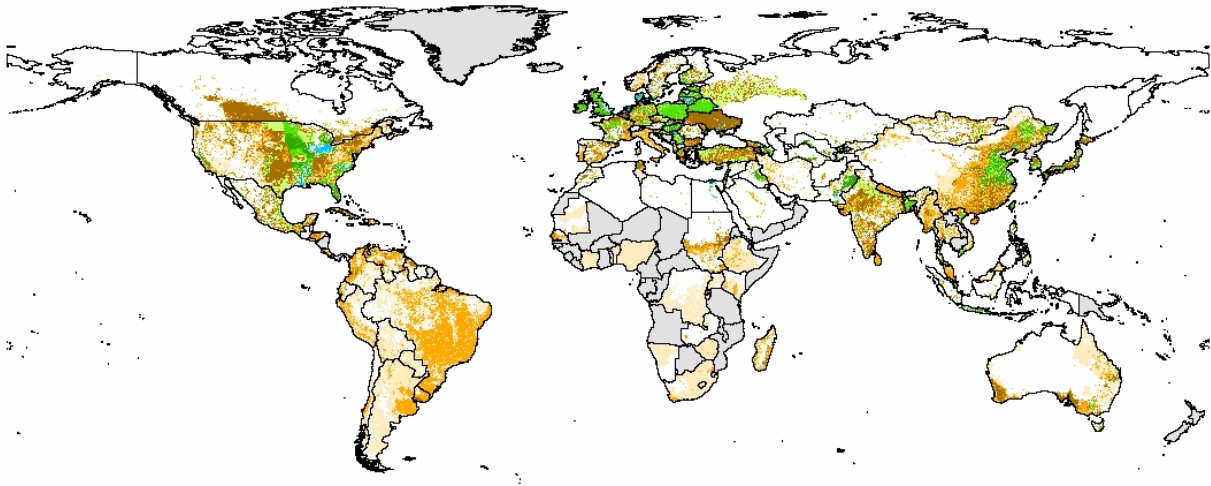


## A Digital Global Map of Artificially Drained Agricultural Areas



Sebastian Feick, Stefan Siebert and Petra Döll

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# Frankfurt Hydrology Paper

**A Digital Global Map of  
Artificially Drained Agricultural Areas**

**Documentation**

Sebastian Feick, Stefan Siebert and Petra Döll

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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 22393, Fax +49 (0)69 798 25058  
<http://www.geo.uni-frankfurt.de/ipg/ag/dl/index.html>

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## **Abstract**

Artificial drainage of agricultural land, for example with ditches or drainage tubes, is used to avoid water logging and to manage high groundwater tables. Among other things it influences the nutrient balances by increasing leaching losses and by decreasing denitrification. To simulate terrestrial transport of nitrogen on a global scale, a digital global map of artificially drained agricultural areas was developed. The map depicts the percentage of each 5' by 5' grid cell that is equipped for artificial drainage. Information on artificial drainage in countries or sub-national units mainly derived by information from international data sets. Distribution to grid cells was based, for most countries, on the "Global Croplands Dataset" of Ramankutty et al. (1998) and the "Digital Global Map of Irrigation Areas" of Siebert et al. (2005). For some European countries CORINE land cover dataset was used instead of the both datasets mentioned above. Maps with outlines of artificially drained areas were available for 6 countries. The global drainage area on the map is 167 Mio hectares. For only 11 out of the 116 countries with information on artificial drainage areas, subnational information could be taken into account. Due to this coarse spatial resolution of the data sources, we recommended to use the map of artificially drained areas only for continental to global scale assessments. This documentation describes the dataset, the data sources and the map generation, and it discusses the data uncertainty.

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## 1 Introduction

In general, artificial drainage<sup>1</sup> of agricultural land is used to avoid water logging and to manage high groundwater tables. In arid regions, drainage of irrigated lands avoids salinization and is thus, for many soils, a prerequisite for sustainable land use. In humid regions, drainage helps to extend the period in which the field can be entered with heavy machines. Artificial drainage decreases the average water content of the subsoil and accelerates the transport of water through the soil. Therefore, it influences nutrient transport by increasing leaching losses and by decreasing denitrification.

Although multiple impacts of artificial drainage exist there is no global map of areas with artificially drained agricultural areas. This required us to use heterogeneous information from national and international sources to produce a first indicative map. The resulting digital global map of artificially drained agricultural areas (or “areas with improved drainage”) is a raster map with a resolution of 5 min longitude by 5 min latitude. For the whole land area of the globe (except Antarctica), the data set provides the fraction of each 5 min by 5 min cell area that is equipped for improved drainage. The map is mainly based on:

- national statistics from international data sources (FAO, ICID, CEMAGREF etc.)
- the “Global Croplands Dataset” (Ramankutty et al., 1998) and
- the “Digital Global Map of Irrigation Areas” (Siebert et al., 2005).

Due to the spatial resolution of the data sources (mainly on country level) we recommend to use the map of artificially drained areas only for continental to global scale assessments. The map will be applied, for example, to simulate terrestrial transport of nitrogen with the model WaterGAP-N (Siebert, 2005) which is a further development of the global model of water availability and water use WaterGAP 2.1 (Alcamo et al., 2003) or to simulate accelerated interflow on drained agricultural lands with the hydrological model WGHM (Döll et al., 2003) of WaterGAP.

This documentation comprises a description of the data set, which includes information on the data sources of the map (Chapter 2). In Chapter 3 the map generation is characterised and in Chapter 4, a short discussion of the results and the uncertainties of the data set follows. In Appendix A, detailed tables with the data sources and the references of the data sources per country

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<sup>1</sup> In this document “drainage” means artificial/improved drainage of agricultural areas (e.g. areas equipped with ditches or drainage tubes)

are provided as well as the value of the artificial drainage area per country and sub-national unit. In Appendix B, the global map of artificially drained agricultural areas and a map with the spatial units of the artificial drainage map for which statistical information on drained areas were available are shown. Moreover, zooms to North and Central America and to Europe and North Africa are provided in Appendix B.

## **2 Description of Data Set**

The digital global map of artificially drained agricultural areas (or “areas with improved drainage”) is a raster map with a resolution of 5 min by 5 min. For the whole land area of the globe (except Antarctica), the data set provides the fraction of each 5 min by 5 min cell area that was equipped for improved drainage. The map is shown in Appendix B. In the following, the artificially drained agricultural areas will be called "drained areas". The global drainage area on the map is 167 Mio hectares. Drainage areas equipped for flood control measurements are not included in the map (if distinguishable from the data).

### **2.1 Data Format**

Two raster maps are available (in ASCII format). The first map shows the drained area in hectares per 5' by 5' grid cell. The other raster map provides the percentage of each 5' by 5' cell area that is drained, the so-called drainage density. The document and the maps are available at: [http://www.geo.uni-frankfurt.de/ipg/ag/dl/forschung/Global\\_Drainage\\_Map/index.html](http://www.geo.uni-frankfurt.de/ipg/ag/dl/forschung/Global_Drainage_Map/index.html).

### **2.2 Data Sources**

The main sources of the global map of artificially drained areas are international data sets from FAO (FAO AQUASTAT, 1994, 2003, 2004), ICID (2005) and CEMAGREF (2005), which are based on various data sources. These datasets often distinguish between drainage in irrigation areas and drainage in rainfed areas. On the basis of the “Global Croplands Dataset” (Ramankutty et al., 1998) and the “Digital Global Map of Irrigation Areas” (Siebert et al., 2005) three 5' grids were generated: 1. Total cropland area, 2. Rainfed cropland area, 3. Irrigated cropland area. Within a country or sub-national unit the drainage area was distributed according to the percentage of the grid cell covered by “Total Cropland” or “Rainfed Cropland” and “Irrigated Cropland” depending on data availability. For 105 countries the drainage area was assigned to the agricultural area in the respective country or the respective sub-national units of the country. For 5 coun-

tries (Algeria, Austria, Romania, Switzerland and Zambia) maps with outlines of improved drainage areas were available from Framji et al. (1981-83), and used to locate drainage areas. For Germany a map with outlines of the tile-drainage density in per cent of the arable land was available (Röpke et al., 2004) and for Russia the shapefile “Land Resources of Russia” (IIASA, 2002) which includes artificially drained areas, was used. In European countries with a high percentage of drained pasture land and/or not enough cropland area to assign the given drainage area, the CORINE land cover data sets from 1990 (Switzerland) and 2000 (Austria, Estonia, Finland, Germany, Latvia, Netherlands and Romania) which including pasture land were used to locate the drainage area. For the 12 countries shown in Table 1 sub-national statistical information were found. For 134 countries no data values about artificial drainage areas were available.

Table 1: Countries with available sub-national statistical information of improved drainage area

<b>Country</b>	<b>Administrative Unit</b>
Afghanistan	Province
Albania	District
Algeria	Province
Australia	State/Territory
China	Province
Egypt	Governorate/Region
Estonia	County
France	Region
Germany	Western Germany, Eastern Germany
Latvia	County
Pakistan	Province
USA	State

For every country, the most recent information or the information with the highest spatial resolution was used to generate the global map of artificially drained agricultural areas. In Table A1 of the appendix used data source(s) and further (not used) data source(s) of drainage areas are listed for each country. In Table A2, the respective references are given.

### 3 Map Generation

The generation of the digital map of artificially drained areas included a number of steps that depended on the type of data that was available for the respective country. The four main calculation routes are depicted in Fig. 1 and shortly characterized below:

- a) For 105 countries the statistical drainage area was assigned to the cropland area in the respective country or the respective sub-national units of the country. Depending on the available data the drainage area assigned either to the “total cropland area” or the “rainfed cropland area” and the “irrigated cropland area”. The total cropland area and the rainfed area are calculated on the basis of the “Global Croplands Dataset” (Ramankutty et al., 1998) and the “Digital Global Map of Irrigation Areas” (Siebert et al., 2005) as shown in Figure 1. For countries with information about the amount of drainage area in irrigated and/or rainfed lands the drainage area was assigned to these areas. For countries without separate information about the amount of the drainage area in irrigated and/or rainfed lands, the drainage area was assigned to the total cropland area (= irrigated + rainfed).
- b) The drainage area of the four countries Estonia, Finland, Latvia and the Netherlands was assigned to the total area of 5 appropriate land cover classes of the CORINE 2000 dataset.
- c) Maps with outlines of drainage areas were digitized for 6 countries. For 4 countries (Austria, Germany, Romania and Switzerland) out of these 6 the drainage area was assigned to the total area of 5 appropriate land cover classes of the CORINE 2000 (for Switzerland the CORINE 1990) dataset inside the digitized outlines. The drainage area of the other 2 countries was assigned to the total cropland area (Algeria) and the irrigated area (Zambia) respectively.
- d) Artificially drained areas in Russia are shown separately in the shapefile “Land Resources of Russia” (IIASA, 2002). The statistical drainage area for Russia (Source: FAO AQUASTAT, 2004) was assigned to the extracted drainage area from the IIASA shapefile.

The procedure of digitizing maps with outlines of drained areas is described in Chapter 3.1. For some countries a special assignment of the statistical drainage area to the spatial units was necessary. These special cases are explained in Chapter 3.2. The drainage area per country is listed in Table A3. For the countries with sub-national information, Tables A4 to A15 provide the drainage area per administrative unit. No Data values in the map as well as in Tables A3 to A15 mean no information was available or found.

