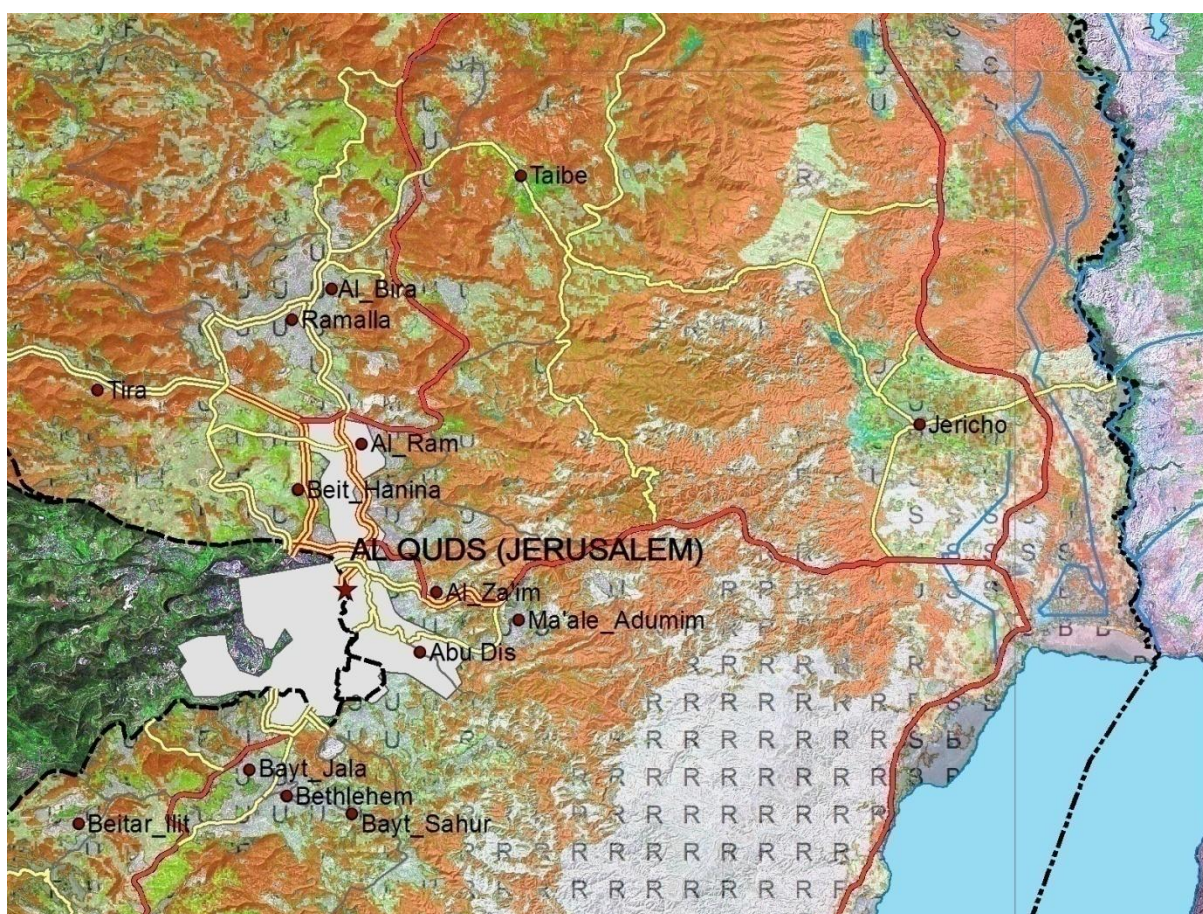# CLIMATE CHANGE, DROUGHT AND POTENTIAL FOR WATER HARVESTING IN THE OCCUPIED PALESTINIAN TERRITORY

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1. INTRODUCTION

The eastern Mediterranean region is, according to the 4th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) and several follow-up studies, likely to be one of the most severely affected by climate change in the world. Predictions from General Climate Models (GCM) are for lower precipitation, increase in precipitation variability leading to more extreme events and more droughts, and of course higher temperatures, resulting into severe stress on already scarce water resources.

On 7-8 September 2009 a WFP delegation discussed with ICARDA the potential for collaboration on climate change mapping at both the Regional (Cairo) and Country Office (oPT) level. As a result of these these discussions, two proposals were formulated by ICARDA for mapping the potential impact of climate change and of water harvesting as a land management principle to adapt to climate change, variability and drought.

These proposals were accepted and led to two projects, of which the first one focused on the characterization and mapping of climate change, precipitation variability and drought for several countries in the eastern Mediterranean within a relatively nearby future (2010-2040). The project has resulted into a set of 340 maps and a technical report "Climate and Drought Atlas for parts of the Near East: a baseline dataset for planning adaptation strategies to climate change".

The second project, targeting the occupied Palestinian Territory, has two components: (i) an analysis of climate change, trends and drought, and (ii) a mapping of land suitability for water harvesting. For the first component the project has benefited from the results of the regional study, using the downscaled climate change, trend and drought maps generated in this project. The unique aspect of the oPT project is therefore its focus on the possibilities for **adaptation to** climate change, variability and drought by assessing the suitability of the entire West Bank for different water harvesting systems. Most emphasis in this report is given towards the suitability assessment, whereas the results from the climate change and drought study are summarized in their impact on the oPT, with references on methodology to the regional study.

This report is constructed as an explanatory text to a set of 340 maps covering the oPT, related to climate change, precipitation and drought, and another set of 21 maps related to the potential of the West Bank for water harvesting. The climate maps are enlargements of the maps produced in the regional study for parts of West Asia.

From a technical perspective the maps can be subdivided into four main groups:
- maps that visualize the spatial extent of climate change through its key variables precipitation, maximum and minimum temperature (Maps 001-160). From these basic variables a number of derived variables were obtained of particular importance to evaluate changes in crop water demand and agricultural potential, such as potential evapotranspiration, aridity, climatic zones, and growing periods (Maps 161-198c).
- maps that show the spatial extent and intensity of historical drought or abnormally wet events during the period 1901-2007 (Maps 201-307)
- maps that show trends in precipitation and drought, as well as precipitation patterns during the period 1901-2007 (maps 308-340)

- maps that visualize suitability for 13 micro-catchment water harvesting systems and 1 general macro-catchment system (maps 351-371).

The structure of this report is very simple, with an explanation of the mapping methodologies used (Chapter 2), a summary of the observations contained in the maps as well as some initial conclusions (Chapter 3), references (Chapter 4) and several annexes.

2. METHODOLOGIES

2.1. CLIMATE CHANGE MAPPING

2.1.1. Climate change maps and planning: the limits of interpretation

When planning for a disaster or emergency, one has to know what kind of disaster or emergency to plan for, where it is likely to occur, whether it will be a slow motion process or instantaneous impact, and other characteristics. Planning adaptation strategies to climate change is notoriously difficult in the light of the uncertainties of climate change science. A much asked question is, if (depending on the season) we cannot trust a weather forecast one week ahead, how can we plan for futures 25, 50 even 100 years ahead? This is certainly a valid question and there is no easy answer to it.

Our decisions to adapt to some future with a changing climate, is guided by what in a criminal investigation would be called 'circumstantial evidence'. Each piece of evidence is in its own right insufficient to deduce that climate is changing, but a constantly growing number of studies from many scientific disciplines converge towards the inescapable conclusion that climate change is happening now, has happened numerous times in the history of the earth, and will happen again.

Global Circulation Models (GCMs), complex models that emulate the interactions between the atmosphere, land and ocean surfaces, geosphere, biosphere and human interventions, have been at the forefront in drawing the main conclusions contained in the 4th Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC, 2007):
(i) that climate change is real and has started to show in the current weather;
(ii) that climate change has a discernible human signature.
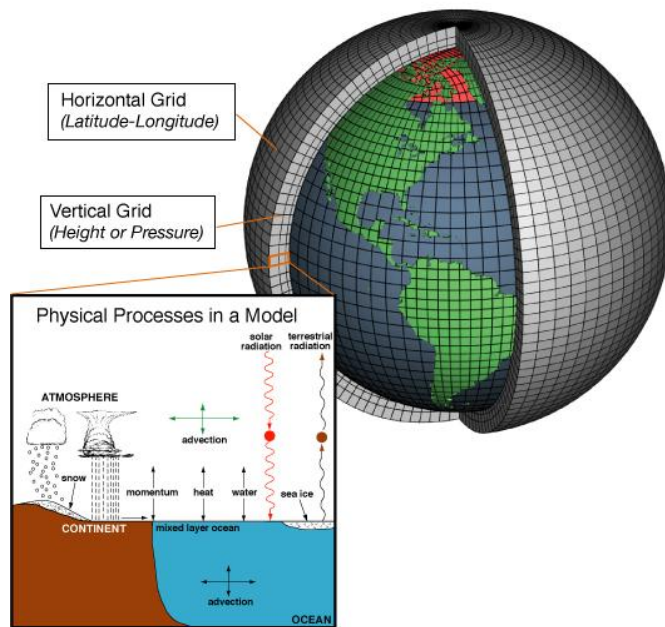
Figure 1. Overview of a typical GCM model

Anyone familiar with AR4 knows that these conclusions are formulated, not as certainties, but in terms of 'likelihoods'. Scientifically this is a more correct formulation, but with the obvious drawback that planning for such changes requires some skilful navigation between interpretations of 'certainty' and 'likelihood'.

In this study we produce maps that provide a comprehensive picture of climatic conditions in a relatively near future, the period 2010-2040. These maps are derived from climate parameter estimates generated by the GCMs contained in AR4. In predicting these climatic variables for the future, there are two main sources of uncertainty.

The first uncertainty is that the future itself is only one possibility out of many that materializes. Given the strong linkage between greenhouse gas (GHG)

emissions and global warming, the practice is therefore to 'model' first different futures, and to run the climate models under these GHG emission assumptions. The futures we worked with in this study are GHG emission scenarios A1b and A2. These are explained in section 2.1.2.
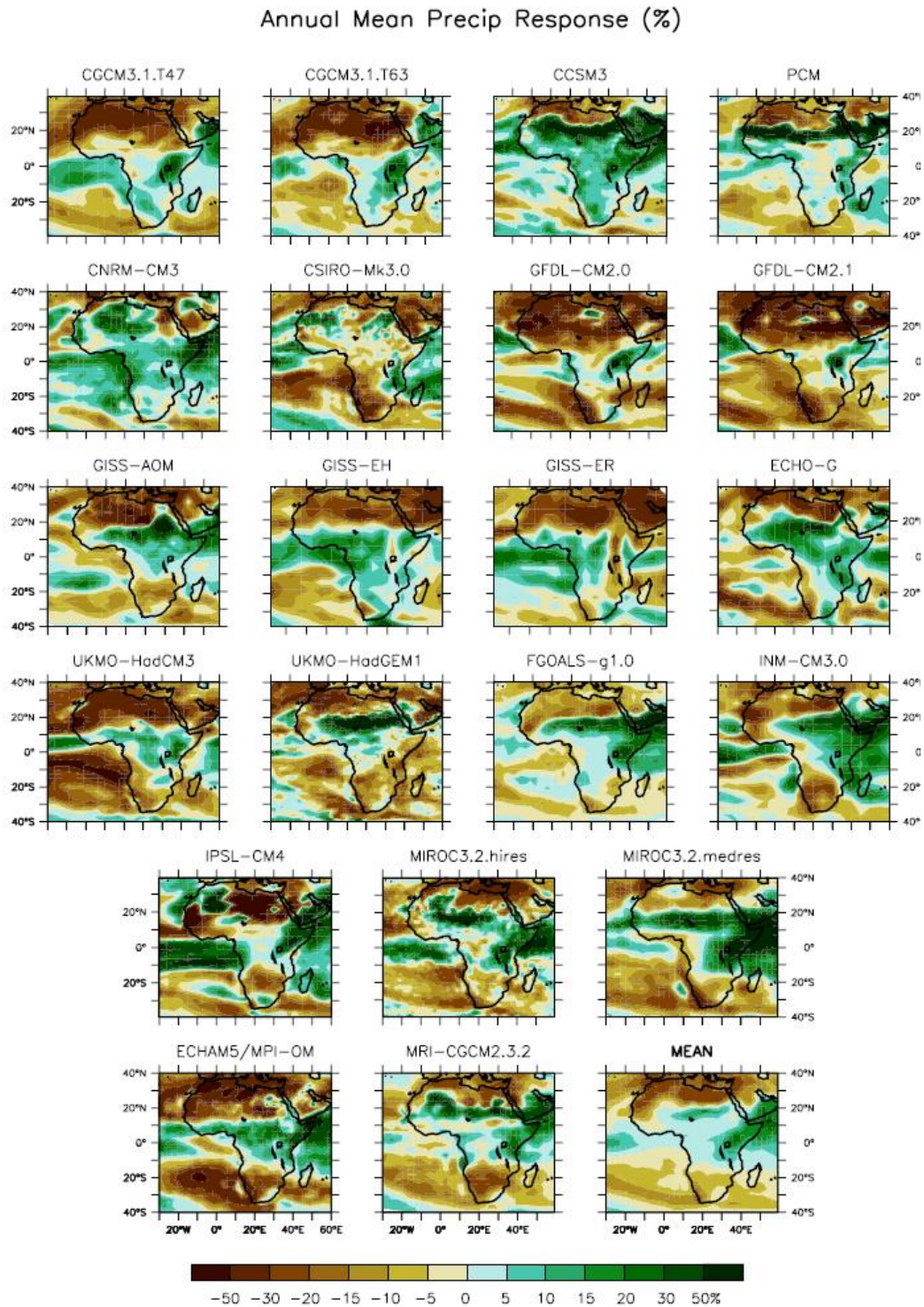
Figure 2. Relative change (%) in annual precipitation in Africa for the period 1980-1999 to 2080-2099 according to 21 GCM models (Christensen et al., 2007)

The second uncertainty is that the IPCC's 4th Assessment Report is based on simulations of 21 GCM models. Since the IPCC published its first Assessment Report in 1990, these models have grown in complexity and are now able to couple atmospheric processes to ocean and land-surface processes (Fig. 1). However, despite increasing sophistication, there are still considerable differences between predictions of different models originating from different research groups. This is illustrated in Figure 2, which shows a huge range in variation in the prediction of annual precipitation in Africa for the period 2080-2099, assuming GHG emission scenario A1B. For this reason it is important to select those models that are considered the most appropriate for developing adaptation strategies, or, alternatively, to apply a kind of averaging process to obtain a 'middle of the road' prediction. This step is further explained in section 2.1.4.

Typical for GCM models is that parameter estimation is at a relatively coarse spatial resolution (typically 2 to 3 degrees, corresponding to a grid cell of 10,000 – 36,000 km^2 depending on the model and geographical latitude). This scale is too coarse to include small-scale processes, the ones responsible for local weather patterns, and particularly in hilly to mountainous terrain these can be very important. Apart from these possible distortions, the coarse resolution of GCMs is perhaps the main bottleneck for planning, as it prevents linkage to features with variability at much finer spatial variability, such as arable land, water resources, human settlements, agricultural production systems, poverty hot-spots etc.

Downscaling the output of GCMs is therefore an extremely important step and is the basis for the climate change maps. The various steps used for downscaling GCMs are summarized in section 2.1.4. For more details is referred to the technical report of the regional study (Göbel and De Pauw, 2010).

2.1.2. Greenhouse gas emission scenarios

The three most commonly used scenarios for assessing the impact of climate change are the SRES[1] scenarios A1b, A2 and B1 (IPCC, 2007). The following description of these scenarios is taken from this summary report.

   A1. The A1 storyline and scenario family describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions, capacity building and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income. The A1 scenario family develops into three groups that describe alternative directions of technological change in the energy system. The A1b scenario assumes a balance between fossil-intensive and non-fossil energy sources, where balance is defined as not relying too heavily on one particular energy source, on the assumption that similar improvement rates apply to all energy supply and end use technologies.
   A2. The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing population. Economic development is primarily regionally oriented and per capita economic growth and technological change more fragmented and slower than other storylines.
   B1. The B1 storyline and scenario family describes a convergent world with the same global population, that peaks in mid-century and declines thereafter, as in the A1 storyline, but with rapid change in economic structures toward a service and information economy, with reductions in

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[1] SRES: Special Report on Emission Scenarios

material intensity and the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to economic, social and environmental sustainability, including improved equity, but without additional climate initiatives.

A1b is the middle-of-the-road GHG emission scenario, A2 the more pessimistic one, and B1 the more optimistic one. With no progress on reducing GHG emissions, the A2 scenario is now being considered more realistic, whereas A1b is slowly becoming the 'optimistic' scenario, and B1 a kind of 'pie-in-the-sky' scenario. In this study, which aims to support disaster and relief planning, the B1 scenario has not been considered for mapping.

2.1.3. Global circulation models

This study is based on the downscaling of 7 Global Circulation Models (GCM), selected from the 23 GCMs on which the IPCC report is based (Table 1).

