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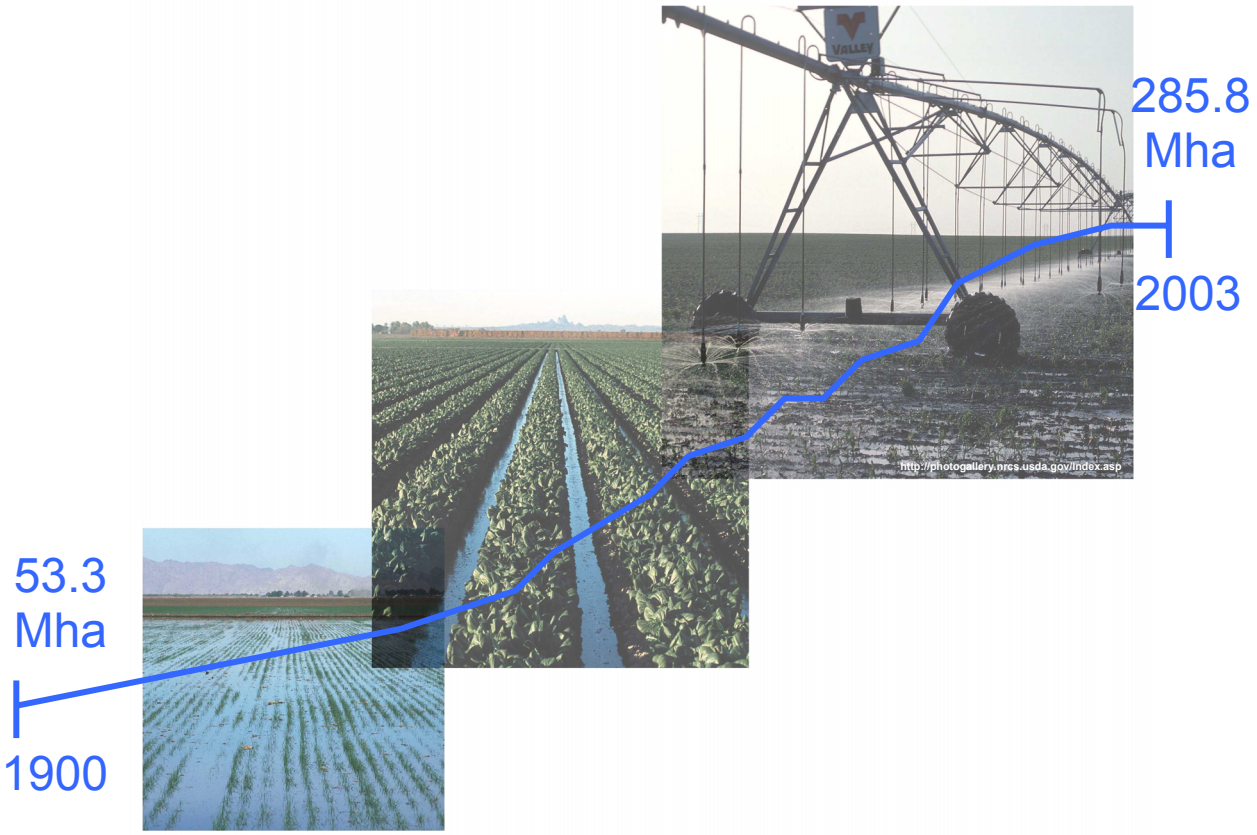
Towards mapping the extent of irrigation in the last century: time series of irrigated area per country



Katharina Freydank and Stefan Siebert

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JOHANN WOLFGANG GOETHE
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Towards mapping the extent of irrigation in the last century: time series of irrigated area per country

Research report

Katharina Freydank and Stefan Siebert

Institute of Physical Geography

University of Frankfurt (Main)

April 2008

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Institute of Physical Geography, Frankfurt University
P.O. Box 11 19 32, D-60054 Frankfurt am Main, Germany
Phone +49 (0)69 798 40220, Fax +49 (0)69 798 40347
http://www.geo.uni-frankfurt.de/ipg/ag/dl/index.html

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Abstract

A data set of annual values of area equipped for irrigation for all 236 countries in the world during the time period 1900 - 2003 was generated. The basis for this data product was information available through various online data bases and from other published materials. The complete time series were then constructed around the reported data applying six statistical methods. The methods are discussed in terms of reliability and data uncertainties. The total area equipped for irrigation in the world in 1900 was 53.2 million hectares. Irrigation was mainly practiced in all the arid regions of the globe and in paddy rice areas of South and East Asia. In some temperate countries in Western Europe irrigation was practiced widely on pastures and meadows. The time series suggest a modest rate of increase of irrigated areas in the first half of the 20th century followed by a more dynamic development in the second half. The turn of the century is characterized by an overall consolidating trend resulting at a total of 285.8 million hectares in 2003. The major contributing countries have changed little throughout the century. This data product is regarded as a preliminary result toward an ongoing effort to develop a detailed data set and map of areas equipped for irrigation in the world over the 20th century using sub-national statistics and historical irrigation maps.

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1 Introduction

Irrigated agriculture has significant impacts on the global water cycle. It increased evapotranspiration on agricultural land by about 1141 km^3/yr (Siebert & Döll, 2008). Irrigation based on surface water raised ground water tables in many areas (China, India, and United States) while groundwater-fed irrigation has lowered water tables up to 1 m/yr (Scanlon et al., 2007). Streamflow was reduced when irrigation water was withdrawn from rivers or shallow aquifers, while it may be increased if water is extracted from fossil ground water sources (Rost et al., submitted). Irrigation also has a significant cooling effect on surface temperature. It was found, for example, that in California August maximum temperature was 7.5 °C lower, where natural vegetation was converted to irrigated agriculture (Kueppers et al., 2007). The main reason why farmers use irrigation is to compensate for missing precipitation and soil moisture to increase crop yields. This also allows an efficient use of additional inputs like fertilizers. As a consequence crop productivity is on average larger on irrigated fields compared to rain fed agriculture.

To model irrigation water requirements, water scarcity, agricultural productivity, interdependency of irrigation water use and climate, virtual water flows induced by trade or to compute soil nutrient balances and changes of river discharge it is thus required to know the spatial extent of irrigated agriculture. The Global Map of Irrigation Areas (Siebert et al., 2005; Siebert et al., 2006), which is showing the area equipped for irrigation around year 2000 in a 5 arc-minute by 5 arc-minute resolution, was therefore applied in many different studies (e.g. Oki et al., 2001; Döll & Siebert, 2002; Döll, 2002; Henrichs et al., 2002; De Rosnay et al., 2003; FAO, 2003; Boucher et al., 2004; Flörke & Alcamo, 2004; FAO, 2005; Gordon et al, 2005; Haddeland et al., 2006; Heistermann, 2006; Lobell et al., 2006; Stehfest, 2006; World Water Assessment Programme, 2006; Bondeau et al., 2007; Bonfils & Lobell, 2007; Douglas et al., 2007; Haberl et al., 2007; Haddeland et al., 2007; Hanasaki et al., 2007; Kueppers et al., 2007; Lesschen et al., 2007; Tang et al., 2007; Liu et al., submitted; Rost et al., submitted). It was also used to develop other spatial data sets like a map of anthropogenic biomes (Ellis & Ramankutty, 2008) or a data set indicating the monthly growing areas of 26 distinct irrigated crops (Portmann et al., 2008).

While more and more information on the actual extent of irrigated agriculture has become available within the last decade and while the quality of the derived data products has been increasing significantly, information on the historical extent of irrigation is still very rare. Such information is required, however, in global change research, in particular for modelling slow changing systems like the global climate system, the global water cycle or decomposition

processes in the soil. The models used here are often applied for periods lasting several decades or even centuries. Similar to existing spatial data bases showing the historical extent of croplands like the HYDE-data base (Klein Goldewijk et al., 2007) or the Historical Croplands Dataset (Ramankutty & Foley, 1999), a spatial data set showing the historical extent of irrigation is also requested to avoid simple ad-hoc assumptions in the models (see for example the discussion in Haddeland et al., 2007 or Rost et al., submitted).

Here we present a data set of annual values of area equipped for irrigation for all 236 countries in the world during the time period 1900-2003. The data set represents a first step towards mapping the historical extent of irrigation. It can be used, for example, to scale irrigated areas in the Global Map of Irrigation Areas (Siebert et al., 2007), available for the year 2000, or to derive a time series of maps showing the approximate extent of irrigated areas in the past. Although this procedure neglects changes of the spatial distribution of irrigated areas inside the countries, such an approach is better than neglecting historical irrigation in global change studies at all. We will conduct further research to improve this product by considering also historical irrigation statistics at the sub-national level and by considering historical irrigation maps available for several countries. Products and documentation reports are made available at the following web-address: http://www.geo.unifrankfurt.de/ipg/ag/dl/forschung/Historical_Irrigation_Extent/index.html.

In the next section of this report the methodology used to develop this data set is explained and references to the main data sources are given. The results are presented in section 3, followed by the discussion (section 4) showing also the major limitations of the methodology and of the input data used here. Areas equipped for irrigation per country for the period 1900-2003 and a detailed list of input data used for the specific countries are presented in the appendix of this publication.

2 Methodology

In this section we give first an overview on the terminology and definitions used in this study. Then the main data sources are presented. Finally we describe the methods used to fill data gaps and to harmonize inconsistent input data.

2.1 Terms and definitions

The time series in this paper refer to *areas that are equipped for agricultural irrigation*. This includes all agricultural areas that have built-in structures to allow for irrigation regardless of whether these structures are used at any given time or not. Many agricultural areas in European and North American countries, for instance, are equipped for irrigation but are only used for supplemental irrigation during times of deficient precipitation and when growing high-value

crops like vegetables or potatoes. These areas are included in the inventory. On the other hand, there are areas that are frequently irrigated, such as residential areas and golf courses, but that are not used for agricultural purposes and were therefore not considered in the development of this data product.

Many of the irrigation statistics used for this study provide a definition to which type of area (e.g. area equipped for irrigation or area actually irrigated in a specific year) the data refer. However, not in all cases a clear distinction was possible. Statistics related to *areas actually irrigated* in a specific year were used when statistics related to areas equipped for irrigation were not available at all for a country (e.g. for Australia), although these statistics most likely underestimate area equipped for irrigation. Some publications provide data on *irrigable area* referring to areas that could potentially be equipped with irrigation structures. Such information, however, was neglected for the purpose of this study. Other sources provide data on *harvested irrigated crop area* which in world regions allowing two or more harvests per year significantly exceeds area equipped for irrigation. Such data were also not considered for the construction of the time series unless additional information was provided to derive area equipped for irrigation from area harvested (e.g. the related cropping intensity).

2.2 Major information sources used to develop the time series

The time series were derived using data available through online data bases and from various publications. The data sources were prioritized so that, in general, when data from multiple data sources for any given year and country were available, the data source with the highest priority assigned was used (Table 1).

The Food and Agriculture Organization of the United Nations (FAO) is collecting national statistics on the extent of irrigated areas and provides these data as part of their data bases FAOSTAT (http://faostat.fao.org/default.aspx) and AQUASTAT (http://www.fao.org/nr/water/aquastat/dbase/index.stm). Additionally, country profiles are available as part of the AQUASTAT-gateway (http://www.fao.org/nr/water/aquastat/countries_regions/index.stm) for most of the developing countries. The data in these country profiles were considered to be most reliable and got therefore the highest priority level (Table 1) because this information was carefully cross-checked against other data during the AQUASTAT surveys. The data on area equipped for irrigation presented in the AQUASTAT data base received the second highest priority (Table 1). These data are available for 5-year periods and originate from national statistics. FAOSTAT data are available for each year back to 1961 and have their origin also in national statistics. However, since data gaps are filled using expert guesses a lower priority level was assigned to this data source (Table 1).

The European Commission provides irrigation statistics for 324 sub-national administrative units of the European countries via the EUROSTAT data base (http://epp.eurostat.ec.europa.eu/). The reporting period starts in 1990 and data are reported for periods of 2-3 years. However, there are also many NODATA-values present in the data base. Statistics on *total irrigable area per country* were extracted from the data base because the EUROSTAT definition of total irrigable area is very close to the FAO definition of area equipped for irrigation. Because of the reporting scheme and the spatial resolution of the data it was assumed that the information is very reliable and the highest priority level was assigned to this data source (Table 1).

Another important data source with country profiles of the irrigation and drainage sector was published by the International Commission on Irrigation and Drainage (ICID) in the beginning of the 1980s (Framji et al., 1981). The publication is comprehensive and contains also many historical irrigation statistics. However, since it seems that the authors use the term irrigated area in different meanings (sometimes related to area equipped for irrigation, sometimes to area actually irrigated, often in an unknown meaning) it was decided to assign the lowest priority level to information originating from this data source (Table 1).

A publication of the German Gesellschaft für Technische Zusammenarbeit (GTZ) on irrigation sector reform in Central- and Eastern European countries with contributions of the ICID National Committees of Bulgaria, Czech Republic, Germany, Hungary, Macedonia, Poland, Romania, Russia, Slovenia and Ukraine (Dirksen & Huppert, 2006) contained detailed and useful information on the historical development of the irrigation sector in these countries. The highest priority level was assigned to this data source (Table 1).

A priority level of two was assigned to statistics derived from other publications referring often to a specific country. References to this additional literature are given in Appendix A2.

Table 1

Priority levels assigned to the main data sources (high values indicate high priority)

Data Source	Assigned Priority
AQUASTAT country profile data as used in Siebert et al. (2007)	3
EUROSTAT	3 (if available)
Dirksen & Huppert (2006)	3 (if available)
AQUASTAT online data base	2
Other publications (see Appendix A2)	2
FAOSTAT online data base	1
Framji et al. (1981)	1

The various priorities were applied as a general guideline when constructing the data series. In some circumstances the strict application of the priorities would have led to contradicting outcomes, so that on a case by case basis the authors deviated from the rule in order to achieve data consistency. A detailed country-specific description of the data sources used to develop the time series is available in Appendix A2.

2.3 Methods used to fill data gaps and to harmonize inconsistent input data

Unfortunately, most of the available information covers only the second half the 20th century and even in this period there are gaps in the data derived from high priority data sources (e.g. EUROSTAT, AQUASTAT). Additionally, data from different sources may report for the same year different figures for the extent of irrigated areas. In the following we describe the approaches used to fill data gaps and to harmonize inconsistent input data.

Linear interpolation:

This method was applied when two data points existed but the values in between were missing (Figure 1). Linear interpolation was applied 1) in between two reported data points, 2) between reported data and values derived by scaling either between data sources or between data from a country believed to be comparable in terms of irrigation history (see section on scaling below), and 3) between estimated values (see section on estimates below) and reported data. For classifying the interpolated computations, values derived through 1) and 2) are classified as interpolated values, whereas values derived through 3) are classified as *interpolated values based on estimates*. The 2-way distinction of interpolated values was made because interpolation involving estimates implies higher uncertainty.

Linear extrapolation:

Linear extrapolation was applied using a known or assumed rate of increase or decrease in area prior or post the period of recorded statistics based on the assumption that the area equipped for irrigation developed in a homogeneous fashion (Figure 2). This method is in general more questionable than interpolation and the uncertainty of the so derived values is believed to be larger.

An example for the use of linear interpolation as well as linear extrapolation is Guatemala (Figure 3). For Guatemala, irrigation statistics were reported for the years 1961-2003 as well as for the year 1920. The data gap between 1921 and 1960 was filled using linear interpolation. The missing data prior to 1920 was then extrapolated using the rate of decrease for the years 1920-1961. It should be noticed that the computed values for the periods 1900-1919 and 1921-1960 are mainly determined by the data point reported for year 1920, which gives it a particular weight.

Interpolation												
									x	x		
								o				
							o					
						o						
					o							
				o								
	x		**x**									
x		x										
1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962

x …. reported data (the two data points in bold were used to calculate the rate)
o …. interpolated data points

Figure 1

Illustration of filling data gaps using linear interpolation.

Extrapolation												**X**
										x	x	
									x			
					x	x	x	x				
				x								
			X									
	o	o										
o												
1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912

x …. Reported data (the two data points in bold were used to calculate the rate)
o …. Extrapolated data points

Figure 2

Illustration of linear extrapolation to estimate data prior to earliest reported information.

