DOI: https://doi.org/10.24297/jssr.v20i.9692

Niger River Water Conflicts: Explanations and Forecasts

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Abstract

The Niger River basin home to more than 100 million people invites rigorous techniques to evaluate water conflicts among riparian areas. Conflict categories of trigger, casualty, and weapon in the interval of 2000-2022 are associated with riparian areas, revealing alternative results. The correspondence analysis reveals a relationship between riparian areas and conflicts depending on whether Benin and Niger are involved in no conflicts in the basin. The inclusion of some riparian areas in the same category implies that riparian areas with different domestic traits, such as population size, political regime, political stability, the number and length of shared borders, and the intensity of scarcity of water are similar in terms of conflicts. Future extensions of the analysis will include alternative factors, such as the destruction of nature, water pollution, and population growth, to assess water conflicts in the Niger River basin. Adding dimensions would help assess the future risks of water conflicts.

Keywords: water conflicts, trigger, casualty, weapon, correspondence analysis

Introduction

The Niger River is the third largest African river, 4,200 km long, giving life to nine riparian states, namely, Benin, Burkina Faso, Cameroon, Chad, Côte d'Ivoire, Guinea, Mali, Niger, and Nigeria. The Niger River Basin is home to more than 100 million people (Andersen *et al,* 2005). Rainfall drops, land degradation, deforestation, soil erosion, and periodic droughts negatively impact food and energy production. While each state is subject to different domestic constraints, conflicts over water are bound to occur under global climate change and population increase (Theisen *et al*, 2011). Hence, riparian areas must explore access to alternative sources of freshwater under the constraints of the number of riparian areas and military means (Gleick 1993). The aim of this study is to shed light on the connections between Niger River riparians and the types of water conflicts they are involved in. We apply the statistical method of correspondence analysis (CA) to explore the implications of the definitions and categorization of water conflicts proposed by Gleick and Shimabuku (Gleick and Shimabuku 2023), namely, trigger, weapon, and casualty, using data from https://www.worldwater.org/conflict/list/. The Trigger category contains water conflicts prompted by the control of water and water systems, economic or physical access to water, and the scarcity of water. The weapons category incorporates those conflicts where water resources or water systems themselves are used as weapons intentionally, such as the release of water from dams to flood enemy territories, appropriation and poisoning water wells, and water sources. The Israeli decision to flood the Hamas tunnels in Gaza with seawater in December 2023 constitutes a perfect example of water as a weapon category. The casualty category includes cases in which water resources or infrastructure have become direct targets of violence. We find two distinct pictures of the correlation between riparian areas and conflicts based on the absence of Niger and Benin. The first picture, covering Niger and Benin, indicates a similarity between Burkina Faso and Côte d'Ivoire, unlike the second picture, which differentiates between Burkina Faso and Côte d'Ivoire. CA implies a similarity of connection of Guinea, Chad, Cameroon, Mali, and Nigeria to the trigger category and their formation of a cluster. None of the water conflicts in the basin are international, and all are domestic. Therefore, any view connecting the geographic contiguity of riparian areas with water conflicts in the basin is incompatible with the observations. The normalization and standardization of the data highlights the particular power of the CA method. They generate orderings of riparian states in terms of their involvement in water conflicts; they do not correlate the types of conflicts and riparian states.

Water conflict data in the Niger River Basin between 2000-2022 as follows:

2002 Trigger (Mali)

Protests in Bamako over the increase in water and power tariffs by the government.

2002 Casualty (Côte d'Ivoire)

Four wells were found in the human remains. Conflict between the government of Laurent Gbagbo and opposing rebel forces leads to extensive violence and regional conflict. Several mass graves were discovered in Bangolo in late September 2002. In Zeregbo and Bahably, four water wells were found in the human remains. Early reports indicate that Western rebel groups who captured the area killed people in the mass graves and wells between December 2002 and January 2003.