Table 1. GCM models used in the study

oN	Name	Country	Year	Resolution (degrees)+ (levels)	Source
01	BCCR-BCM2.0	Norway	2005	2.8 x 2.8 (31)	http://www.ipcc-data.org/ https://esg.llnl.gov:8443/home/publicHomePage.do
02	CSIRO-MK3.0	Australia	2001	1.9 x 1.9 (18)	http://www.ipcc-data.org/ https://esg.llnl.gov:8443/home/publicHomePage.do
04	MIROC3.2	Japan	2004	2.8 x 2.8 (20)	http://www.ipcc-data.org/
08	CGCM3.1(T63)	Canada	2005	2.8 x 2.8 (31)	http://www.ipcc-data.org/ http://www.cccma.ec.gc.ca/data/cgcm3/cgcm3.shtml
09	CNRM-CM3	France	2005	2.8 x 2.8 (45)	http://www.ipcc-data.org/ https ://esg.llnl.gov:8443/home/publicHomePage.do http://www.mad.zmaw.de/projects-at-md/ensembles/experiment-list-for-stream-1/cnrm-cm3/
10	ECHAM5/MPI-OM	Germany	2003	1.9 x 1.9 (31)	http://www.ipcc-data.org/
12	GFDL-CM2.0	USA	2005	2 x 2.5 (24)	http://www.ipcc-data.org/

2.1.4. Approach for climate change downscaling

High-resolution maps of climate change were based on a simple approach to downscaling climate change information, the *calibration method* of GCM downscaling, which involves essentially the superposition of a low-resolution future climate change field on top of a high-resolution current climate surface.
Four climatic variables were considered: precipitation, minimum, maximum and mean temperatures. Climate change, as represented by these variables, was assessed for the 2010-2040 time horizon.
For a brief comparison of this approach with more sophisticated downscaling methods is referred to Göbel and De Pauw (2010).

The transformation of GCM data into high-resolution climate maps is no trivial matter and required the following steps:
- Data extraction procedures
- Change mapping at coarse resolution
- Resampling
- Correcting the precipitation maps
- Generating downscaled climate surfaces
- Calculating averages
- Calculating relative change
- Calculating change in seasonal precipitation

Each of these steps is explained in detail in the regional study report (Göbel and De Pauw, 2010).

For precipitation and mean temperature the data were extracted for all 7 GCM models listed in Table 1: 01, 02, 04, 08, 09, 10, 12. For the maximum and minimum temperature under GHG scenario A1b, data were used for GCM models 01, 02, 04, 08, 09. No data were available for GCM model 12 and the data for GCM model 10 were unreliable. For maximum and minimum temperature under GHG scenario A2, data were used for GCM models 01, 02, 04, 08, 09. No data were available for GCM model 10 and 12.

From the precipitation and temperature primary variables the following derived variables were produced for the time frame 2010-2040 under the two GHG scenarios:
- Climatic zones according to the Köppen classification system
- Potential evapotranspiration (mm) on monthly and annual basis
- aridity index on annual basis
- growing periods

For the methods used in deriving these variables from the primary climatic variables is referred to the regional study report (Göbel and De Pauw, 2010).

2.2. MAPS OF HISTORICAL AND TREND PRECIPITATION AND DROUGHT

2.2.1. The Data Set

All maps are based on a downscaled version of the Full Data Reanalysis Product Version 4 of the Global Precipitation Climatology Centre (GPCC).[2] It is a gridded monthly data set that is available at spatial resolutions of 2.5, 1.0, and 0.5 degrees. The spatial extent is the entire world with the exception of Antarctica. The grids for each month from January 1901 to December 2007 have been constructed as deviations from average monthly precipitation during the period 1951 to 2000.

For this study, the 0.5-degree version of the data set has been used. For more information on the characteristics of the GPCC Full Data Reanalysis Product and its interpretative limitations is referred to Göbel and De Pauw (2010).

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[2] U. Schneider, T. Fuchs, A. Meyer-Christoffer and B. Rudolf (2008): Global Precipitation Analysis Products of the GPCC. Global Precipitation Climatology Centre (GPCC), DWD, Internet publication, 1-12. Data and description can be downloaded from http://gpcc.dwd.de.

The subsequent analyses, computation of precipitation totals and statistics, computation of the Standardized Precipitation Index (SPI) for drought mapping, and regression analysis of precipitation and SPI, have been undertaken for each grid cell in turn and the results rearranged in the form of map layers that have been downscaled to grids with a resolution of 30x30 arc-seconds (roughly 1x1 km).

2.2.2. Computation of the Standardized Precipitation Index (SPI)

The Standardized Precipitation Index (SPI)[3] is a tool designed to make the relative intensities of droughts and wet periods comparable across different climates. A drought condition identified by a certain value of the SPI is expected to happen anywhere with comparable frequency. The SPI can be determined relatively easily as it is based on precipitation totals alone but this is also its main weakness; the index does not take into account differences in evaporative demand or soil moisture storage.

The SPI is used for periods with lengths of between one month and several years. For the current study, the annual SPI has been mapped for each year from 1901 to 2007. To compute the index, a Gamma distribution is fitted to the non-zero precipitation totals of all the years falling into a reference period. In the present case, the entire period 1901/2007 for which data are available has been chosen as reference period. The fitted distribution, together with the probability of precipitation being greater than zero, permits to calculate the probability that a certain precipitation total is exceeded. This probability is then interpreted as applying to a standard normal distribution and converted into a deviation from the mean in multiples of the standard deviation: the SPI.

Table 2. Expected frequencies of SPI values

SPI value	Theoretical frequency from standard normal distribution	Event expected to happen approximately every ... years	Description
> +4.0	$3.1671243*10^{-5}$	31574	
> +3.0	0.001349898	741	Extremely wet
> +2.0	0.022750132	44	
> +1.5	0.0668072	15	Very wet
> +1.0	0.15865526	6	Moderately wet
+1.0 to -1.0	0.6826895	2 out of 3	Near normal
< -1.0	0.15865526	6	Moderately dry
< -1.5	0.0668072	15	Very dry
< -2.0	0.022750132	44	
< -3.0	0.001349898	741	Extremely dry
< -4.0	$3.1671243*10^{-5}$	31574	

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[3] The first publication on the SPI is: McKee, Thomas B., Nolan J. Doesken, and J. Kleist, 1993: The relationship of drought frequency and duration of time scales. Eighth Conference on Applied Climatology, 17-22 January 1993, Anaheim, California. – A good description of the methodology is in: Edwards, Daniel C., and Thomas B. McKee, 1997: Characteristics of 20th century drought in the United States at multiple time scales. Climo Report 97-2, Dept. of Atmos. Sci., CSU, Fort Collins, CO, May, 155 pp.

If the combined model – probability of precipitation greater than zero and Gamma distribution fitted to non-zero values – is a perfect fit for precipitation at a site, the standard normal distribution provides direct information on the expected frequencies of drought or high-rainfall events associated with a certain SPI value (see Table 5).

2.2.3. Time-trend Analysis

Simple linear regression models were fitted to the 107-year time series of annual precipitation of each 0.5x0.5 degree grid cell by the least-squares method. From these models, the following trend surfaces have been derived and mapped:
- average absolute change of annual precipitation in mm per decade,
- average relative change of annual precipitation in % per decade,
- correlation between annual precipitation and time,
- fraction of the change of precipitation explained by the linear time trend (coefficient of determination adjusted for the number of years in the series),
- t-significance level of the linear time trend of precipitation (two-sided t-test).

The annual SPI-values were subjected to a similar regression analysis in order to prepare a set of maps that shows the trends of drought in the region. The simple linear regression proves to be an adequate model to demonstrate the trend of precipitation and drought in the region. In spite of the high year-to-year variability, which is the reason for the generally low coefficients of determination, there is a clear and often highly significant trend as evidenced by the highly significant t-probabilities.

2.2.4. Computation of precipitation statistics

The following annual precipitation statistics have been computed for each grid cell based on the time series from 1901 to 2007:
- Mean annual precipitation for the period 1901/2007
- Standard deviation of annual precipitation 1901/2007
- Annual precipitation totals likely to be exceeded at certain frequencies (selected percentiles and deciles, quartiles, median): 1 and 19 years out of 20, 1 and 9 years out of 10, 1 and 4 years out 5, 1 and 3 years out of 4, 1 year out of 2 (i.e. percentiles 5, 10, 20, 25, 50, 75, 80, 90, and 95)
- Probabilities of exceeding certain annual precipitation totals: 0, 50, 100, 150, 200, 250, 300, 350, 400, 500, 600, 800, and 1000 mm

2.2.5. Downscaling of results

The values in the GPCC data set stand for the spatial averages across each of the 0.5x0.5 degree wide grid cells. Similarly, the results of the various calculations undertaken on these data result in surfaces with the same 0.5x0.5-degree resolution whose grid cells, again, contain values representing spatially average conditions. These surfaces can, therefore, not be simply resampled to a higher resolution by a smoothing interpolation process as this would distort the area averages.
The procedure used for downscaling the initial low-resolution result surfaces to a resolution of 30x30 arcseconds (approximately 1x1 km) is explained in the regional study report (Göbel and De Pauw, 2010).

2. 3. MAPPING SUITABILITY FOR WATER HARVESTING

2.3.1. General principles

The methodology is an adaptation of the method used in Syria (De Pauw et al., 2008) to take into consideration the datasets available in the West Bank and local conditions. The key elements of the methodology are the following:

1. The assessment of suitability for different water harvesting techniques was undertaken by matching in a GIS environment simple biophysical information, systematically available for the entire West Bank, to the broad requirements of the specified water harvesting systems using an expert-based empirical decision model.

2. Suitability was evaluated for both micro-and macro-catchment systems. Suitability was evaluated separately for the following systems:
- Micro-catchment systems
  a. System 11: contour ridges/ range shrubs
  b. System 12: contour ridges/ field crops
  c. System 13: contour ridges/ tree crops
  d. System 21: semi-circular bunds – range shrubs
  e. System 22: semi-circular bunds – field crops
  f. System 23: semi-circular bunds – tree crops
  g. System 31: small pits – range shrubs
  h. System 33: small pits – tree crops
  i. System 41: small runoff-basins – range shrubs
  j. System 43: small runoff basins – tree crops
  k. System 51: runoff strips – range shrubs
  l. System 52: runoff strips – field crops
  m. System 6: contour bench terraces
- Macro-catchment systems: evaluated for suitability as
  a. water catchment area
  b. agricultural use: field crops and tree crops

For details on each of these systems is referred to Oweis et al. (2001).

3. Suitability was evaluated through a scoring system based on climate and land criteria, using threshold values that are considered relevant for the different systems evaluated. The scoring system itself was based on the expert judgment documented in the guidelines for selecting water-harvesting techniques in the drier environments (Oweis et al. , 2001), but modified in function of the current data availability and new research findings. The criteria used in the current suitability maps were the 80% minimum annual precipitation, the slope, the soil depth and the land use/land cover type. In the case of precipitation and slope, the scoring system is *continuous*, with values between 0 and 100. In the case of the soil depth and land use/land cover, the scores are based on classes, which can have only 2 values, 0 (suitable) or 100 (unsuitable).

4. The scores for precipitation, slope, soil type and land use/land cover type were combined using the 'minimum rule': the lowest factor score determines the final score.

5. For each micro-catchment system one evaluation was undertaken. For macro-catchment systems two separate evaluations were undertaken: one to assess suitability for use as water catchment area, the other to assess suitability for agricultural use. The two suitability maps were then overlaid to assess where areas with high suitability for catchment and for agricultural use are within a distance that can be overcome by technical means.

6. In order to implement this model two critical new baseline datasets had to be created as part of this project: a map of soil depth and a map of land use/land cover.

2.3.2. Map of soil depth

All soils are acceptable for micro-catchment systems unless they are too shallow, too saline, too stony or have very severe limitations of soil texture (De Pauw et al., 2008). Other limitations may exist in soils, but these are usually not of such nature that they cannot be addressed through appropriate land management methods. Macro-catchment systems have different soil requirements for the catchment areas (see section 2.3.5.1.).
No information is available for the West Bank on soil stoniness, which may vary considerably over short distances, and is very much influenced by stone removal practices of farmers. Given the limestone or calcareous sediments in which the soils have developed, texture is assumed to be within the spectrum from heavy clays to loams. The presence of soils heavily affected by salinity can be inferred from satellite imagery (see next section).
Thus the key determinant of soil suitability for different water harvesting systems is soil depth. As the available soil map did not provide direct detail about soil depth, this factor was determined by visual interpretation of high-resolution Quickbird imagery in Google Earth Pro. QuickBird is currently the highest resolution commercial optical satellite (operated by Digital Globe) and provides through Google Earth multi-spectral imagery at a resolution of 2.44 m, giving visibility to small or narrow objects such as trees, tracks, check dams, ploughing, drainage lines, houses etc. Quickbird imagery is available for the entire West Bank and allows separating the following soil depth classes:
- deep: > 75 cm
- shallow: 25-75 cm
- rock outcrop: rocks visible or within a depth of < 25 cm
- variable depth (mixed): mixture of deep and shallow soils and rock outcrops
- terraced: probably deep soils in narrow patches separated by walls on steep slopes

2.3.3. Map of land use/land cover

Land use/land cover is an essential theme for assessing suitability for water harvesting for several reasons. Firstly, it represents a reality that has to be taken into consideration. For example, urbanized areas cannot be converted into water harvesting sites (although they have some potential as catchments in macro-catchment systems). Similarly, in terms of land use policy, it would be difficult to justify cutting forests or well-preserved woodland. Moreover, land use/land cover may provide indirect indications on the soil suitability for water harvesting: bare or sparsely vegetated rocks are obvious indicators of poor agricultural suitability, but could, at the same time, be very suitable as water catchment areas for use elsewhere.

A critical evaluation was undertaken of an existing land use/land cover map (ARIJ-WFP, 2010). Whereas this map certainly meets the objectives of its own target audience, it revealed a significant number of misclassifications, which could influence the suitability scores for water harvesting. A key limitation was that several homogeneous classes differentiated by the existing land use/land cover map were in fact mixtures of several land cover types, leading to a high number of errors of commission and omission. For this reason it was decided to make a new land use/land cover map, based on Landsat imagery, with a classification that would be validated using the high-resolution Quickbird imagery in Google Earth.

The new map is based on supervised classification of Landsat imagery. Two Landsat TM and ETM+ images (Path-Row: 174-38) dated Mar 24, 2002 and Jan 30, 2009 were downloaded from the USGS Data Server (http://glovis.usgs.gov/).

For more details on the procedure used in the new land use/land cover map is referred to Annex 1.

The new land use/land cover map differentiates a smaller number of classes than the ARIJ-WFP map, but with a higher level of accuracy (Table 3).

Table 3. Land use/land cover classes

Land use/land cover class	Comments
Built-Up	Including continuous, discontinuous, green urban areas, villages, colonies, refugee camps and roads
Mining or Construction Sites	Mineral mines, stone pits and sites in construction
Irrigated Cropland	Irrigated mixed fruits plantations not included
Rainfed Cropland	Cropland without evident irrigation
Greenhouse Agriculture	
Fallow	Harvested cropland or cropland in fallow
Irrigated Mixed Fruits Plantation	Mainly citrus and banana plantation
Vineyard	
Tree Crops	Dominant olive groves interleaved with some plantations of fruits such as almonds, cherry, plums, peaches and pears
Forest	Tree canopy cover mainly >60%
Maquis and Woodland	Tree and shrub canopy cover largely between 20% and 60%
Rangeland	Tree and shrub canopy cover <20%, herbaceous vegetation dominant; total vegetation cover ranging from 5% to 100%
Sparse Rangeland	Almost no tree, herbaceous vegetation cover varying from 5% to 20%; this kind of rangeland suffers strong erosion
Bare Rock	Vegetation cover in average lower than 5% including some valleys and eroded land
Riparian Vegetation	Composed of trees, shrub and grasses along the Jordan River and the Dead Sea possibly including Halophyte in some parts
Salines	Including salt marsh and salinization along the tributaries and salt crust around the Dead Sea
Beach	Surrounding the Dead Sea
Water Bodies	Lakes, fish ponds and sea

2.3.4. Scoring suitability for micro-catchment systems

2.3.4.1. Factor scoring: precipitation

For precipitation, the scoring of suitability was NOT based on the mean annual precipitation, as in the Syria methodology, but on the 80% minimum annual precipitation, which is the annual precipitation that can be expected to be exceeded in at least 4 years out of 5 (based on frequency counts within a time series). This has two advantages:

   (i)   A safety factor was considered to account for high precipitation variability in the Near East;
   (ii)   the area where water harvesting can be useful was more realistically approximated than by using average annual rainfall.

The location-specific 80% minimum probability annual precipitation was derived by the following procedure:

1. A list of useful precipitation stations in the West Bank and neighbouring areas (Israel, Lebanon, Syria) was compiled. Data sources were the FAOCLIM2 database (FAO, 2001) and meteorological records for the West Bank provided through the WFP Country Office. In order to qualify, only stations with at least 15 years of complete monthly records were required. The criterion of 15 years data was relaxed in areas with few meteorological stations, in order to achieve a better coverage for subsequent spatial interpolation. The stations finally selected for spatial interpolation are given in Annex 2.

2. For each station the average annual precipitation (PrecYr) for the years of record was calculated.

3. The calculation of the 80% probability minimum annual precipitation assumes a standard reference period of 1978-2007. For stations with older data an adjustment was made by adding the trend precipitation per decade as follows:

$$PrecYr_{adj} = PrecYr * (1 + \frac{DecChg\% * No\_Dec}{100}$$

The trend precipitation per decade was obtained from the 1-km grids displayed in Map 313 from the regional study report (Göbel and De Pauw, 2010).

