Dataset on the expansion and consolidation of flooded settlements in the Dosso Region, Niger

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ABSTRACT

Flood risk reduction at the local scale requires knowledge of the settlements which are most exposed to floods, and those where the existing measures are insufficient to handle the threats. The knowledge on spatial dynamics of the flooded human settlements is limited, especially that of the smaller ones, such as the settlements in the sub-Saharan Africa. The dataset on 122 flooded settlements in the Dosso Region (Niger) offers information on: the built-up area and the number of buildings with corrugated iron roofs in 2004, 2012, and 2019 (average dates), the type of human settlements (city, rural town, village, or hamlet), the flood dates and the number of buildings collapsed between 2011 and 2019. The data on the built-up area and the number of buildings with corrugated iron roofs were extracted by visual photointerpretation from very high-resolution images accessible through Google Earth Pro. The information on the settlement category was obtained from the Human Settlements National Directory (French acronym, ReNaLoc) published by the National Institute of Statistics of Niger. The dates of floods and the data on the number of collapsed buildings were obtained from the open access national database on flooding, known by the French acronym, BDINA. These data can be reused to build a geodatabase for flood risk reduction and to draft the municipal and regional development plans. Their potential reuse allows for the identification of settlements undergoing the most rapid physical expansion, built-up area in...
Specifications

| Subject                      | Social Sciences                                                                 |
|------------------------------|--------------------------------------------------------------------------------|
| Specific subject area        | Planning and Development                                                        |
| Type of data                 | Tables, Figures, Vector files                                                   |
| How data were acquired       | Visual photointerpretation of multi temporal very high-resolution (VHR) satellite images |
| Data format                  | Vector files in .kmz format and data tables in csv format                        |
| Parameters for data collection | The database includes only flooded settlements covered by three open access, VHR satellite images. The built-up area includes the developed lots and the roads providing access to these lots. Vacant lots, the ones under construction, and built-up lots more than 60 metres away from the contiguous built-up area are excluded. The roof material is considered only in the settlements covered by at least three clear images. |
| Description of data collection | All the primary data (BDINA, ReNaLoc, and VHR satellite images) are open access. The secondary data on the built-up surfaces and the buildings with corrugated iron roofs were collected by operators experienced in the observed context through visual photointerpretation of VHR satellite images. The Google Earth (GE) Pro-tools are used for built-up area tracking and surface calculation. 365 files of the built-up perimeters are collected in .kmz format and then processed in the QGIS environment for map production. For each of the 122 settlements considered, three perimeters of the built-up area are available at different dates, except for one settlement, which has two perimeters, having merged with the settlement close to the last date. The built-up surfaces are recorded on Excel. |
| Data source location         | BDINA: [https://www.inondations-niger.org/](https://www.inondations-niger.org/)  |
|                             | Institution: Institute of Bio Economy, National Research Council of Italy       |
|                             | City: Florence                                                                  |
|                             | Country: Italy                                                                  |
|                             | ReNaLoc: [https://www.stat-niger.org/?page_id=2394](https://www.stat-niger.org/?page_id=2394) |
|                             | Institution: Institut National de la Statistique du Niger                       |
|                             | City: Niamey                                                                     |
|                             | Country: Niger                                                                  |
|                             | Satellite imagery: GE Pro                                                       |
|                             | Institution: Google                                                             |
|                             | City: Mountain View                                                             |
|                             | State: California, USA                                                          |
|                             | and                                                                             |
|                             | Institution: Maxar Technologies                                                 |
|                             | City: Westminster                                                               |
|                             | State: Colorado, USA                                                            |
| Data accessibility          | Repository name: Mendeley Data                                                  |
|                             | Data identification number: DOI: 10.17632/2xhfxdtxj2.4                         |
|                             | Direct URL to data: [https://data.mendeley.com/datasets/2xhfxdtxj2/4](https://data.mendeley.com/datasets/2xhfxdtxj2/4) |
| Related research article    | M. Tiepolo, A. Galligari, Urban expansion-flood damage nexus: Evidence from the Dosso Region, Niger, Land Use Pol. 108 (2021) 105547. [https://doi.org/10.1016/j.landusepol.2021.105547](https://doi.org/10.1016/j.landusepol.2021.105547).
Value of the Data

- The built-up expansion and consolidation dataset presents an unprecedented overview of the cities, rural towns, villages, and hamlets damaged by floods between 2011 and 2019 in the Dosso Region. The accuracy of the built-up area is higher than those provided by coarse resolution satellite imagery. The dataset is useful for targeting settlements with risk reduction policies and for identifying the expansion areas.
- Local governments (municipalities), the regional government, Official development aid, NGOs, and researchers are the main beneficiaries of the data.
- The data can be used (i) to identify the most rapidly expanding settlements [1], (ii) to verify the accuracy of the built-up area obtained from the coarse resolution images, (iii) to identify the extent of the built-up area under the risk of flooding; (iv) to establish the risk reduction measures; and (v) to determine the extent and the speed of consolidation of the buildings with corrugated iron roofs.
- The value of these data lies: (i) in their detail, as they are extracted by visual photointerpretation of VHR satellite images by operators experienced with the observed context; and (ii) in their high representativeness, as they cover 40% of the flooded settlements in the Dosso region between 2011 and 2019.

1. Data Description

The dataset includes five figures and three tables. Fig. 1 shows the location of the 122 human settlements inundated between 2011 and 2019, covered by very high-resolution (VHR) satellite images on three dates between 2001 and 2020, accessible via GE Pro.

Fig. 2 shows the dates on which the VHR satellite images of the 122 settlements are freely available on GE Pro.

Fig. 3 shows the accuracy in determining the built-up edge achievable through the visual photointerpretation of VHR satellite images freely accessible from GE Pro-compared to that achieved by HBASE dataset, based on Landsat 8 coarse resolution satellite images. The case illustrated is the outskirts of the city of Gaya.

Figs. 4 and 5 show the built-up area on the three dates for the city of Dogondoutchi, the rural town of Velou, the village of Gattawani Kaina, and the hamlet of Dey Koukou Ouest Fang. These settlements are just four examples of some of the most rapidly expanding human settlements amongst the 122 considered. The maps are produced from shape files freely available in the Mendeley repository.

