A Digital Global Map of Irrigated Areas

An Update for Latin America and Europe

Documentation

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- An Update for Latin America and Europe -
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Abstract

For the purpose of global modeling of water use and crop production, a digital global map of irrigated areas was developed. The map depicts the percentage of each 0.5° by 0.5° cell that was equipped for irrigation around 1995. The first version of the map has now been updated and improved for Latin America (including the Caribbean) and Europe, based on 1) new information from FAO`s AQUASTAT and FAOSTAT, 2) national data on irrigation in sub-national units 3) geographic information on the location and extent of irrigated areas and 4) the European land cover map CORINE. The total irrigated area per country has changed considerably in many countries, especially in Latin America where the information acquired by FAO for the new AQUASTAT report is now included. In total, irrigated area has increased by 0.4% in Latin America as compared to the first version of the map, while it has decreased by 4.5% in Europe. Compared to the first version of the map, the spatial resolution of the input data is much higher, and the new maps show a more disperse irrigation. This documentation describes the data sources and the map generation process of the new maps for Latin America and Europe, and discusses the map quality.

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1 Overview

The digital global map of irrigated areas is a raster map with a resolution of 0.5° latitude by 0.5° longitude. For the whole land area of the globe (except Antarctica), the data set provides the irrigation density around 1995, i.e. the percentage of each 0.5 ° by 0.5 ° cell area that was equipped for controlled irrigation in the 1990s. The areas equipped for irrigation include

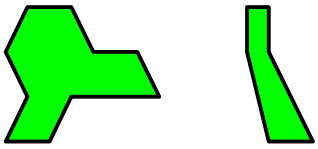
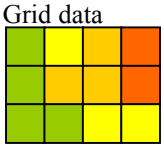
- areas with full or partial control irrigation
- spate irrigation areas and
- equipped wetlands and inland valley bottoms.

They do not include cultivated wetlands and flood recession cropping areas. In such areas there is a lack of control over the application of water, and thus irrigation water use cannot be computed as the optimal irrigation requirement. The area actually irrigated was smaller than the area that was equipped for irrigation, but is unknown for most countries. In the following, "irrigated areas" always stands for "areas equipped for irrigation".

The first version of the map was derived by combining information from large-scale maps with outlines of irrigated areas (one or more countries per map), FAO data on total irrigated area per country around 1995 and national data on total irrigated area per county, drainage basin or federal state. Irrigation density was modeled on a 5' (0.0833°) raster and later aggregated to a 0.5° raster. The first version is documented in Döll and Siebert (2000, 1999).

Here, we present an updated version of the map for Latin America and Europe. In the following, Latin America always includes the Caribbean. The update is based on improved and more detailed data; besides, a different method was used for the map generation. The map is representative for the situation in the 1990s. Information mainly from the years 1990 to 1999 was taken into account, depending on the country or sub-national unit. For the map of Latin America, new information gathered by FAO for the AQUASTAT report on irrigation in Latin America (FAO, 2000) was used. Information included both the total irrigated area in a high number of sub-national units (e.g. counties, federal states) and geographical information on the location and extent of irrigation. For the map of Europe, new national information and literature data on total irrigated area in sub-national units and new geographical information was used, as well as the CORINE land cover data set (European Environmental Agency, 2000). Latin America was divided into 395 (sub)-national units (Table B1) and Europe into 174 (Table B3). The geographic information applied to derive the new maps did not only include outlines of irrigated areas (polygon data) but also information on irrigation projects (point information) and raster information (CORINE database). Table 1 shows the different types of geographic records. We derived new rules for distributing the total irrigated area within the sub-national units to the various geographic records within this unit. In order to facilitate the distribution, we assigned a priority level to each record, based on the type and the reliability of the information (see Table B2 for Latin America and Table B4 for Europe). Irrigation density was modeled on a 0.01° raster, and then aggregated to the 0.5° raster.

Table 1: Types of geographical information used to spatially distribute irrigated area within sub-national units

Polygon data 	- Outlines of main irrigated areas - Outlines of irrigation districts (Mexico, Peru) - Outlines of the main rice growing areas (Bolivia, Cuba, Uruguay ...) - Outlines of areas in which irrigation has been planned (Honduras, Slovakia) - Outlines of potential irrigation areas (Barbados, Costa Rica ...) - Outlines of areas with highest irrigation water use (UK) - Land use information (Belize, Cuba, Chile, Peru, Scandinavia ...) - Outlines of areas in which irrigation can be excluded (Cuba)
Point data	- Location of irrigation projects (Chile, Peru, Italy, France, Brazil ...) - Map, in which each point means 1000 ha irrigated rice (Latin America) - Location of major rice growing schemes (Trinidad + Tobago) - Location of areas suitable for irrigation (Costa Rica) - Location of planned irrigation schemes (Honduras) - Location of major cropping areas (French Guyana, Suriname)
Grid data 	- Land cover map at 250-m resolution for Europe (CORINE database, EEA, 2000) - Global map of agricultural areas at 5-minute resolution (by S. Wood and K. Sebastian from IFPRI)

2 Map generation

For many countries, information on the total irrigated area in sub-national units has been included for generating the new maps for Latin America and Europe (Section 2.1). For most countries, different types of geographic records were available (Tables B2 and B4 in Appendix B). As their relevance and reliability vary, it is necessary to decide which geographic records are taken into account. In Section 2.2, we describe how the geographic information was selected for each sub-national unit. Once we know which records are used to generate the map, we distribute the irrigated area related to the geographic records to the individual grid cells. This procedure is described in chapter 2.3.

2.1 Determination of irrigated area in sub-national units

In the case of Latin America, information about the irrigated area in sub-national units (Table B1 in Appendix B) stems from national statistics collected by FAO to compile the AQUASTAT report on irrigation in Latin America and the Caribbean (FAO, 2000). It is provided for all the large and many of the small countries of Latin America (and the Caribbean). In the cases where the sum of the irrigated areas in the sub-national units, according to the original national statistics, was not equal to the total irrigated area of the country as given in FAO (2000), the values for the sub-national units were adjusted correspondingly. For Europe, information on the distribution of irrigation within countries is not available from FAO. For Russia and Germany, we obtained national statistics of irrigated area in sub-national units (Table B3 in Appendix B). For France, Italy and Portugal, literature values of irrigated area of sub-national units have been adjusted such that their sum is equal to the latest FAOSTAT country value (www.fao.org).

2.2 Selection of the geographical information to distribute total irrigated area within each sub-national unit

For the map generation process, Latin America was divided into 395 and Europe into 174 (sub)-national units (for simplicity, we also call countries, for which no sub-national units are defined, "sub-national units"). A list of these units and the total irrigated area within these units can be found in Appendices B1 and B3. Appendices B2 and B4 list, for each country, the geographical information records that are available to distribute the total irrigated area within the (sub)-national units, and their priority level. The priority level (the highest priority being represented by a value of 10) was introduced to control the distribution process. Only if the total area of all geographical records of priority 10 is smaller than the total irrigated area in the sub-national unit, the geographical records of priority 9 (or lower) are also taken into account.

In general, priorities are assigned as follows. The highest priority is given to point records (irrigation projects) with known irrigated area, followed by point records without size information. Polygon records (outlines of large irrigated areas) with size information get the next lower priority, which is again higher than that of polygon records without size information. Auxiliary information like information of the growing area of certain crops becomes an even lower priority level. Information on the location of surface irrigation from the CORINE data set[1] for Europe has always been given priority 10. Priorities are assigned with respect to the specific sub-national unit in which the geographic record is located.

In order to determine which geographic information on the location of irrigated areas within a sub-national unit is taken into account, the value for the total irrigated area within a sub-national unit as stated in literature AILIT (Tables B1 and B3) is compared to AIDB, the sum of all areas in a sub-national unit that are potentially irrigated according to the geographical information in Tables B2 and B4. To compute AIDB we have to make assumptions for polygon and point records without information about the irrigation density within the polygon or the size of the irrigation scheme represent by the point record. We assume that the irrigation density within the areas with known outlines is 100% and that each point record represents an irrigated area that is equal to the size of the 0.01° cell in which it is located (80–120 ha).

If, for a certain sub-national unit, AIDB≤AILIT, all available geographic records are used. AIDB>AILIT occurs, for instance, in sub-national units with many irrigated areas with known outlines but unknown irrigation density or in cases where there are also records on special land use (cotton, rice). In this case, only the geographic records with the highest priority levels are used. The sum of areas of all geographic records with the same priority level $AIDB_p$ within the sub-national unit is calculated. Then, there exists a priority level p' such that:

$$\sum_{p=p'+1}^{10} AIDB_p \leq AILIT \quad \text{and} \quad \sum_{p=p'}^{10} AIDB_p > AILIT \tag{1}$$

[1] The CORINE data set contains information on land use and land cover types for most European countries. We used a raster file which distinguishes 44 different land cover types on a 250 m grid. We assumed that CORINE land cover types 13 (permanently irrigated land) and 14 (rice fields) are irrigated. Probably, only surface irrigation is covered by the CORINE data set which, for example, shows no irrigated areas in Germany or the Netherlands, see Table B4). In order to facilitate data handling, the raster file was converted to a point data file by creating one point in the middle of each CORINE cell with land cover type 13 or 14. Because of the cell size (250 m x 250 m) each of these points represents 6.25 ha irrigated land. The map projection was changed from Lambert to Geographical Projection, and the sum of all areas of all CORINE points located within a 0.01° cell was assigned to a point in the center of the cell. Altogether, there are 84 667 irrigated 0.01° cells in Europe.

To distribute irrigated area within the sub-national unit, all geographical records having a priority level higher than p' are used, while records having an information priority lower than p' are ignored. Geographical records having a priority of p' are used, but their irrigation density is decreased such that:

$$\sum_{p=p'+1}^{10} AIDB_p + \frac{d}{100} * AIDB_{p'} = AILIT \qquad (0 < d < 100) \qquad (2)$$

An example illustrates the procedure in the case that AIDB>AILIT. In a given sub-national unit there are

a) 7 irrigation projects (point records) of known area (in total 4000 ha), priority 10
b) 3 point records referring to 1000 ha irrigated rice, priority 9
c) 10 irrigation projects (point records) without size information (assuming that each irrigation project covers one 0.01° grid cell: in total 1100 ha), priority 8
d) 3 irrigated areas (polygon records), area information available (known irrigation density within these areas), in total 900 ha, priority 8
e) 2 irrigated areas without size information (irrigation density within these areas unknown, is assumed to be 100%), in total 10000 ha, priority 7
f) 1 potential irrigated area, area information not available (pot. irrigation density unknown, is assumed to be 100%), 12000 ha, priority 6

The total irrigated area within the sub-national unit is 10000 ha. According to a - f we could distribute 31000 ha irrigated area within this sub-national unit. This is much more than stated in literature, so we have to select the most reliable information. There are 4000 ha with priority 10, 3000 ha with priority 9, 2000 ha with priority 8, 10000 ha with priority 7 and 12000 ha with priority 6. According to (1) and (2) all records having a priority of 10, 9 and 8 are included completely, records with priority 6 are ignored. Records with 7 are all taken into account, but with reduced irrigation density. As the sum of the area in records with priority 10, 9 or 8 is 9000 ha, the remaining 1000 ha are distributed to records with priority 7. As the outlines of the two irrigated areas in our example cover a total area of 10 000 ha, the irrigation density in these areas is reduced to 10%.

2.3 Distribution of irrigated area to single grid cells

After the above steps, there exists a list of point or polygon geographical information which now includes also the size of the irrigated area. In the next step, the vector-based information is transferred to a raster-based irrigation density map.

2.3.1 Point data

Irrigated area related to point data is assigned to the 0.01° grid cell in which the point is located. If the irrigated area of such a project is bigger than the cell size, then this difference is distributed to the neighbor cells in proportion to the cell size of the neighbor cells (with same irrigation density).

Example:

A	B	C
D	E	F
G	H	I

The size of cells A-C is 86.5 ha, the size of cells D-E 86 ha and that of cells G-I 85.5 ha. In cell E, an irrigation project (size 258 ha) is located. Then, 86 ha are assigned to cell E, 21.625 ha each to cells A-C, 21.5 ha each to cells D and F and 21.375 each ha to cells G-I. The irrigation density in cell E is 100%, the irrigation density in the other cells 25%.

2.3.2 Polygon data

The irrigated area related to a given polygon is distributed to all cells inside the polygon in proportion to their cell areas. However, if irrigated area from a record with a higher priority level has already been assigned to the cell, the cell is excluded from the distribution process. There is an exception to this rule in the case of point records derived from the CORINE data set for Europe, which represent surface area irrigation. If a part of a 0.01° cell is covered by surface irrigation, then in other parts of this cell other irrigation methods could be applied. Therefore, these cells were not excluded from the distribution process. The following examples illustrate the applied distribution method.

Examples:
Let us assume that a polygon that represents an irrigated area covers the grid cells A, B, C and D (priority level 9). The size of the grid cells A and B is about 102 ha, the size of the grid cells C and D about 101 ha. It is known that the area actually equipped for irrigation, within the irrigated polygon, is 126 ha.

Example 1 in Latin America
In cell A there is an irrigation project with 50 ha (priority level 10).

step 1: 50 ha of irrigated area (the irrigation project) is assigned to cell A.

step 2: The remaining 76 ha are distributed to cells B, C and D in proportion to their cell areas. Thus, there are 25.5 ha irrigated area in cell B, and 25.25 ha both in cells C and D.

resulting irrigated areas:
cell A: 50 ha; cell B: 25.5 ha; cell C: 25.25 ha; cell D: 25.25 ha. The irrigation density in cell A is 49% and in cells B,C and D 25%.

Example 2 in Europe
According to the CORINE database there are 50 ha surface irrigation in cell A (priority level 10).

step 1: 50 ha surface irrigation is assigned to cell A.

step 2: The remaining 76 ha are distributed to all 4 cells in proportion to the remaining cell areas (52 ha in cell A, and the total cell areas of cells B, C and D. Thus, 11.1 ha are distributed to cell A, 21.77 ha to cell B, 21.56 ha to cell C and 21.56 ha to cell D.

resulting irrigated areas:
cell A: 61.1 ha; cell B: 21.77 ha ; cell C: 21.56 ha; cell D: 21.56 ha. The irrigation density in cell A is 59.9% and in cells B, C and D 21.34%.

2.3.3 Distribution of irrigated area in proportion to agricultural area (if AIDB<AILIT)

For some sub-national units, the total irrigated area is known (Tables B1 and B3) but not its location, or only the location of a few small projects. Then the sum of the irrigated area of the schemes in our database (AIDB) is smaller then the irrigated area within the sub-national unit according to statistics (AILIT). The question is how to distribute the difference between AILIT and AIDB to the 0.01° cells within the sub-national unit. We decided to do that in two steps. First the irrigated area, which is related to point information sources is increased by up to 100%. If the resulting area is still smaller than AILIT, the remaining difference is distributed to all grid cells of the sub-national unit in proportion to the agricultural area within the individual cells. To estimate the agricultural area within the grid cells we used an unpublished data set by S. Wood and K. Sebastian from the International Food Policy Research Institute IFPRI which was provided to us in 1999, which describes the fraction of the total 5-minute cell area that is agricultural area and is based on a 10-km land cover map from the Eros Data Center (USA). As suggested by S. Wood, we assume that class 1 indicates 80% of the cell is covered with agricultural area. The corresponding values for class 2 and 3 are 50% and 35%.