4. The individual annual precipitation totals were sorted from low to high and given a rank number n. For each ranked value $Prec_{nn}$ the frequency of exceedance *freqex_n* was calculated as:

$$\frac{N-n}{N}$$

the precipitation to be exceeded in 4 years out of 5 was calculated as:

$$80\%P = Prec_{n,l} + \frac{0.8 - freqex,h}{freqex,l - freqex,h} * (Prec_{n,l} - Prec_{n,h})$$

with $Prec_{n,l}$: the ranked precipitation value immediately below the 0.8 frequency
          $Prec_{n,h}$: the ranked precipitation value immediately above the 0.8 frequency
          freqex,l: the frequency of exceedance immediately below the 0.8 frequency
          freqex,h: the frequency of exceedance immediately above the 0.8 frequency

4. A station-specific ratio Ratio_80%P2Av was calculated as $\frac{80\%P}{PrecYr}$. It was assumed that this ratio remains a constant throughout.

5. The final value for the precipitation to be exceeded in 4 years out of 5 was calculated as:
$$PrecYr\_adj *Ratio\_80\%P2Av$$

6. After due correction to obtain values for a comparable time period, the station data were converted into gridded maps of mean annual precipitation, using the 'thin-plate smoothing spline' method of Hutchinson (1995), as implemented in the ANUSPLIN software (Hutchinson, 2000). The Hutchinson method is a smoothing interpolation technique in which the degree of smoothness of the fitted function is determined automatically from the data by minimizing a measure of the predictive error of the fitted surface, as given by the generalized cross-validation (Hutchinson, 2000). The method uses three independent spline variables: latitude, longitude and altitude. The latter was input to the model in the form of a digital elevation model (DEM) grid file. The DEM used to generate the climate surfaces was the SRTM DEM[4] with 3 arc-second (about 90 m) resolution. Parameter estimation was undertaken over a regular grid with the same dimensions and resolution as the user-provided DEM.

7. Factor scoring: scores for suitability can have a value between 0 (minimum) and 100 (maximum).
Scores for the location-specific 80% minimum annual precipitation were obtained by linear interpolation between cardinal points as follows (Fig. 3):
A: 0 mm (score 0)
B: 150 mm (score 100)
C: 250 mm (score 100)
D: 500 mm (score 0)
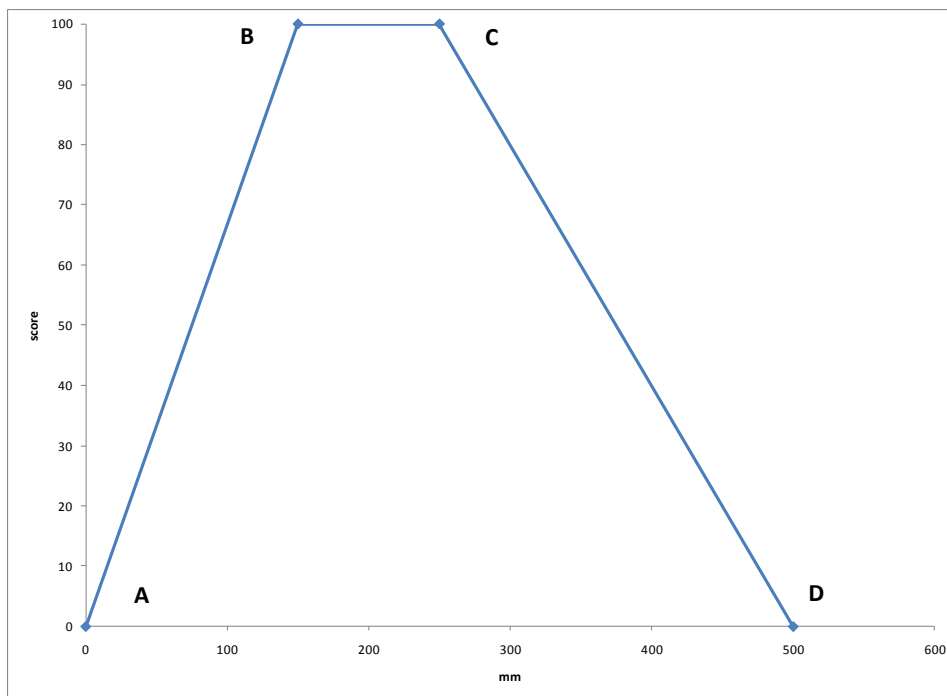
Figure 3. Scores for 80% minimum annual precipitation (all systems)

For all WH micro-catchment systems the same scoring system for precipitation was applied.

2.3.4.2. Factor scoring: slopes

The main source for slope information was the Shuttle Radar Topographic Mission (SRTM) Digital Elevation Model (DEM)[5]. Slopes were calculated using respectively the Slope function of the Spatial Analyst Tools in ESRI ArcGIS software.

Slope scores are also obtained by linear interpolation between cardinal points. The cardinal points are different between the considered WH systems (Fig. 4), which can be divided into 3 'slope response groups':
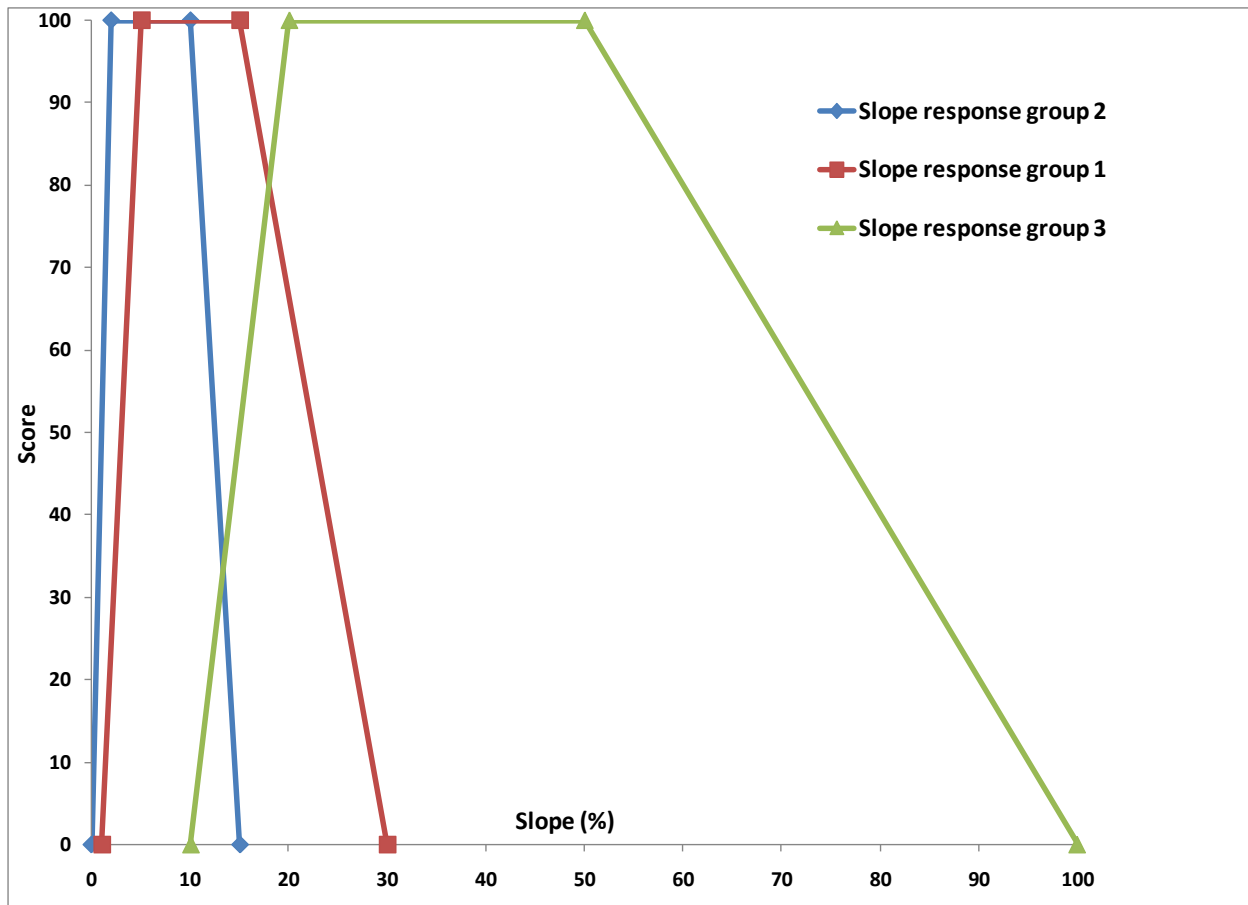
Figure 4. Slope scores for micro-catchment systems

Slope response group 1: contour ridges
A: 1% slope (score 0)
B: 5% slope (score 100)
C: 15% slope (score 100)
D: 30% slope (score 0)

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[5] URL: http://www2.jpl.nasa.gov/srtm/

Slope response group 2: small pits, runoff strips, small runoff basins, semi-circular bunds
A: 0% slope (score 0)
B: 2% slope (score 100)
C: 10% slope (score 100)
D: 15% slope (score 0)

Slope response group 3: contour bench terraces
A: 10% slope (score 0)
B: 20% slope (score 100)
C: 50% slope (score 100)
D: 100% slope (score 0)

The scores are nearly identical to the slope scores used in Syria (De Pauw et al. 2008), with exceptions for response group 1, where point A, previously at 2% slope, has been repositioned to 1 % slope, and for response group 2, where point A, previously at 1% slope, has been repositioned to 0% slope, following new research findings in the Badia area in Jordan[6].

2.3.4.3. Factor scoring: soils

All soils are acceptable for micro-catchment systems unless they are too shallow, too saline, too stony or have very severe limitations of soil texture (De Pauw et al., 2008). No information is available on soil stoniness, which may vary considerably over short distances and is very much influenced by stone removal practices of farmers. Given the limestone or calcareous sediments in which the soils have developed, texture is assumed to be within the spectrum from heavy clays to loams. The presence of soils heavily affected by salinity can be inferred from satellite imagery (see next section).

The key determinant of soil suitability for different water harvesting systems is soil depth. As the available soil map did not provide direct detail about soil depth, this factor was determined by visual interpretation of high-resolution Quickbird imagery in Google Earth Pro. QuickBird[7] is currently the highest resolution commercial optical satellite (operated by Digital Globe) and provides through Google Earth multi-spectral imagery at a resolution of 2.44 m, giving visibility to small or narrow objects such as trees, tracks, check dams, ploughing, drainage lines, houses etc. Quickbird imagery is available for the entire West Bank and allows separating the following soil depth classes:

- deep: > 75 cm
- shallow: 25-75 cm
- rock outcrop: rocks visible or within a depth of < 25 cm
- variable depth (mixed): mixture of deep and shallow soils and rock outcrops
- terraced: probably deep soils in narrow patches separated by walls on steep slopes

Using this simple classification, a detailed soil depth map was prepared (Map 351). On this basis it was possible to subdivide the soils of the West Bank into a limited number of 'soil depth response classes' as shown in Table 4.

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[6] T. Oweis, personal communication.
[7] URL: http://www.digitalglobe.com/index.php/85/QuickBird

Table 4. Scores of soil depth by WH system and soil depth response group

Depth response group	Score for soil depth class			
	Deep	Shallow	Mixed	Other
S11, S21	100	100	66	0
S12, S22, S31, S41, S51	100	50	50	0
S13, S23, S33, S43, S52	100	0	33	0
S6	100	0	0	0

2.3.4.4. Factor scoring: Land use/land cover

Land use/land cover can be a constraint for the development of water harvesting in two ways: from a land use planning/zoning perspective, and from the physical nature of the land cover. To the first category belong the following land use/cover classes (see Table 3): *Built-up, Mining and construction sites, Forest, Maquis and Woodland*. Land cover classes that entail a physical unsuitability for water harvesting are: *Riparian Vegetation, Salines* and *Beach*. These classes are given the suitability score 0, and the remaining classes suitability score 100. On the suitability maps the classes with suitability score 0 are regrouped and mapped as a separate overlay of 'land use constraint' with each type of constraint indicated by a letter symbol.

2.3.4.5. Combined suitability

Individual factor scores are integrated by the 'minimum' rule: the lowest factor score sets the overall suitability score.

$$\text{Combined score} = \text{minimum} (\text{Score}_{precipitation}, \text{Score}_{slope}, \text{Score}_{soil\ depth}, \text{Score}_{land\ use/land\ cover})$$

2.3.5. Scoring suitability for macro-catchment systems

The suitability criteria for the 'catchment' and 'use' areas are different: for the catchment area, strongly sloping land with soils that are shallow, rocky, or have poor infiltration capacity is preferable. On the other hand, for the use area, level or gently undulating land with deep soils and no other limitations to agricultural use is preferable. In addition, land suitable for use as a catchment, must be within a certain distance of land suitable for agricultural use that can be overcome by technical means.

Using these simple rules of thumb, the problem of identifying, in a GIS environment, land with these contrasting requirements is then reduced to a separate assessment of suitability for catchment and agricultural purposes, followed by an assessment of the constraint imposed by distance between these two different environments.

2.3.5.1. Suitability for catchment use

The following factors are considered: precipitation, slope and hydrological properties of soils.

Factor scoring: Precipitation

For macro-catchment systems precipitation suitability is different from micro-catchment systems. The basic principle is: other factors (soil, slope, land cover) being equal, the more rainfall, the better the catchment is for capturing water.

As in the micro-catchment systems, suitability is approximated using the 80% minimum annual precipitation, with the precipitation score calculated by linear interpolation between only 2 inflection points A: 150 mm (0); B: 250 mm (100).

Factor scoring: Slope

Any surface can act as a catchment as long as it has some slope, very limited permeability for precipitation and no obstacles. As a first approximation, one could consider the slope as non-limiting, as long as it is not near zero. This condition can be simulated by a score function with two inflection points A: 0% (0); B: 5% (100) and intermediate values obtained by linear interpolation (Fig.5).
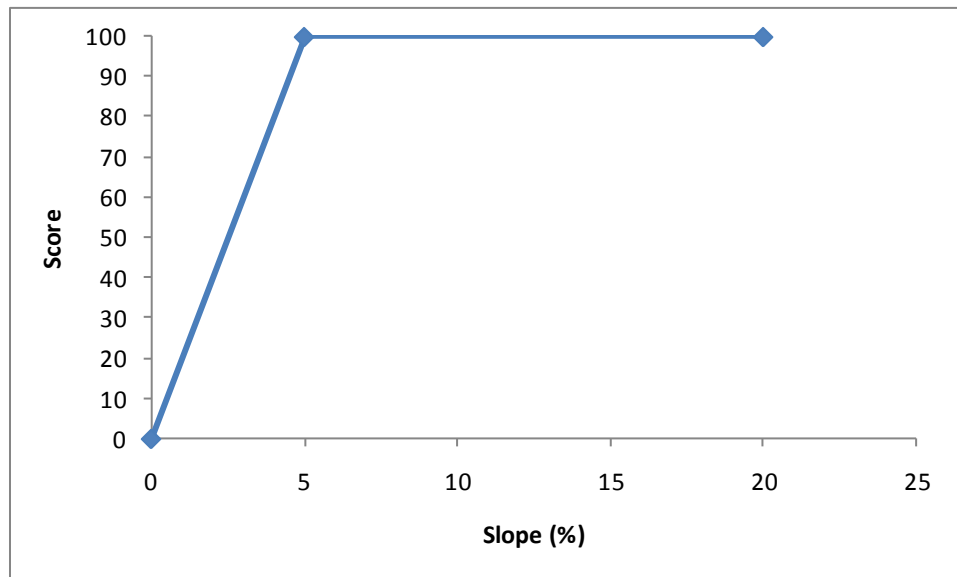
Figure 5. Catchment suitability scores for slope assuming very limited permeability

Taking into consideration soil hydrological properties

Soils have different hydrological properties and as such are a major factor in the run-off generating potential of catchments. The Soil Conservation Service of the US Department of Agriculture (1969) differentiates four major hydrological classes:
•	Class A (low run-off potential): deep sandy soils;
•	Class B: shallow sandy soils and medium-texture soils with above average infiltration rates;
•	Class C: shallow soils of medium to heavy texture with below-average infiltration rates;
•	Class D (high run-off potential): clay and shallow soils with hardpan, high groundwater table etc.

The hydrological properties of the soils were inferred from the combinations of soil depth class and land use/land cover class (Table 5).

Table 5. Hydrological classes based on soil depth and land use/land cover combinations

Soil depth-land use/cover combinations	Hydro-Class	Soil depth-land use/cover combinations	Hydro-Class
Dead sea/Beach	A	mixed/Salines	C
deep soil/Beach	A	mixed/Sparse Rangeland	C
shallow/Beach	A	mixed/Tree Crops	C
deep soil/Built-Up	B	mixed/Vineyard	C
deep soil/Fallow	B	rock/Beach	C
deep soil/Forest	B	rock/Tree Crops	C
deep soil/Greenhouse Agriculture	B	rock/Vineyard	C
deep soil/Irrigated Agriculture	B	shallow/Fallow	C
deep soil/Irrigated Mixed Fruits Plantation	B	shallow/Forest	C
deep soil/Maquis and Woodland	B	shallow/Greenhouse Agriculture	C
deep soil/Mining or Construction Sites	B	shallow/Irrigated Agriculture	C
deep soil/Rainfed Agriculture	B	shallow/Irrigated Mixed Fruits Plantation	C
deep soil/Rangeland	B	shallow/Maquis and Woodland	C
deep soil/Riparian Vegetation	B	shallow/Mining or Construction Sites	C
deep soil/Salines	B	shallow/Rainfed Agriculture	C
deep soil/Sparse Rangeland	B	shallow/Rangeland	C
deep soil/Tree Crops	B	shallow/Riparian Vegetation	C
deep soil/Vineyard	B	shallow/Salines	C
terraced/Fallow	B	shallow/Sparse Rangeland	C
terraced/Forest	B	shallow/Tree Crops	C
terraced/Irrigated Agriculture	B	shallow/Vineyard	C
terraced/Irrigated Mixed Fruits Plantation	B	terraced/Built-Up	C
terraced/Maquis and Woodland	B	terraced/Mining or Construction Sites	C
terraced/Rainfed Agriculture	B	rock/Bare Rock	D
terraced/Rangeland	B	rock/Built-Up	D
terraced/Sparse Rangeland	B	rock/Fallow	D
terraced/Tree Crops	B	rock/Forest	D
terraced/Vineyard	B	rock/Greenhouse Agriculture	D
mixed/Built-Up	C	rock/Irrigated Mixed Fruits Plantation	D
mixed/Fallow	C	rock/Maquis and Woodland	D
mixed/Forest	C	rock/Mining or Construction Sites	D
mixed/Irrigated Agriculture	C	rock/Rangeland	D
mixed/Irrigated Mixed Fruits Plantation	C	rock/Riparian Vegetation	D
mixed/Maquis and Woodland	C	rock/Salines	D
mixed/Mining or Construction Sites	C	rock/Sparse Rangeland	D
mixed/Rainfed Agriculture	C	shallow/Bare Rock	D
mixed/Rangeland	C	shallow/Built-Up	D

Referring to the values [a] and [b] in Table 6, a reduction factor was applied for each soil hydrological class as follows:

if Slope ≥a then $RF_i = 0$
if Slope ≤b then $RF_i = 100$

if Slope between (a,b) then $RF_i = \dfrac{Slope - a_i}{b_i - a_i} * 100$

with RF= reduction factor for soil hydrological class i.