2002 Casualty (Côte d'lvoire)

Youths claiming to be members of the Group of Patriots for Peace (GPP) destroyed facilities of the Ivoirian Water Distribution Company, the Ivoirian Electricity Company, and local water, electric, and telecommunication facilities on October 10. Demonstrators say they were protesting the "free" supply of water, electricity, and telephone in rebel-controlled areas.

2003 Casualty (Nigeria)

A group of women on canoes blocks water access to naval bases by protesting safeguards on oil standards in the Niger Delta.

2004 Trigger (Côte d'lvoire)

Riots occur at the main prison in Abidjan over a water shortage.

2004 Trigger (Nigeria)

Students protest over water shortages.

2004 Weapon (Côte d'lvoire)

On November 4, the army carries out "Operation Dignity" and mounts surprise attacks on Bouake, stronghold of opposition forces and the largest city in the north, shattering an 18-month ceasefire. The Government cut off electricity and water supply to the north on the day before the attacks. The patients remained off for approximately a week.

2004 Trigger (Côte d'lvoire)

There were two incidents in early November in Abidjan's main jail, La Maison d'arrêt et de correction d'Abidjan (MACA), in which prisoners were killed. The first incident was sparked by a lengthy water shortage; prisoners reportedly did not have water for five days, except for small amounts of drinking water. At least seven prisoners died and 30 were injured in the ensuing riots. U.N. human rights officials said that they were investigating the riot and could not give a final death toll.

2007 Trigger (Burkina Faso)

Declining rainfall has led to increasing fights between animal herders and farmers with competing needs. In August, 2007 people were forced to flee their homes by fighting in Zounweogo Province.

2008 Trigger (Mali)

One person is killed, and five are injured when security forces open fire on protests over an attempt to privatize water services in Lere, northwestern Mali.

2008 Trigger (Nigeria)

Violent protests over the price of water in Nyanya, Abuja. Protests can result in violence, including the beating of water vendors.

2017 Trigger (Guinea)

Protests in Boke, Guinea, about a lack of water and electricity, led to clashes between police and protestors, leading to property damage, three deaths, and 41 wounds.

2017 Trigger (Guinea)

People protesting the lack of water supply are dispersed by the police after some items are set on fire, and access to a local highway is blocked in Matam, Conakry.

2017 Trigger (Guinea)

People protesting Sangarédi, Boke, and Guinea against cuts to water and power services are reported to have raided and attacked the gendarmerie, police premises, and residences of several individuals.

2017 Trigger (Guinea)

Violent clashes break out between youth and police, causing injuries on both sides, including reports of two youths sustaining injuries from a gunfire. The youth are protesting power and water cuts in Sangarédi, Boke, and Guinea.

2017 Casualty (Mali)

People identified as militants destroy several water pumps and a number of fields, and seize cattle in Kewa, Djenne, Mopti, and Mali.

2018 Trigger (Mali)

At least eight more people died in an ongoing conflict between the Fulani and Dogon communities in Mali near the town of Koro, sparked by access to water and grazing disputes. Since March 2018, the total death toll from this ongoing conflict has been 25.

2018 Trigger (Nigeria)

On a single day in Nigeria's plateau state, an attack by armed herdsmen leaves dozens in farming communities dead. This attack is part of the ongoing violence that is, in part, triggered by access to water and land resources. Reports vary in the number of dead: one cites 200 and another 86.

2018 Trigger (Nigeria)

Eleven are killed and 11 are injured during an attack by Fulani herdsmen on a farming community in Central Nigeria, ignited by the continuing conflict over land and water resources.

2019 Casualty (Burkina Faso)

On June 24, in an attack on a convoy escorting food and water supplies in Burkina Faso, at least three people were killed, and one was injured. No one claims to be responsible for the attack.

2019 Trigger (Mali)

Thirty-seven civilians were killed in the ongoing conflict between herders and farmers who were fighting access to water and land resources in central Mali.

