The Impact and Response to Climate-Related Disasters in Burkina-Faso

Alexandre Zerbo (crateva@yahoo.fr)
Universidad de Oviedo Facultad de Medicina y Ciencias de la Salud
Rafael Castro Delgado
Universidad de Oviedo Facultad de Medicina y Ciencias de la Salud
Pedro Arcos González
Universidad de Oviedo Facultad de Medicina y Ciencias de la Salud

Research

Keywords: Burkina-Faso, Drought, Disaster management, Flood, Vulnerability

Posted Date: August 27th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-54750/v1

Abstract

Burkina Faso is a West African Sahelian country with climate-related risks because the disaster risk profile, and drought and floods are the main damaging natural disasters, aggravated by the phenomenon of climate change. An effective design and implementation of disaster reduction management strategies requires an understanding of risk factors and vulnerabilities, but also and an assessment of the strengths and weaknesses of national disaster response systems**.**

In this perspective, a literature review and an analysis of climate information were conducted in order to reveal the risks and vulnerabilities to droughts and floods in the country. This was accompanied by a critical evaluation of the performance of the national prevention and intervention system.

Vulnerabilities to drought and floods are exacerbated by the combined effect of climate change and the low performance of the national disaster risk reduction management system. National institutions and frameworks exist for disaster prevention and management, but difficulties persist in implementation due to financial constraints and insufficient human skills. Current trends and estimates suggest that the drawbacks of these natural hazards may be more serious in the future if solutions are not taken to improve early warning forecasts, infrastructure and the implementation of adequate agricultural policies.

1. Introduction

Burkina-Faso is a landlocked country of the Sahel region in West-Africa. The country is located between the 10^{th} and the 15^{th} northern degree latitude, with an area of 274,200 sq. km.(Bank 2011). The country has a dry tropical climate due to its geographic location; its climate is characterized by a long dry season and a short rainy season. In addition, the location in the hinterland between the Sahara Desert to the north and the coastal areas of the Gulf of Guinea to the south, gives to the country a climate with strong seasonal and annual variations. (Carrera 2018).

There are three climatic zones in the country. The northern part is the *Sahelian* zone, a climatic area which receives less than 600 mm as annual rainfall. In the centre, there is the *north Sudanian* climatic zone with an annual rainfall between 600 to 900 mm; and in the southern part, there is the *south Sudanian* climatic zone which receives more than 900mm as annual rainfall (Bank 2011).

Burkina Faso has about 19.7 million inhabitants in 2018 with a population growth rate of around 3% for the general population, the majority of which (71%) resides in rural areas (Bank 2011; Carrera 2018).

According to the United Nations Human Development Index, the country is very low ranked with a high level of illiteracy and poverty, 46% of the population is below the poverty line(2017).

The economy depends heavily on agriculture with a contribution to a third of the country's GDP and most of the population (80%) depends on this activity for their subsistence (Carrera 2018).

The development of a country could be seriously threatened by a disaster. Burkina Faso, like many African countries, has an extreme hydrometeorological event as a disaster profile. Furthermore, these events are expected to increase in magnitude and frequency due to climate change (Bank 2011).

Natural disasters are caused by too little or too much rain, in many countries in sub-Saharan Africa (Oli Brown 2009). The nature of most of the disaster in Burkina-Faso is climate-related, these disasters include chronic drought, floods, high winds, and heat or cold waves, but drought and flood are the main climate risks. Drought affects the largest proportion of the population and flood occurring in many urban areas during the rainy season (Bank 2011; Carrera 2018).

The national system of capacity to respond to the harmful effects of climatic hazards and the management of risks and adaptation to these natural hazards are determinants to reduce vulnerabilities and increase the resilience of populations. It is therefore essential to review these disasters and assess the response capacity of the national system in order to identify weaknesses, strengths and make recommendations.

In this regard, this document paper to highlight the main climate-related disasters and to appraise the national response system in Burkina Faso.

2. Methods

A climate-related disaster risk profile and critical analyse of national disaster risk management system of Burkina-Faso were conducted through literature review and statistical informations.

The statistical analysis was performed with raw data from EM-DAT (database of Centre for Epidemiology of Disaster). Data of drought and flood from 1960 (year of the country independence) to year 2018 were used to design disaster impact. These raw data were introduced in Microsoft Excel software in order to convert data in figures and show the pertinence of information.

For the literature review, the eligibility criteria were scientific articles and reports from official United Nations and World Bank reports and government publications from 1960 to 2018.

A search was performed with Google scholar and ReliefWeb as search engine. The Boolean builds “Drought AND Burkina-Faso” and Floods and Burkina- Faso” were used for Google scholar as was the search term Burkina- Faso disaster for ReliefWeb.

At the date of 15 November 2018, from Google scholar we got 37 publications from the term “Drought AND Burkina-Faso” and 7 publications from the term “Floods AND Burkina-Faso”. From ReliefWeb we got 26 publications

From these 70 publications, after removal of duplicate, screening title or reading full publication for relevance. 20 publications were kept for analysis.

These 20 publications were analysed to obtain information on vulnerability and exposure to drought and floods, disaster management and response capacities, and generate recommendations.

3. Results

3.1. Vulnerability and Climate-related hazards exposure

The impact of climate-related hazards in Burkina Faso is closely linked to the vulnerability of the population, the country's economy and the low capacity to adapt to these natural risks (Bank 2011).

Indeed, the food production is function of spatio-temporal rainfall distribution pattern in most of African country(Bekoe and Logah 2013). This is the case in Burkina Faso where livelihoods depend on rain-fed agriculture and where food security is threatened and vulnerable to unstable rainfall.(Lacombe et al. 2012).

Infrastructure like dam, and drainage system are not risk prone standards and there are often informal settlers in the floodplain, area vulnerable to disasters. In addition, Burkina-Faso has degraded soils and poor in nutrients in most regions, these soils have a low water retention capacity. During dry season, temperature spike, dust storms occur, and food supplies and yields are affected when rainfall decrease. Rivers are intermittent, apart the Mouhoun river in the western area of the country (Bank 2011).