The tables list each of the 122 flooded settlements, ranked alphabetically, provided with a code that allows them to be identified in Fig. 1, the municipality and the settlement category (hamlet, village, rural town, or city) to which they belong. This is followed by data on built-up area expressed in square kilometres, the year being referred (Table 1), the number of buildings with corrugated iron roofs on three dates (the years are the same as those reported in (Table 1), and the total number of buildings in 2012. The last two fields of information are limited to only 49 settlements (Table 2).

The last table shows the number of buildings that collapsed as a result of flooding in the period 2011–19 in each of the 122 human settlements considered, as reported in the BDINA database (Table 3).
Table 1
Built-up area of 122 flooded settlements in the Dosso Region in Niger based on visual photointerpretation of GE Pro-images (Image©Maxan Technologies).

| # | Human settlement       | Latitude N | Longitude E | Municipality       | Settlement category | 1st date | 2nd date | 3rd date | VHR images year |
|---|------------------------|------------|-------------|--------------------|---------------------|----------|----------|----------|-----------------|
| 1 | Adiga Lele             | 12°14'44.4" | 3°20'58.1"  | Yelou              | H                   | 0.135    | 0.196    | 0.250    | 2002–13–19       |
| 2 | Adoua                  | 13°40'55.5" | 3°57'48.7"  | Dogondoutchi       | H                   | 0.038    | 0.046    | 0.057    | 2006–13–19       |
| 3 | Albarkaize             | 12°4'57.1"  | 3°13'47.9"  | Tanda              | V                   | 0.040    | 0.045    | 0.077    | 2002–13–19       |
| 4 | Alfa Koara II          | 12°16'35.5" | 3°7'37.2"   | Sambera            | V                   | 0.012    | 0.020    | 0.023    | 2001–13–19       |
| 5 | Alsandeye              | 12°47'56.3" | 3°24'15.6"  | Tessa              | V                   | 0.053    | 0.099    | 0.117    | 2002–13–19       |
| 6 | Angoual Bozari         | 12°48'57.0" | 3°50'26.5"  | Guechene           | V                   | 0.097    | 0.135    | 0.148    | 2005–13–19       |
| 7 | Angoual Sani           | 12°15'58.3" | 3°31'13.8"  | Yelou              | V                   | 0.045    | 0.091    | 0.104    | 2001–12–19       |
| 8 | Baiourtma              | 11°48'37.1" | 3°31'31.3"  | Gays               | H                   | 0.002    | 0.002    | 0.003    | 2003–11–19       |
| 9 | Bakin Tapki            | 13°23'8.9"  | 4°3'46.4"   | Kieche             | V                   | 0.126    | 0.144    | 0.197    | 2006–13–19       |
| 10 | Bana                   | 12°3'11.5"  | 3°32'59.7"  | Bana               | RT                  | 0.447    | 0.479    | 0.619    | 2010–12–19       |
| 11 | Banikoumey             | 12°11'1.9"  | 3°32'22.3"  | Yelou              | V                   | 0.261    | 0.225    | 0.243    | 2001–12–19       |
| 12 | Banizoumbou Issa       | 13°17'18.4" | 3°47'46.7"  | Kore Mairoua       | V                   | 0.011    | 0.01     | 0.015    | 2005–13–19       |
| 13 | Banizoumbou Madargu    | 11°45'27.9" | 3°36'3.5"   | Tounouga           | V                   | 0.040    | 0.045    | 0.047    | 2008–12–19       |
| 14 | Bantali                | 12°3'10.6"  | 3°13'43.0"  | Tanda              | H                   | 0.013    | 0.013    | 0.006    | 2006–10–19       |
| 15 | Bare Bari              | 13°47'5.7"  | 4°3"2.7"    | Matankari          | V                   | 0.098    | 0.15     | 0.176    | 2002–13–19       |
| 16 | Bargoumawa             | 13°14'29.9" | 4°1'44.5"   | Tibiri             | V                   | 0.036    | 0.047    | 0.050    | 2003–14–19       |
| 17 | Bawada                 | 12°47'18.1" | 3°50'15.5"  | Guechene           | V                   | 0.235    | 0.275    | 0.310    | 2005–13–19       |
| 18 | Bawada Guida           | 13°50'58.8" | 4°13'29.7"  | Dan Kassari        | V                   | 0.062    | 0.076    | 0.104    | 2007–13–19       |
| 19 | Belande Djerma         | 12°44'17.2" | 2°52'3.8"   | Falmey             | V                   | 0.36     | 0.439    | 0.430    | 2008–12–19       |
| 20 | Bengou                 | 11°59'26.9" | 3°35'17.7"  | Bengou             | RT                  | 1.090    | 1.160    | 1.330    | 2003–08–19       |
| 21 | Biraye Garin Mallam    | 13°30'3.4"  | 3°59'23.5"  | Kieche             | H                   | 0.038    | 0.050    | 0.065    | 2003–13–19       |
| 22 | Boukka 3               | 13°28'37.1" | 4°4'2.0"    | Kieche             | H                   | 0.006    | 0.008    | 0.010    | 2006–13–19       |
| 23 | Bouma Bamanza          | 12°4'57.0"  | 3°20'57.0"  | Tanda              | V                   | 0.006    | 0.010    | 0.022    | 2002–13–19       |
| 24 | Boune-Boune            | 11°48'51.4" | 3°33'20.0"  | Tounouga           | V                   | 0.052    | 0.059    | 0.061    | 2003–11–19       |
| 25 | Dadin Kowa             | 13°15'8.3"  | 3°51'19.3"  | Kore Mairoua       | V                   | 0.013    | 0.020    | 0.021    | 2005–14–19       |
| 26 | Dan Kassari            | 13°43'16.9" | 4°22'45.8"  | Dan Kassari        | RT                  | 0.646    | 0.791    | 1.200    | 2009–13–19       |
| 27 | Darfou Tounta          | 12°1'11.1"  | 3°16'18.0"  | Tanda              | V                   | 0.092    | 0.117    | 0.130    | 2002–12–19       |
| 28 | Dey Koukou Ouest Fand  | 12°48'32.2" | 3°24'26.0"  | Tessa              | H                   | 0.013    | 0.019    | 0.048    | 2003–12–19       |
| 29 | Dogondoutchi           | 13°38'18.6" | 4°1’45.1"   | Dogondoutchi       | C                   | 4.880    | 6.100    | 6.590    | 2007–13–19       |
| 30 | Donoudibi Djerma       | 13°5’46.2"  | 2°55’13.0"  | Birni N’Gaoure     | V                   | 0.052    | 0.062    | 0.053    | 2008–12–19       |
| 31 | Fabidji                | 12°54’33.4" | 2°51’48.2"  | Fabidji            | RT                  | 0.456    | 0.682    | 0.815    | 2008–12–19       |