2019 Trigger (Chad)

Herders and farmers who used to coexist peacefully are now inflicting deadly wounds on each other during fights driven by water shortages in the Sahel region of Chad.

2019 Trigger (Mali)

More than 130 people were killed in the conflict between hunter and herder communities in Mali. In this instance, dogon hunters are accused of attacking Fulani herders.

2019 Trigger (Mali)

A series of massacres in central Mali, fueled by conflicts over land and water resources, caused 50,000 people to flee their homes.

2020 Trigger (Chad)

In January, members of the Arab and Boulala communities clashed in the area of Djokhana (Dababa, Hadjer-Lamis) and had overuse of water wells. Six people were killed in the study.

2020 Trigger (Chad)

Around June 1, youth militias from Kouri Bougoudi and Sakine Chad clashed over water for their cattle at Hadjar Hadid (Ouaddai). A dozen people have been reported to have been injured.

2020 Trigger (Guinea)

On July 14, residents demonstrated in Siguiri town (Siguiri, Kankan), Guinea, to demand better electricity and water supplies. Security forces fire tear gas to disperse it, injuring several people.

2020 Trigger (Burkina Faso)

On July 11, members of the Lobi and Dogosse communities clashed over the use of a water pump for a Lobi customary rite in Tako-Yoyora (Loropeni, Poni), Burkina Faso. Three people were killed and two were injured.

2021 Trigger (Guinea)

On May 17, villagers of Dankakoro and Banfelebougou villages, Guinea, engaged in fire fights around Dankakoro village over access to a disputed water point. Eleven individuals were shot and injured.

2021 Trigger (Cameroon)

On May 18, villagers fought over access to a water point in Waza village (Logone-et-Chari, Extreme-Nord), Cameroon. One person was killed, and two others were injured.

2021 Trigger (Cameroon)

On December 9, armed men from the Musgum and Massa ethnic groups clashed with Arab Choas in Kousseri town (Logone-et-Chari, Extreme-Nord), Cameroon, over ownership of a water spot. At least 22 people were killed over three days, and hundreds of people were displaced to N'Djamena in Chad.

2021 Casualty (Burkina Faso)

In December, militants sabotage the electric lines and destroy the water pump near Ouorou (Toeni, Sourou), Burkina Faso, cutting off the water supply to the area.

2022 Casualty (Mali)

On January 3, ISWAP (Greater Sahara) militants attacked the villages of Labodji, Doreye, and Oussadia in Gao and Mali. Four people were killed, houses were burned, and the water tank was destroyed.

Materials and Methods

CA is useful for exploring the relationships between categorical variables. It starts with a simple tool to visualize data by constructing a contingency table, which is a cross-tabulation of two categorical variables. The goal of correspondence analysis is to capture the most important patterns of association or dissimilarity between categorical variables while reducing dimensionality. The CA uses the contingency table to place each variable as a point on a biplot graph showing the correspondence between types of water conflict and Niger River riparian areas. The biplot can be interpreted as follows:

1) The distance between variable points explains the strength and the nature of connection between variables.
2) The closer the points get to each other, the higher is the correlation between variables.
3) Data points forming clusters identify a trend, an association, between riparians and types of water conflict.

The contingency table (Table 1), based on data provided by Gleick and Shimabuku (Gleick and Shimabuku 2023), displays the association between the Niger River riparian states and categories of water conflict.

The table displays the frequency counts or proportions of observations that fall into each combination of categories for the two variables. Row and column profiles were calculated from the contingency table. The row profile represents the distribution of one variable's categories across rows, whereas the column profile represents the distribution of the categories of the other variables across columns. Because there were two variables in this study, a simple correspondence analysis was used.