Table 6. Reduction factors for slope in relation to hydrological classes

Hydrological class	a	b
A	40	15
B	15	8
C	8	3
D	3	0

The relationship between the reduction factor and slope per soil hydrological class is shown in Figure 6.
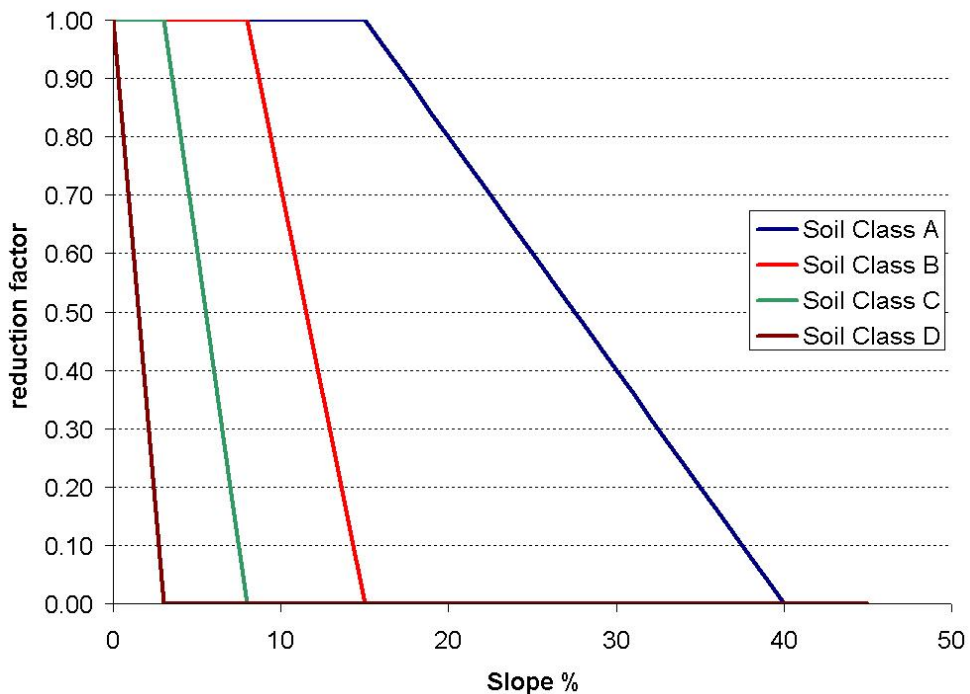
Figure 6. Reduction factors for soil hydrological classes

The interpretation of Figure 6 is that if, for example, the soil in a particular pixel belongs to hydrological class D, there will be no reduction in runoff if the slope is 3% or higher; if, on the other hand, the soil

belongs to hydrological class C, a reduction factor of .5 will be applied as compared to the optimal slope range for this class (> 8%).

It is useful to use for Class D, with its very low permeability, the analogy of a plastic sheet. No water will run away from the sheet if the slope is zero. However, the slightest slope will be cause for runoff. At the other end one could visualize for Class A the same plastic sheet, but full of holes. Water poured over the sheet will drain through the holes. To generate runoff, the slope must be quite steep for the water to run off before it has the time to seep through the holes. Classes B and C have intermediate drainage properties.

The soil-corrected score for slope is then taken as the lowest value of either the slope score or the reduction factor as follows:

$$S_{slope,cor} = Min(S_{slope}, 100\text{-}RF_i)$$

Apart from its influence on the hydrological class (Table 5), no land use/cover category has a prohibitive effect on the suitability as a catchment. Thus, the final score for suitability as a catchment is then taken as the lowest of the precipitation score and the soil-corrected slope score:

$$S = Min (S_{slope,cor}; S_{precip})$$

2.3.5.2. Suitability for agricultural use

The same precipitation criterion and thresholds apply as in the micro-catchment systems.

In terms of slope suitability, 'flat to gentle' slopes are optimal for agricultural use. This condition is simulated by a score function with two inflection points A: 0% (100); B: 15% (0) and intermediate values obtained by linear interpolation (Fig.7).
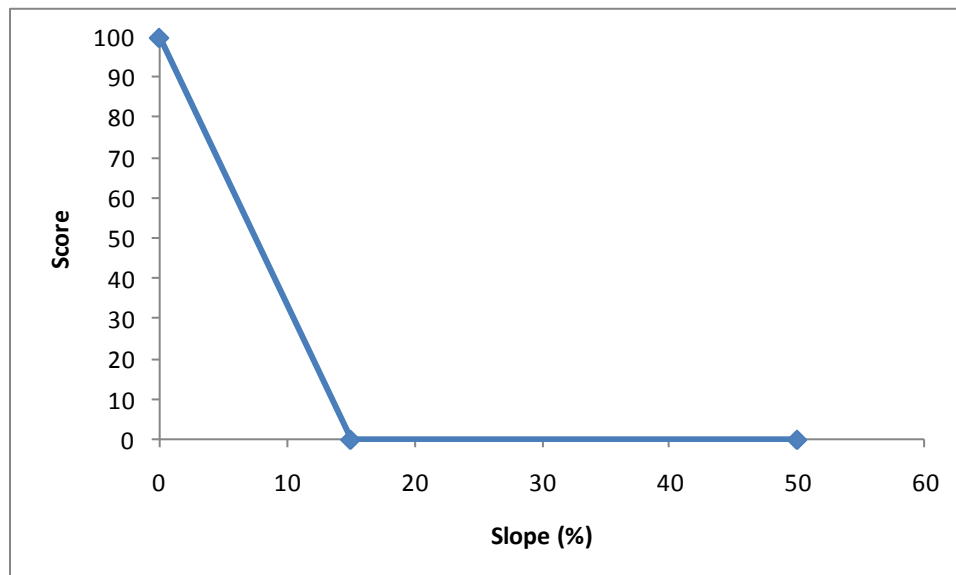
Figure 7. Slope suitability scores for agricultural use

Soil suitability is, as in the micro-catchment systems, evaluated using the soil depth classes (Table 7).

Table 7. Soil suitability scores by soil depth class and use

	Soil depth class			
Agricultural use	Deep	Shallow	Mixed	Other
Field crops	100	0	33	0
Tree crops	100	50	50	0

2.3.5.3. Combining suitability for catchment and agricultural uses

The combined suitability for catchment and agricultural purposes is assessed by identifying those areas where suitable catchments and agricultural areas are close together. The limiting distance between the two is taken as 1km.
This is implemented in a GIS environment through the following steps:
- Step 1: suitability scores for catchment use are reclassified into 5 groups (score: 0, >0 – 20, >20 – 40, >40 – 60, > 60)
- Step 2: to avoid over-fragmented patterns, a smoothing function is applied
- Step 3: the reclassified smoothened suitability score rasters are converted to vector layers.
- Steps 1-3 are repeated for the suitability scores for agricultural use
- Step 4: 1km buffer zones are created around the vector features that represent the highest score class (>60)
- Step 5: The geometric intersection is calculated of the buffer zones for both the high-score catchment and agricultural use classes, as well as with the watershed boundary.

The output of the intersection procedure is the area suitable for catchment and agricultural use within 1km proximity of each other.

3. SUMMARY OF OBSERVATIONS

3.1. CLIMATE CHANGE IN THE OCCUPIED PALESTINIAN TERRITORY

The summary of climate change projections in this section is derived from the regional picture summarized in Göbel and De Pauw (2010). The oPt consist of two territories, Gaza and the West Bank, which are geographically non-contiguous. As a result the patterns of change are not always perfectly aligned between the two territories.

3.1.1. Changes in precipitation

Tables 8 and 9 summarize the projected changes in mean seasonal and annual precipitation for the futures, defined by GHG emission scenarios A1b and A2 as compared to the current climate.
The patterns between the two scenarios are similar. A severe decline is projected in both winter and spring precipitation (10-20%), which represent more than 90% of the annual total. The decline in precipitation in autumn and summer is less severe, and in the case of Gaza might even increase by 0-10%, obviously a meaningless statistic, given the fact that the rain in autumn and summer is less than 10% of the annual total.
Obviously, the overall losses in precipitation are very serious ones, as they are predicted to occur in the 'near' future and during the growth cycle of the winter crops.

Table 8 . Relative change (%) of seasonal and annual precipitation from current climate to 2010-2040, scenario A1b

Season	Territory	Percent of each class in the included territory							
		<-20	-20 to -10	-10 to -5	-5 to 0	0 to 5	5 to 10	10 to 20	>20
Spring	Gaza	0	100	0	0	0	0	0	0
	West Bank	0	81	19	0	0	0	0	0
Summer	Gaza	0	0	0	0	57	43	0	0
	West Bank	1	2	20	33	28	15	0	0
Autumn	Gaza	0	0	3	97	0	0	0	0
	West Bank	0	0	95	5	0	0	0	0
Winter	Gaza	0	100	0	0	0	0	0	0
	West Bank	0	100	0	0	0	0	0	0
Year	Gaza	0	100	0	0	0	0	0	0
	West Bank	0	86	14	0	0	0	0	0

Table 9. Relative change (%) of seasonal and annual precipitation from current climate to 2010-2040, scenario A2

Season	Territory	Percent of each change class in the included territory							
		<-20	-20 to -10	-10 to -5	-5 to 0	0 to 5	5 to 10	10 to 20	>20
Spring	Gaza	0	91	9	0	0	0	0	0
	West Bank	0	56	44	0	0	0	0	0
Summer	Gaza	0	0	0	0	100	0	0	0
	West Bank	0	11	72	16	1	0	0	0
Autumn	Gaza	0	0	0	100	0	0	0	0
	West Bank	0	39	61	0	0	0	0	0
Winter	Gaza	0	0	100	0	0	0	0	0
	West Bank	0	44	56	0	0	0	0	0
Year	Gaza	0	0	100	0	0	0	0	0
	West Bank	0	41	59	0	0	0	0	0

3.1.2. Changes in temperature, potential evapotranspiration and aridity

Table 10 summarizes for Gaza and the West Bank the changes in maximum, minimum and mean annual temperature, as well as the changes in the seasonal means.

Table 10. Absolute change (°C) of the temperature from current climate to 2010-2040, scenarios A1b and A2

Temperature element	Territory	Percent of each change class per geographical entity					
		A1b			A2		
		0.5 to 1°C	1 to 1.5°C	1.5 to 2°C	0.5 to 1°C	1 to 1.5°C	1.5 to 2°C
Annual maximum	Gaza	100	0	0	100	0	0
	West Bank	100	0	0	100	0	0
Annual minimum	Gaza	100	0	0	100	0	0
	West Bank	100	0	0	100	0	0
Mean annual	Gaza	100	0	0	0	100	0
	West Bank	69	31	0	0	100	0
Mean winter	Gaza	100	0	0	100	0	0
	West Bank	100	0	0	100	0	0
Mean spring	Gaza	0	100	0	0	100	0
	West Bank	0	100	0	2	98	0
Mean summer	Gaza	0	100	0	0	100	0
	West Bank	0	100	0	0	100	0
Mean autumn	Gaza	0	100	0	0	100	0
	West Bank	0	100	0	0	100	0

A moderate increase (0.5 to 1°C) is expected under bothscenarios for the annual temperatures. In spring and summer, when respectively rainfed and irrigated crops develop, reach flowering and maturity, the temperature increase projection is in the range 1 to 1.5°C. As the average hides a large temperature variability at small time-scales (e.g. days), an increase in the average temperature of this magnitude is likely to bring about more heat stress during sensitive growth stages.

Higher temperatures also entail a higher water demand by the atmosphere and hence higher potential evapotranspiration rates and higher irrigation requirements to meet the crop water needs. However, the increases at annual level are relatively modest (Table 11) and perfectly manageable by increasing the efficiency of water management methods.

Table 11. Changes in annual potential evapotranspiration, scenarios A1b and A2

Territory	Percent of each change class per geographical entity							
	A1b				A2			
	2-3%	3-4%	4-5%	5-6%	2-3%	3-4%	4-5%	5-6%
Gaza	100	0	0	0	100	0	0	0
West Bank	87	13	0	0	41	59	0	0

As precipitation is expected to go down and temperatures to go up, it is only natural that the aridity index (the ratio of annual precipitation over annual potential evapotranspiration) will decrease. The decrease of the aridity index (or the increase in aridity) is more pronounced in the West Bank than in Gaza (Table 12).

Table 12. Changes in aridity index, scenarios A1b and A2

Scenario	Territory	Percent of each aridity class per geographical entity					
		-1.0 to -.2	-.2 to -.1	-.1 to -.05	-.05 to 0	0 to .05	.05 to .1
A1b	Gaza	0	0	0	100	0	0
	West Bank	0	0	42	58	0	0
A2	Gaza	0	0	0	100	0	0
	West Bank	0	0	38	62	0	0

3.1.3. Changes in climatic zones and growing periods

Under current climatic conditions, the oPt contains 4 climatic zones according to the Köppen system: BWwh (94% of Gaza, 26% of the West Bank), BSwh (54% of the West Bank, 6% of Gaza), BSwk (16% of the West Bank) and Csa (4% of the West Bank). The definitions and characteristics of these zones are summarized in Table 13.
Under both scenarios significant changes are expected in the climatic zones. This is quite remarkable, given the small size of the oPt. In Gaza the small area of steppic climate (BSwh) is expected to disappear completely, and the entire Strip comes arid (BWwh climate). In the west Bank the changes are probably more significant: 22% of the territory is expected to become more arid. The Csa zone with temperate climate is expected to disappear, whereas more steppic conditions move up the elevation zones (15% becomes BSwh climate) and an additional 6% enters the arid zone BWwh.

Table 13. Köppen climatic zones inside the oPT

Köppen symbol	Description
BSwh	**Hot semi-arid (steppe) climate, winter precipitation** $Temp_{year} \geq 18°C$ and $Prec_{year} \leq 20 * (Temp_{year} +14)$ and $Prec_{year} \geq 10 * (Temp_{year} +14)$ and $Prec_{Nov-Mar} \geq 1.2 * Prec_{May-Sep}$
BSwk	**Cool semi-arid (steppe) climate, winter precipitation** $Temp_{year} <18°C$ and $Temp_{warmest} \geq 18°C$ and $Prec_{year} \leq 20 * (Temp_{year} +14)$ and $Prec_{year} \geq 10 * (Temp_{year} +14)$ and $Prec_{Nov-Mar} \geq 1.2 * Prec_{May-Sep}$
BWwh	**Hot arid (desert) climate, winter precipitation** $Temp_{year} \geq 18°C$ and $Prec_{year} < 10 * (Temp_{year} +14)$ and $Prec_{Nov-Mar} \geq 1.2 * Prec_{May-Sep}$
Csa	**Warm temperate rainy climate with dry and hot summers** Not a B-climate and $Temp_{coldest} \leq 18°C$ and $Temp_{coldest} \geq -3°C$ and $Temp_{warmest} \geq 22°C$ (hot summer) and $Precip_{wettest\ Dec-Feb} > 3 * Prec_{driest\ Jun-Aug}$ (summer drought)

Notes:

$Temp_{year}$: Mean annual temperature

$Temp_{coldest}$: Mean temperature of the coldest month of the year ($Temp_{coldest}$)

$Temp_{warmest}$: Mean temperature of the warmest month of the year

$Prec_{year}$: Mean annual precipitation total

$Prec_{Nov-Mar}$: Mean precipitation total from November to March

$Prec_{May-Sep}$: Mean precipitation total from May to September

$Prec_{driest\ Jun-Aug}$: Mean precipitation of the driest month in the period June-August

$Prec_{wettest\ Dec-Feb}$: Mean precipitation of the wettest month in the period December-February

Growing period features for the current climate are summarized in Table 14. Striking is the wide range of moisture-limited growing periods in the West Bank, whereas the growing period range in Gaza is more clustered. For the temperature-limited growing period the pattern is extremely clustered into one growing period class (330-365 days). As temperature is in fact non-limiting, and the moisture regime is the main limiting factor, the combined moisture-and temperature-limited growing period is the same as the moisture-limited growing period.