(continued on next page)
| #  | Human settlement | Coordinates | Municipality | Settlement category | 1st date Km² | 2nd date Km² | 3rd date Km² | VHR images year |
|----|-----------------|-------------|--------------|---------------------|--------------|--------------|--------------|----------------|
| 32 | Foma Touna      | 12°7′4.2″   | Sambera      | V                   | 0.041        | 0.064        | 0.068        | 2006–13–19     |
| 33 | Foo             | 11°53′56.9″ | Gaya         | H                   | 0.017        | 0.023        | 0.033        | 2002–12–19     |
| 34 | Gagila Mai Fala | 13°26′16.4″ | Kieche       | V                   | 0.136        | 0.155        | 0.215        | 2006–13–19     |
| 35 | Gaouna          | 13°53′18.1″ | Matankari    | H                   | 0.054        | 0.067        | 0.099        | 2007–13–19     |
| 36 | Garanga         | 13°51′42.2″ | Matankari    | H                   | 0.008        | 0.010        | 0.011        | 2007–13–19     |
| 37 | Garin Bana      | 13°43′2.3″  | Matankari    | H                   | 0.040        | 0.047        | 0.061        | 2005–13–19     |
| 38 | Garin Dan Bina  | 13°24′15.4″ | Kore Mairoua | V                   | 0.020        | 0.027        | 0.027        | 2003–13–19     |
| 39 | Garin Kada      | 13°42′9.5″  | Matankari    | H                   | 0.009        | 0.010        | 0.011        | 2005–13–19     |
| 40 | Garin Lela      | 12°48′18.4″ | Guecheme     | V                   | 0.027        | 0.034        | 0.052        | 2005–13–19     |
| 41 | Garin Moudi     | 13°42′37.6″ | Matankari    | H                   | 0.010        | 0.012        | 0.015        | 2005–13–19     |
| 42 | Gattawani Beri | 11°46′59.0″ | Tounouga     | V                   | 0.132        | 0.150        | 0.177        | 2003–12–19     |
| 43 | Gattawani Kaina | 11°47′26.8″ | Tounouga     | V                   | 0.119        | 0.225        | 0.295        | 2003–12–19     |
| 44 | Gaya            | 11°53′23.0″ | Gaya         | C                   | 3.061        | 5.607        | 6.710        | 2003–12–19     |
| 45 | Gazere Koira    | 12°12′43.3″ | Sambera      | V                   | 0.017        | 0.020        | 0.023        | 2005–13–19     |
| 46 | Goberi Gouby    | 12°57′48.0″ | Fabidji      | V                   | 0.152        | 0.172        | 0.230        | 2008–12–19     |
| 47 | Gondorou        | 11°44′35.2″ | Tounouga     | V                   | 0.130        | 0.142        | 0.165        | 2008–13–19     |
| 48 | Goron Kondo     | 11°55′32.2″ | Tounouga     | V                   | 0.060        | 0.084        | 0.105        | 2003–12–19     |
| 49 | Gouala          | 13°28′26.9″ | Kieche       | V                   | 0.162        | 0.232        | 0.263        | 2006–13–19     |
| 50 | Haoua Hanga     | 12°1′22.8″  | Tanda        | H                   | 0.017        | 0.022        | 0.023        | 2002–13–19     |
| 51 | Here Damtche Peulh | 12°48′6.8″  | Guecheme     | V                   | 0.063        | 0.088        | 0.114        | 2005–13–19     |
| 52 | Himadey         | 12°50′39.9″ | Karguibangou | V                   | 0.045        | 0.059        | 0.089        | 2005–12–19     |
| 53 | Illela Makera   | 12°12′45.9″ | Yelou        | H                   | 0.004        | 0.006        | 0.016        | 2001–12–19     |
| 54 | Jikata          | 13°14′2.2″  | Tibiri       | H                   | 0.021        | 0.021        | 0.032        | 2003–14–19     |
| 55 | Jikata Toudou   | 13°13′41.9″ | Tibiri       | V                   | 0.063        | 0.077        | 0.086        | 2003–14–19     |
| 56 | Kanaré          | 13°14′38.7″ | Ngonga       | H                   | 0.205        | 0.238        | 0.297        | 2010–11–19     |
| 57 | Kankandi        | 12°52′25.8″ | Kankandi     | RT                  | 0.051        | 0.078        | 0.089        | 2002–12–19     |
| 58 | Karra           | 13°0′56.1″  | Birni N'Gaoure | V               | 1.341  | 1.840  | 2.790  | 2002–12–19     |
| 59 | Kieché          | 13°28′54.0″ | Kieche       | RT                  | 0.295        | 0.367        | 0.416        | 2006–13–19     |
| 60 | Kiota Mayaki    | 13°17′27.6″ | Kiota        | V                   | 1.130        | 1.520        | 1.910        | 2005–12–19     |
| 61 | Kiota Oumarou   | 13°16′29.6″ | Kiota        | V                   | 0.153        | 0.162        | 0.184        | 2008–12–19     |
| 62 | Kobassi         | 11°51′39.3″ | Gaya         | H                   | 0.002        | 0.005        | 0.005        | 2003–12–19     |

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Table 1 (continued)

