Field Trip Report - Vulnerability Mapping Búzi

Project: Scientific Support Action - Strengthening of National Disaster Risk Management Systems in Mozambique, PRO- GRC
Munich RE Foundation, INGC, IP-Consult, Ambero
http://projects.stefankienberger.at/vulmoz/

Expert ***Stefan Kienberger***
Locations ***Maputo, Beira, Búzi – Mozambique***
Time Line ***13.10. – 09.11.2007***

Summary

Within the context of the Scientific Support Action to the project PRO-GRC, Strengthening of national Disaster Risk Management systems in Mozambique, Stefan Kienberger, Centre for Geoinformatics (Z_GIS) – Salzburg University/Austria, has undertaken a research field trip to Maputo, Beira and Búzi (Mozambique) between 13.10 and 09.11.2007. The main objective of the field trip was to carry out necessary data collection and research activities. The work conducted links to the proposed research context (PhD research, vulnerability assessment at the community and district level) of Stefan Kienberger. The field trip was characterised through four specific objectives:

(i) expert interviews (12) with brainstorming exercises to identify relevant vulnerability indicators

(ii) accomplishment of mapping and scoring exercises with local community members in the District of Búzi (communities of Inharongue, Muchenessa and Munamicua) to identify areas at risk and to collect and quantify different triggers of vulnerability to floods and droughts within a participatory approach

(iii) collection of ground truth samples for enhanced satellite image classification and

(iv) additional data collection (Census data, reports, etc...) and expert consultancy (10).

A time schedule and itinerary is provided in the table below (see Tab. 1).
The report will make use of the structure of the above mentioned objectives to report on the progress and results achieved.
The field trip was supported through the local staff of PRO-GRC in Maputo, Beira and Búzi. The results of the tasks (ii) and (iii) are summarised within a Google Earth application which is attached to this report.

Preliminary results:

Factors often mentioned at the national expert level within a general context of vulnerability are climatic characteristics, lack of coordination among institutions, reliance on subsistence agriculture, and the issue of access. In regard to floods the specific location of vulnerable people within high risk zones was an important issue. The long lasting and slow onset character was highlighted in the context of droughts.
At the level of local communities, the most important factors named, with relevance to drought and flood, are the lack of health services and the lack of storage facilities. In regard to drought only the most urgent issues are the lack of an irrigation system, uncontrolled fires and the lack of rain. The most urgent issues in the context of floods are the destruction of dams, a lacking dam management, torrential rainfall and settlements within flood zones.

Sumário

No âmbito do Projecto da Açcão de Suporte Científico (PRO-GRC), Institucionalização da Gestão de Risco de Calamidades em Moçambique PRO-GRC, Stefan Kienberger, Centre for Geoinformatics (Z_GIS) – Universidade de Salzburgo, Austria, empreendeu uma viagem de pesquisa de campo à Maputo, Beira e Búzi (Moçambique) entre 13.10 e 09.11.2007. O objective principal da viagem de campo foi executar a recolha de dados necessários e a actividade de pesquisa.
O trabalho conduziu conexões ao contexto de pesquisa proposto (pesquisa de PhD, avaliação de vulnerabilidade na comunidade e a nível de distrito) de Stefan Kienberger. O trabalho de campo pode ser caracterizado por quatro objetivos específicos:

(i) Condução de entrevistas aos peritos (12) com muito exercício de modo a identificar indicadores de vulnerabilidade relevantes

(ii) A realização de mapeamento e exercícios com membros de comunidade locais no Distrito de Búzi (as comunidades do Inharongue, Muchenessa e Munamicua) para identificar áreas em perigo;reunir e quantificar gatilhos diferentes da vulnerabilidade a inundações e secas dentro de uma abordagem participativa

(iii) Colecção de pontos de referência no campo de modo a melhorar a classificação da imagem de satélite

(iv) Recolha de dados adicionais (dados de Censo, relatórios, etc. ...) e consultoria de peritos(10). O horário e o itinerário são fornecidos na tabela a seguir (veja 2 Horário)

O relatório fará o uso da estrutura dos objetivos mencionados para fazer a reportagem do progresso e resultados alcançados.
A viagem de campo foi apoiado pelo pessoal local de PRO-GRC em Maputo, Beira e Búzi.
Os resultados das tarefas (ii) e (iii) são sumarizados dentro de uma aplicação de Google Earth que é anexado a este relatório.