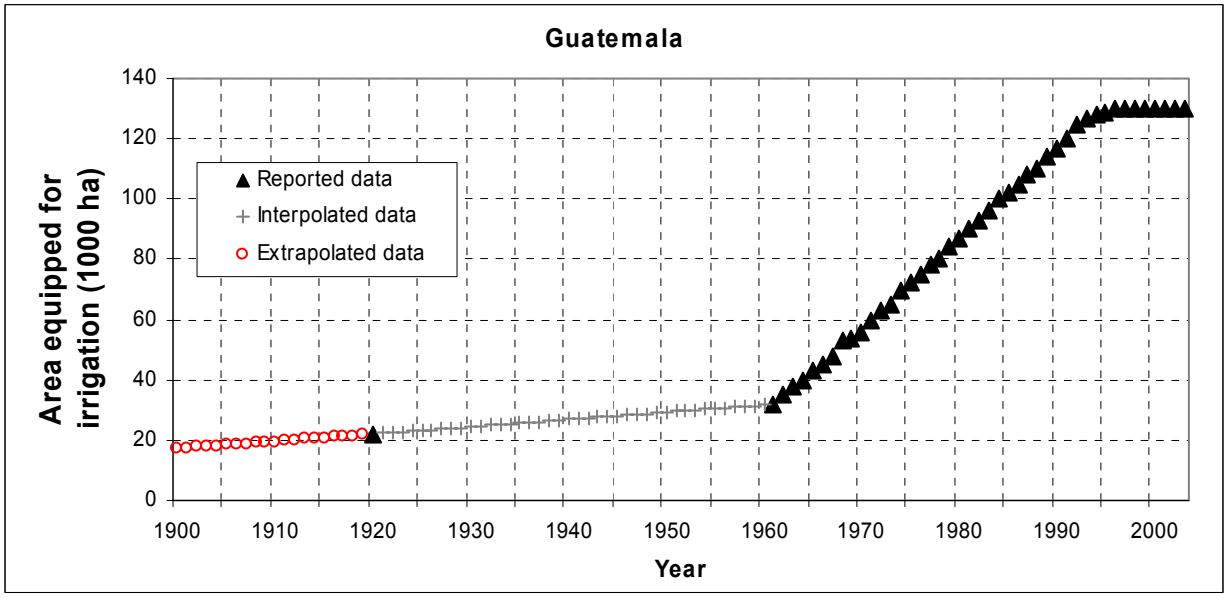

Figure 3

Time series developed for Guatemala as example for linear interpolation and linear extrapolation.

Scaling of lower priority data to higher priority data between data reported for the same country:

When for a time period data from a high priority source existed and for a time period prior or subsequent to the aforementioned period data from a source with lower priority existed but was offset by some factor, the lower priority data was scaled to the level of the data source with the higher priority (Figure 4).

An example for the use of data scaling of lower priority data to data with higher priority is Peru (Figure 5). For Peru, data existed for the time period of 1961-2003. However, only one data point for the year 1994 was provided by the data source with the highest priority (AQUASTAT country profile). The remaining data were provided by the AQUASTAT online data base for 1998-2002 and by FAOSTAT for 1961-2003. The AQUASTAT online data base showed lower values for 1998-2002 than the AQUASTAT country profile value for the year 1994 which would have indicated a decline in area equipped for irrigation whereas the FAOSTAT data does not display a decline over the same period. In order to reconcile these deviating trends in the AQUASTAT online data base data were therefore in this particular case ignored although a higher priority was initially assigned. The FAOSTAT data were then scaled to the level of the 1994 data point from the AQUASTAT country profile which showed an about 30% higher value for the year 1994

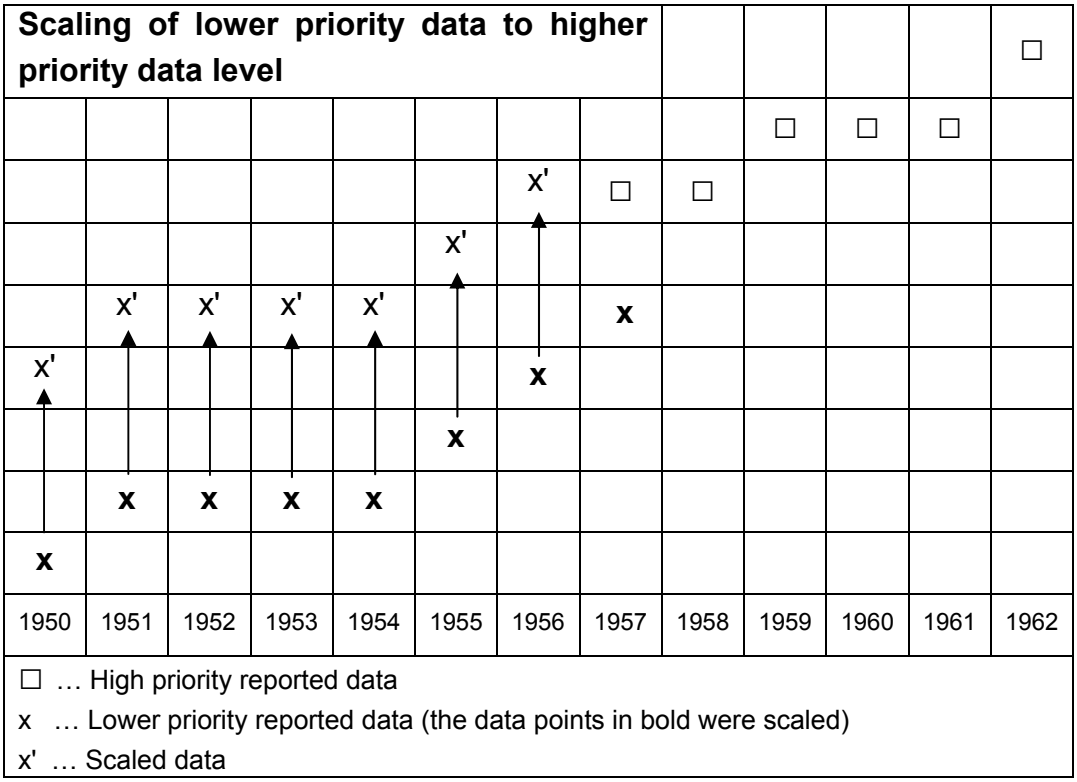

Figure 4

Illustration of the scaling of lower priority data to higher priority data between data reported for the same country.

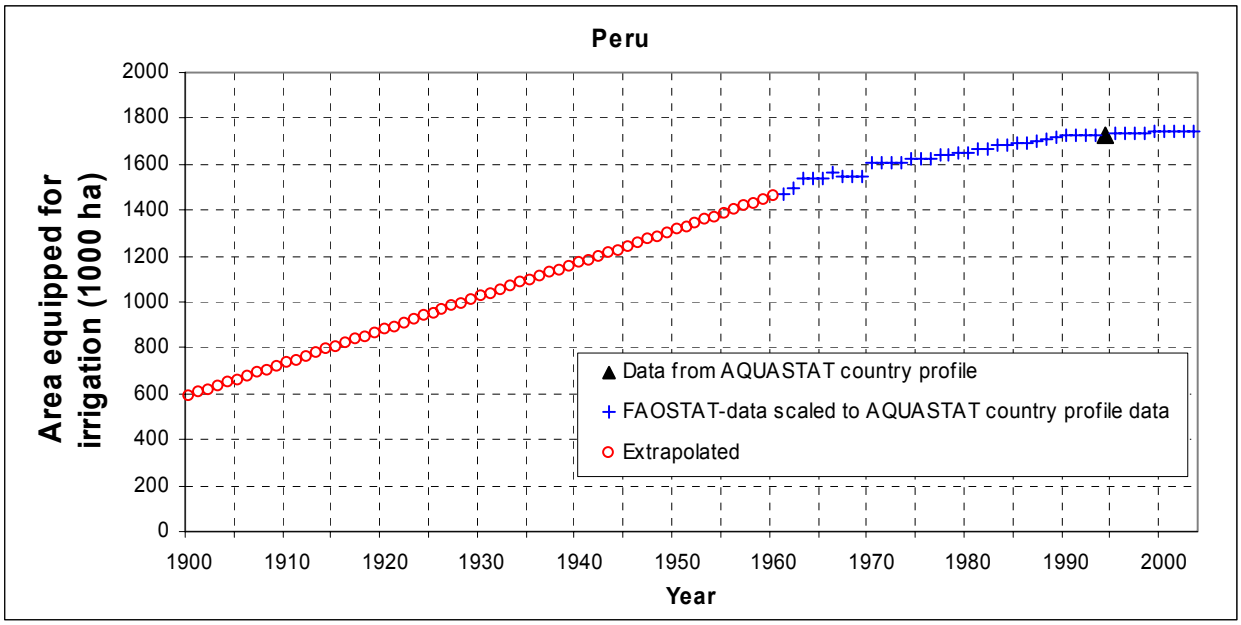

Figure 5

Time series developed for Peru as example for scaling of lower priority data to higher priority data.

than FAOSTAT. The missing data prior to 1961 were extrapolated using the rate of decrease between 1970 and 1961.

Scaling of data from one country to data from a country believed to be comparable in irrigation development:

When data were not available for a long period but a complete data series was already constructed for a country that was believed to be comparable in irrigation development, the time series was derived by scaling the existing data from the compared country to the data level of the country in question (Figure 6). In the course of using this method, 18 country groups were created. The country groups were formed based on historical information mainly from Framji et al. (1981), the online CIA-factbook available online (https://www.cia.gov/library/publications/the-world-factbook/index.html), as well as common geographical knowledge. These groups are:

1. India, Pakistan, Bangladesh
2. North Korea, South Korea

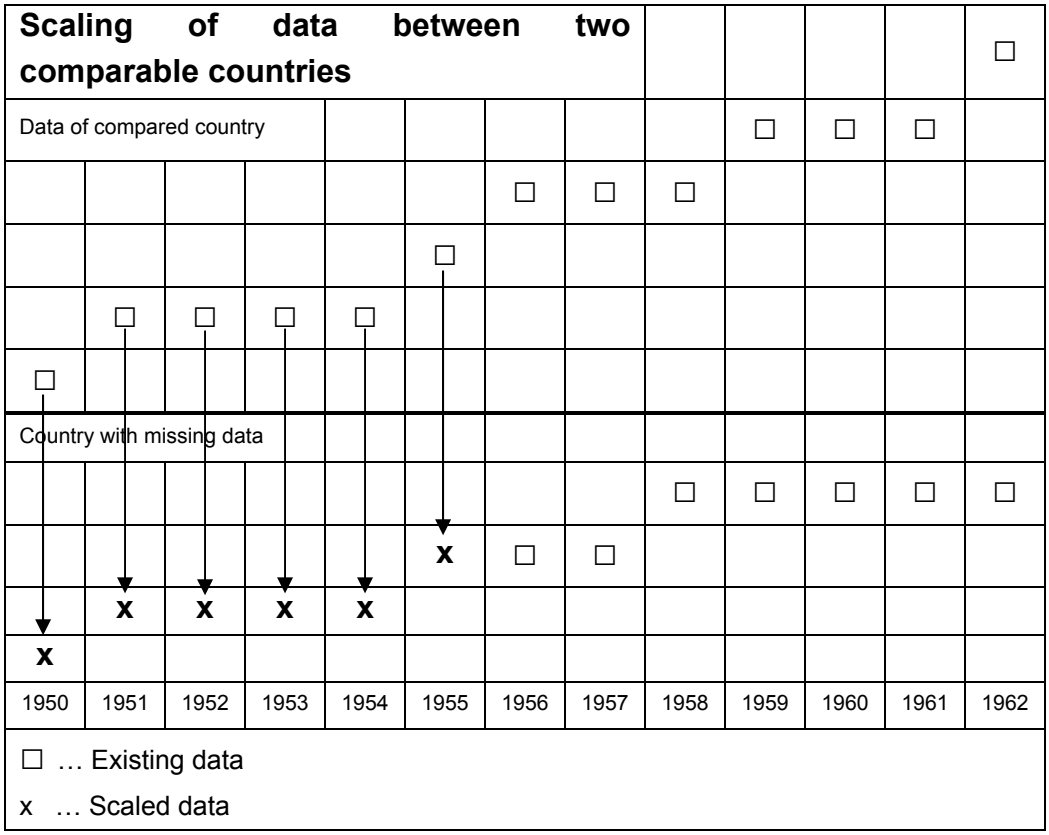

Figure 6

Illustration of scaling of data from one country to data from a country believed to be comparable in irrigation development.

3. China, Taiwan
4. Cambodia, Laos, Vietnam
5. Indonesia, East Timor
6. Jordan, Iraq, Iran, Afghanistan
7. Israel, Gaza, West Bank
8. Kazakhstan, Turkmenistan, Uzbekistan, Kyrgyzstan, Tajikistan
9. Georgia, Armenia, Azerbaijan
10. Ukraine, Moldova, Russia, Romania
11. Czech Republic, Slovakia, former Czechoslovakia
12. Bosnia and Herzegovina, Croatia, Macedonia, Serbia/Montenegro/Kosovo, former Yugoslavia, Albania, Bulgaria
13. Libya, Algeria
14. Eritrea, Ethiopia, Ethiopia PDR
15. Uganda, Burundi, Rwanda
16. Tanzania, Mozambique
17. Madagascar, Mauritius, Reunion
18. Islands of the Small Antilles

An example for the application of this method is Eritrea (Figure 7). Eritrea separated from Ethiopia in 1993, therefore only data from 1993-2003 were available. To cover the time period for the geographic area of today's country of Eritrea prior to 1993, the data of the former Ethiopia PDR were used. AQUASTAT-data was used for 1993-1997. The subsequent period between 1998 and 2003 was derived by scaling FAOSTAT-data to AQUASTAT-data.

Estimation based on qualitative information:

In the absence of data for the early 20th century, especially for the year 1900, estimates were made whenever qualitative information on historical irrigation extent was available. The richest source for qualitative information was Framji et al. (1981), however, qualitative information from other publications (see Appendix A2) and from the CIA – The World Factbook available online (https://www.cia.gov/library/publications/the-world-factbook/index.html) was used as well. An example is Nicaragua (Figure 8) with the estimated value of 2000 ha for the year 1900 based on the information in Framji et al. (1981) that there was no tradition of large scale irrigation in that country prior to 1960 and that only private irrigation of primarily sugar cane on a very small scale took place.

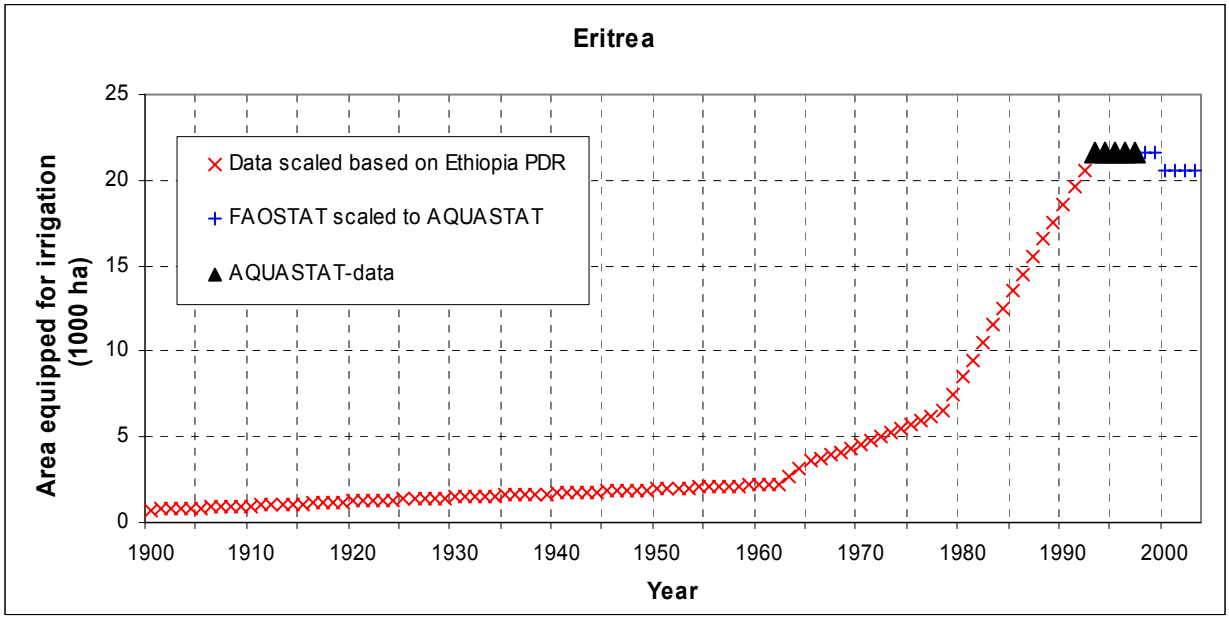

Figure 7

Time series developed for Eritrea as example of scaling of data from one country using data from another country believed to be comparable in irrigation development.