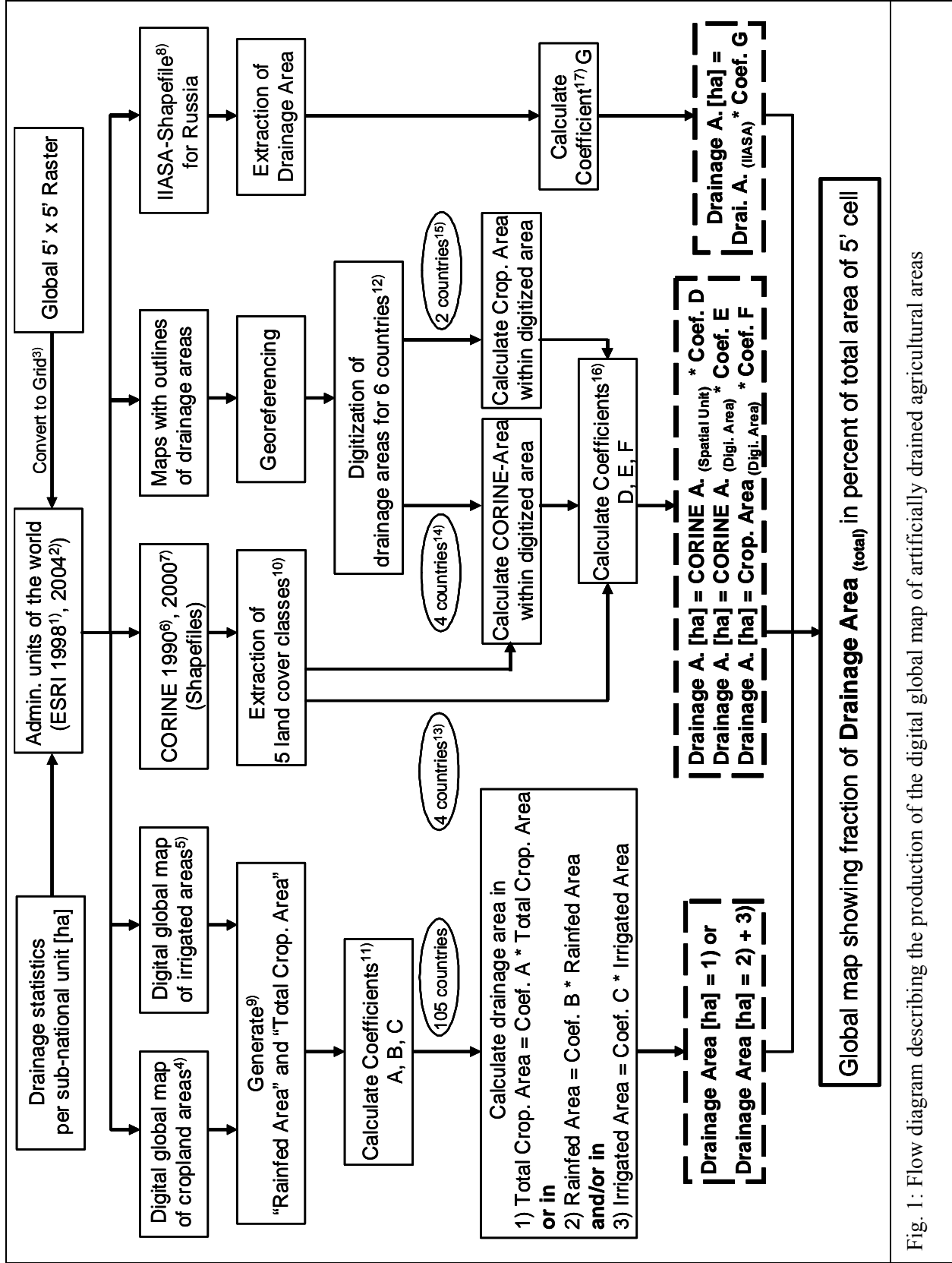


Fig. 1: Flow diagram describing the production of the digital global map of artificially drained agricultural areas

- 1) Environmental Systems Research Institute (ESRI) (1998): CD-Rom ESRI - Data and Maps.
- 2) Environmental Systems Research Institute (ESRI) (2004): CD-Rom ESRI - Data and Maps.
- 3) This step resulting in a lost of 13 countries. But all of the 13 are small islands without cropland and drainage area. The 13 countries are: Tuvalu, Tokelau, Spratly Islands, Nauru, Juan De Nova Island, Johnston Atoll, Howland Island, Glorioso Islands, Monaco, Baker Island, Cocos (Keeling) Island, Bouvet Island and Bermuda.
- 4) Ramankutty, N. and Foley, J.A. (1998): Characterizing patterns of global land use: An analysis of global croplands data. *Global Biogeochemical Cycles* 12(4), 667-685.  
(The data format used was: ArcINFO ASCII with a resolution of 5 minutes)
- 5) Siebert, S., Döll, P., Feick, S., Hoogeveen, J. (2005): *Global map of irrigated areas version 3.0* Johann Wolfgang Goethe University, Frankfurt am Main, Germany / Food and Agriculture Organization of the United Nations, Rome, Italy.  
(The data format used was: ArcINFO ASCII with a resolution of 5 minutes)
- 6) + 7) Datasets available at: <http://dataservice.eea.eu.int/dataservice/>  
(The data format used was: Vector format (ESRI Shapefile))
- 8) International Institute for Applied Systems Analysis (IIASA) (2002): Land Resources of Russia. CD-Rom Data available for download at:  
[http://www.iiasa.ac.at/collections/IIASA\\_Research/Research/FOR/russia\\_cd/download.htm](http://www.iiasa.ac.at/collections/IIASA_Research/Research/FOR/russia_cd/download.htm) (2005)
- 9) Rainfed Area = (Digital global map of cropland areas) – (Digital global map of irrigated areas) [ha]  
Total Cropland Area = Rainfed Area + Irrigated Area [ha]
- 10) Land cover classes extracted from the CORINE Datasets (1990 and 2000): 1. Non-irrigated arable land, 2. Permanently irrigated land, 3. Pastures, 4. Annual crops associated with permanent crops, 5. Complex cultivation patterns.
- 11) Coefficient A = Drainage Area <sub>(Spatial Unit)</sub> / Total Cropland Area <sub>(Spatial Unit)</sub>  
Coefficient B = Rainfed Drainage Area <sub>(Spatial Unit)</sub> / Rainfed Area <sub>(Spatial Unit)</sub>  
Coefficient C = Irrigated Drainage Area <sub>(Spatial Unit)</sub> / Irrigated Area <sub>(Spatial Unit)</sub>
- 12) Algeria, Austria, Germany, Romania, Switzerland, Zambia
- 13) Estonia, Finland, Latvia, Netherlands
- 14) Austria, Germany, Romania, Switzerland
- 15) Algeria, Zambia
- 16) Coefficient D = Drainage Area <sub>(Spatial Unit)</sub> / CORINE Area <sub>(Spatial Unit)</sub>  
Coefficient E = Drainage Area <sub>(Spatial Unit)</sub> / CORINE Area <sub>(in digitized areas per Spatial Unit)</sub>  
Coefficient F = Drainage Area <sub>(Spatial Unit)</sub> / Total Cropland Area <sub>(in digitized areas per Spatial Unit)</sub>
- 17) Coefficient G = Drainage Area <sub>(Statistics)</sub> / Drainage Area <sub>(IIASA)</sub>

### 3.1 Digitization of maps with outlines of drained areas

In Framji et al. (1981-83) maps with outlines of drained areas are available for 5 countries (Algeria, Austria, Romania, Switzerland and Zambia). For Germany a map with outlines of the tile-drainage density in per cent of the arable land was available (Röpke et al., 2004). These maps were digitised using the GIS software ArcView 3.2. First, the maps were scanned with a resolution of 600 dpi. Then the scanned maps were georeferenced by the country-border lines because no map has a (geographic) coordinate system. The georeferencing was done with the GIS ArcView 3.2. This step was followed by a manual digitization of the drainage areas on the screen using the mouse cursor.

### 3.2 Special assignments of statistical drainage area to the respective spatial units

In some countries a special assignment of the drainage data to the spatial units, which is not described in Fig. 1, was necessary. These cases are listed below with a short description of the respective assignment method:

#### Algeria

Sub-national units listed in the CEMAGREF (2005) database are not available in the ESRI shapefile datasets (1998, 2004) of administrative units. Therefore, the country value for drainage area was taken and assigned to cropland area within digitised outlines.

#### China

Drainage area for each province (Agricultural Yearbook, 1995) and the value for total drainage area in irrigated lands from FAO (2004) were taken into account. To determine drained irrigated area per province, the drained irrigated area of China as a fraction of the drained area of China was multiplied by the drainage area per province. In one province (Heilongjiang), the thus computed drained irrigated area is higher than the total irrigated area from Siebert et al. (2005). The surplus drainage area:

$$\text{Surplus drainage area} = \left[ \left( \frac{\text{Total Drainage Area}_{(\text{in irrigated lands})}}{\sum \text{Drainage Area}_{(\text{Province})}} \right) * \text{Drainage Area}_{(\text{Heilongjiang})} \right] - \text{Irrigation Area}_{(\text{Heilongjiang})}$$

was distributed to the remaining provinces with drainage area and irrigation area.

To determine the drainage area in rainfed lands per province, the drained rainfed area of China as a fraction of the total drained area of China was multiplied by the drainage area per province.

### **Egypt**

In Egypt all drainage area is placed within irrigated lands (FAO, 2004). For the “West Delta” region total irrigation area is lower than the area for drained irrigated areas. Therefore, the surplus drainage area was assigned to rainfed area in this region (Annex A, Tab. A9).

### **Estonia**

Drainage area per county was assigned to the area of 5 land cover classes of the CORINE (2000) dataset (Fig. 1). In one county (Hiiumaa) CORINE (2000) area is lower than necessary. Therefore, drainage area for Estonia in the map is smaller than the value from the FAO (1998) statistic.

### **France**

In one région (Limousin) total crop area is lower than drainage area from statistic (Agreste, 1991). Although drainage area was distributed to all of the irrigation and rainfed area within this région, the computed drainage area for France is smaller than the value from the Agreste (1991) statistic (Annex A, Tab. A1 and A11).

### **Germany**

In Röpke et al. (2004) the outlines of tile-drainage density in per cent of the arable land are shown in a map (based on data from Behrendt et al. 1999). These outlines were digitised and assigned to the area of 5 land cover classes (= total arable land) of the CORINE (2000) dataset. Percent values from Röpke et al. (2004) then multiplied with arable land per digitised area (= calculated arable land). The total resulting area for Western-Germany and Eastern-Germany is larger than the given drainage areas of Behrendt et al. (1999) for these two parts of Germany. Therefore, one coefficient for Western-Germany and another coefficient for Eastern-Germany had to be calculated:

$$1) \text{ Coefficient}_{(W-Germany)} = \text{Drainage Area}_{(W-Germany)} / \sum \text{Calc. Arable Land}_{(W-Germany)}$$

$$2) \text{ Coefficient}_{(E-Germany)} = \text{Drainage Area}_{(E-Germany)} / \sum \text{Calc. Arable Land}_{(E-Germany)}$$

Finally the coefficients were multiplied with the calculated arable land per digitised area to get the necessary drainage area (s. Fig.1).

### **Greece**

According to Framji et al. (1981-83) 42 % of the 600.000 ha drained land are located within irrigated areas. In the “international drainage database” of CEMAGREF (2005), a drainage area of 600.000 ha is given, too. The cited data source (Field, W.P., 1990) is older than the cited data sources of the ICID (2005) dataset and so the ICID value of 520.000 ha drained area was taken into account. To get a value for drainage area in irrigated and rainfed lands, the 520.000 ha were multiplied by 0.42.

### **Hungary**

The total irrigated area of Hungary (214.039 ha) is smaller than the 320.000 ha drained area in irrigated lands from the CEMAGREF (2005) dataset. The resulting surplus drainage area was assigned to the rainfed part of the total crop area in Hungary.

### **Japan**

It was tried to assign the total drainage area of Japan to irrigated land, because most of the irrigated land in Japan is paddy cultivation, and paddy cultivation and drainage are linked in general (FAO, 1999). However, the irrigated area of Japan (3.129.000 ha) is smaller than the total drainage area (3.660.000 ha). So the resulting surplus drainage area was assigned to rainfed cropland.

### **Slovenia**

The total irrigated area of Slovenia (2.802 ha) is smaller than the 8.000 ha drained area in irrigated lands from the CEMAGREF (2005) dataset. The resulting surplus drainage area was assigned to rainfed cropland.

### **Suriname**

According to CEMAGREF (2005), all of Suriname’s drainage area (51.180 ha) is in areas equipped for irrigation. But the irrigated area of Suriname is only 50.069 ha. The resulting surplus drainage area was assigned to rainfed cropland.

## USA

Based on the drainage values from the US Department of Agriculture (USDA, 1987) and CEMAGREF (2005), the assignment of drained areas per state was realized. USDA (1987) provides values for 23 states (Sum: 41.356.189 ha) and a value for the whole United States (44.384.620 ha). The difference between the two values was distributed to the other 28 states proportional to the cropland area per state (only 28 remainder states because in Guantanamo Bay no cropland area exists). In the CEMAGREF (2005) database a value for the United States (47.500.000 ha) is given and split into a part of drainage area in irrigated (5.750.000 ha) and in rainfed (41.750.000 ha) lands. The difference between the value of total drained area in CEMAGREF (2005) and USDA (1987) was distributed to the 23 states given from the USDA (1987) proportional to the amount of existing drainage area.