| #  | Human settlement     | Latitude N | Longitude E | Municipality          | Settlement category | 1st date Km² | 2nd date Km² | 3rd date Km² | VHR images year |
|----|----------------------|------------|-------------|-----------------------|---------------------|-------------|-------------|-------------|----------------|
| 63 | Kofo                 | 11°50'14.2" | 3°31'41.2"  | Gaya                  | H                   | 0.027       | 0.078       | 0.110       | 2003–11–19     |
| 64 | Koma                 | 11°44'53.8" | 3°37'19.3"  | Tounouga              | V                   | 0.038       | 0.042       | 0.051       | 2008–12–19     |
| 65 | Komaguindi Zou       | 13°22'51.9" | 2°52'43.8"  | Harikanassou          | V                   | 0.033       | 0.039       | 0.051       | 2008–12–19     |
| 66 | Kombo                | 11°52'40.6" | 3°25'22.3"  | Gaya                  | H                   | 0.003       | 0.003       | 0.003       | 2002–12–19     |
| 67 | Konko Rindo          | 13°28'54.4" | 4°1'35.6"   | Kieche                | V                   | 0.034       | 0.049       | 0.066       | 2006–12–19     |
| 68 | Koré Mairoua         | 13°18'6.9"  | 3°54'34.1"  | Kore Mairoua          | RT                  | 0.878       | 1.190       | 1.460       | 2005–13–19     |
| 69 | Korwa                | 12°7'30.5"  | 3°10'6.2"   | Tanda                 | H                   | 0.006       | 0.012       | 0.011       | 2006–13–19     |
| 70 | Kotcha (Tendarou)    | 11°53'14.8" | 3°24'8.5"   | Gaya                  | H                   | 0.026       | 0.051       | 0.067       | 2002–12–19     |
| 71 | Kouka Bakoye        | 13°34'39.1" | 4°4'16.1"   | Dogondoutchi          | V                   | 0.201       | 0.280       | 0.326       | 2006–12–19     |
| 72 | Kouka Mailamba       | 11°57'50.5" | 3°20'20.0"  | Tanda                 | H                   | 0.007       | 0.009       | 0.009       | 2002–12–20     |
| 73 | Koukadin             | 13°55'43.3" | 4°5'49.6"   | Matankari             | H                   | 0.012       | 0.016       | 0.020       | 2007–13–19     |
| 74 | Koukoli              | 13°16'23.3" | 3°52'19.0"  | Kore Mairoua          | H                   | 0.091       | 0.153       | 0.160       | 2005–14–19     |
| 75 | Kountou Dey          | 13°2'48.6"  | 3°17'17.3"  | Dogso                  | V                   | 0.026       | 0.039       | 0.061       | 2003–12–20     |
| 76 | Kourbeye             | 12°2'6.8"   | 3°15'12.6"  | Tanda                 | H                   | 0.010       | 0.019       | 0.022       | 2002–12–19     |
| 77 | Kouringuell Mayaki   | 13°21'43.5" | 2°54'13.6"  | Harikanassou          | V                   | 0.175       | 0.181       | 0.232       | 2008–12–19     |
| 78 | Koygolo              | 13°29'7.1"  | 3°0'23.3"   | Koygolo               | RT                  | 0.670       | 0.743       | 0.776       | 2008–12–20     |
| 79 | Ladan Koira          | 12°9'49.7"  | 3°20'53.5"  | Tanda                 | V                   | 0.046       | 0.074       | 0.078       | 2002–13–19     |
| 80 | Lette                | 12°9'14.2"  | 3°8'26.6"   | Tanda                 | V                   | 0.095       | 0.205       | 0.241       | 2002–12–19     |
| 81 | Liguido              | 13°36'48.4" | 4°6'47.2"   | Dogondoutchi          | V                   | 0.336       | 0.428       | 0.492       | 2007–13–19     |
| 82 | Loma                 | 13°18'51.8" | 4°6'5.4"    | Kore Mairoua          | H                   | 0.228       | 0.288       | 0.314       | 2003–13–19     |
| 83 | Mabatounga           | 12°2'36.0"  | 3°14'33.0"  | Tanda                 | H                   | 0.006       | 0.01        | 0.015       | 2002–12–19     |
| 84 | Magangama            | 12°3'50.2"  | 3°13'14.0"  | Tanda                 | H                   | 0.003       | 0.003       | 0.003       | 2003–12–19     |
| 85 | Makera II            | 13°57'40.7" | 4°5'2.9"    | Matankari             | V                   | 0.061       | 0.092       | 0.105       | 2007–13–19     |
| 86 | Matankari            | 13°46'1.7"  | 4°0'23.0"   | Matankari             | RT                  | 1.106       | 1.227       | 1.548       | 2002–13–19     |
| 87 | Mayaki Dey           | 12°48'53.8" | 3°24'57.5"  | Tessa                 | V                   | 0.047       | 0.071       | 0.098       | 2005–12–19     |
| 88 | Mombaye Tounga       | 12°1'7.4"   | 3°16'3.2"   | Tanda                 | V                   | 0.068       | 0.070       | 0.082       | 2002–12–19     |
| 89 | Nantougou            | 12°1'36.1"  | 3°15'36.8"  | Tanda                 | H                   | 0.015       | 0.016       | 0.016       | 2002–13–19     |
| 90 | Niabere Bella        | 13°19'1.4"  | 2°50'22.7"  | Harikanassou          | V                   | 0.105       | 0.129       | 0.163       | 2008–12–19     |

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### Table 1 (continued)