Example. A sub-national unit consists of only four grid cells A, B, C and D. 71 ha of the surface area of this sub-national unit are irrigated. The cell size of each of the cells is 100 ha. In cell B there exists an irrigation project of 25 ha, but there are no further geographic records available for this unit. 50 ha (25 * 2) are assigned to cell B, while the remaining 21 ha are distributed among all four cells. According to the IFPRI map, cells A and B belong to class 1 (80% agricultural area) and cells C and D to class 2 (50% agricultural area), and we assume that in cells A and B there are 80 ha agricultural area and in cells C and D 50 ha. Because 50 ha of irrigated area have already been assigned to cell B, only 30 ha agricultural area in that cell is available for further distribution. So the whole available agricultural area is 80 ha + 30 ha + 50 ha + 50 ha = 210 ha, and 10% of the remaining agricultural area has to be irrigated (100*21/210). As a result, in cell A there are 8 ha irrigated (10% of 80% of 100 ha), in cell B 53 ha, in cells C and D 5 ha.

3 Integration of the new maps for Latin America and Europe into the existing global irrigation map

The updated version of the digital global map of irrigated areas was constructed by merging the new maps for Latin America and Europe with the first version of the map for the other continents. The first version of the global map of irrigated areas was modeled at a resolution of 5 min, and the new maps for Latin America and Europe at a resolution of 0.01°. The different resolutions lead to several problems related to the merging of the maps, especially at the boundaries between the old map and the new maps. Because of the different resolutions, there are map overlaps. The following steps were taken to avoid double-counting:

1. First version of map: calculate irrigated area in all 5-minute grid cells, in ha, set value of all 5-minute grid cells belonging to Latin America or Europe to 0, and generate a new grid at the 0.5° resolution
2. Updated maps for Latin America and Europe: generate grids at the 0.5° resolution which indicate the irrigated area in each cell, in ha
3. Merge the three 0.5° maps by computing the irrigated area in each grid cell as the sum of the values of the three maps.

A country-wise summation of the irrigated area in all grid cells at the original resolution would lead exactly to the total irrigated area per country, as stated in literature. This is not the case for the resulting 0.5° resolution, because the irrigated area of some cells belonging to a certain country at the original resolution could be assigned to the neighbor country at the 0.5° resolution. The reason for this is that 0.5° cells as a whole belong to one country.

4 Discussion

To discuss the results of the map update, we first show the differences between the original and the new irrigation map for Latin America and Europe. Appendices A1 and A3 show the old version of the maps for Latin America and Europe, and Appendices A2 and A4 the updated version. Then, the map quality is discussed.

4.1 Differences between the original map and the updated map

Differences between the original irrigation map (see maps A1 and A3) and the new map (see maps A2 and A4) are due to

1. changed values for the whole irrigated area in a country
2. different distribution of the irrigated area within a country (due to more sub-national units that are distinguished and different geographic information on the location and extent of irrigated areas).

4.1.1 Changed values of the total irrigated area per country

The changes of the irrigated area per country are documented in Table 2 (for Latin America) and Table 3 (for Europe). In Latin America, there are significant changes as for all countries AQUASTAT (FAO, 2000) instead of FAOSTAT (http://www.fao.org) values of irrigated area per country are now used. Different from FAOSTAT data, AQUASTAT data are based on special country reports on irrigation and drainage, which were obtained by FAO for the compilation of FAO's new AQUASTAT report on irrigation in Latin America (FAO, 2000). Compared to the previous map, there is a strong increase of irrigated area in Ecuador, Chile and Venezuela and a strong decrease in Brazil and Peru. In many small countries, there are significant relative decreases, e.g. in El Salvador, Puerto Rico, Trinidad + Tobago, St. Lucia and St. Vincent. Comparing the new (Fig. A2) with the previous (Fig. A1) map, the increase of irrigated area in Chile and Ecuador is particularly obvious. In 13 out of the 35 countries with irrigation infrastructure in Latin America, the irrigated area has changed by more than 20%. At the sub-continental scale, however, increases and decreases almost cancel. In total, irrigated area has increased by 0.4% in Latin America as compared to the first version of the map.

Table 2: Differences of irrigated area per country in Latin America (countries without change are not listed).

Country	irrigated area in previous map [ha]	Irrigated area in new map [ha]	absolute change [ha]	relative change [%]
ANTIGUA + BARBUDA	0	130	130	---
ARGENTINA	1699999	1437275	-262724	-15
BOLIVIA	78000	128240	50240	+64
BRAZIL	3168910	2656284	-512626	-16
CHILE	1265000	1900000	635000	+50
COLOMBIA	1037001	900000	-137001	-13
COSTA RICA	126000	103084	-22916	-18
CUBA	910000	870319	-39681	-4
DOMINICAN REP.	259000	269710	10710	+10
ECUADOR	240000	863370	623370	+260
EL SALVADOR	120000	44993	-75007	-63
GRENADA	0	219	219	---
GUATEMALA	125000	129803	4803	+4
GUYANA	130000	150134	20134	+15
HAITI	90000	91502	1502	+2
HONDURAS	74000	73210	-790	-1
JAMAICA	33000	25214	-7786	-24
MEXICO	6099960	6104956	4996	0
NICARAGUA	88000	61365	-26635	-30
PANAMA	32000	34626	2626	+8
PERU	1752997	1195228	-557769	-32
PUERTO RICO	40000	15407	-24593	-61
ST. KITTS + NEVIS	0	18	18	---
ST. LUCIA	3000	297	-2703	-90
ST. VINCENT	1000	0	-1000	-100
SURINAME	60000	51180	-8820	-15
TRINIDAD + TOBAGO	22000	3600	-18400	-84
URUGUAY	140000	181200	41200	+29
VENEZUELA	185000	570219	385219	+208
LATIN AMERICA	**17,857,867**	**17,939,583**	**+81,716**	**+0.4**

For most European countries, the discrepancies of irrigated areas in the previous and in the new map are smaller than for the Latin America countries. Different from Latin America, we could not take advantage of new AQUASTAT data. Some discrepancies are due to taking inot account more recent FAOSTAT data (1994 - 1999). For some countries we use data from national statistics (UK, Spain, Germany, Russia) instead of FAO data. In the first version of the global irrigation map, the total irrigated area of Russia was located in the European part of the country. According to recent national data (GOSCOMSTAT, 1998), 3,983,000 ha irrigated area are situated in the European part of the country and 885,000 ha in the Asian part. For Austria we did not use the FAO estimate (4000 ha), because according to Janetschek (1992) there are 16,000 ha sprinkler irrigation in one important irrigation area (Marchfeld). Therefore, the estimate of Framji et. al (1984) of 46000 ha irrigated area for Austria appears to be more realistic. The huge difference in the case of Belgium is due to a correction in the FAOSTAT database. In 7 out of the 38 countries with irrigation infra structure in Europe, the irrigated area has changed by more than 20%. In total, irrigated area in Europe has decreased by 4.5% as compared to the first version of the map.

Table 3: Differences of irrigated area per country in Europe (countries without change are not listed).

Country	irrigated area in previous map [ha]	irrigated area in new map [ha]	absolute change [ha]	relative change [%]
ANDORRA	0	150	150	---
AUSTRIA	4000	46000	42000	+1050
BELGIUM	1000	40000	39000	+3900
BULGARIA	800001	800000	-1	0
BELARUS	131000	115000	-16000	-12
CYPRUS	39938	40000	62	0
DENMARK	481000	476000	-5000	-1
ESTONIA	3680	4000	320	+9
FRANCE	1630000	2000000	370000	+19
GERMANY	475000	531120	56120	+12
GREECE	1328000	1422000	94000	+7
ITALY	2709998	2698000	-11998	-0.4
LITHUANIA	9247	9000	-247	-3
MACEDONIA	61000	55000	-6000	-10
MALTA	763	2000	1237	+162
MOLDOVA REP.	312000	307000	-5000	-2
NORWAY	100000	127000	27000	+27
ROMANIA	3110010	2880000	-230010	-8
RUSSIA (Europe)	5158000	3983000	-1175000	-23
SERBIA	65000	57000	-8000	-12
SLOVAKIA	299000	174000	-125000	-42
SPAIN	3526999	3268306	-258693	-7
UKRAINE	2605004	2454000	-151004	-6
UK	108000	142687	34687	+32
EUROPE	**29,246,550**	**27,919,173**	**-1,327,377**	**-4.5**

4.1.2 Changed distribution of irrigated area within the countries

In the previous irrigation map most irrigated area was concentrated in the major irrigation schemes of a country. This has changed in the most of the countries. The number of irrigated 0.5° cells has increased from 1749 to 3849 in Latin America and from 1091 to 3257 in Europe. There are two reasons for the more disperse irrigation. First, much more geographical information on the location of irrigation schemes has been included. Second, information on the total irrigated area in sub-national units is available for many more countries,. The number of sub-national units (federal states, districts ...) has increased from 83 to 370 in Latin America and from 11 to 135 in Europe. As a consequence, irrigated area has to be distributed within sub-national units, in which no geographic information on the location of irrigation schemes is available (e.g. in Russia). This leads to a homogeneous distribution of irrigation over a wide area.

4.2 Discussion of map quality in Latin America and Europe

For the new maps of irrigated areas in Latin America and Europe, more geographic information about the location of irrigation schemes has been taken into account than for the generation of the first version of the maps. Besides, improved statistical data with a higher spatial resolution have been included. Therefore, the quality of the new maps is better than the quality of the first version. How well the maps represent actual areas that were equipped for irrigation around 1995 strongly varies between countries, and even within countries, depending on the quality and quantity of the input information. For example, the quality of the map certainly depends on the size of the sub-national units. In general, quality is better in regions where irrigation plays an important role in agriculture, as for such regions there tends to exist better irrigation-related information.

To give an idea of how uncertain the total irrigated area in a sub-national unit (and probably for the whole country) may be, let us consider the federal state of Ceará in Brazil. For the purpose of modeling water use Ceará, we estimated that the irrigated area in 1996/98 was about 43,000 ha, based on licensing information from the state's water ministry and expert opinion. Ceará's agricultural ministry, however, estimates that there are approximately 60,000 ha, while the value given by Brazilian statistics, which is applied in the map, is 77,000 ha. It may be that the lower values correspond to areas that were actually irrigated (and not just equipped for irrigation) but distinctions between "actually irrigated" and "equipped for irrigation" are not made explicit.

Although the new global irrigation map is based on much more geographic information than the previous one, there are still regions in which the distribution of irrigated areas is quite uncertain, e.g. in large parts of Russia and Brazil, or the Scandinavian countries. Due to the lack of information on the location of irrigation schemes, the irrigated area in the most sub-national units of Russia and in parts of Brazil had to be distributed only in relationship to the agricultural area. For most of the Eastern European countries the development of the irrigation sub-sector since 1990 is uncertain, and it is often unknown which irrigation schemes are still in operation. In many countries, small-scale irrigation plays an important role. So more than 40,000 farmers irrigate approximately half of the irrigated area in Mexico, and detailed mapping of all the small irrigation plots seems to be impossible. Nevertheless, the representation of irrigated areas in Mexico appears to be reasonably good. In a few countries, we judge the map quality to be very good: in the Caribbean countries, Ecuador and Chile in Latin America, and in Portugal, Spain and Italy in Europe.

Due to the map uncertainties, we advise to use the global map of irrigated areas only for global and regional assessments (also in the case of Latin America and Europe). For future improvements of the map in Africa, Asia, Australia and Oceania, information from remote sensing projects should be included, in particular in arid and semi-arid regions.

Acknowledgments: We acknowledge the financial support of FAO and their willingness to share their data on irrigation in Latin America.

5 References

Döll, P., Siebert, S. (2000): A digital global map of irrigated areas. ICID Journal, 49(2), 55-66.

Döll, P., Siebert, S.(1999): A digital global map of irrigated areas. World Water Series 1, Center for Environmental Systems Research, University of Kassel, Germany, 23 pp. + Appendix.

EEA - European Environmental Agency (2000): "CORINE LAND COVER OF EUROPE", Copenhagen, Denmark (http://natlan.eea.eu.int)

FAO (2000): Irrigation in Latin America and the Caribbean in figures. FAO Water Report 20. FAO/AGL, Rome.

Janetschek, H. (1992): Wirtschaftlichkeit der Feldberegnung auf der Hochterrasse des Marchfeldes. Report 68, Bundesanstalt für Agrarwirtschaft, Vienna.

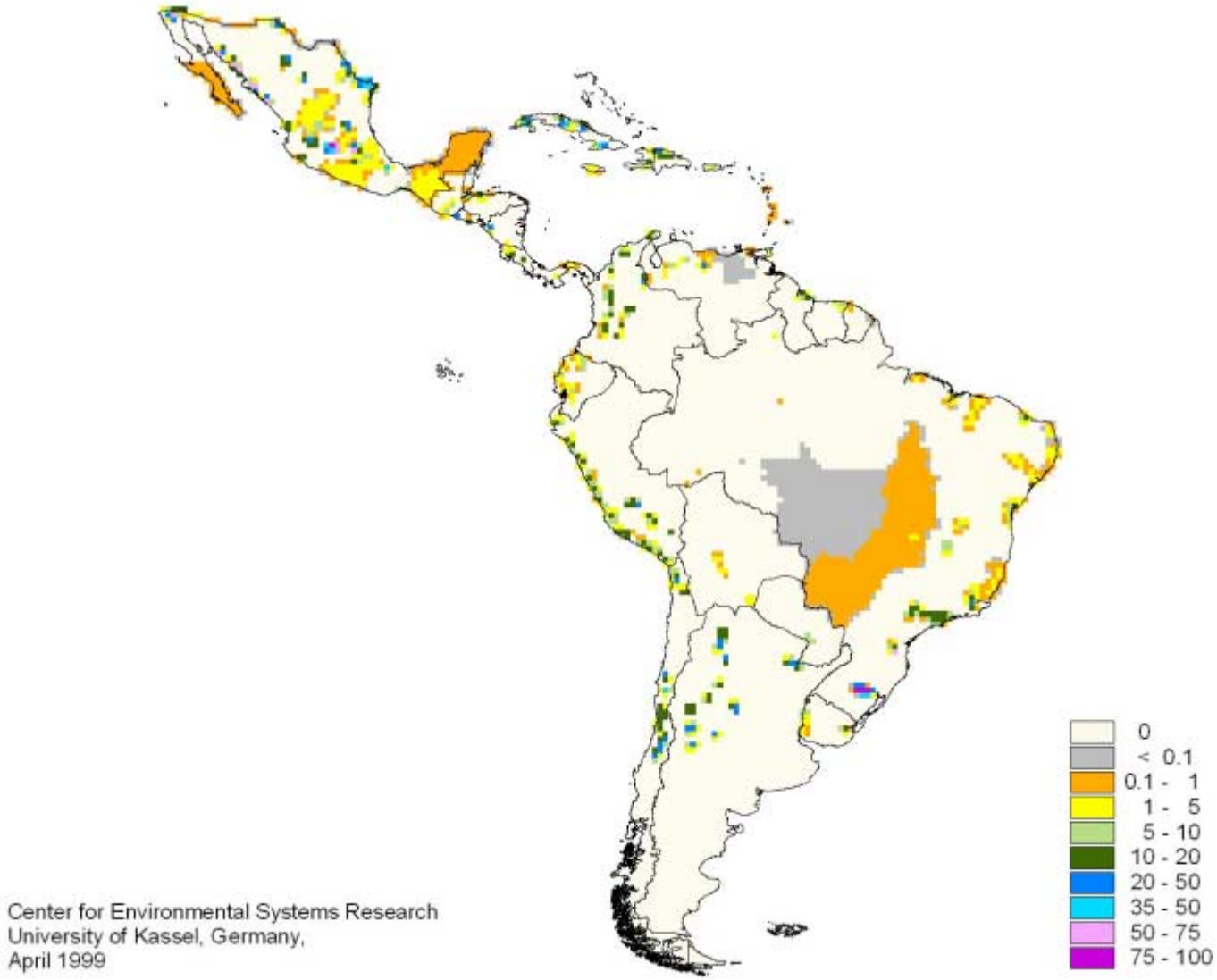


Fig. A1: Irrigated areas in Latin America. Part of the first version of the global map of irrigated areas (Döll and Siebert, 1999, 2000). Map shows the fraction of the area of each 0.5° by 0.5° cell that was equipped for irrigation around 1995.

