ENDELEO Newsletter

November 2009 **Number 4**

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Introduction

We are happy to announce that funding for the ENDELEO project has been extended till July 2010. As in the first phase of the project, funding is provided by the Belgian Science Policy Office (BELSPO).

The objectives of the 2nd phase of the ENDELEO project are (1) to optimize the ENDELEO monitoring website (http://endeleo.vgt.vito.be/) according to the recommendations received during the last ENDELEO workshop (April 2009) and (2) to install the monitoring website at the Department of Resource Surveys and Remote sensing (DRSRS) to assure sustainability of the system.

Extension of the ENDELEO project also means that we will continue to provide support to users of the ENDELEO monitoring website on technical issues, specific data requests, analysis techniques, etc. We also look forward to continue receiving feedback from users on the monitoring website and to get to know for which real world applications the monitoring tools are used. To further demonstrate the use of the ENDELEO monitoring website we will provide new case studies on a regular basis. In this newsletter we present two case studies: one case study on the recent droughts and another on Grevy's Zebras in which tracking data and earth observation data is combined.

We would also like to announce some change of personnel. Toon Westra will be leaving Ghent University and he will be replaced by Flore Devriendt. You can contact her on Flore.Devriendt@Ugent.be .

ENDELEO monitoring website

The ENDELEO monitoring website has been online since April 2009. Since then the website has received an average of approximately 20 visitors a week from 15 different countries. Most visitors come from Kenya and Belgium, but we have had also quite a few visitors from the USA, United Kingdom, Ethiopia, Switzerland, and Italy. 20 users have already registered to download full data from the FTP server.

During the next phase of the project we would like to increase the number of visitors by promoting the ENDELEO monitoring website to a wider group of potential users. An important event will be the official launch of the website by the Kenyan Minister of Environment. This will take place once the website has been installed at DRSRS.

We also aim to gain a better insight in the use of the ENDELEO monitoring website. Therefore a short questionnaire will be prepared and send to you to get to know how often the monitoring website is consulted, which tools are being used, what applications are they being used for, which additional data would be of interest, etc. We are looking forward to gather information on the use of the ENDELEO tool.

Additionally we are keen to receive ideas from users on new case studies related to natural resource management, if possible combining ENDELEO monitoring tools and ground data. We are looking forward to receiving your suggestions. As an example, we provide two case studies in this newsletter on the recent droughts and on Grevy's Zebras.

ENDELEO Help Desk

Any questions related to the ENDELEO project can be send to Flore.Devriendt@UGent.be. For technical assistance with the monitoring website, specific data requests, data or support with analysis techniques you may contact Josefien.Delrue@vito.be.