Table 14. Distribution of growing period classes by geographical entity under current climatic conditions

Type of growing period	Territory	30-60 days	60-90	90-120	120-150	150-180	180-210	210-240	240-270	270-300	300-330	330-365
Moisture-limited	Gaza	0	0	45	45	9	0	0	0	0	0	0
	West Bank	1	3	10	13	36	36	0	0	0	0	0
Temperature-limited	Gaza	0	0	0	0	0	0	0	0	0	0	100
	West Bank	0	0	0	0	0	0	0	0	0	0	100
Moisture- and temperature-limited	Gaza	0	0	45	45	9	0	0	0	0	0	0
	West Bank	1	3	10	13	36	36	0	0	0	0	0

In respect of the changes in growing period duration, in both territories a decline in the moisture-limited growing period is expected of 0-15 days in about 80% of the Gaza Strip and 85% of the West Bank under scenario A1b (Table 15) and of 95% of Gaza under scenario A2 (Table 16), whereas it remains 85% in the West Bank.

Table 15. Changes in the growing period under scenario A1b

Type of growing period	Territory	Percent of each LGP change class per geographical entity						
		-60 to -45	-45 to -30	-30 to -15	-15 to 0	0-1	1-15	15-30
Moisture-limited	Gaza	0	0	20	80	0	0	
	West Bank	0	1	14	85	0	0	
Temperature-limited	Gaza					100		
	West Bank					100		
Moisture- and temperature-limited	Gaza		0	20	80			
	West Bank		1	14	85			

Table 16. Changes in the growing period under scenario A2

Type of growing period	Territory	Percent of each LGP change class per geographical entity						
		-60 to -45	-45 to -30	-30 to -15	-15 to 0	0-1	1-15	15-30
Moisture-limited	Gaza	0	0	5	95	0	0	0
	West Bank	0	0	15	85	0	0	0
Temperature-limited	Gaza	0	0	0	0	100	0	0
	West Bank	0	0	0	0	100	0	0
Moisture- and temperature-limited	Gaza			5	95			
	West Bank			15	85			

3.2. PATTERNS AND TRENDS OF PRECIPITATION AND DROUGHT

The annual maps of the Standardized Precipitation Index (SPI) (Maps 201-307) show for the period 1901 to 2007 year by year which parts of the territories and surrounding areas were affected by drought, and which parts enjoyed an unusually ample supply of precipitation. For the areas producing rainfed crops, this indicates when and where, according to the moisture supply, it was possible to achieve high crop yields and when and where yield reductions or crop failures due to drought may have occurred. Similarly for rangelands, the maps show the extent of drought affected areas for each year and where, in contrast, good range conditions due to a higher than average precipitation facilitated livestock production.

In Palestine the wettest year was 1911 except for the northern part, where 1904 was the wettest year. Other very wet years were 1905, 1918, 1938, 1944, 1949, and, in the central part, 1974, 1991, 1992, and 1994. Widespread drought occurred in 1915, 1925, 1932, 1933, 1946, 1947, 1952, 1958, 1960, 1962, 1978 and 1981 (except for the North), 1993 (except for the South), 1995, 1998 (except for the North), and 1999, with 1999 and 1915 being the most extreme droughts. Although the picture is not quite as clear as in the surrounding countries, **there still is a visible trend towards more dry years and fewer wet years in the second half of the century**. Remarkable are the 1990s during which three years were unusually wet and four were unusually dry.

As in most of the agriculturally important areas in the region, over the last century the SPI has dropped in the oPt by around 0.5 to 1 points. This reduction of the SPI means that a year that in most places would still have been considered a normal year taking the early years of the 19th century as a reference period, would be regarded as a moderately wet one by the standards of one hundred years later, and many years that are considered normal now, would have been classified as moderately dry hundred years ago. Likewise, a moderately dry year now would have been regarded as very dry a century ago, and a very dry year of today would then have been seen then as an extremely dry one. The trends of the SPI confirm the perceptions of farmers that droughts are increasing and becoming more severe.

The entire region covered by the maps prepared for this project has negative trends of annual SPI and annual precipitation. This can be seen from the coefficients of correlation between time and SPI or between time and precipitation. In all but the most humid areas along the coast of the Mediterranean Sea, this negative trend is highly significant as shown by the probability levels of the t-tests. The low values of the coefficients of determination are due to the high interannual variability of precipitation overlying the small, but – due to the long observation period – significant trends.

This negative trend of precipitation during the past century is of a similar magnitude as that predicted by most of the Global Circulation Models for the Mediterranean Region in the coming decades. This suggests that forces of climate change have been active in the region since at least a century and that human activity is only exacerbating an already existing trend.

3.3. SUITABILITY FOR WATER HARVESTING IN THE WEST BANK

Water harvesting covers various techniques to collect rainwater from natural terrains or modified areas and concentrating it for use on smaller sites or cultivated fields to assure economic crop yields. In micro-catchment systems the source and target areas are essentially that close together that they cannot be at scales larger than the field level, and the storage facility is either the soil's root zone for immediate or a small reservoir for later use. In macro-catchment systems run-off water is collected from a relatively large catchment outside a relatively small target area with storage provided by surface structures, such as small farm reservoirs, subsurface structures, such as cisterns, or the soil in the target area itself.

Water harvesting systems are relevant in moisture-deficit areas: a choice is made to sacrifice part of the land, on which (in theory) a crop could be grown, but yielding poorly in most years, in order to concentrate water on a smaller fraction of the land , where a higher soil moisture supply would allow for better yields in most years. Water harvesting systems remain dependent on precipitation and therefore offer no panacea for prolonged droughts. Nevertheless, they offer certainly a useful dryland land management practice that may gain in relevance under the climate change futures envisaged in earlier sections of this report.

In this study 13 micro-catchment systems and one general macro-catchment system were evaluated for their potential suitability. The suitability assessment was undertaken solely on the basis of physical criteria. It serves the objective of identifying the overall potential for each evaluated system, as well as the location of 'hot spots' of high suitability. In these areas follow-up studies can be undertaken at watershed and sub-watershed level, to decide which particular systems are most appropriate in which parts of the watersheds, to identify suitable locations for pilot development areas, water harvesting structures. At this stage it would also be necessary to conduct socioeconomic studies, e.g. on acceptability of specific water harvesting practices.

The results of the study are contained in a set of 20 maps (Maps 352-371), which are included in Annex 4 of this report. Based on these maps, the areas in different suitability classes for each evaluated water harvesting system have been calculated. The potential areas for micro-catchment systems are shown for the entire West Bank in Table 17 (in hectare) and Table 18 (as a percentage of the West Bank). For the meaning of the system labels (S11, S12 etc.) used in the tables is referred to section 2.3.1.
A quick interpretation of these results indicates that the majority of the West Bank is not suitable for water harvesting, in most cases due to a mismatch between the slope-soil requirements of a particular water harvesting system and site-specific conditions. However, the sum of the areas with a suitability score above 50 is quite high (between 50,000 and 70,000 ha, depending on the system), except for system 6 (contour bench terraces). Hence, there is definitely potential for micro-catchment systems on a relatively scale.

The potential area with high suitability for macro-catchment systems is much lower, due to the requirement of having a suitable catchment within 1 km distance of a suitable agricultural use area. Thus the total area with high suitability for both catchment use and tree or field crops (Maps 370 and 371) within 1 km proximity is 120,756 hectare. The net area with high suitability under this system is 21,976 hectare, again a not inconsiderable amount.

In short, this report identified potential for a wide suite of water harvesting techniques. The accuracy of the data used does not allow to go into more detail. Follow-up studies can make use of this information by focusing on the hot-spots of high suitability identified in this study.

Table 17. Areas (in hectare) in different suitability classes per water harvesting system

Suitability scores	S11	S12	S13	S21	S22	S23	S31	S33	S41	S43	S51	S52	S6
0-10	321,863	294,831	318,713	322,143	322,143	342,232	322,143	342,232	322,143	342,232	322,143	342,232	432,163
10-20	3,086	7,106	6,207	3,088	3,088	2,628	3,088	2,628	3,088	2,628	3,088	2,628	1,247
20-30	15,120	26,043	23,127	15,134	15,134	13,342	15,134	13,342	15,134	13,342	15,134	13,342	2,180
30-40	17,391	25,681	25,693	17,319	17,319	16,892	17,319	16,892	17,319	16,892	17,319	16,892	1,810
40-50	17,050	39,558	19,478	17,072	31,079	13,669	31,079	13,669	31,079	13,669	31,079	13,669	1,935
50-60	17,974	18,637	18,637	17,846	14,992	14,992	14,992	14,992	14,992	14,992	14,992	14,992	1,671
60-70	13,710	9,877	9,877	13,643	10,311	10,311	10,311	10,311	10,311	10,311	10,311	10,311	2,722
70-80	10,707	6,552	6,552	10,708	8,960	8,960	8,960	8,960	8,960	8,960	8,960	8,960	115
80-90	11,126	7,555	7,555	11,148	9,448	9,448	9,448	9,448	9,448	9,448	9,448	9,448	5
90-100	15,917	8,009	8,009	15,748	11,375	11,375	11,375	11,375	11,375	11,375	11,375	11,375	
Score >50	69,433	50,630	50,630	69,093	55,085	55,085	55,085	55,085	55,085	55,085	55,085	55,085	4,513

Table 18. Areas (in percent) in different suitability classes per water harvesting system

Suitability scores	S11	S12	S13	S21	S22	S23	S31	S33	S41	S43	S51	S52	S6
0-10	73	66	72	73	73	77	73	77	73	77	73	77	97
10-20	1	2	1	1	1	1	1	1	1	1	1	1	0
20-30	3	6	5	3	3	3	3	3	3	3	3	3	0
30-40	4	6	6	4	4	4	4	4	4	4	4	4	0
40-50	4	9	4	4	7	3	7	3	7	3	7	3	0
50-60	4	4	4	4	3	3	3	3	3	3	3	3	0
60-70	3	2	2	3	2	2	2	2	2	2	2	2	1
70-80	2	1	1	2	2	2	2	2	2	2	2	2	0
80-90	3	2	2	3	2	2	2	2	2	2	2	2	0
90-100	4	2	2	4	3	3	3	3	3	3	3	3	0
Score >50	16	11	11	16	12	12	12	12	12	12	12	12	1

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Annex 1

Technical report on the
LAND USE/COVER MAPPING FOR THE WEST BANK
USING REMOTE SENSING

Weicheng Wu and Eddy De Pauw

A1.1. Introduction

An essential input for analyzing the suitability for water harvesting in the West Bank is reliable land use and land cover information. An existing land use/land cover map, hereafter named the 'ARIJ[8]-WFP land use/cover map' was evaluated whether it would be adequate for this purpose. It was found that, whereas the existing map was certainly useful for other purposes, it contained a number of erroneous or vague classifications, which might diminish the reliability of any suitability maps, based (in part) on land use/land cover information. Especially in the major land cover classes such as "Agri. Land with Nat. Vegetation", "Olive Groves", "Vineyard", and others. Other classes, such as "Urban", "Citrus plantation", "Palm groves" were correctly identified, probably based on field work or knowledge of the area. A problem for suitability mapping for water harvesting arises from the fact that several important classes are mixtures of several land cover types, which might lead, in technical jargon, to a high risk of 'errors of commission and omission' in the major classes. For example, the class "Agri. Land with Nat. Vegetation" is actually a combination of Tree Crops (mainly Olive), Rainfed Agriculture, Woodland and Rangeland. Given the fact that in the potential for water harvesting practice, land use/land cover plays a major role, it was found necessary to produce a more accurate map for this project, using remote sensing technology.

A1.2. Data and methods for mapping

(1) Data

In general, for a small region like the West Bank (about 5848km^2 in surface area), high to very high resolution data are needed for this purpose. Two relevant Landsat TM and ETM+ images (Path-Row: 174-38) dated Mar 24, 2002 and Jan 30, 2009 were identified and downloaded from the USGS Data Server (http://glovis.usgs.gov/).

The full coverage of the West Bank by very high resolution data, such as QuickBird and SPOT 5 images (with resolution of 1m and 2.5m respectively) in Google Earth or Google Map, made it possible to use these products as ground-truth data.

Additionally, the existing Land Use Map provided a useful reference for our mapping work, since a number of classes like "Urban" and different sorts of artificial land use and fruits plantations were identified on the basis of field investigations.

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[8] ARIJ: Applied Research Institute-Jerusalem

(2) Method

Land use/cover mapping is usually conducted by either visual interpretation on the pseudo-color composites or by machine-based classification on the numeric image data. Both methods have been widely practiced by a great number of individual scientists and research institutions in line with the land cover complexity and research scale. The former is the most traditional one and is easy to operate in terms of interpreter's field knowledge and understanding about the color and patches in the composite image. However, it is subject to missing small land cover groups and to producing unnatural boundaries. Moreover, the accuracy depends completely on an interpreter's understanding and digitizing skills.

With the advance of computer technology in recent decades, machine-based classification has gained dominance, especially in land cover mapping at regional and global scale. This approach entails a clustering procedure, based on the similarity of spectral reflectance and adopting pattern recognition techniques, assuming that the study area is composed of a number of unique internally homogeneous classes that are mutually exclusive (Wu et al 2003). However, no matter which algorithm (e.g., supervised, unsupervised or decision tree) is used, some mixture or confusion is inevitable, especially in cases where the reflectance of different land cover units is similar or close to each other, or put differently, where land over types exist as continua, rather than a mosaic of discrete classes. Hence, it is critical to apply some pre-classification (e.g., atmospheric correction, relevant training area selection based on the ground-truth data) and post-classification processing (e.g., aggregation/combination and visual amendment) to increase the reliability of the identified classes. In general, however, in most cases the results produced by digital processing are correct and small clusters can also be identified. The borders of classes follow in most cases the natural separation between different spectral features or clusters.

From the above introduction, it is clear that both visual interpretation and machine-based methods have their own advantages and disadvantages. A combined use of the two approaches is therefore optimal.

Based on experience in other areas, the method involved in this study is to use a supervised classification algorithm to complete the major classification incorporated with pre- and post-classification processing and adjustment.

A1.3. Procedures

(1) Atmospheric correction

Satellite image usually contains noise due to atmospheric scattering and absorption, therefore it is necessary to remove these effects before any application like classification and change detection. Another factor affecting a satellite image is the seasonal effect due to different Sun-Earth Distance and Solar Elevation Angle. To reduce these effects, a radiometric calibration is also needed. For these two purposes, the COST model of Chavez (1996), an image-based atmospheric correction approach was applied to the Landsat TM and ETM+ images. To remove the additive scattering (haze) and multiplicative transmittance effects (Table 8), the digital number (DN) value of pixel was transformed into spectral reflectance taking the Sun-Earth Distance and Sun Elevation Angle into consideration (for details, see Wu 2003).

Date	Captor	B1	B2	B3	B4	B5	B7
2009 Jan 30	TM	40	18	12	9	7	5
2002 Mar 24	ETM+	44	32	27	16	11	9

Note:

the Haze value, shown in radiance (Digital Number), is measured using the Dark-Object method and to be removed from each band in the course of atmospheric correction

After this correction, the 2002 image, which was acquired during the growing period for most spring crops, could be used for the major land cover classification. The image of 2009 served as a complementary dataset to capture more recent urbanization, and extract recently extended urban areas or recently developed villages.

(2) Definition of the classification scheme

In general, before undertaking the land cover classification, it is necessary to know the major land cover types that occur in the study area, either by field investigation or through other sources of data (e.g. available land use maps, very high resolution images, such as those in Google Earth). The second step is to decide at what level the land cover category can be highlighted, which depends on the scale of interest, the resolution of the original data used, and the complexity of the land cover.

In recent decades, a number of organizations and programs such as the US Geological Survey (USGS, 1976), the European CORINE program (1994), the FAO LCCS (2000) have developed their own land cover classification system, applicable at different mapping scales. For example, in the multi-level CORINE scheme, Level 1 consists of 5 categories (Artificial surface, Agricultural areas, Forests and semi-natural areas, and Wetlands). Level 2 and Level 3 contain respectively 15 and 44 classes. The existing Land Use Map was produced by following the CORINE scheme (Level 3), based on an intensive field investigation. Landsat data with resolution of 30m do not allow to discern land cover as detailed as the Level 3 CORINE. In order to overcome the problem of accessibility in the West Bank, which made it impossible to conduct some field work, it was decided to identify the land cover types by checking Google Earth and by using the ARIJ-WFP Land Use Map as reference.

(3) Classification training and class separability

Training is a sampling process to select homogeneous areas where the spectral reflectance is similar (visually showing in the same or similar color). The objective is to outscale the corresponding land cover types based on existing knowledge, obtained from field/ground data, an existing land use map, or other knowledge prior to classification. The selection of representative training areas is an important indicator to assure the accuracy of the classification. Normally, training areas should account for more than 5% of the whole image.

The second key indicator is the **class separability,** which is measured by the Jeffries-Matusita Distance (JM) measure (Richard and Jia, 1999). Whether a classification can be achieved by machine processing depends to a large extent on the separability of different classes represented by different sampling areas. For the pair of classes i and j, this distance can be expressed as:

$$JM_{ij} = \sqrt{2(1 - e^{-\alpha})}$$

where

$$\alpha = \frac{1}{8}\left(\mu_i - \mu_j\right)^T \left(\frac{C_i + C_j}{2}\right)^{-1} \left(\mu_i - \mu_j\right) + \frac{1}{2}\ln\left[\frac{\frac{1}{2}\left|C_i + C_j\right|}{\sqrt{\left|C_i\right| \times \left|C_j\right|}}\right]$$

C_i is the covariance matrix of class i; μ_i is the mean vector of class i; ln is the natural logarithm function; T is the transposition function; and $|C_i|$ is the determinant of C_i; the same meanings for class j.