To split now the drainage area per state into a part located in irrigated areas and a part located in rainfed areas, a federal state was identified to have dominantly irrigated agriculture if:

$$(\text{Irrigation area}_{(\text{State})} / \text{Rainfed area}_{(\text{State})}) > 0.75.$$

In the resulting 10 states (Arizona, California, Colorado, Hawaii, Idaho, Nevada, New Mexico, Oregon, Utah and Wyoming), drained area was completely assigned to irrigated lands. In the remaining 40 states (in the District of Columbia there is no irrigation) the surplus drained irrigated area was distributed. In two states (Washington and Nebraska) irrigation area is too small to contain all of the resulting drainage area. The surplus drainage area was assigned to the irrigated area of the other 38 states.

The per state rainfed part of the drainage area resulted by the following calculation:

$$5) \text{ Drainage Area}_{(\text{rainfed per State})} = \text{Drainage Area}_{(\text{State})} - \text{Drainage Area}_{(\text{irrigated per State})} .$$

## 4 Discussion and Conclusions

The digital global map of artificially drained agricultural areas shows the percentage of 5' grid cell area with artificial drainage. The quality of the generated global map of artificially drained areas depends mainly on the quality of used base data, in particular on its (low) spatial resolution. For only 11 out of the 116 countries with information on artificial drainage areas sub-national information could be taken into account. For 5 out of the 6 countries with maps of outlines of

artificial drainage areas, data are from the 1960s and 1970s (in Framji et al., 1981-83). In these cases, the mapped drainage area is probably too localized. Furthermore, for many countries different and deviating data sources exist (Table A1). For example, in the CEMAGREF (2005) data set a difference is made between “on farm drainage systems” and “main drainage system only”. For many countries the sum of both values is the drainage value given by ICID (2005). Therefore, if data for a country is available from ICID (2005) and from CEMAGREF (2005) we consider only the values for “on farm drainage systems” from CEMAGREF (2005). Moreover in the FAO datasets and the ICID (2005) dataset no difference is made between drainage facilities for agricultural and construction purposes. Due to this, in humid regions with heavy soils like in the Baltic States the drained area is larger than the cultivated area (FAO, 1997) and the drained area is probably overestimated in the map. Besides, it must be pointed out, that there is no global dataset of pasture areas. Thus, drainage areas could be distributed to pasture lands only in countries with CORINE land cover information which include the land cover class “pasture land” (done for 8 countries), even though in other countries drained pastures exist. That means, that in all other countries except the 8 countries for which CORINE data used, the drainage area maybe distributed (to some extent) to the wrong cells.

The high spatial heterogeneity of the mapped drainage density is misleading, in that it is not due to spatially highly resolved information on drainage areas but on the different cropland areas in each 5' grid cell. The drainage density as defined by the drained area as a ratio of cropland area is assumed to be constant within each country or sub-national unit, respectively. Besides, we could not consider the relation between soil type and drainage necessity as we think that within each grid cell agriculture preferentially takes place on relatively favourable soils which are not necessarily the dominant soils.

In summary, the information provided by the global map of artificially drained areas is rather uncertain. This is mainly due to the quality of the data that served as input to the map. Thus, we recommended using the map of artificially drained areas only for continental to global-scale assessments.

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## **Annex A**

### **Tables**

**Table A1: Data sources per country**

<b>ID</b>	<b>Country</b>	<b>Data source used for drainage area statistic</b>	<b>Further data sources and/or comments</b>
1	Afghanistan	USAID 1976 (13,000 ha)	drainage areas in Helmand valley
2	Albania	FAO AQUASTAT: 1994 (information on provinces) (276,080 ha)	World Bank 1994 (304,560 ha) with information on provinces
3	Algeria	CEMAGREF: International drainage database 2005 (56,000 ha)	CEMAGREF 2005: sub-national informations (61,061 ha); ICID 2005 (60,000 ha)
4	American Samoa	No Data	
5	Andorra	No Data	
6	Angola	No Data	
7	Anguilla	No Data	
8	Antarctica	No Data	
9	Antigua and Barb.	FAO AQUASTAT: 2004 (808 ha)	just 130 ha croparea total
10	Argentina	ICID 2005 (130,000 ha)	
11	Armenia	FAO AQUASTAT: 2004 (60,400 ha)	
12	Aruba	No Data	
13	Australia	CEMAGREF: International drainage database 2005 (information on states) (1,964,000 ha)	ICID 2005 (2,170,000 ha); CEMAGREF 2005: 1,964,000 ha on farm drainage, 207,000 ha main drainage
14	Austria	CEMAGREF: International drainage database 2005 (195,000 ha)	ICID 2005 (210,000 ha); CEMAGREF 2005: 210,000 ha drainage or flood control, 195,000 ha on farm drainage
15	Azerbaijan	FAO AQUASTAT: 2003 (599,970 ha)	
16	Bahamas, The	No Data	
17	Bahrain	FAO AQUASTAT: 2004 (1,300 ha)	
18	Bangladesh	FAO AQUASTAT: 2004 (1,501,000 ha)	ICID 2005 (1,500,000 ha)
19	Barbados	No Data	
20	Belgium	CEMAGREF: International drainage database 2005 (70,000 ha)	ICID 2005 (270,000 ha); CEMAGREF 2005: 70,000 ha on farm drainage and 2,000,000 ha main drainage system
21	Belize	No Data	
22	Benin	FAO AQUASTAT: 2004 (563 ha)	

<b>ID</b>	<b>Country</b>	<b>Data source used for drainage area statistic</b>	<b>Further data sources and/or comments</b>
23	Bhutan	No Data	
24	Bolivia	CEMAGREF: International drainage database 2005 (20,000 ha)	drainage or flood control
25	Bosnia and Herz.	No Data	
26	Botswana	No Data	
27	Brazil	FAO AQUASTAT: 2004, ICID 2005	both: 1,280,000 ha
28	British Indian O.	No Data	
29	British Virgin I.	No Data	
30	Brunei	No Data	
31	Bulgaria	FAO 1991 (260,000 ha)	ICID 2005 (80,000 ha)
32	Burkina Faso	No Data	
33	Burundi	No Data	
34	Byelarus	FAO AQUASTAT: 2004 (3,001,000 ha)	
35	Cambodia	No Data	
36	Cameroon	No Data	
37	Canada	CEMAGREF: International drainage database 2005 (1,665,000 ha)	ICID 2005 (9,460,000 ha); CEMAGREF 2005: 1,665,000 ha on farm drainage and 7,800,000 ha main drainage system only
38	Cape Verde	No Data	
39	Cayman Islands	No Data	
40	Central African	No Data	
41	Chad	No Data	
42	Chile	CEMAGREF: International drainage database 2005 (15,000 ha)	FAO AQUASTAT: 2004 (7,800 ha); ICID 2005 (10,000 ha)
43	China	Agricultural Yearbook 1995 (information on provinces) (19,978,550 ha)	FAO AQUASTAT: 2004 (20,065,000 ha) with information about drainage in irrigated areas; ICID 2005 (20,000,000 ha); FAO AQUASTAT: 1994 (19,337,000 ha) with information on provinces

<b>ID</b>	<b>Country</b>	<b>Data source used for drainage area statistic</b>	<b>Further data sources and/or comments</b>
44	Christmas Island	No Data	
45	Colombia	CEMAGREF: International drainage database 2005 (233,800 ha)	FAO AQUAST.: 2004 (96,950 ha); ICID 2005 (230,000 ha)
46	Comoros	No Data	
47	Congo	No Data	
48	Cook Islands	No Data	
49	Costa Rica	FAO AQUASTAT: 2004 (37,790 ha)	
50	Croatia	CEMAGREF: International drainage database 2005 (762,000 ha)	
51	Cuba	CEMAGREF: International drainage database 2005 (327,000 ha)	FAO AQUAST.: 2004 (327,500 ha); ICID 2005 (20,000 ha)
52	Cyprus	ICID 2005 (20,000 ha)	
53	Czech Republic	ICID 2005 (400,000 ha)	CEMAGREF: International drainage database 2005 (405,000 ha, source: personal contact without date)
54	Denmark	ICID 2005 (1,500,000 ha)	
55	Djibouti	No Data	
56	Dominica	No Data	
57	Dominican Rep.	ICID 2005 (30,000 ha)	
58	Ecuador	FAO AQUASTAT: 2003 (52,034 ha)	ICID 2005 (50,000 ha)
59	Egypt	FAO AQUASTAT: 1994 (information on regions), 2004 (100 % in irrigated lands) (2,931,000 ha)	ICID 2005 (3,000,000 ha)
60	El Salvador	FAO AQUASTAT: 2004 (8,000 ha)	
61	Equatorial Guin.	No Data	
62	Eritrea	No Data	
63	Estonia	FAO 1998 (i0nformations on counties) (732,098 ha)	
64	Ethiopia	CEMAGREF: International drainage database 2005 (29,200 ha)	ICID 2005 (20,000 ha)

<b>ID</b>	<b>Country</b>	<b>Data source used for drainage area statistic</b>	<b>Further data sources and/or comments</b>
65	Falkland Islands	No Data	
66	Faroe Islands	No Data	
67	Federated States	No Data	
68	Fiji	Nuku, W. 2002 (750 ha)	
69	Finland	CEMAGREF: International drainage database 2005 (1,454,000 ha)	ICID 2005 (2,500,000 ha); CEMAGREF 2005: 1,454,000 ha drainage on irrigated and rainfed areas, 2,100,000 ha on farm drainage and 400,000 ha main drainage
70	France	Agreste 1991 (2,491,241 ha)	ICID 2005 (2,500,000 ha)
71	French Guiana	No Data	
72	French Polynesia	No Data	
73	French Southern	No Data	
74	Gabon	No Data	
75	Gambia, The	No Data	
76	Gaza Strip	No Data	
77	Georgia	FAO AQUASTAT: 2004 (164,740 ha)	
78	Germany	Behrendt et al. 1999 (2,645,841 ha)	ICID 2005 (4,900,000 ha)
79	Ghana	No Data	
80	Gibraltar	No Data	
81	Greece	ICID 2005; Framji et al. 1981-83 (600,000 ha) (42 % in irrigated areas)	CEMAGREF 2005: International drainage database 2005 (drainage or flood control) (600,000 ha)
82	Greenland	No Data	
83	Grenada	No Data	
84	Guadeloupe	No Data	
85	Guam	No Data	
86	Guatemala	FAO AQUASTAT: 2004 (1,200 ha)	
87	Guernsey	No Data	
88	Guinea	No Data	

<b>ID</b>	<b>Country</b>	<b>Data source used for drainage area statistic</b>	<b>Further data sources and/or comments</b>
89	Guinea-Bissau	No Data	
90	Guyana	FAO AQUASTAT: 2003 (150,134 ha)	ICID 2005 (150,000 ha)
91	Haiti	No Data	
92	Heard Island	No Data	
93	Honduras	FAO AQUASTAT: 2004 (62,000 ha)	ICID 2005 (60,000 ha)
94	Hungary	CEMAGREF: International drainage database 2005 (2,320,000 ha)	Framji et al. 1981-83 (4,112,700 ha)
95	Iceland	No Data	
96	India	FAO AQUASTAT: 2004, ICID 2005	both: 5,800,000 ha
97	Indonesia	FAO AQUASTAT: 2004 (3,350,000 ha)	ICID 2005 (270,000 ha); FAO 1999: drainage is closely linked to irrigation
98	Iran	FAO AQUASTAT: 2004 (40,000 ha)	ICID 2005 (40,000 ha); Framji et al. 1981-83 (47,550 ha)
99	Iraq	ICID 2005 (1,540,000 ha)	
100	Ireland	CEMAGREF: International drainage database 2005 (100 % rainfed) (1,150,000 ha)	ICID 2005 (1,150,000 ha)
101	Israel	ICID 2005 (100,000 ha)	
102	Italy	CEMAGREF: International drainage database 2005 (60,000 ha)	ICID 2005 (2,940,000 ha); CEMAGREF 2005: 60,000 ha on farm drainage and 2,887,552 ha main drainage system only
103	Ivory Coast	CEMAGREF: International drainage database 2005 (3,000 ha)	drainage or flood control
104	Jamaica	No Data	
105	Jan Mayen	No Data	
106	Japan	ICID 2005, CEMAGREF: International drainage database 2005 (both: 3,660,000 ha)	CEMAGREF 2005: drainage or flood control; FAO 1999: drainage is closely linked to irrigation
107	Jersey	No Data	
108	Jordan	FAO AQUASTAT: 2004 (4,000 ha)	ICID 2005 (10,000 ha)
109	Kazakhstan	FAO AQUASTAT: 2004 (433,100 ha)	