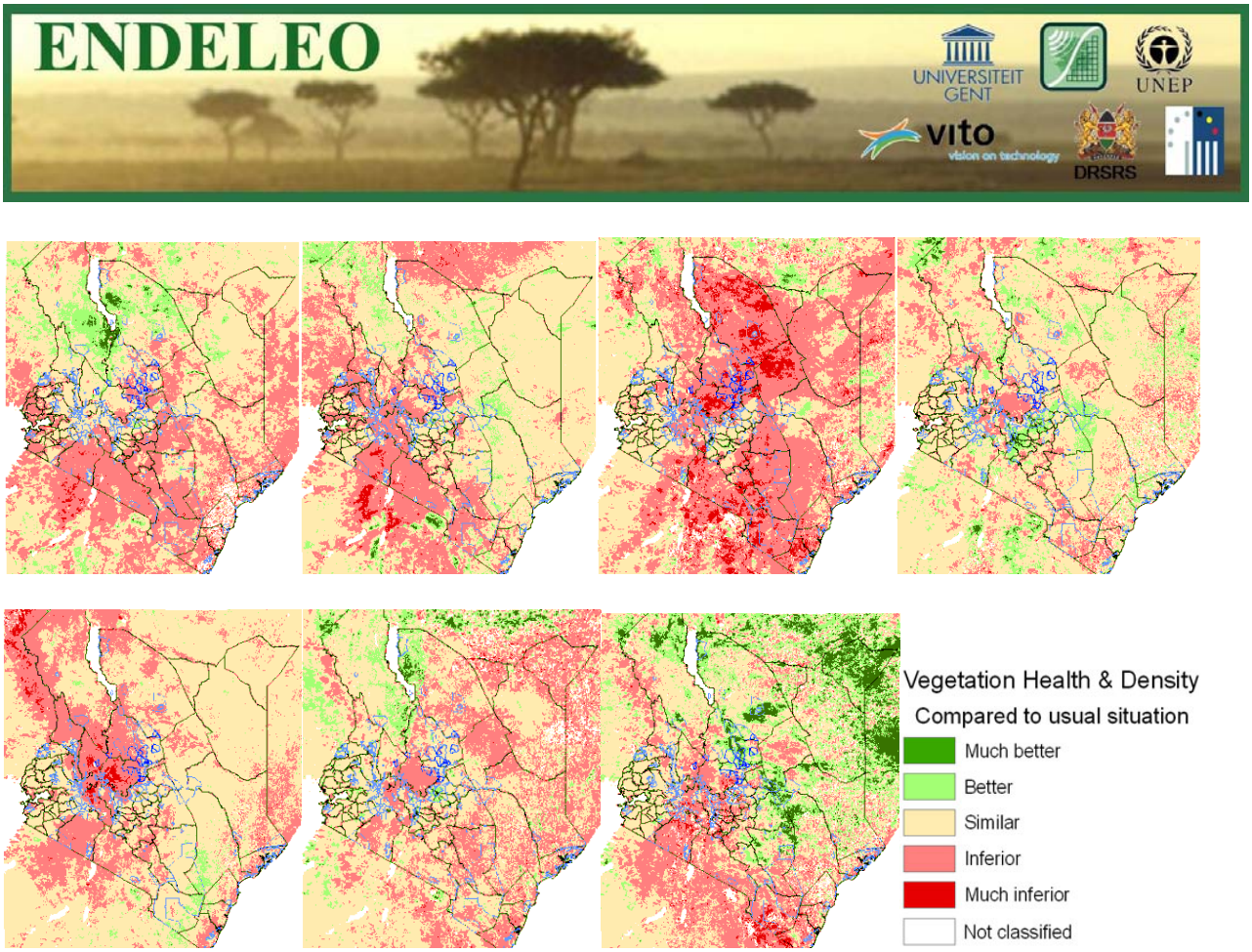
Case study on recent droughts

A devastating drought has swept across Kenya during 2009. The long rainy season from March to May failed completely. The long drought period has affected the vegetation in all regions of Kenya. The government declared a state of emergency in the country, saying 10 million people may face hunger and starvation after a poor harvest because of crop failure due to a lack of rain and rising food prices. Conflicts between communities have increased with the drought, concerning access to water and pasture.

Examining the 'vegetation health and density' (NDVI) for 2009 compared to the usual conditions reveals that up till mid October the vegetation status in major parts of Kenya is inferior compared to the average year. The image of the middle of May clearly depicts the consequences of the failure of the long rainy season on the vegetation. The vegetation health and density at the end of the rainy season is inferior to much inferior compared to the average year in almost all regions.

Right now, at the end of October, the short rainy season appears to start earlier compared to average. The vegetation in the eastern half of the country already seems to benefit, as the 'vegetation health and density' in some areas is performing better than the usual situation.

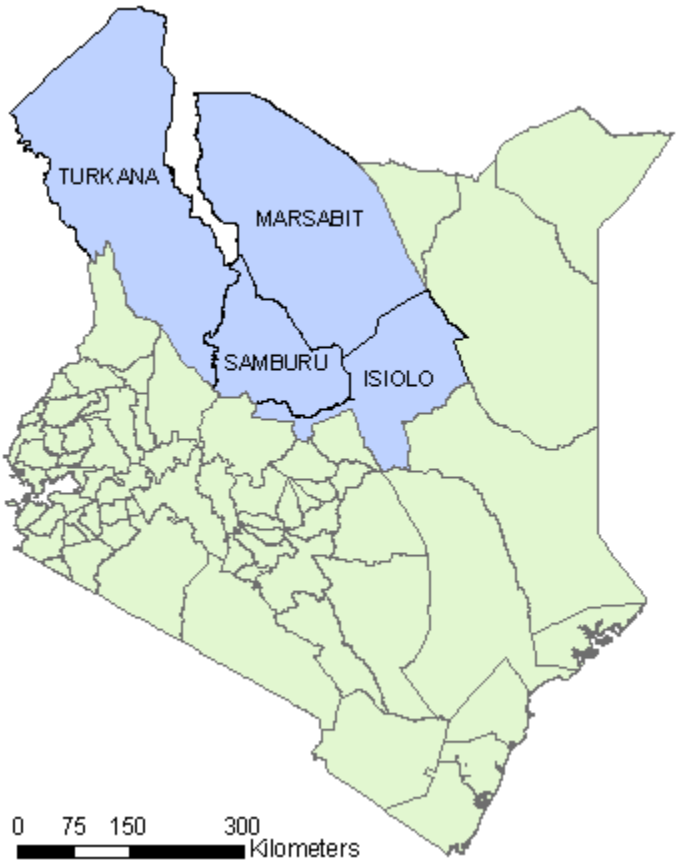
Meteorologists expect a lot of rain. The images that will appear on the ENDELEO monitoring website during the next decades will show to what extend this may lead to the recovery of the vegetation status. However, if the intensity of the rain will be too high, negative effects might be identified. Because the country has been parched for so long and now suddenly a more than normal rainfall is expected, they warn for flooding. Since the land is hard and dry infiltration of the water is slow and a lot of water remains on the field. This can result in the rotting of crop.