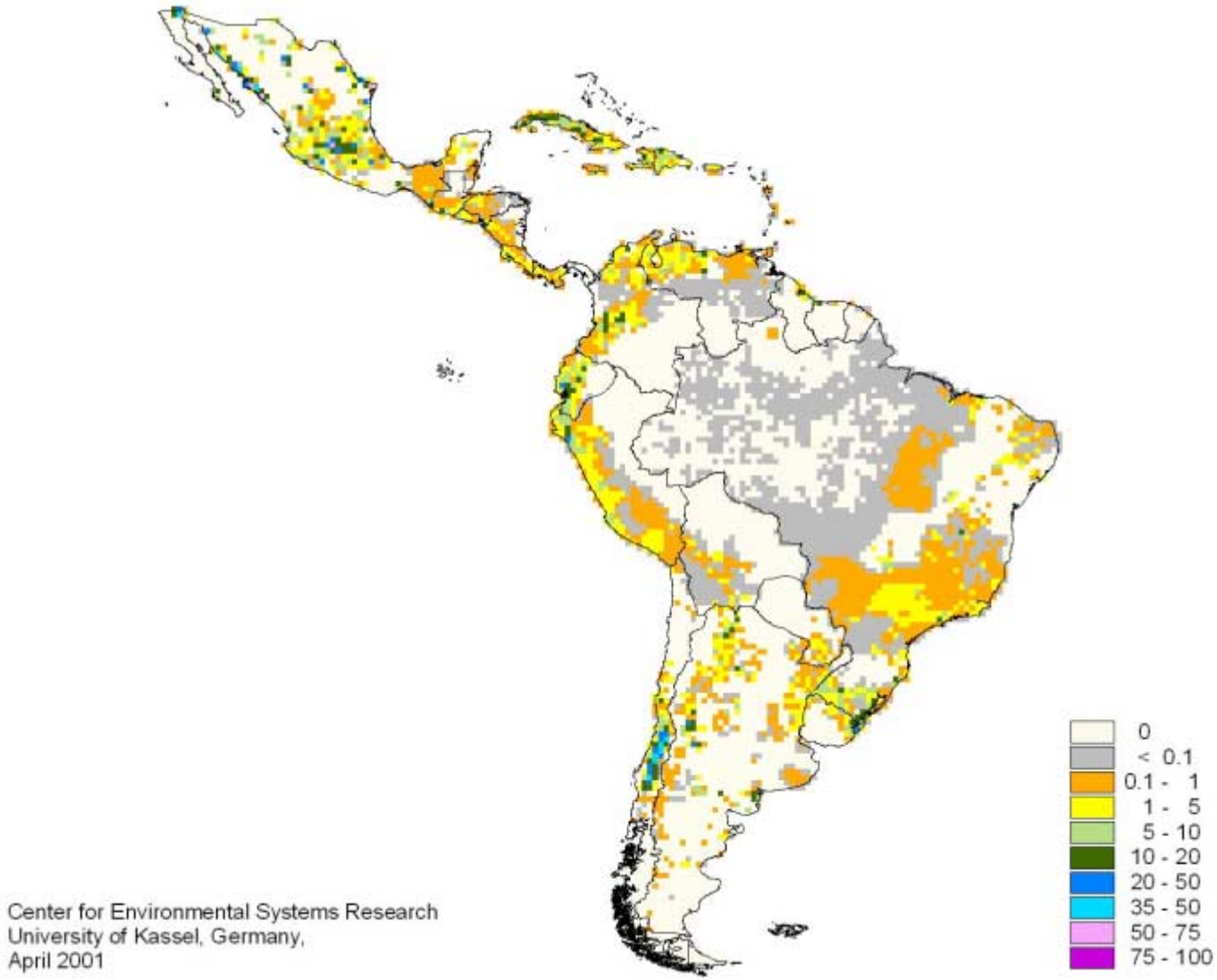


Fig. A2: Irrigated areas in Latin America. Part of the new global map of irrigated areas. Map shows the fraction of the area of each 0.5° by 0.5° cell that was equipped for irrigation around 1995.

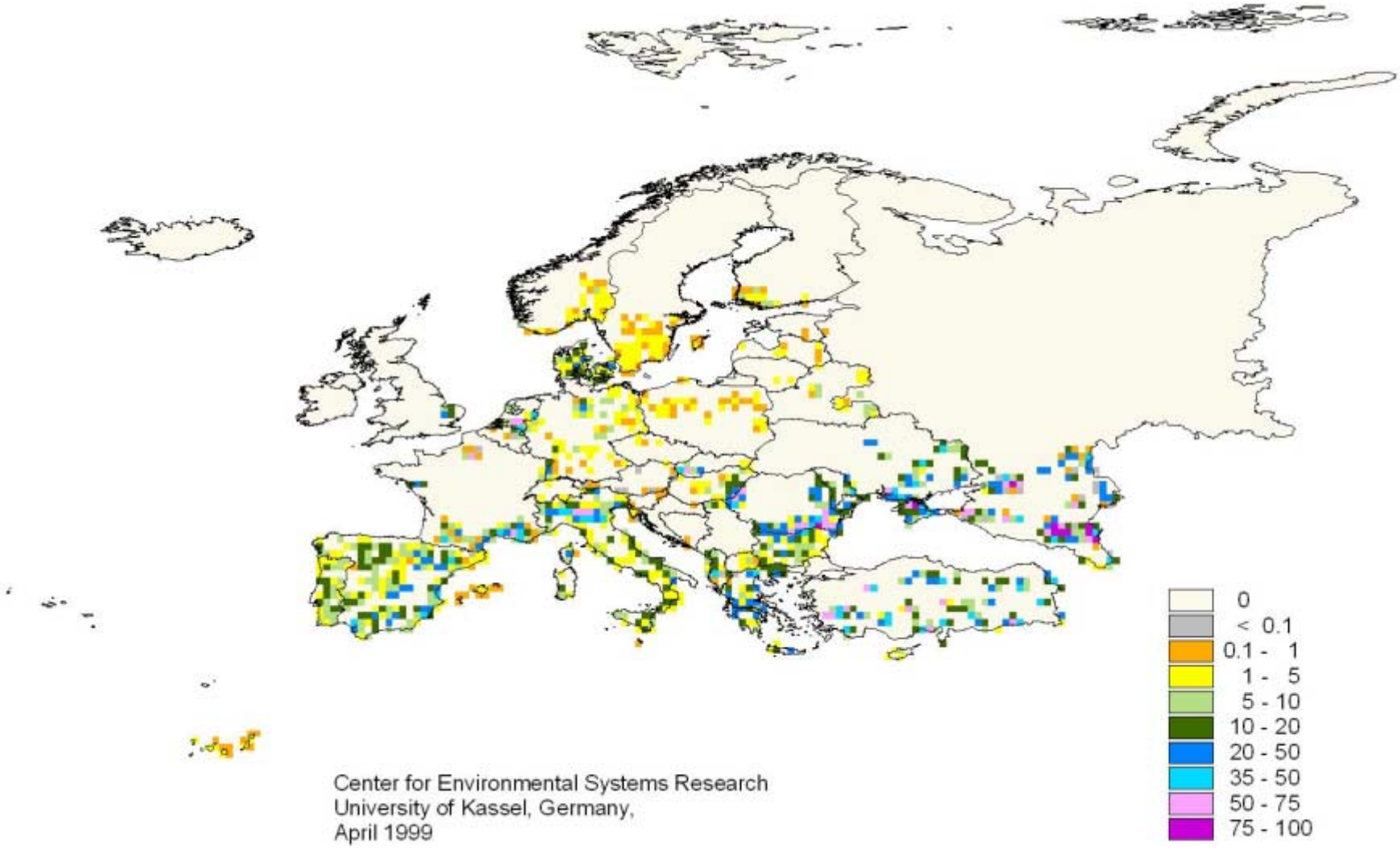


Fig. A3: Irrigated areas in Europe. Part of the first version of the global map of irrigated areas (Döll and Siebert, 1999, 2000). Map shows the fraction of the area of each 0.5° by 0.5° cell that was equipped for irrigation around 1995.

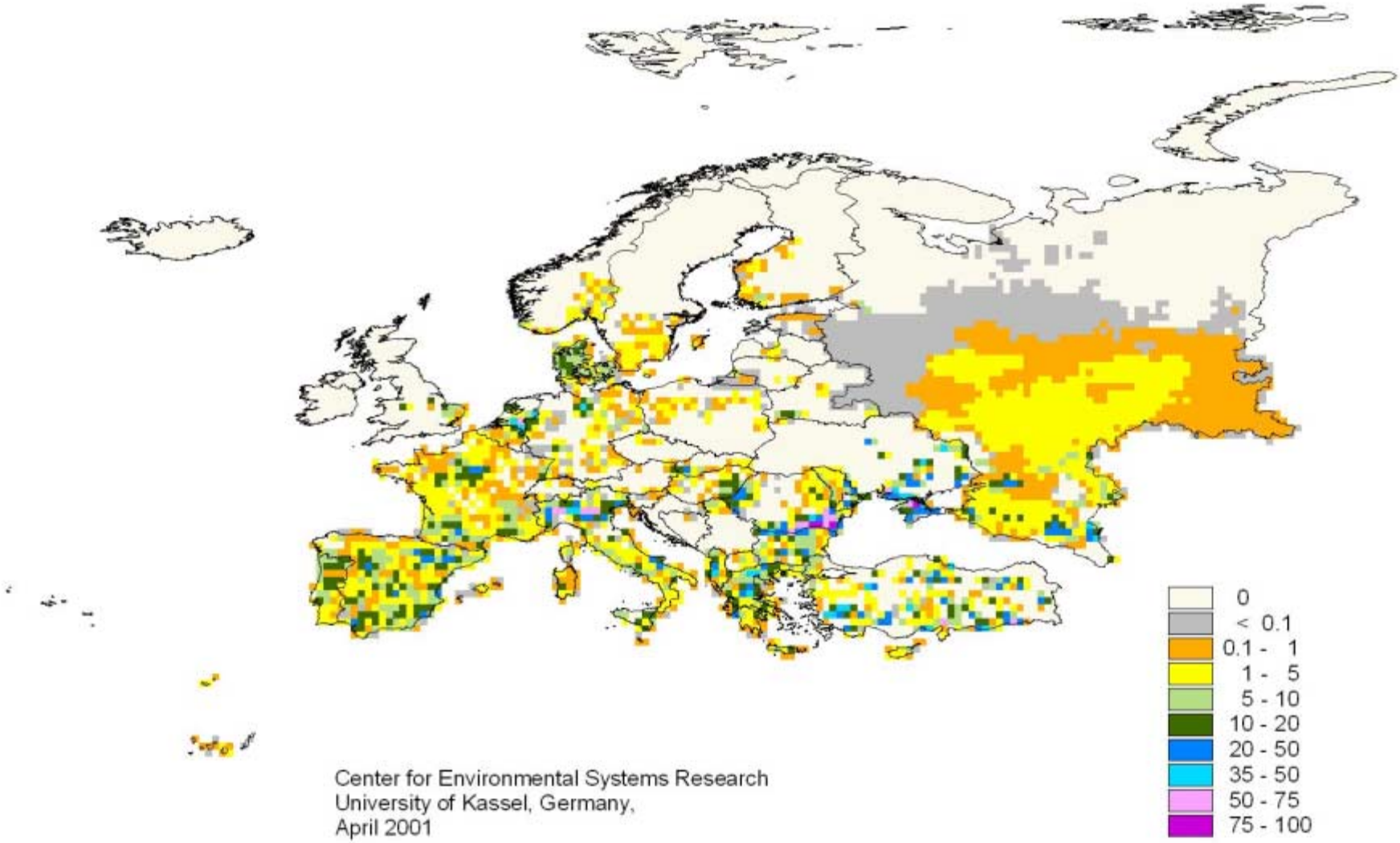


Fig. A4: Irrigated areas in Europe. Part of the new global map of irrigated areas. Map shows the fraction of the area of each 0.5° by 0.5° cell that was equipped for irrigation in around 1995.

Appendix B1: Irrigated area per (sub-)national unit in Latin America (information according to FAO, 2000, and additional information obtained from FAO)

COUNTRY	ADMINISTRATIVE UNIT	IRRIGATED AREA [HA]	YEAR
ANGUILLA	**ANGUILLA**	**0**	
ANTIGUA AND BARBUDA	**ANTIGUA AND BARBUDA**	**130**	**1997**
ARGENTINA	BUENOS AIRES	101254	1995
ARGENTINA	BUENOS AIRES D.F.	0	1995
ARGENTINA	CATAMARCA	64304	1995
ARGENTINA	CHACO	6000	1995
ARGENTINA	CHUBUT	34449	1995
ARGENTINA	CORDOBA	55000	1995
ARGENTINA	CORRIENTES	68000	1995
ARGENTINA	ENTRE RIOS	109000	1995
ARGENTINA	FORMOSA	11513	1995
ARGENTINA	JUJUY	120000	1995
ARGENTINA	LA PAMPA	6104	1995
ARGENTINA	LA RIOJA	5447	1995
ARGENTINA	MENDOZA	339600	1995
ARGENTINA	MISIONES	0	1995
ARGENTINA	NEUQUEN	17700	1995
ARGENTINA	RIO NEGRO	120659	1995
ARGENTINA	SALTA	150000	1995
ARGENTINA	SAN JUAN	68900	1995
ARGENTINA	SAN LUIS	4571	1995
ARGENTINA	SANTA CRUZ	1850	1995
ARGENTINA	SANTA FE	9000	1995
ARGENTINA	SANTIAGO DEL ESTERO	85000	1995
ARGENTINA	TIERRA DEL FUEGO	0	1995
ARGENTINA	TUCUMAN	58924	1995
ARGENTINA	**ARGENTINA**	**1437275**	**1995**
ARUBA	**ARUBA**	**0**	
BAHAMAS, THE	**BAHAMAS**	**0**	
BARBADOS	**BARBADOS**	**1000**	**1997**
BELIZE	**BELIZE**	**3000**	**1997**
BOLIVIA	LAGO TITICACA	0	1999
BOLIVIA	BENI	0	1999
BOLIVIA	CHUQUISACA	8277	1999
BOLIVIA	COCHABAMBA	29052	1999
BOLIVIA	LA PAZ	37722	1999
BOLIVIA	ORURO	15395	1999
BOLIVIA	PANDO	0	1999
BOLIVIA	POTOSI	13333	1999
BOLIVIA	SANTA CRUZ	4942	1999
BOLIVIA	TARIJA	19519	1999
BOLIVIA	**BOLIVIA**	**128240**	**1999**
BRAZIL	ACRE	600	1996
BRAZIL	ALAGOAS	7500	1996
BRAZIL	AMAPA	100	1996
BRAZIL	AMAZONAS	1200	1996
BRAZIL	BAHIA	140610	1996

