

THE SOCIAL AND ECONOMIC EFFECT OF CLIMATE
CHANGE OVER ZAMBIA: A CASE STUDY OF THE
POOR 2014/2015 RAINFALL.

(Conference ID: CFP/152/2017)

Oliver Mudenda
Zambia Meteorological Department
P.O.BOX 30200, Lusaka.
Email: Mudendaoliver@yahoo.com
Cell phone No: +260 972 254 641
Fax No: +260 211 271469 (Attn: KKIA Met Dept)

ABSTRACT

Climate change can be defined as long term changes in the weather patterns. The negative effect of climate change and variability has never been so prominent in Zambia's social –economic development than during the 2014/2015 rain season. The country's climate-sensitive sectors such as agriculture and food security, water and energy have been negatively affected by climate change and variability such that according to the country's Vice President, Her honor, Mrs. I.Wina "Zambia is now experiencing one of the worst energy crises in its history because Zambia's power supply is largely hydro" (Daily Mail, 2015). The purpose of this paper is to set out the lessons learnt, mitigation measures adopted and how the poor 2014/2015 rain season had affected the general populace in Zambia. From the study that was conducted in Lusaka, the capital city of Zambia, it was very clear among the general Zambian populace that climate change and variability is a cross-cutting issue that borders not only on their livelihood, healthy and safety but also on the sustainable development of the country. This is because rain fed Agriculture is Zambia's largest contribution sector to the Gross Domestic Product (GDP) employing about 85% of the labor force. Therefore, any climate change, variability and extremes due to inter and intra variations of rainfall has had a negative ripple effect on the general livelihood of the people not only in Zambia but the whole southern Africa because heavy summer rains are the basis for agriculture in many tropical areas of Africa.

1. INTRODUCTION AND BACKGROUND

The rain bearing systems over Zambia are the Intertropical Convergence Zone (I.T.C.Z) bounded by the leading Northern edge (N.I.T.C.Z) and the leading Southern edge (S.I.T.C.Z). The Congo Air mass whose leading edge called the Congo Air Boundary (CAB) starts affecting North-West of Zambia by mid-October hence bringing the first rains to these areas. The leading Northern edge (N.I.T.C.Z) of the Intertropical Convergence Zone (I.T.C.Z) comprises of the moist North Easterlies that start the first rains over the North- East of Zambia in early December.

The leading southern edge (S.I.T.C.Z) comprises of South- easterlies. Basically, the Zambian climatology consists of two major climatic features; the dry season that starts from May to September and the rainy season that starts from November to March. The months of October and April considered as transitional months.

Climate trends in Zambia over the last 30 years exhibit rising temperatures, declining rainfall and increasing frequency of drought (de Wit, 2006). More generally, future climate change and variability in Eastern and Southern Africa is expected to lead to an increase in the frequency or severity of extreme weather events like drought and flooding, and reduced length and regularity of rainfall seasons (Dinar et al., 2008). These changes are likely to have widespread effects on agriculture production, health, water availability, energy use, infrastructure, biodiversity and ecosystem services that lead to potentially large economic costs. Impacts are likely to fall disproportionately on vulnerable groups such as the poor who have fewer resources to adapt to climate change and variability (DFID, 2010). It is envisaged that this case study will make the policy makers, researchers and the general populace better understand and appreciate the fact that Climate change and variability is real. Its effects and negative impacts are already influencing our life styles.

2. DATA AND METHODOLOGY

The following data used in this study was acquired from the Zambia National Meteorological Department Headquarters in Lusaka; the 2013/2014 and 2014/2015 season general synoptic conditions and rainfall distribution per dekad, the 2014/2015 seasonal forecast and start of the season, January to March 2015 soil water index and other climatic information on Zambia. This data was analyzed and sometimes compared with what was prevailing during the preceding season over the same period (Fig 1). In addition, the performance of the whole 2014/2015 season was monitored and tracked from the onset up to the outset using both primary and secondary meteorological data. For agriculture purposes, the soil moisture index for 1st dekad of March 2015 was analyzed to determine the Water Requirement Satisfaction Index (WRSI) and other agrometeorological condition requirements for maize. The agrometeorological analysis was reinforced by the Crop weather bulletins that monitors crops at ten-day

(dekad) intervals and published by the Meteorological Department for the public. As alluded to earlier in this study, March signifies the end of the rainy season in Zambia.