Vegetation health & density compared to the average situation, in the middle of January 2009, March 2009, May 2009, July 2009, September 2009, October 2009 and at the end of October 2009.

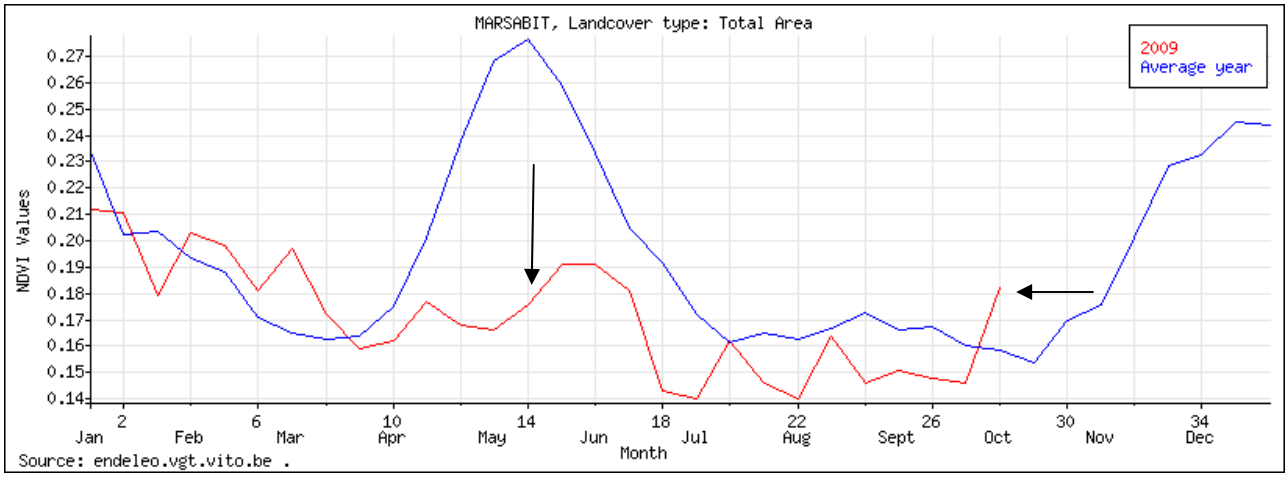
By means of the graphs tool on the ENDELEO monitoring website, the status of vegetation in a specific area of interest can be studied in more detail. An example is given for the Northern districts.

The Northern districts Marsabit, Isiolo, Samburu and Turkana (see map below) have been hard-hit by drought and were experiencing severe food shortages, massive population displacement and deaths from conflict on control of water points and pasture. The wildlife in these districts is as well victim of the lack of rain, especially the less drought-resistant animals like elephant, buffalo, warthog, some antelope species and hippopotami. Only in Samburu district, 24 elephants have died in two months time.

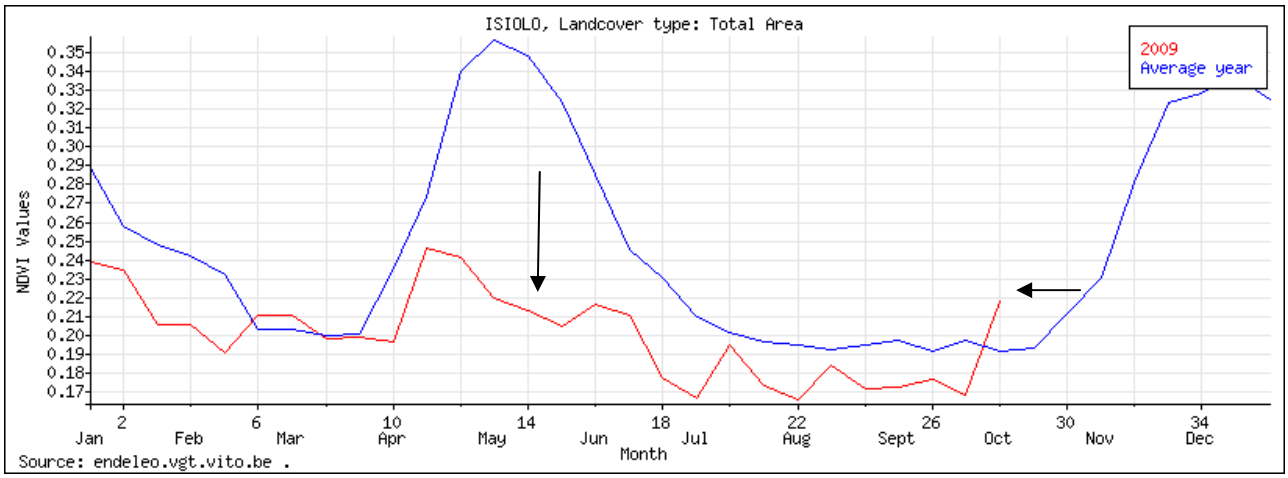


Situation of the Northern districts Marsabit, Isiolo, Samburu and Turkana in Kenya.