COUNTRY	ADMINISTRATIVE UNIT	IRRIGATED AREA [HA]	YEAR
BRAZIL	CEARA	77030	1996
BRAZIL	CAPANEMA	0	1996
BRAZIL	ESPIRITU SANTO	39500	1996
BRAZIL	GOIAS + DISTRITO FEDERAL	116440	1996
BRAZIL	MARANHAO	40000	1996
BRAZIL	MARANHAO/PIAUI	0	1996
BRAZIL	MATO GROSSO	8100	1996
BRAZIL	MATO GROSSO DO SUL	55600	1996
BRAZIL	MINAS GERAIS	260020	1996
BRAZIL	PARA	6260	1996
BRAZIL	PARAIBA	27600	1996
BRAZIL	PARANA	55000	1996
BRAZIL	PERNAMBUCO	85000	1996
BRAZIL	PIAUI	18190	1996
BRAZIL	PORTO XAVIER	0	1996
BRAZIL	RIO DE JANEIRO	72000	1996
BRAZIL	RIO GRANDE DO NORTE	14494	1996
BRAZIL	RIO GRANDE DO SUL	974000	1996
BRAZIL	RONDONIA	100	1996
BRAZIL	RORAIMA	5000	1996
BRAZIL	SANTA CATARINA	118800	1996
BRAZIL	SAO PAULO	450000	1996
BRAZIL	SERGIPE	18040	1996
BRAZIL	TOCANTINS	65100	1996
BRAZIL	**BRAZIL**	**2656284**	**1996**
BRITISH VIRGIN ISLANDS	**BRITISH VIRGIN ISLANDS**	**0**	
CAYMAN ISLANDS	**CAYMAN ISLANDS**	**0**	
CHILE	ANTOFAGASTA (II)	3600	1996
CHILE	ARAUCANIA (IX)	205700	1996
CHILE	ATACAMA (III)	24700	1996
CHILE	BIOBIO (VIII)	489860	1996
CHILE	COQUIMBO (IV)	106300	1996
CHILE	AYSEN DEL GEN.D.C. (XI)	1560	1996
CHILE	LIBERTADOR (VI)	277100	1996
CHILE	LOS LAGOS (X)	3000	1996
CHILE	MAGALLANES (XII)	1680	1996
CHILE	MAULE (VII)	467100	1996
CHILE	METROPOLITANA (XIII)	228500	1996
CHILE	TARAPACA (I)	6500	1996
CHILE	VALPARAISO (V)	84400	1996
CHILE	**CHILE**	**1900000**	**1996**
COLOMBIA	AMAZONAS	0	1992, 1997
COLOMBIA	ANTIOQUIA	3752	1992
COLOMBIA	ARAUCA	0	1992, 1997
COLOMBIA	ATLANTICO	26730	1992
COLOMBIA	BOLIVAR	22033	1997
COLOMBIA	BOYACA	17439	1997
COLOMBIA	BUENAVENTURA	0	1992, 1997
COLOMBIA	CALDAS	2862	1992

COUNTRY	ADMINISTRATIVE UNIT	IRRIGATED AREA [HA]	YEAR
COLOMBIA	CAQUETA	0	1992, 1997
COLOMBIA	CASANARE	656	1997
COLOMBIA	CAUCA	38284	1997
COLOMBIA	CESAR	48537	1997
COLOMBIA	CHOCO	0	1992, 1997
COLOMBIA	CORDOBA	58006	1992
COLOMBIA	CUNDINAMARCA	40546	1992
COLOMBIA	GUAINIA	0	1992, 1997
COLOMBIA	GUAJIRA	17020	1997
COLOMBIA	GUAVIARE	0	1992, 1997
COLOMBIA	HUILA	38540	1997
COLOMBIA	MAGDALENA	57727	1992
COLOMBIA	META	58497	1992
COLOMBIA	NARINO	3894	1997
COLOMBIA	NORTE DE SANTANDER	26916	1997
COLOMBIA	PUTUMAYO	0	1992, 1997
COLOMBIA	QUINDIO	0	1992, 1997
COLOMBIA	RISARALDA	1277	1997
COLOMBIA	SAN ANDRES Y PROVIDENCIA	0	1992, 1997
COLOMBIA	SANTANDER	16249	1992
COLOMBIA	SUCRE	3696	1997
COLOMBIA	TOLIMA	196416	1997
COLOMBIA	VALLE DEL CAUCA	220923	1997
COLOMBIA	VAUPES	0	1992, 1997
COLOMBIA	VICHADA	0	1992, 1997
COLOMBIA	**COLOMBIA**	**900000**	**1992**
COSTA RICA	ALAJUELA	6077	1997
COSTA RICA	CARTAGO	1676	1997
COSTA RICA	GUANACASTE	45960	1997
COSTA RICA	HEREDIA	2083	1997
COSTA RICA	LIMON	0	1997
COSTA RICA	PUNTARENAS	43991	1997
COSTA RICA	SAN JOSE	3297	1997
COSTA RICA	LAG.ARENAL	0	1997
COSTA RICA	**COSTA RICA**	**103084**	**1997**
CUBA	PINAR DEL RIO	123778	1997
CUBA	CIUDAD DE LA HABANA	0	1997
CUBA	MATANZAS	112460	1997
CUBA	ISLA DE LA JUVENTUD	14371	1997
CUBA	CAMAGUEY	66285	1997
CUBA	CIEGO DE AVILA	91837	1997
CUBA	CIENFUEGOS	35591	1997
CUBA	GRANMA	87263	1997
CUBA	GUANTANAMO	13650	1997
CUBA	LA HABANA	99720	1997
CUBA	HOLGUIN	39132	1997
CUBA	LAS TUNAS	28822	1997
CUBA	SANCTI SPIRITUS	51607	1997
CUBA	SANTIAGO DE CUBA	19211	1997

COUNTRY	ADMINISTRATIVE UNIT	IRRIGATED AREA [HA]	YEAR
CUBA	VILLA CLARA	86592	1997
CUBA	**CUBA**	**870319**	**1997**
DOMINICA	**DOMINICA**	**0**	
DOMINICAN REPUBLIC	LA ESTRELLETA	2219	1994, 1999
DOMINICAN REPUBLIC	SANTO DOMINGO	0	1994, 1999
DOMINICAN REPUBLIC	AZUA	6801	1994, 1999
DOMINICAN REPUBLIC	BAORUCO	5946	1994, 1999
DOMINICAN REPUBLIC	BARAHONA	15513	1994, 1999
DOMINICAN REPUBLIC	DAJABON	4572	1994, 1999
DOMINICAN REPUBLIC	DISTRITO NACIONAL	0	1994, 1999
DOMINICAN REPUBLIC	DUARTE	0	1994, 1999
DOMINICAN REPUBLIC	ESPAILLAT	0	1994, 1999
DOMINICAN REPUBLIC	INDEPENDENCIA	16450	1994, 1999
DOMINICAN REPUBLIC	LA ALTAGRACIA	14310	1994, 1999
DOMINICAN REPUBLIC	LA ROMANA	0	1994, 1999
DOMINICAN REPUBLIC	MARIA TRINIDAD S	19659	1994, 1999
DOMINICAN REPUBLIC	MONTE CRISTI	35423	1994, 1999
DOMINICAN REPUBLIC	PEDERNALES	4247	1994, 1999
DOMINICAN REPUBLIC	PERAVIA	13350	1994, 1999
DOMINICAN REPUBLIC	PUERTO PLATA	0	1994, 1999
DOMINICAN REPUBLIC	SALCEDO	0	1994, 1999
DOMINICAN REPUBLIC	SAMANA	0	1994, 1999
DOMINICAN REPUBLIC	SANCHEZ RAMIREZ	18384	1994, 1999
DOMINICAN REPUBLIC	SAN JUAN	30728	1994, 1999
DOMINICAN REPUBLIC	SAN PEDRO DE MACORIS	0	1994, 1999
DOMINICAN REPUBLIC	SANTIAGO	40314	1994, 1999
DOMINICAN REPUBLIC	SANTIAGO RODRIGU	9951	1994, 1999
DOMINICAN REPUBLIC	VALVERDE	4867	1994, 1999
DOMINICAN REPUBLIC	EL SEIBO	0	1994, 1999
DOMINICAN REPUBLIC	HATO MAJOR	0	1994, 1999
DOMINICAN REPUBLIC	LA VEGA	20420	1994, 1999
DOMINICAN REPUBLIC	MONSENOR NOVEL	1013	1994, 1999
DOMINICAN REPUBLIC	MONTE PLATA	4816	1994, 1999
DOMINICAN REPUBLIC	SAN CRISTOBAL	727	1994, 1999
DOMINICAN REPUBLIC	**DOMINICAN REPUBLIC**	**269710**	**1999**
ECUADOR	AZUAY	36976	1997
ECUADOR	BOLIVAR	11554	1997
ECUADOR	CANAR	14752	1997
ECUADOR	CARCHI	16852	1997
ECUADOR	CHIMBORAZO	28201	1997
ECUADOR	COTOPAXI	33094	1997
ECUADOR	EL ORO	45378	1997
ECUADOR	ESMERALDAS	2810	1997
ECUADOR	GALAPAGOS	0	1997
ECUADOR	GUAYAS	306921	1997
ECUADOR	IMBABURA	23550	1997
ECUADOR	LOJA	69842	1997
ECUADOR	LOS RIOS	27162	1997
ECUADOR	MANABI	77114	1997
ECUADOR	MORONA SANTIAGO	0	1997

COUNTRY	ADMINISTRATIVE UNIT	IRRIGATED AREA [HA]	YEAR
ECUADOR	NAPO	0	1997
ECUADOR	PASTAZA	0	1997
ECUADOR	PICHINCHA	115549	1997
ECUADOR	SUCUMBIOS	0	1997
ECUADOR	TUNGURAHUA	53615	1997
ECUADOR	ZAMORA CHINCHIPE	0	1997
ECUADOR	ZONA NO DELIMTDA	0	1997
ECUADOR	**ECUADOR**	**863370**	**1997**
EL SALVADOR	**EL SALVADOR**	**44993**	**1997**
FALKLAND ISLANDS		**0**	
GRENADA	**GRENADA**	**219**	**1997**
GUADELOUPE	**GUADELOUPE**	**2000**	**1995**
GUATEMALA	ALTA VERAPAZ	71	1990, 1997
GUATEMALA	BAJA VERAPAZ	1264	1990, 1997
GUATEMALA	CHIMALTENANGO	257	1990, 1997
GUATEMALA	CHIQUIMULA	144	1990, 1997
GUATEMALA	EL PROGRESO	1674	1990, 1997
GUATEMALA	EL QUICHE	906	1990, 1997
GUATEMALA	ESCUINTLA	65150	1990, 1997
GUATEMALA	GUATEMALA	371	1990, 1997
GUATEMALA	HUEHUETENANGO	1206	1990, 1997
GUATEMALA	IZABAL	14997	1990, 1997
GUATEMALA	JALAPA	419	1990, 1997
GUATEMALA	JUTIAPA	4899	1990, 1997
GUATEMALA	PETEN	0	1990, 1997
GUATEMALA	QUEZALTENANGO	2370	1990, 1997
GUATEMALA	RETALHULEU	6327	1990, 1997
GUATEMALA	SACATEPEQUEZ	479	1990, 1997
GUATEMALA	SAN MARCOS	8830	1990, 1997
GUATEMALA	SANTA ROSA	10085	1990, 1997
GUATEMALA	SOLOLA	351	1990, 1997
GUATEMALA	SUCHITEPEQUEZ	2114	1990, 1997
GUATEMALA	TOTONICAPAN	48	1990, 1997
GUATEMALA	ZACAPA	7841	1990, 1997
GUATEMALA	**GUATEMALA**	**129803**	**1997**
GUYANA	BARIMA/WAINI	0	1991
GUYANA	CUYUNI/MAZARUNI	0	1991
GUYANA	DEMERARA/MAHAICA	24372	1991
GUYANA	EAST BERBICE/CORENTYNE	44564	1991
GUYANA	ESSEQUIBO I./WEST D.	39182	1991
GUYANA	MAHAICA/BERBICE	22800	1991
GUYANA	POMEROON/SUPENAAM	19216	1991
GUYANA	POTARO/SIPARUNI	0	1991
GUYANA	UPPER DEMERARA/BERBICE	0	1991
GUYANA	UPPER TAKUTU/U.ESSEQUIBO	0	1991
GUYANA	**GUYANA**	**150134**	**1991**
GUYANE FR.	**GUYANE FR.**	**2000**	**1995**
HAITI	NORD-OUEST	2732	1991

COUNTRY	ADMINISTRATIVE UNIT	IRRIGATED AREA [HA]	YEAR
HAITI	ARTIBONITE	42836	1991
HAITI	CENTRE	1463	1991
HAITI	GRAND ANSE	0	1991
HAITI	NORD	3586	1991
HAITI	NORD-EST	0	1991
HAITI	OUEST	29855	1991
HAITI	SUD	9573	1991
HAITI	SUD-EST	1457	1991
HAITI	**HAITI**	**91502**	**1991**
HONDURAS	ATLANTIDA	1500	1997
HONDURAS	CHOLUTECA	7105	1997
HONDURAS	COLON	211	1997
HONDURAS	COMAYAGUA	10000	1997
HONDURAS	COPAN	1000	1997
HONDURAS	CORTES	34562	1997
HONDURAS	FRANCISCO MORAZAN	2246	1997
HONDURAS	GRACIAS A DIOS	250	1997
HONDURAS	INTIBUCA	573	1997
HONDURAS	ISLAS DE BAHIA	0	1997
HONDURAS	LA PAZ	1054	1997
HONDURAS	LEMPIRA	350	1997
HONDURAS	OCOTEPEQUE	344	1997
HONDURAS	OLANCHO	1275	1997
HONDURAS	PARAISO	992	1997
HONDURAS	SANTA BARBARA	5055	1997
HONDURAS	VALLE	1000	1997
HONDURAS	YORO	5693	1997
HONDURAS	**HONDURAS**	**73210**	**1997**
JAMAICA	CLARENDON	10801	1997
JAMAICA	HANOVER	7	1997
JAMAICA	MANCHESTER	3	1997
JAMAICA	PORTLAND	10	1997
JAMAICA	SAINT ANDREW	32	1997
JAMAICA	SAINT ANN	69	1997
JAMAICA	SAINT CATHERINE	9720	1997
JAMAICA	SAINT ELIZABETH	1386	1997
JAMAICA	SAINT JAMES	103	1997
JAMAICA	SAINT MARY	721	1997
JAMAICA	SAINT THOMAS	1488	1997
JAMAICA	TRELAWNY	549	1997
JAMAICA	WESTMORELAND	325	1997
JAMAICA	KINGSTON	0	1997
JAMAICA	**JAMAICA**	**25214**	**1997**
MARTINIQUE	**MARTINIQUE**	**3000**	**1995**
MEXICO	AGUASCALIENTES	66414	1997
MEXICO	BAJA CALIFORNIA	263592	1997
MEXICO	BAJA CALIFORNIA SUR	95229	1997
MEXICO	CAMPECHE	36809	1997
MEXICO	CHIAPAS	96840	1997
MEXICO	CHIHUAHUA	370372	1997