<b>ID</b>	<b>Country</b>	<b>Data source used for drainage area statistic</b>	<b>Further data sources and/or comments</b>
110	Kenya	FAO AQUASTAT: 2004 (18,640 ha)	
111	Kiribati	No Data	
112	Kuwait	FAO AQUASTAT: 2004 (2 ha)	
113	Kyrgyzstan	FAO AQUASTAT: 2004 (149,000 ha)	
114	Laos	No Data	
115	Latvia	Central Stat. Bureau of Latvia (inform. on counties) (939,194 ha)	FAO AQUASTAT: 2004 (1,583,000 ha)
116	Lebanon	CEMAGREF: International drainage database 2005 (3,000 ha in irrig. and 7,000 ha in rainfed areas)	ICID 2005 (10,000 ha); FAO AQUAST.: 2004 (10,800 ha)
117	Lesotho	No Data	
118	Liberia	No Data	
119	Libya	FAO AQUASTAT: 2004 (9,000 ha)	
120	Liechtenstein	No Data	
121	Lithuania	CEMAGREF: International drainage database 2005 (6,800 ha in irrig. and 2,613,200 ha in rainfed areas)	FAO AQUAST.: 2004 (3,043,000 ha total drained area, 8,469 ha in irrigated areas)
122	Luxembourg	No Data	
123	Macau	No Data	
124	Macedonia	No Data	
125	Madagascar	Framji et al. 1981-83 (113,500 ha)	
126	Malawi	No Data	
127	Malaysia	CEMAGREF: International drainage database 2005 (53,000 ha)	ICID 2005 (360,000 ha); FAO AQU.: 2004 (940,600 ha); CEMAGREF 2005: 53,000 ha on farm drainage, 600,000 ha drainage or flood control, 304,697 ha main drainage system only
128	Maldives	No Data	
129	Mali	No Data	
130	Malta	No Data	

<b>ID</b>	<b>Country</b>	<b>Data source used for drainage area statistic</b>	<b>Further data sources and/or comments</b>
131	Man, Isle of	No Data	
132	Marshall Islands	No Data	
133	Martinique	No Data	
134	Mauritania	CEMAGREF: International drainage database 2005 (12,784 ha)	
135	Mauritius	No Data	
136	Mayotte	No Data	
137	Mexico	CEMAGREF: International drainage database 2005 (5,203,300 ha)	
138	Midway Islands	No Data	
139	Moldova	FAO AQUASTAT: 2004 (42,000 ha)	
140	Mongolia	ICID 2005 (1,500,000 ha)	
141	Montenegro	No Data	
142	Montserrat	No Data	
143	Morocco	CEMAGREF: International drainage database 2005 (120,000 ha)	
144	Mozambique	No Data	
145	Myanmar	FAO AQUASTAT: 1994 (193,363 ha)	ICID 2005 (190,000 ha)
146	Namibia	FAO AQUASTAT: 2004 (2,000 ha)	
147	Nepal	ICID 2005 (90,000 ha)	CEMAGREF 2005: 105000 ha drainage or flood control
148	Netherlands	CEMAGREF: International drainage database 2005, ICID 2005 (both: 3,000,000 ha)	just 2,297,160 ha CORINE area (cropland total is just an area of 1,702,222 ha)
149	Netherlands Anti.	No Data	
150	New Caledonia	No Data	
151	New Zealand	No Data	Hudson, H. R. et al. 2004 (tile drain length in kilometers)
152	Nicaragua	No Data	
153	Niger	No Data	

<b>ID</b>	<b>Country</b>	<b>Data source used for drainage area statistic</b>	<b>Further data sources and/or comments</b>
154	Nigeria	CEMAGREF: International drainage database 2005 (4,000 ha)	
155	Niue	No Data	
156	Norfolk Island	No Data	
157	North Korea	No Data	
158	Northern Mariana	No Data	
159	Norway	Jord forsk: Norwegian Centre for Soil and Environmental Research (36,552 ha)	
160	Oman	No Data	
161	Pacific Islands	No Data	
162	Pakistan	CEMAGREF: International drainage database 2005 (information on regions) (6,160,000 ha)	FAO AQUASTAT: 2004 (5,100,000 ha, all area in irrigated land); ICID 2005 (6,000,000 ha)
163	Panama	No Data	
164	Papua New Guin.	No Data	
165	Paracel Islands	No Data	
166	Paraguay	CEMAGREF: International drainage database 2005 (10,000 ha)	drainage or flood control
167	Peru	ICID 2005 (80,000 ha)	CEMAGREF: International drainage database 2005 (85,000 ha drainage or flood control)
168	Philippines	FAO AQUASTAT: 2003 (1,470,691 ha)	FAO 1999: drainage is closely linked to irrigation
169	Pitcairn Islands	No Data	
170	Poland	CEMAGREF: International drainage database 2005 (4,205,000 ha)	
171	Portugal	CEMAGREF: International drainage database 2005 (8,000 ha)	ICID 2005 (40,000 ha)
172	Puerto Rico	CEMAGREF: International drainage database 2005 (drainage or flood control) (15,000 ha)	

<b>ID</b>	<b>Country</b>	<b>Data source used for drainage area statistic</b>	<b>Further data sources and/or comments</b>
173	Qatar	No Data	
174	Reunion	No Data	
175	Romania	CEMAGREF: International drainage database 2005 (300,000 ha)	FAO AQUAST.: 2004 (3,100,000 ha); ICID 2005 (3,400,000 ha); CEMAGREF 2005: 300,000 ha on farm drainage, 3,100,000 ha main drainage system only
176	Russia	FAO AQUASTAT: 2004 (5,027,000 ha)	ICID 2005 (7,400,000 ha)
177	Rwanda	FAO 2000 (90,000 ha)	
178	San Marino	No Data	
179	Sao Tome and Pri.	No Data	
180	Saudi Arabia	CEMAGREF: International drainage database 2005 (44,000 ha)	
181	Senegal	CEMAGREF: International drainage database 2005 (44,525 ha)	
182	Serbia	World Bank 2004 (2.080,000 ha)	
183	Seychelles	FAO AQUASTAT: 2004 (15 ha)	0 ha cropland, therefore drained area also 0 ha
184	Sierra Leone	No Data	
185	Singapore	No Data	
186	Slovakia	CEMAGREF: International drainage database 2005 (600,000 ha)	
187	Slovenia	CEMAGREF: International drainage database 2005 (72,000 ha)	ICID 2005 (120,000 ha); CEMAGREF 2005: 72,000 ha on farm drainage, 50,000 ha main system only
188	Solomon Islands	No Data	
189	Somalia	No Data	
190	South Africa	FAO AQUASTAT: 2004 (54,000 ha)	
191	South Georgia	No Data	
192	South Korea	CEMAGREF: International drainage database 2005 (1,152,600 ha)	FAO AQUASTAT: 2004 (327,500 ha)

<b>ID</b>	<b>Country</b>	<b>Data source used for drainage area statistic</b>	<b>Further data sources and/or comments</b>
193	Spain	CEMAGREF: International drainage database 2005 (300,000 ha)	
194	Sri Lanka	ICID 2005 (30,000 ha)	
195	St. Helena	No Data	
196	St. Kitts and Ne.	No Data	
197	St. Lucia	No Data	
198	St. Pierre and M.	No Data	
199	St. Vincent and Gr.	No Data	
200	Sudan	FAO AQUASTAT: 2004, ICID 2005 (both: 560,000 ha)	CEMAGREF 2005: (565,000 ha drainage or flood control)
201	Suriname	CEMAGREF: International drainage database 2005 (100% in irrigated areas) (51,180 ha)	FAO AQUAST.: 2004 (51,180 ha); ICID 2005 (50,000 ha)
202	Svalbard	No Data	
203	Swaziland	No Data	
204	Sweden	CEMAGREF: International drainage database 2005 (1,100,000 ha)	
205	Switzerland	CEMAGREF: International drainage database 2005 (121,000 ha)	just 100,098 ha CORINE area; ICID 2005: 160,000 ha; Framji et al. 1981-83 (164,000 ha)
206	Syria	FAO AQUASTAT: 2003 (273,030 ha)	FAO AQUASTAT: 2004 (100 % in irrigated areas)
207	Taiwan	CEMAGREF: International drainage database 2005 (731,000 ha)	
208	Tajikistan	FAO AQUASTAT: 2004 (328,600 ha)	
209	Tanzania, United	No Data	
210	Thailand	ICID 2005 (150,000 ha)	
211	Togo	No Data	
212	Tonga	No Data	
213	Trinidad and Tob.	FAO AQUASTAT: 2004	

<b>ID</b>	<b>Country</b>	<b>Data source used for drainage area statistic</b>	<b>Further data sources and/or comments</b>
214	Tunisia	FAO AQUASTAT: 2004 (date of source: 2002) (197,000 ha)	CEMAGREF 2005: 80,000 ha, 100 % in irrigated areas, date of source: 2000
215	Turkey	FAO AQUASTAT: 2004 (3,143,000 ha)	Framji et al. 1981-83: 200,000 ha in irrigated areas
216	Turkmenistan	FAO AQUASTAT: 2003 (1,022,126 ha)	FAO AQUASTAT: 2004 (100 % in irrigated areas)
217	Turks and Caicos	No Data	
218	Uganda	CEMAGREF: International drainage database 2005 (3,000 ha)	
219	Ukraine	FAO AQUASTAT: 2004 (3,281,000 ha)	
220	United Arab Emir.	No Data	
221	United Kingdom	CEMAGREF: International drainage database 2005 (4,650,000 ha)	
222	United States	CEMAGREF: International drainage database 2005 (47,500,000 ha)	US Department of Agriculture 1987: 41,356,189 ha
223	Uruguay	CEMAGREF: International drainage database 2005 (100,000 ha)	CEMAGREF 2005: drainage or flood control
224	Uzbekistan	FAO AQUASTAT: 2004 (2,840,000 ha)	ICID 2005 (2,820,000 ha)
225	Vanuatu	No Data	
226	Venezuela	ICID 2005 (310,000 ha)	CEMAGREF 2005: 370,000 ha (drainage or flood control)
227	Vietnam	FAO AQUASTAT: 2004 (1,000,000 ha)	
228	Virgin Islands	No Data	
229	Wake Island	No Data	
230	Wallis and Futun	No Data	
231	West Bank	No Data	
232	Western Sahara	No Data	
233	Western Samoa	No Data	
234	Yemen	0 ha (ICID value much to high)	ICID 2005: 1,500,000 ha drained area but only 705,423 ha cropland total

<b>ID</b>	<b>Country</b>	<b>Data source used for drainage area statistic</b>	<b>Further data sources and/or comments</b>
235	Zaire	FAO AQUASTAT: 2004 (3,900 ha)	
236	Zambia	FAO AQUASTAT: 1994 (10,000 ha)	
237	Zimbabwe	FAO AQUASTAT: 2004 (46,850 ha)	

**Table A2: Dataset references**

ID	Country	Data source for drainage area
1	Afghanistan	USAID 1976: Mission to Afghanistan. Central Helmand drainage (phase II). Project Num.: 3060149 (available at <a href="http://www.dec.org/default.cfm">http://www.dec.org/default.cfm</a> , 2005)
2	Albania	FAO AQUASTAT 1994: Survey on water use for agriculture and rural development - Questionnaire for: Albania. Draft. FAO, Rome.; World Bank 1994: Staff appraisal report: Albania - First irrigation rehabilitation project. Agriculture and Water Supply Operations Division, Central Europe Department, Europe and Central Asia Region, Report No. 12609-ALB. (available at <a href="http://www.worldbank.org">http://www.worldbank.org</a> , 2005)
3	Algeria	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
4	American Samoa	
5	Andorra	
6	Angola	
7	Anguilla	
8	Antarctica	
9	Antigua and Barb.	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
10	Argentina	ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005)
11	Armenia	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
12	Aruba	
13	Australia	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
14	Austria	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
15	Azerbaijan	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2003)
16	Bahamas, The	
17	Bahrain	
18	Bangladesh	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
19	Barbados	
20	Belgium	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
21	Belize	
22	Benin	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)