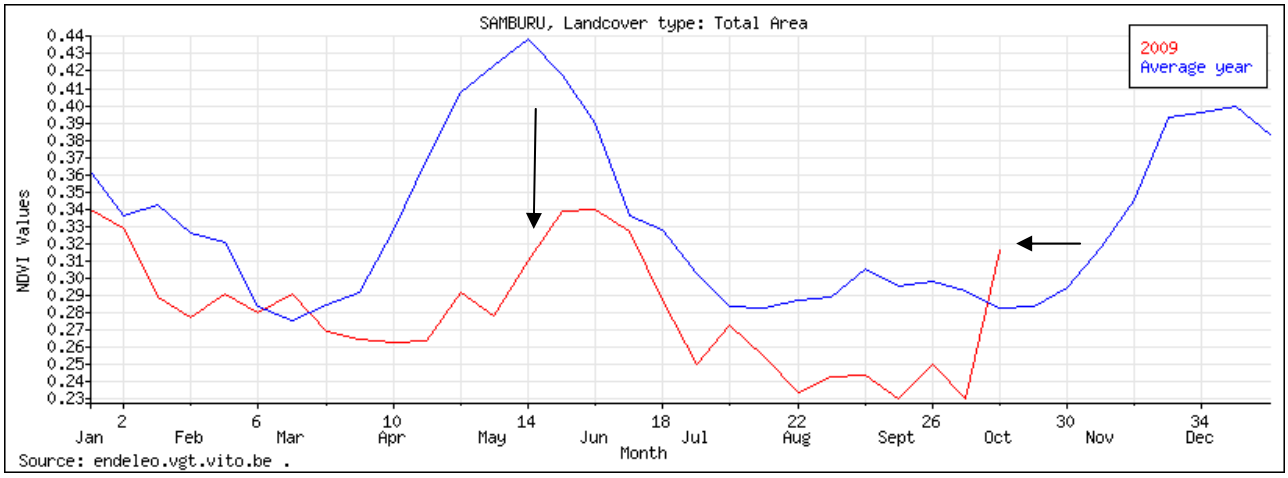
In the graphs below the evolution of the 'vegetation health and density' is plotted against the average situation for all land cover types in these four districts. The vegetation conditions were considerably lower than average. The lack of rain during the long rainy season is clear for all four districts. Furthermore, the influence of the early onset of the short rainy season is visible as an early increase of the 'vegetation health and density', at the end of October, whereas this normally occurs in half November.



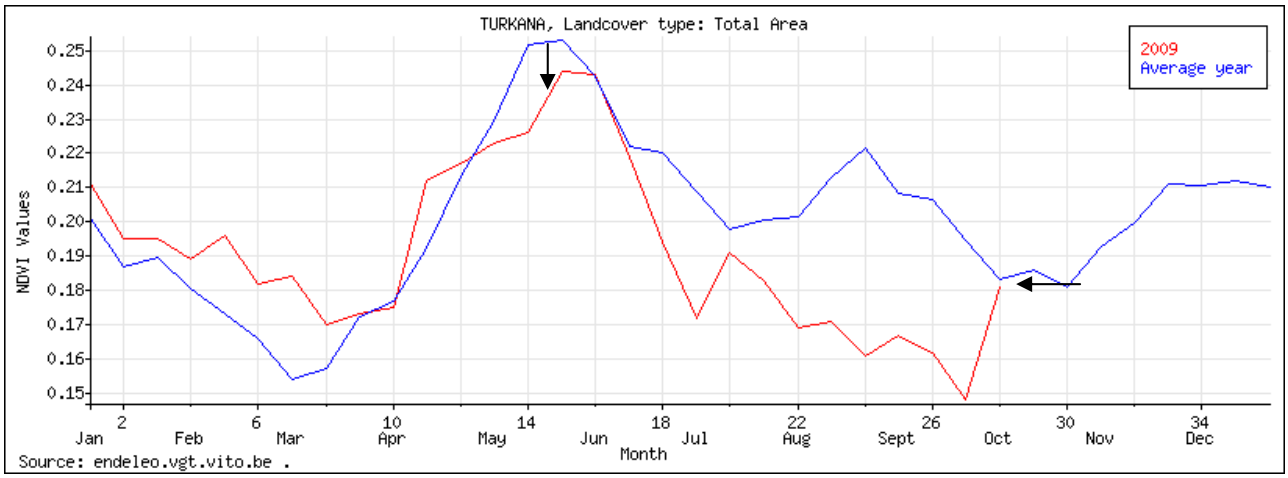
Vegetation health & density for the total area of Marsabit for 2009 and for average year.



