique Noire*, Avril 2008, pp.207-212
Dabat M. H., Gastineau B., Jenn-Treyer O., Rolland J.P., Martignac C., Pierre-Bernard A., 2008, « L'agriculture malgache peut-elle sortir de l'impasse démo-économique ? », *Autrepart*, n°47, pp.181-194.
Gastineau B., Gathier L., Rakotovao I. 2009. Nommer, compter et raconter la violence conjugale à Antananarivo. Saint Denis de la Réunion, Antananarivo. *Revue Tsingy* n°11.

Partner 7 : CNRM/GAME

Françoise Guichard

1964 : born in Vannes, France
1992-1995 : PhD, University Paul Sabatier et Institut National Polytechnique de Toulouse
physique et chimie de l'environnement
2001 : Permanent position at CNRS (CR1)

Expertise:

- Modeling of boundary layer and moist convective processes
- Energetics of the surface, diurnal cycle, water cycle
- West African monsoon, physical processes

Publications available at : http://francoise.guichard.free.m.fr/publications.html

5 most significative publications in the 5 last years:

Agusti-Panareda, A, A. Beljaars, M. Ahlgrimm, O. Bock, R. Forbes, A. Ghelli, F. Guichard, M. Koehler, R. Meynadier and J. J. Morcrette, 2010 : The ECMWF re-analysis for the AMMA observational campaign . Quart. J. Roy. Meteor. Soc., accepted.

Frappart, F. P. Hiernaux, F. Guichard, E. Mougin, L. Kergoat, M. Arjounin, F. Lavenu, M. Koité, J.-E. Paturel and T. Lebel, 2009 : Rainfall regime over the Sahelian climate gradient in the Gourma, Mali, J. Hydrology, 375, 128-142 . doi : 10.1016/j.jhydrol.2009.03.007

Guichard, F., L. Kergoat, E. Mougin, F. Timouk, F. Baup, P. Hiernaux and F. Lavenu , 2009 : Surface thermodynamics and radiative budget in the Sahelian Gourma: seasonal and diurnal cycles, J. Hydrology, 375, 161-177. doi : 10.1016/j.jhydrol.2008.09.007

Guichard, F., N. Asencio, C. Peugeot, O. Bock, J.-L. Redelsperger, X. Cui, M. Garvert, B. Lamptey, E. Orlandi, J. Sander, F. Fierli, M. A. Gaertner, S. Jones, J.-P. Lafore, A. Morse, M. Nuret, A. Boone, G. Balsamo, P. de Rosnay, B. Decharme, P. P. Harris and J.-C. Bergès, 2010 : An intercomparison of simulated rainfall and evapotranspiration associated with a mesoscale convective system over West Africa, Weather and Forecasting. doi : 10.1175/2009WAF2222250.1

Hourdin, F., I. Musat, F. Guichard, F. Favot, P. Marquet, A. Boone, J.-P. Lafore, J.-L. Redelsperger, P. Ruti, A. Dell' Aquila, T. Losada Doval, A. Khadre Traore and H. Gallee, 2009 : AMMA-Model Intercomparison Project, Bull. Amer. Meteor. Soc. doi : 10.1175/2009BAMS2791.1

6.3. INVOLVEMENT OF PARTNERS IN OTHER RELATED PROJECTS

Partner	Name of the participant to the project	Man-month	Title of the programme Organism Budget of the project	Title of the project	Name of the coordinator	Start – end of the project
1	Janicot	10	ANR VMCS 2008 650k€	PICREVAT	Vincent Moron	2009-2012
1	Sultan	10	ANR VMCS 2008 650k€	PICREVAT	Vincent Moron	2009-2012
1	Ducharne	6	R2DS 2009 115 kE	HYDROSOL	Ducharne	2009-2012
4	Seguis	12	ANR VMCS 2008	ECLIS	Eric Mougin	2009-2011
4	Peugeot	12	ANR VMCS 2008	ECLIS	Eric Mougin	2009-2011
7	Guichard	3	ANR BLLAST	BLLAST	Marie Lothon	
3	Affholder	6	Food Security Thematic Programme (FSTP) Component 1 – Research and Technology European Union 3 500 000 Euros	ABACO (agro-ecology based aggradation-conservation agriculture)	Saidi S. Mkomwa African association for Conservation Tillage (ACT)	2011-2014
3	Patrick d'Aquino	2	UE FP7 2 903 597 Euros	Funci-Tree	Graziella Rusch	2009-2013
3	Patrick d'Aquino	6	ANR VMCS 2008	ECLIS	Eric Mougin	2009-2012
3	Michael Dingkuhn	6	Adaptation of African Agriculture to Climate	RISOCAS (developing	Folkard Asch (Prof.)	2008-2010