In order to better understand how ordinary Zambian populace was coping with ‘load shedding’ and how trade-offs are made in decisions about energy use, in-depth interviews and observations sessions were held. A total of 30 in-depth interviews and sessions were held with low and middle-income household in urban and peripheral areas of Lusaka (approximately an even divide between these two categories of households, though it must be noted that making such distinction on the ground is not always clear). Other data collection methods used were verbal interactions with small scale traders and entrepreneurs whose businesses are dependant on electricity, literature materials from the daily tabloids, mobile phone load-shedding alerts, daily television and radio news, street gossip, questionnaires, interactive interviews and observable mitigation measures.

2.1 General synoptic situations

A review of the 2014/2015 rainfall season indicates that the Congo Air boundary (CAB) moved into Zambia in November 2014 while the Intertropical Convergence Zone (I.T.C.Z) became well established by mid-December 2014. The consecutive developments of tropical depressions in the Mozambique Channel became prominent from January to March 2015. Low to middle level anticyclone over Botswana/Namibia by February to March 2015. The I.T.C.Z weakened in February to March 2015. The start of the 2014/2015 season was normal over some areas of western Zambia but delayed over the rest of the country than during the 2013/2014 season.

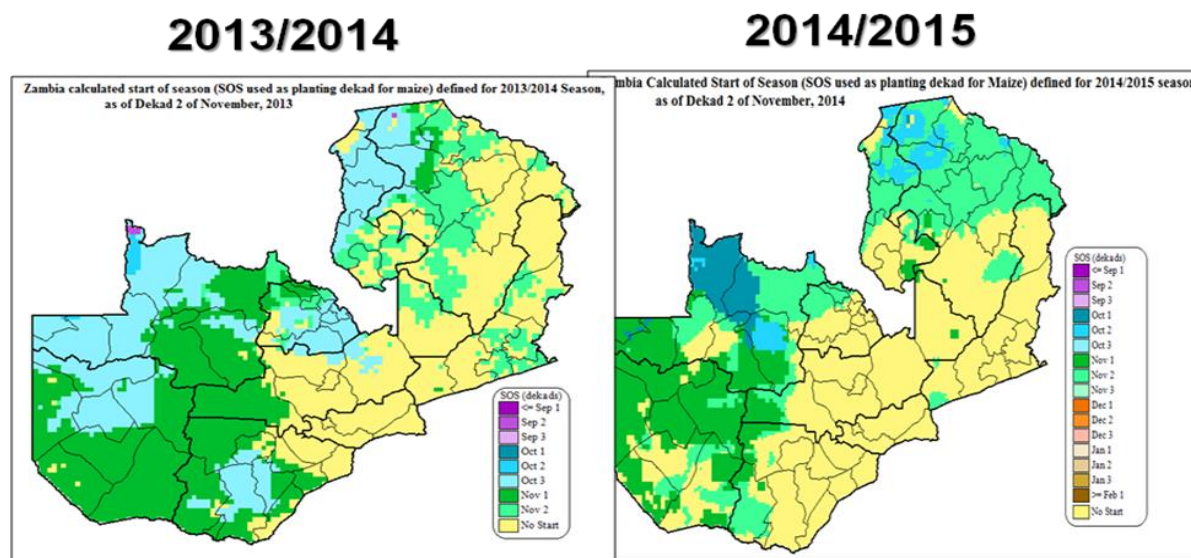
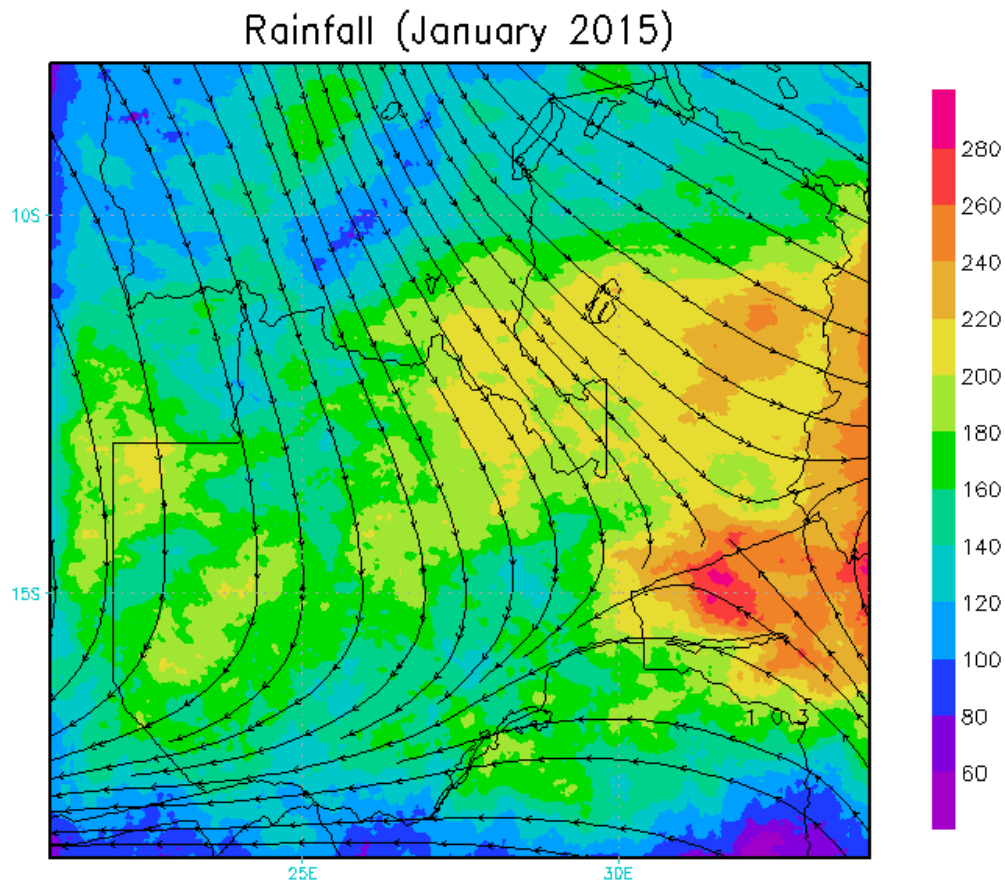