Vegetation health & density for the total area of Isiolo for 2009 and for average year.



Vegetation health & density for the total area of Samburu for 2009 and for average year.



Vegetation health & density for the total area of Turkana for 2009 and for average year.

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Case study: Modelling movements and habitat preference of Grevy's Zebra

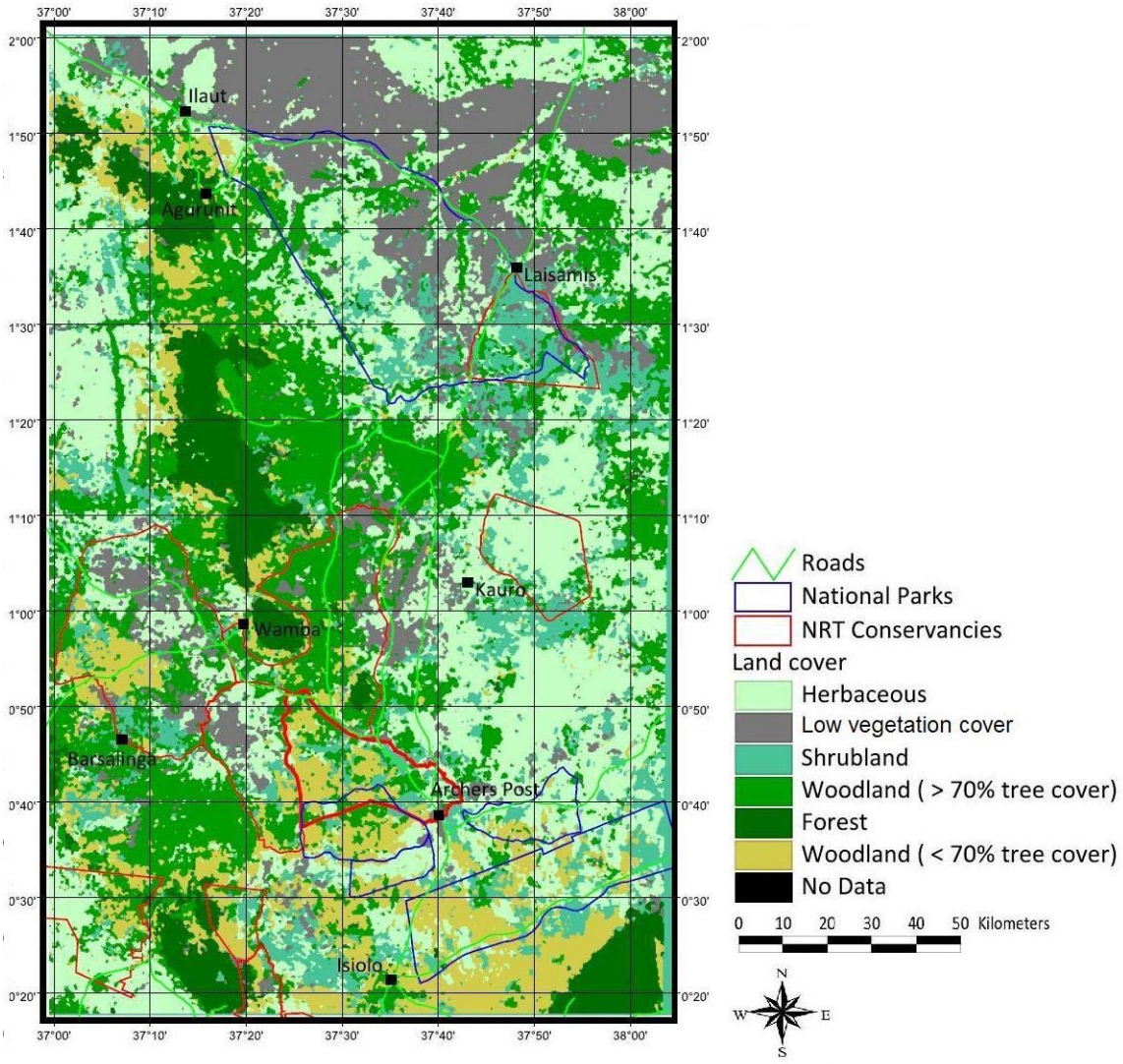
Tracking data of Grevy's zebra was analyzed in combination with NDVI data and a habitat classification to model movements and habitat preference of Grevy's Zebra has been made. This research was conducted by Eline Hostens (UGent student) for her master's thesis. The thesis can be downloaded using following link:
http://dfwm.ugent.be/forsit/content/projects/endeleo/documents/GZthesis_Eline_Hostens.pdf

The tracking of Grevy's zebras is part of the overall GSM GPS tracking project supported by Safaricom and executed by Save the Elephants. The tracking of Grevy's Zebras is jointly executed by Save the Elephants and Lewa Wildlife Conservancy with further collaboration with the Northern Rangelands Trust (NRT) and other stakeholders.

