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Effects of Climate Change and Variability on Pastoral Resources Availability in South-Eastern Sudanian Zone of Burkina Faso

C. L. Sanou^{1,2}, D.N. Tsado², A. Kiema³, J.O. Eichie^{1,2} and A.A. Okhimamhe^{1,2}

¹Federal University of Technology, Minna, Nigeria; ²West African Science Service Centre on Climate Change and Adapted Land Use, Nigeria; ³Institut de l'Environnement et la Recherches Agricoles, Région du Centre Burkina Faso

Corresponding author: C.L. Sanou; E-mail: sclamoussa@gmail.com; Tel: + 2348164091648

Abstract

The study aims to assess the availability of pastoral resources under climate change and variability within South-eastern Sudanian Zone of Burkina Faso. For this purpose, both climatic data (rainfall and temperature) and households' survey data were retrieved and analysed. The results show a high variability in rainfall from the long-term rainfall pattern of the climatology. Monthly temperature has shown a gradual increase over each month of the year compared to the climatology. According to researchers, these changes and variabilities in rainfall and temperature affect negatively pasture biomass and forage quality within the grazing lands. In the same line, respondents' perceptions depicted a shortage in the pasture over the last decades, disappearance of forages species (herbaceous, ligneous), and decline in their nutritive quality. A total of 43, 21 and 73 forage species were found threatened/disappeared by respectively *Gourmatche*, *Mossi* and *Fulani* ethnic groups. Finally, from respondents' perspective the accessibility of forage resources is becoming gradually problematic in host countries (Benin Republic, Togo). The Government of Burkina Faso must undertake a comprehensive study to introduce as much as possible most palatable forage species within the grazing lands where they are threatened/disappeared.

Keywords: Pastoral resources, climate change, forage species, Sudanian Zone

Introduction

The pastoral system is mostly found in Africa's vast arid and semi-arid areas characterized by marked rainfall variability, and associated uncertainties in the spatial and temporal distribution of water resources and grazing for animals (African Union, 2010). In these areas, the equilibrium of the pastoral system is usually disrupted through mainly the depletion of the environment component. It is precisely for this reason that in the system, livestock frequently moves from areas of scarcity towards zones rich in pastoral resources in order to ensure their access to pasture (Liao *et al.*, 2014). However, despite the essential role of mobile herding involving a sustainable utilisation of natural fragile and sparse pastoral resources, numerous challenges are affecting its effectiveness.

Indeed, the mobile farming is experiencing a marginalization of pastoral communities and increased competition with other user groups, particularly crop farmers for access to natural resources (grazing, watering points) (Touré *et al.*, 2012). In the recent years, climate change and variability remain beside land use and cover dynamics, one of the drivers of natural resources deterioration. It affects seriously pastoral resources and accordingly livestock production and reproduction performances (Sanfo, 2014; Zampaligré *et al.*, 2013; PANA, 2007). Furthermore, climate deterioration will affect forage quality through the lignification of plant tissues with a rise in temperature (Minson, 1990). Moreover, according to Martin *et al.* (2014), climate change through a decrease in yearly rainfall amount associated with high variabilities has important implications for grazing lands productivity and pastoralists' livelihoods accordingly.

This research work aims to understand the availability of natural forage in the pastoral system under climate change and variability. This could allow to give a signal to policymaker and underpinned a good and informed decision making.

Materials and Methods

Study area: The study was conducted in Kompienga province belonging to the east-southern Sudanian zone of Burkina Faso. Gourma, Topoa and Koulpélogo provinces constitute borders to Kompienga in the North, East and West respectively. Togo and Benin Republic constitute southern borders countries. It lies between 0°30'4.96" and 1°22'22.25" longitude East and 10°56'16.85" and 11°27'21.09" latitude North and has 6 998 km² (INSD, 2014) of land mass. Sudanian climate characterized the province with a shorter rainy season. Its annual rainfall fluctuates between 700 and 1000 mm on average. The average annual temperatures range from 30.7 ° to 39.7 °

C for the maximum and 17.5°C to 26.3°C for the minimum. The population is estimated at 75,867 with 13,239 households (INSD, 2008).

Data collection and analysis: Climate data and household survey data were used in this research work. Climatic data consisted in rainfall and temperature over the period 1981-2016. Two periods, the climatology (1981-2010) and the period (2011-2016) were studied comparing the mean of climate parameters over the two periods. Household survey was conducted through individual semi-structured interviews (SSI) and group discussions. The SSI was carried out with 271 households' heads within twelve villages while group discussions were done with pastoralists of 5 to 10 respondents.