ID	Country	Data source for drainage area
23	Bhutan	
24	Bolivia	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
25	Bosnia and Herz.	
26	Botswana	
27	Brazil	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004), ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005)
28	British Indian O.	
29	British Virgin I.	
30	Brunei	
31	Bulgaria	FAO 1991: Review Mission: Bulgaria - Irrigation Subsector Review. Investment Centre, FAO/World Bank Cooperative Programme, Report No. 109/91 CP-BUL 2. FAO, Rome.
32	Burkina Faso	
33	Burundi	
34	Byelarus	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
35	Cambodia	
36	Cameroon	
37	Canada	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
38	Cape Verde	
39	Cayman Islands	
40	Central African	
41	Chad	
42	Chile	
43	China	China Agriculture Press: Agricultural Yearbook 1995; FAO AQUASTAT 1994: Survey on water use for agriculture and rural development - Questionnaire for: China. Draft. FAO, Rome.
44	Christmas Island	
45	Colombia	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)

ID	Country	Data source for drainage area
46	Comoros	
47	Congo	
48	Cook Islands	
49	Costa Rica	
50	Croatia	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
51	Cuba	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
52	Cyprus	ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005)
53	Czech Republic	ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005)
54	Denmark	ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005)
55	Djibouti	
56	Dominica	
57	Dominican Rep.	ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005)
58	Ecuador	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2003)
59	Egypt	FAO AQUASTAT 1994: Survey on water use for agriculture and rural development - Questionnaire for: Egypt. Draft. FAO, Rome.; <a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
60	El Salvador	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
61	Equatorial Guinea	
62	Eritrea	
63	Estonia	FAO 1998: Sustainable water management strategies for the land drainage and irrigation sector - Estonia. TCP/EST/5612, Field Document. FAO, Rome.
64	Ethiopia	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
65	Falkland Islands	
66	Faroe Islands	
67	Federated States	
68	Fiji	Nuku, W. 2002: Fiji. In: Organizational Change for Participatory Irrigation Management. Report of the APO Seminar on Organizational Change for Participatory Irrigation Management. Phillippines, 23-27 Oct. 2000. ISBN: 92-833-2306-8

ID	Country	Data source for drainage area
69	Finland	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
70	France	Agreste 1991: Irrigation et drainage en France. Analyses & Études. Agreste-études N° 13. Ministère de l'agriculture et de la forêt.
71	French Guiana	
72	French Polynesia	
73	French Southern	
74	Gabon	
75	Gambia, The	
76	Gaza Strip	
77	Georgia	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
78	Germany	Behrendt, H. et al. 1999: Nährstoffbilanzierung der Flussgebiete Deutschlands. Forschungsber. 29625515, UBA-FB 99-087. Umweltforschungsplan des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit. ; Röpke, B. et al. 2004: Prediction of pesticide concentrations in German river basins from diffuse agricultural inputs. Forschungsber. 29924272, UBA-FB 000501. Umweltforschungsplan des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit.
79	Ghana	
80	Gibraltar	
81	Greece	ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005) Framji, K.K. et al. 1981, 1982, 1983: Irrigation and Drainage in the World - A Global Review (Vol. I, II, III).
82	Greenland	
83	Grenada	
84	Guadeloupe	
85	Guam	
86	Guatemala	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
87	Guernsey	
88	Guinea	

ID	Country	Data source for drainage area
89	Guinea-Bissau	
90	Guyana	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2003)
91	Haiti	
92	Heard Island & M.	
93	Honduras	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
94	Hungary	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
95	Iceland	
96	India	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004), ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005)
97	Indonesia	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004); FAO 1999: Irrigation in Asia in figures. Water Report 18, FAO/AGL, Rome.
98	Iran	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
99	Iraq	ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005)
100	Ireland	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
101	Israel	ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005)
102	Italy	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
103	Ivory Coast	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
104	Jamaica	
105	Jan Mayen	
106	Japan	ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005); FAO 1999: Irrigation in Asia in figures. Water Report 18, FAO/AGL, Rome.
107	Jersey	
108	Jordan	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
109	Kazakhstan	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
110	Kenya	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
111	Kiribati	

<b>ID</b>	<b>Country</b>	<b>Data source for drainage area</b>
112	Kuwait	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
113	Kyrgyzstan	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
114	Laos	
115	Latvia	Central Statistical Bureau of Latvia 2003: Amelioration of agricultural land by districts (hectares) and Indicators. (available at <a href="http://data.csb.lv/EN/Database/Agriculture/Agriculture.asp">http://data.csb.lv/EN/Database/Agriculture/Agriculture.asp</a> , Number of farms land use, 2005)
116	Lebanon	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
117	Lesotho	
118	Liberia	
119	Libya	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
120	Liechtenstein	
121	Lithuania	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
122	Luxembourg	
123	Macau	
124	Macedonia	
125	Madagascar	Framji, K.K. et al. 1981, 1982, 1983: Irrigation and Drainage in the World - A Global Review (Vol. I, II, III).
126	Malawi	
127	Malaysia	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
128	Maldives	
129	Mali	
130	Malta	
131	Man, Isle of	
132	Marshall Islands	
133	Martinique	
134	Mauritania	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
135	Mauritius	

ID	Country	Data source for drainage area
136	Mayotte	
137	Mexico	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
138	Midway Islands	
139	Moldova	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
140	Mongolia	ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005)
141	Montenegro	
142	Montserrat	
143	Morocco	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
144	Mozambique	
145	Myanmar (Burma)	FAO AQUASTAT 1994: Survey on water use for agriculture and rural development - Questionnaire for: Myanmar (Burma). Draft. FAO, Rome
146	Namibia	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
147	Nepal	ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005)
148	Netherlands	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005); ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005)
149	Netherlands Anti.	
150	New Caledonia	
151	New Zealand	Hudson H. R. et al. 2004: Drainage Management in New Zealand. A review of existing activities and alternative management practices. SCIENCE FOR CONSERVATION 235. ISBN: 0-478-22521-0
152	Nicaragua	
153	Niger	
154	Nigeria	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
155	Niue	
156	Norfolk Island	
157	North Korea	
158	Northern Mariana	

ID	Country	Data source for drainage area
159	Norway	<a href="http://www.jordforsk.no/english/watershed/drainage.htm">http://www.jordforsk.no/english/watershed/drainage.htm</a>
160	Oman	
161	Pacific Islands	
162	Pakistan	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
163	Panama	
164	Papua New Guin.	
165	Paracel Islands	
166	Paraguay	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
167	Peru	ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005)
168	Philippines	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2003); FAO 1999: Irrigation in Asia in figures. Water Report 18, FAO/AGL, Rome.
169	Pitcairn Islands	
170	Poland	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
171	Portugal	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
172	Puerto Rico	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
173	Qatar	
174	Reunion	
175	Romania	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
176	Russia	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
177	Rwanda	FAO 2000: Rwanda: Rural Sector Support Project Environmental Assessment. Final Report. (available at: <a href="http://www-wds.worldbank.org/default.jsp">http://www-wds.worldbank.org/default.jsp</a> )
178	San Marino	
179	Sao Tome and P.	
180	Saudi Arabia	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
181	Senegal	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
182	Serbia	World Bank 2004: Water Resource Management Project, Vol. 1 of 1. Integrated Safeguards Data Sheet. (available at: <a href="http://www-wds.worldbank.org/default.jsp">http://www-wds.worldbank.org/default.jsp</a> , 2005)

<b>ID</b>	<b>Country</b>	<b>Data source for drainage area</b>
183	Seychelles	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
184	Sierra Leone	
185	Singapore	
186	Slovakia	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
187	Slovenia	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
188	Solomon Islands	
189	Somalia	
190	South Africa	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
191	South Georgia	
192	South Korea	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
193	Spain	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
194	Sri Lanka	ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005)
195	St. Helena	
196	St. Kitts and Ne.	
197	St. Lucia	
198	St. Pierre and M.	
199	St. Vincent and Gr.	
200	Sudan	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004); ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005)
201	Suriname	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
202	Svalbard	
203	Swaziland	
204	Sweden	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
205	Switzerland	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
206	Syria	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2003)
207	Taiwan	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)

<b>ID</b>	<b>Country</b>	<b>Data source for drainage area</b>
208	Tajikistan	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
209	Tanzania, United	
210	Thailand	ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005)
211	Togo	
212	Tonga	
213	Trinidad and Tob.	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
214	Tunisia	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
215	Turkey	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
216	Turkmenistan	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2003)
217	Turks and Caicos	
218	Uganda	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
219	Ukraine	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
220	United Arab Emir.	
221	United Kingdom	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
222	United States	USDA 1987: Farm Drainage in the United States: History, Status and Prospects. Misc. Pub. No. 1455. Washington, D.C., 1987.; <a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
223	Uruguay	<a href="http://drainage.montpellier.cemagref.fr/drainage_systems.php">http://drainage.montpellier.cemagref.fr/drainage_systems.php</a> (2005)
224	Uzbekistan	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
225	Vanuatu	
226	Venezuela	ICID Databases: Important Data of ICID Member Countries (available at <a href="http://www.sancid.org.za/">http://www.sancid.org.za/</a> , 2005)
227	Vietnam	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
228	Virgin Islands	
229	Wake Island	
230	Wallis and Futun	
231	West Bank	
232	Western Sahara	

<b>ID</b>	<b>Country</b>	<b>Data source for drainage area</b>
233	Western Samoa	
234	Yemen	
235	Zaire	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)
236	Zambia	FAO AQUASTAT: 2003
237	Zimbabwe	<a href="http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm">http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm</a> (2004)

**Table A3: Drainage area per country**

<b>ID</b>	<b>Country</b>	<b>Drainage Area (ha)</b>	<b>D.A. in irrigated area (ha)</b>	<b>D.A. in rainfed area (ha)</b>
1	Afghanistan	13,000	n.a.	n.a.
2	Albania	276,080	n.a.	n.a.
3	Algeria	56,000	n.a.	n.a.
4	American Samoa	n.a.	n.a.	n.a.
5	Andorra	n.a.	n.a.	n.a.
6	Angola	n.a.	n.a.	n.a.
7	Anguilla	n.a.	n.a.	n.a.
8	Antarctica	n.a.	n.a.	n.a.
9	Antigua and Barb.	130	130	0
10	Argentina	130,000	n.a.	n.a.
11	Armenia	60,400	n.a.	n.a.
12	Aruba	n.a.	n.a.	n.a.
13	Australia	1,964,000	1,095,000	869,000
14	Austria	195,000	n.a.	n.a.
15	Azerbaijan	599,970	599,970	0
16	Bahamas, The	n.a.	n.a.	n.a.
17	Bahrain	1,300	1,300	0
18	Bangladesh	1,501,000	118,400	1,382,600
19	Barbados	n.a.	n.a.	n.a.
20	Belgium	70,000	0	70,000
21	Belize	n.a.	n.a.	n.a.
22	Benin	563	563	0
23	Bhutan	n.a.	n.a.	n.a.
24	Bolivia	20,000	n.a.	n.a.
25	Bosnia and Herz.	n.a.	n.a.	n.a.
26	Botswana	n.a.	n.a.	n.a.
27	Brazil	1,280,000	n.a.	n.a.
28	British Indian O.	n.a.	n.a.	n.a.
29	British Virgin I.	n.a.	n.a.	n.a.
30	Brunei	n.a.	n.a.	n.a.
31	Bulgaria	260,000	100,000	160,000
32	Burkina Faso	n.a.	n.a.	n.a.
33	Burundi	n.a.	n.a.	n.a.
34	Byelarus	3,001,000	0	3,001,000
35	Cambodia	n.a.	n.a.	n.a.
36	Cameroon	n.a.	n.a.	n.a.
37	Canada	1,665,000	0	1,665,000
38	Cape Verde	n.a.	n.a.	n.a.