The results of the correspondence analysis are visualized on a biplot, which is a two-dimensional graphical representation of row and column categories in a low-dimensional space. The distances and angles between points reflect the strength and nature of the relationships between categories. Inertia, also known as total inertia or total variance, is equal to the chi-square divided by the total frequency. The chi-square test assesses the goodness of fit

between the observed and theoretically expected values. Therefore, inertia represents the mean of the chi-square values that measure the total variability of the goodness of fit of the data. It finds a lower-dimensional representation of the data that retains as much of the total inertia as possible and, therefore, the total spread of observations in the dataset.

Inertia is calculated as the sum of the squared distances between each observation and the overall centroid (mean) of the data to evaluate the amount of information preserved in a biplot. We use the "ca" R package to obtain the mass of each point, inertia of the point, contribution of the point to the inertia of the dimension, and contribution of the dimension to the inertia of the point values (Nenadic and Greenacre 2007). The biplot of row and column variables used to visualize the results of multivariate data analyses was drawn using the *"factoextra"* R package (Kassambara and Mundt 2020). The statistical significance level was set at $P < 0.05$. Hence, the null hypothesis has a chance smaller than %5, that is, there is a smaller chance than %5 of committing a Type-1 error corresponding to inferring that there exists a relationship while there is no relationship.

Results and Discussion

Correspondence Analysis Results <u>with</u> Benin and Niger

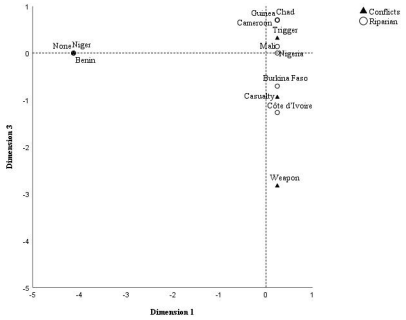

Figure 1. Biplot of row-column variables including Benin and Niger

Table 2 shows that the total inertia was different from 0, as a result of the chi-square test ($\chi 2=48.6$, $p=0.002$). The contribution of the row and column variables to the dimensions and inertia values explained are given in the table.

Accordingly, there is a relationship between countries and conflicts. The rows and columns are not independent of one another. It is also observed that 74.1% of the total inertia is explained by the first dimension, 14.8% by the second dimension, and 11.1% by the third dimension.

The biplot shows that Burkina Faso and Côte d'Ivoire are mostly correlated with casualty type of water conflict, while Côte d'Ivoire is the unique riparian closest to the weapon category (Figure 1). The contingency table shows that Côte d'Ivoire and Burkina Faso are involved in an unequal number of casualty conflicts: Burkina Faso is involved in two, and Côte d'Ivoire in only one. However, their difference does not prevent their strong connection to the casualty category. The connection of Mali, Nigeria, Cameroon, Chad, and Guinea with the trigger category identifies a cluster, and therefore, a trend. Consequently, while Côte d'Ivoire and Burkina Faso are also involved in an equal number of trigger conflicts as Cameroon and Chad, they are not placed in the trigger cluster but are closely connected to the casualty category. Niger and Benin, being involved in no water conflicts, formed a group distant from others.

Correspondence Analysis Results <u>without</u> Benin and Niger

When Table 3 is examined, the inertia values of countries and conflicts, contribution of the points to the dimensions, and contribution of the dimensions to the points are observed. Benin and Niger have the highest rate of explanation of total inertia (inertia = 0.472). Accordingly, Benin (inertia = 0.472) and Niger (inertia = 0.472) make the largest contribution to the first dimension among the categories of the country variable. The "none" category affects inertia the most (inertia = 0.944) in the category of water conflicts.