Figure 1:

A comparison of the calculated start of season (SOS) at end of dekad 2 using the threshold of 25mm in first dekad followed by a total of 20mm in the next 2 consecutive dekad.

In this study, the start of the season (SOS) at end of dekad 2 of November 2014 was calculated using the threshold of 25mm in first dekad followed by a total of 20mm in the next 2 consecutive dekad (Fig.1). The calculated start of season (SOS) used in Zambia is the planting dekad of maize, which is the major staple diet in the country.

From the end of November dekad 3 up to December dekad 2 of 2015, most parts of Zambia had recorded below normal rainfall. It was only during the months of January and February that the Congo Air mass and the Intertropical Convergence Zone (I.T.C.Z) were so pronounced that much of Zambia recorded at least normal rainfall though not above normal. Though the Congo Air mass (Fig.2) enhanced the rainfall performance during the months of January and February of 2015, the poor distribution both in time and space could not make any significant positive impact on the livelihood of the general populace.



Figure

2. The 850mb Congo Air mass stream lines superimposed with the satellite image showing the average rainfall distribution in January (Adapted from: 2014/2015 Zambian seasonal forecast).

3. RESULTS

The entire 2014/2015 Zambian rain season that normally starts from November to March was so poor that it resulted in ruined crops and other environmental and social challenges. Only few places over Northwestern and Northern Zambia had satisfactory to sufficient soil water index for Maize. This is mainly because the onset and withdraw of the moist Congo Air mass is earliest and least respectively in those areas than the rest of the country.