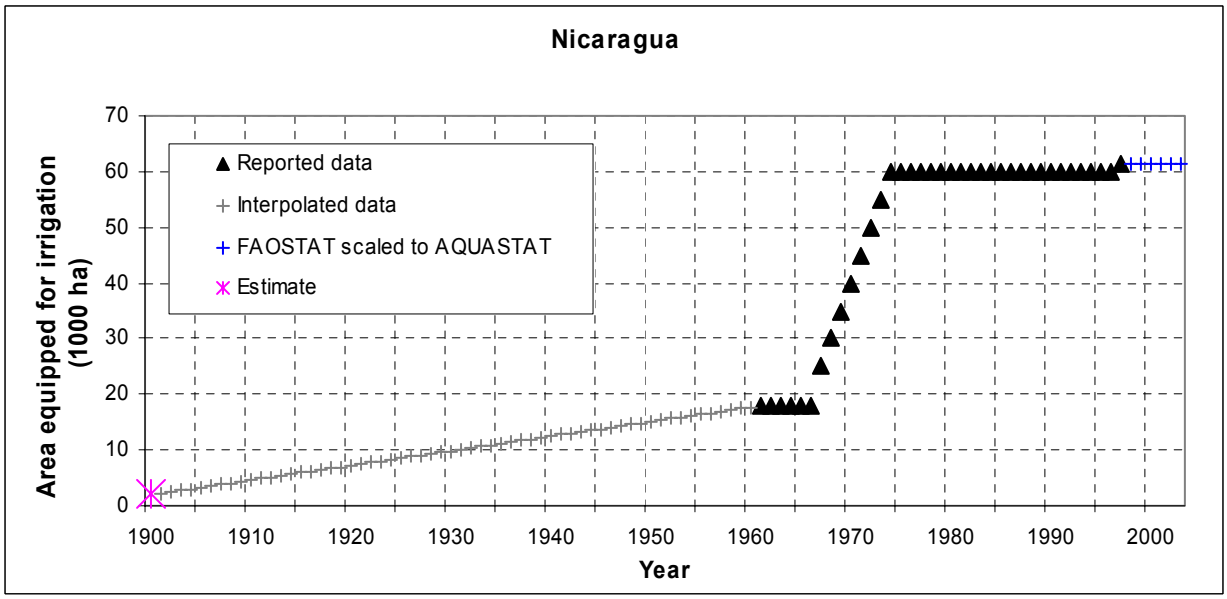

Figure 8

Time series developed for Nicaragua as example of using qualitative information on historical irrigation extent as found in the literature.

3 Results

The total area equipped for irrigation in the year 1900 was 53.3 Mha compared to 285.8 Mha in 2003 which is 5.37 times as much as in the year 1900. The top four countries with the largest area equipped for irrigation in 1900 are India, China, Pakistan and the USA with India ranging first. These four countries combined account for almost 57% of the total area equipped for irrigation in 1900. In 2003 the same four countries lead the ranking only that the USA and Pakistan swapped positions. In 2003 these four countries account for about 55% of the total area equipped for irrigation in the world. The fractions of the total area equipped for irrigation that these top four countries account for over the period of 1900-2003 in comparison to all others was remarkably stable (Figure 9).

The data show that the first half of the 20th century is characterized by a modest increase in area equipped for irrigation. Starting in the 1950s, the development becomes more dynamic. Many countries show sharp increases between 1960 and 1990, e.g. North African countries and countries in Latin America. Many countries that have no historic tradition of irrigation at all start

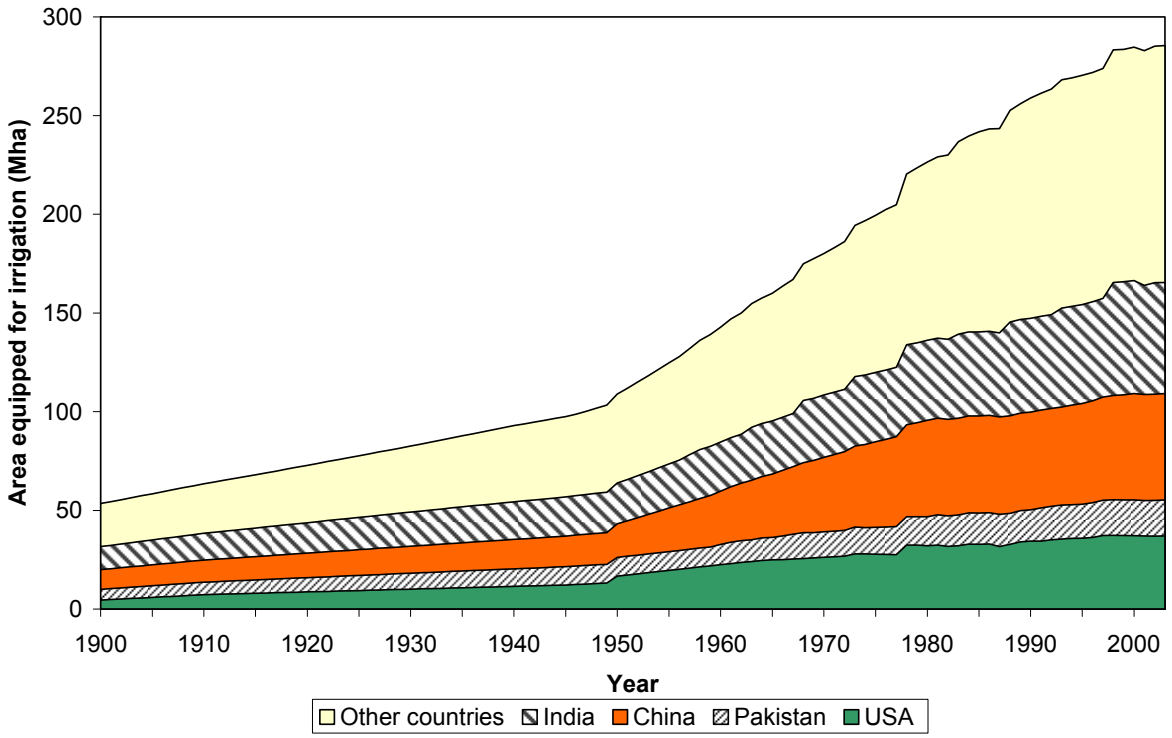

Figure 9

Area equipped for irrigation 1900-2003 in stacked order for the four major irrigating countries compared to irrigation extent in the other countries.

installing irrigation equipment as part of national efforts of economic development past 1960, e.g. Barbados or Uruguay. The period past 1990 shows an overall consolidating trend with less pronounced increases. Countries in Eastern Europe and the former Soviet Union characterized by the transition from central planning economies to market economies showed significant decreases in area equipped for irrigation past 1991. Irrigation extent in Ukraine, for instances, reached a peek value of 2.6 Mha in 1992 and then dropped down to 0.9 Mha in the year 2000. Few of these countries have started to reverse the trend again. Area equipped for irrigation in Poland, for instance, shows an increasing trend between 2001 and 2003 after reaching a minimum at 89,300 ha in 2000.

The complete time series sorted by country name are shown in Appendix A1. The formatting of each value indicates the method used to compile the data as described in the methodology section. The data source for each value for any given year sorted by country name is listed in Appendix A2. There are values for 236 countries and for the time period of 1900 to 2003 resulting in a total of 24,544 data points. The values are provided in 1000 ha units.

The percentage of cropland (Klein Goldewijk et al., 2007) that was equipped for irrigation in 2000 (Figure 10a) was larger than 10% in most Asian countries, in Southern Europe, in countries located in the Western part of South America, in the United States, in Mexico and in several countries in North and South Africa (e.g. Egypt, Libya, Sudan, Morocco, Republic of South Africa, Madagascar). For some countries percentages larger than 100 were computed, indicating inconsistencies between cropland data and irrigation data that may be explained by the different methods used to compile the data sets. These countries are Egypt, Japan, Kuwait, Oman, Panama, Turkmenistan and the United Arab Emirates making them prime candidates for a more in-depth analysis in subsequent studies. Only very low percentages of irrigated cropland were computed for most of the West African countries and some Baltic states. There are only a few countries or regions without any irrigation, e.g. Greenland, Antarctica, Iceland (Figure 10a). In the year 1900, more than 10% of the cropland was irrigated in arid environments (e.g. in the Near East and Middle East regions, Chile, Peru, Egypt, South Africa) and in the major East Asian rice-growing countries like China, Japan, Indonesia or Thailand but also in Italy and Argentina. There were large regions without any irrigation, e.g. in Sub-Saharan Africa and Northern Europe (Figure 10b). The percentage of irrigated cropland increased in most of the countries between 1900 and 2000 (Figure 10).

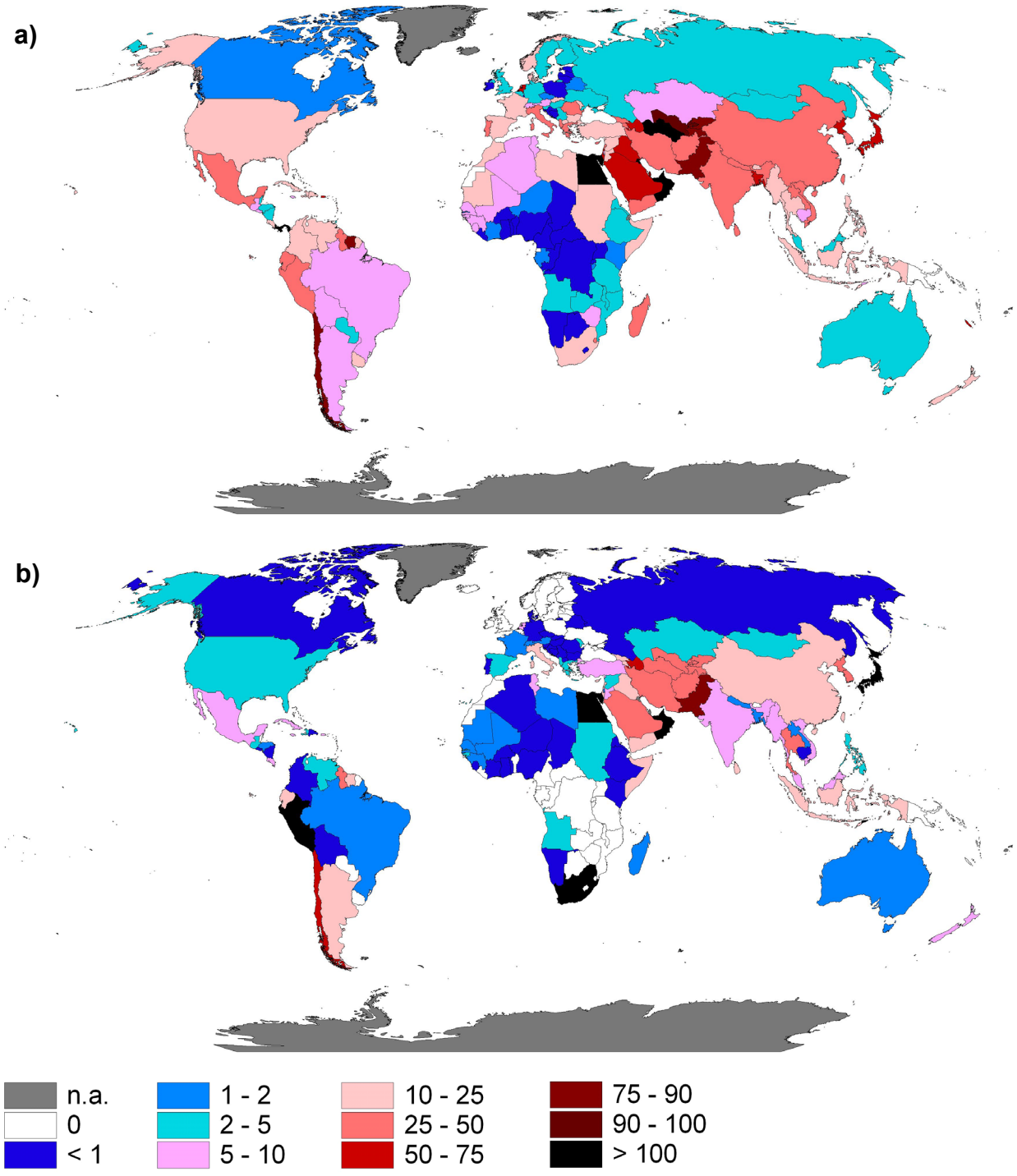

Figure 10

Area equipped for irrigation as percentage of total cropland area (taken from Klein Goldewijk et al., 2007) in 2000 (a) and 1900 (b), values were provided per country using the administrative setting of the year 2000.

4 Discussion

23% of the 24,544 provided data values are reported data. As mentioned earlier, the bulk of reported data occurred in the second half of the 20th century, especially in between 1961 and 2003 when the FAOSTAT data were available. The percentage of reported data was largest for the year 2000 when 73% of all values were reported data. Accordingly, the first half of the 20th century showed a very low fraction of reported data. This low percentage was primarily due to the many island states that have little or no area equipped for irrigation and for which only few data around the year 2000 existed. Because of the unique conditions on island states it seemed appropriate to assume that the missing values for the remaining time series were also extremely small or zero. For example, if for the Marshall Islands data for the year 2000 were provided with area equipped for irrigation equalling zero, than it is extremely likely that all other values of the time series, although being estimates, are zero as well. If all 51 countries with data for the year 2000 equalling zero, e.g. the island of Nauru, or for which no data were reported at all, e.g. the Christmas Islands, were eliminated, the percentage of reported values was significantly increasing to 71% for the period 1961-2000 (Figure 11). Please note that even after this statistical adjustment the percentage of reported values still does not contain all countries that had little irrigation at the end of the last century but no irrigation reported for years before, and for which the remaining data of the time series were consequently filled with estimates. An example for such a case is the country of Brunei with reported data for 1980-2003 equalling 1000 ha and 1961-1979 equalling zero. The records for 1900-1960 were then assumed to be zero as well and counted as estimates.

In order to relate the frequency of computed values and reported data to the actual extent of area equipped for irrigation, we calculated the sum of areas for each data type and show percentages of the total area equipped for irrigation in Figure 12. The sum of irrigated area in the data set that is based on estimated values (black) was small within the entire period compared to the total irrigated area. The highest percentage of irrigated area based on estimates occurred for the year 1900 where estimated values accounted for a little less than 30%. The absolute value for estimates for 1900 was 15.7 Mha of which China accounted for 10.0 Mha alone followed by Mexico and Indonesia with 1.0 Mha each. If it was possible to find reported data for China for the year 1900, the percentage for estimated values in terms of area equipped for irrigation based on estimates would drop from 30% to 10%. The area in the data set that was based on interpolation between estimated values (pink) was directly linked to the use of estimates in the year 1900 so that the bulk of these values occurred between 1901 and 1960 accounting for about

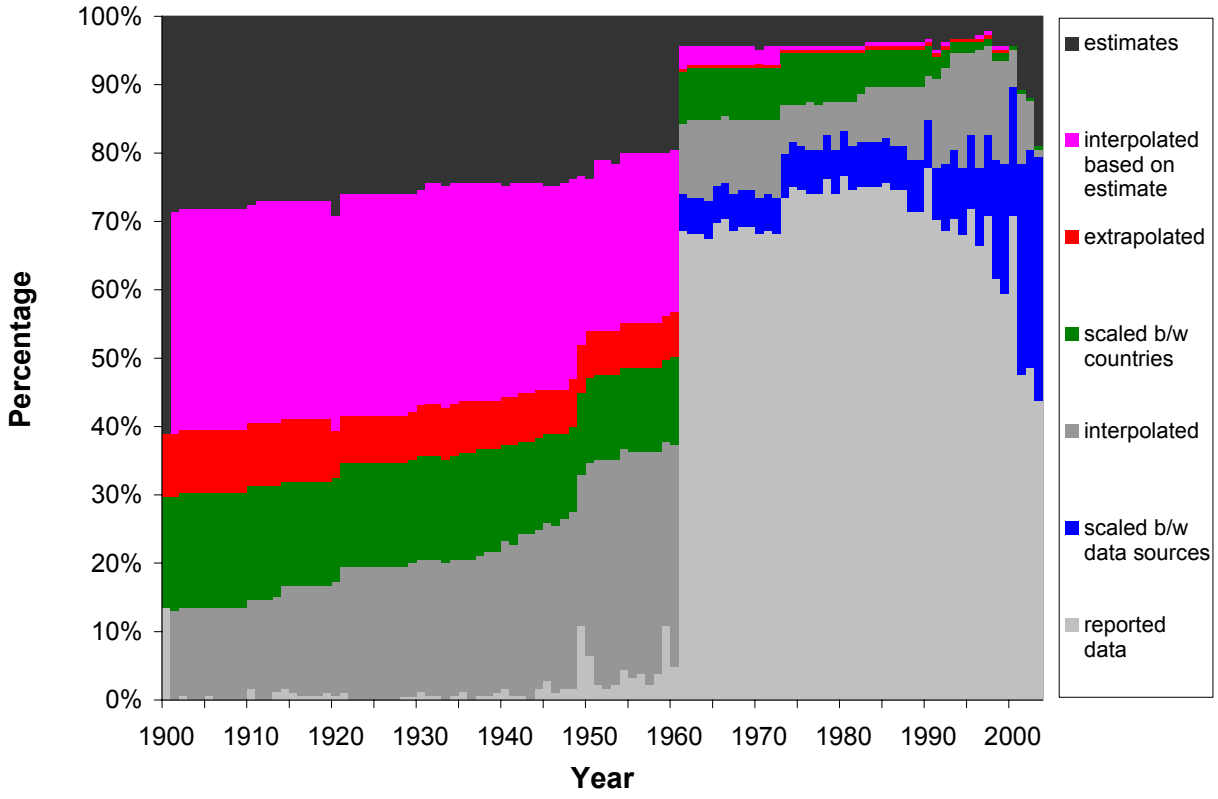

Figure 11

Percentage of data points in the developed time series originating from reported statistics (light grey), reported data scaled to higher priority information (blue), interpolated data (dark grey), data scaled according to information from similar countries (green), extrapolated data (red), interpolated data based on estimates (pink) and estimates (black), countries with reported irrigation extent of 0 ha in 2000 were excluded.