When JM^2 < 1.0, two classes have *poor separability*;
       JM^2 = 1.0-1.5, they are *separable but with confusion or mixture*;
       JM^2 = 1.5-1.9, they have a *good separability*; and
       JM^2 >1.9, two classes are *completely separable*.

The third important indicator to judge the goodness of a classification or to evaluate the agreement degree between the classification and ground-truth data is the Overall Accuracy (0-100%) together with the Kappa Coefficient (0.000-1.000). The higher the values, the better the accuracy of the classification. In general, the Overall Accuracy should not be less than 85% (USGS, 1976).

Table 20. Examples of separability problems between class pairs in the existing land use/cover map

Class comparison	JM-value
Non-Irrigated Arable L ^ Non-irrig. complex cul:	0.22826946
Agr.Land With Nat. Veg^ Olive groves:	0.23186339
Agr.Land With Nat. Veg ^Fruit trees&berry plan:	0.24678098
Drip irrig.Vineyards ^ Irrig. complex cult. pl:	0.29160570
Olive groves ^ Transitional wood land:	0.30491038
Olive groves ^ Sclerophylous vegt.:	0.31020526
Sclerophylous vegt ^ Transitional wood land:	0.33903307
Agr.Land With Nat. Veg ^ Natural grass land:	0.33903840
Forest ⏑ Olive groves:	0.38147707
Fruit trees&berry plan ^ Olive groves:	0.41190911
Fruit trees&berry plan ^ Vineyards:	0.41331958
Forest ^ Sport&leisture facility:	0.46748606
Bare rock ^ Sparsely veg. area:	0.47208383
Agr.Land With Nat. Veg ^ Forest:	0.47232940
Sport&leisture facilit ^ Transitional wood land:	0.47292368
Forest ^ Sclerophylous vegt.:	0.47505739
Agr.Land With Nat. Veg ^ Discontinuous Urban Fa:	0.72780629
Drip Irrigated Arable ^ Non-irrig. complex cul:	0.73252200
Natural grass land ^ Olive groves:	0.73985829
Green urban areas ^ Irrig. complex cult. pl:	0.78705716
Non-irrig. complex cul ^ Transitional wood land:	0.80203111
Natural grass land ^ Vineyards:	0.89204508

While conducting the first selection of training areas, we used the ARIJ-WFP Land Use Map (37 classes) as sample areas to classify the 2002 Landsat image. Unfortunately, the Overall Accuracy was extremely low, only 27.43% (Kappa Coefficient 0.229), because the visually digitized classes have very low separability. Exceptions exist for the classes with strong difference in spectral reflectance, e.g., between various types of agricultural land and water bodies or bare rock.

Some examples of low separability among the major classes (Agriculture, Urban and Natural Vegetation Cover) are listed in Table 20. For a comprehensive listing of separability between classes is referred to Appendix 1 of this Technical report).

The results from Table 20 and Appendix 1 evidenced that it was unfeasible to use these ARIJ-WFP land cover classes as training areas to produce a new land cover map, and that we had to select our own training areas. For this purpose, we used QuickBird and SPOT images in Google Earth as ground-truth data and linked the Landsat image with Google Earth to draw carefully the training areas (Region of Interest —ROI) in the Landsat TM images.

The ARIJ-WFP class "Sclerophylous vegetation" is in fact a mosaic of Mediterranean maquis or macchia together with woodland, and was therefore renamed "Maquis and Woodland".

As mentioned earlier, the ARIJ-WFP group "Agricultural Land With Natural Vegetation" was a mixture of olive tree crops, woody trees and herbaceous rangeland. This heterogeneous group was resampled into 3 separate classes, "Tree Crops", "Wooded Rangeland" and "Rangeland", based on the observations in Google Earth.

The groups of "Olive Groves" and "Vineyard" of the ARIJ-WFP Land Use Map were found to be mostly correct, although some important patches were either missed or committed to another class. They were directly incorporated into the training areas of "Tree Crops", which is composed of olive plantation, fig, cherry, peach, pear and apricot (PIALES 1996) and "Vineyard".

Besides these groups, "Forest", "Maquis and Woodland", and "Wooded Rangeland", "Rangeland" and "Sparse Rangeland" were largely identified based on the density of the tree canopy and herbaceous covers. Some sub-classes, "Valley Shadow" and "Massad Erosion" (eroded land near Massad in the Jordan River valley), to be incorporated in the "Bare Rock" class in the final classification result, were also defined.

In respect to the Urban and other Built-up training areas, we used those of ARIJ-WFP Land Use Map since they were already visually identified as "Continuous Urban", "Discontinuous Urban", "Green urban" and so on. In total 33 classes of training areas were selected (Fig. 8), and their separability is shown in Appendix 2 of this Technical Report.

(4) Classification and retraining

After training, a classification was launched with the Maximum Likelihood classifier. The Overall Accuracy and Kappa Coefficient were much better than those using ARIJ-WFP Land Use Map as training areas but still low (45.39% and 0.391 respectively). Clearly, this result was still far from acceptable.

We went back to the training step and added more ground-truth polygons, using Google Earth, to most of the land cover groups, such as "Tree Crops", "Forest", "Maquis and Woodland", "Wooded Rangeland", and particularly to the class "Sparse Rangeland" which was previously classified as "Discontinuous Urban". Classification was launched again, and the results were checked again against Landsat pseudo-color composite and Google Earth. In the wrongly classified areas, more training polygons were added to each group and the spectral reflectance images were classified again, etc. This iterative procedure "from training to classification and then back to training for a new classification" was

repeated nearly 20 times up, but did not manage to raise classification accuracy to more than an Overall Accuracy = 51.75% and Kappa Coefficient = 0.464, using a total training area of 2356km^2 , about 25% of the entire classified image.

From this practice, it was learned that only on the basis of spectral reflectance features, it is nearly impossible to obtain a higher accuracy, due to the similarity of spectral features between classes with low separability, e.g., between Olive groves (which in fact occur together with cherry, fig, peach, pear and apricot) and Vineyards, between low cover Olive/Vineyard and Fallow, between Green Urban and Wooded Rangeland and between Discontinuous Urban and Sparse Rangeland, etc. (see their low separabilities in Annex 2). Therefore, other techniques were required to eliminate these confusions.

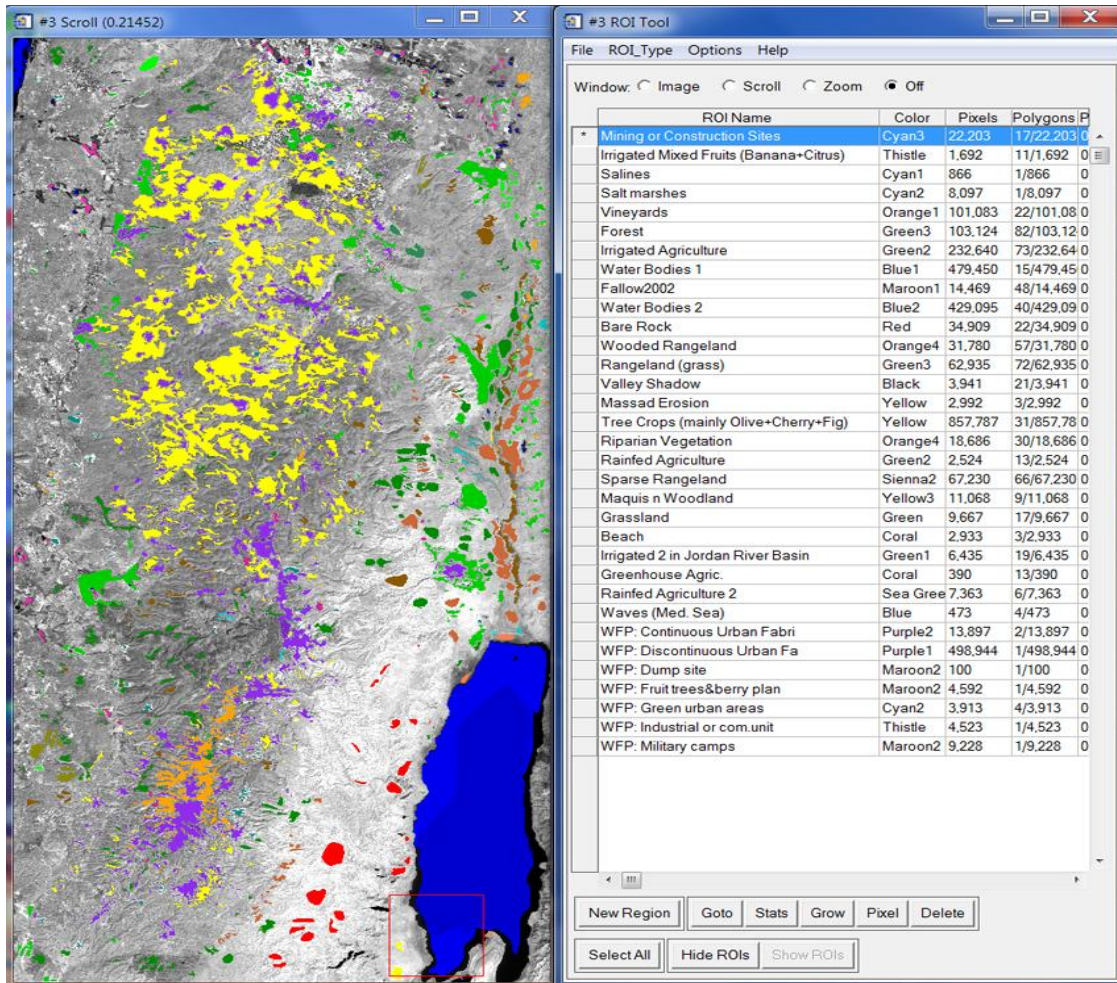Figure 8. Training areas of different land cover classes

(5) Post-classification processing — manual adjustment

The first objective of this processing step was to merge classes with low separability (e.g., all urban related classes, such as "Continuous urban", "Discontinuous urban", "Green urban", "Military camps", into a new class "Built-Up". This step also included the incorporation of Wooded Rangeland into the

"Rangeland" class, and of the "Valley shadow" and "Massad Eroded land" sub-classes into the "Bare Rock" class.

The second objective was to allocate the wrongly classified parts to the class in which they actually belong, by using a series of mask operations. Whereas the first step (class mergers) is easy to operate, the correct allocation of misclassified pixels is a more delicate process, as it requires checking in Google Earth and then defining a custom mask to remove the wrong parts and patch them to the correct classes. For instance, for the class "Tree Crops", a large number of pixels of "Rangeland", "Maquis and Woodland" and "Vineyard" were mixed. These pixels had to be picked out by masking and then patched onto the correct homogeneous class. Errors of omission, such as pixels of olive plantation that were actually classified as Rangeland or Vineyard had to be carefully identified by checking in Google Earth, and were then reallocated back to Tree Crops. The classified Built-Up areas along the Jordan River is mainly Sparse Rangeland suffering strong erosion (when vegetation goes below 5%, it becomes Bare Rock). These parts were cut from the group "Built-Up" and returned to "Sparse Rangeland". In summary, this part of the post-classification processing is very time-consuming and requires visual interpretation and manual adjustment.

Table 21. Distribution of Land Use/Cover in the West Bank

No	Land Use/Cover Type	Remark	Area (Km²)	%
1	Built-Up	Including continuous, discontinuous, green urban areas, villages, colonies, refugee camps and roads	502.60	8.59
2	Mining or Construction Sites	Mineral mines, stone pits and sites in construction	32.58	0.56
3	Irrigated Cropland	Irrigated mixed fruits plantations not included	82.86	1.42
4	Rainfed Cropland	Cropland without evident irrigation	419.09	7.17
5	Greenhouse Agriculture		7.06	0.12
6	Fallow	Harvested cropland or cropland in fallow	45.81	0.78
7	Irrigated Mixed Fruits Plantation	Mainly citrus and banana plantation	73.26	1.25
8	Vineyard		97.29	1.66
9	Tree Crops	Dominant olive groves interleaved with some plantations of fruits such as almonds, cherry, plums, peaches and pears	860.48	14.71
10	Forest	Tree canopy cover mainly >60%	68.42	1.17
11	Maquis and Woodland	Tree and shrub canopy cover largely between 20% and 60%	157.92	2.70
12	Rangeland	Tree and shrub canopy cover <20%, herbaceous vegetation dominant; total vegetation cover ranging from 5% to 100%	2438.54	41.69
13	Sparse Rangeland	Almost no tree, herbaceous vegetation cover varying from 5% to 20%; this kind of rangeland suffers strong erosion	231.47	3.96
14	Bare Rock	Vegetation cover in average lower than 5% including some valleys and eroded land	536.49	9.17
15	Riparian Vegetation	Composed of trees, shrub and grasses along the Jordan River and the Dead Sea possibly including Halophyte in some parts	20.78	0.36
16	Salines	Including salt marsh and salinisation along the tributaries and salt crust around the Dead Sea	64.45	1.10
17	Beach	Surrounding the Dead Sea	21.57	0.37
18	Water Bodies	Lakes, fish ponds and sea	188.05	3.22

After post-classification processing, it was still found that some "Green Urban" and "Discontinuous Urban" (mainly recent construction with plantation of trees) were missing because they were classified as "Rangeland" and "Sparse Rangeland". In order to clearly separate urban areas, the boundaries of all towns and villages were digitized in the 2009 image, with ground-truthing using Google Earth. These digitized urban and other built-up areas were overlaid on the classified "Built-Up" group. We have thus the most accurate and recently urbanized areas in our land use map, which comprises 18 land cover classes in total (Table 21).

After these processing steps, a minimum mapping unit filter (3×3 pixels, equivalent to 0.81ha) was applied to remove the isolated pixels but there is not much information loss for mapping on scale of 1/100, 000 -1/250,000. The final result of the new land use/cover mapping is shown in Table 10 and Figure 9. For comparison, the ARIJ-WFP Land Use Map is shown in Appendix 4 of this Technical Report.

A1.4. Validation of results

To verify and validate the classification result, a new set of ground-truth Regions of Interest (ROIs) as shown in Table 22 were produced for each land cover group with an area sum of 1903km^2 (20.21% of the total classified land) based on Google Earth.

Table 22. Regions of interest for validation of the new map

Mining or Construction Sites:	19.98 Km²
Irrigated Mixed Fruit Plantations:	1.52 Km²
Salines:	8.07 Km²
Water Bodies:	435.40 Km²
Fallow:	13.24 Km²
Bare Rock:	409.83 Km²
Rangeland:	151.97 Km²
Riparian Vegetation:	16.82 Km²
Rainfed Cropland:	23.92 Km²
Sparse Rangeland:	61.85 Km²
Maquis and Woodland:	31.62 Km²
Beach:	2.64 Km²
Greenhouse Agriculture:	0.35 Km²
Irrigated Cropland:	5.19 Km²
Vineyard:	8.68 Km²
Tree Crops:	33.22 Km²
Forest:	21.95 Km²
Built-Up:	656.66 Km²

From the Confusion Matrix Report (for details see Appendix 3 to this Technical Report), it follows that the Overall Accuracy of verification is **94.81%** and Kappa Coefficient 0.933 This means that after post-classification processing the land cover map, despite some small misclassified patches, shows a high agreement with the ground-truth data and is hence reliable and relevant for water harvesting suitability analysis.
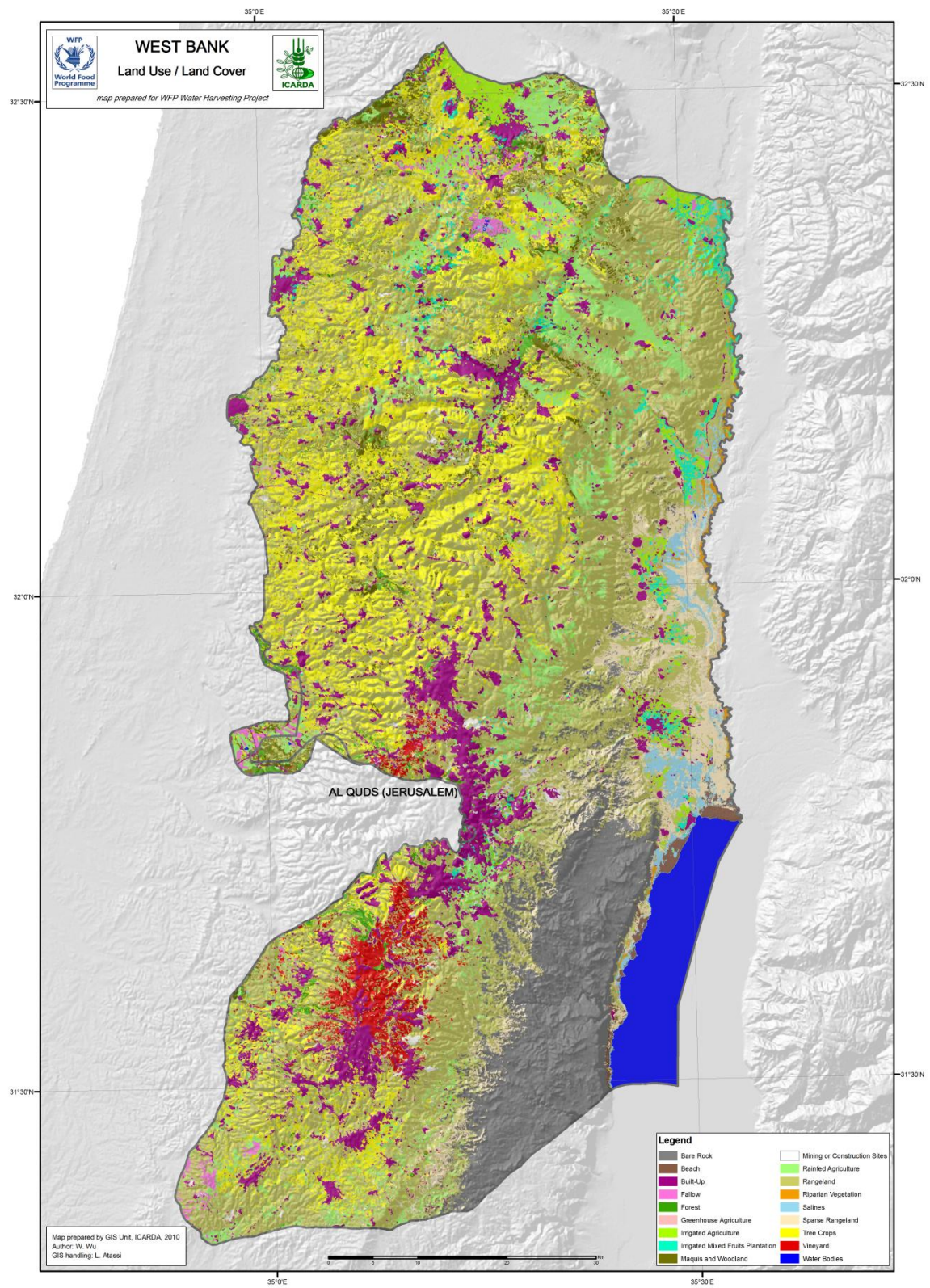
Figure 9. Current land use/cover pattern in the West Bank

A1.5. Deliverable

Name: Land Use/Cover Map of the West Bank
Format: raster and shapefile
Datum and Projection: WGS1984 and UTM36N
Relevant scales: between 1/100,000 to 1/250,000

A1.6. References

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FAO, 2000: Land Cover Classification System (LCCS), Classification Concepts and User Manual, Rome (available at: http://www.fao.org/docrep/003/x0596e/x0596e00.htm).