Resultados Preliminares

Os factores muitas vezes mencionados ao nível dos peritos nacionais dentro de um contexto geral da vulnerabilidade são características climáticas, a falta da coordenação entre instituições, confiança na agricultura de subsistência, e a questão do acesso. Com respeito a inundações, a posição específica das pessoas vulneráveis dentro de altas zonas dos riscos foi uma questão importante. A duração longa e o carácter de ataque lento foram destacados no contexto de secas.
Ao nível de comunidades locais, os factores mais importantes mencionados, com a relevância para seca e inundação, são a falta de serviços de saúde e a falta de facilidades de armazenamento. No que concerne à seca, apenas as questões mais urgentes são: a falta de um sistema de irrigação, queimadas descontroladas e a falta da chuva. As questões mais urgentes no contexto de inundações são: a destruição de represas, fraca gestão da represa, chuvas torrenciais e acordos dentro de zonas de inundação.

Time Schedule

	Date	Task
Travel	Sat 13.10./ Sun 14.10.2007	- Travel from Salzburg via Munich (2155) and Johannesburg (0835) to Maputo (1455);
MAPUTO	**Mon 15.10. – Fri 19.10.2007**	- Briefing with W. Stiebens, Introduction to Dr. B. Schmidt (IP-Consult), Joint Dinner - Expert Interviews (12) and conduction of brainstorming exercises with experts related to the wider field of disaster risk reduction and vulnerability science - Additional meetings with experts in the field of disaster risk reduction - Data collection (GIS data, statistical datasets, current reports,…)
Travel	Sat 20.10.2007	- Travel Maputo – Beira - Expert interview (1)
	Sun 21.10.2007	- Travel Beira – Búzi
BÚZI	**Mon 22.10. - Tue 23.10.2007**	- Regional Disaster Management Workshop Búzi - Preparation of upcoming field work in Búzi
BEIRA	**Wed 24.10. - Fri 26.10.2007**	- Data collection - Preparation of upcoming field work in Búzi - Additional expert interviews - Data collection (Census datasets, GIS data,…)
	Sat 27.10. - Sun 28.10.2007	- Weekend
BÚZI	**Mon 29.10. - Tue 06.11.2007**	- Presentation of research to District Administrator - Finalisation of planning of field work with local representatives and committee leaders - Data collection at provincial level (health, agriculture, water, education) - Mapping exercises through very high resolution satellite images together with risk reduction committee members in three selected communities (Inharongue, Muchenessa, Munamicua) - Scoring/Ranking exercises of vulnerability factors to flood and drought in the selected communities - Visit to community and situation awareness - Collection of ground truth sample points with georeferenced photo images and GPS points
BEIRA	**Wed 07.11.2007**	- Finalisation of work and debriefing at INGC in Beira - Meeting with representatives of the Catholic University of Mozambique, Beira
Travel	**Thu 08.11./ Fri 09.11.2007**	- Travel Beira (1545) – Johannesburg (2115) – Munich (0700) – Salzburg