30% of the total area equipped for irrigation. Again, finding reported data for China for 1900 would significantly reduce this portion and at the same time decrease data uncertainty as the combination of estimated values and interpolated values based on estimates produces the least certain data part within the time series.

The estimates necessary for the period between 2001 and 2003 were mainly for those countries for which only data until the year 2000 were reported. Since most of the data sources used in this analysis reported data until 2003, it was decided to construct the time series accordingly. For the small number of countries for which no data for 2001-2003 were available, area equipped for irrigation was kept constant at the level reported for year 2000. So although these values were classified as estimates suggesting high uncertainty, we believe that they constitute a solid

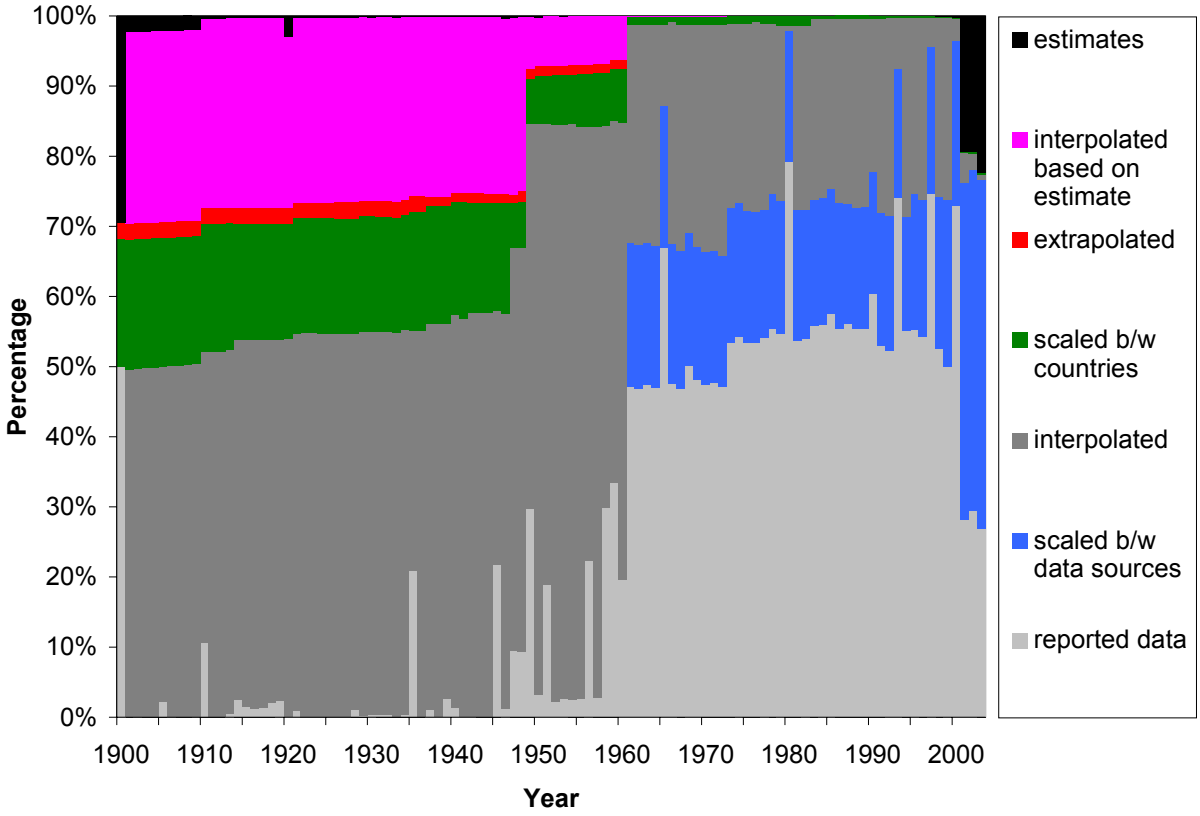

Figure 12

Percentage of cumulative area equipped for irrigation originating from reported statistics (light grey), reported data scaled to higher level information (blue), interpolated data (dark grey), data scaled according to information from similar countries (green), extrapolated data (red), interpolated data based on estimates (pink) or estimates (black), countries with reported irrigation extent of 0 ha in 2000 were excluded.

approximation of the actual area equipped for irrigation and, thus, have much lower uncertainty than those estimates made for the early part of the 20th century.

The most reliable data portions within the time series are composed of reported data (light grey), values derived by scaling between data reported from different sources for the same country (blue) and interpolations between reported data (dark grey). In terms of cumulative area equipped for irrigation as shown in Figure 12, this data portion accounted for nearly 100% between 1960 and 2000 and for about 60% between 1900 and 1960. In general it can be assumed that the older reported data are less reliable than the more recent reported data. In addition to that, reported data are always to some degree subject to institutional and individual failure. The reporting methods vary among countries and among agencies. In isolated cases, data may be subject to politically

induced bias. For Jordan, for example, it was indicated that the census data likely overestimate irrigated area because reported values reflected a personal achievement of the regional irrigation engineers being faced with ambitious goals set by the central planning agency (Popp and Rother, 1993). However, we believe that errors resulting from such circumstances are small compared to other sources of uncertainty and do not significantly compromise the overall quality of census data. When data from multiple data sources were available the comparison often showed an overall high consistency. Larger deviations could mostly be explained by the use of varying definitions of irrigated land and could therefore be accounted for in the analysis. Interpolations, while believed to yield values with relatively high certainty, also cause time series to appear smoother than in reality. When larger irrigation projects, such as dams, are commissioned the data representing irrigated area should show a significant increase in a short time period. Interpolated data would mask such short term increases with a more long term trend.

Values that were derived through scaling between similar countries (green) are intermediary with respect to data uncertainty. The method is based on the assumption that irrigation development evolved in a similar fashion between countries believed to be comparable. This data type occurs frequently in the first half of the 20th century accounting for about 20% of total area equipped for irrigation. Many of the countries that changed their political boundaries at some point within the study period are represented by this data type and are therefore oftentimes found within the country groups introduced above. Gathering more reported data on sub-national levels for the earlier part of the 20th century in subsequent studies will hopefully eliminate many of these scaled values and, henceforth, improve data certainty with respect to these countries.

Extrapolated values (red) along with estimates (black) and interpolations based on estimates (pink) formed the least reliable data portion within the time series. The number of extrapolated values was about 10% for the early part of the 20th century tapering off as time progressed and were only marginally present between 1960 and 2003. In terms of total area, extrapolations were making up only 2% of the total area equipped for irrigation. Similar to interpolated values, extrapolated values suggest a homogeneous development where a more dynamic and phased development may have occurred. However, they are by far more subjective as the assumption that the rate of development was constant over prolonged periods of time adds a significant degree of uncertainty to them. Estimates based on qualitative information are educated guesses. These data have a high degree of uncertainty and should be used with appropriate consideration and care. As the data coverage for countries and regions with so far scant quantitative information, e.g. Africa, improves, the estimated values should be replaced accordingly. However, for the purpose of this analysis with the goal of complete global and temporal coverage

estimated values are believed to provide an acceptable means when no other ways of obtaining data was at disposal.

The only global estimate for irrigated area in 1900 to which the values in this study could be compared was provided in Framji et al. (1981). The world total was estimated at about 40 Mha. This compares to a total of about 53 Mha computed in this study (Table 2). The sum of the major irrigating countries (India, USSR, USA, Egypt, Japan and Italy) was estimated by Framji et al. (1981) to be about 30 Mha which would mean that all other countries including China would account for 10 Mha. Unfortunately the authors did not provide a value for China for the year 1900. The earliest data reported for China and known to us is 16 Mha for 1949. In the study presented here the sum of the irrigated area in major irrigating countries (30 Mha) is similar to the figures listed by Framji et al. (1981). All other countries including China therefore sum up to 23 million ha (Table 2). Irrigated area for China was estimated at 10 Mha for year 1900 so that the extent of irrigation increased between 1900 and 1949 by 6 Mha. This resulted in 13 Mha for all other countries. Provided that the 10 Mha estimate for China was a realistic approximation, the main difference of 13 Mha between the total provided by Framji et al. (1981) and the total of this study was primarily due to the contributions of all other countries. The largest contributors among those were Iran, Mexico, Indonesia and Spain (≥ 1 Mha) and Chile, Turkey, Peru and Argentina (< 1 Mha and ≥ 0.5 Mha).

Despite the obvious limitations that our new data set certainly has it can be of high value in numerous settings where land use data with respect to irrigated areas are important, especially because no comparable compilation existed so far. Since the methods for filling data gaps and harmonizing inconsistent input data were explicitly outlined and documented in this study it will be possible to assign confidence scores to results that are produced based on this data product. The documentation of the statistical data types will also make it straight forward to replace values carrying a high degree of uncertainty once more reliable data is found. There are already efforts

Table 2

Area equipped for irrigation in year 1900 as reported by Framji et al. (1981) and as computed in this study

Country / region	Irrigated area (Mha) reported or computed for year 1900 in	
	Framji et al. (1981)	This study
Major irrigating countries (India + USSR + USA + Egypt + Japan + Italy)	30	30
China	?	10
Other countries	?	13
World	40	53

on gathering data on sub-national levels under way that will allow to fill data gaps, to verify existing data and computed values and to replace low confidence data. In that sense the authors regard this data product as a work in progress.

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Appendix A1: Time series of irrigated area per country 1900-2003

Values refer to areas equipped for irrigation in thousand hectares, except for Australia, Brazil, Canada and India where area equipped for irrigation was not known. For these countries the statistics refer to area actually irrigated.

Number format and colour codes used in the table:

unformatted figure, black: census data / reported data

bold figure, black:	estimated value based on qualitative information
italic figure, black:	value derived by linear interpolation between two reported data points
italic figure, blue:	value derived by scaling of reported data of lower priority to reported data with higher priority within the same country
italic figure, green:	value derived by scaling of statistical values from a country believed to be comparable in irrigation development to data of target country
italic figure, red:	value derived by linear extrapolation based on known rate
italic figure, pink:	value derived by linear interpolation based on estimate

Country setting as in ESRI. (2004): ESRI Data & Maps 2004. DVD-ROM.

In this documentation report area equipped for irrigation is presented in ten-year steps beginning with year 1900. Annual time series are available in tabular format at:
http://www.geo.uni-frankfurt.de/ipg/ag/dl/forschung/Historical_Irrigation_Extent/index.html

COUNTRY	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
Afghanistan	1,113.15	1,249.20	1,385.25	1,521.30	1,657.36	2,264.56	3,342.93	3,442.09	3,278.57	3,019.42	3,019.42
Albania	25.00	26.08	27.16	28.24	30.80	39.30	145.39	284.00	371.00	423.00	340.00
Algeria	22.63	63.81	104.99	146.17	187.35	228.53	231.29	238.00	253.00	455.00	569.42
American Samoa	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Andorra	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.15	**0.15**
Angola	**37.50**	43.65	49.80	55.94	62.09	68.24	74.39	75.00	80.00	80.00	80.00
Anguilla	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Antarctica others	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Antigua and Barbuda	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.50**	0.34	0.18	**0.13**
Argentina	564.39	655.09	745.80	836.51	927.21	1,017.92	1,108.63	1,459.85	1,767.78	1,767.78	1,767.78
Armenia	84.88	93.97	64.59	110.50	156.41	202.32	248.23	275.16	272.50	286.03	**285.65**
Aruba	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Australia	60.70	131.68	202.65	273.63	388.66	590.04	891.36	1,476.00	1,500.00	1,909.53	2,051.42
Austria	**18.57**	**18.57**	**18.57**	18.57	26.19	33.81	41.43	52.92	70.21	87.50	95.14
Azerbaijan	831.12	920.17	879.45	934.27	989.09	1,043.91	1,098.73	1,153.55	1,215.00	1,410.60	1,455.00
Bahamas	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00	1.00	1.00	1.00
Bahrain	**0.50**	0.58	0.66	0.75	0.83	0.91	0.99	1.00	1.00	2.00	4.06
Bangladesh	123.03	142.75	162.46	182.18	200.64	258.64	410.79	1,058.00	1,520.00	2,790.00	4,187.00
Barbados	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	1.00	1.00	5.00	5.00
Belarus	**21.46**	33.21	44.97	56.73	68.48	80.24	92.00	103.75	125.81	115.00	101.11
Belgium	**0.00**	1.87	3.74	5.61	7.48	9.16	9.17	10.91	14.40	17.88	35.17
Belize	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	1.00	1.00	2.00	3.00
Benin	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	2.00	9.67	9.72	12.26
Bermuda	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Bhutan	0.00	0.00	0.00	0.00	0.00	0.00	6.89	18.00	26.00	39.00	40.00
Bolivia	**3.00**	6.33	9.67	13.00	16.33	26.98	67.50	80.00	140.00	125.00	130.00
Bosnia and Herzegovina	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	2.56	3.80	3.41	2.91	4.63
Botswana	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	1.00	2.00	1.38	1.44
Bouvet Island	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Brazil	**64.00**	**64.00**	**64.00**	**64.00**	**64.00**	64.00	320.00	796.00	1,600.00	2,332.00	3,080.00
British Indian Ocean Ter	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
British Virgin Islands	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Brunei	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00	1.00	1.00	1.00
Bulgaria	30.00	31.30	32.59	33.89	35.18	144.79	667.71	1,001.00	1,197.00	1,148.22	541.90
Burkina Faso	**0.50**	0.75	0.99	1.24	1.48	1.73	1.98	4.00	10.00	20.00	25.00
Burundi	0.00	0.00	0.00	0.00	0.00	0.00	11.20	14.00	14.00	15.00	21.43
Cambodia	2.19	11.87	21.63	31.44	41.27	51.13	61.01	89.00	120.00	240.00	284.17
Cameroon	0.00	0.00	0.00	0.00	0.00	0.00	1.50	7.00	14.00	22.00	25.65
Canada	32.40	118.80	186.33	235.00	271.28	307.57	343.85	421.00	596.00	718.00	785.04
Cape Verde	**0.00**	0.33	0.66	0.98	1.31	1.64	1.97	2.00	2.00	2.78	3.11
Cayman Islands	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Central African Republic	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00	0.00	0.78	1.00
Chad	**1.00**	1.98	2.97	3.95	4.93	5.92	6.90	8.00	12.00	16.00	26.00
Chile	800.00	800.00	848.86	923.76	972.55	1,021.33	1,070.12	1,180.00	1,255.00	1,600.00	1,900.00
China	**10,000.00**	11,224.49	12,448.98	13,673.47	14,897.96	17,004.38	27,048.13	37,669.00	48,867.00	49,533.15	53,823.00
Christmas Island	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Cocos (Keeling) Islands	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Colombia	**10.00**	15.00	20.00	25.00	**30.00**	80.00	220.00	250.00	400.00	650.00	900.00
Comoros	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.13	0.13
Congo Dem.											