ID	Country	Drainage Area	D.A. in irrigated area	D.A. in rainfed area
		(ha)	(ha)	(ha)
39	Cayman Islands	n.a.	n.a.	n.a.
40	Central African	n.a.	n.a.	n.a.
41	Chad	n.a.	n.a.	n.a.
42	Chile	15,000	n.a.	n.a.
43	China	19,978,550	15,862,000	4,116,550
44	Christmas Island	n.a.	n.a.	n.a.
45	Colombia	233,800	120,000	113,800
46	Comoros	n.a.	n.a.	n.a.
47	Congo	n.a.	n.a.	n.a.
48	Cook Islands	n.a.	n.a.	n.a.
49	Costa Rica	37,790	37,790	0
50	Croatia	762,000	n.a.	n.a.
51	Cuba	327,000	262,000	65,000
52	Cyprus	20,000	n.a.	n.a.
53	Czech Republic	400,000	0	400,000
54	Denmark	1,500,000	0	1,500,000
55	Djibouti	n.a.	n.a.	n.a.
56	Dominica	n.a.	n.a.	n.a.
57	Dominican Republ.	30,000	n.a.	n.a.
58	Ecuador	52,034	52,034	0
59	Egypt	2,931,000	2,918,537	12,463
60	El Salvador	8,000	n.a.	n.a.
61	Equatorial Guinea	n.a.	n.a.	n.a.
62	Eritrea	n.a.	n.a.	n.a.
63	Estonia	732,098	n.a.	n.a.
64	Ethiopia	29,200	n.a.	n.a.
65	Falkland Islands	n.a.	n.a.	n.a.
66	Faroe Islands	n.a.	n.a.	n.a.
67	Federated States	n.a.	n.a.	n.a.
68	Fiji	750	n.a.	n.a.
69	Finland	1,454,000	n.a.	n.a.
70	France	2,491,241	10,316	2,480,925
71	French Guiana	n.a.	n.a.	n.a.
72	French Polynesia	n.a.	n.a.	n.a.
73	French Southern	n.a.	n.a.	n.a.
74	Gabon	n.a.	n.a.	n.a.
75	Gambia, The	n.a.	n.a.	n.a.
76	Gaza Strip	n.a.	n.a.	n.a.
77	Georgia	164,740	31,800	132,940
78	Germany	2,645,841	n.a.	n.a.

<b>ID</b>	<b>Country</b>	<b>Drainage Area (ha)</b>	<b>D.A. in irrigated area (ha)</b>	<b>D.A. in rainfed area (ha)</b>
79	Ghana	n.a.	n.a.	n.a.
80	Gibraltar	n.a.	n.a.	n.a.
81	Greece	520,000	301,600	218,400
82	Greenland	n.a.	n.a.	n.a.
83	Grenada	n.a.	n.a.	n.a.
84	Guadeloupe	n.a.	n.a.	n.a.
85	Guam	n.a.	n.a.	n.a.
86	Guatemala	1,200	1,200	0
87	Guernsey	n.a.	n.a.	n.a.
88	Guinea	n.a.	n.a.	n.a.
89	Guinea-Bissau	n.a.	n.a.	n.a.
90	Guyana	150,134	n.a.	n.a.
91	Haiti	n.a.	n.a.	n.a.
92	Heard Island & M.	n.a.	n.a.	n.a.
93	Honduras	62,000	n.a.	n.a.
94	Hungary	2,320,000	214,039	2,105,961
95	Iceland	n.a.	n.a.	n.a.
96	India	5,800,000	5,800,000	0
97	Indonesia	3,350,000	3,350,000	0
98	Iran	40,000	40,000	0
99	Iraq	1,540,000	1,540,000	0
100	Ireland	1,150,000	0	1,150,000
101	Israel	100,000	100,000	0
102	Italy	60,000	0	60,000
103	Ivory Coast	3,000	n.a.	n.a.
104	Jamaica	n.a.	n.a.	n.a.
105	Jan Mayen	n.a.	n.a.	n.a.
106	Japan	3,660,000	3,129,000	531,000
107	Jersey	n.a.	n.a.	n.a.
108	Jordan	4,000	4,000	0
109	Kazakhstan	433,100	433,100	0
110	Kenya	18,640	n.a.	n.a.
111	Kiribati	n.a.	n.a.	n.a.
112	Kuwait	2	2	0
113	Kyrgyzstan	149,000	149,000	0
114	Laos	n.a.	n.a.	n.a.
115	Latvia	939,194	n.a.	n.a.
116	Lebanon	10,000	3,000	7,000
117	Lesotho	n.a.	n.a.	n.a.
118	Liberia	n.a.	n.a.	n.a.

<b>ID</b>	<b>Country</b>	<b>Drainage Area (ha)</b>	<b>D.A. in irrigated area (ha)</b>	<b>D.A. in rainfed area (ha)</b>
119	Libya	9,000	9,000	0
120	Liechtenstein	n.a.	n.a.	n.a.
121	Lithuania	2,620,000	6,800	2,613,200
122	Luxembourg	n.a.	n.a.	n.a.
123	Macau	n.a.	n.a.	n.a.
124	Macedonia	n.a.	n.a.	n.a.
125	Madagascar	113,500	0	113,500
126	Malawi	n.a.	n.a.	n.a.
127	Malaysia	53,000	10,000	43,000
128	Maldives	n.a.	n.a.	n.a.
129	Mali	n.a.	n.a.	n.a.
130	Malta	n.a.	n.a.	n.a.
131	Man, Isle of	n.a.	n.a.	n.a.
132	Marshall Islands	n.a.	n.a.	n.a.
133	Martinique	n.a.	n.a.	n.a.
134	Mauritania	12,784	12,784	0
135	Mauritius	n.a.	n.a.	n.a.
136	Mayotte	n.a.	n.a.	n.a.
137	Mexico	5,203,300	2,783,400	2,419,900
138	Midway Islands	n.a.	n.a.	n.a.
139	Moldova	42,000	29,400	12,600
140	Mongolia	1,500,000	n.a.	n.a.
141	Montenegro	n.a.	n.a.	n.a.
142	Montserrat	n.a.	n.a.	n.a.
143	Morocco	120,000	120,000	0
144	Mozambique	n.a.	n.a.	n.a.
145	Myanmar (Burma)	193,363	n.a.	n.a.
146	Namibia	2,000	2,000	0
147	Nepal	90,000	n.a.	n.a.
148	Netherlands	2,297,160	n.a.	n.a.
149	Netherlands Anti.	n.a.	n.a.	n.a.
150	New Caledonia	n.a.	n.a.	n.a.
151	New Zealand	n.a.	n.a.	n.a.
152	Nicaragua	n.a.	n.a.	n.a.
153	Niger	n.a.	n.a.	n.a.
154	Nigeria	4,000	n.a.	n.a.
155	Niue	n.a.	n.a.	n.a.
156	Norfolk Island	n.a.	n.a.	n.a.
157	North Korea	n.a.	n.a.	n.a.
158	Northern Mariana	n.a.	n.a.	n.a.

<b>ID</b>	<b>Country</b>	<b>Drainage Area (ha)</b>	<b>D.A. in irrigated area (ha)</b>	<b>D.A. in rainfed area (ha)</b>
159	Norway	36,552	0	36,552
160	Oman	n.a.	n.a.	n.a.
161	Pacific Islands	n.a.	n.a.	n.a.
162	Pakistan	6,160,000	6,160,000	0
163	Panama	n.a.	n.a.	n.a.
164	Papua New Guinea	n.a.	n.a.	n.a.
165	Paracel Islands	n.a.	n.a.	n.a.
166	Paraguay	10,000	n.a.	n.a.
167	Peru	80,000	n.a.	n.a.
168	Philippines	1,470,691	1,470,691	0
169	Pitcairn Islands	n.a.	n.a.	n.a.
170	Poland	4,205,000	36,000	4,169,000
171	Portugal	8,000	n.a.	n.a.
172	Puerto Rico	15,000	n.a.	n.a.
173	Qatar	n.a.	n.a.	n.a.
174	Reunion	n.a.	n.a.	n.a.
175	Romania	300,000	n.a.	n.a.
176	Russia	5,027,000	n.a.	n.a.
177	Rwanda	90,000	0	90,000
178	San Marino	n.a.	n.a.	n.a.
179	Sao Tome and Pri.	n.a.	n.a.	n.a.
180	Saudi Arabia	44,000	44,000	0
181	Senegal	44,525	n.a.	n.a.
182	Serbia	2,080,000	n.a.	n.a.
183	Seychelles	n.a.	n.a.	n.a.
184	Sierra Leone	n.a.	n.a.	n.a.
185	Singapore	n.a.	n.a.	n.a.
186	Slovakia	600,000	150,000	450,000
187	Slovenia	72,000	2,802	69,198
188	Solomon Islands	n.a.	n.a.	n.a.
189	Somalia	n.a.	n.a.	n.a.
190	South Africa	54,000	54,000	0
191	South Georgia	n.a.	n.a.	n.a.
192	South Korea	1,152,600	834,233	318,367
193	Spain	300,000	300,000	0
194	Sri Lanka	30,000	n.a.	n.a.
195	St. Helena	n.a.	n.a.	n.a.
196	St. Kitts and Ne.	n.a.	n.a.	n.a.
197	St. Lucia	n.a.	n.a.	n.a.
198	St. Pierre and M.	n.a.	n.a.	n.a.

ID	Country	Drainage Area	D.A. in irrigated area	D.A. in rainfed area
		(ha)	(ha)	(ha)
199	St. Vincent and Gr.	n.a.	n.a.	n.a.
200	Sudan	560,000	n.a.	n.a.
201	Suriname	51,180	50,069	1,111
202	Svalbard	n.a.	n.a.	n.a.
203	Swaziland	n.a.	n.a.	n.a.
204	Sweden	1,100,000	0	1,100,000
205	Switzerland	100,098	n.a.	n.a.
206	Syria	273,030	273,030	0
207	Taiwan	731,000	388,000	343,000
208	Tajikistan	328,600	328,600	0
209	Tanzania, United	n.a.	n.a.	n.a.
210	Thailand	150,000	150,000	0
211	Togo	n.a.	n.a.	n.a.
212	Tonga	n.a.	n.a.	n.a.
213	Trinidad and Tob.	776	776	0
214	Tunisia	197,000	192,000	5,000
215	Turkey	3,143,000	200,000	2,943,000
216	Turkmenistan	1,022,126	1,022,126	0
217	Turks and Caicos	n.a.	n.a.	n.a.
218	Uganda	3,000	n.a.	n.a.
219	Ukraine	3,281,000	1,800,000	1,481,000
220	United Arab Emir.	n.a.	n.a.	n.a.
221	United Kingdom	4,650,000	0	4,650,000
222	United States	47,500,000	5,750,000	41,750,000
223	Uruguay	100,000	n.a.	n.a.
224	Uzbekistan	2,840,000	2,840,000	0
225	Vanuatu	n.a.	n.a.	n.a.
226	Venezuela	310,000	n.a.	n.a.
227	Vietnam	1,000,000	1,000,000	0
228	Virgin Islands	n.a.	n.a.	n.a.
229	Wake Island	n.a.	n.a.	n.a.
230	Wallis and Futun	n.a.	n.a.	n.a.
231	West Bank	n.a.	n.a.	n.a.
232	Western Sahara	n.a.	n.a.	n.a.
233	Western Samoa	n.a.	n.a.	n.a.
234	Yemen	n.a.	n.a.	n.a.
235	Zaire	3,900	n.a.	n.a.
236	Zambia	10,000	n.a.	n.a.
237	Zimbabwe	46,850	46,850	0
<b>Total</b>		<b>166,657,792</b>	<b>62,341,343</b>	<b>82,650,066</b>

**Table A4: Drainage area per sub-national unit of Afghanistan**

Province	Drainage Area (ha)	Province	Drainage Area (ha)
Badakhshan	0	Laghman	0
Badghis	0	Lowgar	0
Baghlan	0	Nangarhar	0
Balkh	0	Nimruz	0
Bamian	0	Oruzgan	0
Farah	0	Paktia	0
Faryab	0	Paktika	0
Ghazni	0	Parvan	0
Ghowr	0	Quandahar	0
Helmand	13,000	Samangan	0
Herat	0	Takhar	0
Jowzjan	0	Vardak	0
Kabul	0	Zabol	0
Kapisa	0	<b>Total</b>	<b>13,000</b>
Konarha	0		
Konduz	0		

**Table A5: Drainage area per sub-national unit of Albania**

District	Drainage Area (ha)	District	Drainage Area (ha)
Berat	8,160	Mat	1,050
Dibre	3,200	Mirdite	100
Durres	29,160	Permet	2,400
Elbasan	10,540	Pogradec	1,700
Fier	38,640	Puke	0
Gjirokaster	9,300	Sarande	11,150
Gramsh	0	Shkoder	30,600
Kolonje	1,070	Skrapar	0
Korce	30,820	Tepelene	1,500
Kruje	18,350	Tirane	7,950
Kukes	2,100	Tropoje	1,200
Lezhe	17,420	Vlore	13,620
Librazhd	730	<b>Total</b>	<b>276,080</b>
Lushnje	35,320		

**Table A6: Drainage area per sub-national unit of Algeria**

Province	Drainage Area (ha)
Algiers	600
Chelif	32,160
Macta	21,160
Sahara	7,141
<b>Total</b>	<b>61,061</b>