| #  | Human settlement     | Latitude N | Longitude E | Municipality   | Settlement category | 1st date Km² | 2nd date Km² | 3rd date Km² | VHR images year |
|----|----------------------|------------|-------------|----------------|---------------------|--------------|--------------|--------------|-----------------|
| 91 | Niabere Kaina        | 13°19'0.8" | 2°51'12.9"  | Harikanassou   | V                   | 0.084        | 0.094        | 0.107        | 2008–12–19      |
| 92 | Noufawa              | 13°31'30.1"| 4°0'11.2"   | Kieche         | H                   | 0.046        | 0.057        | 0.065        | 2006–13–19      |
| 93 | Rouda Adoua          | 13°31'11.9"| 4°2'19.5"   | Kieche         | V                   | 0.076        | 0.083        | 0.096        | 2006–13–19      |
| 94 | Rountoua Tanda       | 12°1'11.0" | 3°16'27.4"  | Tanda          | V                   | 0.023        | 0.029        | 0.03         | 2002–13–18      |
| 95 | Sabarou Dey          | 12°50'19.3"| 3°29'18.3"  | Karguibangou   | H                   | 0.004        | 0.007        | 0.010        | 2005–12–19      |
| 96 | Sabon Birni          | 11°53'8.8" | 3°35'37.2"  | Tounouga       | V                   | 0.607        | 0.794        | 0.917        | 2008–12–19      |
| 97 | Sakoira              | 12°42'32.0"| 3°52'22.1"  | Guechene       | V                   | 0.020        | 0.021        | 0.039        | 2005–13–19      |
| 98 | Sakondji Birni       | 11°50'51.5"| 3°32'6.5"   | Gaya           | V                   | 0.022        | 0.022        | 0.028        | 2003–12–19      |
| 99 | Sandi Toungha        | 11°49'52.4"| 3°30'28.5"  | Gaya           | V                   | 0.002        | 0.002        | 0.002        | 2003–12–19      |
| 100| Sia                  | 12°6'30.2"  | 3°17'35.7"  | Tanda          | V                   | 0.286        | 0.409        | 0.424        | 2002–13–19      |
| 101| Sira Lelesso         | 12°51'54.0"| 2°52'39.0"  | Fabidji        | H                   | 0.011        | 0.016        | 0.021        | 2008–12–19      |
| 102| Tanda                | 11°59'23.7"| 3°18'55.4"  | Tanda          | RT                  | 0.792        | 1.26         | 1.70         | 2002–12–19      |
| 103| Taramna              | 13°14'19.8"| 4°1'16.1"   | Tibiri         | V                   | 0.020        | 0.028        | 0.038        | 2003–14–19      |
| 104| Tchelele             | 12°0'33.4"  | 3°17'13.4"  | Tanda          | H                   | 0.019        | 0.022        | 0.028        | 2002–11–20      |
| 105| Tchiara Koira        | 12°57'31.4"| 3°3'12.0"   | Gaya           | V                   | 0.054        | 0.088        | 0.089        | 2001–11–14      |
| 106| Tessa                | 12°46'14.0"| 3°24'32.6"  | Tessa          | RT                  | 0.385        | 0.505        | 0.556        | 2005–12–19      |
| 107| Togone               | 13°42'19.0"| 4°1'34.3"   | Dogondoutchi   | V                   | 0.332        | 0.380        | 0.502        | 2007–13–19      |
| 108| Tombo Kirey          | 13°3'24.1"  | 3°16'28.6"  | Dosso          | V                   | 0.148        | 0.225        | 0.291        | 2003–12–19      |
| 109| Toudou               | 13°17'18.6"| 3°52'17.5"  | Kore Mairoua   | H                   | 0.010        | 0.013        | 0.016        | 2005–13–19      |
| 110| Toullou Maadi I      | 13°5'43.8"  | 4°5'29.9"   | Tibiri         | V                   | 0.070        | 0.070        | 0.077        | 2003–14–19      |
| 111| Tounga Djado         | 11°52'7.9"  | 3°36'33.0"  | Tounouga       | V                   | 0.010        | 0.011        | 0.012        | 2008–12–19      |
| 112| Tounga Goumbi        | 12°3'44.3"  | 3°14'8.0"   | Tanda          | V                   | 0.024        | 0.047        | 0.043        | 2002–13–19      |
| 113| Tounga Maikada       | 11°48'28.8"| 3°31'34.9"  | Gaya           | H                   | 0.002        | 0.002        | 0.004        | 2003–11–19      |
| 114| Tounga Nanadina      | 11°45'58.4"| 3°34'59.8"  | Tounouga       | V                   | 0.027        | 0.030        | 0.037        | 2003–12–19      |
| 115| Tounga Zaoure        | 11°46'12.2"| 3°35'17.2"  | Tounouga       | H                   | 0.018        | 0.018        | 0.023        | 2003–12–19      |
| 116| Tounouga             | 11°48'4.7"  | 3°37'24.4"  | Tounouga       | RT                  | 0.717        | 0.736        | 0.926        | 2002–12–19      |
| 117| Tsourin Boubou       | 13°18'14.4"| 3°52'6.1"   | Kore Mairoua   | H                   | 0.006        | 0.013        | 0.021        | 2005–13–19      |
| 118| Wadata               | 11°49'48.2"| 3°32'13.0"  | Gaya           | H                   | 0.037        | 0.054        | 0.074        | 2003–11–19      |
| 119| Wadata               | 12°4'41.6"  | 3°13'49.3"  | Tanda          | H                   | 0.006        | 0.009        | 0.013        | 2002–13–19      |
| 120| Windi Bago Peuhl     | 12°43'13.3"| 2°53'57.9"  | Guilladjie     | H                   | 0.025        | 0.034        | 0.046        | 2008–12–19      |
| 121| Yelou                | 12°15'39.4"| 3°34'40.1"  | Yelou          | RT                  | 0.350        | 0.539        | 0.668        | 2001–12–19      |
| 122| Zanga Babadey        | 12°49'42.4"| 3°29'14.6"  | Karguibangou   | V                   | 0.066        | 0.085        | 0.142        | 2003–12–19      |

**Total** | 25,700 | 34,280 | 41,560 | 2004–12–19 |

**Average** | 121 | 121 | 121 | 2004–12–19 |

Abbreviations: C-City, RT-Rural town, H-Hamlet, V-Village.
Fig. 1. The one hundred and twenty-two flooded settlements examined in the Dosso Region based on the BDINA flood database. Figure modified from [1] showing the numbering of cities and rural towns in accordance with Table 1.
Fig. 2. Number of VHR satellite images per year covering the flooded settlements in the Dosso Region. Figure modified from [1].

Fig. 3. Built-up edge at Gaya city according to visual photointerpretation of GE Pro-images and according to Landsat images, respectively at 2012 and 2013 (Image © 2020 MaxanTechnologies).
Fig. 4. Built-up area dynamics of Dogondoutchi city between 2007 and 2019 (left) and Yelou rural town between 2001 and 2019 (right).
Fig. 5. Built-up area dynamics of the Gattawani Kaina village in the municipality of Tounouga and the Dey Koukou Ouest Fang hamlet in the municipality of Tessa between 2003 and 2019.
Table 2
Constructions (number) with corrugated iron roofs in 49 settlements of the Dosso Region, flooded between 2011 and 2019 based on visual photointerpretation of GE Pro-images (Image©Maxan Technologies).