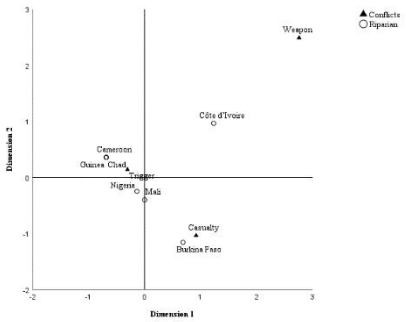

Figure 2. Biplot of row-column variables excluding Benin and Niger

According to Table 4, it can be concluded that the total inertia was not different from zero, as a result of the chi-square test ($\chi 2 = 11.9$, $p = 0.614$). Accordingly, it can be said that there is not a relationship between countries and conflicts and that the rows and columns are independent of each other. It is also observed that 57.1% of the total inertia is explained by the first dimension and 42.9% by the second dimension.

Figure 2 offers an alternative picture in the absence of Benin and Niger. The first difference concerns Côte d'Ivoire and Burkina Faso: Burkina Faso is now strongly connected with the casualty category, while Côte d'Ivoire is distant and the only riparian associated with the weapon category. Thus, the second biplot represents weapon data better than the first one because the single observation of weapon data is associated with Côte d'Ivoire rather than other riparian areas. Figure 2 again reveals that Cameroon, Guinea, Chad, Nigeria, and Mali are clustered around the trigger category, but there is a larger distance between Côte d'Ivoire and Burkina Faso. Thus, the absence of Niger and Benin accentuates correlative differences among riparians; it shows a crisp distinction among groups against the two separate cases of Côte d'Ivoire and Burkina Faso.

Table 1. Contingency table

		Water Conflict Categories			
		Trigger	*Casualty*	*Weapon*	*Total*
Riparian	*Benin*	0	0	0	0
	Burkina Faso	2	2	0	4
	Cameroon	2	0	0	2
	Chad	3	0	0	3
	Côte d'Ivoire	3	1	1	5
	Guinea	6	0	0	6
	Mali	6	2	0	8
	Niger	0	0	0	0
	Nigeria	4	1	0	5
	Total	26	6	1	33

Table 2. Number of dimensions and inertia values including Benin and Niger

					Proportion of inertia	
Dimension	*Singular value*	*Inertia*	*Chi-square*	*p*	*Accounted for*	*Cumulative*
1	1.00	1.00			0.741	0.741
2	0.447	0.200			0.148	0.889
3	0.387	0.150	48.6	0.002	0.111	1.000
Total		1.350			1.000	1.000

Table 3. Number of dimensions and inertia values

			Score in Dimension			**Inertia**	**Contribution**					
							Of Point to Inertia of Dimension			**Of Dimension to Inertia of Point**		
		Mass	**1**	**2**	**3**		**1**	**2**	**3**	**1**	**2**	**3**
Conflicts	*None*	0.056	-4.123	0.000	0.000	0.944	0.944	0.000	0.000	1.000	0.000	0.000
	Trigger	0.750	0.243	0.315	-0.142	0.083	0.044	0.167	0.039	0.529	0.400	0.071
	Casualty	0.167	0.243	-0.946	1.067	0.150	0.010	0.333	0.490	0.065	0.444	0.490
	Weapon	0.028	0.243	-2.837	-2.562	0.172	0.002	0.500	0.471	0.009	0.581	0.410
	Active Total	1.000				1.350	1.000	1.000	1.000			
Riparian	*Benin*	0.028	-4.123	0.000	0.000	0.472	0.472	0.000	0.000	1.000	0.000	0.000
	Burkina Faso	0.111	0.243	-0.705	1.194	0.093	0.007	0.123	0.409	0.071	0.267	0.663
	Cameroon	0.056	0.243	0.705	-0.367	0.019	0.003	0.062	0.019	0.176	0.667	0.157
	Chad	0.111	0.243	0.705	-0.367	0.037	0.007	0.123	0.039	0.176	0.667	0.157
	Côte d'Ivoire	0.139	0.243	-1.269	-0.992	0.161	0.008	0.500	0.353	0.051	0.621	0.329
	Guinea	0.167	0.243	0.705	-0.367	0.056	0.010	0.185	0.058	0.176	0.667	0.157
	Mali	0.222	0.243	0.000	0.413	0.028	0.013	0.000	0.098	0.471	0.000	0.529