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Wu, W., 2003: Application de la géomatique au suivi de la dynamique environnementale en zones arides, PhD thesis, Université de Paris 1, pp.217.

Wu, W. and Zhang, W., 2003, Present land use and cover patterns and their development potential in North Ningxia, China, *Journal of Geographical Sciences*, Vol.13, No.1, p.54-62.

Appendix 1 to Land Use/Cover Map of the West Bank

Separability of ARIJ-WFP Land Use Map

Input image file: Landsat TM, 2002 Mar24, atmospherically corrected reflectance image, 6 bands, 30m resolution
ROI Name: (Jeffries-Matusita, Transformed Divergence)

Classes Pair Separability (least to most):

WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Irrig. complex cult. pl [Aquamarine] 108085 points - 0.16940638
WFP: Colonies [White] 122694 points and WFP: Military camps [White] 9272 points - 0.21537768
WFP: Non-Irrigated Arable L [Green3] 284445 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 0.22826946
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Olive groves) [Green2] 852222 points - 0.23186339
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Fruit trees&berry plan [Yellow3] 4603 points - 0.24678098
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Military camps [White] 9272 points - 0.27913262
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Irrig. complex cult. pl [Aquamarine] 108085 points - 0.29160570
WFP: Olive groves) [Green2] 852222 points and WFP: Transitional wood land [Yellow3] 28869 points - 0.30491038
WFP: Olive groves) [Green2] 852222 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 0.31020526
WFP: Colonies [White] 122694 points and WFP: Discontinuous Urban Fa [White] 498692 points - 0.33787842
WFP: Sclerophylous vegt. [Maroon] 123131 points and WFP: Transitional wood land [Yellow3] 28869 points - 0.33903307
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Natural grass land [Sea Green] 1655893 points - 0.33903840
WFP: Irrig. complex cult. pl [Aquamarine] 108085 points and WFP: Others [Black] 3086 points - 0.37704684
WFP: Forest [Green3] 67466 points and WFP: Olive groves) [Green2] 852222 points - 0.38147707
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Olive groves) [Green2] 852222 points - 0.41190911
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Vineyards [Orange4] 93668 points - 0.41331958
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Drip irrig. Vineyards [Green2] 19238 points - 0.42188507
WFP: Forest [Green3] 67466 points and WFP: Sport&leisure facilit [White] 2884 points - 0.46748606
WFP: Bare rock [Red] 20454 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 0.47208383
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Forest [Green3] 67466 points - 0.47232940
WFP: Sport&leisure facilit [White] 2884 points and WFP: Transitional wood land [Yellow3] 28869 points - 0.47292368
WFP: Forest [Green3] 67466 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 0.47505739
WFP: Aiports [White] 949 points and WFP: Discontinuous Urban Fa [White] 498692 points - 0.48636197
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Others [Black] 3086 points - 0.48887956
WFP: Aiports [White] 949 points and WFP: Military camps [White] 9272 points - 0.50511120
WFP: Sclerophylous vegt. [Maroon] 123131 points and WFP: Sport&leisure facilit [White] 2884 points - 0.50593336
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Transitional wood land [Yellow3] 28869 points - 0.51075203
WFP: Colonies [White] 122694 points and WFP: Construction sites [White] 9368 points - 0.51368404
WFP: Mineral extrac. sites [Red2] 18131 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 0.52028700
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 0.52733594
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Others [Black] 3086 points - 0.54375765
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Others [Black] 3086 points - 0.54844308
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Green urban areas [White] 1677 points - 0.54861625
WFP: Forest [Green3] 67466 points and WFP: Transitional wood land [Yellow3] 28869 points - 0.57081571
WFP: Aiports [White] 949 points and WFP: Colonies [White] 122694 points - 0.58186843
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Industrial or com.unit [White] 4491 points - 0.59322219
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Vineyards [Orange4] 93668 points - 0.59674816
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Refugee Camps [White] 7782 points - 0.60398982
WFP: Military camps [White] 9272 points and WFP: Others [Black] 3086 points - 0.61427129
WFP: Citrus plantations [Orchid] 12546 points and WFP: Irrig. complex cult. pl [Aquamarine] 108085 points - 0.61650071
WFP: Colonies [White] 122694 points and WFP: Industrial or com.unit [White] 4491 points - 0.62459546
WFP: Irrig. complex cult. pl [Aquamarine] 108085 points and WFP: Military camps [White] 9272 points - 0.62655290
WFP: Forest [Green3] 67466 points and WFP: Fruit trees&berry plan [Yellow3] 4603 points - 0.62737424
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 0.62809785
WFP: Aiports [White] 949 points and WFP: Industrial or com.unit [White] 4491 points - 0.62900189
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Palm groves [Green] 6411 points - 0.64521643
WFP: Irrig. complex cult. pl [Aquamarine] 108085 points and WFP: Palm groves [Green] 6411 points - 0.65374334
WFP: Olive groves [Green2] 852222 points and WFP: Sport&leisure facilit [White] 2884 points - 0.65859068
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Military camps [White] 9272 points - 0.66261313
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Natural grass land [Sea Green] 1655893 points - 0.66311455
WFP: Colonies [White] 122694 points and WFP: Drip Irrigated Arable [Green] 100227 points - 0.67445783
WFP: Construction sites [White] 9368 points and WFP: Military camps [White] 9272 points - 0.67591785
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 0.67959534
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 0.67966433
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Others [Black] 3086 points - 0.68239197
WFP: Industrial or com.unit [White] 4491 points and WFP: Military camps [White] 9272 points - 0.68278234
WFP: Military camps [White] 9272 points and WFP: Natural grass land [Sea Green] 1655893 points - 0.68720374
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Sport&leisure facilit [White] 2884 points - 0.69845647

WFP: Non-irrig. complex cul) [Green3] 237369 points and WFP: Olive groves) [Green2] 852222 points - 0.69918018
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Drip Irrigated Arable [Green] 100227 points - 0.70144153
WFP: Colonies [White] 122694 points and WFP: Natural grass land [Sea Green] 1655893 points - 0.70445483
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Transitional wood land [Yellow3] 28869 points - 0.70503067
WFP: Natural grass land [Sea Green] 1655893 points and WFP: Others [Black] 3086 points - 0.70829863
WFP: Colonies [White] 122694 points and WFP: Refugee Camps [White] 7782 points - 0.71027561
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Irrig. complex cult. pl [Aquamarine] 108085 points - 0.71433079
WFP: Colonies [White] 122694 points and WFP: Irrig. complex cult. pl [Aquamarine] 108085 points - 0.71777482
WFP: Colonies [White] 122694 points and WFP: Drip irrig. Vineyards [Green2] 19238 points - 0.72179904
WFP: Olive groves [Green2] 852222 points and WFP: Others [Black] 3086 points - 0.72437025
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Discontinuous Urban Fa [White] 498692 points - 0.72780629
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Military camps [White] 9272 points - 0.72871453
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 0.73252200
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Refugee Camps [White] 7782 points - 0.73949667
WFP: Natural grass land [Sea Green] 1655893 points and WFP: Olive groves) [Green2] 852222 points - 0.73985829
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Fruit trees&berry plan [Yellow3] 4603 points - 0.74538238
WFP: Halophytes [Coral] 44716 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 0.74554547
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WFP: Industrial or com.unit [White] 4491 points and WFP: Refugee Camps [White] 7782 points - 0.75509210
WFP: Colonies [White] 122694 points and WFP: Others [Black] 3086 points - 0.76763375
WFP: Forest [Green3] 67466 points and WFP: Others [Black] 3086 points - 0.77922547
WFP: Military camps [White] 9272 points and WFP: Refugee Camps [White] 7782 points - 0.78327642
WFP: Green urban areas [White] 1677 points and WFP: Irrig. complex cult. pl [Aquamarine] 108085 points - 0.78705716
WFP: Construction sites [White] 9368 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 0.78928939
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WFP: Colonies [White] 122694 points and WFP: Mineral extrac. sites [Red2] 18131 points - 0.83726451
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WFP: Citrus plantations [Orchid] 12546 points and WFP: Others [Black] 3086 points - 0.86113659
WFP: Green urban areas [White] 1677 points and WFP: Military camps [White] 9272 points - 0.86129661
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Palm groves [Green] 6411 points - 0.86848169
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WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Natural grass land [Sea Green] 1655893 points - 0.88096434
WFP: Construction sites [White] 9368 points and WFP: Drip irrig. Vineyards [Green2] 19238 points - 0.89028313
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 0.89120374
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WFP: Green urban areas [White] 1677 points and WFP: Refugee Camps [White] 7782 points - 0.89650603
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WFP: Olive groves) [Green2] 852222 points and WFP: Vineyards [Orange4] 93668 points - 0.90671572
WFP: Colonies [White] 122694 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 0.90753297
WFP: Military camps [White] 9272 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 0.90795872
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Military camps [White] 9272 points - 0.90845674
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Drip Irrigated Arable [Green] 100227 points - 0.91855701
WFP: Green urban areas [White] 1677 points and WFP: Industrial or com.unit [White] 4491 points - 0.91857714
WFP: Citrus plantations [Orchid] 12546 points and WFP: Green urban areas [White] 1677 points - 0.92304942
WFP: Non-Irrigated Arable L [Green3] 284445 points and WFP: Others [Black] 3086 points - 0.92365043
WFP: Others [Black] 3086 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 0.92662645
WFP: Colonies [White] 122694 points and WFP: Green urban areas [White] 1677 points - 0.92880603
WFP: Aiports [White] 949 points and WFP: Construction sites [White] 9368 points - 0.93283506
WFP: Natural grass land [Sea Green] 1655893 points and WFP: Sport&leisture facilit [White] 2884 points - 0.93339310
WFP: Non-Irrigated Arable L [Green3] 284445 points and WFP: Olive groves) [Green2] 852222 points - 0.93917991
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Industrial or com.unit [White] 4491 points - 0.95549365
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Natural grass land [Sea Green] 1655893 points - 0.95966428

WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 0.96176756
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Vineyards [Orange4] 93668 points - 0.96287420
WFP: Forest [Green3] 67466 points and WFP: Green urban areas [White] 1677 points - 0.97103938
WFP: Citrus plantations [Orchid] 12546 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 0.97188603
WFP: Others [Black] 3086 points and WFP: Transitional wood land [Yellow3] 28869 points - 0.97432106
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Forest [Green3] 67466 points - 0.97542521
WFP: Citrus plantations [Orchid] 12546 points and WFP: Sport&leisture facilit [White] 2884 points - 0.97689197
WFP: Irrig. complex cult. pl [Aquamarine] 108085 points and WFP: Natural grass land [Sea Green] 1655893 points - 0.97805628
WFP: Citrus plantations [Orchid] 12546 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 0.98332775
WFP: Non-irrig. complex cul) [Green3] 237369 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 0.98348014
WFP: Natural grass land [Sea Green] 1655893 points and WFP: Transitional wood land [Yellow3] 28869 points - 0.98351812
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Forest [Green3] 67466 points - 0.98366307
WFP: Colonies [White] 122694 points and WFP: Fruit trees&berry plan [Yellow3] 4603 points - 0.98440400
WFP: Forest [Green3] 67466 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 0.98589640
WFP: Construction sites [White] 9368 points and WFP: Palm groves [Green] 6411 points - 0.98747960
WFP: Dump site [White] 95 points and WFP: Military camps [White] 9272 points - 0.98790594
WFP: Bare rock [Red] 20454 points and WFP: Halophytes [Coral] 44716 points - 0.98848088
WFP: Citrus plantations [Orchid] 12546 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 0.99265594
WFP: Irrig. complex cult. pl [Aquamarine] 108085 points and WFP: Sport&leisture facilit [White] 2884 points - 0.99338065
WFP: Citrus plantations [Orchid] 12546 points and WFP: Transitional wood land [Yellow3] 28869 points - 0.99373440
WFP: Others [Black] 3086 points and WFP: Vineyards [Orange4] 93668 points - 0.99393139
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Salt marshes [Cyan2] 8118 points - 0.99398811
WFP: Irrig. complex cult. pl [Aquamarine] 108085 points and WFP: Olive groves) [Green2] 852222 points - 0.99447679
WFP: Aiports [White] 949 points and WFP: Green urban areas [White] 1677 points - 0.99611647
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 0.99770627
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Olive groves) [Green2] 852222 points - 1.00087493
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Discontinuous Urban Fa [White] 498692 points - 1.00157625
WFP: Citrus plantations [Orchid] 12546 points and WFP: Forest [Green3] 67466 points - 1.00247942
WFP: Construction sites [White] 9368 points and WFP: Dump site [White] 95 points - 1.00563454
WFP: Colonies [White] 122694 points and WFP: Forest [Green3] 67466 points - 1.00625064
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Drip irrig. Vineyards [Green2] 19238 points - 1.01410597
WFP: Bare rock [Red] 20454 points and WFP: Mineral extrac. sites [Red2] 18131 points - 1.02364006
WFP: Dump site [White] 95 points and WFP: Refugee Camps [White] 7782 points - 1.02965367
WFP: Forest [Green3] 67466 points and WFP: Military camps [White] 9272 points - 1.03278393
WFP: Colonies [White] 122694 points and WFP: Vineyards [Orange4] 93668 points - 1.03420752
WFP: Halophytes [Coral] 44716 points and WFP: Salt marshes [Cyan2] 8118 points - 1.03522808
WFP: Citrus plantations [Orchid] 12546 points and WFP: Olive groves) [Green2] 852222 points - 1.04005107
WFP: Others [Black] 3086 points and WFP: Sport&leisture facilit [White] 2884 points - 1.04786117
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 1.04970851
WFP: Construction sites [White] 9368 points and WFP: Discontinuous Urban Fa [White] 498692 points - 1.05033968
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Natural grass land [Sea Green] 1655893 points - 1.05133256
WFP: Non-irrig. complex cul) [Green3] 237369 points and WFP: Vineyards [Orange4] 93668 points - 1.05204370
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Olive groves) [Green2] 852222 points - 1.05383338
WFP: Irrig. complex cult. pl [Aquamarine] 108085 points and WFP: Refugee Camps [White] 7782 points - 1.06490393
WFP: Construction sites [White] 9368 points and WFP: Irrig. complex cult. pl [Aquamarine] 108085 points - 1.06913819
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WFP: Others [Black] 3086 points and WFP: Palm groves [Green] 6411 points - 1.07737038
WFP: Natural grass land [Sea Green] 1655893 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 1.07838657
WFP: Irrig. complex cult. pl [Aquamarine] 108085 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.07919341
WFP: Military camps [White] 9272 points and WFP: Olive groves) [Green2] 852222 points - 1.09235433
WFP: Aiports [White] 949 points and WFP: Refugee Camps [White] 7782 points - 1.09467822
WFP: Aiports [White] 949 points and WFP: Mineral extrac. sites [Red2] 18131 points - 1.09632551
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Sport&leisture facilit [White] 2884 points - 1.09729355
WFP: Bare rock [Red] 20454 points and WFP: Military camps [White] 9272 points - 1.09741076
WFP: Aiports [White] 949 points and WFP: Fruit trees&berry plan [Yellow3] 4603 points - 1.09835950
WFP: Construction sites [White] 9368 points and WFP: Drip Irrigated Arable [Green] 100227 points - 1.10704239
WFP: Bare rock [Red] 20454 points and WFP: Construction sites [White] 9368 points - 1.10844308
WFP: Colonies [White] 122694 points and WFP: Olive groves) [Green2] 852222 points - 1.11012644
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Irrig. complex cult. pl [Aquamarine] 108085 points - 1.11213124
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Refugee Camps [White] 7782 points - 1.11235510
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Citrus plantations [Orchid] 12546 points - 1.11283490
WFP: Dump site [White] 95 points and WFP: Forest [Green3] 67466 points - 1.11337955
WFP: Palm groves [Green] 6411 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.11358988
WFP: Palm groves [Green] 6411 points and WFP: Refugee Camps [White] 7782 points - 1.11621569
WFP: Non-Irrigated Arable L [Green3] 284445 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.11632510
WFP: Natural grass land [Sea Green] 1655893 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.11892833
WFP: Military camps [White] 9272 points and WFP: Vineyards [Orange4] 93668 points - 1.12133268
WFP: Irrig. complex cult. pl [Aquamarine] 108085 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.12390696
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Refugee Camps [White] 7782 points - 1.12420602