Tab. 1: Time Schedule

1_Expert Interviews

With the overall aim to derive vulnerability maps for the District of Búzi an expert based approach has been chosen. This allows a knowledge based approach to model the complexity of vulnerability. Additionally, a clearer understanding and insights can be derived how vulnerability is perceived among different levels (national to community, expert to local stakeholder). The approach applied derives from methodologies in multicriteria decision analysis and decision support systems (multi criteria evaluation). Furthermore, this will be the starting point to integrate the multi-dimensional characteristic of vulnerability within a spatial modelling and visualisation approach (final results).
Therefore different stakeholders and experts in the wider field of disaster risk reduction and with relevant expertise within the specific context in Mozambique have been identified and contacted prior to the field trip. The list was compiled through already established contacts, web-based research and additional expert input from W. Stiebens (PRO-GRC). The experts were contacted through E-Mail and if possible preliminarily time arrangements have been made. Additionally a short summary and explanation of the planned exercise has been sent out to the experts (see Annex 1). An additional timing was made during the first day in Maputo.
16 experts have been interviewed within 12 brainstorming sessions (see Tab. 1). The duration of the meetings was between 1 and 1.5 hrs.

Name	Organisation	Field
Rui BRITO	INGC/PRO-GRC	Agriculture
Michel MATERA	UNDP	Disaster Risk Reduction
Carlos TIBANA	IOM	Migration
Moisés Vicente BENESSENE	INAM	Meteorology/Climatology
Noel COOKE & Albert LOSSEAU	European Commission	Agriculture/Food Security
Olanda BATA	FEWS-NET	Food Security
Nadia VAZ & Lara CARRILHO	WFP	Food Security
Joaquim SIMÃO	CENACARTA	Remote Sensing
Ebenizário CHONGUICA	IUCN	Nature Conservation
Dr. Ana CHRISTINA, Marta MANJATA & Mrs DULCE	INGC	Disaster Risk Reduction/ Early Warning
Adriano NUVUNGA	UEM	Political Scientist
Aurelio GOMES	UCM-Medical Research Centre	Public Health

Tab. 2: List of Experts consulted (Brainstorming Exercise)

The structure of each meeting was as follows:

- Introduction to the general objectives of the research
- Presentation of the expert and his/her link to disaster risk reduction
- Brainstorming exercise
    - Question being asked: “What do you think are the issues which make people vulnerable to droughts and floods?” - Within the context of Central Mozambique, on a district and community level
    - Collection of factors on moderation cards
- Summary of exercises
- Outlook and help for further assistance within the quantification of vulnerability indicators (scoring exercises)

Name	Organisation	Field
Manfred SCHUG	INGC	Agriculture
Destina UINGE	INE/Maputo	Statistical Office
Alexander BOHR	ODAmap	Development Consultant
Fatima ZACARIAS	INE/Maputo	Statistical Office
Mathias SPALIVIERO	UN-HABITAT	Disaster Risk Reduction
Stefano VISANI	UNICED, devInfo	Monitoring of MDGs
José RAFAEL	UEM	GIS/Remote Sensing
Franziska STEINBRUCH, Anjos Luis DA COSTA	CIG-UCM	GIS/Remote Sensing
Nicolas LAMADE	GTZ	Disaster Risk Reduction
Mr. NHAMIZINGA	INE/Beira	Statistical Office

Tab.3: List of additional experts consulted (Data exchange, presentation of research, ...)

The different factors have been collected on moderation cards which facilitated the discussions with the experts (see Fig. 1). Afterwards the factors have been post-processed and structured within a Mind Map. As a next step, indicators will be identified and weights will be assigned according to the importance of each vulnerability indicator. This task is scheduled after the field trip and will be facilitated through E-Mail conversation with the different stakeholders.

A characterisation of the different driving forces into general factors and those which apply specifically to floods or droughts has been applied. The overall classification into a social, environmental, economic and physical dimension is driven through the conceptual framework developed for this research.

Factors often mentioned within a general context of vulnerability are climatic characteristics (e.g. El Nino), lack of coordination among institutions, reliance on subsistence agriculture, and the issue of access. In regard to floods the specific location of vulnerable people within high risk zones was an important issue. Additionally the importance of an Early Warning System and the cause of torrential rainfall have been mentioned. The long lasting and slow onset character was highlighted in the context of droughts. Additionally factors such as the influence of relief organisations, lack of knowledge and capacity, the use of certain types of crops, and the lack of appropriate infrastructures has been highlighted.