COUNTRY	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
Rep.	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00	7.00	10.00	11.00
Congo, Rep	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	1.00	1.00	1.00	2.00
Cook Islands	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Costa Rica	*10.10*	*12.13*	**14.15**	*16.17*	*18.20*	*20.22*	*25.21*	26.00	61.00	77.00	108.00
Cote D'Ivoire	**1.00**	*1.49*	*1.98*	*2.48*	*2.97*	*3.46*	*3.95*	20.00	44.00	66.00	73.00
Croatia	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	*2.56*	*2.46*	*2.21*	*1.88*	3.00
Cuba	**30.00**	*36.12*	*42.24*	*48.37*	*54.49*	*71.33*	*207.33*	450.00	762.00	890.00	*870.32*
Cyprus	**9.35**	*11.08*	*12.81*	*14.54*	*16.27*	*18.00*	*25.81*	27.00	30.00	36.00	*47.88*
Czech Republic	*4.69*	*8.90*	*12.52*	*15.55*	18.00	*22.19*	*26.39*	*44.46*	*97.39*	127.39	50.59
Denmark	10.00	*10.00*	*10.00*	*10.00*	*10.00*	*11.00*	*30.00*	90.00	391.00	430.00	447.00
Djibouti	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	1.00	1.00	1.00	*1.01*
Dominica	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Dominican Republic	**1.00**	*1.68*	*2.36*	3.04	*29.37*	*110.80*	*147.69*	*173.85*	200.00	*249.79*	*296.68*
East Timor	*3.14*	*4.63*	*6.12*	*7.62*	*9.11*	*10.60*	*12.10*	*12.24*	*12.89*	14.00	**7.00**
Ecuador	157.00	*203.39*	*249.79*	*296.18*	*342.57*	*388.97*	*435.36*	470.00	620.00	820.00	865.00
Egypt	2,310.00	*2,327.31*	*2,344.62*	*2,361.92*	*2,379.23*	*2,396.54*	*2,697.96*	*2,952.00*	3,000.00	*3,189.23*	3,422.18
El Salvador	**1.00**	*1.12*	*1.24*	*1.36*	*1.48*	1.60	*16.51*	20.00	36.00	40.00	45.00
Equatorial Guinea	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Eritrea	*0.74*	*0.96*	*1.17*	*1.39*	*1.61*	*1.82*	*2.04*	*4.25*	*8.25*	*19.37*	*20.61*
Estonia	**0.00**	*1.14*	*2.27*	*3.41*	*4.55*	*5.69*	*6.82*	*7.96*	13.63	10.30	1.36
Ethiopia	**10.00**	*12.89*	*15.78*	*18.67*	*21.56*	*24.45*	*27.34*	*57.15*	*110.83*	*260.14*	*289.53*
Faeroe Islands	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Falkland Islands (Malvinas)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Federated States of Micronesia	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Fiji	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	1.00	1.00	1.00	3.00
Finland	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	16.00	60.00	64.00	88.14
France	**252.00**	*293.31*	*334.62*	*375.93*	*417.25*	*458.56*	*499.87*	767.00	1,370.00	2,099.70	2,633.68
French Guyana	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	1.00	1.00	2.00	2.00
French Polynesia	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00	0.00	1.00	1.00
Gabon	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	*3.64*	4.00	4.00	*5.56*	*7.79*
Gambia	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	1.00	1.00	1.67	2.15
Gaza Strip	*0.67*	*0.81*	*0.95*	*1.09*	*1.23*	*2.10*	*6.07*	*7.68*	*8.95*	9.66	*9.26*
Georgia	98.00	*108.77*	*74.55*	*120.79*	*177.23*	*233.67*	*290.11*	*346.55*	*402.99*	448.14	469.00
Germany	**110.00**	*132.45*	*154.90*	*177.35*	*199.80*	*228.42*	*312.58*	419.00	460.00	482.00	496.87
Ghana	**2.00**	*2.57*	*3.13*	*3.70*	*4.26*	*4.83*	*13.75*	15.00	20.00	30.00	30.90
Gibraltar	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Greece	**100.00**	*131.03*	*162.07*	*199.00*	*275.45*	230.00	425.00	730.00	961.00	1,195.00	1,451.00
Greenland	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Grenada	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	*0.00*	*0.04*	*0.04*	*0.22*	**0.22**
Guadeloupe	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.89*	2.00	2.00	2.00	6.00
Guam	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.02*	0.31
Guatemala	*17.12*	*19.56*	22.00	*24.44*	*26.88*	*29.32*	*31.76*	56.00	87.00	117.00	130.00
Guinea	**5.00**	*7.46*	*9.92*	*12.38*	*14.84*	*17.30*	*19.75*	50.00	90.00	90.00	94.91
Guinea Bissau	**2.00**	*4.46*	*6.92*	*9.38*	*11.84*	*14.30*	*16.75*	17.00	17.00	17.00	25.00
Guyana	28.33	*37.38*	*46.44*	*55.49*	*64.55*	*62.81*	*85.88*	115.00	125.00	140.00	*150.13*
Haiti	**7.00**	**7.00**	*13.87*	*20.74*	*27.62*	34.20	*34.93*	60.00	70.00	80.00	92.00
Heard and McDonald Is	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Honduras	*8.67*	*10.93*	**13.20**	*15.47*	*17.73*	20.00	*39.00*	66.00	66.00	70.00	*83.67*
Hungary	20.00	*21.43*	*22.86*	*24.29*	*25.71*	*31.55*	*92.39*	*420.49*	*430.85*	*333.18*	235.50
Iceland	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
India	11,660.00	*13,528.57*	*15,397.14*	*17,265.71*	*19,015.00*	*20,721.67*	24,880.00	31,550.00	40,500.00	47,430.00	57,291.41

COUNTRY	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
Indonesia	**1,000.00**	*1,475.00*	**1,950.00**	*2,425.61*	*2,901.22*	*3,376.83*	*3,852.44*	3,900.00	4,107.00	4,459.00	*4,502.71*
Iran	*1,443.04*	*1,619.41*	*1,795.78*	*1,972.15*	*2,148.52*	*2,935.68*	*4,333.62*	*4,949.31*	*4,709.46*	*6,662.53*	*7,210.76*
Iraq	*403.23*	*452.51*	*501.79*	*551.08*	*600.36*	*820.31*	*1,210.94*	1,480.00	1,750.00	3,525.00	3,525.00
Ireland	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	1.10
Israel	**15.00**	*18.13*	*21.25*	*24.38*	*27.50*	47.00	136.00	172.00	200.30	205.70	194.00
Italy	1,300.00	*1,407.14*	*1,625.00*	*1,875.00*	*2,125.09*	*2,376.02*	*2,844.02*	*3,172.01*	3,500.00	3,857.71	3,892.20
Jamaica	6.48	*8.48*	*10.97*	*13.47*	*15.96*	*18.53*	*21.68*	24.00	24.00	25.00	*25.21*
Japan	2,720.00	*2,751.20*	*2,782.40*	*2,813.60*	*2,844.80*	2,876.00	*2,934.18*	3,415.00	3,055.00	3,012.31	*2,970.41*
Johnston Island	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Jordan	**10.00**	*11.22*	*12.44*	*13.67*	*14.89*	*20.34*	*30.03*	34.00	37.00	63.00	76.91
Kazakhstan	877.51	*973.65*	*1,069.78*	*1,165.92*	*1,262.06*	*1,358.20*	*1,454.33*	*1,550.47*	*1,867.77*	*2,092.81*	1,855.20
Kenya	**5.00**	*5.88*	*6.75*	*7.63*	*8.51*	*9.39*	*13.00*	29.00	40.00	54.00	85.00
Kiribati	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Kuwait	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	1.00	1.00	3.00	6.97
Kyrgyzstan	341.54	*416.99*	*500.82*	*584.64*	*668.47*	*752.30*	*836.12*	*919.95*	974.80	1,072.60	1,072.00
Laos	*3.60*	*4.98*	*6.35*	*7.73*	*9.11*	*10.49*	*11.86*	17.00	115.00	135.00	295.54
Latvia	**0.00**	*1.78*	*3.56*	*5.34*	*7.12*	*8.90*	*10.68*	*12.47*	17.00	15.00	0.56
Lebanon	11.00	*13.65*	*16.31*	*18.96*	*21.61*	*25.42*	*39.58*	68.00	86.00	86.00	*104.10*
Lesotho	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	1.00	1.00	2.00	2.64
Liberia	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	2.00	2.00	*3.15*	*3.15*
Libya	**10.00**	*28.20*	*46.39*	*64.59*	*82.79*	*100.98*	*119.18*	175.00	225.00	470.00	470.00
Liechtenstein	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Lithuania	**0.00**	*3.05*	*6.11*	*9.16*	*12.22*	*15.27*	*18.33*	*21.38*	27.10	42.70	7.00
Luxembourg	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**
Macedonia	*4.34*	*4.51*	*4.70*	*4.89*	*5.07*	*13.39*	*89.08*	*103.84*	*115.82*	*135.79*	127.80
Madagascar	**10.00**	**10.00**	**10.00**	*80.73*	*151.46*	*222.20*	*292.93*	330.00	645.00	1,000.00	1,086.29
Malawi	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.00**	4.00	18.00	20.00	55.00
Malaysia	**100.00**	*113.99*	*127.99*	*141.98*	*155.97*	*169.97*	*205.28*	262.00	320.00	342.00	365.00
Maldives	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Mali	**10.00**	*12.05*	*14.10*	*16.15*	*18.20*	20.25	*56.91*	61.00	60.00	78.00	235.79
Malta	**0.20**	**0.20**	**0.20**	**0.20**	**0.20**	**0.50**	**0.50**	1.00	1.00	1.00	2.00
Marshall Islands	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Martinique	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	1.00	5.00	4.00	7.00
Mauritania	**1.00**	*4.11*	*7.23*	*10.34*	*13.46*	*16.57*	*19.69*	30.00	49.00	49.00	45.01
Mauritius	*0.27*	*0.27*	*0.27*	*2.15*	*4.04*	*5.93*	*7.81*	15.00	16.00	17.00	21.22
Mexico	**1,000.00**	1,000.00	*948.95*	*897.91*	*846.86*	*1,398.57*	*2,854.42*	3,583.00	4,980.00	5,600.00	*6,476.92*
Midway Islands	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Moldova Republic	*39.76*	*46.99*	*54.21*	*61.44*	*68.67*	*100.91*	*127.15*	*153.38*	217.10	312.00	302.00
Monaco	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Mongolia	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	*6.82*	*23.88*	*53.21*	*57.30*
Montserrat	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Morocco	**0.00**	**0.00**	**0.00**	*27.34*	*300.78*	*574.22*	*847.66*	920.00	1,217.00	1,258.20	1,442.64
Mozambique	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*7.20*	26.00	65.00	105.00	118.12
Myanmar	**400.00**	*454.00*	*508.00*	*562.00*	616.00	*559.08*	*536.75*	839.00	1,006.00	1,056.00	1,841.32
Namibia	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**2.00**	4.00	4.00	6.14	7.57
Nauru	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Nepal	**14.70**	**14.70**	**14.70**	**14.70**	**14.70**	*26.55*	*66.05*	117.00	520.00	985.00	1,135.00
Netherlands	**58.00**	*96.03*	*134.07*	*172.10*	*210.13*	*248.16*	*286.20*	380.00	480.00	555.00	565.00
Netherlands Antilles	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
New Caledonia	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.00**	**1.00**	2.00	2.00	4.00	9.00
New Zealand	**39.03**	*58.23*	*77.42*	*96.62*	*115.82*	*135.01*	*154.21*	*225.07*	*371.06*	*567.74*	577.88
Nicaragua	**2.00**	*4.62*	*7.25*	*9.87*	*12.49*	*15.11*	*17.74*	40.00	60.00	60.00	*61.37*
Niger	**2.00**	*4.30*	*6.59*	*8.89*	*11.18*	*13.48*	*15.77*	18.00	23.00	66.00	73.35
Nigeria	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	*33.31*	*184.85*	200.00	200.00	230.00	290.30
Niue	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Norfolk Island	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
North Korea	*218.09*	*250.19*	*282.29*	*314.39*	*355.43*	*392.79*	*485.13*	500.00	1,120.00	1,420.00	1,460.00

COUNTRY	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
Northern Marianna Islands	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.06
Norway	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*3.33*	*16.67*	30.00	74.00	97.00	*134.40*
Oman	**10.00**	*11.64*	*13.28*	*14.92*	*16.56*	*18.20*	*19.84*	29.00	38.00	58.00	72.63
Pacific Islands (Palau)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Pakistan	*5,451.40*	*6,325.01*	*7,198.62*	*8,072.24*	*8,890.08*	*9,459.55*	*10,148.63*	12,950.00	14,680.00	15,820.00	18,090.00
Panama	*7.05*	*8.19*	**9.33**	*10.47*	*11.61*	*12.75*	*13.89*	20.00	28.00	31.00	*42.54*
Papua New Guinea	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Paraguay	**0.00**	*4.92*	*9.84*	*14.75*	*19.67*	*24.59*	*29.51*	40.00	60.00	65.00	67.00
Peru	*588.43*	*733.37*	*878.30*	*1,023.24*	*1,168.17*	*1,313.11*	*1,458.04*	*1,602.98*	*1,652.25*	*1,724.72*	*1,740.69*
Philippines	**50.00**	*121.45*	*192.91*	*264.36*	*335.81*	*426.21*	*675.50*	826.00	1,219.00	1,550.00	1,550.00
Pitcairn Islands	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Poland	**0.00**	**0.00**	**0.00**	**0.00**	*3.68*	*18.85*	*137.38*	*297.48*	339.50	301.50	89.30
Portugal	**19.12**	*33.99*	*48.86*	**63.73**	*130.82*	*214.08*	*446.43*	*652.20*	*733.78*	877.69	791.99
Puerto Rico	**8.80**	*12.04*	*13.73*	*14.38*	*19.07*	*27.93*	*37.99*	39.00	39.00	39.00	40.00
Qatar	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	1.00	3.00	5.71	*12.52*
Reunion	*0.10*	*0.10*	*0.10*	*0.81*	*1.51*	*2.22*	*2.93*	5.00	5.00	11.00	12.00
Romania	**10.00**	*11.82*	*13.64*	*15.45*	*17.27*	42.50	*171.65*	*686.50*	2,301.00	3,168.70	*2,618.92*
Russia	88.03	**88.03**	*507.56*	*1,106.88*	*1,706.21*	*2,305.54*	*2,904.87*	*3,504.20*	4,960.00	6,124.00	*5,003.14*
Rwanda	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*3.20*	4.00	4.00	4.00	8.50
Saint Helena	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Saint Pierre & Miquelon	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Samoa	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
San Marino	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Sao Tome and Principe	**2.00**	*3.26*	*4.52*	*5.79*	*7.05*	*8.31*	*9.57*	*9.70*	*9.70*	*9.70*	*9.70*
Saudi Arabia	**171.50**	*199.61*	*227.73*	*255.84*	*283.96*	*312.07*	*340.19*	365.00	600.00	1,600.00	1,730.77
Senegal	**10.00**	*19.84*	*29.67*	*39.51*	*49.34*	*59.18*	*69.02*	78.00	62.00	94.00	119.68
Serbia, Montenegro, Kosovo	*6.39*	*6.66*	*6.94*	*7.22*	*7.49*	*30.83*	*142.18*	*157.45*	*176.25*	188.00	**163.31**
Seychelles	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.26
Sierra Leone	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	6.00	20.00	28.00	*30.37*
Singapore	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Slovakia	*0.31*	*1.21*	*2.69*	*4.76*	*7.41*	*6.21*	*12.61*	*62.73*	*77.98*	*189.17*	*221.44*
Slovenia	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	*11.58*
Solomon Island	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Somalia	**45.00**	*52.38*	*59.75*	*67.13*	*74.51*	*81.89*	*89.26*	95.00	125.00	200.00	200.00
South Africa	**404.00**	*484.00*	*564.00*	*625.10*	*684.10*	*743.10*	*802.10*	1,000.00	1,128.00	1,200.00	1,498.00
South Korea	**283.61**	*325.24*	*366.97*	*408.70*	*462.07*	*510.63*	*630.89*	*848.35*	*893.37*	*988.41*	*880.37*
Spain	1,000.00	*1,203.58*	*1,375.06*	*1,418.14*	*1,461.22*	*1,530.00*	*1,875.00*	2,379.00	3,029.00	3,402.00	3,735.00
Sri Lanka	**100.00**	*106.97*	*113.95*	*120.92*	*127.90*	*176.11*	*320.56*	465.00	457.00	520.00	665.00
St. Kitts and Nevis	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**
St. Lucia	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.80*	1.00	1.00	2.00	3.00
St. Vincent and the Grenadines	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	1.00	1.00	1.00	1.00
Sudan	**100.00**	*163.32*	*226.64*	*289.96*	*395.55*	*592.66*	*1,202.50*	1,625.00	1,700.00	1,800.00	1,863.00
Suriname	**1.00**	*3.13*	*5.26*	*7.39*	*9.52*	*11.66*	*13.79*	28.00	42.00	47.00	*51.18*
Svalbard and Jan Mayen	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Swaziland	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	*31.59*	40.00	40.00	45.00	49.86
Sweden	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*4.11*	*18.56*	33.00	70.00	114.00	136.73
Switzerland	**5.00**	*7.46*	*9.92*	*12.38*	*14.84*	*17.30*	*19.75*	25.00	25.00	25.00	*37.50*
Syria	65.00	*75.61*	*86.21*	*96.82*	*175.38*	*313.85*	520.00	451.00	539.00	693.00	1,211.00
Taiwan	145.64	*249.73*	*353.82*	*457.91*	562.00	*501.69*	*488.70*	*521.06*	*546.65*	*554.10*	*602.09*