\* Not available in ESRI's "Administrative-Shapefiles" and therefore not used for map generation

**Table A7: Drainage area per sub-national unit of Australia**

State/Territory	Drainage Area (ha)	D.A. in irrigated area (ha)	D.A. in rainfed area (ha)
NSW/ACT	304,000	304,000	0
Northern Territory	0	0	0
Queensland	380,000	330,000	50,000
South Australia	412,000	12,000	400,000
Tasmania	117,000	5,000	112,000
Victoria	470,000	420,000	50,000
Western Australia	281,000	24,000	257,000
<b>Total</b>	<b>1,964,000</b>	<b>1,095,000</b>	<b>869,000</b>

**Table A8: Drainage area per sub-national unit of China**

Province	Drainage Area (ha)	D.A. in irrigated area (ha)	D.A. in rainfed area (ha)
Anhui	2,028,785	1,612,622	416,162
Beijing	167,125	134,555	32,570
Fujian	119,435	96,691	22,744
Gansu	21,505	18,939	2,565
Guangdong	504,635	402,521	102,114
Guangxi	199,615	160,350	39,265
Guizhou	51,055	42,401	8,654
Hainan	18,955	16,915	2,040
Hebei	1,605,995	1,276,948	329,047
Heilongjiang	2,607,550	2,021,760	585,790
Henan	1,691,545	1,344,870	346,675
Hong Kong	0	0	0
Hubei	1,197,455	952,587	244,868
Hunan	456,415	364,237	92,178
Jiangsu	2,737,655	2,175,431	562,224

Province	Drainage Area	D.A. in irrigated area	D.A. in rainfed area
	(ha)	(ha)	(ha)
Jiangxi	336,885	269,336	67,549
Jilin	993,005	790,263	202,741
Liaoning	980,585	780,402	200,182
Nei Mongol	255,185	204,470	50,715
Ningxia	0	0	0
Qinghai	0	0	0
Shaanxi	141,925	114,547	27,378
Shandong	2,466,995	1,960,540	506,455
Shanghai	72,715	59,598	13,117
Shanxi	97,005	78,883	18,122
Sichuan	100,995	82,051	18,944
Tianjin	414,475	330,938	83,536
Xinjiang	47,355	39,463	7,892
Xizang	0	0	0
Yunnan	200,185	160,803	39,382
Zhejiang	463,525	369,882	93,643
<b>Total</b>	<b>19,978,550</b>	<b>15,862,000</b>	<b>4,116,550</b>

**Table A9: Drainage area per sub-national unit of Egypt**

Governorate/Region	Drainage Area	D.A. in irrigated area	D.A. in rainfed area
	(ha)	(ha)	(ha)
Al Bahr al Ahmar	0	0	0
Al Wadi al Jadid	0	0	0
East Delta	845,000	845,000	0
Janub Sina'	0	0	0
Marsa Matruh	0	0	0
Mid Delta	537,000	537,000	0
Shamal Sina'	0	0	0
Upper Delta	993,000	993,000	0
West Delta	556,000	543,537	12,463
<b>Total</b>	<b>2,931,000</b>	<b>2,918,537</b>	<b>12,463</b>

**\*East Delta:** Al Qahrirah, Bur Said, As Ismailiyah, As Suways, Dumyat, Al Daqahliya, Ash Sharqiyah, Al Qalyubiyah

**\*Mid Delta:** Kafr-El-Sheikh, Al Gharbiya, Al Minufiyah

**\*West Delta:** Al Ishanpariyah, Al Buhayran

**\*Upper Delta:** Al Jizah, Al Fayyum, Beni Suwayf, Al Minya, Asyiut, Suhaj, Qina, Aswan

**Table A10: Drainage area per sub-national unit of Estonia**

County	Drainage Area (ha)	County	Drainage Area (ha)
Harju	61,343	Rapla	59,508
Hiiu	13,433	Saare	26,629
Ida-Viru	22,677	Tartu	87,237
Joegeva	59,573	Voeru	38,299
Jõrva	46,948	Valga	41,478
Lõõne	36,966	Viljandi	81,361
Lõõne-Viru	29,174	<b>Total</b>	<b>732,098</b>
Poelva	38,504		
Põrnu	88,970		

**Table A11: Drainage area per sub-national unit of France**

Region	Drainage Area (ha)	D.A. in irrigated area (ha)	D.A. in rainfed area (ha)
Alsace	17,000	0	17,000
Aquitaine	226,000	0	226,000
Auvergne	95,000	0	95,000
Basse-Normandie	83,000	0	83,000
Bourgogne	135,000	0	135,000
Bretagne	112,000	0	112,000
Centre	442,000	0	442,000
Champagne-Ard.	94,000	0	94,000
Corse	600	0	600
Franche-Comté	27,000	0	27,000
Haute-Normandie	38,000	0	38,000
Ile-del-France	145,000	0	145,000
Languedoc-Roussi	74,000	0	74,000
Limousin	14,641	10,316	4,325
Lorraine	132,000	0	132,000
Midi-Pyrénées	205,000	0	205,000
Nord-Pas-de-C.	149,000	0	149,000
Pays de la Loire	271,000	0	271,000
Picardie	54,000	0	54,000
Poitou-Charentes	90,000	0	90,000
Provence-Alpes-C.	14,000	0	14,000
Rhone-Alpes	73,000	0	73,000
<b>Total</b>	<b>2,491,241</b>	<b>10,316</b>	<b>2,480,925</b>

**Table A12: Drainage area per sub-national unit of Germany**

Region	Drainage Area (ha)
Eastern-Germany	1,120,880
Western-Germany	1,524,961
<b>Total</b>	<b>2,645,841</b>

**Table A13: Drainage area per sub-national unit of Latvia**

County	Drainage Area (ha)	County	Drainage Area (ha)
Aizkraukles	25,035	Ludzas	17,549
Aluksnes	19,056	Madonas	49,365
Balvu	28,308	Ogres	32,480
Bauskas	56,610	Preilu	40,602
Cesu	26,190	Rezeknes	31,581
Daugavpils	23,899	Rigas	31,025
Dobeles	63,715	Saldus	56,042
Gulbenes	20,287	Talsu	35,086
Jekabpils Rajons	41,053	Tukuma	45,073
Jelgavas	71,075	Valkas	19,555
Kraslavas	16,107	Valmieras	35,465
Kuldigas	30,312	Ventspils	23,511
Liepajas	71,243	<b>Total</b>	<b>939,194</b>
Limbazu	28,970		

**Table A14: Drainage area per sub-national unit of Pakistan**

Province	Drainage Area (ha)	D.A. in irrigated area (ha)
Federally Admin.	0	0
Baluchistan	70,000	70,000
North-west Front	240,000	240,000
Punjab	3,700,000	3,700,000
Sind	2,150,000	2,150,000
Azad Kashmir Province	0	0
Northern Areas	0	0
<b>Total</b>	<b>6,160,000</b>	<b>6,160,000</b>

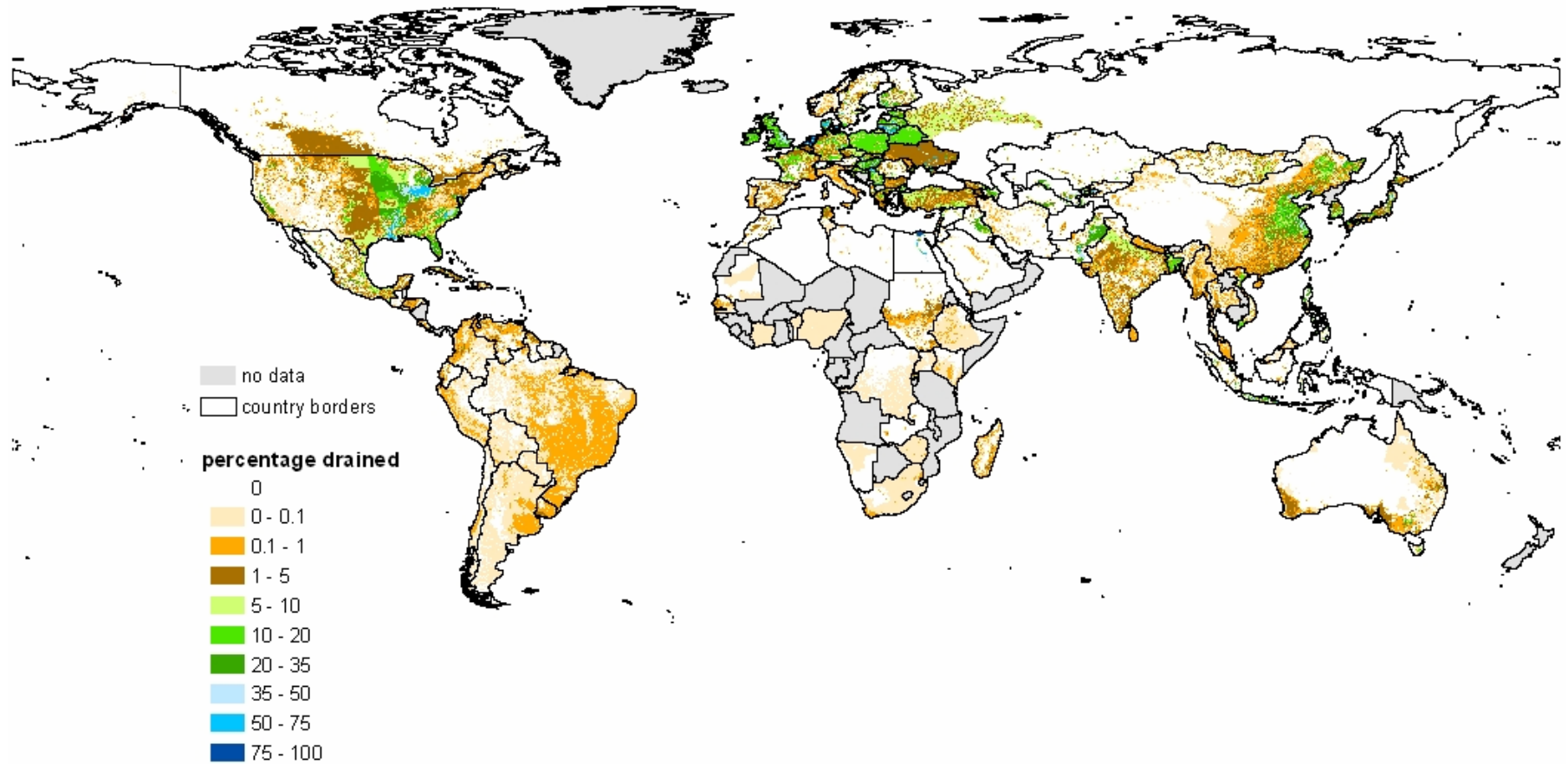
**Table A15: Drainage area per sub-national unit of the USA**

State	Drainage Area (ha)	D.A. in irrigated area (ha)	D.A. in rainfed area (ha)
Alabama	177,709	13,088	164,621
Alaska	1,206	485	721
Arizona	32,870	32,870	0
Arkansas	3,030,994	486,642	2,544,352
California	1,298,997	1,298,997	0
Colorado	175,411	175,411	0
Connecticut	2,875	2,067	808
Delaware	199,180	10,801	188,379
District of Col.	434	0	434
Florida	2,727,894	242,394	2,485,501
Georgia	649,499	164,368	485,131
Guantanamo Bay	0	0	0
Hawaii	3,060	3,060	0
Idaho	132,917	132,917	0
Illinois	4,241,226	48,967	4,192,259
Indiana	3,500,798	34,314	3,466,483
Iowa	3,373,063	18,429	3,354,634
Kansas	592,619	350,207	242,413
Kentucky	160,214	9,012	151,201
Louisiana	3,030,994	115,206	2,915,788
Maine	17,178	3,869	13,309
Maryland	519,599	8,729	510,870
Massachusetts	11,621	4,521	7,100
Michigan	2,387,990	52,568	2,335,422
Minnesota	2,758,204	62,963	2,695,242
Mississippi	2,511,395	169,418	2,341,977
Missouri	1,835,916	143,759	1,692,157
Montana	427,703	233,545	194,158
Nebraska	432,999	432,999	0
Nevada	20,161	20,161	0
New Hampshire	3,772	951	2,821
New Jersey	34,301	13,472	20,829
New Mexico	32,708	32,708	0
New York	396,194	12,975	383,219
North Carolina	2,338,195	33,441	2,304,754
North Dakota	1,039,198	27,702	1,011,496
Ohio	3,204,193	8,705	3,195,488
Oklahoma	343,643	69,418	274,225
Oregon	120,960	120,960	0