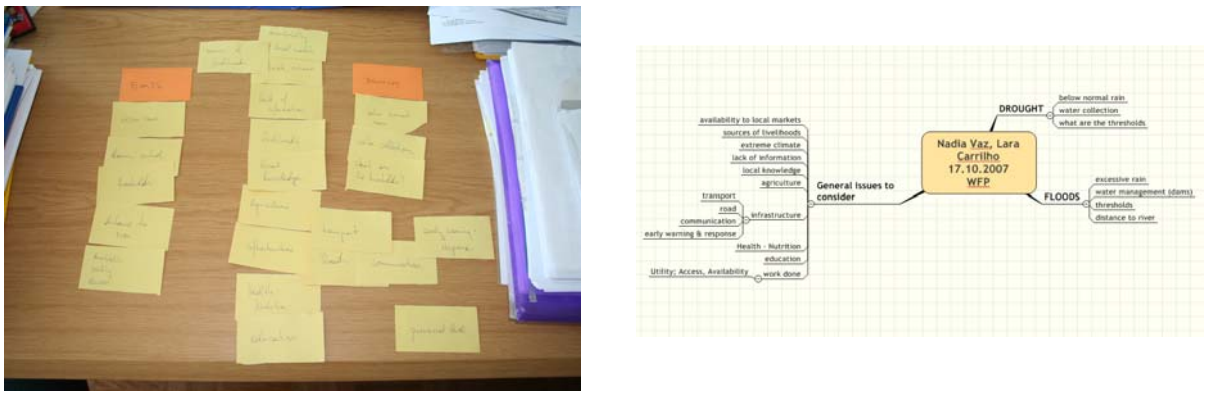

Fig 1. Collection of vulnerability factors through expert interviews on moderation cards (right), visualisation within a Mind Map (left); Interview at WFP

Starting from these results, specific indicators to model vulnerability on a district scale will be developed. However, the data availability will somehow limit the integration of different datasets and therefore a pragmatic and applied approach will be chosen.
In a next step the experts will be consulted again within a scoring exercise to quantify the importance of the different factors/indicators. This approach allows the calculation of weights for the different indicators and in an additional step the modelling of vulnerability within a spatial context.

Results achieved:

- Establish contacts to experts in the field of disaster risk reduction in Mozambique
- Collection of vulnerability factors in a collaborative way
- Accomplishment of 12 expert interviews in various fields involved in vulnerability science and disaster risk reduction
- Collection of additional datasets and literature

→ **Next Steps:**

- Identification of final indicators
- Online scoring exercise with experts
- Visualisation/Modelling of vulnerability

2_Mapping and Scoring of vulnerability factors in Búzi

A core objective of the field trip has been the vulnerability mapping and scoring exercises in three selected communities in the District of Búzi (Inharongue, Muchenessa, Munamicua). The base station was in the village of Búzi from where the different communities were contacted. The activity was supported through logistical arrangements by PRO-GRC. During the 9 day field trip period in Búzi the exercises with local communities have been facilitated through the help and experience of Mr. Gomes, who acts as the District Disaster Risk Manager. As mentioned in the general time table, the regional INGC disaster preparedness workshop held in Búzi (22.9-23.9.2007) was used to start an initial planning and establish further contacts to regional disaster risk reduction experts and key persons in the District of Búzi.
In an initial meeting with representatives from the Communities (Disaster Risk Committees) the intended activities have been presented and a time plan was agreed. It was decided to hold the exercises in an afternoon period. Therefore the communities had to be visited twice.