| Human settlement | 1st date | 2nd date | 3rd date | Number of constructions in 2012 |
|------------------|----------|----------|----------|---------------------------------|
| Alsandeye        | 0        | 22       | 33       | 73                              |
| Angoual Sani     | 0        | 2        | 8        | 202                             |
| Bana             | 187      | 192      | 351      | 341                             |
| Bare Bari        | 10       | 17       | 42       | 131                             |
| Bawada Guida     | 8        | 15       | 26       | 101                             |
| Belande Djerma   | 52       | 79       | 233      | 142                             |
| Bengou           | 134      | 828      | 1469     | 1403                            |
| Bouma Bamanzo    | 0        | 0        | 3        | 52                              |
| Boune-Boune      | 15       | 42       | 48       | 49                              |
| Dan Kassari      | 145      | 260      | 189      | 761                             |
| Dey Koukou Ouest Fand | 4  | 11       | 26       | 30                              |
| Fabidji          | 201      | 294      | 372      | 520                             |
| Gaouna           | 5        | 5        | 7        | 91                              |
| Garanga          | 0        | 0        | 1        | 6                               |
| Gattawani Kaina  | 17       | 63       | 201      | 224                             |
| Gaya             | 1640     | 6897     | 8216     | 7929                            |
| Gazere Koira     | 0        | 4        | 6        | 24                              |
| Goberi Goubey    | 67       | 73       | 114      | 172                             |
| Goron Kondo      | 12       | 64       | 70       | 115                             |
| Himadey          | 9        | 22       | 30       | 131                             |
| Kankandi         | 19       | 24       | 80       | 125                             |
| Karra            | 38       | 149      | 297      | 301                             |
| Kiota Mayaki     | 192      | 210      | 471      | 1764                            |
| Kofo             | 4        | 42       | 92       | 79                              |
| Koma             | 14       | 34       | 38       | 87                              |
| Kore Mairoua     | 252      | 398      | 529      | 1393                            |
| Koukadin         | 0        | 0        | 1        | 25                              |
| Koukoki          | 8        | 22       | 52       | 131                             |
| Kountou Dey      | 7        | 18       | 46       | 75                              |
| Koygolo          | 135      | 123      | 144      | 855                             |
| Lette            | 2        | 38       | 85       | 275                             |
| Liguido          | 39       | 95       | 173      | 631                             |
| Loma             | 3        | 25       | 87       | 226                             |
| Makera II        | 1        | 5        | 0        | 136                             |
| Matankari        | 254      | 467      | 627      | 1380                            |
| Sabara Dey       | 3        | 5        | 5        | 8                               |
| Sabon Birni      | 2        | 3        | 38       | 34                              |
| Taramna          | 0        | 6        | 20       | 76                              |
| Tessa            | 27       | 86       | 157      | 300                             |
| Togone           | 69       | 85       | 145      | 632                             |
| Tombo Kirey      | 30       | 87       | 225      | 249                             |
| Toudou           | 1        | 1        | 15       | 18                              |
| Tounga Nadania   | 14       | 25       | 54       | 69                              |
| Tounga Zaoure    | 6        | 10       | 28       | 50                              |
| Tsaurin Boubou   | 0        | 2        | 5        | 27                              |
| Wadata           | 5        | 35       | 66       | 57                              |
| Windi Bago Peulh| 2        | 3        | 2        | 9                               |
| Yelou            | 33       | 86       | 253      | 501                             |
| Zanga Babadey    | 18       | 39       | 54       | 106                             |
| Dosso region     | 3684     | 11,013   | 15,234   | 22,116                          |
### Table 3
Houses collapsed between 2011 and 2019 in 122 flooded settlements of the Dosso Region (Niger) according the BDINA open access database.

| Human settlement           | Category | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2011–19 |
|----------------------------|----------|------|------|------|------|------|------|------|------|------|---------|
| Adiga Lele                 | H        |      |      |      |      | 96   |      |      |      |      | 96      |
| Adoua                      | H        |      |      |      |      | 57   |      |      |      |      | 57      |
| Albarkaize                 | V        | 96   |      | 63   |      | 250  |      |      |      |      | 409     |
| Alfa Koara II              | V        | 6    |      |      |      | 6    |      |      |      |      | 6       |
| Alsandeye                  | V        |      |      |      |      | 4    |      |      |      |      | 4       |
| Angoual Bozari             | V        |      |      |      |      | 70   |      |      |      |      | 70      |
| Angoual Sani               | V        |      |      |      |      | 11   |      |      |      |      | 11      |
| Baitounga                  | H        | 18   |      |      |      | 81   |      |      |      |      | 99      |
| Bakin Tapki                | V        | 18   |      |      |      |      |      |      |      |      | 18      |
| Bana                       | RT       | 61   |      |      |      |      |      |      |      |      | 61      |
| Banikoubey                 | V        |      |      |      |      |      |      |      |      | 19    | 19      |
| Banizoumbou Issa           | V        |      |      |      |      |      |      |      |      |      | 35      |
| Banizoumbou Madargwuwo     | V        | 11   |      |      |      |      |      |      |      |      | 68      |
| Bantali                    | H        | 71   |      |      |      | 75   |      |      |      |      | 146     |
| Bare Bari                  | V        | 16   |      |      |      |      |      |      |      |      | 16      |
| Bargoumawa                 | V        |      |      |      |      | 39   |      |      |      |      | 39      |
| Bawada                     | V        |      |      |      |      | 43   |      |      |      |      | 43      |
| Bawada Guida               | V        | 67   |      |      |      |      |      |      |      |      | 67      |
| Belande Djerma             | V        | 67   |      |      |      |      |      |      |      |      | 67      |
| Bengou                     | RT       | 49   | 40   |      |      |      |      |      |      |      | 89      |
| Biraye Garin Mallam        | H        | 1    |      |      |      |      |      |      |      |      | 37      |
| Bouka 3                    | H        | 6    |      |      |      |      |      |      |      |      | 6       |
| Bouma Bamanzo              | V        |      |      |      |      | 15   |      |      |      |      | 15      |
| Bouna                      | V        | 76   |      |      |      | 15   |      |      |      |      | 91      |
| Dadin Kowa                 | V        |      |      |      |      | 3    |      |      |      |      | 3       |
| Dan Kassari                | RT       | 40   |      |      |      | 73   |      |      |      |      | 113     |
| Darfou Tounga              | V        |      |      |      |      | 125  |      |      |      |      | 125     |
| Dey Koukou Ouest Fand      | H        |      |      |      |      | 11   |      |      |      |      | 11      |
| Dogondoutchi               | C        | 540  |      | 58   |      | 14   |      |      |      |      | 612     |
| Donoudibi Djerma           | V        |      |      |      |      | 11   |      |      |      |      | 11      |
| Fabidji                    | RT       | 56   |      |      |      |      |      |      |      |      | 50      |