In Burkina Faso, floods and droughts are recurrent and have consequences for the economy, livelihoods and life. About 2.1 million people suffer from chronic food insecurity and 61.7% of the population is exposed to multiple dangers (Carrera 2018).

	Value	Rank	Trend for 3 years
INFORM	5.3	33	equal
Hazard	4.2	71	Increase
Vulnerability	5.9	23	decrease
Coping Capacity	6.1	46	equal

Source infom-index

3.2. Drought

Many kinds of drought exist, the meteorological drought due to deficit of precipitation, the soil moisture drought and the hydrological drought referring to the deficit of streamflow, and groundwater. But they are all due to little precipitation and evapotranspiration([CSL STYLE ERROR: reference with no printed form.]).

The delayed rainfall and extreme drought are exacerbated by the climate change phenomenon, and West-Africa is the region more vulnerable to drought because of climate change(Giesen et al.).

As a slow onset and complex natural hazard with adverse effects on the environment, society and the economy, drought is considered to displace more people and cause more deaths than other natural hazards(Mohamed Bazza et al. 2015).

In fact, a third of the African population lives in drought-prone areas and is vulnerable to the consequences of this natural disaster([CSL STYLE ERROR: reference with no printed form.]).

Since early 1970's, Burkina-Faso has experienced a "quasi-drought" conditions (Carrera 2018). According to the data of EM-DAT, there were 11 events of drought, since 1960 in the country (figure 1).

Drought is expected to increase in frequency, duration and spatial expansion and will expose many people in the country to food insecurity (Mohamed Bazza et al. 2015).

3.3. Flood

Continuing urbanization, land use practices, social and political barriers and climate change are factors that increase the risk of flooding (Arnell and Gosling 2016).

Heavy rainfall mainly triggers floods, but the worsening is due to the occupation of at-risk areas, lack of rainwater management, inadequate maintenance of dams, non-compliance with planning regulations and poor land use management practices (Mathon et al. 2002).

Large populated cities like the capital Ouagadougou and the second main city Bobo-Dioulasso face frequent flooding. But also the northern region of the country where soil degradation is due to livestock and the southwest region which has the highest annual rainfall (Niang 2006).

According to EM-DAT data, flood is the natural disaster which cause the most direct death in the country. The number of events is increasing, we have 20 events from 1960 to 2018 and more people are affected by river floods than other types of floods.

There is an upward trend and positive correlation. The number of deaths grows with the number of affected people

3.4. Climate variability and climate change in Burkina- Faso

According to the fourth assessment report of the Intergovernmental Panel on Climate Change; the Sahel region will experience climate change in the 21st century. Variations in rainfall and temperature are expected to increase due to climate change ([CSL STYLE ERROR: reference with no printed form.]).

The unpredictability of rainfall over time and space and the increase in temperatures are expected to increase, as well as the intensity and frequency of extreme weather, including drought and floods in sub-Saharan African countries. (Case 2006; Kotir 2011).

The analysis of the climatic trends of Burkina-Faso, show a displacement of isotherms and isohyets from the north to the south of the country with a disturbance of seasonal cycle. There is a real decrease in rainfall and increase in average temperature (M. 2017). An increase in average rainfall for wet days, an increase of maximum consecutive dry days and decrease of maximum consecutive wet and dry days, are noticed in the change of climatic pattern (De Longueville et al. 2016).

According to the country's estimates, by 2025 there will be an increase of 0.8ºc in average temperature and an increase of 1.7ºC by 2050. Concerning the rainfall, there will be a slight decrease projection by 2025 of -3.4% and -7.3% by 2050 (Burkina Faso - government 2009).

The seasonal and inter-annual variability of the climate, and the climate change impact like the decrease in rainfall and the increase of temperatures (with potential risk of bush and forest fire), will have consequence on natural disaster venue, food security and the economy of the country(Burkina Faso - government 2009).

3.5. National disaster management and response

Institutions

Many institutions are responsible for disaster management and response for the country. These national institutions are involved in the prevention, monitoring, climate information and response delivery.

- The National Agency for Meteorology (ANAM): National office responsible for the collection, production and delivery of weather and climate services (ANAM report).
- The Directorate General for Water Resources (DGRE): National hydrological office responsible for information, and monitoring of groundwater and surface water.
- The Directorate General for Civil Protection (DGPC) office in charge of national fire brigade and delivery of first emergency aid.
- The National Commission for Emergency and Rehabilitation Aid (CONASUR), an interdepartmental unit whose mission is to raise awareness and educate people about disaster response and prevention. This commission provides assistance during an emergency event and the distribution of materials to help people restore their normalcy before the disaster (CONASUR report).

The CONASUR is chaired by the Ministry of Women, National Solidarity and Family and gathers representative of 13 sectors: food security, shelter, protection, infrastructures, health, nutrition, water and hygiene, logistic and transport, climate service, communication and education.

Legal framework and disaster management

To cope with disaster risks, the government of Burkina-Faso has designed many political instruments, framework and laws.

In 2014, le country has adopted the law nº 012-2014/AN from April 22-2014 which legislates on humanitarian crises and disaster response but also on risk management and prevention ([CSL STYLE ERROR: reference with no printed form.]).

The policy instruments mostly concern action plan and strategies on climate change and adaptation, information and early warning system, food security and response.

Burkina-Faso is signatory of the Hyogo framework for action. And the country has a national framework for climate services, this framework deals with climate-related disaster management though climate service. It involves the improvement of weather forecast for fast onset disaster like floods and seasonal forecast for latent disaster like drought. But also involves the establishment of meteorological early warning system and the training disaster stakeholders in the use of meteorological information(M. 2017).