On the following days the exercises were conducted:

Inharongue – Mapping	30.10.2007
Inharongue – Scoring	31.10.2007
Muchenessa – Mapping	01.11.2007
Muchenessa – Scoring	02.11.2007
Munamicua – Mapping	03.11.2007
Munamicua – Scoring	04.11.2007

Mapping
The main objectives of this exercise were:

(i) *to get an in-depth understanding of the environment and perception of vulnerabilities in the communities*
(ii) *to collect essential data at the community level (such as boundaries ...)*
(iii) *to identify risk zones*
(iv) *to raise the spatial awareness among the community members*

In an earlier stage Quickbird satellite images (resolution ~ 0,8 m) have been processed and enhanced for printing. For each community two maps have been plotted on A0 paper format with a scale of 1:8.000 (for Munamicua on a scale of 1:13.000, due to the large extent of the community). In the exercise a representative cross section of the community (mainly members of the disaster risk committees; 10 – 14) have been asked to mark the following features on the map:

- Boundary of the community
- Agriculture (field, different qualities, crops)
- Living zones
- Risk areas/Safe areas (high/low level)
- Other important infrastructure

The community members could easily orientate themselves on the satellite images (Fig. 2). Landmarks such as roads, the Búzi river or fields were easily identified. Most debated was the identification of boundaries of the community, because no documentation yet exists and knowledge still remains with the elderly. The whole exercise was facilitated through Mr. Gomes in the local language Ndau. The exercise was held in local school buildings using the blackboard as an appropriate board to fix the map and additional gave protection against the sun and strong winds.

The results of this exercise have been copied to the second map. One map remained with the community, the second map was kept for further analysis and digitalisation of the features (integration into a GIS).

Fig 2. Mapping exercise with community members (above) based on Quickbird images; collection of vulnerability factors and quantification of factors with beans (below) – Mangos were used to protect the cards against the strong winds

Scoring

The main objectives of this exercise were:

> *(i) to collect and understand the vulnerability factors to droughts and floods from a community perspective*
>
> *(ii) to quantify the different vulnerability factors for further integration of indicators within a GIS analysis (weighting of vulnerability factors)*
>
> *(iii) to raise the awareness on the complexity of different driving forces of vulnerability within each community*
>
> *(iv) to identify differences in the perception of vulnerability factors between community level and national/expert level*

On the second day, scoring exercises have been held with the same committee members. The central question asked was to name the factors which determine the vulnerability of the community to droughts and floods. The exercises were facilitated again through Mr. Gomes. The exercise was held outside at traditional meeting sites. The factors were collected within a brainstorming exercise on moderation cards. The factors were grouped according to droughts and floods.

In a second step, after the group decided that the important and essential factors have been named, a predefined amount of beans (40) were distributed according to the importance of the different factors.

This was jointly done with the community members. After the distribution of the beans/points to the various factors of drought and floods, another predefined amount of beans (10) was distributed between drought and flood in general, to determine the affectedness of the community to these hazards.
The most important factors named, with relevance to drought and flood, are the lack of health services and the lack of storage facilities. In regard to drought only the most urgent issues are the lack of an irrigation system, uncontrolled fires and the lack of rain. The most urgent issues in the context of floods are the destruction of dams, a lacking dam management, torrential rainfall and settlements within flood zones.
These results will be used to identify appropriate indicators and derive a weighting of the different indicators to model the vulnerability considering the perceptions of communities.

Results achieved:

- Participatory mapping of communities based on very high resolution satellite images
- Collection and scoring of vulnerability factors in a collaborative way

→ **Next Steps:**

- Identification of final indicators
- Visualisation/Modelling of vulnerability

3_Data collection

An additional and essential task of this field trip was to collect available data sets. Within this research a central aim is the integration of available data sources from governmental, research or other institutions. However, still a challenge in this context is the acquisition of such datasets as some organisations do not allow external users to apply and make use of their datasets. However, the most important datasets are those originating from the Census. As Mozambique has recently (2007) conducted an up-to-date census it is foreseen to integrate these results. The following types of data have been collected through different institutions:

- Reports: various reports in the context of disaster risk reduction and food security
- Statistical Data:
  - Reports
  - Inventories
  - Various Statistical Yearbooks and data of the National Statistical Office (INE)
  - Agricultural data (PERFIS-ICRISAT)
  - devInfo data (ESDEM)
  - Data of local directorates in Búzi (Health, Water, Education, Agriculture)
- Census Data
  - Cartographic data of Census 2007
- GIS Data
  - Baseline Data of CIG-UCM
  - Additional resources of UEM
  - Livelihood zones of FEWS-NET
- Other data
  - Risk maps of FEWS-NET
  - Presentations and documents of PRO-GRC and related workshops (attendance of workshop in Búzi)

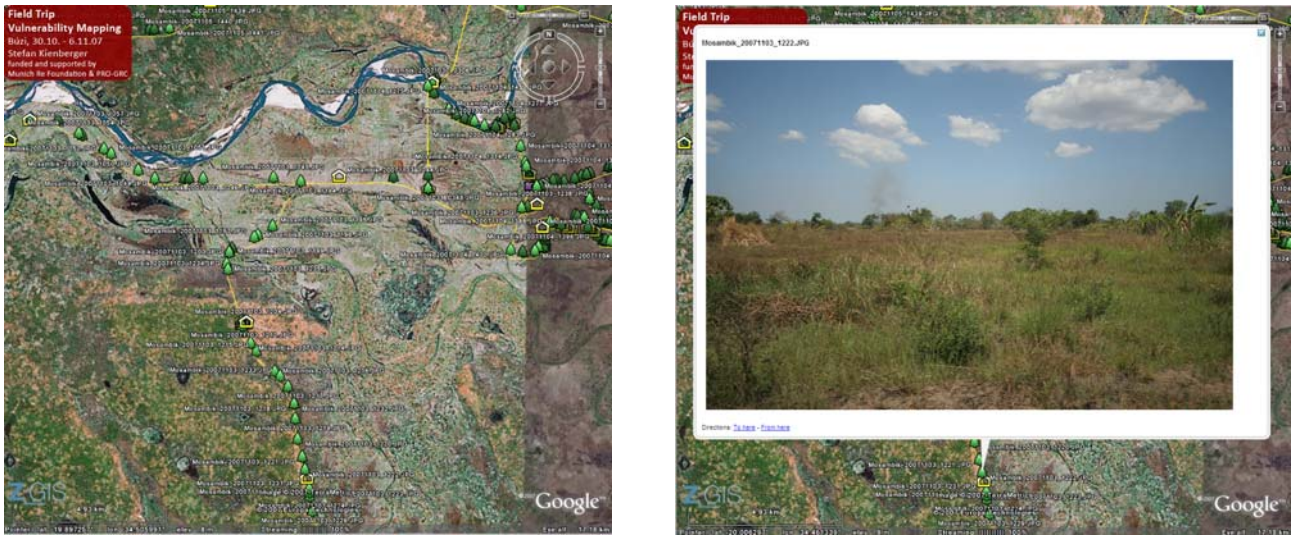

Fig 3. Google Earth Visualisation of ground truth data and georefrenced photos

Another central activity during the field work in the District of Búzi was the collection of ground truth data for enhanced analysis of remote sensing data. Therefore the route and different locations have been collected through a GPS device and through the means of georeferenced photos (see Fig 3). A total amount of 1400 images have been collected which will support the analysis and enhance the land use/land cover classification deriving from satellite data. The route and the georeferenced images are attached to this report. It was aimed to visit a representative cross section of the District. Therefore the

route of the field trip was extended to the West (Estaquinha, Gruja), the South (Bandua) and South-East (Nova Sofala).