The analysis was carried out on annual and monthly rainfall, monthly temperature, rain onset, rain cessation, the number of rainy days and the length of rainy season using R-packages and Excel software. The methodology of Somé and Sivakumar (1994) were used in the computation of onset, cessation, length of rainy season. Survey data were submitted to a statistical analysis using the Statistical Package for Social Science (SPSS) software, version 23.

The obtained results were presented in charts and tables. Furthermore, a survey on threatened forage species, was carried out both through an individual survey with 271 respondents (pastoralists, agro-pastoralists) and group discussions. The name of different forage species investigated was given in local languages: *Gourmathe*, *Mossi* and *Fulani* and their scientific names were determined accordingly.

Results and Discussion

Climate parameter studied (Rainfall and temperature) are experiencing important variabilities and changes within Kompienga province; more perceptible in monthly temperature than in monthly rainfall. These changes and variabilities affect negatively crops production and pasture growth within rangelands. This is in line with the viewpoint of Thornton *et al.* (2007) who think that the most visible impacts of climate changes on the pastoral system, is changes in primary productivity of crops, forages and rangelands. In addition, climate deterioration will affect forage quality. Indeed, Minson (1990) indicated an increased lignification of plant tissues with a rise in temperature. Consequently, forage digestibility decreases, resulting in lower animal production. This may affect negatively food security and incomes of pastoral households through the reduction of milk and meat production.

From respondents' perspective, changes in climate condition of Kompienga Province are affecting pastoral resources negatively during the last 30 years (Figure 1). Indeed, pastoralists and agro-pastoralists asserted that the changing climate have induced: (i) disappearance of herbaceous and woody forages species (100% of respondents); (ii) decline of herbaceous and woody forages nutritive quality (97.8% of respondents); (iii) shortage of pasture biomass over the last 5, 10 and 20 years (respectively by 99.6%, 93.3% and 73.8% of respondents) (Figure 1).