As the Grevy's zebra is a threatened species, it is important to know as much as possible about their habitat use and migration pattern. This thesis had two main objectives: the creation of a habitat classification and the analysis of the Grevy's zebras migration. The habitat classification was based on Landsat and MODIS images. Both Maximum Likelihood and Neural Networks were used to conduct the classification. To analyse the migration, data obtained from the GPS-tracking of sixteen Grevy's zebras was used. Several factors with a possible influence on the migration were examined: distribution of biomass, water, livestock and towns. The final step was to make an integration of all these factors to predict the areas within the study area that are most suitable for Grevy's zebras.

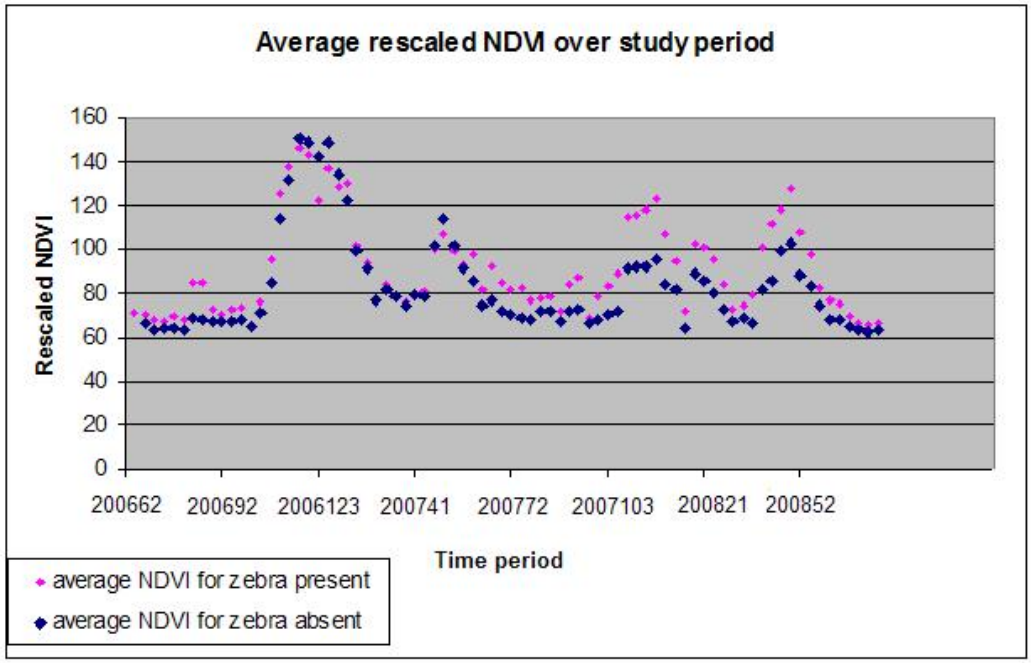
The first objective of this thesis was to make a habitat classification of the study area. The use of Landsat satellite images was abandoned as no good result was obtained using these images. Instead time series of MODIS images were used which enhanced the distinction between different classes providing information on the plant phenology. The Maximum Likelihood classification method only made a good separation of the forest class from the other habitat classes. Using the Neural Networks classification technique, a better distinction between the different savanna sub-classes was obtained.

The best classification result was obtained with NN using all MODIS spectral images, all NDVI images and all EVI images as input.