COUNTRY	ADMINISTRATIVE UNIT	IRRIGATED AREA [HA]	YEAR
MEXICO	COAHUILA	249652	1997
MEXICO	COLIMA	88057	1997
MEXICO	DISTRITO FEDERAL	400	1997
MEXICO	DURANGO	147750	1997
MEXICO	GUANAJUATO	461081	1997
MEXICO	GUERRERO	60270	1997
MEXICO	HIDALGO	143443	1997
MEXICO	JALISCO	213704	1997
MEXICO	MEXICO	177228	1997
MEXICO	MICHOACAN	413839	1997
MEXICO	MORELOS	63311	1997
MEXICO	NAYARIT	106353	1997
MEXICO	NUEVO LEON	163202	1997
MEXICO	OAXACA	87653	1997
MEXICO	PUEBLA	145383	1997
MEXICO	QUERETARO	48892	1997
MEXICO	QUINTANA ROO	16888	1997
MEXICO	SAN LUIS POTOSI	123464	1997
MEXICO	SINALOA	891367	1997
MEXICO	SONORA	663442	1997
MEXICO	TABASCO	14553	1997
MEXICO	TAMAULIPAS	478155	1997
MEXICO	TLAXCALA	31489	1997
MEXICO	VERACRUZ	131886	1997
MEXICO	YUCATAN	34810	1997
MEXICO	ZACATECAS	219428	1997
MEXICO	**MEXICO**	**6104956**	**1997**
MONTSERRAT	**MONTSERRAT**	**0**	
NETHERLANDS ANTILLES	**NETHERLANDS ANTILLES**	**0**	
NICARAGUA	ATLANTICO NORTE	0	1997
NICARAGUA	ATLANTICO SUR	0	1997
NICARAGUA	BOACO	1000	1997
NICARAGUA	CARAZO	1550	1997
NICARAGUA	CHINANDEGA	25784	1997
NICARAGUA	CHONTALES	10750	1997
NICARAGUA	ESTELI	1194	1997
NICARAGUA	GRANADA	1550	1997
NICARAGUA	JINOTEGA	0	1997
NICARAGUA	LEON	4195	1997
NICARAGUA	MADRIZ	0	1997
NICARAGUA	MANAGUA	2975	1997
NICARAGUA	MASAYA	0	1997
NICARAGUA	MATAGALPA	8700	1997
NICARAGUA	NICARAGUA	0	1997
NICARAGUA	NUEVA SEGOVIA	0	1997
NICARAGUA	REGI.AUTO.ATLANT.SUR	0	1997
NICARAGUA	RIO SAN JUAN	2097	1997
NICARAGUA	RIVAS	1570	1997
NICARAGUA	**NICARAGUA**	**61365**	**1997**
PANAMA	BOCAS DEL TORO	0	1997

COUNTRY	ADMINISTRATIVE UNIT	IRRIGATED AREA [HA]	YEAR
PANAMA	CHIRIQUI	14085	1997
PANAMA	COCLE	11597	1997
PANAMA	COLON	0	1997
PANAMA	COMARCA DE SAN BLAS	0	1997
PANAMA	DARIEN	0	1997
PANAMA	HERRERA	499	1997
PANAMA	LOS SANTOS	1339	1997
PANAMA	PANAMA	493	1997
PANAMA	VERAGUAS	6613	1997
PANAMA	**PANAMA**	**34626**	**1997**
PARAGUAY	**PARAGUAY**	**67000**	**1997**
PERU	LAGO TITICACA	0	1992, 1998
PERU	AMAZONAS	33450	1992, 1998
PERU	ANCASH	63866	1992, 1998
PERU	APURIMAC	9509	1992, 1998
PERU	AREQUIPA	107879	1992, 1998
PERU	AYACUCHO	987	1992, 1998
PERU	CAJAMARCA	28854	1992, 1998
PERU	CUZCO	23896	1992, 1998
PERU	HUANCAVELICA	436	1992, 1998
PERU	HUANUCO	10017	1992, 1998
PERU	ICA	115516	1992, 1998
PERU	JUNIN	31289	1992, 1998
PERU	LA LIBERTAD	168522	1992, 1998
PERU	LAMBAYEQUE	200016	1992, 1998
PERU	LIMA	129239	1992, 1998
PERU	LORETO	0	1992, 1998
PERU	MADRE DE DIOS	0	1992, 1998
PERU	MOQUEGUA	4927	1992, 1998
PERU	PASCO	1483	1992, 1998
PERU	PIURA	191735	1992, 1998
PERU	PUNO	19216	1992, 1998
PERU	SAN MARTIN	32106	1992, 1998
PERU	TACNA	9403	1992, 1998
PERU	TUMBES	12882	1992, 1998
PERU	UCAYALI	0	1992, 1998
PERU	**PERU**	**1195228**	**1998**
PUERTO RICO	**PUERTO RICO**	**15407**	**1995**
ST. KITTS AND NEVIS		**18**	**1997**
ST. LUCIA	**ST. LUCIA**	**297**	**1997**
ST. VINCENT AND THE GRENADINES	**SAINT VINCENT AND THE GRENADINES**	**0**	**1997**
SURINAME	**SURINAME**	**51180**	**1998**
TRINIDAD AND TOBAGO	**TRINIDAD AND TOBAGO**	**3600**	**1997**
TURKS AND CAICOS ISLANDS	**TURKS AND CAICOS ISLANDS**	**0**	
URUGUAY	**URUGUAY**	**181200**	**1998**
VENEZUELA	RIO ORINOCO	0	1989, 1995, 1998
VENEZUELA	AMAZONAS	0	1989, 1995,

COUNTRY	ADMINISTRATIVE UNIT	IRRIGATED AREA [HA]	YEAR
			1998
VENEZUELA	ANZOATEGUI	10826	1989, 1995, 1998
VENEZUELA	APURE	766	1989, 1995, 1998
VENEZUELA	ARAGUA	48602	1989, 1995, 1998
VENEZUELA	BARINAS	6728	1989, 1995, 1998
VENEZUELA	BOLIVAR	1330	1989, 1995, 1998
VENEZUELA	CARABOBO	36825	1989, 1995, 1998
VENEZUELA	COJEDES	10588	1989, 1995, 1998
VENEZUELA	DELTA AMACURO	290	1989, 1995, 1998
VENEZUELA	DISTRITO FEDERAL	875	1989, 1995, 1998
VENEZUELA	FALCON	12021	1989, 1995, 1998
VENEZUELA	GUARICO	64978	1989, 1995, 1998
VENEZUELA	LARA	58611	1989, 1995, 1998
VENEZUELA	MERIDA	28670	1989, 1995, 1998
VENEZUELA	MIRANDA	12081	1989, 1995, 1998
VENEZUELA	MONAGAS	13710	1989, 1995, 1998
VENEZUELA	NUEVA ESPARTA	164	1989, 1995, 1998
VENEZUELA	PORTUGUESA	47833	1989, 1995, 1998
VENEZUELA	SUCRE	9486	1989, 1995, 1998
VENEZUELA	TACHIRA	32990	1989, 1995, 1998
VENEZUELA	TRUJILLO	42458	1989, 1995, 1998
VENEZUELA	YARACUY	21578	1989, 1995, 1998
VENEZUELA	ZULIA	108809	1989, 1995, 1998
VENEZUELA	**VENEZUELA**	**570219**	**1998**
VIRGIN ISLANDS	**VIRGIN ISLANDS**	**0**	

Appendix B2*:* Information sources for distributing the irrigated area within (sub-)national units of Latin America

Country	Subject	Size of irrigated area known*	Data Type	Records	Priority **	Source Info
ANTIGUA + BARBUDA	Cropland	N	Polygon	1	10	USGS (2001): Global Land Cover Characterization, map version 2, (http://edcdaac.usgs.gov/index.html)
ARGENTINA	Location of irrigation projects	Y	Point	46	10	Direcion Nacional de Recursos Hidricos (1995): "Areas Irrigadas de la Argentina"
ARGENTINA	Location of irrigation projects	N	Point	40	9	Direcion Nacional de Recursos Hidricos (1995): "Areas Irrigadas de la Argentina"
ARGENTINA	Outlines of major irrigated areas	N	Polygon	126	7	Secretaria de Agricultura, Granaderia y Pesca, Instituto Nacional de Tecnologia Agropecuaria (1986): "Aptitud y Uso Actual de las Tierras Argentinas"
ARGENTINA	Outlines of major irrigation districts	E	Polygon	65	8	Direcion Nacional de Recursos Hidricos (1995): "Areas Irrigadas de la Argentina"
BARBADOS	Potential irrigation areas	N	Polygon	8	10	Government of Barbados (1978): "Barbados Water Resources Study" - Vol. 4 - Irrigation, map 4.42
BELIZE	1000 ha irrigated rice	Y	Point	1	10	CIAT (1997): "Distribution of rice in Latin America" (1000 ha irrigated rice), http://www.gis.ciat.cgiar.org or http://www.grida.no/prog/global/cgiar/
BELIZE	Cultivated area in the more dry northern part of the country	N	Polygon	4	9	Instituto Geografico Nacional Guatemala (1982): "Mapa de cobertura y uso actual de tierra"
BOLIVIA	Proyectos de Riego	Y	Point	7	10	UNEP (19XX): "Diagnostico Ambiental del Sistema Titicaca-Desaguadero-Poopo-Salar de Coipasa Bolivia-Peru"
BOLIVIA	Location of irrigation projects	Y	Point	24	10	Albornos, J.S. (19XX): "La Agricultura de Riego en Bolivia, Situacion Actual y Perspectivas"
BOLIVIA	Location of irrigation projects	Y	Point	10	10	Ministerio de Desarrollo sostenible y medio Ambiente (1996): "Situacion de los Recursos Hidricos en Bolivia", p. 120 - 128
BOLIVIA	Outlines of an irrigated area	Y	Polygon	1	10	Albornoz, J.S. (19XX): "La Agricultura de Riego en Bolivia, Situacion actual y Perspectivas"
BOLIVIA	Proyectos de Riego	N	Point	12	9	UNEP (19XX): "Diagnostico Ambiental del Sistema Titicaca-Desaguadero-Poopo-Salar de Coipasa Bolivia-Peru"
BOLIVIA	Irrigated area per department	Y	Polygon	56	8	Ministerio de Desarrollo sostenible y medio Ambiente (1996): "Situacion de los Recursos Hidricos en Bolivia", list of irrig. projects
BRAZIL	1000 ha irrigated rice	Y	Point	1210	9-10	CIAT (1997): "Distribution of rice in Latin America" (1000 ha irrigated rice), http://www.gis.ciat.cgiar.org or http://www.grida.no/prog/global/cgiar/
BRAZIL	Location of irrigation projects in Rio Sao Francisco valley	Y	Point	20	10	http://www.codevasf.gov.br (1999): "Mapa da irrigacao publica - perimetros irrigados do Vale do Rio Sao Francisco"
BRAZIL	Location of irrigation projects in Rio Sao Francisco valley	N	Point	19	9	http://www.codevasf.gov.br (1999): "Mapa da irrigacao publica - perimetros irrigados do Vale do Rio Sao Francisco"
BRAZIL	Outlines of major irrigated areas in Sao	N	Polygon	10	9	http://www.codevasf.gov.br (1999): "Mapa da irrigacao publica - perimetros irrigados

Country	Subject	Size of irrigated area known*	Data Type	Records	Priority **	Source Info
	Francisco valley					do Vale do Rio Sao Francisco"
BRAZIL	Outlines of major irrigated areas	N	Polygon	12	9	Ministerio da Agricultura (1979): "aptidao agricola das terras do Ceara"
BRAZIL	Outlines of major irrigated areas	N	Polygon	2	9	Ministerio da Agricultura (1978): "aptidao agricola das terras do Rio Grande do Norte"
BRAZIL	Outlines of major irrigated areas	N	Polygon	4	9	Ministerio da Agricultura (1978): "aptidao agricola das terras da Paraiba"
BRAZIL	Outlines of major irrigated areas	N	Polygon	8	9	Ministerio da Agricultura (1979): "aptidao agricola das terras de Pernambuco"
BRAZIL	Outlines of major irrigated areas	N	Polygon	10	9	Ministerio da Agricultura (1979): "aptidao agricola das terras da Bahia"
BRAZIL	Outlines of major irrigated areas	N	Polygon	10	9	Ministerio da Agricultura (1979): "aptidao agricola das terras de Alagoas"
BRAZIL	Outlines of major irrigated areas	N	Polygon	9	9	Ministerio da Agricultura (1979): "aptidao agricola das terras de Sergipe"
BRAZIL	Outlines of major irrigated areas	N	Polygon	53	9	Ministerio da Agricultura (1978): "aptidao agricola das terras - Rio Grande do Sul"
CHILE	Location of irrigation projects	Y	Point	5	10	El Mercurio (24.06.1984): "Las Nuevas Obras de Regadio"
CHILE	Outlines of major irrigated areas	N	Polygon	80	9	source unknown
CHILE	Outlines of irrigated areas in the N and the S of the country	N	Polygon	1	9	Ministerio de Obras Publicas Chile (1965): "Inventario de Obras Publicas - Riego"
CHILE	Arable land in the S of the country (Magallanes)	N	Polygon	1	7	Instituto Geografico de Agostini (1969): "World Atlas of Agriculture"
CHILE	Fruit trees, vineyards, bushes, orchard lands in the S of the country	N	Polygon	5	8	Instituto Geografico de Agostini (1969): "World Atlas of Agriculture"
CHILE	Market-gardens, gardens and nursery gardens in the S of the country	N	Polygon	1	8	Instituto Geografico de Agostini (1969): "World Atlas of Agriculture"
COLOMBIA	Location of medium and large irrigation schemes	Y	Point	23	10	INAT Subdireccion de Planeacion e Informatica (1999), map of medium and large irrigation schemes
COLOMBIA	Location of medium and large irrigation schemes	N	Point	1	9	INAT Subdireccion de Planeacion e Informatica (1999), map of medium and large irrigation schemes
COLOMBIA	Location of irrigation projects	N	Point	1	9	Atlas de Colombia (1998): "Mapa de los Distritos de Riego de la Republica de Colombia"
COLOMBIA	1000 ha irrigated rice	Y	Point	239	8	CIAT (1997): "Distribution of rice in Latin America" (1000 ha irrigated rice), http://www.gis.ciat.cgiar.org or http://www.grida.no/prog/global/cgiar/
COSTA RICA	Location of important private irrigation schemes	Y	Point	3	10	World Bank (1993): "Central America - Subsector Study on private Irrigation", Vol. 1, p. 109
COSTA RICA	Ubicacon de las areas con riego	E	Point	28	10	World Bank (1993): "Central America - Subsector Study on private Irrigation", Vol. 1, p. 121
COSTA RICA	Ubicacon de las areas con riego	N	Point	23	9	World Bank (1993): "Central America - Subsector Study on private Irrigation", Vol. 1, p. 121