In 2009, a multi-risk contingency plan was developed and revised in 2010. This contingency plan is a framework of multi-sectorial integrated approach about preparedness and emergency response(Burkina Faso - government 2009).

This contingency plan:

- States role between different national technical institutions and humanitarian stakeholders
- Enhances coordination of action of different sectors.
- Identifies and mitigates urgent risks.
- Gives an integrate framework on emergency risks.
- Keeps updated strategies for preparedness, prevention and response in national plan and programs.
- Manages the intervention to reduce the delay and then reduce numbers of victims.

With this plan, the interventions are at three levels:

- The pre-disaster level by managing intervention structure for rapid intervention.
- The disaster level, when the crisis occurs by saving victim life, coordinated assistance for first aid, assessment of damage, and information management.
- The post-disaster phase, period for rehabilitation and rebuilding for a return to normalcy.

4. Discussion And Conclusions

The impact of climate-related disasters depends on the nature and severity of the event, the vulnerability of the population and the level of exposure. Climate variability and socio-economic development of a country are factors that are interconnected and interact in the risk of natural disaster([CSL STYLE ERROR: reference with no printed form.]).

The scarcity of information on the climate, climatic variability and the slow technological evolution in the countries of sub-Saharan Africa contribute to worsen the vulnerability to climatic hazards (Dinar et al.

2008).

The climate variability and change phenomenon make the use of most modern climate information technologies essential. Furthermore, climate information should be available and accessible for all people exposed to climate-related hazards. In many low-income countries, climate services are unable to provide time-tailored and quality weather and climate information's(Lindsey Jones 2016).

Despite the will and efforts of the government of Burkina Faso and national institutions for disaster preparedness and response, only a few emergency information and emergency response services can be provided. The response is delivery with low performance because of the insufficiency in institutional and human capacity and limited financial resources. Also because of the lack in preparedness and intervention equipment tools to face disasters (Carrera 2018).

Even though Burkina-Faso has ratified most of international conventions for disaster risk reduction, their implementation remains difficult. The implementations face limited financial resources and low-skilled human capacities. The national legislative instruments are in the majority limited because of inadequate implementation protocol.

The national office for meteorology lack in performance to delivery weather forecast, and there is no flood early warning system in the country. The CONASUR and DGPC have limited capacity in delivery first emergency response. DGESS/ SAP has low capacity to deliver information on food security (Bank 2011).

Referring to Lugen's research work on climate services in Burkina Faso, there are difficulties in communication, understanding and providing precise information on climate information. And also a low density and quality of the climate network service and weather forecasts are not provided on a localized scale. Added to this, there is a problem of understanding of climate information by the most illiterate rural communities.(M. 2017).

The oriented solutions strategies could be more axed on :

The reinforcement of climate service performance in the delivery of forecast as early warning tools. The training of communities in the understanding of climate information.

The improvement of drainage and sewage system and the strengthening of infrastructures to face flooding.

A better implementation of agriculture policies to face drought threat and prevent food insecurity., through the implementation of a sustainable farming practice with drought resistant crop

Declarations

Acknowledgements

NA

Competing interests

The authors declare that they have no competing interests.

Funding

NA

Authors'contributions

A, Zerbo has conducted the data curation and analysis under the supervision of P, Arcos and R, Castro.

Availability of data and materials

The datasets generated and analysed during the current study are available in the [EM-DAT: The Emergency Events Database - Université catholique de Louvain (UCL) – CRED, Brussels, Belgium] repository, [www.emdat.be]; but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from a collaboration agreement between the CRED and the Unit for Research in Emergency and Disaster, University of Oviedo.

References

1. Arnell NW, Gosling SN (2016) The impacts of climate change on river flood risk at the global scale. Clim Change 134:387–401. https://doi.org/10.1007/s10584-014-1084-5
2. Bank TW (2011) Burkina Faso - disaster risk management country note. 1–28
3. Bekoe EO, Logah FY (2013) The impact of droughts and climate change on electricity generation in Ghana. Environ Sci 1:13–24. https://doi.org/10.12988/es.2013.13002
4. Burkina Faso - government (2009) Plan national multi risques de preparation et de reponse aux catastrophes - National Policy, Plans & Statements - Burkina Faso - Africa - Countries & Regions - PreventionWeb.net. https://www.preventionweb.net/english/policies/v.php?id=21621&cid=27. Accessed 14 Jan 2019
5. Carrera L (2018) Project Information Document-Integrated Safeguards Data Sheet - Strengthening Climate Resilience in Burkina Faso - P164078. 1–0
6. Case M (2006) Climate change impacts on East Africa
7. De Longueville F, Hountondji Y-C, Kindo I, et al (2016) Long-term analysis of rainfall and temperature data in Burkina Faso (1950-2013). Int J Climatol 36:4393–4405. https://doi.org/10.1002/joc.4640
8. Dinar A, Hassan R, Mendelsohn R, et al (2008) Climate Change and Agriculture in Africa. Routledge
9. Giesen N Van de, Liebe J, science GJ-C, 2010 undefined Adapting to climate change in the Volta Basin, West Africa. academia.edu