Niger	0.028	-4.123	0.000	0.000	0.472	0.472	0.000	0.000	1.000	0.000	0.000
Nigeria	0.139	0.243	0.141	0.257	0.013	0.008	0.006	0.024	0.630	0.095	0.275
Active Total	1.000				1.350	1.000	1.000	1.000			

1. **Table 4.** Number of dimensions and inertia values excluding Benin and Niger

					Proportion of inertia	
Dimension	*Singular value*	*Inertia*	*Chi-square*	*p*	*Accounted for*	*Cumulative*
1	0.447	0.200			0.571	0.571
2	0.387	0.150			0.429	1.000
Total		0.350	11.9	0.614	1.000	1.000

Table 5. Normalized conflict scores and water conflict indicator

Riparians	***Trigger***	***Normalized Value***	***Casualty***	***Normalized Value***	***Weapon***	***Normalized Value***	***Indicator Value***
Benin	0	0	0	0	0	0	0
Burkina Faso	2	1/3	2	1	0	0	0.44
Cameroon	2	1/3	0	0	0	0	0.11
Chad	3	1/2	0	0	0	0	0.16
Côte d'Ivoire	3	1/2	1	1/2	1	1	0.66
Guinea	6	1	0	0	0	0	0.33
Mali	6	1	2	1	0	0	0.66
Niger	0	0	0	0	0	0	0
Nigeria	4	2/3	1	1/2	0	0	0.39

Table 6. Standardized conflict scores and water conflict indicator

Riparians	***Trigger***	***Standardized Value***	***Casualty***	***Standardized Value***	***Weapon***	***Standardized Value***	***Indicator Value***
Benin	0	−1.385	0	−0.808	0	− 0.354	−0.849
Burkina Faso	2	−0.423	2	1.641	0	−0.354	0.288
Cameroon	2	−0.423	0	−0.808	0	−0.354	−0.528
Chad	3	0.058	0	−0.808	0	−0.354	−0.368
Côte d'Ivoire	3	0.058	1	0.4164	1	2.831	1.102
Guinea	6	1.500	0	−0.808	0	−0.354	0.113
Mali	6	1.500	2	1.641	0	−0.354	0.930
Niger	0	−1.385	0	−0.808	0	−0.354	−0.849
Nigeria	4	0.538	1	0.415	0	−0.354	0.200

The results of the correspondence analysis became more meaningful under indicators based on the normalization and standardization of water conflict scores in the Niger Basin. The normalization of scores generates values between 1 and 0, permitting comparisons. Standardization places scores based on the mean and standard deviation of the data of the three conflict categories. Normalization takes the conflict-type data of each riparian and generates normalized values by the proportion of the difference between the original and minimum values to the difference between the maximum and minimum values in the dataset. The normalized indicator value was assumed to be the mean of three normalized conflict values for each riparian, as listed in Table 5.

Normalization reveals that Mali and Côte d'Ivoire are the riparians most involved in water conflicts, while Niger and Benin are the most peaceful. The three types of conflict scores are different for Mali and Côte d'Ivoire, but their differences do not prevent them from being equally prone to water conflict in the basin. Benin and Niger are the most peaceful riparian areas, encountering no conflict in each category. The Benin and Niger populations comprised 14,219,908, 25, 396, and 840 individuals. Similarly, the number of Benin's neighbors is four, whereas Niger's number of neighbors is seven. If one hypothesizes that the higher the number of neighbors of a country, the higher its conflict incidence. Consequently, Niger is expected to experience more conflicts than Benin, but this is not the case. Therefore, this hypothesis is rejected. The difference between the Benin and Niger populations and neighbors does not imply any difference between the conflict scores of the two riparian areas.