COUNTRY	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
Tajikistan	204.90	250.17	300.46	350.75	401.04	451.33	501.62	551.91	617.00	706.15	719.20
Tanzania	0.00	0.00	0.00	0.00	0.00	0.00	18.00	38.00	120.00	144.00	184.33
Thailand	**50.00**	72.00	363.43	654.86	946.29	1,237.71	1,560.50	1,960.00	3,015.00	4,238.00	4,985.71
Togo	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	1.00	1.00	7.01	7.30
Tokelau	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Tonga	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Trinidad and Tobago	0.00	0.18	0.54	0.89	1.25	1.61	1.96	2.32	3.51	3.63	3.60
Tunisia	103.00	102.51	102.02	101.52	101.03	100.54	100.05	200.00	243.00	300.00	394.06
Turkey	**603.17**	666.59	730.00	793.41	856.83	918.13	1,133.12	1,800.00	2,700.00	4,071.00	4,745.00
Turkmenistan	309.71	378.12	454.13	530.14	606.16	682.17	758.18	834.20	942.00	1,510.70	1,800.00
Turks and Caicos Islands	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Tuvalu	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Uganda	0.00	0.00	0.00	0.00	0.00	0.00	1.60	4.00	6.00	9.13	9.15
Ukraine	0.72	0.64	18.85	96.13	233.01	429.49	685.55	1,001.22	2,040.82	2,291.60	892.60
United Arab Emirates	**10.00**	13.28	16.56	19.84	23.11	26.39	29.67	45.00	53.00	63.00	224.01
United Kingdom	0.00	4.00	8.00	12.00	16.00	**20.00**	100.00	88.00	140.00	157.12	248.18
United States of America	3,120.00	5,680.30	6,900.74	8,121.17	9,341.61	13,762.84	18,178.44	21,280.00	27,374.06	27,797.00	29,982.19
Uruguay	0.00	0.00	0.00	0.00	0.00	14.43	28.93	60.19	91.44	144.68	217.59
US Virgin Islands	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.06	0.06	0.06	0.18
Uzbekistan	1,081.26	1,320.10	1,585.48	1,850.86	2,116.24	2,381.62	2,647.01	2,912.39	3,454.00	4,222.00	4,223.00
Vanuatu	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Venezuela	**40.00**	56.00	72.00	88.00	104.00	**120.00**	192.73	275.00	370.00	480.00	575.00
Vietnam	**300.00**	414.75	529.51	644.26	759.02	873.77	988.52	1,200.00	1,700.00	2,900.00	3,000.00
Wake Island	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Wallis and Futuna	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
West Bank	0.51	0.62	0.72	0.83	0.93	1.60	4.62	5.84	6.80	7.33	7.00
Western Sahara	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Yemen	**100.00**	117.54	135.08	152.62	170.16	187.70	205.25	260.00	289.00	348.00	500.00
Zambia	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.00**	1.91	9.00	19.00	46.40	155.91
Zimbabwe	**0.00**	**0.00**	**0.00**	2.47	4.93	7.40	19.90	46.00	80.00	108.99	173.51
WORLD	**53,262**	**63,205**	**72,413**	**82,112**	**92,219**	**108,421**	**141,893**	**179,403**	**226,023**	**258,558**	**284,677**

Appendix A2: Data description per country

Country	Period	Data source / method
Afghanistan	1998-2003	FAOSTAT scaled to AQUASTAT
	1997	Siebert et al. (2007)
	1961-1996	FAOSTAT scaled to AQUASTAT
	1900-1960	scaled based on Jordan
Albania	1961-2003	FAOSTAT
	1951-1960	interpolated
	1950	Popp & Rother (1993)
	1939-1949	interpolated
	1938	Popp & Rother (1993)
	1900-1937	scaled based on Bulgaria
Algeria	2003	FAOSTAT scaled to AQUASTAT
	1998-2002	AQUASTAT
	1961-1997	FAOSTAT
	1955-1960	interpolated
	1954	Framji et al. (1981)
	1900-1953	scaled based on Libya
American	2001-2003	assumed constant
Samoa	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Andorra	1991-2003	assumed constant
	1990	AQUASTAT online
	1900-1989	assumed constant
Angola	1961-2003	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate 1/2 of 1961
Anguila	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Antarktica	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Antigua and	1998-2003	assumed constant
Barbuda	1997	AQUASTAT online
	1993-1996	AQUASTAT
	1971-1992	interpolated based on estimate
	1970	estimate
	1961-1969	interpolated based on estimate
	1960	estimate
	1900-1959	assumed constant
Argentina	2003	FAOSTAT scaled to AQUASTAT
	2002	Siebert et al. (2007)
	1961-2001	FAOSTAT scaled to AQUASTAT
	1938-1960	interpolated
	1937	Framji et al. (1981)
	1900-1936	extrapolated based on 37-61rate
Armenia	1998-2003	assumed constant
	1973-1997	AQUASTAT
	1963	Greenwood (1965)
	1920-1962	interpolated
	1919	Shtepa et al. (1985)
	1914-1918	interpolated
	1913	Shtepa et al. (1985)
	1900-1912	scaled based on Georgia
Aruba	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Australia	1997-2003	FAOSTAT scaled to AQUASTAT
	1996	Siebert et al. (2007)
	1961-1995	FAOSTAT
	1959-1960	Framji et al. (1981)
	1947-1958	interpolated
	1945-1946	Framji et al. (1981)
	1933-1944	interpolated
	1931-1932	Framji et al. (1981)
	1901-1930	interpolated

Country	Period	Data source / method
	1900	Framji et al. (1981)
Austria	2003	Siebert et al. (2007)
	2001-2002	interpolated
	2000	EUROSTAT
	1998-1999	interpolated
	1997	EUROSTAT
	1996	interpolated
	1995	EUROSTAT
	1967-1994	interpolated
	1966	Framji et al. (1981)
	1946-1965	interpolated
	1945	Framji et al. (1981)
	1930-1944	extrapolated based on 45-55 rate
	1900-1929	assumed constant
Azerbaijan	1998-2003	FAOSTAT
	1973-1997	AQUASTAT
	1918-1972	interpolated
	1914-1917	Shtepa et al. (1985)
	1900-1913	scaled based on Georgia
Bahamas	1961-2003	FAOSTAT
	1900-1960	assumed constant
Bahrain	2002-2003	FAOSTAT scaled to AQUASTAT
	2001	Siebert et al. (2007)
	1993-2000	AQUASTAT
	1961-1992	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Bangladesh	1961-2003	FAOSTAT
	1948-1960	interpolated
	1947	1/2 of 1961
	1900-1946	scaled based on India
Barbados	1961-2003	FAOSTAT
	1900-1960	assumed constant
Belarus	1998-2003	FAOSTAT scaled to AQUASTAT
	1991-1997	AQUASTAT scaled to Siebert et al. (2007)
	1990	Siebert et al. (2007)
	1973-1989	AQUASTAT scaled to Siebert et al. (2007)
	1901-1972	interpolated based on estimate
	1900	estimate 1/5 of 73
Belgium	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1998-1999	interpolated
	1997	EUROSTAT
	1994-1996	interpolated
	1993	EUROSTAT
	1991-1992	interpolated
	1990	EUROSTAT
	1966-1989	interpolated
	1965	Framji et al. (1981)
	1950-1964	interpolated
	1949	Framji et al. (1981)
	1901-1948	interpolated based on estimate
	1900	estimate
Belize	1999-2003	FAOSTAT
	1998	Siebert et al. (2007)
	1961-1997	FAOSTAT
	1900-60	assumed constant
Benin	2003	assumed constant
	1973-2002	AQUASTAT
	1961-1972	FAOSTAT
	1900-1960	assumed constant
Bermuda	1900-2003	assumed constant
Bolivia	2000-2003	FAOSTAT

Country	Period	Data source / method
	1999	Siebert et al. (2007)
	1961-1998	FAOSTAT
	1955-1960	interpolated
	1954	Framji et al. (1981)
	1949-1953	interpolated
	1948	Framji et al. (1981)
	1943-1947	interpolated
	1942	Framji et al. (1981)
	1901-1941	interpolated based on estimate
	1900	estimate
Bosnia and	2003	Siebert et al. (2007)
Herzegowina	1992-2002	FAOSTAT scaled to AQUASTAT
	1991	assumed constant
	1961-1990	scaled based on data for former Yugoslavia
	1954-1960	interpolated based on estimate
	1953	estimate
	1900-1952	assumed constant
Botswana	2003	assumed constant
	2002	Siebert et al. (2007)
	2001	interpolated
	1998-2000	AQUASTAT
	1993-1997	interpolated
	1988-1992	AQUASTAT
	1961-1987	FAOSTAT
	1900-1960	assumed constant
Bouvet Island	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Brazil	2002-2003	FAOSTAT scaled to AQUASTAT
	2001	Siebert et al. (2007)
	1994-2000	Cortez-Cortijo & Casanova (2000)
	1991-1993	interpolated
	1990	Cortez-Cortijo & Casanova (2000)
	1986-1989	interpolated
	1985	Cortez-Cortijo & Casanova (2000)
	1961-1984	FAOSTAT
	1960	Cortez-Cortijo & Casanova (2000)
	1956-1959	interpolated
	1955	Cortez-Cortijo & Casanova (2000)
	1951-1954	interpolated
	1950	Cortez-Cortijo & Casanova (2000)
	1900-1959	assumed constant
British Ocean Territories	1900-2003	assumed constant
British Virgin	2001-2003	assumed constant
Islands	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Brunei	1961-2003	FAOSTAT
	1900-1960	assumed constant
Bulgaria	2003	Siebert et al. (2007)
	1997-2002	interpolated
	1996	Dirksen & Huppert (2006)
	1990-1995	interpolated
	1989	Dirksen & Huppert (2006)
	1961-1988	FAOSTAT
	1949	Framji et al. (1981)
	1948	interpolated
	1947	Framji et al. (1981)
	1944	Framji et al. (1981)
	1902-1943	interpolated
	1900	Framji et al. (1981)
Burkina Faso	1961-2003	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Burundi	2001-2003	FAOSTAT scaled to AQUASTAT
	2000	Siebert et al. (2007)
	1998-1999	AQUASTAT
	1961-1997	FAOSTAT
	1956-1960	scaled based on Uganda
	1900-1955	assumed constant
Buthan	1961-2003	FAOSTAT
	1953-1960	extrapolated based on 1961-1970 rate
	1900-1952	assumed constant
Cambodia	2002-2003	FAOSTAT scaled to AQUASTAT
	2001	Siebert et al. (2007)
	1993-2000	AQUASTAT
	1961-1992	FAOSTAT
	1900-1960	scaled based on Vietnam
Cameroon	2003	assumed constant
	1998-2002	AQUASTAT
	1961-1997	FAOSTAT
	1957-1960	extrapolated based on rate 61-71
	1900-1956	assumed constant
Canada	2001-2003	FAOSTAT scaled to AQUASTAT
	2000	Siebert et al. (2007)
	1961-1999	FAOSTAT
	1960	Framji et al. (1981)
	1931-1959	interpolated
	1930	Framji et al. (1981)
	1916-1929	interpolated
	1915	Framji et al. (1981)
	1901-1914	interpolated
	1900	Framji et al. (1981)
Cape Verde	2001-2003	FAOSTAT scaled to AQUASTAT
	2000	Siebert et al. (2007)
	1999	interpolated
	1988-1998	AQUASTAT
	1961-1987	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Cayman	2001-2003	assumed constant
Island	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Central	1991-2003	FAOSTAT
African	1988-1990	interpolated
Republic	1983-1987	AQUASTAT
	1961-1982	FAOSTAT
	1900-1960	assumed constant
Chad	2003	assumed constant
	2002	Siebert et al. (2007)
	1961-2001	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Chile	1997-2003	FAOSTAT
	1996	Siebert et al. (2007)
	1961-1995	FAOSTAT
	1929-1960	interpolated
	1928	Framji et al. (1981)
	1915-1927	interpolated
	1914	Framji et al. (1981)
	1900-13	assumed constant
China	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1998-1999	interpolated
	1997	Guangzhi et al. (unknown)
	1994-1996	interpolated
	1993	Guangzhi et al. (unknown)
	1981-1992	interpolated
	1980	Guangzhi et al. (unknown)
	1966-1979	interpolated

Country	Period	Data source / method
	1965	Guangzhi et al. (unknown)
	1950-1964	interpolated
	1949	Guangzhi et al. (unknown)
	1901-1948	interpolated based on estimate
	1900	estimate
Cocos	2001-2003	assumed constant
(Keeling)	2000	Siebert et al. (2007)
Islands	1900-1999	assumed constant
Colombia	1998-2003	FAOSTAT
	1997	Siebert et al. (2007)
	1961-1996	FAOSTAT
	1960	Framji et al. (1981)
	1951-1959	interpolated
	1950	Framji et al. (1981)
	1941-1949	interpolated based on estimate
	1940	estimate
	1901-1939	interpolated based on estimate
	1900	estimate
Comoros	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1988-1999	interpolated
	1983-1987	AQUASTAT
	1900-1982	assumed constant
Cook Islands	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Costa Rica	1998-2003	FAOSTAT
	1997	Siebert et al. (2007)
	1961-1996	FAOSTAT
	1955-1960	interpolated
	1955	AQUASTAT Country Report
	1921-1954	interpolated
	1920	2/3 of 55 based on Guatelama
	1900-1919	extrapolated based on 20-55 rate
Côte d'Ivoire	1998-2003	FAOSTAT
	1993-1997	AQUASTAT
	1961-1992	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Croatia	2003	Siebert et al. (2007)
	1992-2002	FAOSTAT
	1991	assumed constant
	1961-1990	scaled based on data for former Yugoslavia
	1954-1960	interpolated based on estimate
	1953	estimate
	1900-1952	assumed constant
Cuba	1998-2003	FAOSTAT scaled to AQUASTAT
	1997	Siebert et al. (2007)
	1961-1996	FAOSTAT
	1958	AQUASTAT Country Report
	1950-1957	interpolated
	1949	Framji et al. (1981)
	1901-1948	interpolated based on estimate
	1900	estimate 1/2 of 49
Cyprus	2003	Siebert et al. (2007)
	1998-2002	interpolated
	1993-1997	AQUASTAT
	1961-1992	FAOSTAT
	1955-1960	interpolated
	1954	Framji et al. (1981)
	1901-1953	interpolated based on estimate
	1900	estimate 1/2 of 54
Czech	2001-2003	assumed constant
Republic	2000	Siebert et al. (2007)
	1996-1999	interpolated
	1981-1995	Dirksen & Huppert (2006)
	1979-1980	interpolated
	1978	Dirksen & Huppert (2006)
	1975-1977	interpolated
	1974	Dirksen & Huppert (2006)
	1970-1973	interpolated
	1969	Dirksen & Huppert (2006)
	1941-1968	interpolated
	1940	Dirksen & Huppert (2006)
	1900-1939	scaled based on values for Czechoslovakia
Democratic	1998-2003	FAOSTAT
Republic of	1993-1997	AQUASTAT
Congo	1961-1992	FAOSTAT
	1900-1960	assumed constant
Denmark	1998-2003	FAOSTAT
	1997	Siebert et al. (2007)
	1961-1996	FAOSTAT
	1960	interpolated
	1959	Framji et al. (1981)
	1950-1958	interpolated
	1949	Framji et al. (1981)
	1901-1948	interpolated
	1900	Framji et al. (1981)
Djibouti	2000-2003	FAOSTAT scaled to AQUASTAT
	1999	Siebert et al. (2007)
	1961-1998	FAOSTAT
	1900-1960	assumed constant
Dominica	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Dominican	1995-2003	FAOSTAT scaled to AQUASTAT
Republic	1994	Siebert et al. (2007)
	1981-1993	interpolated
	1980	AQUASTAT
	1955-1979	interpolated
	1954	AQUASTAT
	1945-1953	interpolated
	1944	AQUASTAT
	1942-1943	interpolated
	1941	AQUASTAT
	1931-1940	interpolated
	1930	Framji et al. (1981)
	1901-1929	interpolated based on estimate
	1900	estimate
East Timor	2003	estimate
	2002	estimate
	2001	estimate
	2000	estimate
	1990-1999	assumed constant
	1990	Siebert et al. (2007)
	1900-1989	scaled based on Indonesia
Egypt	2003	assumed constant
	1993-2002	AQUASTAT
	1981-1992	interpolated
	1978-1980	Framji et al. (1981)
	1969-1977	interpolated
	1968	Framji et al. (1981)
	1960-1967	interpolated
	1959	Framji et al. (1981)
	1952-1958	Popp & Rother (1993)
	1901-1951	interpolated
	1900	Framji et al. (1981)
El Salvador	1961-2003	FAOSTAT
	1951-1960	interpolated
	1950	AQUASTAT Country Report
	1901-1949	interpolated based on estimate
	1900	estimate
Equador	1998-2003	FAOSTAT
	1997	Siebert et al. (2007)
	1961-1996	FAOSTAT
	1901-1960	interpolated