10. Kotir JH (2011) Climate change and variability in Sub-Saharan Africa: a review of current and future trends and impacts on agriculture and food security. Environ Dev Sustain 13:587–605. https://doi.org/10.1007/s10668-010-9278-0
11. Lacombe G, McCartney M, Forkuor G (2012) Drying climate in Ghana over the period 1960–2005: evidence from the resampling-based Mann-Kendall test at local and regional levels. Hydrol Sci J 57:1594–1609. https://doi.org/10.1080/02626667.2012.728291
12. Lindsey Jones BH and RG-W (2016) The changing role of NGOs in supporting climate services | Overseas Development Institute (ODI)
13. M. LB (2017) Climate services for development in Burk ina Faso: institutions, use and needs for national planning. KLIMOS Work Pap n°13, KLIM:84
14. Mathon V, Laurent H, Lebel T, et al (2002) Mesoscale Convective System Rainfall in the Sahel. J Appl Meteorol 41:1081–1092. https://doi.org/10.1175/1520-0450(2002)041<1081:MCSRIT>2.0.CO;2
15. Mohamed Bazza, Emmanuel Chinyamakobvu, David Coates, et al (2015) Capacity Development to Support National Drought Management Policies | Integrated Drought Management Programme
16. Niang D (2006) Fonctionnement hydrique de différents types de placages sableux dans le sahel burkinabè. https://doi.org/10.5075/EPFL-THESIS-3667
17. Oli Brown AC (2009) Rising Temperatures, Rising Tensions: Climate change and the risk of violent conflict in the Middle East | IISD
18. (2017) Burkina Faso Country Profile | U.S. Agency for International Development. https://www.usaid.gov/documents/1860/burkina-faso-country-profile. Accessed 7 Jan 2019
19. AR4 Climate Change 2007: Impacts, Adaptation, and Vulnerability — IPCC. https://www.ipcc.ch/report/ar4/wg2/. Accessed 11 Jan 2019a
20. ANAM : Agence Nationale de la Météorologie - Burkina Faso. http://www.meteoburkina.bf. Accessed 14 Jan 2019b
21. Conseil National de Secours d'Urgence et de Réhabilitation (CONASUR). http://www.conasur.gov.bf/. Accessed 14 Jan 2019c
22. Assemblée Nationale du Burkina Faso. https://www.assembleenationale.bf/spip.php?rubrique17. Accessed 14 Jan 2019d

Figures

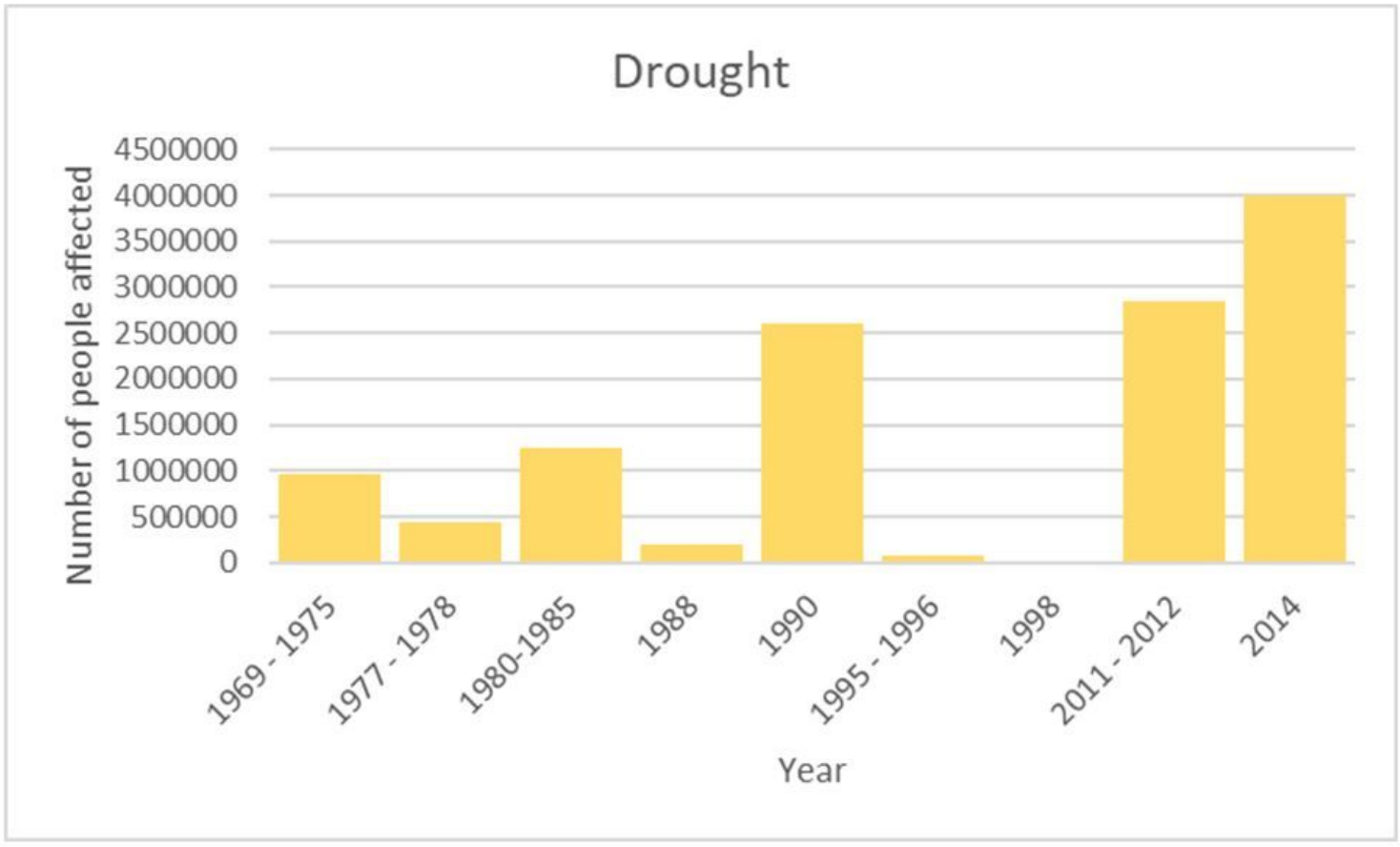

Figure 1

Number of people affected by drought from 1960 to 2018. (source EM-DAT)