			Change GTZ/BMZ 1 009 596 Euros	rice and sorghum crop adaptation strategies for climate change in vulnerable environments of Africa)	Univ. Hohenheim, Germany	
3	Bertrand Muller	3	Same	same	same	Same
3	Bertrand Muller	16	WAAPP (West Africa Agricultural Productivity Program) Senegal Component 293 276 Euros	Réduction de la vulnérabilité et intensification des systèmes	Bertrand Muller (as CERAAS / CIRAD staff)	2009-2012
2	Bonnassieux	12	ANR VMCS 2008	ECLIS	E Mougin	2009-2011
2	Gangneron	18	ANR VMCS 2008	ECLIS	E Mougin	2009-2011
2	Grippa	6	ANR VMCS 2008	ECLIS	E Mougin	2009-2011
2	Kergoat	6	ANR VMCS 2008	ECLIS	E Mougin	2009-2011
2	Mougin	12	ANR VMCS 2008	ECLIS	E Mougin	2009-2011
2	Timouk	6	ANR VMCS 2008	ECLIS	E Mougin	2009-2011

6.4. DETAILS ON THE METHODOLOGICAL FRAMEWORK OF WP2

FW = fieldwork; S = Senegal; M = Mali; N = Niger; B = Benin; D = days; NR = Natural Resources; GIS = Geographic Information System; PU = Production Unit

	Year 1		Year 2		Year 3		Year 4	
Semesters/ Work axes	S1	S2	S3	S4	S5	S6	S7	S8
Sociological Survey (LMTG) **Fields:** S, N, M, B **Methodology:** Free and semi-structured interviews	**References/problem** According to sites S, N, M, B Choices of survey sites in each local authority Representative sample definition : ethnic groups Social groups, subspaces to survey **Survey tools design**	T **Free and semi-structured interviews**/individual and collective : Ethnic groups, social groups **Questionnaires** Focusing on characteristics by family types, PU	T **Interview (until S6)** Semi-structured focus group and individual with actors in PU types, in families : head of families, women, youth Life histories, Families, Migrants	T **Intermediary report** : socio-environmental conditions for access to NR **Site overview of subsistence**	T **Publication** on diversification strategies as an adaptive response to socio-environmental causes	T	T **Overall site overview** Following the report-out overview Surveys for further information on access to NR and subsistence strategies	**Final report** : vulnerability indicators, representations, practices, strategies ; forecasting, links with WP4 **Publication** on vulnerability indicators
Socio-geographic Survey (LMTG) **Fields:** M & N **Methodology:** SIG	**Methodology and links between WPs fieldworks**	T **Mind map collection** Spatial patterns and seasonalities of NR (primary production and waters) : Test phase	T **Mind map collection (until S6)** Spatial patterns and seasonalities of NR (primary production and waters)	T **GIS ressources : M et N, V1 Integration of WP1 works**	T	T	T **GIS ressources M and N V2** **Publication** comparison representation of NR dynamics and conclusions of WP1	
Ethnographic fieldwork (LMTG) Theme – risk-nature perceptions and groups' socio-political relationships **Fields:** S & M **Methodology:** qualitative research, participative observation	**Literature survey** **Ethnographic data elaboration from past fieldworks** (Mali with AMMA, Benin with ECLIS and Senegal River Valley for PhD) **Methodology**	**Fieldwork S 30days** Field definition of a common analysis units with other WP	**Fieldwork in Mali 45 days** Field definition of a common analysis units with other WP and research Development of past researches (2008 fieldwork for AMMA) and new perspectives on nature-risk perceptions	**Fieldwork S 45 days** Ethnography of different risk and nature perceptions in pastoral and farmer groups	**Fieldwork M 45 days** Political and social competitions between groups in accessing to natural and exterior resources	**Fieldwork S 45 days** Political and social competitions between groups in accessing to natural and exterior resources, particularly the herders-farmers interface between the Ferlo and the Senegal River Valley	**Provisional reports 1 & 2 on the S & M field sites** **Writing and publication of** Field-focused articles in peer-reviewed journals (French-speaking or English-speaking)	**General WP2 Report** on socio-political dynamics in natural resources management **Contribution** to the other General WP2 Report

Historical and sociological Survey (LPED) **Fields:** M & N **Methodology:** qualitative research, participative observation	**Problem/Choice of survey site / methods**. Related to WP1. **References**/ framework for survey within WP2, related to WP1 and WP4. **Surveys on archives**	**Archives** (France), colonial recollection of droughts and environmental issues. **Archives** (Mali) **and oral field surveys** (Mali). Local recollection on same issues.	**Initiate data Processing for data collected within** WP2 et related to WP1	**Intermediary report**. **Archives** (Niger) and oral field surveys (Niger). The same for Mali	**Publication** on historical trends of perceptions on environment and adaptive strategies.	**Field survey** (Mali, Niger). Contemporary history, 2010 drought Related to WP4. Assessment of watching and alert systems.	**Intermediary report** **Report-out workshops** (Mali and/or Niger, France)	**General WP2 Report** on socio-political dynamics in natural resources management **Contribution** to the other General WP2 Report. **Publications**
Quantitative socio-demographic surveys (LPED) **Fields:** M, N, B & S **Methodology:** biogeographical surveys	Methodological strategy and sample design	Survey preparation and questionnaire design		**Quantitative survey** fieldwork (information campaign, training fieldworkers, data collection) and data processing (data entry using CSPro software, data entry checking, final data cleaning) Several **biographical surveys** will be conducted, particularly focusing on five aspects of household and personal trajectories: land use, agricultural practices, extra-rural activities, migrations and marital and reproductive life.			Data analysis	Final report