Standardization takes each riparian's conflict-type data and generates standardized values by the ratio of the distance between the original conflict value and the mean of the data divided by the standard deviation. Each value measures the distance of the original data value from the mean in terms of standard deviation. Similar to the normalization indicator, the standardization indicator is the mean of the three standardized values displayed in Table 6.

Standardization reveals again that Mali and Côte d'Ivoire constitute the two riparian conflicts most involved, yet in contrast with normalization, Côte d'Ivoire is relatively more conflictive than Mali, as its conflict score is higher than that of Mali. Standardization yields equivalent scores as normalization generates. Overall, unlike normalization, standardization adds a ranking between Côte d'Ivoire and Mali, with the former riparian being more conflictive.

Normalization and standardization generate similar, but not identical, orderings of the nine riparian areas in terms of the water conflicts they are involved in. Normalization orders riparian areas as follows: Mali and Côte d'Ivoire appear to be riparian areas that are equally involved in the maximum amount of water conflicts, while Benin and Niger are involved in no water conflicts at all. Standardization, in turn, reveals that Mali is a unique riparian involved in the maximum amount of water conflicts, eliminating Burkina Faso. It represents Guinea and Niger as riparians that conflict equals, while Benin is again the riparian involved in the minimum number of water conflicts.

Unlike correspondence analysis, both normalization and standardization offer ordering information. We find that depending on alternative ways to categorize conflict, namely, whether Niger and Benin that suffer no conflict type are included or excluded from the data set. If Niger and Benin are included in the analysis, Chad, Guinea, Cameroon, and Mali reveal themselves as constituting a category separate from Burkina-Faso and Côte d'Ivoire. Chad, Guinea, Cameroon, and Mali were associated with the trigger category of water conflict, while Burkina Faso and Côte d'Ivoire were associated with the casualty category.

Thus, the result implies that there is a relationship between riparian areas and types of conflict corresponding to the dependence of the rows and columns of the contingency table. Nigeria has separated these two classes. However, if Niger and Benin are excluded from the dataset, the CA implies no relationship between riparian areas and types of conflict; rows and columns become independent of each other. Chad, Guinea, Cameroon, and Mali constituting a separate category imply that Chad, Guinea, Cameroon, and Mali, respectively, with 1%, 4.6%, 4.4%, and 30.3% of territories in the basin (Andersen *et al,*2005) are associated with the control of water and water systems, economic or physical access to water, and the scarcity of water, that is, the trigger conflict category. The wide discrepancy between Chad and Mali does not reflect equivalent conflict differentiation between the four riparians. Similarly, Burkina Faso and Côte d'Ivoire associated with conflicts due to water resources and water infrastructure becoming direct violence targets as 3.9% and 1.2% of their populations are in the basin, implying that low percentages of populations living in the basin do not prevent such water conflicts. As for Niger and Benin, 23.8 and 2.5 percentages of their populations

living in the basin, respectively, are distant from both groups of states. The discrepancy between the two percentages of 23.8 and 2.5 does not reflect a sharp inequality of water conflicts; in fact, both states experience no water conflicts at all according to the data.

Conclusion

This study offers three alternative descriptions of water conflicts in the Niger River Basin under normalization, standardization, and correspondence analysis. The inclusion of some riparian areas in the same category implies that riparian areas with different domestic traits, such as population size, political regime, political stability, the number and length of shared borders, and the intensity of scarcity of water are similar in terms of conflicts. Hence, data can be used in both ways: one data set with a zero point and the other without a zero point, implying different results.

Future extensions of this article will develop a correspondence analysis by including alternative factors, such as destruction of nature, water pollution, and population growth, to describe water conflicts in the Niger River basin. The added dimensions would help produce more detailed water conflict pictures.

Funding: *No financial support was received from any institution for this research.*

Ethical statement: *This research was not conducted on human subjects, human data or tissue, or animals.*

Data availability: *The scenario data that support the findings of this study can be explored interactively at the following URL: https://www.worldwater.org/conflict/list/*

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