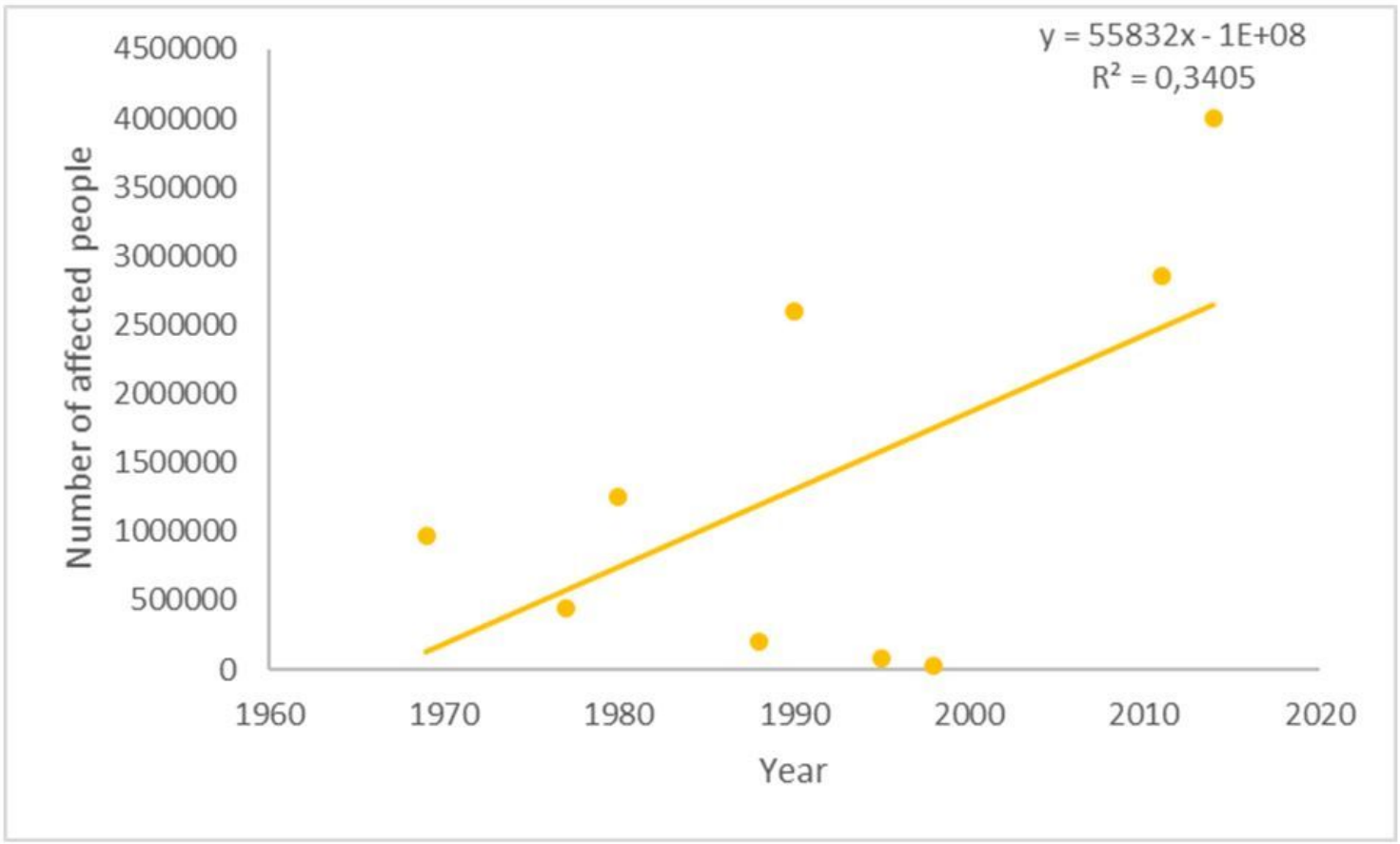

Figure 2

Correlation between the number of people affected by drought and increasing year. There is an upward trend and positive correlation.

