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The Global Map of Irrigation Areas

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Introduction

Agriculture accounts for about 70% of all water withdrawn worldwide from rivers and aquifers. Although globally only 18% of the cultivated area is irrigated, 40% of the global food production comes from irrigated agriculture.


Irrigated and non-irrigated areas in the Indus valley, Northern India

To conduct global studies related to water use, land cover, food production or the impact of climate change it is often necessary to know where irrigation is practiced. The first version of a digital global map of irrigation areas (Döll and Siebert, 1999)[1] was updated and improved several times.


Irrigation of a field in Crete, Greece

Here we present map version 4.0 that shows the percentage of each 5 arc minute by 5 arc minute grid cell (about 86 km² at the equator) that was equipped for irrigation around the year 2000.


Irrigation equipment in the semi-arid Northeast of Brazil

Data and Methods

Irrigation statistics for 26 909 sub-national statistical units (Fig. 1) from national census surveys and from reports of FAO and other international organizations were combined to geospatial information on the position and extent of irrigation areas extracted from hundreds of irrigation maps or digital atlases, maps and inventories that were often based on remote sensing (Fig. 2). For most of the countries, more than one data source was used. As the relevance and reliability of the maps varies, it was necessary to decide which geospatial record should be used in a specific sub-national unit. This was realized by applying a priority level to each record (Fig. 3). Only if the extent of all digitized irrigated areas with the highest priority level was smaller than the total irrigated area reported for the specific sub-national unit, also records with the second highest priority were considered. This distribution process was repeated down to the next lower priority level until the sum of irrigated area in the map was equal to the irrigated area in the sub-national statistics (Fig. 4).