Country	Period	Data source / method
	1900	Cortez-Cortijo & Casanova (2000)
Equatorial Guinea	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Eritrea	1998-2003	FAOSTAT scaled to AQUASTAT
	1994-1997	AQUASTAT
	1993	Siebert et al. (2007)
	1963-1992	Difference between Ethiopia PDR-Ethiopia
	1900-1962	scaled based on Ethiopia
Estonia	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1992-1999	interpolated
	1973-1991	AQUASTAT
	1901-1972	interpolated based on estimate
	1900	estimate
Ethiopia	2002-2003	FAOSTAT scaled to AQUASTAT
	2001	Siebert et al. (2007)
	1993-2000	FAOSTAT scaled to AQUASTAT
	1963-1992	scaled based on Ethiopia PDR (data source Framji et al. (1981), with interpolations)
	1901-1962	interpolated based on estimate
	1900	estimate
Faeroe Islands	1900-2003	assumed constant
Falkland Islands	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Fiji	1961-2003	FAOSTAT
	1900-1960	assumed constant
Finland	2003	Siebert et al. (2007)
	2001-2002	interpolated
	2000	EUROSTAT
	1998-1999	interpolated
	1997	EUROSTAT
	1996	interpolated
	1995	EUROSTAT
	1961-1994	FAOSTAT
	1959-1960	extraploated based on 61-64 rate
	1900-1958	assumed constant
France	2003	Siebert et al. (2007)
	2001-2002	interpolated
	2000	EUROSTAT
	1998-1999	interpolated
	1997	EUROSTAT
	1996	interpolated
	1995	EUROSTAT
	1994	interpolated
	1993	EUROSTAT
	1991-1992	interpolated
	1990	EUROSTAT
	1961-1989	FAOSTAT
	1901-1960	interpolated
	1900	estimate 1/2 of 61
French Guyana	1996-2003	FAOSTAT
	1995	Siebert et al. (2007)
	1961-1994	FAOSTAT
	1900-1960	assumed constant
French Polynesia	1961-2003	FAOSTAT
	1900-1960	assumed constant
Gabon	1988-2003	FAOSTAT scaled to AQUASTAT
	1983-1987	AQUASTAT
	1961-1982	FAOSTAT
	1951-1960	interpolated based on estimate
	1950	estimate
	1900-1949	assumed constant
Gambia	2003	assumed constant
	1998-2002	AQUASTAT
	1993-1997	FAOSTAT
	1988-1992	AQUASTAT
	1961-1987	FAOSTAT
	1900-1960	assumed constant
Gaza Strip	2002-2003	assumed constant
	2001	AQUASTAT
	1991-1999	interpolated
	1990	AQUASTAT
	1983-1989	interpolated
	1982	AQUASTAT
	1900-1981	extrapolaed based on Israel
Georgia	1992-2003	FAOSTAT
	1988-1991	AQUASTAT
	1922-1987	interpolated
	1921	Shtepa et al. (1985)
	1914-1920	interpolated
	1913	Shtepa et al. (1985)
	1901-1912	interpolated
	1900	Shtepa et al. (1985)
Germany	2001-2003	FAOSTAT scaled to AQUASTAT
	2000	Siebert et al. (2007)
	1961-1999	FAOSTAT
	1950-1960	interpolated
	1949	Framji et al. (1981)
	1901-1948	interpolated based on estimate
	1900	estimate 1/2 of 49
Ghana	2001-2003	FAOSTAT
	2000	Siebert et al. (2007)
	1961-1999	FAOSTAT
	1954-1960	interpolated based on estimate
	1953	estimate
	1901-1952	interpolated based on estimate
	1900	estimate
Gibraltar	1900-2003	assumed constant
Greece	2003	Siebert et al. (2007)
	1988-2002	AQUASTAT
	1961-1987	FAOSTAT
	1960	Framji et al. (1981)
	1959	interpolated
	1958	Framji et al. (1981)
	1957	interpolated
	1956	Framji et al. (1981)
	1951-1955	interpolated
	1950	Framji et al. (1981)
	1940-1949	interpolated
	1939	Framji et al. (1981)
	1930-1938	interpolated
	1929	Framji et al. (1981)
	1901-1928	interpolated based on estimate
	1900	estimate
Greenland	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Grenada	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Guadeloup	1996-2003	FAOSTAT
	1995	Siebert et al. (2007)
	1961-1994	FAOSTAT
	1900-1960	extrapolaed based on 61-70 rate
Guam	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1989-1999	extrapolated with 3/4 ratio of following year
	1900-1988	assumed constant
Guatemala	1998-2003	FAOSTAT
	2000	Siebert et al. (2007)
	1961-1999	FAOSTAT

Country	Period	Data source / method
	1921-1960	interpolated
	1920	Cortez-Cortijo & Casanova (2000)
	1900-1919	extrapolated based on 20-61 rate
Guinea	2003	assumed constant
	1993-2002	AQUASTAT
	1961-1992	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Guinea-Bissau	1997-2003	FAOSTAT
	1997	Siebert et al. (2007)
	1961-1995	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Guyana	1992-2003	FAOSTAT scaled to AQUASTAT
	1991	Siebert et al. (2007)
	1961-1990	interpolated
	1960	interpolated
	1959	Framji et al. (1981)
	1950-1958	interpolated
	1949	Framji et al. (1981)
	1900-1948	interpolated
	1900	Framji et al. (1981)
Haiti	1992-2003	FAOSTAT
	1991	Siebert et al. (2007)
	1961-1990	FAOSTAT
	1951-1960	interpolated
	1949-1950	Framji et al. (1981)
	1910-1948	interpolated based on estimate
	1900-1910	estimate
Heard and McDonald Islands	1900-2003	assumed constant
Honduras	1992-2003	FAOSTAT scaled to AQUASTAT
	1991	Siebert et al. (2007)
	1961-1990	FAOSTAT
	1960	interpolated
	1959	Framji et al. (1981)
	1958	interpolated
	1950-1957	Framji et al. (1981)
	1921-1949	interpolated based on estimate
	1920	estimate 2/3 of 50
	1900-1919	extrapolated based on 20-50 rate
Hungary	2003	Siebert et al. (2007)
	2001-2002	interpolated
	1998-2000	Dirksen & Huppert (2006)
	1979-1997	interpolated
	1978	Framji et al. (1981)
	1975-1977	interpolated
	1974	Dirksen & Huppert (2006)
	1968-1973	interpolated
	1967	Dirksen & Huppert (2006)
	1960-1966	interpolated
	1959	Framji et al. (1981)
	1950-1958	interpolated
	1949	Framji et al. (1981)
	1901-1948	interpolated
	1900	Framji et al. (1981)
Iceland	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
India	2002-2003	FAOSTAT scaled to AQUASTAT
	2001	Siebert et al. (2007)
	1958-1999	AQUASTAT
	1957	interpolated
	1956	Framji et al. (1981)
	1952-1955	interpolated
	1951	Framji et al. (1981)
	1946-1950	interpolated
	1945	Framji et al. (1981)
	1936-1944	interpolated
	1935	Framji et al. (1981)
	1901-1934	interpolated
	1900	Framji et al. (1981)
Indonesia	1991-2003	FAOSTAT scaled to Siebert et al. (2007)
	1990	Siebert et al. (2007)
	1961-1989	FAOSTAT
	1921-1960	interpolated based on estimate
	1920	estimate 1/2 of 1961
	1901-1919	interpolated based on estimate
	1900	estimate
Iran	1995-2003	FAOSTAT scaled to AQUASTAT
	1994	Siebert et al. (2007)
	1961-1993	FAOSTAT scaled to AQUASTAT
	1900-1960	scaled based on Jordan
Iraq	1961-2003	FAOSTAT
	1900-1960	scaled based on Jordan
Ireland	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1998-1999	interpolated
	1997	EUROSTAT
	1900-1996	assumed constant
Israel	1991-2003	FAOSTAT
	1948-1990	Popp & Rother (1993)
	1901-1947	interpolated based on estimate
	1900	estimate 1/2 of 48
Italy	2001-2003	FAOSTAT scaled to AQUASTAT
	2000	Siebert et al. (2007)
	1998-1999	interpolated
	1997	EUROSTAT
	1994-1996	interpolated
	1993	EUROSTAT
	1991-1992	interpolated
	1990	EUROSTAT
	1981-1989	interpolated
	1980	Framji et al. (1981)
	1959-1979	interpolated
	1958	Framji et al. (1981)
	1940-1955	interpolated
	1939	Framji et al. (1981)
	1920-1938	interpolated
	1919	Framji et al. (1981)
	1906-1918	interpolated
	1905	Framji et al. (1981)
	1901-1904	interpolated
	1900	Framji et al. (1981)
Jamaica	1998-2003	FAOSTAT scaled to AQUASTAT
	1997	Siebert et al. (2007)
	1993-1996	AQUASTAT
	1961-1992	FAOSTAT
	1950-1960	interpolated
	1949	Framji et al. (1981)
	1903-1948	interpolated
	1902	Framji et al. (1981)
	1900-1901	assumed constant
Japan	1994-2003	FAOSTAT scaled to AQUASTAT
	1993	Siebert et al. (2007)
	1988-1992	AQUASTAT
	1961-1987	FAOSTAT
	1951-1960	interpolated
	1950	Framji et al. (1981)
	1901-1949	interpolated
	1900	Framji et al. (1981)
Johnston Island	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Jordan	2001-2003	FAOSTAT scaled to AQUASTAT

Country	Period	Data source / method
	2000	Siebert et al. (2007)
	1961-1999	FAOSTAT
	1946-1960	interpolated based on estimate
	1945	estimate 1/2 of 61
	1901-1944	interpolated based on estimate
	1900	estimate
Kazakhstan	2001-2003	FAOSTAT scaled to AQUASTAT
	2000	Siebert et al. (2007)
	1994-1999	interpolated
	1993	Siebert et al. (2007)
	1973-1992	FAOSTAT scaled to AQUASTAT
	1901-1973	interpolated
	1900	1973 times ratio (sum central asian states 1900 (Shtepa et al. 1985) / sum central Asian states 1973)
Kenya	2003	Siebert et al. (2007)
	1961-2002	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Kiribati	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Kuwait	2001-2003	FAOSTAT scaled to AQUASTAT
	2000	Siebert et al. (2007)
	1993-1999	AQUASTAT
	1961-1992	FAOSTAT
	1900-1960	assumed constant
Kyrkyzstan	1998-2003	FAOSTAT
	1973-1997	AQUASTAT
	1901-1972	interpolated
	1900	1973 times ratio (sum central asian states 1900 (Shtepa et al. 1985) / sum central Asian states 1973)
Laos	2001-2003	FAOSTAT scaled to AQUASTAT
	1993-2000	AQUASTAT
	1961-1992	FAOSTAT
	1900-1960	scaled based on Vietnam
Latvia	2003	FAOSTAT scaled to AQUASTAT
	2002	Siebert et al. (2007)
	2001	interpolated
	2000	EUROSTAT
	1992-1999	interpolated
	1973-1991	AQUASTAT
	1901-1972	interpolated based on estimate
	1900	estimate
Lebanon	1998-2003	FAOSTAT scaled to AQUASTAT
	1997	Siebert et al. (2007)
	1961-1996	FAOSTAT
	1950-1960	interpolated
	1949	Framji et al. (1981)
	1901-1948	interpolated
	1900	Framji et al. (1981)
Lesotho	2001-2003	FAOSTAT scaled to AQUASTAT
	1993-2000	AQUASTAT
	1961-1992	FAOSTAT
	1900-1960	assumed constant
Liberia	1988-2003	FAOSTAT scaled to AQUASTAT
	1987	Siebert et al. (2007)
	1983-1986	AQUASTAT
	1961-1982	FAOSTAT
	1900-1960	assumed constant
Libya	1961-2003	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Liechtenstein	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Lithuania	2003	Siebert et al. (2007)
	2001-2002	interpolated
	1973-2000	AQUASTAT
	1901-1972	interpolated based on estimate
	1900	estimate
Luxembourg	2003	assumed constant
	2002	Siebert et al. (2007)
	1991-2001	assumed constant
	1900-1990	assumed constant
Macedonia	2001-2003	FAOSTAT scaled to Dirksen & Huppert (2006)
	2000	Dirksen & Huppert (2006)
	1992-1999	interpolated
	1991	Dirksen & Huppert (2006)
	1961-1990	scaled based on data for former Yugoslavia
	1900-1960	scaled based on Bulgaria
Madagascar	2001-2003	FAOSTAT scaled to AQUASTAT
	1998-2000	AQUASTAT
	1961-1997	FAOSTAT
	1921-1960	interpolated based on estimate
	1920	estimate
	1900-1919	assumed constant
Malawi	2003	FAOSTAT scaled to AQUASTAT
	2002	Siebert et al. (2007)
	1961-2001	FAOSTAT
	1955-1960	assumed constant
	1900-1954	assumed constant
Malaysia	1995-2003	FAOSTAT
	1994	Siebert et al. (2007)
	1961-1993	FAOSTAT
	1960	interpolated
	1959	Framji et al. (1981)
	1901-1958	interpolated based on estimate
	1900	estimate
Maldives	2002-2003	assumed constant
	2001	Siebert et al. (2007)
	1900-2000	assumed constant
Mali	2003	assumed constant
	2001-2002	AQUASTAT
	2000	Siebert et al. (2007)
	1993-1999	AQUASTAT
	1961-1992	FAOSTAT
	1951-1960	interpolated
	1950	Harrison Church (1951)
	1901-1949	interpolated based on estimate
	1900	estimate
Malta	2003	assumed constant
	2002	Siebert et al. (2007)
	1961-2001	FAOSTAT
	1945-1960	estimate
	1900-1944	estimate
Marshall Islands	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Martinique	1961-2003	FAOSTAT
	1900-1960	assumed constant
Mauretania	1992-2003	AQUASTAT
	1961-1991	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Mauritius	2003	FAOSTAT scaled to AQUASTAT
	2002	Siebert et al. (2007)
	2001	interpolated
	1993-2000	Siebert et al. (2007)
	1961-1992	FAOSTAT
	1900-1960	scaled based on Madagascar
Mexico	1999-2003	FAOSTAT scaled to AQUASTAT
	1998	Siebert et al. (2007)

Country	Period	Data source / method
	1993-1997	AQUASTAT
	1961-1992	FAOSTAT
	1947-1960	interpolated
	1946	Framji et al. (1981)
	1911-1945	interpolated
	1910	Framji et al. (1981)
	1900-1909	assumed constant
Micronesia	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Midway Islands	1900-2003	assumed constant
Moldova	1993-2003	FAOSTAT
	1978-1992	AQUASTAT
	1945-1977	extrapolaed based on Russia
	1900-1944	scaled based on Romania
Monaco	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Mongolia	1996-2003	FAOSTAT scaled to AQUASTAT
	1995	Siebert et al. (2007)
	1961-1994	FAOSTAT scaled to AQUASTAT
	1900-1960	assumed constant
Montserrat	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Morocco	1998-2003	AQUASTAT
	1993-1997	interpolated
	1988-1992	AQUASTAT
	1961-1987	FAOSTAT
	1931-1960	interpolated based on estimate
	1930	estimate
	1900-1929	assumed constant
Mozambique	2003	Siebert et al. (2007)
	2001-2002	interpolated
	1993-2000	AQUASTAT
	1961-1992	FAOSTAT
	1951-1960	scaled based on Tanzania
	1900-1960	assumed constant
Myanmar	2001-2003	FAOSTAT
	2000	Siebert et al. (2007)
	1998-1999	FAOSTAT
	1978-1997	AQUASTAT
	1961-1977	FAOSTAT
	1954-1960	interpolated
	1953	Framji et al. (1981)
	1941-1952	interpolated
	1940	Framji et al. (1981)
	1901-1939	interpolated based on estimate
	1900	estimate
Namibia	2003	assumed constant
	2002	Siebert et al. (2007)
	1998-2000	AQUASTAT
	1993-1997	interpolated
	1988-1992	AQUASTAT
	1961-1987	FAOSTAT
	1951-1960	estimate
	1900-1950	estimate
Nauru	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Nepal	2002-2003	FAOSTAT
	2001	Siebert et al. (2007)
	1961-2000	FAOSTAT
	1948-1960	interpolated
	1947	Framji et al. (1981)
	1900-1946	assumed constant
Netherlands	1961-2003	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate 1/5 of 61
Netherlands	2001-2003	assumed constant
Antilles	2000	Siebert et al. (2007)
	1900-1999	assumed constant
New	1961-2003	FAOSTAT
Caledonia	1950-1960	assumed constant
	1900-1949	assumed constant
New Zealand	2001-2003	FAOSTAT scaled to AQUASTAT
	2000	Siebert et al. (2007)
	1961-1999	FAOSTAT scaled to AQUASTAT
	1901-1960	interpolated based on estimate
	1900	estimate 1/4 of 1961
Nicaragua	1998-2003	FAOSTAT scaled to AQUASTAT
	1997	Siebert et al. (2007)
	1961-1996	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Niger	1998-2003	AQUASTAT
	1961-1997	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Nigeria	1998-2003	AQUASTAT
	1964-1997	FAOSTAT
	1949-1960	interpolated based on estimate
	1948	estimate
	1900-1947	assumed constant
Niue	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Norfolk	2001-2003	assumed constant
Island	2000	Siebert et al. (2007)
	1900-1999	assumed constant
North Korea	1961-2003	FAOSTAT
	1955-1960	scaled based on South Korea
	1942-1954	interpolated
	1935-1941	Framji et al. (1981) in 55 scaled to ratio North Korea/South Korea
	1900-1934	scaled based on South Korea
Northern	2001-2003	assumed constant
Marianna	2000	Siebert et al. (2007)
Islands	1991-1999	assumed constant
	1900-1990	assumed constant
Norway	2000-2003	FAOSTAT scaled to AQUASTAT
	1999	Siebert et al. (2007)
	1961-1999	FAOSTAT
	1948-1960	extrapolated based on 61-70 rate
	1900-1947	assumed constant
Oman	2002-2003	FAOSTAT scaled to AQUASTAT
	2001	Siebert et al. (2007)
	1993-2000	AQUASTAT
	1961-1992	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Pakistan	1961-2003	FAOSTAT
	1960	interpolated
	1958-1959	Framji et al. (1981)
	1949-1957	interpolated
	1948	Framji et al. (1981)
	1900-1946	scaled based on India
Palau	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Panama	1998-2003	FAOSTAT scaled to AQUASTAT
	1997	Siebert et al. (2007)
	1961-1996	FAOSTAT
	1921-1960	interpolated
	1920	2/3 of 61 based on Guatemala
	1900-1919	extrapolated based on 20-61 rate
Papua New	2001-2003	assumed constant