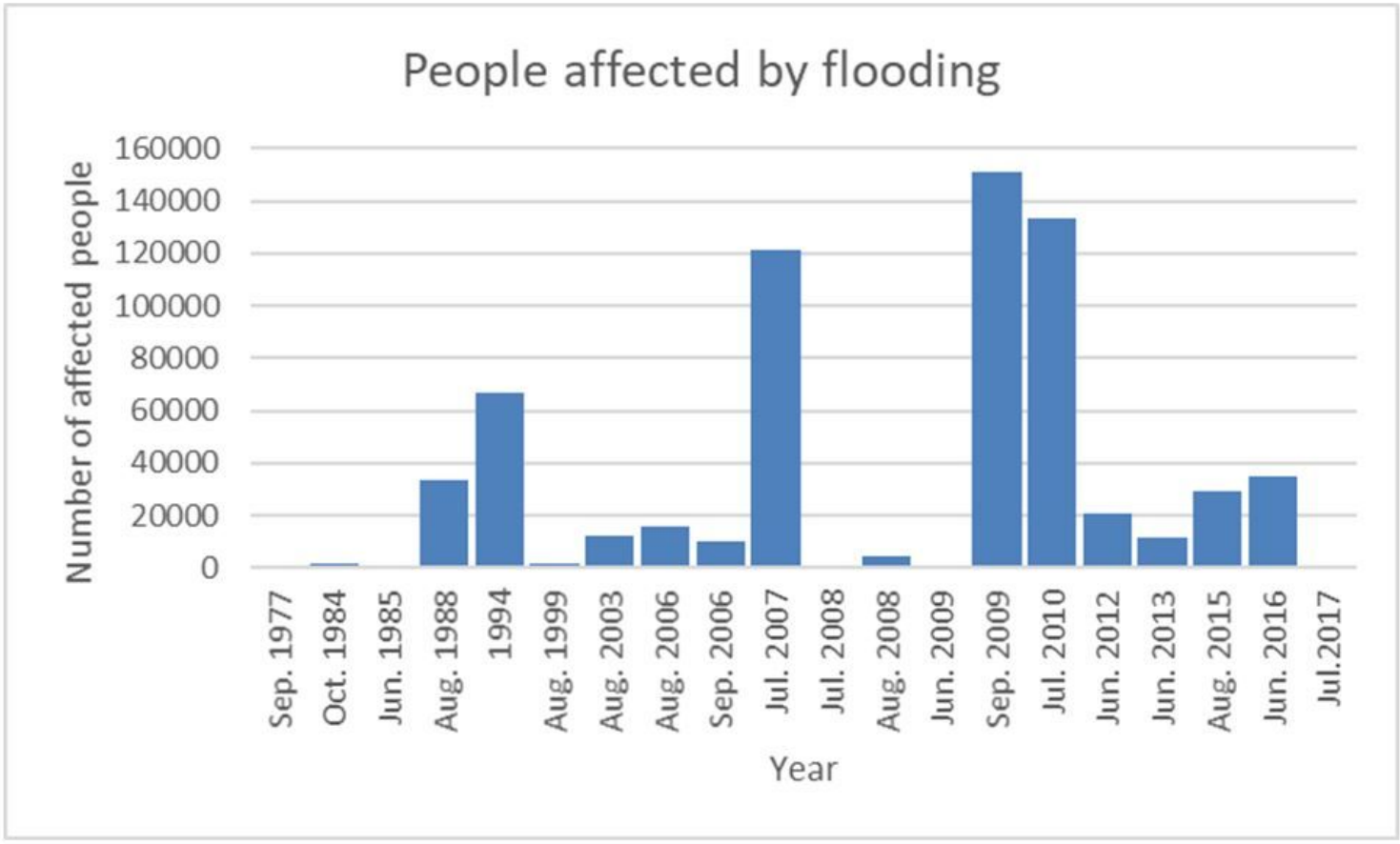

Figure 3

Number of affected people by flooding from 1960 to 2018

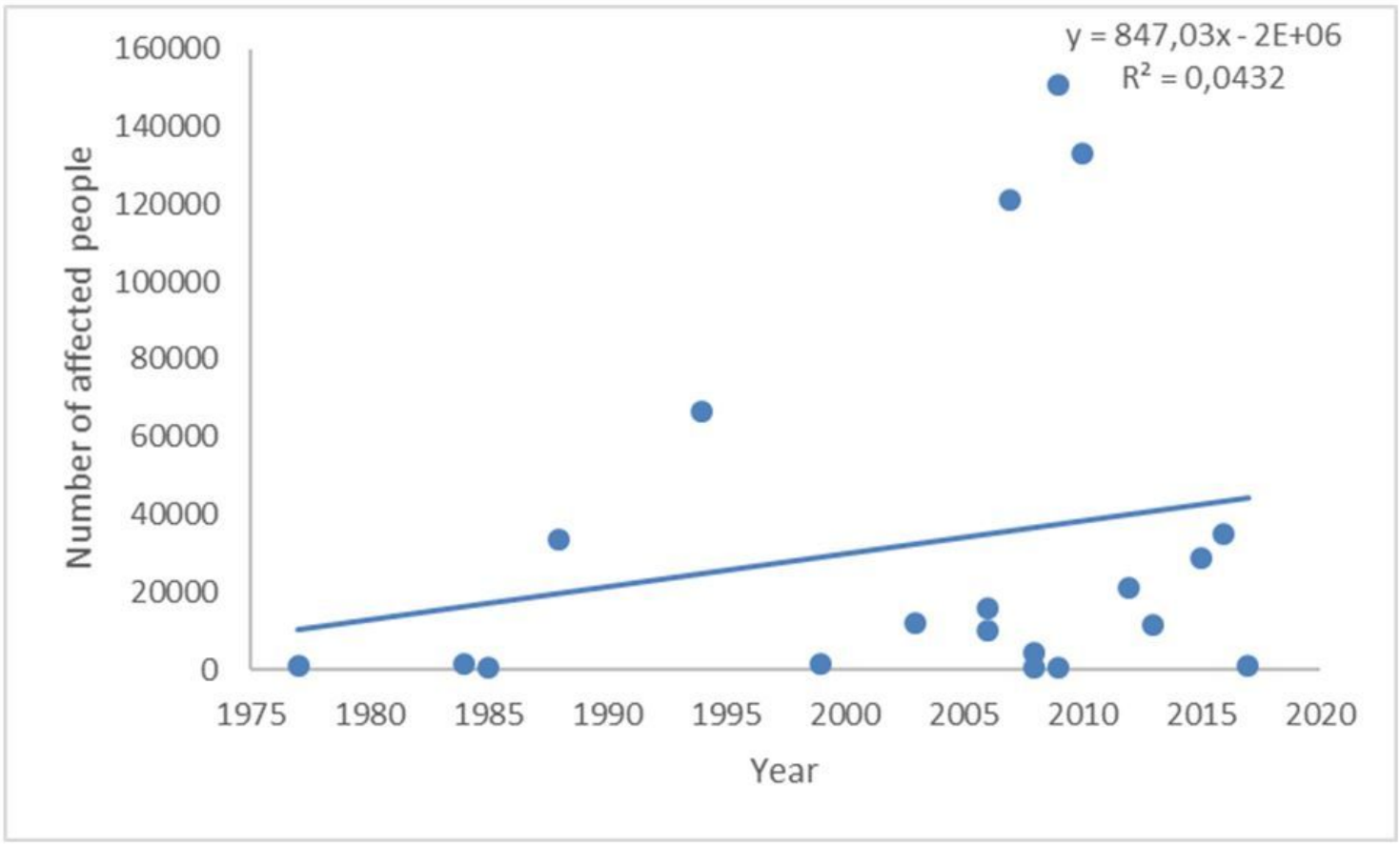

Figure 4

Correlation between the number of people affected by flooding and increasing year. There is an upward trend and positive correlation.