Country	Subject	Size of irrigated area known*	Data Type	Records	Priority **	Source Info
COSTA RICA	Location of areas suitable for irrigation	N	Point	2	8	World Bank (1993): Central America - Subsector Study on private Irrigation, Vol. I, p. 122 (pot. irrig. area)
CUBA	1000 ha irrigated rice	Y	Point	123	10	CIAT (1997): "Distribution of rice in Latin America" (1000 ha irrigated rice), http://www.gis.ciat.cgiar.org or http://www.grida.no/prog/global/cgiar/
CUBA	Rice growing areas	N	Polygon	8	9	Academica de Ciencias de Cuba (1997): "nuevo Atlas National de Cuba", p. XVI. 1.2-3 (uso de la Tierra)
CUBA	Forests, swamps, urban areas (excluded from irrigation)	N	Polygon	37	0	Academica de Ciencias de Cuba (1997): "nuevo Atlas National de Cuba", p. XVI. 1.2-3 (Uso de la Tierra)
DOMINICAN REPUBLIC	1000 ha irrigated rice	Y	Point	45	10	CIAT (1997): "Distribution of rice in Latin America" (1000 ha irrigated rice), http://www.gis.ciat.cgiar.org or http://www.grida.no/prog/global/cgiar/
DOMINICAN REPUBLIC	Outlines of major irrigated areas	Y	Polygon	88	9	Organizacion de los Estados Americanos (1969): "Reconocimiento y Evaluacion de los Recursos Naturales de la Republica Dominica"
DOMINICAN REPUBLIC	Outlines of major irrigated areas	N	Polygon	7	8	Organizacion de los Estados Americanos (1969): "Reconocimiento y Evaluacion de los Recursos Naturales de la Republica Dominica"
DOMINICAN REPUBLIC	Areas suitable for irrigation	N	Polygon	7	7	Organizacion de los Estados Americanos (1969): "Reconocimiento y Evaluacion de los Recursos Naturales de la Republica Dominica"
ECUADOR	Outlines of irrigated areas	Y	Polygon	56	10	INHERI (1993): "Mapa de Ubicacion de los Sistemas de Riego del Ecuador" + CNRH-Direccion de Planificacion (1997): "Inventario de Proyectos de Riego"
ECUADOR	Outlines of irrigated areas	N	Polygon	14	9	INHERI (1993): "Mapa de Ubicacion de los Sistemas de Riego del Ecuador" + CNRH-Direccion de Planificacion (1997): "Inventario de Proyectos de Riego"
ECUADOR	1000 ha irrigated rice	Y	Point	58	8	CIAT (1997): "Distribution of rice in Latin America" (1000 ha irrigated rice), http://www.gis.ciat.cgiar.org or http://www.grida.no/prog/global/cgiar/
EL SALVADOR	Ubicacion de las areas con riego	Y	Point	39	10	Division de Riego y Drenaje (1999): "Listado de Asociaciones de Regantes"
EL SALVADOR	Ubicacion de las areas con riego	Y	Polygon	1	10	Division de Riego y Drenaje (1999): "Listado de Asociaciones de Regantes"
EL SALVADOR	Ubicacion de las areas con riego	N	Point	24	9	World Bank (1993): "Central America - Subsector Study on private Irrigation", Mapas El Salvador, Mapa 3
GRENADA	Cropland on island Grenada	N	Polygon	1	10	USGS (2001): Global Land Cover Characterization, map version 2, (http://edcdaac.usgs.gov/index.html)
GUADELOUPE	Shugar cane, coffee, fruit trees, vineyards, bushes, orchard lands	N	Polygon	4	10	Instituto Geografico de Agostini (1969): "World Atlas of Agriculture"
GUATEMALA	Location of irrigation projects	Y	Point	18	10	Ministerio de Agricultura (1967): "Programa Nacional de Pequeno Riego", Anexo II-12
GUATEMALA	Ubicacon de las areas con riego	N	Point	18	9	World Bank (1993): "Central America - Subsector Study on private Irrigation", Vol. 2, p. 120
GUATEMALA	Location of irrigation projects	N	Point	4	9	World Bank (1993): Central America - Subsector Study on private Irrigation, Vol. II,

Country	Subject	Size of irrigated area known*	Data Type	Records	Priority **	Source Info
						p. 113, + landuse map of Guatemala
GUATEMALA	Outlines of irrigated areas	N	Polygon	5	9	Instituto Geografico Nacional (1982): "Mapa de cobertura y uso actual de la tierra", cultivos y pastos bajo riego
GUATEMALA	Ubicacon de las areas con riego	Y	Point	1	10	World Bank (1993): "Central America - Subsector Study on private Irrigation", Vol. 2, p. 120
GUATEMALA	Location of irrigation projects	Y	Point	21	10	World Bank (1993): Central America - Subsector Study on private Irrigation, Vol. II, p. 113, + landuse map of Guatemala
GUATEMALA	Location of irrigation projects	N	Point	6	9	Ministerio de Agricultura (1974): "Operacion Conservacion y Tecnificacion de Distritos de Riego", Vol. 1, Anexo 3
GUATEMALA	Potential irrigation areas	N	Polygon	8	8	World Bank (1993): "America Central - Estudio sub-sectoral del riego privado" + land use map Guatemala
GUYANA	Outlines of major irrigated areas	N	Polygon	13	10	Worldbank (1992): Report No. 10410-GUA, "Guyana Agricultural Sector Review", map coastal lands, showing irrigation and drainage areas
GUYANE FR.	Location of major cropping areas	N	Point	21	10	Centre d'Etudes de GÚographie Tropicale (1979): "Atlas des DÚpartements D'Outre-Mer", 23, Utilisation du Sol, major cropping areas
HAITI	Outlines of major irrigated areas	N	Polygon	84	10	Organisation des Etats Americains (1972): "Mission d'Assistance Technique Integree, Cartes, map: Donnees Hydrologiques et Utilisation des Eaux
HONDURAS	Location of irrigation projects	Y	Point	10	10	AID Resources Inventory Center, Corps of Engineers, USA (ca. 1970): map Honduras - Drainage
HONDURAS	Planned irrigation	Y	Point	6	8	Org. de los Estados Americanos (1992): "Honduras - Proyecto de Manejo de los Recursos Naturales Renovables de la Cuenca del Embalse el Cajon", mapa 10
HONDURAS	Outlines of major irrigated areas	Y	Polygon	8	9	Gov. of the Rep. of Honduras (1978): "Feasibility Study on the agricultural Development in the Choluteca River Basin", Vol. 1, p. 96, 106, 177
HONDURAS	Location of irrigation projects	N	Point	6	9	AID Resources Inventory Center, Corps of Engineers, USA (ca. 1970): map Honduras - Drainage
HONDURAS	Ubicacon de las areas con riego	N	Point	19	9	World Bank (1993): "Central America - Subsector Study on private Irrigation", Vol. 1, p. 193
HONDURAS	Agricultural area	N	Polygon	1	7	AID Resources Inventory Center, Corps of Engineers, USA (ca. 1970): map Honduras - land use
JAMAICA	Outlines of major irrigated areas	N	Polygon	15	10	National Irrigation Commission Ltd. (1998): "National Irrigation Developement Plan", map major current irrigated area
JAMAICA	Shugar cane growing areas	N	Polygon	3	9	Instituto Geographico de Agostini - Novara (1969): "World Atlas of Agriculture", p. 48
JAMAICA	Fruit trees, vineyards, bushes, orchard lands	N	Polygon	2	8	Instituto Geographico de Agostini - Novara (1969): "World Atlas of Agriculture", p. 48

Country	Subject	Size of irrigated area known*	Data Type	Records	Priority **	Source Info
MARTINIQUE	Areas irrigable	N	Polygon	2	10	Institut Geographique National (1977): "Atlas des Départements Francais d'Outre-Mer - La Martinique", map 21 (êquipements Agricoles)
MEXICO	1000 ha irrigated rice	Y	Point	15	10	CIAT (1997): "Distribution of rice in Latin America" (1000 ha irrigated rice), http://www.gis.ciat.cgiar.org or http://www.grida.no/prog/global/cgiar/
MEXICO	Outlines of irrigation districts	N	Polygon	205	9	World Bank (1993): "Irrigation Management Transfer in Mexico", map Mexico Irrigation Districts
NICARAGUA	1000 ha irrigated rice	Y	Point	29	10	CIAT (1997): "Distribution of rice in Latin America" (1000 ha irrigated rice), http://www.gis.ciat.cgiar.org or http://www.grida.no/prog/global/cgiar/
NICARAGUA	Ubicacon de las areas con riego	E	Point	6	10	World Bank (1993): "Central America - Subsector Study on private Irrigation", Vol. 2, p. 55
NICARAGUA	Ubicacon de las areas con riego	N	Point	20	10	World Bank (1993): "Central America - Subsector Study on private Irrigation", Vol. 2, p. 55
PANAMA	Ubicacion de las Principales Areas de Riego Existentes por Tipo	Y	Point	2	10	Ministerio de Desarrollo Agropecuario (1997): "Plan Nacional de Riego", Fig. 1
PANAMA	Ubicacion de las Principales Areas de Riego Existentes por Tipo	E	Point	3	10	Ministerio de Desarrollo Agropecuario (1997): "Plan Nacional de Riego", Fig. 1
PANAMA	Ubicacion de las Principales Areas de Riego Existentes por Tipo	N	Point	17	10	Ministerio de Desarrollo Agropecuario (1997): "Plan Nacional de Riego", Fig. 1
PARAGUAY	Location of irrigation projects	Y	Point	1	10	FAO (1973): "Programa de las Naciones Unidas para el Desarrollo, Riego y Usos del Agua", (report no. 3185)
PARAGUAY	1000 ha irrigated rice	Y	Point	18	9	CIAT (1997): "Distribution of rice in Latin America" (1000 ha irrigated rice), http://www.gis.ciat.cgiar.org or http://www.grida.no/prog/global/cgiar/
PARAGUAY	Cotton, wheat, cane, potatoes	N	Polygon	2	8	Aero Service Corporation (196X): "plan Triangulo - Informe Final", map: regionalization of present land use
PARAGUAY	Wheat, peanuts	N	Polygon	3	8	Aero Service Corporation (196X): "plan Triangulo - Informe Final", map: regionalization of present land use
PARAGUAY	Rice growing areas	N	Polygon	4	8	Aero Service Corporation (196X): "plan Triangulo - Informe Final", map: regionalization of present land use
PARAGUAY	Subsistence farming, some fruits	N	Polygon	2	8	Aero Service Corporation (196X): "plan Triangulo - Informe Final", map: regionalization of present land use
PARAGUAY	Corn, mandioca, potatoes	N	Polygon	1	8	Aero Service Corporation (196X): "plan Triangulo - Informe Final", map: regionalization of present land use
PARAGUAY	Shugar cane growing areas	N	Polygon	3	8	Aero Service Corporation (196X): "plan Triangulo - Informe Final", map: regionalization of present land use
PARAGUAY	Soybeans, rice, cane, potatoes	N	Polygon	1	8	Aero Service Corporation (196X): "plan Triangulo - Informe Final", map:

Country	Subject	Size of irrigated area known*	Data Type	Records	Priority **	Source Info
						regionalization of present land use
PARAGUAY	Tobacco, pineapples, bananas	N	Polygon	1	8	Aero Service Corporation (196X): "plan Triangulo - Informe Final", map: regionalization of present land use
PARAGUAY	Subsistence farming, rice, fruit trees	N	Polygon	2	8	Aero Service Corporation (196X): "plan Triangulo - Informe Final", map: regionalization of present land use
PARAGUAY	Fruit trees, vineyards, bushes, orchard land or arable land	N	Polygon	3	8	Instituto Geografico de Agostini (1969): "World Atlas of Agriculture", map: fruit trees, vineyards, bushes, orchard land or arable land
PARAGUAY	Vineyards	N	Polygon	1	8	Aero Service Corporation (196X): "plan Triangulo - Informe Final", map: regionalization of present land use
PERU	Proyectos de Riego	Y	Point	18	10	UNEP (19XX): "Diagnostico Ambiental del Sistema Titicaca-Desaguadero-Poopo-Salar de Coipasa Bolivia-Peru"
PERU	1000 ha irrigated rice	Y	Point	128	9	CIAT (1997): "Distribution of rice in Latin America" (1000 ha irrigated rice), http://www.gis.ciat.cgiar.org or http://www.grida.no/prog/global/cgiar/
PERU	Outlines of irrigation districts	Y	Polygon	69	8	Ministerio de Agricultura (1998) "Distritos de Riego del Peru" + DGAS (1992): "Ubicacion de Distritos de Riego" (map)
PERU	Proyectos de Riego	N	Point	8	8	UNEP (19XX): "Diagnostico Ambiental del Sistema Titicaca-Desaguadero-Poopo-Salar de Coipasa Bolivia-Peru"
PUERTO RICO	County boundaries	Y	Polygon	15	10	USGS (1995): National water-use data 1995 (http://water.usgs.gov)
ST. KITTS AND NEVIS	Agricultural areas	N	Polygon	1	10	USGS (2001): Global Land Cover Characterization, map version 2, (http://edcdaac.usgs.gov/index.html)
ST. LUCIA	Agricultural areas	N	Polygon	6	10	Organization of American States, Dpmt. of Regional Development (1987): "Saint Lucia Development Atlas", map Land Use and Vegetation
SURINAME	Location of important agricultural projects	E	Point	5	10	Framji, Mahajan (1969): "Irrigation and Drainage in the World" + AQUASTAT
SURINAME	Location of important agricultural projects	N	Point	6	10	Framji, Mahajan (1969): "Irrigation and Drainage in the World"
TRINIDAD AND TOBAGO	Rice growing areas	N	Point	22	10	Government of Trinidad and Tobago (1977): Topo maps 1:25000, Series 804, Edition 1
TRINIDAD AND TOBAGO	Shugar cane, coffee, fruit trees, vineyards, bushes, orchard lands	N	Polygon	17	9	Instituto Geografico de Agostini (1969): "World Atlas of Agriculture"
URUGUAY	1000 ha irrigated rice	Y	Point	122	10	CIAT (1997): "Distribution of rice in Latin America" (1000 ha irrigated rice), http://www.gis.ciat.cgiar.org or http://www.grida.no/prog/global/cgiar/
URUGUAY	Outlines of major rice growing areas	Y	Polygon	11	9	Ministerio de Ganaderia, Agricultura Y Pesca (1998): "Anuario Estadistico Agropecuario 1998 - Republica Oriental del Uruguay"
URUGUAY	Outlines of major rice growing areas	N	Polygon	58	8	Ministerio de Ganaderia, Agricultura Y Pesca (1998): "Anuario Estadistico Agropecuario 1998 - Republica Oriental del Uruguay"

Country	Subject	Size of irrigated area known*	Data Type	Records	Priority **	Source Info
VENEZUELA	Ubicacion de Proyectos de Riego, (only public irrigation)	Y	Point	22	10	FAO (1990): "Venezuela - Irrigation and Drainage Subsector Review", map 3
VENEZUELA	Location of irrigation projects	Y	Point	3	10	FAO (1990): "Venezuela – Irrigation and Drainage Subsector Review", map 4 (Aprovechamiento Hidraulico)
VENEZUELA	1000 ha irrigated rice	Y	Point	142	9	CIAT (1997): "Distribution of rice in Latin America" (1000 ha irrigated rice), http://www.gis.ciat.cgiar.org or http://www.grida.no/prog/global/cgiar/
VENEZUELA	Ubicacion de Proyectos de Riego, (only public irrigation)	N	Point	4	9	FAO (1990): "Venezuela - Irrigation and Drainage Subsector Review", map 3
VENEZUELA	Location of irrigation projects	N	Point	41	9	FAO (1990): "Venezuela – Irrigation and Drainage Subsector Review", map 4 (Aprovechamiento Hidraulico)

* Y = yes, N = no, E = estimated

** In some countries (Brazil, Columbia) the priority of the CIAT information on irrigated rice differs within the sub-national units