Zambia Soil Water Index for Maize in 2014/15 season as at 20th March, 2015

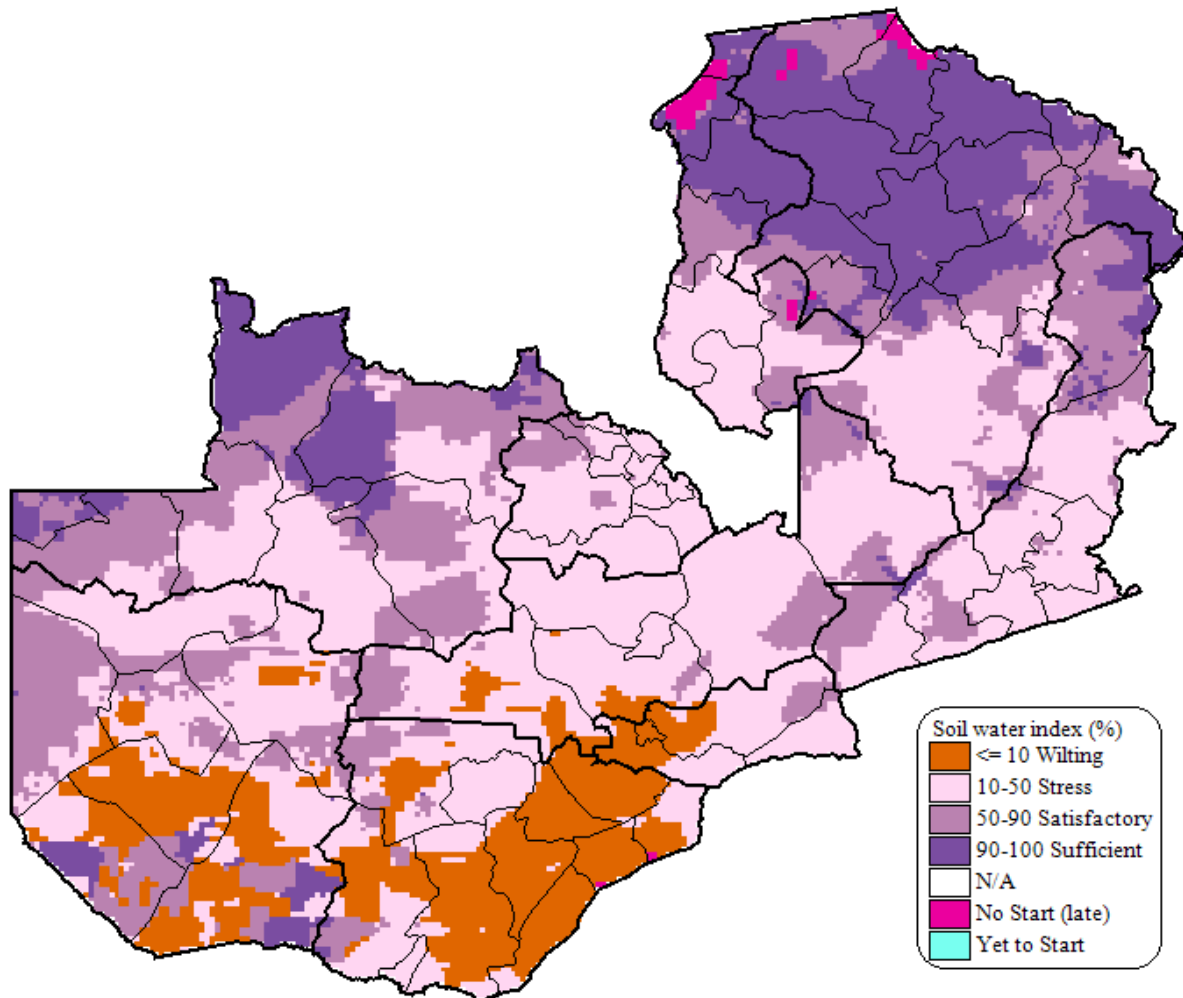


Figure 3: Soil water index for 25th March 2015

By the end of the season, it was evident that the major part of the country had less than satisfactory soil water index (Fig.3). In case of Zambia, most of these environmental, social and economic challenges were very visible even by the highest level of decision and policy makers. The country's climate-sensitive sectors such as agriculture and food security, water and energy have been negatively affected by climate change and variability such that according to the country's Vice President, Her honor, Mrs. I.Wina "Zambia is now experiencing one of the worst energy crises in its history because Zambia's power supply is largely hydro" (Daily Mail, 2015). Many rural and small scale urban entrepreneurs were being encouraged to be climate-smart by using solar panels to process produce so that it lasts all year and generator sets respectively.

According to Departmental Crop weather bulletin of 1st dekad of March 2015 there was a continuous reduction in rainfall amounts and number of rain days especially over the southern half of Zambia. The reduction was caused by a deep low-pressure system in the Mozambique Channel that was inducing moist Congo airflow over the northern parts of Zambia leaving much of the country under relatively dry south-easterly. However, some few stations in the northern parts of Zambia recorded substantial amounts of rainfall. The further reduction in rainfall over much of the southern half of the country also signified a further reduction in the Soils moisture country wide. By this time, 1st dekad of March, about Ninety percent of all the meteorological data stations in the country had recorded rainfall seasonal deficits ranging from 8mm over Western Zambia to 400mm over the Southern half of Zambia, indicated as negative(-8) and negative(-400) rainfall departures from normal since 1st July 2014. This represents rainfall seasonal deficits ranging from -1% to -51% respectively. By location, other significant deficits and surpluses in percentages were Mwinilunga (-29%), Kasempa (-8%) and Zambezi (3%) over Northwest Zambia, Mansa (-9%), Kasama (-12%) and Misamfu(-23%) over the North, Mongu(-19%), Sesheke(-38%) and Kaoma(1%) over the West, Lusaka(-6%), Kabwe(-33%) and Kafue(-2%) over Central, Lundazi(-20%), Mfuwe(-41%)and Petauke(-14) over the East, Magoye(-51%) and Choma(-19%) over the South. Overall, the 2014/2015 season was normal to below normal.