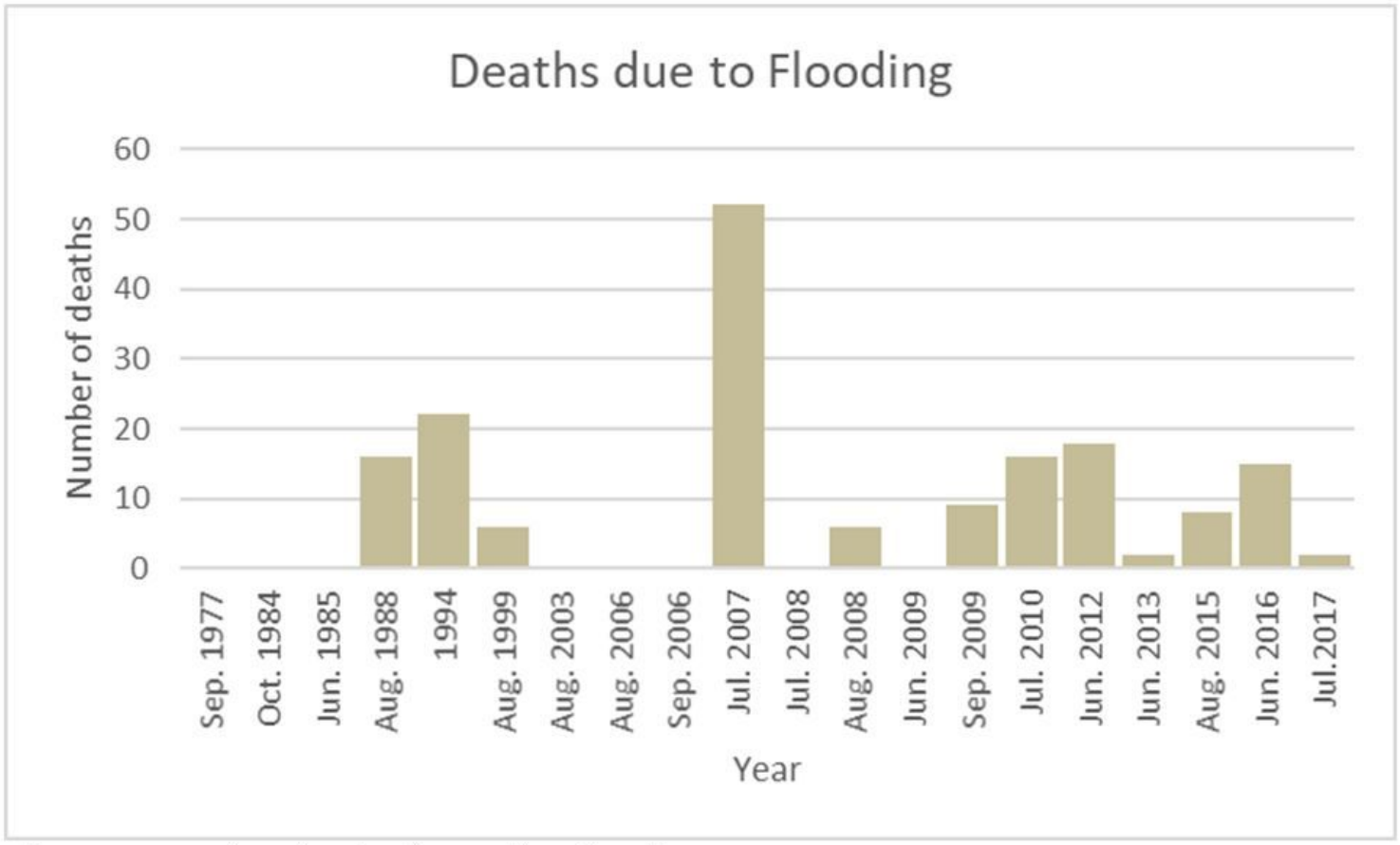

Figure 5

Number deaths due to flooding from 1960 to 2018

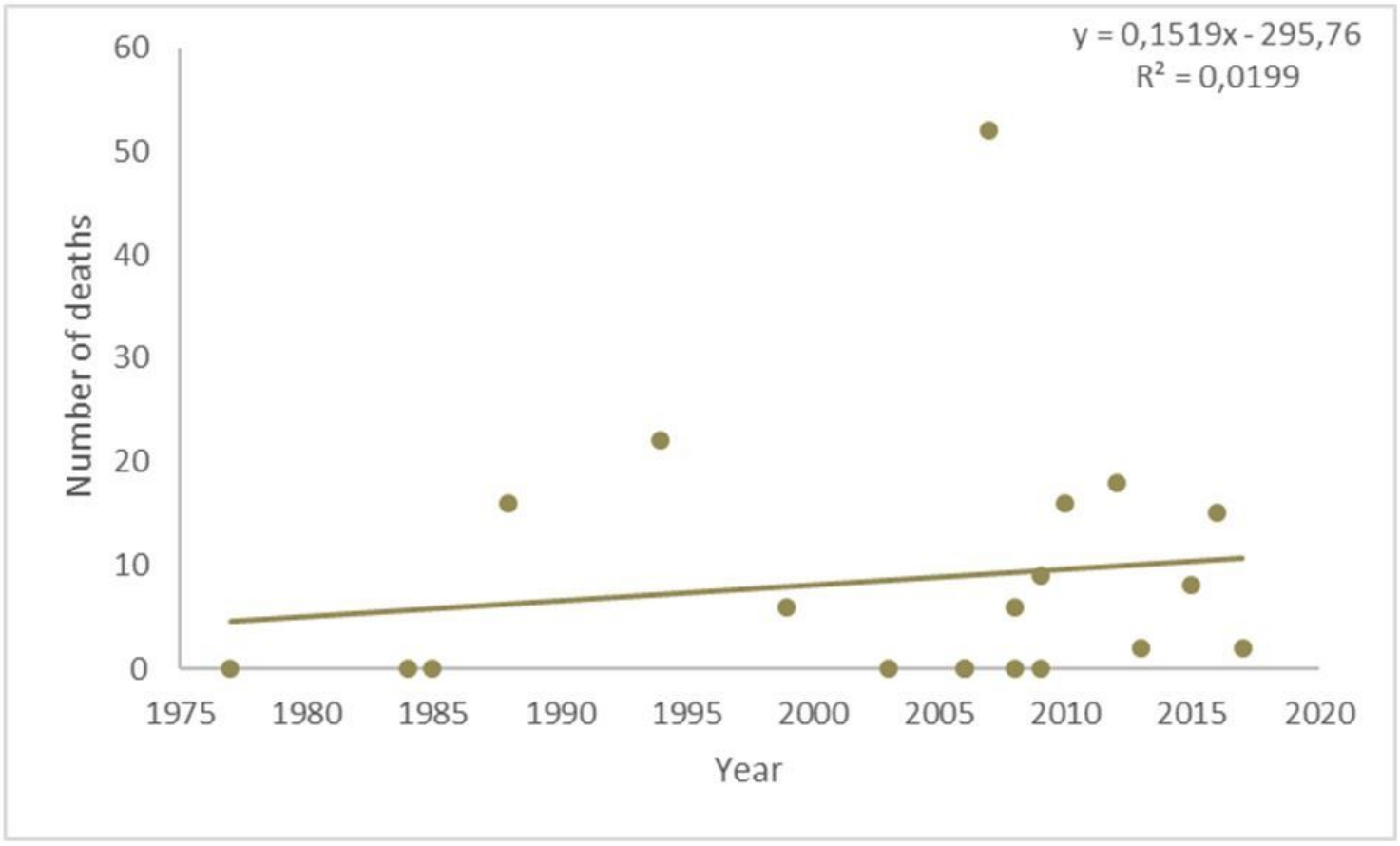

Figure 6

Correlation between the number of deaths due to flooding and increasing year. There is an upward trend and positive correlation