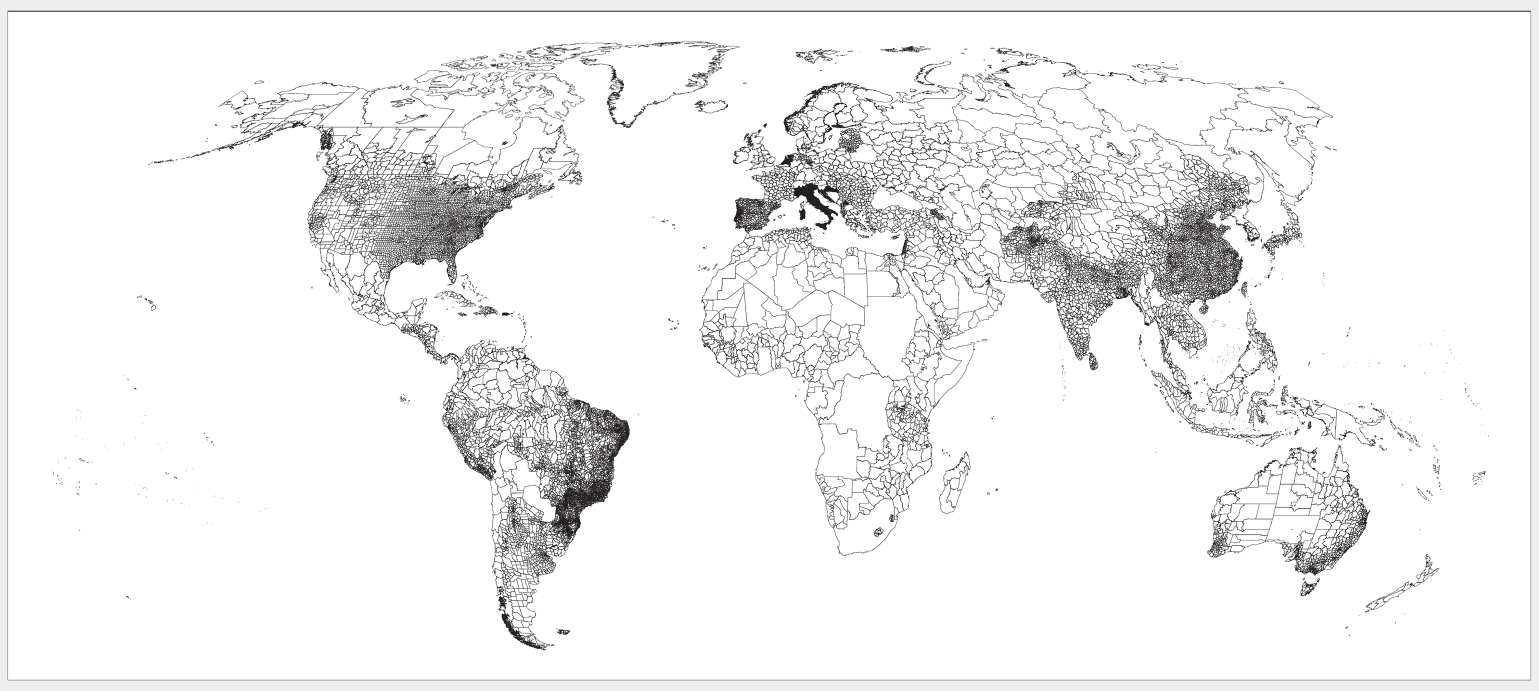


Fig. 1: Location and extent of sub-national units with information on area equipped for irrigation (or areas actually irrigated)

Priority	Geographical Data Type
10	Point records (irrigation projects) with known command area
	Point records without known command area
	Polygon records (outlines of large irrigated areas) with known command area
	Polygon records without command area
	Any other, less reliable records
1	Areas potentially irrigated as derived from global landcover maps