4. DISCUSSION

Climate change and variability is real and visible. From the study, it was very clear among the general Zambian populace that this is a cross-cutting issue that borders not only on their livelihood, healthy and safety but also on the sustainable development of the country. The negative and positive effects of the 2014/2015 poor rainfall season are evident on all households.

4.1 Delayed planting

According to the Daily mail tabloid ‘Deputy Minister of Agriculture and Livestock told parliament that some parts of the country will this year record reduced yields due to the poor 2014/2015 rain season. He said Western, Southern and Eastern provinces will experience considerable reduced low yields due to poor rainfall’. The country’s high level of dependence on maize makes rural communities highly vulnerable to climate variability and change. Maize is highly vulnerable to climate fluctuations because its phenology is sensitive to changes in moisture and temperature (Kanyanga, *et al.*, 2013). Adapting to climatic change patterns is difficult because most rural farming communities have limited access to capital, technology and extension services. The few extension officers are normally based near urban centers, far from most rural farming communities. However, Crop diversity can mitigate the vulnerability. Drought resistant crops like Cassava, Sorghum and millet can be encouraged in Western, Southern and Eastern provinces where rainfall is normally not adequate. According to the Zambia agriculture Institute, the institute has scaled up research to promote the adoption of new seed varieties that suit the changes in the agricultural sector with respect to climate change.

4.2 Insufficient Water recharges

Besides rain fed agriculture, Zambia’s power source is mainly hydro. “According to the country’s Vice President, Her honor Mrs. I.Wina “Zambia is now experiencing one of the worst energy crises in its history because Zambia’s power supply is largely hydro” (Daily Mail, 2015). Most of these major hydro power stations are located either over the Southern or Central parts of the country that receive the least and moderate amounts of rainfall respectively. From a social, political and economic point, power outages’ duration, frequency and their perceived severity have changed the consumers’ habits and life styles. For example, to mitigate the effect of load-shedding by the Zambian power utility company, those households that can afford generator sets (gensets) have resorted to them as a source of power; something that was uncommon in Zambia when compared to other neighboring countries like Tanzania. According to the Zambian Association of Manufactures’ chief executive officer ‘we are worried about the country’s growing trade deficit which we attribute to power load shedding that has led to low productivity of business houses. Efficiency levels by most companies have reduced to about 30 percent’. Indiscriminate cutting of trees for charcoal as a source of cooking energy has also doubled so is the price of charcoal per bag. Yet Charcoal is problematic in many ways. Its production drives deforestation and inefficient burning is linked to health and economic problems. Concurrently, climate change is predicted to affect the growth of woodlands that currently supply most of the charcoal implying the fuel itself may become hard to access (Atteridge, 2013).

According to one of the daily tabloids, Saturday Post of July 25, 2015, ‘the Energy minister has told parliament that 34 sites have been identified for the construction of mini-hydro power stations to mitigate the power deficit that Zambia is currently facing’. In addition, other programmes to support

generation of renewable energy from a number of sources including solar and gas to benefit farmers, households and entrepreneurs are being explored by the government (Daily mail, 2015). Meanwhile, Zambians have been urged to turn to generators (gensets) in a big way like their Tanzanian counter parts have done to reduce the impact on load shedding. The country should diversify into various sources of energy and move towards more usage of generators and solar energy instead of heavily depending on hydro electricity ((Daily Nation, 2015). That was to ensure that there was no break in production chain as a result of load shedding; thus, reducing poverty and vulnerability of the poor,

4.3 Short growing periods and water stressed crops

According to the Agriculture Consultative Forum (ACF), ‘Zambia will this year face a rice deficit of about 15,000 metric tonnes’ (The Daily Nation, 2015). He said there was need for farmers to adopt and invest in irrigation system so that they adapted to the various climatic changes, adding that the country had a huge potential to increase rice production. He observed that lack of pure and drought tolerant seed varieties was one of the challenges affecting rice and maize farming as it had made it difficult to have good yields, especially with climate changes.