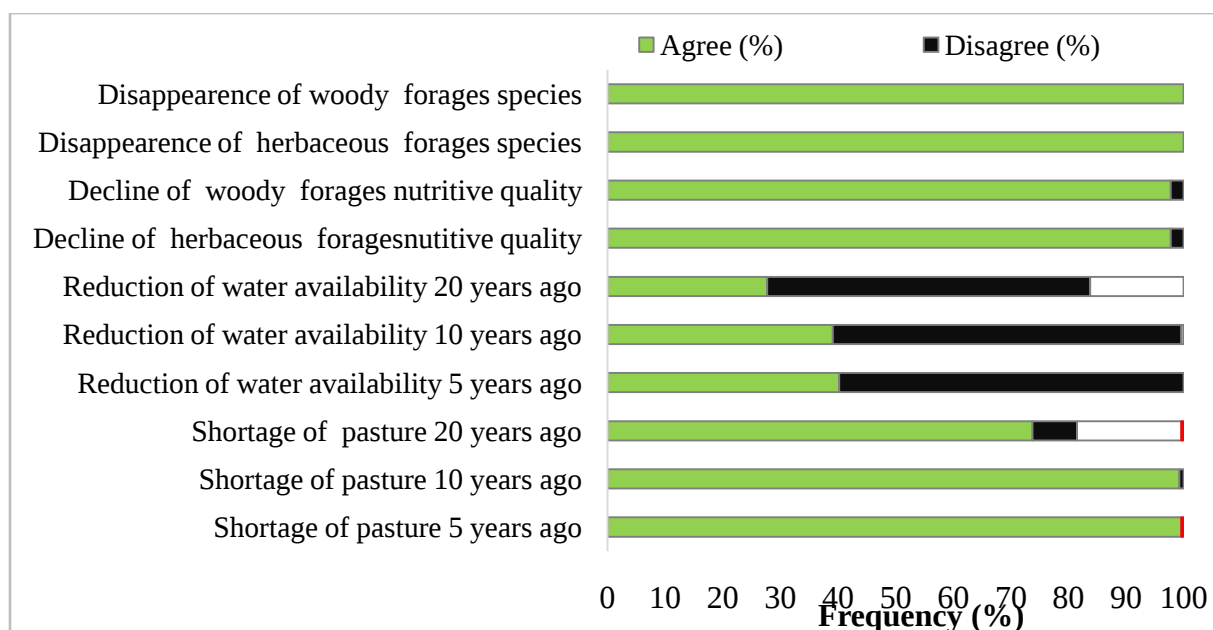


Fig.1: Impacts of climate change on pastoral resource

This situation affects negatively the production performance of the pastoral system which directly relies on the productivity of natural grassland. These results are corroborated by Zampaligré *et al.* (2013) in their findings across different zones of Burkina Faso. These authors found from pastoralists and agro-pastoralists shrinkage of grazing areas and the decline of forage resources over the past 20 years. Furthermore, similar results were found by Breusers (2001), Sawadogo (2011) and Kiema *et al.* (2013). They attest that a decreased rainfall affects negatively the quality of pasture biomass and their productivity, inducing ultimately, the disappearance of most palatable species within grazing lands. Moreover, it was reported that climate change is affecting pastoral resources (Joshi *et al.*, 2013) through decreases in water and pasture, the replacement of palatable grasses by invasive weeds (Gentle and Thwaites 2016). Similarly, Han and Hou (2011) and Maina and Mundia (2016), respectively, in Suniteyou District of China and Kajiado Region of Kenya, found that pastoral resources were negatively affected by climate change.

Both individual survey and group discussion depicted that numerous forages are threatened or already disappeared from grazing lands. These forages names were given in three local languages: *Fulani*, *Gourmatche* and *Mossi*. Most of forages species reported in local languages could not be identified by their scientific names. Indeed, from the individual survey, only 5 (11.6%), 10 (47.6%) and 11 (15.1%) forages species were identified out of 43, 21 and 73 species respectively indicated in *Gourmatche*, *Moore* and *Fulani* (Figure 2).

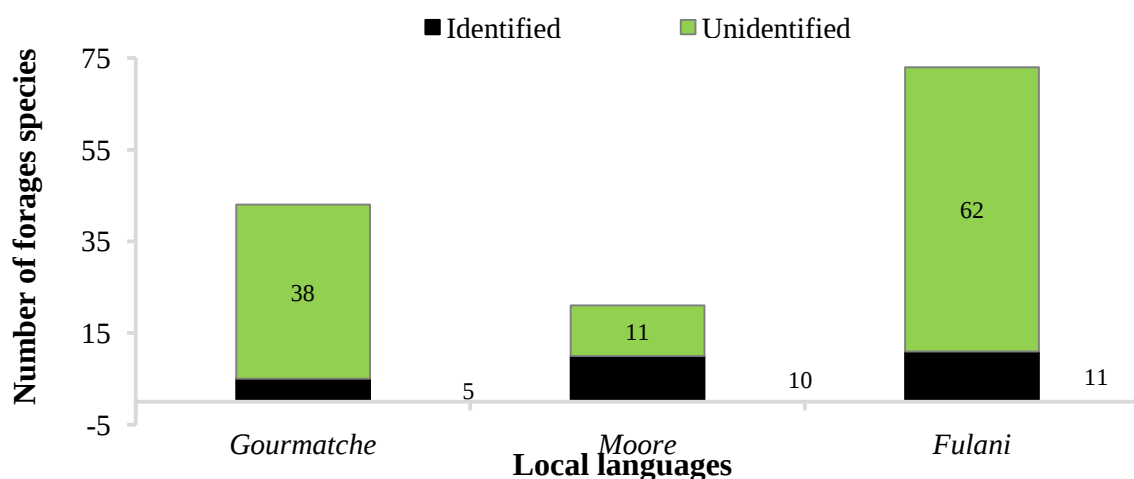


Fig.II: Number of forages species threatened or disappeared according to ethnic group

Over the last six years (2011-2016) the rainy season in the province last 111 days (3 months and 21 days) with an onset and a cessation of respectively 20th June and 10th October. The rainfall dictates the growth and the establishment of pasture. Its availability, according to respondents, last about four months after the onset (20th June to end of October). Therefore, livestock is facing a long period (about 6 to 7 months) of forage deficit that encourages departure in transhumance to find pasture elsewhere. Unfortunately, this practice is gradually disturbed during the recent years by numerous constraints. Recently, the main host countries (Togo and Benin) have established official dates of entry and release from their countries (MAEH, 2016; MAEP, 2017). These authorized durations are far shorter than the necessary duration (about six months). According to the respondents, the best return period from transhumance that could be suitable for now is June. This will allow to cope with forage scarcity of Burkina Faso grazing lands.

Conclusion

The results have shown that there are changes in climate conditions over the last decades within Kompienga province. However, these changes are more perceptible in monthly temperature than in monthly rainfall. These changes and variabilities are seen by respondents to have caused the disappearances of some forage species and affected negatively pasture quality and growth within rangelands. This underpins underperformances in livestock production and reproduction. The Government must undertake a comprehensive study to introduce as much as possible most palatable forage species within the grazing lands where they are threatened/disappeared.