Results achieved:

- Collection of primary and secondary datasets (essential GIS data, Census)
- Collection of ground truth data

→ **Next Steps:**

- Acquisition of further census data (at the level of enumeration areas) for enhanced spatial population modelling
- Follow-up for missing data sets

Map

See Google Earth application annexed to this report which can also be downloaded at http://projects.stefankienberger.at/ (Map)

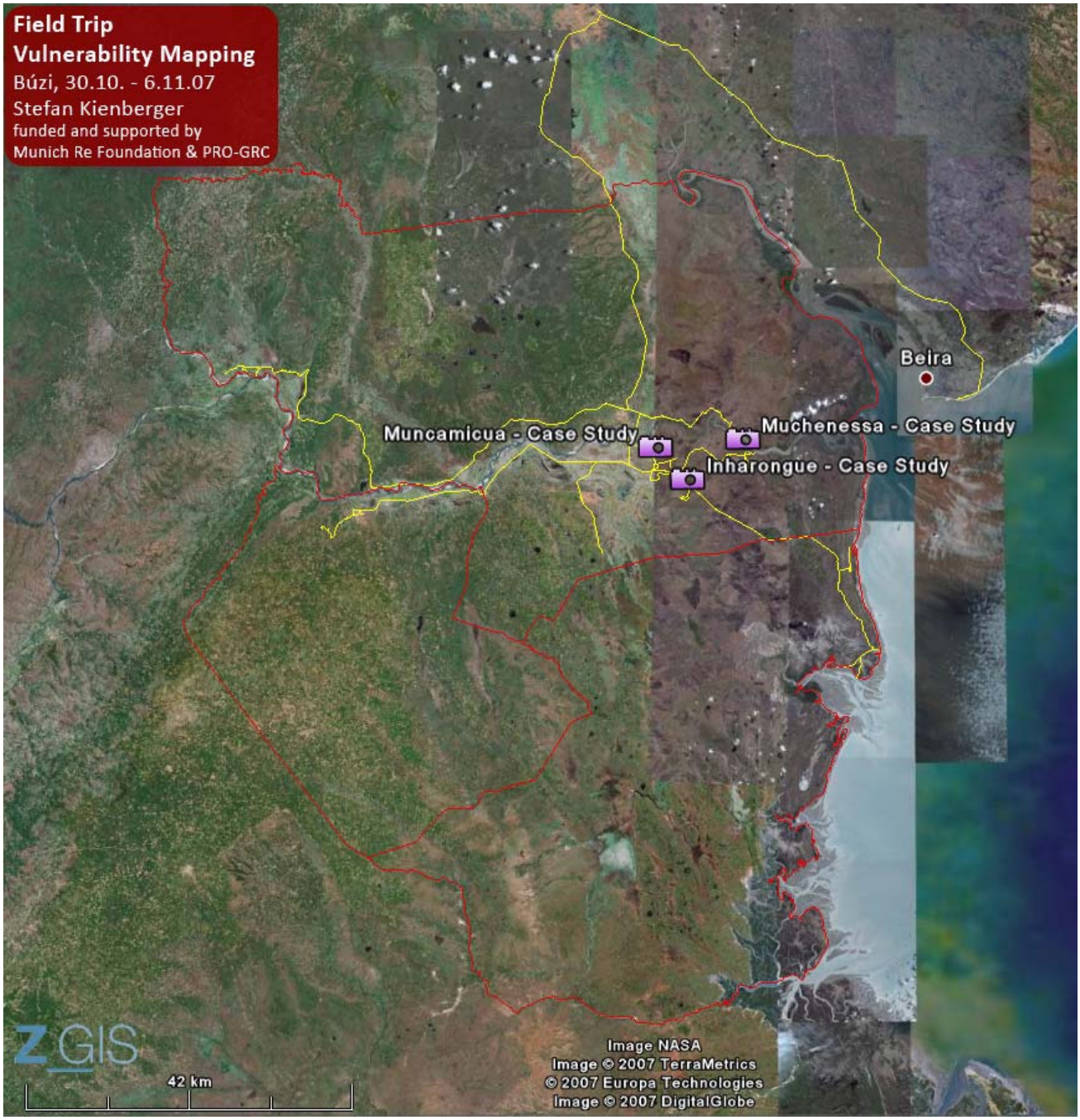

Fig 4. Map of the District of Búzi (Boundaries: red) showing the case study locations and the route travelled (yellow line)

ANNEX 1 – Information sheet - Expert Interviews