<b>State</b>	<b>Drainage Area (ha)</b>	<b>D.A. in irrigated area (ha)</b>	<b>D.A. in rainfed area (ha)</b>
Pennsylvania	125,805	5,127	120,678
Rhode Island	1,229	690	539
South Carolina	779,398	20,259	759,139
South Dakota	477,816	48,457	429,360
Tennessee	519,599	11,731	507,868
Texas	2,511,395	761,390	1,750,004
Utah	46,196	46,196	0
Vermont	17,935	545	17,390
Virginia	63,457	12,710	50,747
Washington	144,350	144,350	0
West Virginia	11,328	621	10,707
Wisconsin	972,083	44,308	927,775
Wyoming	61,519	61,519	0
<b>Total</b>	<b>47,500,000</b>	<b>5,750,000</b>	<b>41,750,000</b>

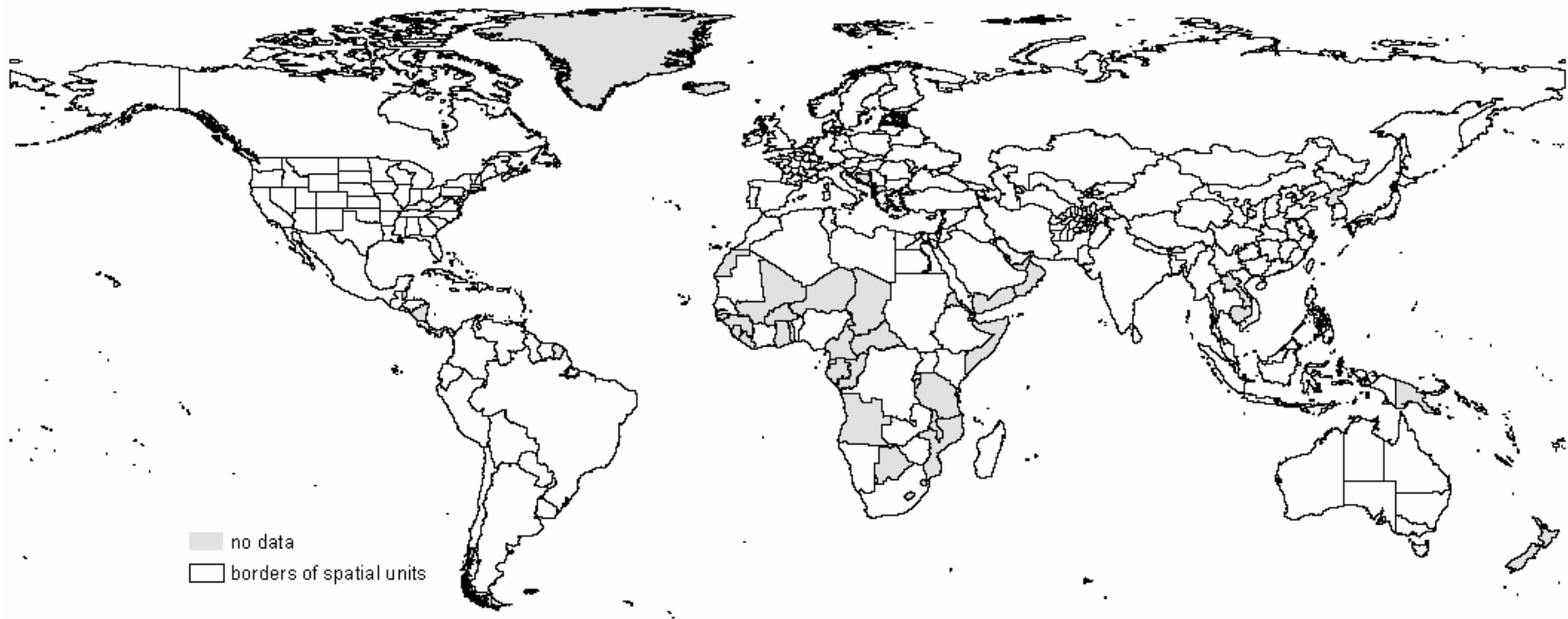
## **Annex B**

### **Maps**



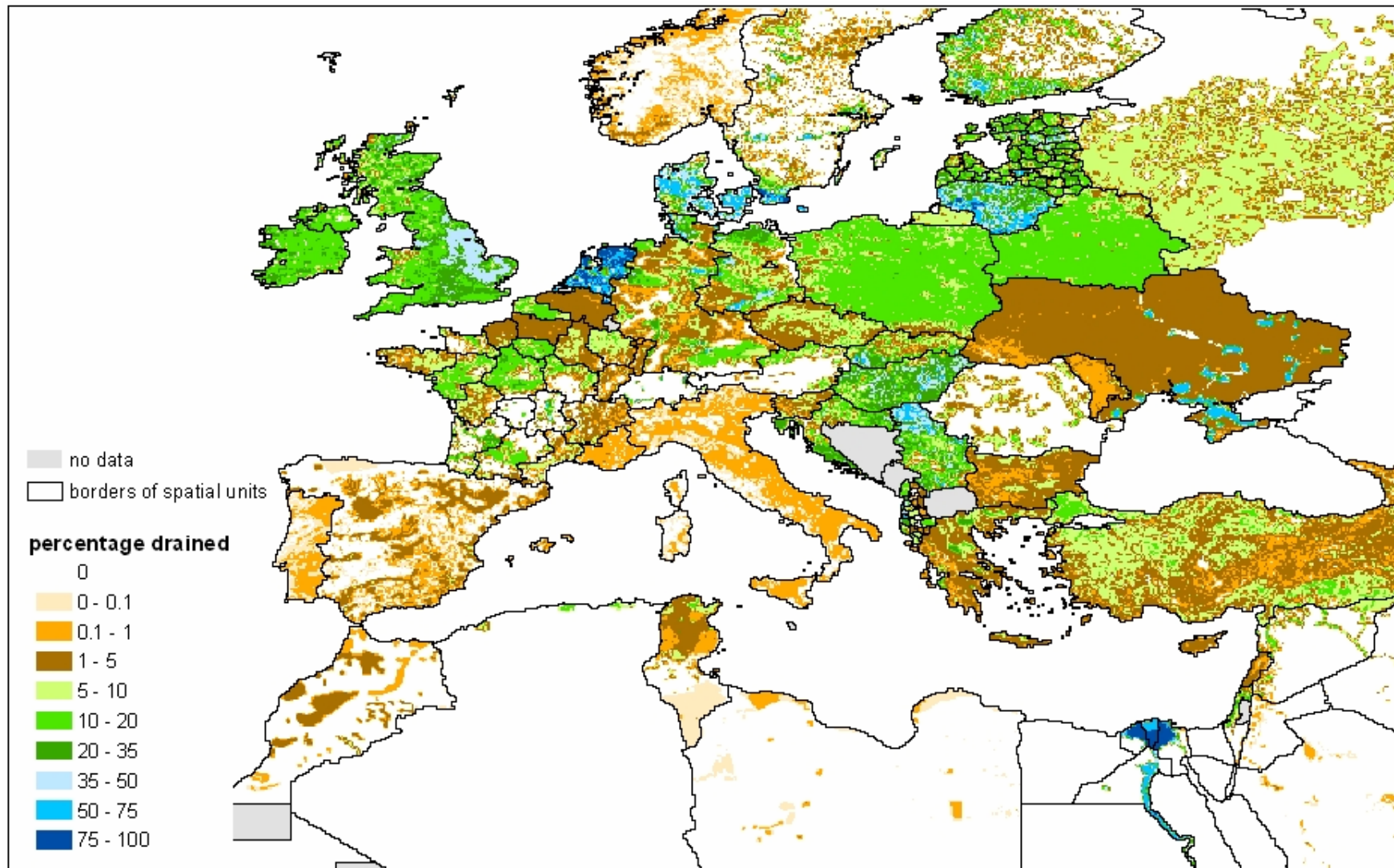
**Map B1**

Digital global map of artificially drained agricultural areas – Map shows percentage of 5' grid cell areas with artificial drainage



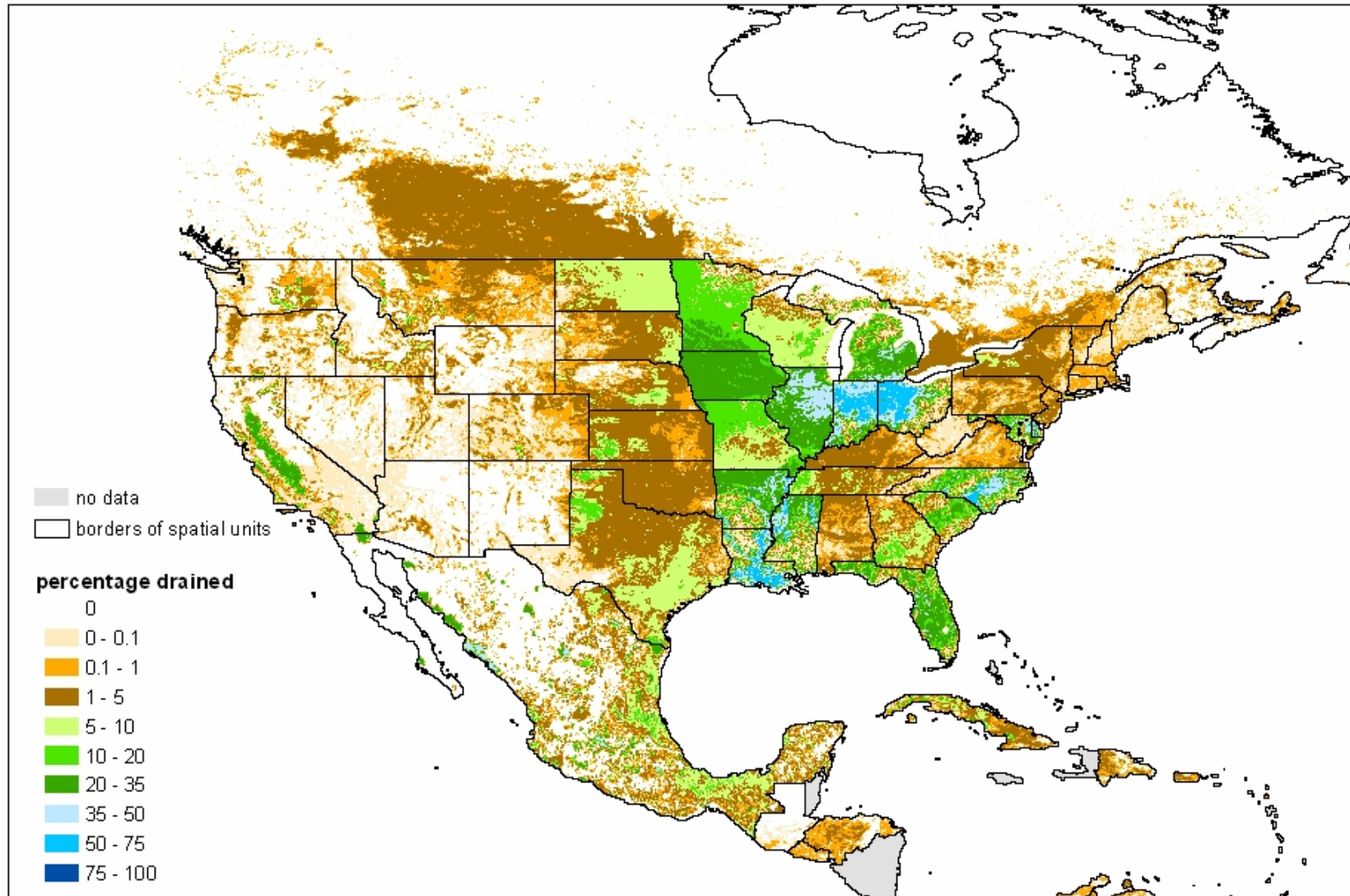
**Map B2**

Spatial units of the digital global map of artificially drained agricultural areas for which statistical information on drained areas was available



**Map B3**

Digital global map of artificially drained agricultural areas – Map shows percentage of 5' grid cell area with artificial drainage (Zoom to Europe and North-Africa)



**Map B4**

Digital global map of artificially drained agricultural areas – Map shows percentage of 5' grid cell area with artificial drainage (Zoom to North and Central America)