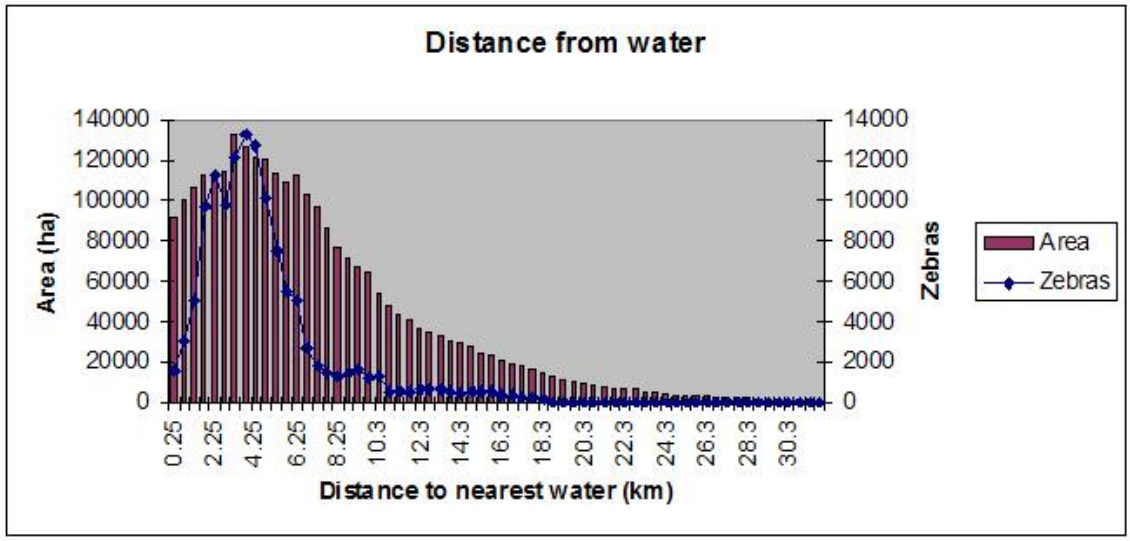
Land cover classification.

The second objective was to model the migration of the Grev*y's zebras. The most important factor influencing the migration of the Grevy's zebras was the available* biomass as food source. NDVI was used as a proxy for available biomass. The Grevy's zebras almost always used areas with significantly higher NDVI values than in the surroundings. Only during the first rainy season they preferred areas with significantly lower NDVI values and in the second rainy season there was no significant difference between the NDVI values in pixels where zebras were absent or present. The fact that in the first rainy season areas with lower NDVI values were chosen can be explained by the very wet rainy season.



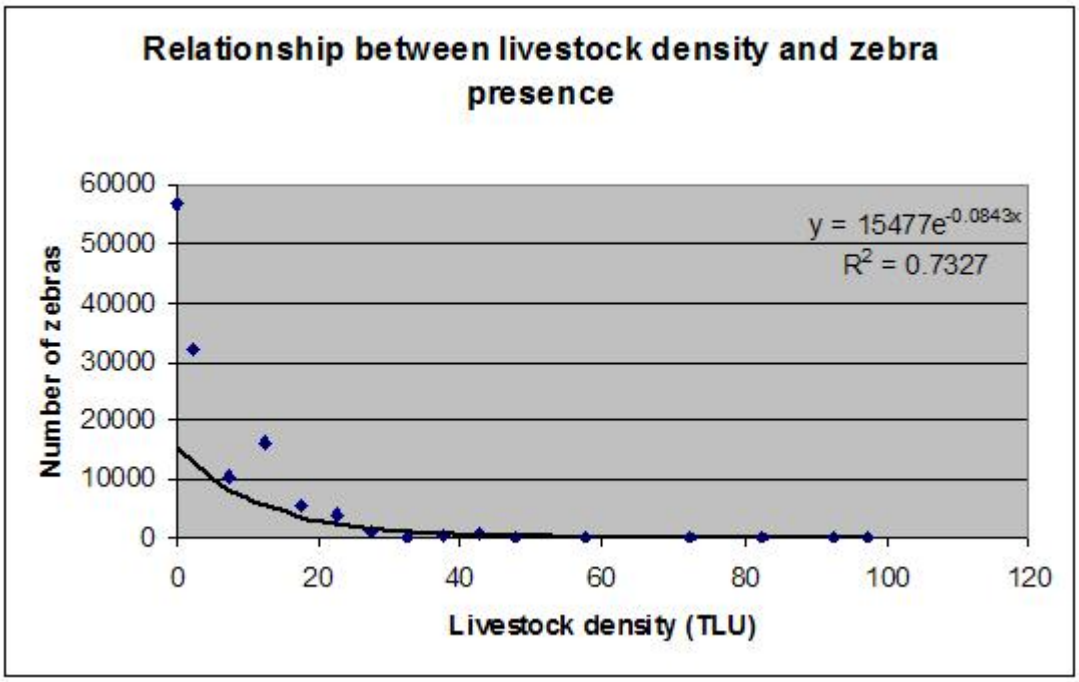
Comparison of average NDVI in areas where Grevy's zebra were observed and areas where Grevy's zebras were not observed.

The other factors influencing Grevy's zebra migration are proximity to water and livestock density. The zebras mostly prefer areas between 0–15km of water. They are most present within the range of 2.5–4.5km from the nearest water point. Areas very close to water are less preferred as there is more competition in these areas with other wildlife and livestock. In this study, all zebras were always in relatively close proximity to water, as they can go without water for 2–5 days and can travel between 10 and 15km per day.