(continued on next page)
| Human settlement | Category | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2011–19 |
|------------------|----------|------|------|------|------|------|------|------|------|------|----------|
| Foma Tounga      | V        | 20   |      |      |      |      |      |      |      |      | 20       |
| Foo              | H        |      | 10   |      | 5    |      |      |      |      |      | 75       |
| Gagila Mai Fala  | V        |      |      | 40   |      |      |      |      |      |      | 40       |
| Gaouna           | H        |      |      |      | 17   |      |      |      |      |      | 17       |
| Garanga          | H        |      |      |      |      | 27   |      |      |      |      | 27       |
| Garin Bana       | H        |      |      |      |      |      | 8    |      |      |      | 8        |
| Garin Dan Bina   | V        |      |      |      |      |      |      | 4    |      |      | 4        |
| Garin Kada       | H        |      |      |      |      |      |      |      | 13   |      | 13       |
| Garin Lela       | V        |      |      |      |      |      |      |      |      |      | 24       |
| Garin Moudi      | H        |      |      |      |      |      |      |      |      |      | 6        |
| Gatawani Beri    | V        |      |      |      |      |      |      |      |      |      | 60       |
| Gatawani Kaina   | V        |      |      |      |      |      |      |      |      |      | 42       |
| Gaya             | C        |      |      |      |      |      |      |      |      |      | 457      |
| Gazere Koira     | V        |      |      |      |      |      |      |      |      |      | 77       |
| Goberi Goubey    | V        |      |      |      |      |      |      |      |      |      | 765      |
| Gondarou         | V        |      |      |      |      |      |      |      |      |      | 35       |
| Goron Kondo      | V        |      |      |      |      |      |      |      |      |      | 20       |
| Gouala           | V        |      |      |      |      |      |      |      |      |      | 35       |
| Haoua Hanga      | H        |      |      |      |      |      |      |      |      |      | 98       |
| Here Damtche Peulh | V      |      |      |      |      |      |      |      |      |      | 98       |
| Himadey          | V        |      |      |      |      |      |      |      |      |      | 30       |
| Illela Makera    | H        |      |      |      |      |      |      |      |      |      | 30       |
| Jikata           | H        |      |      |      |      |      |      |      |      |      | 30       |
| Jikata Toudou    | V        |      |      |      |      |      |      |      |      |      | 30       |
| Kanaré           | H        |      |      |      |      |      |      |      |      |      | 76       |
| Kankandji        | RT       |      |      |      |      |      |      |      |      |      | 20       |
| Karra            | V        |      |      |      |      |      |      |      |      |      | 128      |
| Kiéché           | RT       |      |      |      |      |      |      |      |      |      | 128      |
| Kiota Mayaki     | V        |      |      |      |      |      |      |      |      |      | 62       |
| Kiota Oumarou    | V        |      |      |      |      |      |      |      |      |      | 1        |
| Kobassi          | H        |      |      |      |      |      |      |      |      |      | 3        |
| Kofo             | H        |      |      |      |      |      |      |      |      |      | 65       |
| Koma             | V        |      |      |      |      |      |      |      |      |      | 17       |
| Komaguindi Zou   | V        |      |      |      |      |      |      |      |      |      | 5        |

(continued on next page)
Table 3 (continued)

| Human settlement       | Category | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2011–19 |
|------------------------|----------|------|------|------|------|------|------|------|------|------|---------|
| Kombo                  | H        | 10   |      |      |      |      | 23   |      |      |      | 23      |
| Konko Rindo            | V        |      | 35   |      |      | 48   |      |      |      |      | 35      |
| Kore Mairoua           | RT       |      |      |      |      | 48   |      |      |      |      | 48      |
| Korwa                  | H        |      |      |      |      | 80   |      |      |      |      | 80      |
| Kotcha (Tandarou)      | H        | 3    | 13   |      |      | 105  | 121  | 23   |      |      |         |
| Kouka Bakoye          | V        |      |      |      |      | 23   |      |      |      |      |         |
| Kouka Mailamba        | H        | 3    |      |      |      |      |      |      |      |      |         |
| Koukadja               | H        |      |      | 17   |      |      |      |      |      |      |         |
| Koukoikii              | H        |      |      |      |      |      |      |      | 48   | 48   |         |
| Kountou Dey            | V        |      |      |      |      |      |      |      | 12   |      |         |
| Kourbeye               | H        |      |      |      | 74   |      | 114  |      |      | 188  |         |
| Kouringuel Mayaki      | V        |      |      |      |      |      |      |      | 42   | 42   |         |
| Koygolo                | RT       |      |      |      |      |      |      |      | 98   | 98   |         |
| Ladan Koira            | V        |      |      |      |      |      |      |      |      |      | 5       |
| Lette                  | V        |      |      |      |      | 194  |      | 119  |      | 313  |         |
| Liguindo               | V        |      |      |      |      |      | 74   |      |      |      | 74      |
| Loma                   | V        |      |      |      |      |      |      |      | 26   |      | 26      |
| Mabatounga             | H        |      |      |      |      |      |      |      | 12   |      | 12      |
| Magangama              | H        |      |      |      |      |      |      |      | 7    |      | 7       |
| Makera II              | V        |      |      |      |      |      |      |      |      |      | 20      |
| Matankari              | RT       |      | 69   |      | 147  |      | 52   |      | 268  |      |         |
| Mayaki Dei             | V        |      |      |      |      |      |      |      |      |      | 27      |
| Momboye Tounga         | V        | 36   |      |      | 4    | 63   | 146  |      |      |      | 249     |
| Nantougou              | H        |      |      |      |      |      |      |      | 13   |      | 13      |
| Niabere Bella          | V        |      |      |      |      |      |      |      | 19   |      | 19      |
| Niabere Kaina          | V        | 1    |      |      |      |      |      |      |      |      |         |
| Noufawa                | H        |      |      |      |      |      |      |      |      | 31   | 31      |
| Rouda Adoua            | V        |      |      |      |      |      |      |      | 54   |      | 54      |
| Rountoua Tanda         | V        | 34   | 2    |      |      |      | 88   |      |      |      | 124     |