References

African Union. (2010). *Policy framework for pastoralism in Africa: Securing, Protecting and Improving the Lives,*

- Livelihoods and Rights of Pastoralist Communities*. Addis Ababa, Ethiopia. Retrieved from www.africa-union.org
- Breusers, M. (2001). Searching for livelihood security: Land and mobility in Burkina Faso. *Journal of Development Studies*, 37(4), 49–80. <http://doi.org/10.1080/00220380412331322041>
- Gentle, P., and Thwaites, R. (2016). Transhumant Pastoralism in the Context of Socioeconomic and Climate Change in the Mountains of Nepal. *Mountain Research And Development*, 36(2), 173–182. <http://doi.org/10.1659/MRD-JOURNAL-D-15-00011.1>
- INSD. (2008). *Recensement General De La Population Et De L'Habitation De 2006 (RGPH-2006)*. Retrieved from http://www.insd.bf/documents/publications/insd/publications/resultats_enquetes/autres_enq/Resultats_definitifs_RGPH_2006.pdf
- Joshi, S., Jasra, W. A., Ismail, M., Shrestha, R. M., Yi, S. L., and Wu, N. (2013). Herders' perceptions of and responses to climate change in Northern Pakistan. *Environmental Management*, 52(3), 639–648. <http://doi.org/10.1007/s00267-013-0062-4>
- Kiema, A., Some, L., Nacro, B. H., Compaore, H., Kagone, H., & Kpoda, C. S. Y. (2013). Stratégie d'adaptation des éleveurs de la zone Est du Burkina Faso aux Effets des changements climatiques. *Agronomie Africaine Numéro Spécial (6) Sur Les Changements Climatiques*, 79(6), 67–79.
- Liao, C., Morreale, S. J., Kassam, K. A. S., Sullivan, P. J., & Fei, D. (2014). Following the Green: Coupled pastoral migration and vegetation dynamics in the Altay and Tianshan Mountains of Xinjiang, China. *Applied Geography*, 46, 61–70. <http://doi.org/10.1016/j.apgeog.2013.10.010>
- MAEH (Ministère de l'Agriculture de l'Elevage et de l'Hydraulique. (2016). Plan Operationnel de Gestion de la Transhumance (POGT-2017).
- MAEP (Ministère de l'Agriculture, de l'Elevage et de la pêche du B. (2017). Arrêté interministériel N°2017 002/MAEP/MISP/DC/SGM/DE/SA/002SGG17 portant modification de l'arrêté interministériel N°270/MISP/MAEP/DC/SGM/SA/125SGG16 du 25 Novembre 2016 portant modalités de la campagne de transhumance 2016-2017 en République du Bénin.
- Martin, R., Müller, B., Linstädter, A., and Frank, K. (2014). How much climate change can pastoral livelihoods tolerate? Modelling rangeland use and evaluating risk. *Global Environmental Change*, 24(1), 183–192. <http://doi.org/10.1016/j.gloenvcha.2013.09.009>
- Minson, D. J. (1990). *Forage in Ruminant Nutrition*. (A. Press, Ed.), *Forage in Ruminant Nutrition*. Université du Wisconsin - Madison. <http://doi.org/10.1016/B978-0-12-498310-6.50007-9>
- Sawadogo, I. (2011). Ressources fourragères et représentations des éleveurs, évolution des pratiques pastorales en contexte d'aire protégée: Cas du terroir de Kotchari a la périphérie de la réserve de biosphère du W au Burkina Faso. *Thèse de Doctorat, Museum National D'histoire Naturelle*, 336.
- Thornton, P., Herrero, M., Freeman, A., and Mwai, O. (2007). Vulnerability, Climate change and Livestock – Research Opportunities and Challenges for Poverty Alleviation. *SAT eJournal*, 4(1), 171. <http://doi.org/http://www.dfid.gov.uk/research/climate-change.asp>
- Touré, I., Gerber, P., Djibo, S., Niang, I., and Sow, N. A. (2012). *Atlas of trends in pastoral systems in the Sahel*. (I. Touré, A. Ickowicz, A. Wane, I. Garba, & P. Gerber, Eds.).
- Zampaligré, N., Dossa, L. H., & Schlecht, E. (2013). Climate change and variability: Perception and adaptation strategies of pastoralists and agro-pastoralists across different zones of Burkina Faso. *Regional Environmental Change*, 14(2), 769–783. <http://doi.org/10.1007/s10113-013-0532-5>