Appendix B3: Irrigated area per (sub-)national unit in Europe

COUNTRY	ADMINISTRATIVE UNIT	IRRIGATED AREA (HA)	SOURCE	YEAR
ALBANIA	**ALBANIA**	**340000**	**[3]**	**1995**
ANDORRA	**ANDORRA**	**150**	**[1]**	**Unknown**
AUSTRIA	**AUSTRIA**	**46000**	**[4] + [7]**	**1990**
BELARUS	**BELARUS**	**115000**	**[3]**	**1995**
BELGIUM	**BELGIUM**	**40000**	**[3]**	**1998**
BOSNIA HERZEGOVINA	**BOSNA I HERCEGOVINA**	**2000**	**[3]**	**1995**
BULGARIA	**BULGARIA**	**800000**	**[3]**	**1995**
CROATIA	**CROATIA**	**3000**	**[3]**	**1995**
CYPRUS	**CYPRUS**	**40000**	**[3]**	**1995**
CZECH REPUBLIC	**CZECH REPUBLIC**	**24000**	**[3]**	**1995**
DENMARK	**DENMARK**	**476000**	**[3]**	**1997**
ESTONIA	**ESTONIA**	**4000**	**[3]**	**1995**
FINLAND	**FINLAND**	**64000**	**[3]**	**1995**
FRANCE	ILE-DEL-FRANCE	70000	estimated using [1], [3], [4], [10] and [12]	1998
FRANCE	CHAMPAGNE-ARDENNE	20000	estimated using [1], [3], [4], [10] and [12]	1998
FRANCE	PICARDIE	35000	estimated using [1], [3], [4], [10] and [12]	1998
FRANCE	HAUTE-NORMANDIE	25000	estimated using [1], [3], [4], [10] and [12]	1998
FRANCE	CENTRE	320000	[10]	1991
FRANCE	BASSE-NORMANDIE	21000	estimated using [1], [3], [4], [10] and [12]	1998
FRANCE	BOURGOGNE	47000	estimated using [1], [3], [4], [10] and [12]	1998
FRANCE	NORD-PAS-DE-CALAIS	17000	estimated using [1], [3], [4], [10] and [12]	1998
FRANCE	LORRAINE	10000	estimated using [1], [3], [4], [10] and [12]	1998
FRANCE	ALSACE	60000	estimated using [1], [3], [4], [10] and [12]	1998
FRANCE	FRANCHE-COMTE	8000	estimated using [1], [3], [4], [10] and [12]	1998
FRANCE	PAYS DE LA LOIRE	160000	estimated using [1], [3], [4], [10] and [12]	1998
FRANCE	BRETAGNE	31000	estimated using [1], [3], [4], [10] and [12]	1998
FRANCE	POITOU-CHARENTES	78000	estimated using [1], [3], [4], [10] and [12]	1998
FRANCE	AQUITAINE	260000	estimated using [1], [3], [4], [10] and [12]	1998
FRANCE	MIDI-PYRENEES	280000	[10]	1991
FRANCE	LIMOUSIN	10000	estimated using [1], [3], [4], [10] and [12]	1998
FRANCE	RHONE-ALPES	160000	estimated using [1], [3], [4], [10] and [12]	1998
FRANCE	AUVERGNE	30000	estimated using [1], [3], [4], [10] and [12]	1998
FRANCE	LANGUEDOC-	148000	[10]	1991

COUNTRY	ADMINISTRATIVE UNIT	IRRIGATED AREA (HA)	SOURCE	YEAR
FRANCE	ROUSSILLON			
FRANCE	PROVENCE-ALPES-COTE D'AZUR	170000	[10]	1991
FRANCE	CORSE	40000	[4]	1998
FRANCE	**FRANCE**	**2000000**	**[3]**	**1998**
GERMANY	BADEN-WÜRTEMBERG	20000	[11]	1995
GERMANY	BAYERN	35000	[11]	1995
GERMANY	BRANDENBURG	20200	[11]	1995
GERMANY	BREMEN	0	[11]	1995
GERMANY	HAMBURG	0	[11]	1995
GERMANY	HESSEN	45000	[11]	1995
GERMANY	MECKLENBURG	12500	[11]	1995
GERMANY	NIEDERSACHSEN	233500	[11]	1995
GERMANY	NORDRHEIN-WESTFALEN	35000	[11]	1995
GERMANY	RHEINLAND-PFALZ	25800	[11]	1995
GERMANY	SAARLAND	170	[11]	1995
GERMANY	SACHSEN	26600	[11]	1995
GERMANY	SACHSEN-ANHALT	56900	[11]	1995
GERMANY	SCHLESWIG-HOLSTEIN	5450	[11]	1995
GERMANY	THÜRINGEN	15000	[11]	1995
GERMANY	**GERMANY**	**531120**	**[11]**	**1995**
GREECE	**GREECE**	**1422000**	**[3]**	**1998**
HUNGARY	**HUNGARY**	**210000**	**[3]**	**1995**
ICELAND	**ICELAND**	**0**	**[3]**	**1995**
IRELAND	**IRELAND**	**0**	**[3]**	**1995**
ITALY	PIEMONTE	373071	estimated using [3] and [13]	1998
ITALY	VALLE D'AOSTA	11074	estimated using [3] and [13]	1998
ITALY	LIGURIA	11055	estimated using [3] and [13]	1998
ITALY	LOMBARDIA	588652	estimated using [3] and [13]	1998
ITALY	TRENTINO-ALTO ADIGE	32365	estimated using [3] and [13]	1998
ITALY	VENETO	351642	estimated using [3] and [13]	1998
ITALY	FRIULI-VENEZIA GIULIA	57800	estimated using [3] and [13]	1998
ITALY	EMILIA-ROMAGNA	232362	estimated using [3] and [13]	1998
ITALY	TOSCANA	80248	estimated using [3] and [13]	1998
ITALY	UMBRIA	38174	estimated using [3] and [13]	1998
ITALY	MARCHE	41383	estimated using [3] and [13]	1998
ITALY	LAZIO	117426	estimated using [3] and [13]	1998
ITALY	ABRUZZI	44813	estimated using [3] and [13]	1998
ITALY	MOLISE	6998	estimated using [3] and [13]	1998
ITALY	CAMPANIA	107062	estimated using [3] and [13]	1998
ITALY	PUGLIA	218790	estimated using [3] and [13]	1998
ITALY	BASILICATA	50705	estimated using [3] and [13]	1998
ITALY	CALABRIA	81142	estimated using [3] and [13]	1998
ITALY	SICILIA	189947	estimated using [3] and [13]	1998
ITALY	SARDEGNA	63291	estimated using [3] and [13]	1998
ITALY	**ITALY**	**2698000**	**[3]**	**1998**
LATVIA	**LATVIA**	**20000**	**[2]**	**1995**
LIECHTENSTEIN	**LIECHTENSTEIN**	**0**	**[3]**	**1995**

COUNTRY	ADMINISTRATIVE UNIT	IRRIGATED AREA (HA)	SOURCE	YEAR
LITHUANIA	**LITHUANIA**	**9000**	**[3]**	**1995**
LUXEMBOURG	**LUXEMBOURG**	**0**	**[3]**	**1995**
MACEDONIA	**MACEDONIA**	**55000**	**[3]**	**1998**
MALTA	**MALTA**	**2000**	**[3]**	**1996**
MONACO	**MONACO**	**0**	**[3]**	**1995**
MOLDOVA REP	**MOLDOVA REP**	**307000**	**[3]**	**1998**
NETHERLANDS	**NETHERLANDS**	**565000**	**[3]**	**1995**
NORWAY	**NORWAY**	**127000**	**[3]**	**1995**
POLAND	**POLAND**	**100000**	**[3]**	**1995**
PORTUGAL	NORTE	240117	estimated using [3] and [13]	1990, 1995
PORTUGAL	CENTRO	193462	estimated using [3] and [13]	1990, 1995
PORTUGAL	LISBAO E VALE DO TEJO	122821	estimated using [3] and [13]	1990, 1995
PORTUGAL	ALENTEJO	50076	estimated using [3] and [13]	1990, 1995
PORTUGAL	ALGARVE	19438	estimated using [3] and [13]	1990, 1995
PORTUGAL	AZORES	0	estimated using [3] and [13]	1990, 1995
PORTUGAL	MADEIRA	6086	estimated using [3] and [13]	1990, 1995
PORTUGAL	**PORTUGAL**	**632000**	**[3]**	**1995**
ROMANIA	**ROMANIA**	**2880000**	**[3]**	**1998**
RUSSIA	NENETSKIY AVTONOMNYY OKRUG	0	[5]	1997
RUSSIA	MURMANSKAYA OBLAST'	0	[5]	1997
RUSSIA	KALININGRADSKAJA OBLAST	2000	[5]	1997
RUSSIA	LENINGRADSKAJA OBLAST	25000	[5]	1997
RUSSIA	IVANOVSKAYA OBLAST'	9000	[5]	1997
RUSSIA	KALUZHSKAYA OBLAST'	18000	[5]	1997
RUSSIA	KOSTROMSKAYA OBLAST'	3000	[5]	1997
RUSSIA	LIPETSKAYA OBLAST'	58000	[5]	1997
RUSSIA	RESPUBLIKA MORDOVIYA	45000	[5]	1997
RUSSIA	MOSKOVSKAYA OBLAST'	143000	[5]	1997
RUSSIA	NIZHEGORODSKAYA OBLAST'	26000	[5]	1997
RUSSIA	ORLOVSKAYA OBLAST'	7000	[5]	1997
RUSSIA	PENZENSKAYA OBLAST'	68000	[5]	1997
RUSSIA	RYAZANSKAYA OBLAST'	34000	[5]	1997
RUSSIA	TAMBOVSKAYA OBLAST'	53000	[5]	1997
RUSSIA	TUL'SKAYA OBLAST'	20000	[5]	1997
RUSSIA	TVERSKAYA OBLAST'	6000	[5]	1997
RUSSIA	VLADIMIRSKAYA OBLAST'	34000	[5]	1997

COUNTRY	ADMINISTRATIVE UNIT	IRRIGATED AREA (HA)	SOURCE	YEAR
RUSSIA	YAROSLAVSKAYA OBLAST'	8000	[5]	1997
RUSSIA	VOLOGODSKAYA OBLAST'	4000	[5]	1997
RUSSIA	NOVGORODSKAYA OBLAST'	2000	[5]	1997
RUSSIA	BRYANSKAYA OBLAST'	6000	[5]	1997
RUSSIA	PSKOVSKAYA OBLAST'	3000	[5]	1997
RUSSIA	RESPUBLIKA BASHKORTOSTAN	65000	[5]	1997
RUSSIA	CHUVASHSKAYA RESPUBLIKA	24000	[5]	1997
RUSSIA	KOMI-PERMYATSKIY AVTON. OKRUG	0	[5]	1997
RUSSIA	KIROVSKAYA OBLAST'	8000	[5]	1997
RUSSIA	RESPUBLIKA MARIY-EL	15000	[5]	1997
RUSSIA	ORENBURGSKAYA OBLAST'	88000	[5]	1997
RUSSIA	PERMSKAYA OBLAST'	17000	[5]	1997
RUSSIA	SAMARSKAYA OBLAST'	179000	[5]	1997
RUSSIA	RESPUBLIKA TATARSTAN	169000	[5]	1997
RUSSIA	UDMURTSKAYA RESPUBLIKA	22000	[5]	1997
RUSSIA	UL'YANOVSKAYA OBLAST'	28000	[5]	1997
RUSSIA	ARKHANGEL'SKAYA OBLAST'	1000	[5]	1997
RUSSIA	RESPUBLIKA KOMI	0	[5]	1997
RUSSIA	RESPUBLIKA KARELIYA	0	[5]	1997
RUSSIA	RESPUBLIKA ADYGEYA	27000	[5]	1997
RUSSIA	ASTRAKHANSKAYA OBLAST'	230000	[5]	1997
RUSSIA	CHECHENSKAYA RESPUBLIKA	77000	[5]	1997
RUSSIA	RESPUBLIKA DAGESTAN	387000	[5]	1997
RUSSIA	INGUSHSKAYA RESPUBLIKA	23000	[5]	1997
RUSSIA	KABARDINO-BALKARSKAYA RESP.	130000	[5]	1997
RUSSIA	KARACHAYEVO-CHERKESSKAYA RESP.	20000	[5]	1997
RUSSIA	KALMYKIYA-KHAL'MG TANGCH	54000	[5]	1997
RUSSIA	KRASNODARSKIY KRAY	396000	[5]	1997

COUNTRY	ADMINISTRATIVE UNIT	IRRIGATED AREA (HA)	SOURCE	YEAR
RUSSIA	RESPUBLIKA SEVERNAYA OSETIYA	0	[5]	1997
RUSSIA	SARATOVSKAYA OBLAST'	258000	[5]	1997
RUSSIA	STAVROPOL'SKIY KRAY	385000	[5]	1997
RUSSIA	VOLGOGRADSKAYA OBLAST'	289000	[5]	1997
RUSSIA	KURSKAYA OBLAST'	45000	[5]	1997
RUSSIA	BELGORODSKAYA OBLAST'	57000	[5]	1997
RUSSIA	VORONEZHSKAYA OBLAST'	90000	[5]	1997
RUSSIA	ROSTOVSKAYA OBLAST'	325000	[5]	1997
RUSSIA (EUROP. PART)	**RUSSIA (EUROP. PART)**	**3983000**	**[5]**	**1997**
SAN MARINO	**SAN MARINO**	**0**	**[3]**	**1995**
SERBIA	**SERBIA**	**57000**	**[3]**	**1998**
SLOVAKIA	**SLOVAKIA**	**174000**	**[3]**	**1998**
SLOVENIA	**SLOVENIA**	**2000**	**[3]**	**1995**
SPAIN	GALICIA	70644	[6] + [9]	1989, 1999
SPAIN	ASTURIAS	5673	[6] + [9]	1989, 1999
SPAIN	CANTABRIA	982	[6] + [9]	1989, 1999
SPAIN	PAIS VASCO	12396	[6] + [9]	1989, 1999
SPAIN	NAVARRA	72891	[6] + [9]	1989, 1999
SPAIN	LA RIOJA	41613	[6] + [9]	1989, 1999
SPAIN	ARAGON	417204	[6] + [9]	1989, 1999
SPAIN	MADRID	27607	[6] + [9]	1989, 1999
SPAIN	CASTILLA Y LEON	468051	[6] + [9]	1989, 1999
SPAIN	CASTILLA LA MANCHA	440605	[6] + [9]	1989, 1999
SPAIN	EXTREMADURA	214306	[6] + [9]	1989, 1999
SPAIN	CATALUNA	269930	[6] + [9]	1989, 1999
SPAIN	VALENCIANA	277909	[6] + [9]	1989, 1999
SPAIN	ISLES BALEARES	24007	[6] + [9]	1989, 1999
SPAIN	ANDALUCIA	744809	[6] + [9]	1989, 1999
SPAIN	MURCIA	162039	[6] + [9]	1989, 1999
SPAIN	ISLES CANARIAS	17640	[6] + [9]	1989, 1999
SPAIN	**SPAIN**	**3268306**	**[6]**	**1999**
SVALBARD	**SVALBARD AND JAN MAYEN**	**0**	**[3]**	**1995**
SWEDEN	**SWEDEN**	**115000**	**[3]**	**1995**
SWITZERLAND	**SWITZERLAND**	**25000**	**[3]**	**1995**
TURKEY	**TURKEY**	**4185910**	**[2]**	**1994**
KINGDOM	**UNITED KINGDOM**	**142687**	**[8]**	**1990, 1992 1995**
UKRAINE	**UKRAINE**	**2454000**	**[3]**	**1998**

References:

[1]: European Environmental Agency (2000): "CORINE LAND COVER OF EUROPE", Copenhagen, Denmark, (http://natlan.eea.eu.int)

[2]: FAO (2000):"AQUASTAT", Rome, (http://www.fao.org/ag/AGL/AGLW/aquastat/aquastat.htm)
[3]: FAO (2000):"FAOSTAT", Rome, (http://aps.fao.org/)
[4]: Framji, K., Garg, B., Luthra, S. (1981): "Irrigation and Drainage in the World", Volume I, New Delhi
[5]: Goscomstat (1998): "Environment Protection in Russia", Moscow
[6]: Instituto Nacional de Estadistica (INE): "INEBASE", (http://www.ine.es)
[7]: Janetschek, H. (1992): Wirtschaftlichkeit der Feldberegnung auf der Hochterrasse des Marchfeldes. Report 68, Bundesanstalt für Agrarwirtschaft, Vienna.
[8]: Ministry of Agriculture, Fisheries and Food (MAFF) (1997): "Survey of irrigation of outdoor crops in 1995" (http://www.maff.gov.uk), mean value for years 1990, 1992 and 1995
[9]: Censo Agrario 1989 (1991), Resultados nacionales por comunidades autonomas y provincias, Madrid
[10]: Reparaz, A. (1993): "Irrigation et agriculture irriguee dans les regions mediterraneennes francaises" in Popp, H., Rother, K.: "Die Bewässerungsgebiete im Mittelmeerraum", Uni Passau
[11]: Roth, D., Eggers, Th.,Seeßelberg, F., Albrecht, M. (1995): "Status of Sprinkler Irrigation in Germany – an analysis of the Federal Sprinkler Irrigation Association" in "Zeitschrift für Bewässerungswirtschaft, 2/95, p. 113-120
[12]: Roudié, P. (1987): "La France – Agriculture, Forêt, Pêche", p. 131, Paris
[13]: Thiede, G. (1990): "Landwirt in Europa", Frankfurt/M.