Fig. 3: Priority levels assigned to geo-spatial information

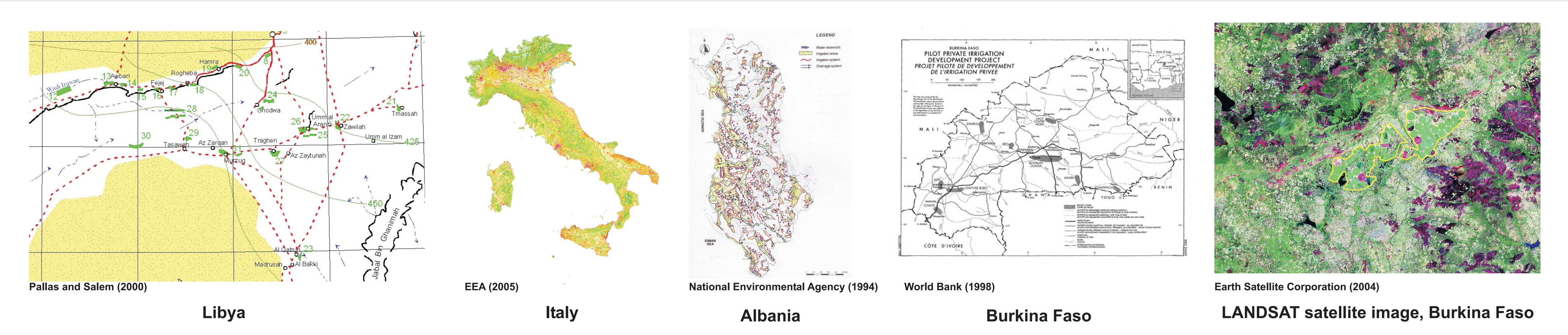


Fig. 2: Examples of input data

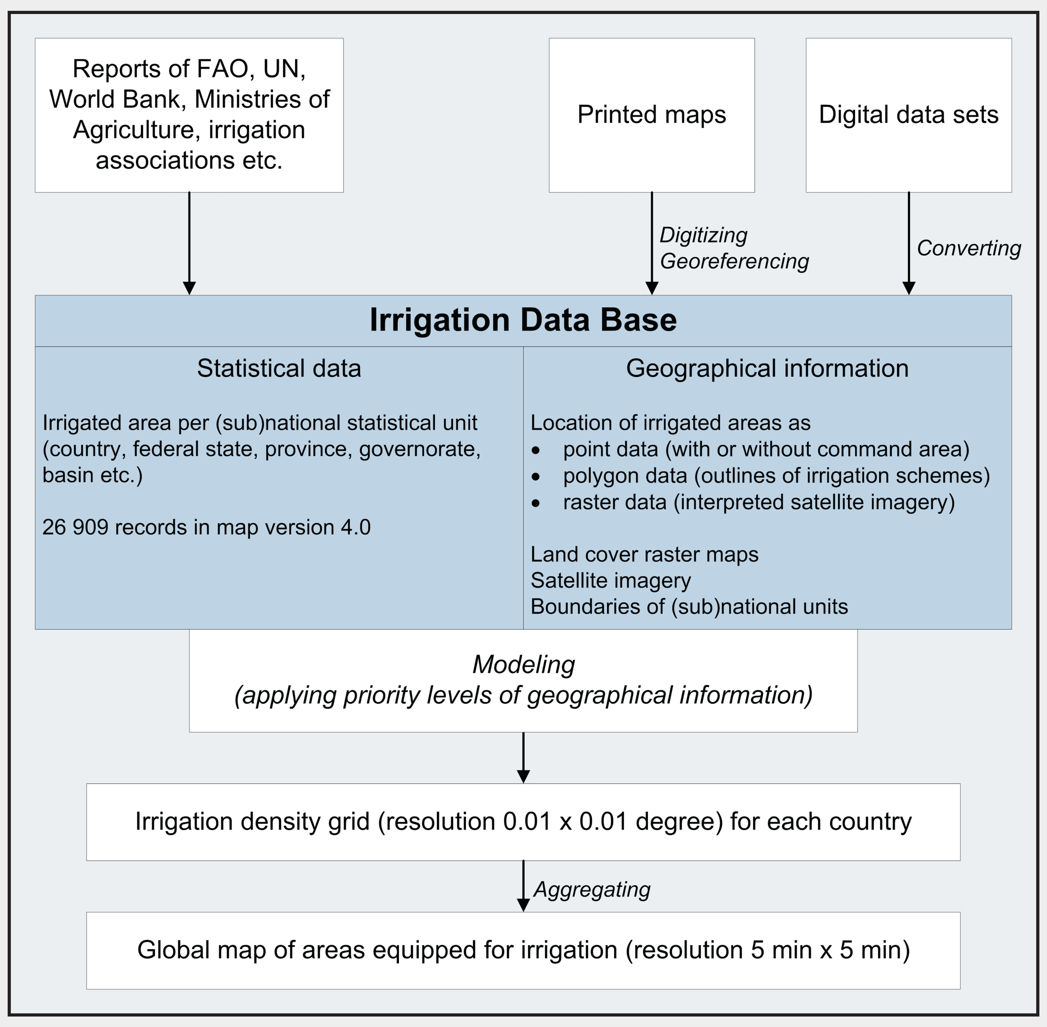
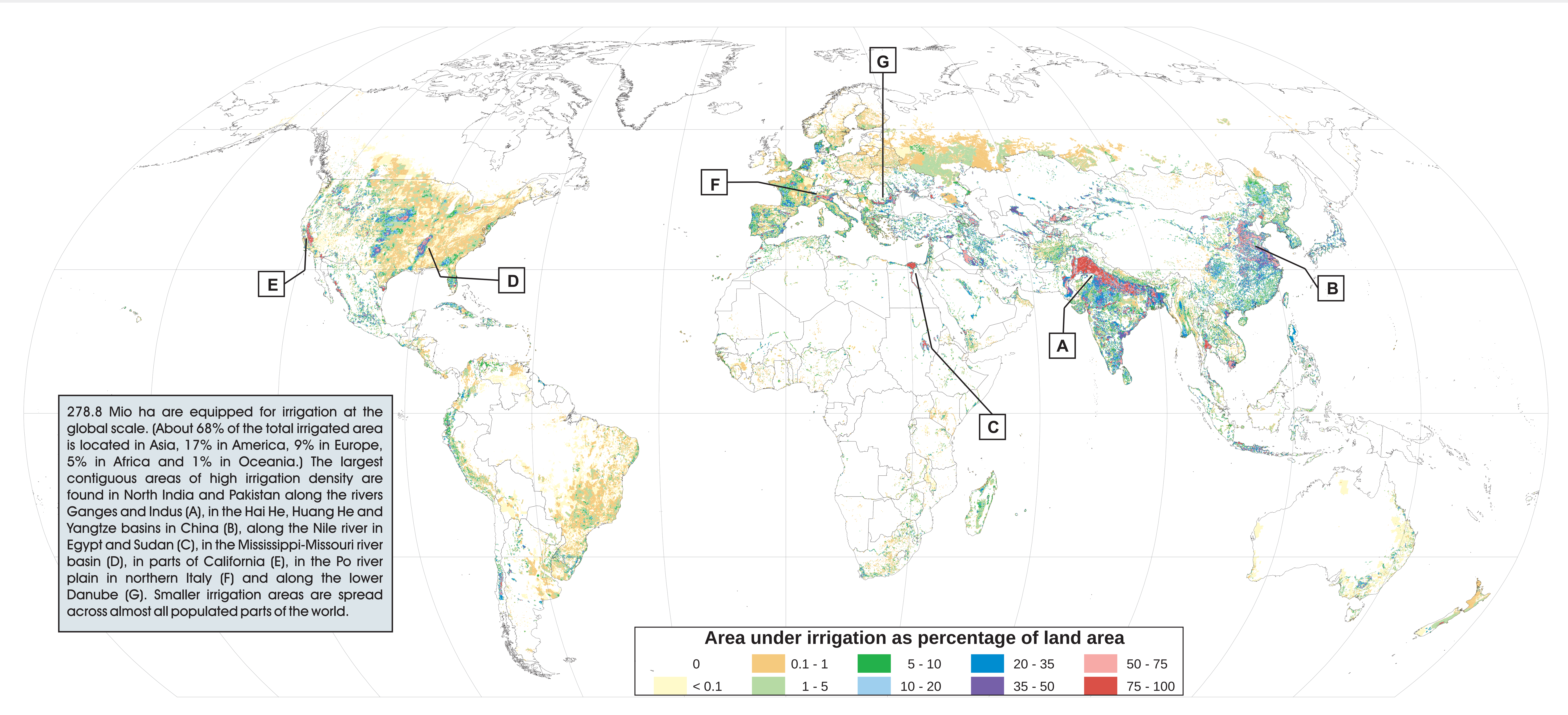