Relationship between number of zebra observations and distance to the nearest water.

When comparing the tracking data and livestock density it was found that Grevy's zebras avoid areas with high livestock density. This can be explained by the direct competition between zebras and livestock for water and food. The relationship of the Grevy's zebras and the distance to the nearest town resembles the relationship between the zebras and the distance to the nearest water point. Their migration and occurrence is probably not very affected by the towns in the study area.



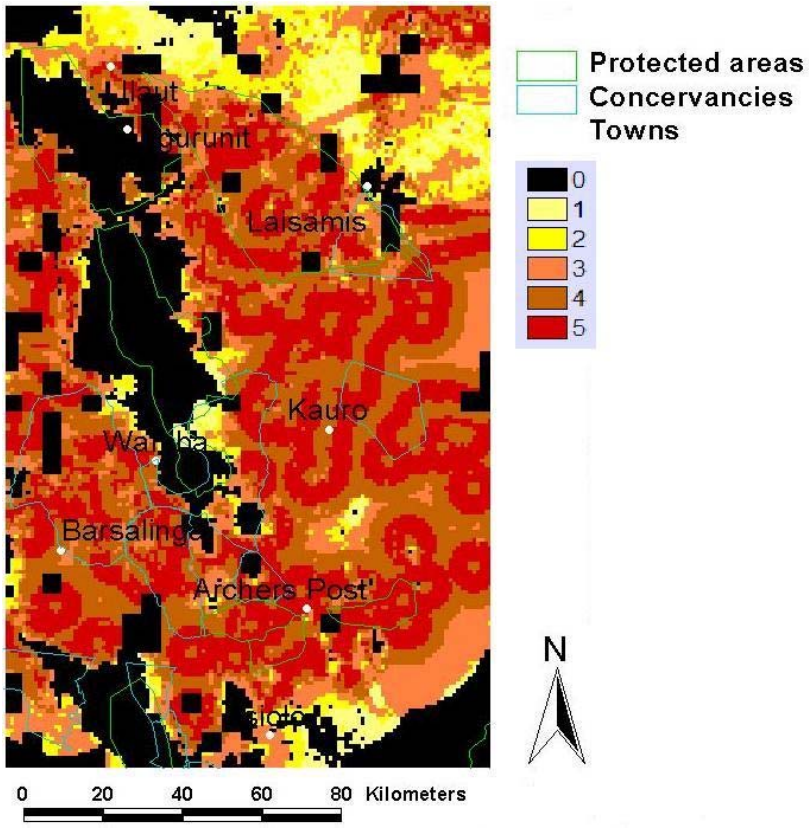
Relationship between livestock density and number of zebra observations.

Based on the MODIS and Africover classification, a habitat preference ranking for the Grevy's zebras was performed. First it was tested whether there was a random use of habitat or not. In the case of a random use, the zebras use the available habitat in proportion to the area of each habitat type. In case of a non-random use of habitats, a ranking was made per zebra of which habitat they preferred. Finally, the result of all sixteen zebras was integrated to obtain an overall habitat preference ranking for all Grevy's zebras tracked in the study area. From the preference ranking based on the MODIS classification, it could only be concluded that Grevy's zebras avoid forest habitat. Between the other habitat types no significant distinction in preference could be made. A possible explanation is that the classification does not correspond with reality very well.

From the preference ranking based on the Africover classification could be concluded that in the first level comparison, between the composition of the study area and that of the home ranges of each animal, there is a significant preference of the habitats settlements and shrubs & herbaceous, followed by a preference for open-sparse shrubs. All other habitat types could not be ranked in a significant order. For the second level comparison, this is between the home range compositions and the GPS data, there is a significant preference of the habitat types

herbaceous & shrubs, and herbaceous. The next habitat types in the preference ranking are open woody and open-sparse shrubs. The other habitat types could be left out as most of the MCPs were composed of these four habitat types.

Finally an integration of all the factors influencing the migration was made based on the obtained results. The areas not suitable for Grevy's zebras were determined. For the other areas the influence of the distance to the nearest water point and of the NDVI was taken into account to divide these areas into different preference classes. The result showed a 2.4 times more usage of the most suitable areas by the Grevy's zebras than would be expected from the area of this class. However, there are a lot more factors influencing the occurrence and migration of the Grevy's zebras. For instance, there is an influence of predators, other ungulates and reproductive state of the Grevy's zebra females. Data about all these influences and maybe even more should be collected and taken into account to get a better idea of the areas preferred and used by Grevy's zebras.



Modeled habitat preference of Grevy's Zebra within the study area (0=avoided,5=most preferred).

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Links:

ENDELEO Monitoring website
ENDELEO project website