Appendix B4 Information sources for distributing the irrigated area within (sub-)national units of Europe

Country	Subject	Size of irrigated area known*	Data Type	Records	Priority	Source Info
ALBANIA	Location of irrigation projects	E	Point	18	10	Toepfer, H. (1993): "Die Bewässerungslandwirtschaft und Nahrungsmittelproduktion in Albanien" in Popp, H., Rother, K.: "Die Bewässerungsgebiete im Mittelmeerraum", p. 107, Passau
ALBANIA	Outlines of major irrigated areas	N	Polygon	14	9	Toepfer, H. (1993): "Die Bewässerungslandwirtschaft und Nahrungsmittelproduktion in Albanien" in Popp, H., Rother, K.: "Die Bewässerungsgebiete im Mittelmeerraum", p. 107, Passau
ANDORRA	Surface irrigation or rice growing	Y	Point	9	10	CORINE Database (2000), processed
AUSTRIA	Outlines of irrigated areas	Y	Polygon	2	10	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 25 + Janetschek, H. (1992): "Wirtschaftlichkeit der Feldberegnung auf der Hochterrasse des Marchfeldes", Österreichischer Agrarverlag Wien, p. 9
AUSTRIA	Outlines of major irrigated areas	N	Polygon	7	9	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 25
BELARUS	Outlines of major fruits and vegetable growing areas	N	Polygon	3	10	Statistisches Bundesamt (1994): "Länderbericht Weissrussland", Wiesbaden, p. 12
BELARUS	Polesye-Region	N	Polygon	1	10	According to FAO (1997): "Irrigation in the Countries of the former Soviet Union in Figures", Rome, p. 82 irrigation mainly in Polesye-Region
BELGIUM	Outlines of major vegetable growing areas	N	Polygon	4	10	Statistisches Bundesamt (1993): "Länderbericht Belgien", Wiesbaden, p. 12
BELGIUM	Most important shugar beet growing areas	N	Polygon	5	10	Statistisches Bundesamt (1993): "Länderbericht Belgien", Wiesbaden, p. 12
BOSNIA HERZEGOVINA	Shugar beet growing area	N	Polygon	1	10	Statistisches Bundesamt (1990): "Länderbericht Jugoslawien", Wiesbaden, p. 10
BULGARIA	Surface irrigation or rice growing	Y	Point	6352	10	CORINE Database (2000), processed
BULGARIA	Outlines of major irrigated areas	N	Polygon	27	9	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 17
CROATIA	Outlines of an irrigated area	N	Polygon	1	10	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, worldmap (coverage)
CYPRUS	Outlines of irrigated areas	N	Polygon	23	10	Statistisches Bundesamt (1991): "Länderbericht Zypern", Wiesbaden, p. 12
CZECH REPUBLIC	Outlines of major irrigated areas	N	Polygon	4	10	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 31
DENMARK	Agricultural areas	N	Polygon	1	10	CORINE Database (2000)
ESTONIA	Pastures in the N and E	N	Polygon	1	10	CORINE Database (2000)
ESTONIA	Cropping areas near urban centres	N	Polygon	1	10	CORINE Database (2000)
FINLAND	Important cropping areas	N	Polygon	15	10	CORINE Database (2000)
FRANCE	Surface irrigation or rice growing	Y	Point	586	10	CORINE Database (2000), processed

Country	Subject	Size of irrigated area known*	Data Type	Records	Priority	Source Info
FRANCE	Location of irrigation projects	Y	Point	16	9	Reparaz, A. (1993): "Irrigation et agriculture irriguee dans les regions mediterraneennes francaises" in Popp, H., Rother, K.: "Die Bewässerungsgebiete im Mittelmeerraum", Uni Passau
FRANCE	Location of irrigated areas	Y	Point	469	9	Roudié, P. (1987): “La France – Agriculture, Forêt, Pêche”, p. 131, Paris
FRANCE	Outlines of major irrigated areas along the mediterranean coast	N	Polygon	60	8	Reparaz, A. (1993): "Irrigation et agriculture irriguee dans les regions mediterraneennes francaises" in Popp, H., Rother, K.: "Die Bewässerungsgebiete im Mittelmeerraum", Uni Passau
FRANCE	Outlines of major irrigated areas	E	Polygon	5	8	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 20
FRANCE	Location of areas, in which more than 4.5 % of cultivated area are irrigated	N	Polygon	8	7	Roudié, P. (1987): “La France – Agriculture, Forêt, Pêche”, p. 131, Paris
GERMANY	Outlines of major irrigated areas in West Germany	Y	Polygon	2	10	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 18
GERMANY	Outlines of major irrigated areas in Nordrhein-Westfalen	Y	Polygon	7	10	Erlenbach, K.H. (1984): "Feldberegnung in Nordrhein-Westfalen" in Zeitschrift f. Bewässerungswirtschaft, 1/84, p. 30-46, DLG-Verlag Frankfurt/M.
GERMANY	Outlines of major irrigated areas in East Germany	N	Polygon	27	9	Framji, K.K. u.a. (1981-83): " Irrigation and Drainage in the World", p. 395, Intern. Commission on Irrigation and Drainage, New Delhi
GERMANY	Outlines of major irrigated areas in West Germany	N	Polygon	15	9	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 18
GERMANY	Outlines of major irrigated areas in Bavaria	N	Polygon	8	9	Borchert, H., Breuch-Moritz M. (1985): "Feldberegnung in Bayern" in Zeitschrift f. Bewässerungswirtschaft, 1/85, p. 15-37, DLG-Verlag Frankfurt/M.
GERMANY	Outlines of major irrigated areas in Hessen	N	Polygon	2	9	Herrmann, E. W. (1985): "Entwicklung und Stand der Feldberegnung in Hessen" in Zeitschrift f. Bewässerungswirtschaft, 1/85, p. 38-54, DLG-Verlag Frankfurt/M.
GREECE	Surface irrigation or rice growing	Y	Point	9502	10	CORINE Database (2000), processed
GREECE	Outlines of major irrigated areas	Y	Polygon	2	9	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 21
GREECE	Outlines of major irrigated areas	N	Polygon	1	8	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 21
GREECE	Outlines of major public irrigation schemes	N	Polygon	28	8	Sauerwein, F. (1993): "Der Bewässerungsfeldbau in Griechenland - Entwicklung, Formen und Probleme" in Popp, H., Rother, K.: "Die Bewässerungsgebiete im Mittelmeerraum", p. 113-117, Passau
GREECE	CORINE classes 12, 15, 16, 19, 20; clipped with existing irrigated areas	N	Polygon	1	7	CORINE Database (2000)
HUNGARY	Surface irrigation or rice growing	Y	Point	242	10	CORINE Database (2000), processed
HUNGARY	Outlines of major irrigated areas	N	Polygon	25	9	Jaksch, T. et. al. (1996): "Landnutzung in Mittel- und Osteuropa", p. 178, Budapest
HUNGARY	Outlines of major irrigated areas	N	Polygon	14	8	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 32

Country	Subject	Size of irrigated area known*	Data Type	Records	Priority	Source Info
ITALY	Surface irrigation or rice growing	Y	Point	12059	10	CORINE Database (2000), processed
ITALY	Location of irrigation projects	E	Point	482	9	Wagner, H. (1993): "Die Bewässerungslandwirtschaft in den italienischen Regionen Latium, Abruzzen, Molise und Kampanien 1991" in Popp, H., Rother, K.: "Die Bewässerungsgebiete im Mittelmeerraum", p. 87-92, Uni Passau
ITALY	Outlines of major irrigated areas	N	Polygon	26	8	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 23
ITALY	Outlines of major irrigated areas	N	Polygon	96	8	Wagner, H. (1993): "Die Bewässerungslandwirtschaft in den italienischen Regionen Latium, Abruzzen, Molise und Kampanien 1991" in Popp, H., Rother, K.: "Die Bewässerungsgebiete im Mittelmeerraum", p. 87-92, Passau
ITALY	Outlines of major irrigated areas	N	Polygon	134	8	Rother, K. (1993): "Die Bewässerungsgebiete des fernsten Italiens" in Popp, H., Rother, K.: "Die Bewässerungsgebiete im Mittelmeerraum", p. 93-103, Passau
LATVIA	Agricultural areas in the districts Bauska, Jelgava and Riga (Zemgales plain)	N	Polygon	1	10	according to FAO (1997): "Irrig. in the countries of the former Soviet Union in Figures", Rome, irrigation is located mainly in the districts Bauska, Jelgava and Riga (Zemgales plain)
LITHUANIA	own estimate	N	Polygon	2	10	own estimate
LITHUANIA	Nemunas delta	N	Polygon	2	10	according to FAO (1997): "Irrig. in the countries of the former Soviet Union in Figures", Rome, irrigation is located in the Nemunas delta
MACEDONIA	Outlines of an irrigated area	N	Polygon	1	10	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, worldmap (coverage)
MALTA	Island Gozzo, 40 ha irrig. area per cropping season on Gozzo	Y	Polygon	1	10	Statistisches Bundesamt (1992): "Länderbericht Malta", p. 38
MALTA	Outlines of whole island	Y	Polygon	1	10	Statistisches Bundesamt (1992): "Länderbericht Malta", p. 38
MOLDOVA REP	Outlines of major irrigated areas	N	Polygon	153	10	Catrinescu, V., Calasnic, A., Melian, R. (1999): " Irrigation in Moldova" in EWRG Letter 7 (1-99), European Regional Working Group of the ICID
NETHERLANDS	Most important vegetable growing areas, shugar-beet growing areas in the E and the S	N	Polygon	4	10	Statistisches Bundesamt (1993): "Länderbericht Niederlande", p. 13, main part of irrigated areas in the east and the south (Achtnich, Framji)
NORWAY	Location of main agricultural areas	N	Polygon	12	10	main irrigation areas in the south near the coastline and in big river valleys (Achtnich), map of agricultural areas in Statistisches Bundesamt (1991): "Länderbericht Norwegen", p. 12,
POLAND	Surface irrigation or rice growing	Y	Point	8	10	CORINE Database (2000), processed
POLAND	Outlines of major irrigated areas	N	Polygon	13	9	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 26
PORTUGAL	Surface irrigation or rice growing	Y	Point	2439	10	CORINE Database (2000), processed
PORTUGAL	Outlines of major irrigated areas	N	Polygon	22	9	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 27
PORTUGAL	Outlines of major public irrigation schemes	N	Polygon	44	9	Freund, B. (1993): "Entwicklung und Perspektiven der Bewässerungswirtschaft in Portugal" in Popp, H., Rother, K. (1993): "Die Bewässerungsgebiete im Mittelmeerraum", p. 13, Passau

Country	Subject	Size of irrigated area known*	Data Type	Records	Priority	Source Info
PORTUGAL	Outlines of major irrigated areas	N	Polygon	3	9	Framji, K.K. et. al. (1981-83): " Irrigation and Drainage in the World", p. 1132, Intern. Commission on Irrigation and Drainage, New Delhi
PORTUGAL	Outlines of the island Madeira (97% of the cropping area irrigated)	N	Polygon	1	9	Thiede, G. (1990): "Landwirt in Europa", p. 244, Frankfurt/M.
ROMANIA	Surface irrigation or rice growing	Y	Point	1094	10	CORINE Database (2000), processed
ROMANIA	Outlines of major irrigated areas	N	Polygon	22	9	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 28
RUSSIA	Outlines of major irrigated areas in S-Russia	N	Polygon	40	10	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 35
RUSSIA	Area near Petrograd	N	Polygon	2	10	according to Jaksch, T. et. al. (1996) "Landnutzung in Mittel- und Osteuropa", p. 242, 63% of crop. area near Petrograd irrigated
RUSSIA	Nemunas Basin	N	Point	2	9	according to FAO (1997): "Irrig. in the countries of the former Soviet Union in Figures", Rome, there is irrigation located in the Nemunas Basin
SERBIA	Surface irrigation or rice growing	Y	Point	21	10	CORINE Database (2000), processed
SERBIA	Outlines of an irrigated area	N	Polygon	2	9	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, worldmap (coverage)
SLOVAKIA	Outlines of major irrigated areas	N	Polygon	6	10	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 31
SLOVAKIA	Planned irrigated areas	N	Polygon	22	9	Framji et al (1981): "Irrigation and Drainage in the World", Vol. I, p. 304, New Delhi
SLOVENIA	Surface irrigation or rice growing	Y	Point	17	10	CORINE Database (2000), processed
SLOVENIA	Vine, fuit and vegetable growing areas	N	Polygon	2	9	Statistisches Bundesamt (1995): "Länderbericht Slowenien", p. 12
SPAIN	Surface irrigation or rice growing	Y	Point	52122	10	CORINE Database (2000), processed
SPAIN	Outlines of major irrigated areas	N	Polygon	41	9	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 30
SPAIN	Outlines of major irrigated areas	N	Polygon	2	9	Müller, A. (1993): "Die Ausweitung des Bewässerungsfeldbaus in Castilla-Leon. Oekologische und oekonomische Probleme" in Popp,H., Rother, K. (1993): "Die Bewässerungsgebiete im Mittelmeerraum", Passau
SWEDEN	Location of most important agricultural areas	N	Polygon	11	10	Statistisches Bundesamt (1994): "Länderbericht Schweden", p. 12
SWITZERLAND	Outlines of major irrigated areas	N	Polygon	8	10	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 29
SWITZERLAND	Outlines of major irrigated areas	N	Polygon	2	10	Framji, K.K. et. al. (1981-83): " Irrigation and Drainage in the World", p. 1306, Intern. Commission on Irrigation and Drainage, New Delhi
TURKEY	Surface irrigation or rice growing	Y	Point	216	10	CORINE Database (2000), processed
TURKEY	Outlines of the irrigated areas in the GAP Region	Y	Polygon	18	9	Struck,E. (1993): "Sozialgeographische und geopolitische Aspekte des Südost-Anatolien-Projektes (GAP)" in Popp. H., Rother, K. (1993): "Die Bewässerungsgebiete im Mittelmeerraum", p. 119, Passau
TURKEY	Location of irrigation projects	Y	Point	89	9	Republic of Turkey, Ministry of Energy and Natural Resources (1997): "Dams and

Country	Subject	Size of irrigated area known*	Data Type	Records	Priority	Source Info
						Hydroelectric Power Plants in Turkey", Ankara
TURKEY	Outlines of major irrigated areas	Y	Polygon	2	9	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 59 + Republic of Turkey, Ministry of Energy and Natural Resources (1997): "Dams and Hydroelectric Plants in Turkey", Ankara
TURKEY	Outlines of major irrigated areas	N	Polygon	28	8	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 59
UKRAINE	Outlines of major irrigated areas	N	Polygon	21	10	Achtnich, W. (1980): "Bewässerungslandbau", Ulmer, Stuttgart, p. 34
UNITED KINGDOM	Areas with major irrigation water use	N	Polygon	7	10	Knox, J.W. et al. (1997): "Mapping the total volumetric irrigation water requirements in England and Wales" in Agricultural Water Management 33 (1997) p. 1 - 18

* Y = yes, N = no, E = estimated