Fig. 4: Scheme of mapping methodology

Global Map of Irrigation Areas Version 4



278.8 Mio ha are equipped for irrigation at the global scale. (About 68% of the total irrigated area is located in Asia, 17% in America, 9% in Europe, 5% in Africa and 1% in Oceania.) The largest contiguous areas of high irrigation density are found in North India and Pakistan along the rivers Ganges and Indus (A), in the Hai He, Huang He and Yangtze basins in China (B), along the Nile river in Egypt and Sudan (C), in the Mississippi-Missouri river basin (D), in parts of California (E), in the Po river plain in northern Italy (F) and along the lower Danube (G). Smaller irrigation areas are spread across almost all populated parts of the world.

Discussion

Two indicators quantifying the density of the used sub-national irrigation statistics and the density of the available geospatial records on position and extent of irrigated areas were computed to assess the quality of the global irrigation map (Siebert et al., 2005)[2]. Marks derived from the two indicators were combined to obtain a mark for the overall map quality for each country (Fig. 5). While the density of information was taken into account that way, lack of information made it impossible to assess the reliability of the input information systematically. This is the major source of uncertainty. However, map quality for a country was downgraded when it was found that sub-national statistics coming from different sources disagreed, when statistics were found to be incomplete or when geospatial information was found to be out of date.

References:
1) Döll, P., Siebert, S. (2000): A digital global map of irrigated areas. ICID Journal, 49(2), 55-66.
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3) Thenkabail, P. S., Biradar, C. M., Turral, H., Noojipady, P., Li, Y. J., Vithanage, J., Dheeravath, V., Velpuri, M., Schull, M., Cai, X. L., Dutta, R. (2006): An Irrigated Area Map of the World (1999) Derived from Remote Sensing. Research Report 105, International Water Management Institute (IWMI), Colombo, Sri Lanka, 62 pp.