5. CONCLUSION

Climate change and variability is real. In case of Zambia, most of these environmental and social challenges were very visible and evident during the poor 2014/2015 rainfall season even at the highest level of decision making. “We want to run away from the negative effects of climate change by not only depending on fossil fuels but rather to explore other areas such as solar energy” His Excellency the President of the Republic of Zambia. From the study, it was very clear among the general Zambian populace that this is a cross-cutting issue that borders not only on their livelihood, healthy and safety but also on the sustainable development of the country.

ACKNOWLEDGEMENT

The Author would like to thank the ‘2017 International Multi-Disciplinary Conference on knowledge sharing and innovation competitiveness for responsive and sustainable development’ for accepting my abstract so that together with other participants, we can learn from each other.

REFERENCES

- [1] Atteridge, A. 2013: Transforming household energy practices to reduce climate risks-Charcoal use in Lusaka, Zambia, *Boiling Point*, issue 61-2013, and pp. 5-7.
- [2] Daily Nation of Zambia, 2015: Thursday, July 23.
- [3] De Wit, M. 2006: Climate Change and African Agriculture.CEEPA Policy Note No.27, University of Pretoria, August.
- [4] DFID, 2010: The Economics of Climate change in Tanzania; [http://economics-of-cc-in-tanzania.org/images/Economics-of-climate-change-in-tanzania-Factsheet vs 3-1-1-1-v2.pdf](http://economics-of-cc-in-tanzania.org/images/Economics-of-climate-change-in-tanzania-Factsheet%20vs%203-1-1-1-v2.pdf)
- [5] Dinar, A., Rashid H., Robert M., James B., 2008: *Climate change and Agriculture in Africa.Impact Assessment and Adaptation strategies*. London: Earth Scan. Zambia.
- [6] Kanyanga, J., Thomas, S. T., Hachigonta, S., Sibanda, M.L., 2013: *Southern African Agriculture and climate change- a comprehensive analysis*, International food policy research institute.
- [7] Post Newspaper of Zambia 2015: Climate change and load shedding, Sunday, July 26.
- [8] Sunday Mail of Zambia, 2015: No bride price due to load shedding, Sunday, July 26.
- [9] The Times of Zambia, 2015: The effects of climate change are visible, Friday, August 07.
- [10] Zambia Daily Mail, 2015: Help Zambia on climate Change mitigation, Friday, July 17; Climate change effects visible, Friday, August 07; Climate-smart Gwembe women improve yields, *stay health-using solar panels to process produce so that it lasts all year*, Friday, August 28;
- [11] Zambia Daily Mail, 2014: Western Province leads climate fight back, Monday, June 16.

Table 1: Rainfall and rain days summary as of 1st Dekad of March 2015 of 2014/2015.

Station	Observed		Normal	Totals since 1 st July 2014				
	Rainfall (mm)	Rain days	Rainfall (mm)	Rainfall (mm)	Rain days	Normal Rainfall(mm)	Rainfall Depart(mm)	Percent (%)
Mwinilunga	24	6	94	789	86	1110	-321	-29
Mansa	102	4	73	823		909	-86	-9
Kasama	86	6	82	915		1044	-129	-12
Mpika	8	2	69	760		924	-161	-18
Mongu	18	4	55	671	60	829	-158	-19
Kabwe	31	2	54	580	48	862	-282	-33
Lusaka	18	2	50	715	53	762	-47	-6
Chipata	0	0	60	798	50	875	-77	-9
Choma	38	3	31	615	48	751	-136	-19
Ndola	100	5	67	1009		963	-46	-5
Magoye	4	1	42	389	43	789	-400	-51
Petauke	83	2	61	721		840	-119	-14
Mfuwe	12	2	61	505	49	861	-356	-41
Misamfu	91	7	82	799		1044	-245	-23
Sesheke	6	2	44	392		636	-244	-38
Isoka	20	3	84	700	61	879	-179	-20
Serenje	69	2	69	786	69	1049	-263	-25
Kasempa	88	4	71	959		1041	-82	-8
Kaoma	26	4	51	838	55	846	-8	-1



Figure 4: Author's thematic expression of 'Climate Change effects are visible'.