(continued on next page)
Table 3 (continued)

| Human settlement                         | Category | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2011–19 |
|-----------------------------------------|----------|------|------|------|------|------|------|------|------|------|---------|
| Sabara Dey                               | H        | 4    |      |      |      |      |      |      |      |      | 4       |
| Sabon Birni                              | V        |      | 56   |      |      | 2    |      |      |      |      | 58      |
| Sakoira                                  | V        |      |      |      | 37   |      |      |      |      |      | 37      |
| Sakondji Birni                           | V        |      | 30   |      |      |      |      |      |      |      | 30      |
| Sandi Tounga                             | V        |      |      |      |      |      |      |      |      |      | 49      |
| Sia                                      | V        |      |      |      |      |      |      |      |      | 136   | 136     |
| Sira Lelesso                             | H        |      |      |      |      |      |      |      |      |      | 11      |
| Tanda                                    | RT       |      |      |      |      | 14   |      |      |      |      | 14      |
| Taramna                                  | V        |      |      |      |      |      |      |      |      |      | 32      |
| Tchelele                                 | H        |      |      |      |      | 15   |      |      |      |      | 34      |
| Tchiara Koira                            | V        |      |      |      |      |      |      |      |      |      | 49      |
| Tessa                                    | RT       |      |      |      |      |      |      |      |      |      | 22      |
| Togone                                   | V        |      |      |      |      |      |      |      |      |      | 35      |
| Tombo Kirey                              | V        |      |      |      |      | 82   |      |      |      |      | 28      |
| Toudou                                   | H        |      |      |      |      |      |      |      |      |      | 17      |
| Toullou Maadi I                         | V        |      |      |      |      |      |      |      |      |      | 10      |
| Tounga Djado                             | V        |      |      |      |      |      |      |      |      |      | 10      |
| Tounga Goumbi                            | V        |      |      | 56   |      |      |      |      |      |      | 168     |
| Tounga Maikada                           | H        |      |      |      |      |      |      |      |      |      | 173     |
| Tounga Nadania                           | V        |      |      | 24   |      |      |      |      |      |      | 397     |
| Tounga Zaoire                           | H        |      |      |      |      |      |      |      |      |      | 9       |
| Tounouga                                 | RT       |      |      |      |      |      |      |      |      |      | 10      |
| Tsourin Boubou                           | H        |      |      |      |      |      |      |      |      |      | 8       |
| Wadata                                   | H        |      |      |      |      |      |      |      |      |      | 8       |
| Wadata                                   | H        |      |      |      |      |      |      |      |      |      | 30      |
| Windi Bago Peulh                         | H        |      |      |      |      |      |      |      |      |      | 65      |
| Yelou                                    | RT       |      |      |      |      |      |      |      |      |      | 44      |
| Zanga Babadey                            | V        |      |      |      |      |      |      |      |      |      | 24      |

Abbreviations: C-City, RT-Rural town, H-Hamlet, V-Village.
2. Experimental Design, Materials and Methods

The flooded settlements in the Dosso Region were obtained from the open access national database on flooding-BDINA (www.inondations-niger.org) [2]. This source of information provides access to data on flooded sites, loss and damage as collected annually since 1998 by the Early Warning System Coordination Unit through its network of observers on the ground and currently run by the Ministry of Humanitarian Action and Disaster Management. This source has proved to be much richer and more up to date than the global flood databases as Desinventar, the Dartmouth observatory on floods, the EM-DAT, and is therefore used here [3]. Further, 290 flooded settlements were determined between 2011 and 2019 from this primary dataset. These settlements were then identified on satellite images through the geographical coordinates listed in the Human Settlements National Directory, ReNaLoc [4]. For each flooded settlement, the availability of at least three VHR images on GE Pro were verified over the course of the last 20 years. Therefore, 122 settlements (Fig. 1) were documented by the images captured between 2001 and 2009 (2004 on average), 2010 and 2014 (2012 on average), 2018 and 2020 (2019 on average) (Fig. 2).

Settlements were characterized into urban and rural according to the definition provided by the National Institute of Statistics of Niger. The first category includes cities, i.e. all regional or departmental capitals (41,000 inhabitants on average). The rural category includes the capitals of rural municipalities (5300 inhabitants on average), villages, the lowest level at which taxes are collected and health and education services are provided (1200 inhabitants on average), and hamlets, simple aggregations of dwellings without administrative functions and community services (500 inhabitants on average) [5,6].

The built-up area of each settlement was visually identified on three dates including all the contiguous developed lots and the road surfaces providing access to these lots. Playgrounds, graveyards, and communication tower lots are also included. Vacant lots, the ones under construction, and the isolated developed lots are excluded when they are separated from the contiguous built-up area more than 60 m away or two standard vacant lots [7] (Fig. 3).

The built-up area is acquired using the “View” and the “Historic imagery” buttons of GE Pro. It was then manually measured using the “Add polygon” GE Pro-tool. A .kmz file is then generated for each built-up area in each year and for the settlement, thereby generating a total of 365 files, freely available at the Mendeley repository. These files are transferred into the QGIS environment to initiate the map production (Figs. 4 and 5).

In rural Niger, adobe buildings prevail. Substituting the earthen roof with a corrugated iron roof is the most common measure to protect houses from heavy rains. Corrugated iron sheets are identified through the visual photointerpretation of VHR satellite images, which are accessible with true colours from GE Pro. The images captured in the months of February-March (two-thirds) and September (22%) were not usable. Conversely, the images captured in December-January and June-August have suitable illumination and excellent atmospheric conditions and allowed for the coverage of 40% of the settlements with three images within the period of interest. The colours light grey or light blue indicate corrugated iron roofs. However, as the region is seasonally exposed to dust winds the colour of the roof can be masked. To limit visual photointerpretation errors field inspections were conducted in the villages of Gagila, Sabon Birni, and Takouidawa and in the rural towns of Guéchémé and Tessa (Fig. 3). However, only images captured from unmanned aerial vehicles show without any doubt the roof material [8].

The effectiveness of roof retrofitting can be appreciated by comparing the widespread use of corrugated iron sheet in building roofs with the number of buildings that have collapsed as a result of pluvial flooding between 2011 and 2019. The latter were taken from the BDINA open access database for the human settlements considered (Table 3). In a few cases flood damage is recorded by the BDINA for clusters of human settlements (three to ten villages and hamlets). To overcome this lack of detail, the number of collapsed buildings for the settlement of interest was estimated by multiplying the number of collapsed buildings in the cluster by the population of the settlement of interest and dividing the result by the total population of the cluster.
Ethics Statement

No ethical issues are associated with this study.

Data Availability

Data on Flooded Settlements in the Dosso Region, Niger (Original data) (Mendeley Data).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships which have or could be perceived to have influenced the work reported in this article.

CRediT Author Statement

Maurizio Tiepolo: Conceptualization, Methodology, Software, Data curation, Writing – original draft; Andrea Galligari: Software, Visualization, Writing – review & editing.

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Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi: 10.1016/j.dib.2022.107935.

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