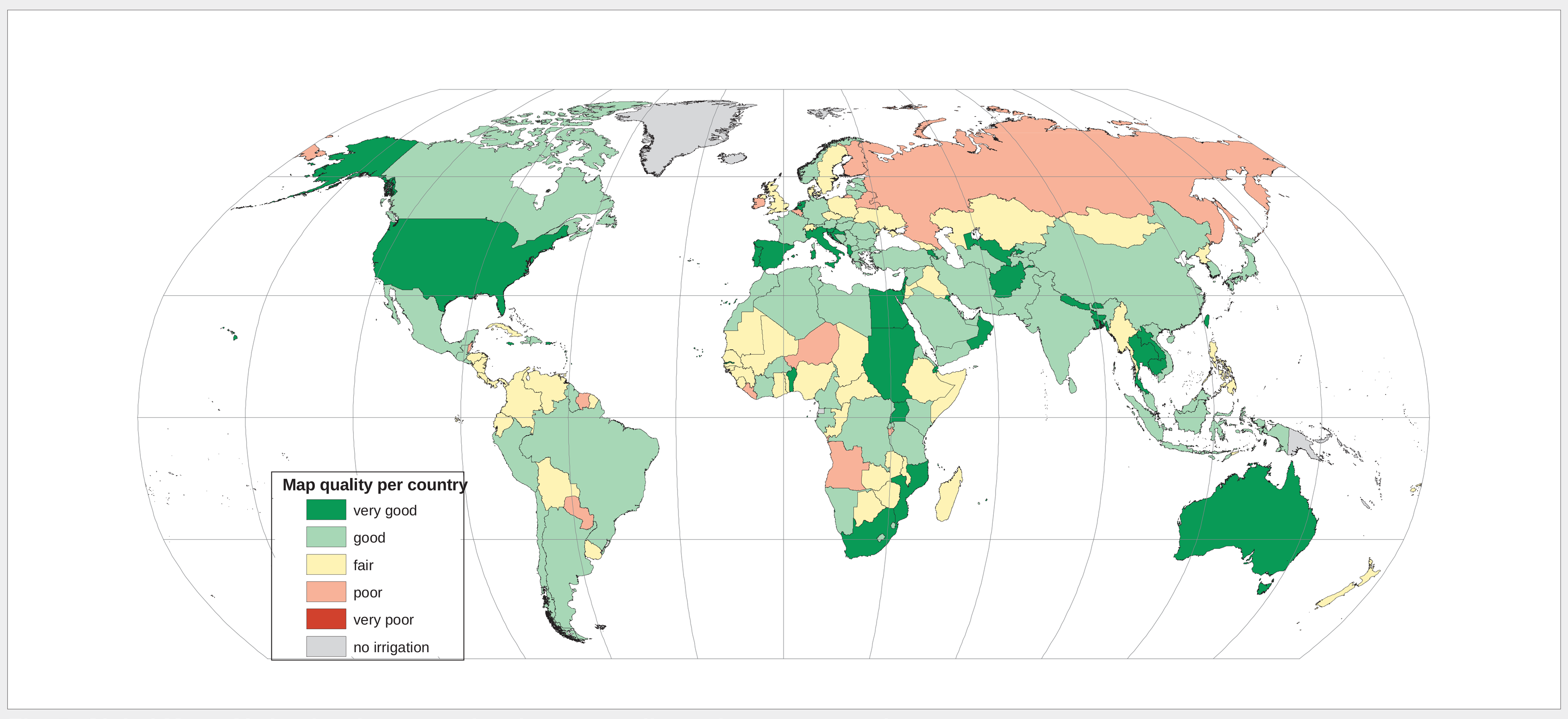

Fig. 5: Global Map of Irrigation Areas version 4 - map quality at the country scale

At the global scale, the overall map quality is good, but there are large regional differences of map quality. At the level of world regions, map quality in North America (overall mark 1.03), Southern Europe (1.35), Oceania (1.44), Northern Africa (1.46), Southern Africa (1.50) and Central Asia (1.63) is best. Western Africa (2.90) and the Russian Federation (4.00) have the worst map quality. About 65 Mio ha of areas equipped for irrigation are located in countries where map quality is estimated to be very good, 187 Mio ha in countries with good map quality, 21 Mio ha in countries with fair map quality and 5 Mio ha in countries with poor map quality. Map regions of very poor map quality do not exist anymore at the country scale. Consequently about 90% of the total irrigated area of the world is located in countries where the map quality is assessed to be very good or good. It was found that remote sensing based inventories report higher values for the global extent of irrigated land[3] and that there is a need for a systematic comparison of the different data sets.

http://www.fao.org/ag/agl/aglw/aquastat/irrigationmap/index.stm