Country	Period	Data source / method
Guinea	2000	Siebert et al. (2007)
	1989-1999	assumed constant
	1993-1997	AQUASTAT
	1900-1992	assumed constant
Paraguay	1961-2003	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Peru	1995-2003	FAOSTAT scaled to AQUASTAT
	1994	Siebert et al. (2007)
	1961-1993	FAOSTAT scaled to AQUASTAT
	1900-1960	extrapolated based on 61-70 rate
Philippines	1961-2003	FAOSTAT
	1960	interpolated
	1959	Framji et al. (1981)
	1950-1958	interpolated
	1949	Framji et al. (1981)
	1901-1948	interpolated based on estimate
	1900	estimate based on National Irrigation Administration (1990)
Pitcairn	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Poland	2003	Siebert et al. (2007)
	2001-2002	interpolated
	1999-2000	Dirksen & Huppert (2006)
	1996-1998	interpolated
	1995	Dirksen & Huppert (2006)
	1991-1994	interpolated
	1990	Dirksen & Huppert (2006)
	1981-1989	interpolated
	1980	Dirksen & Huppert (2006)
	1976-1979	interpolated
	1975	Dirksen & Huppert (2006)
	1967-1974	interpolated
	1966	Dirksen & Huppert (2006)
	1950-1965	interpolated
	1949	Dirksen & Huppert (2006)
	1931-1948	interpolated based on estimate
	1930	estimate
	1900-1929	assumed constant
Portugal	2001-2003	FAOSTAT scaled to AQUASTAT
	2000	Siebert et al. (2007)
	1996-1999	interpolated
	1995	Siebert et al. (2007)
	1991-1994	interpolated
	1990	Siebert et al. (2007)
	1979-1989	interpolated
	1978	Framji et al. (1981)
	1969-1977	interpolated
	1968	Framji et al. (1981)
	1967	interpolated
	1966	Framji et al. (1981)
	1960-1965	interpolated
	1959	Framji et al. (1981)
	1950-1958	interpolated
	1949	Framji et al. (1981)
	1931-1948	interpolated based on estimate
	1930	estimate 1/3 of 1949
	1901-1929	interpolated based on estimate
	1900	estimate 1/10 of 1949
Puerto Rico	1961-2003	FAOSTAT
	1950-1960	interpolated
	1949	Framji et al. (1981)
	1936-1948	interpolated
	1935	Framji et al. (1981)
	1915-1934	interpolated
	1914	Framji et al. (1981)
	1901-1913	interpolated based on estimate
	1900	estimate 2/3 of 1914
Quatar	1998-2003	FAOSTAT scaled to AQUASTAT
	1988-1997	AQUASTAT
	1961-1987	FAOSTAT
	1900-1960	assumed constant
Republic of	2003	Siebert et al. (2007)
Congo	1961-2002	FAOSTAT
	1900-1960	assumed constant
Reunion	1961-2003	FAOSTAT
	1900-1960	scaled based on Madagascar
Romania	2003	Siebert et al. (2007)
	1996-2003	interpolated
	1995	Dirksen & Huppert (2006)
	1991-1994	interpolated
	1990	Dirksen & Huppert (2006)
	1984-1989	interpolated
	1985	Dirksen & Huppert (2006)
	1981-1984	interpolated
	1980	Dirksen & Huppert (2006)
	1978-1979	interpolated
	1977	Framji et al. (1981)
	1975-1976	interpolated
	1974	Framji et al. (1981)
	1972-1973	interpolated
	1971	Framji et al. (1981)
	1970	interpolated
	1969	Framji et al. (1981)
	1966-1968	interpolated
	1965	Framji et al. (1981)
	1962-1964	interpolated
	1961	Framji et al. (1981)
	1960	interpolated
	1959	Framji et al. (1981)
	1951-1958	interpolated
	1950	Framji et al. (1981)
	1946-1949	interpolated
	1944	Framji et al. (1981)
	1901-1943	interpolated based on estimate
	1900	estimate
Russia	2003	assumed constant
	2002	Siebert et al. (2007)
	1998-2001	interpolated
	1973-1997	AQUASTAT
	1914-1972	interpolated
	1900-1913	Framji et al. (1981) scaled by sum of separated states
Rwanda	2001-2003	FAOSTAT scaled to AQUASTAT
	1998-2000	Siebert et al. (2007)
	1961-1997	FAOSTAT
	1956-1960	scaled based on Uganda
	1900-1955	assumed constant
Samoa	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
San Marino	2002-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Sao Tome	1992-2003	FAOSTAT scaled to AQUASTAT
and Prinicipe	1991	Siebert et al. (2007)
	1961-1990	FAOSTAT scaled to AQUASTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Saudi Arabia	2001-2003	FAOSTAT scaled to AQUASTAT
	2000	Siebert et al. (2007)
	1998-1999	AQUASTAT
	1993-1998	interpolated
	1961-1992	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate 1/2 of 1961
Senegal	2003	FAOSTAT

Country	Period	Data source / method
	1993-2002	AQUASTAT
	1961-1992	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Serbia,	2001-2003	assumed constant
Montenegro	2000	Siebert et al. (2007)
and Kosovo	1992-1999	interpolated
	1991	Siebert et al. (2007)
	1961-1990	scaled based on data for former Yugoslavia
	1900-1960	scaled based on Bulgaria
Seychelle	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1996-1999	interpolated based on estimate
	1995	estimate
	1900-1994	assumed constant
Sierra Leone	1993-2003	FAOSTAT scaled to AQUASTAT
	1992	Siebert et al. (2007)
	1961-1991	FAOSTAT
	1900-1960	assumed constant
Singapore	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Slovakia	2001-2002	assumed constant
	2001	Siebert et al. (2007)
	1996-2000	interpolated
	1998-1995	scaled based on Czech Republic
	1940-1988	difference between values for Czechoslovakia and Czech Republic
	1900-1939	scaled based on Czechoslovakia (1900=Framji et al. (1981))
Slovenia	2003	Siebert et al. (2007)
	1996-2002	interpolated
	1995	Siebert et al. (2007)
	1993-1994	interpolated
	1992	FAOSTAT
	1900-1991	assumed constant
Solomon	2001-2003	assumed constant
Island	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Somalia	1961-2003	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate 1/2 of 1961
South Africa	1961-2003	FAOSTAT
	1922-1960	interpolated
	1921	Forde (1995)
	1901-1920	interpolated based on estimate
	1900	estimate 1/2 of 1961
South Korea	2003	FAOSTAT scaled to AQUASTAT
	2002	Siebert et al. (2007)
	1961-2001	FAOSTAT scaled to AQUASTAT
	1956-1960	interpolated
	1955	Framji et al. (1981)
	1942-1954	interpolated
	1935-1941	Framji et al. (1981) in 55 scaled to ratio North Korea/South Korea
	1901-1934	interpolated based on estimate
	1900	estimate 2/3 of 1935
Spain	2003	Siebert et al. (2007)
	1989-2002	AQUASTAT
	1961-1988	FAOSTAT
	1960	interpolated
	1959	Framji et al. (1981)
	1950-1958	interpolated
	1949	Framji et al. (1981)
	1919-1948	interpolated
	1918	Houston (1950)
	1901-1917	interpolated

Country	Period	Data source / method
	1900	Framji et al. (1981)
Sri Lanka	1996-2003	FAOSTAT
	1995	Siebert et al. (2007)
	1961-1994	FAOSTAT
	1948-1960	extrapolated based on 1961-1970 rate
	1901-1947	interpolated based on estimate
	1900	estimate
St. Helena	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
St. Kitts and	1998-2003	assumed constant
Nevis	1997	Siebert et al. (2007)
	1993-1996	AQUASTAT
	1900-1992	assumed constant
St. Lucia	1961-2003	FAOSTAT
	1956-1960	scaled based on Guadeloup
	1900-1955	assumed constant
St. Pierre	1900-2003	assumed constant
St. Vincent	1961-2003	FAOSTAT
and the	1900-60	assumed constant
Grenadines		
Sudan	1961-2003	FAOSTAT
	1960	interpolated
	1959	Framji et al. (1981) scaled based on FAOSTAT
	1958	interpolated
	1957	Barbour (1959)
	1946-1956	interpolated
	1945	Barbour (1959)
	1935-44	interpolated
	1934	Barbour (1959)
	1901-1933	interpolated based on estimate
	1900	estimate
Suriname	1999-2003	FAOSTAT scaled to AQUASTAT
	1998	Siebert et al. (2007)
	1961-1997	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Svalbard and	1900-2003	assumed constant
Jan Mayen		
Swaziland	2001-2003	FAOSTAT scaled to AQUASTAT
	2000	Siebert et al. (2007)
	1998-1999	AQUASTAT
	1961-1997	FAOSTAT
	1955-1960	interpolated
	1954	Framji et al. (1981)
	1951-1953	interpolated based on estimate
	1950	estimate
	1900-1949	assumed constant
Sweden	2003	Siebert et al. (2007)
	2001-2002	interpolated
	2000	EUROSTAT
	1998-1999	interpolated
	1997	EUROSTAT
	1996	interpolated
	1995	EUROSTAT
	1961-194	FAOSTAT
	1948-1960	extrapolated based on 61-70 rate
	1900-1947	assumed constant
Switzerland	2003	assumed constant
	2002	Siebert et al. (2007)
	1991-2001	interpolated
	1961-1990	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Syria	2002-2003	FAOSTAT
	2001	Siebert et al. (2007)
	1993-2000	AQUASTAT

Country	Period	Data source / method
	1961-1992	FAOSTAT
	1959-1960	Popp & Rother (1993)
	1947-1958	interpolated based on estimate
	1946	estimate 1/2 of 59
	1934-1945	interpolated based on estimate
	1933	estimate
	1901-1932	interpolated
	1900	Framji et al. (1981)
Taiwan	1977-2003	scaled based on China
	1976	Framji et al. (1981)
	1967-1975	interpolated
	1966	Framji et al. (1981)
	1960-1956	interpolated
	1959	Framji et al. (1981)
	1950-1958	interpolated
	1949	Framji et al. (1981)
	1946-1948	interpolated
	1945	Framji et al. (1981)
	1941-1944	interpolated
	1940	Framji et al. (1981)
	1901-1939	interpolated
	1900	Framji et al. (1981)
Tajikistan	2001-2003	FAOSTAT scaled to AQUASTAT
	1973-2000	AQUASTAT
	1901-1972	interpolated
	1900	scaled based on ratio (sum central Asian states 1900 (Shtepa et al. 1985) / sum central Asian states 1973)
Tanzania	2003	FAOSTAT scaled to AQUASTAT
	2002	Siebert et al. (2007)
	2001	interpolated
	1993-2000	AQUASTAT
	1961-1992	FAOSTAT
	1951-1960	extrapolated based on 61-66 rate
	1900-1950	assumed constant
Thailand	2001-2003	FAOSTAT
	2000	Siebert et al. (2007)
	1961-1999	FAOSTAT
	1960	interpolated
	1959	Framji et al. (1981)
	1911-1958	interpolated
	1910	Framji et al. (1981)
	1901-1909	interpolated based on estimate
	1900	estimate
Togo	1998-2003	FAOSTAT scaled to AQUASTAT
	1983-1997	AQUASTAT
	1961-1982	FAOSTAT
	1900-1960	assumed constant
Tokelau	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Tonga	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Trinidad and	1998-2003	FAOSTAT scaled to AQUASTAT
Tobago	1997	Siebert et al. (2007)
	1993-1996	AQUASTAT
	1982-1992	interpolated
	1981	AQUASTAT
	1976-1980	interpolated
	1975	AQUASTAT
	1962-1974	interpolated
	1961	AQUASTAT
	1905-1960	extrapolated based on 61-75 rate
	1900-1904	assumed constant
Tunesia	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1961-1999	FAOSTAT

Country	Period	Data source / method
	1901-1960	interpolated
	1900	Framji et al. (1981)
Turkey	1995-2003	FAOSTAT
	1994	Siebert et al. (2007)
	1961-1993	FAOSTAT
	1960	interpolated
	1959	Framji et al. (1981)
	1950-1958	interpolated
	1949	Framji et al. (1981)
	1901-1948	interpolated based on estimate
	1900	estimate 2/3 of 49
Turkmenistan	1998-2003	FAOSTAT
	1973-1997	AQUASTAT
	1901-1972	interpolated
	1900	1973 times ratio (sum central asian states 1900 (Shtepa et al. 1985) / sum central asian states 1973)
Turks and	2001-2003	assumed constant
Caicos	2000	Siebert et al. (2007)
Islands	1900-1999	assumed constant
Tuvalu	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Uganda	1999-2003	FAOSTAT scaled to AQUASTAT
	1998	Siebert et al. (2007)
	1988-1997	interpolated
	1983-1987	AQUASTAT
	1961-1984	FAOSTAT
	1956-1960	extrapolated based on 61-66 rate
	1900-1955	assumed constant
Ukraine	2001-2003	FAOSTAT adjust to Dirksen & Huppert (2006)
	2000	Dirksen & Huppert (2006)
	1999	interpolated
	1998	Dirksen & Huppert (2006)
	1996-1997	interpolated
	1995	Dirksen & Huppert (2006)
	1993-1994	interpolated
	1992	Dirksen & Huppert (2006)
	1991	interpolated
	1990	Dirksen & Huppert (2006)
	1988-1989	interpolated
	1983-1987	AQUASTAT
	1900-1982	scaled based on Russia
United Arab	2002-2003	assumed constant
Emirates	2001	Siebert et al. (2007)
	1999-2000	interpolated
	1998	Siebert et al. (2007)
	1993-1997	interpolated
	1992	Siebert et al. (2007)
	1961-1991	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
United	2003	Siebert et al. (2007)
Kingdom	1998-2002	interpolated
	1997	EUROSTAT
	1994	interpolated
	1995	EUROSTAT
	1994	interpolated
	1993	EUROSTAT
	1991-1992	interpolated
	1990	EUROSTAT
	1961-1989	FAOSTAT
	1951-1960	interpolated based on estimate
	1950	estimated
	1901-1949	interpolated
	1900	Framji et al. (1981)
United States	1961-2003	1.33 * FAOSTAT based on ratio

Country	Period	Data source / method
of America		Siebert et al. (2007) / FAOSTAT
	1950-1960	interpolated
	1949	Framji et al. (1981)
	1911-1948	interpolated
	1910	Framji et al. (1981)
	1901-1909	interpolated
	1900	Framji et al. (1981)
Uruguay	2001-2003	FAOSTAT scaled to AQUASTAT
	2000	Siebert et al. (2007)
	1961-1999	FAOSTAT scaled to AQUASTAT
	1960	interpolated
	1959	Framji et al. (1981)
	1957-1958	interpolated
	1956	Framji et al. (1981)
	1952-1955	interpolated
	1951	Framji et al. (1981)
	1939-1950	extrapolated based on 51-61 rate
	1900-1938	assumed constant
US Virgin	2000-2003	assumed constant
Islands	2000	Siebert et al. (2007)
	1956-1999	scaled based on Guadeloup
	1900-1955	assumed constant
Uzbekistan	1997-2003	FAOSTAT scaled to AQUASTAT
	1996	Siebert et al. (2007)
	1992-1995	interpolated
	1973-1991	AQUASTAT
	1901-1972	interpolated
	1900	1973 times ratio (sum central asian states 1900 (Shtepa et al. 1985) / sum central asian states 1973)
Vanuatu	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Venezuela	1999-2003	FAOSTAT
	1998	Siebert et al. (2007)
	1961-1997	FAOSTAT
	1951-1960	interpolated based on estimate
	1950	estimate
	1901-1949	interpolated based on estimate
	1900	estimate

Country	Period	Data source / method
Vietnam	1961-2003	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Wake Island	2001-2003	assumed constant
	2000	Siebert et al. (2007)
	1900-1999	assumed constant
Wallis and	2001-2003	assumed constant
Futuna	2000	Siebert et al. (2007)
	1900-1999	assumed constant
West Bank	2002-2003	assumed constant
	2001	Siebert et al. (2007)
	1991-2000	interpolated
	1990	Siebert et al. (2007)
	1983-1989	interpolated
	1982	Siebert et al. (2007)
	1900-1981	scaled based on Israel
Western	1900-2003	assumed constant
Sahara		
Yemen	1961-2003	FAOSTAT
	1901-1960	interpolated based on estimate
	1900	estimate
Zambia	2003	FAOSTAT
	2002	Siebert et al. (2007)
	2001	interpolated
	1998-2000	AQUASTAT
	1993-1997	interpolated
	1988-1992	AQUASTAT
	1961-1987	FAOSTAT
	1951-1960	interpolated based on estimate
	1950	estimate
	1900-1949	assumed constant
Zimbabwe	2001-2003	FAOSTAT scaled to AQUASTAT
	1988-2000	AQUASTAT
	1961-1987	FAOSTAT
	1960	Framji et al. (1981)
	1951-1959	interpolated
	1950	Framji et al. (1981)
	1921-1949	interpolated
	1900-1920	assumed constant

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