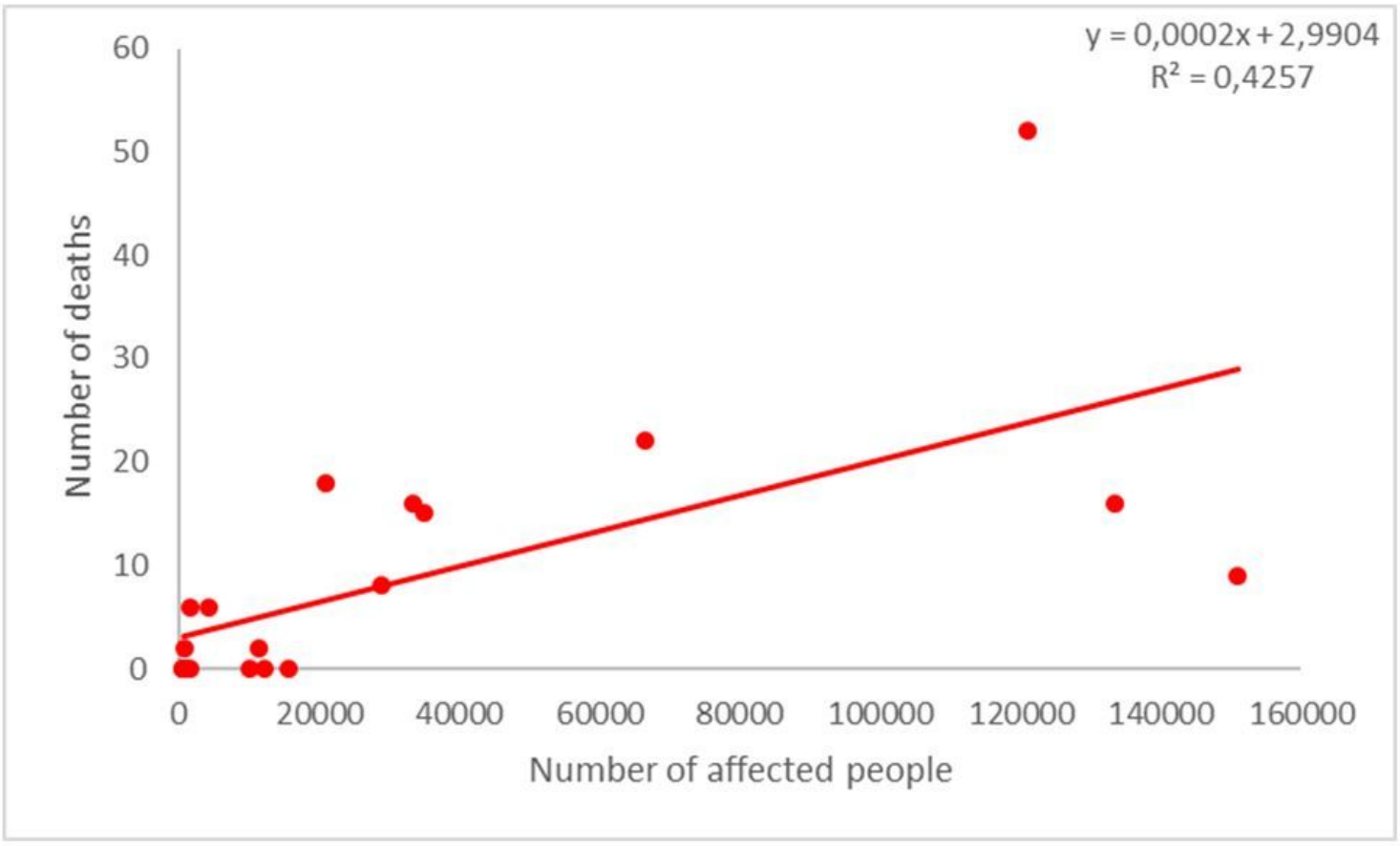

Figure 7

Correlation between the number of death and people affected. There is an upward trend and positive correlation. The number of deaths grows with the number of affected people