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WFP: Mineral extrac. sites [Red2] 18131 points and WFP: Natural grass land [Sea Green] 1655893 points - 1.12444530
WFP: Green urban areas [White] 1677 points and WFP: Others [Black] 3086 points - 1.12453325
WFP: Aiports [White] 949 points and WFP: Others [Black] 3086 points - 1.12520810
WFP: Aiports [White] 949 points and WFP: Drip Irrigated Arable [Green] 100227 points - 1.12641253
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Sport&leisure facilit [White] 2884 points - 1.12760072
WFP: Military camps [White] 9272 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 1.12959053
WFP: Forest [Green3] 67466 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 1.13165493
WFP: Military camps [White] 9272 points and WFP: Palm groves [Green] 6411 points - 1.13554819
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Aiports [White] 949 points - 1.13670515
WFP: Construction sites [White] 9368 points and WFP: Industrial or com.unit [White] 4491 points - 1.14032825
WFP: Forest [Green3] 67466 points and WFP: Vineyards [Orange4] 93668 points - 1.14066916
WFP: Dump site [White] 95 points and WFP: Others [Black] 3086 points - 1.14138702
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Dump site [White] 95 points - 1.14149255
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Fruit trees&berry plan [Yellow3] 4603 points - 1.14778578
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Dump site [White] 95 points - 1.14901118
WFP: Bare rock [Red] 20454 points and WFP: Colonies [White] 122694 points - 1.14993856
WFP: Green urban areas [White] 1677 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 1.15296001
WFP: Aiports [White] 949 points and WFP: Irrig. complex cult. pl [Aquamarine] 108085 points - 1.15301501
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.15426183
WFP: Colonies [White] 122694 points and WFP: Continuous Urban Fabri [White] 13586 points - 1.15625380
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Green urban areas [White] 1677 points - 1.15820291
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 1.15866017
WFP: Dump site [White] 95 points and WFP: Irrig. complex cult. pl [Aquamarine] 108085 points - 1.16617781
WFP: Halophytes [Coral] 44716 points and WFP: Palm groves [Green] 6411 points - 1.16684433
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Forest [Green3] 67466 points - 1.16803436
WFP: Non-irrig. complex cul) [Green3] 237369 points and WFP: Sport&leisure facilit [White] 2884 points - 1.16853048
WFP: Industrial or com.unit [White] 4491 points and WFP: Irrig. complex cult. pl [Aquamarine] 108085 points - 1.17595895
WFP: Green urban areas [White] 1677 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 1.18045159
WFP: Colonies [White] 122694 points and WFP: Palm groves [Green] 6411 points - 1.18100287
WFP: Citrus plantations [Orchid] 12546 points and WFP: Discontinuous Urban Fa [White] 498692 points - 1.18157442
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Dump site [White] 95 points - 1.18322398
WFP: Non-Irrigated Arable L [Green3] 284445 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.18836838
WFP: Green urban areas [White] 1677 points and WFP: Sport&leisure facilit [White] 2884 points - 1.18993624
WFP: Construction sites [White] 9368 points and WFP: Natural grass land [Sea Green] 1655893 points - 1.19262942
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.19706603
WFP: Halophytes [Coral] 44716 points and WFP: Refugee Camps [White] 7782 points - 1.19882294
WFP: Colonies [White] 122694 points and WFP: Halophytes [Coral] 44716 points - 1.19923297
WFP: Military camps [White] 9272 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 1.20309729
WFP: Green urban areas [White] 1677 points and WFP: Olive groves) [Green2] 852222 points - 1.21017394
WFP: Aiports [White] 949 points and WFP: Vineyards [Orange4] 93668 points - 1.21116751
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Green urban areas [White] 1677 points - 1.21266421
WFP: Citrus plantations [Orchid] 12546 points and WFP: Palm groves [Green] 6411 points - 1.21314365
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.21681956
WFP: Citrus plantations [Orchid] 12546 points and WFP: Fruit trees&berry plan [Yellow3] 4603 points - 1.21806153
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Mineral extrac. sites [Red2] 18131 points - 1.21828120
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 1.21976366
WFP: Aiports [White] 949 points and WFP: Natural grass land [Sea Green] 1655893 points - 1.21984651
WFP: Bare rock [Red] 20454 points and WFP: Natural grass land [Sea Green] 1655893 points - 1.22083322
WFP: Dump site [White] 95 points and WFP: Natural grass land [Sea Green] 1655893 points - 1.22141955
WFP: Military camps [White] 9272 points and WFP: Sport&leisure facilit [White] 2884 points - 1.22426784
WFP: Natural grass land [Sea Green] 1655893 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 1.22585438
WFP: Construction sites [White] 9368 points and WFP: Others [Black] 3086 points - 1.22747705
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Halophytes [Coral] 44716 points - 1.22755768
WFP: Aiports [White] 949 points and WFP: Drip irrig. Vineyards [Green2] 19238 points - 1.23271043
WFP: Palm groves [Green] 6411 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.23884786
WFP: Colonies [White] 122694 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 1.23888580
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Dump site [White] 95 points - 1.23914881
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Green urban areas [White] 1677 points - 1.23936923
WFP: Dump site [White] 95 points and WFP: Halophytes [Coral] 44716 points - 1.24167087
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Olive groves) [Green2] 852222 points - 1.24255349
WFP: Dump site [White] 95 points and WFP: Salt marshes [Cyan2] 8118 points - 1.24270798
WFP: Industrial or com.unit [White] 4491 points and WFP: Others [Black] 3086 points - 1.24376903
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Sport&leisure facilit [White] 2884 points - 1.25502025
WFP: Citrus plantations [Orchid] 12546 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.25550514
WFP: Refugee Camps [White] 7782 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.25730942
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.25981665
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.26207871
WFP: Colonies [White] 122694 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 1.26520913
WFP: Irrig. complex cult. pl [Aquamarine] 108085 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.26857186

WFP: Citrus plantations [Orchid] 12546 points and WFP: Military camps [White] 9272 points - 1.27059265
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.27119436
WFP: Colonies [White] 122694 points and WFP: Salt marshes [Cyan2] 8118 points - 1.27571186
WFP: Industrial or com.unit [White] 4491 points and WFP: Mineral extrac. sites [Red2] 18131 points - 1.27701131
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Industrial or com.unit [White] 4491 points - 1.27805882
WFP: Bare rock [Red] 20454 points and WFP: Palm groves [Green] 6411 points - 1.28016613
WFP: Military camps [White] 9272 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.28021204
WFP: Dump site [White] 95 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.28160100
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.28274387
WFP: Transitional wood land [Yellow3] 28869 points and WFP: Vineyards [Orange4] 93668 points - 1.28511855
WFP: Military camps [White] 9272 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.28997899
WFP: Halophytes [Coral] 44716 points and WFP: Military camps [White] 9272 points - 1.29092184
WFP: Colonies [White] 122694 points and WFP: Sport&leisure facilit [White] 2884 points - 1.29387289
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Sport&leisure facilit [White] 2884 points - 1.29390830
WFP: Non-Irrigated Arable L [Green3] 284445 points and WFP: Vineyards [Orange4] 93668 points - 1.29637798
WFP: Others [Black] 3086 points and WFP: Refugee Camps [White] 7782 points - 1.29701890
WFP: Green urban areas [White] 1677 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.29782081
WFP: Irrig. complex cult. pl [Aquamarine] 108085 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.29984488
WFP: Dump site [White] 95 points and WFP: Fruit trees&berry plan [Yellow3] 4603 points - 1.30311239
WFP: Dump site [White] 95 points and WFP: Olive groves) [Green2] 852222 points - 1.31322429
WFP: Aiports [White] 949 points and WFP: Forest [Green3] 67466 points - 1.31726417
WFP: Bare rock [Red] 20454 points and WFP: Refugee Camps [White] 7782 points - 1.32466341
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Fruit trees&berry plan [Yellow3] 4603 points - 1.32495665
WFP: Bare rock [Red] 20454 points and WFP: Irrig. complex cult. pl [Aquamarine] 108085 points - 1.33045303
WFP: Aiports [White] 949 points and WFP: Olive groves) [Green2] 852222 points - 1.33168640
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Military camps [White] 9272 points - 1.33249104
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Industrial or com.unit [White] 4491 points - 1.33285227
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.33479239
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Palm groves [Green] 6411 points - 1.33628404
WFP: Construction sites [White] 9368 points and WFP: Salt marshes [Cyan2] 8118 points - 1.33725691
WFP: Colonies [White] 122694 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.33989480
WFP: Refugee Camps [White] 7782 points and WFP: Salt marshes [Cyan2] 8118 points - 1.34118038
WFP: Bare rock [Red] 20454 points and WFP: Drip irrig. Vineyards [Green2] 19238 points - 1.34164798
WFP: Green urban areas [White] 1677 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.34267491
WFP: Industrial or com.unit [White] 4491 points and WFP: Vineyards [Orange4] 93668 points - 1.35496889
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Industrial or com.unit [White] 4491 points - 1.35678230
WFP: Sclerophylous vegt. [Maroon] 123131 points and WFP: Vineyards [Orange4] 93668 points - 1.35788166
WFP: Halophytes [Coral] 44716 points and WFP: Irrig. complex cult. pl [Aquamarine] 108085 points - 1.36505809
WFP: Aiports [White] 949 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 1.36507172
WFP: Others [Black] 3086 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.37505323
WFP: Dump site [White] 95 points and WFP: Palm groves [Green] 6411 points - 1.38189380
WFP: Non-Irrigated Arable L [Green3] 284445 points and WFP: Sport&leisure facilit [White] 2884 points - 1.38229714
WFP: Halophytes [Coral] 44716 points and WFP: Mineral extrac. sites [Red2] 18131 points - 1.38418761
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Salines [Cyan] 882 points - 1.38891938
WFP: Mineral extrac. sites [Red2] 18131 points and WFP: Refugee Camps [White] 7782 points - 1.39186240
WFP: Industrial or com.unit [White] 4491 points and WFP: Natural grass land [Sea Green] 1655893 points - 1.39460251
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Mineral extrac. sites [Red2] 18131 points - 1.39618016
WFP: Green urban areas [White] 1677 points and WFP: Water bodies [Blue2] 700 points - 1.39626706
WFP: Green urban areas [White] 1677 points and WFP: Palm groves [Green] 6411 points - 1.39779270
WFP: Aiports [White] 949 points and WFP: Dump site [White] 95 points - 1.39869700
WFP: Colonies [White] 122694 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.40164559
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Mineral extrac. sites [Red2] 18131 points - 1.40244599
WFP: Bare rock [Red] 20454 points and WFP: Drip Irrigated Arable [Green] 100227 points - 1.40404935
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Halophytes [Coral] 44716 points - 1.40491952
WFP: Aiports [White] 949 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 1.40548862
WFP: Bare rock [Red] 20454 points and WFP: Dump site [White] 95 points - 1.40946393
WFP: Aiports [White] 949 points and WFP: Continuous Urban Fabri [White] 13586 points - 1.41166874
WFP: Dump site [White] 95 points and WFP: Vineyards [Orange4] 93668 points - 1.41248961
WFP: Dump site [White] 95 points and WFP: Industrial or com.unit [White] 4491 points - 1.41381037
WFP: Industrial or com.unit [White] 4491 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 1.41581660
WFP: Mineral extrac. sites [Red2] 18131 points and WFP: Others [Black] 3086 points - 1.41598384
WFP: Citrus plantations [Orchid] 12546 points and WFP: Natural grass land [Sea Green] 1655893 points - 1.41617604
WFP: Industrial or com.unit [White] 4491 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 1.41749449
WFP: Citrus plantations [Orchid] 12546 points and WFP: Colonies [White] 122694 points - 1.41889830
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Vineyards [Orange4] 93668 points - 1.42268204
WFP: Bare rock [Red] 20454 points and WFP: Others [Black] 3086 points - 1.42292928
WFP: Irrig. complex cult. pl [Aquamarine] 108085 points and WFP: Mineral extrac. sites [Red2] 18131 points - 1.43420531
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Salt marshes [Cyan2] 8118 points - 1.43487133
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.43761219

WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Construction sites [White] 9368 points - 1.44413908
WFP: Irrig. complex cult. pl [Aquamarine] 108085 points and WFP: Salt marshes [Cyan2] 8118 points - 1.45157019
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.45464544
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.45473768
WFP: Bare rock [Red] 20454 points and WFP: Discontinuous Urban Fa [White] 498692 points - 1.45939143
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Halophytes [Coral] 44716 points - 1.45956708
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Construction sites [White] 9368 points - 1.46265812
WFP: Dump site [White] 95 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.46475665
WFP: Military camps [White] 9272 points and WFP: Salt marshes [Cyan2] 8118 points - 1.46507476
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.46564912
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Salt marshes [Cyan2] 8118 points - 1.46589238
WFP: Aiports [White] 949 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.46636430
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Mineral extrac. sites [Red2] 18131 points - 1.47004807
WFP: Dump site [White] 95 points and WFP: Sport&leisure facilit [White] 2884 points - 1.47060551
WFP: Green urban areas [White] 1677 points and WFP: Natural grass land [Sea Green] 1655893 points - 1.47336661
WFP: Aiports [White] 949 points and WFP: Citrus plantations [Orchid] 12546 points - 1.47551911
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Water bodies [Blue2] 700 points - 1.47639818
WFP: Dump site [White] 95 points and WFP: Mineral extrac. sites [Red2] 18131 points - 1.48689049
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Colonies [White] 122694 points - 1.48794071
WFP: Dump site [White] 95 points and WFP: Green urban areas [White] 1677 points - 1.48949287
WFP: Irrig. complex cult. pl [Aquamarine] 108085 points and WFP: Vineyards [Orange4] 93668 points - 1.49065488
WFP: Aiports [White] 949 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.49335853
WFP: Aiports [White] 949 points and WFP: Palm groves [Green] 6411 points - 1.49722029
WFP: Forest [Green3] 67466 points and WFP: Industrial or com.unit [White] 4491 points - 1.49767617
WFP: Others [Black] 3086 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.49973638
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Refugee Camps [White] 7782 points - 1.50217119
WFP: Industrial or com.unit [White] 4491 points and WFP: Olive groves) [Green2] 852222 points - 1.50416031
WFP: Aiports [White] 949 points and WFP: Sport&leisure facilit [White] 2884 points - 1.50470586
WFP: Construction sites [White] 9368 points and WFP: Green urban areas [White] 1677 points - 1.52343619
WFP: Natural grass land [Sea Green] 1655893 points and WFP: Refugee Camps [White] 7782 points - 1.52484310
WFP: Industrial or com.unit [White] 4491 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.52892634
WFP: Industrial or com.unit [White] 4491 points and WFP: Palm groves [Green] 6411 points - 1.52968182
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Drip Irrigated Arable [Green] 100227 points - 1.53519558
WFP: Aiports [White] 949 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.53557104
WFP: Sport&leisure facilit [White] 2884 points and WFP: Vineyards [Orange4] 93668 points - 1.53620486
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Irrig. complex cult. pl [Aquamarine] 108085 points - 1.53627798
WFP: Mineral extrac. sites [Red2] 18131 points and WFP: Palm groves [Green] 6411 points - 1.53665721
WFP: Forest [Green3] 67466 points and WFP: Refugee Camps [White] 7782 points - 1.53940642
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Vineyards [Orange4] 93668 points - 1.54505666
WFP: Dump site [White] 95 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 1.54864929
WFP: Aiports [White] 949 points and WFP: Bare rock [Red] 20454 points - 1.55364789
WFP: Palm groves [Green] 6411 points and WFP: Sport&leisure facilit [White] 2884 points - 1.55407719
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Salt marshes [Cyan2] 8118 points - 1.55442075
WFP: Dump site [White] 95 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.55490714
WFP: Industrial or com.unit [White] 4491 points and WFP: Salt marshes [Cyan2] 8118 points - 1.55586142
WFP: Construction sites [White] 9368 points and WFP: Forest [Green3] 67466 points - 1.55984382
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.56035676
WFP: Mineral extrac. sites [Red2] 18131 points and WFP: Vineyards [Orange4] 93668 points - 1.56192762
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Military camps [White] 9272 points - 1.56381372
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Drip Irrigated Arable [Green] 100227 points - 1.56381503
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Mineral extrac. sites [Red2] 18131 points - 1.56550624
WFP: Natural grass land [Sea Green] 1655893 points and WFP: Palm groves [Green] 6411 points - 1.56643660
WFP: Green urban areas [White] 1677 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.57362403
WFP: Pannana Plantation [Sea Green] 377 points and WFP: Sport&leisure facilit [White] 2884 points - 1.57523656
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Bare rock [Red] 20454 points - 1.57526111
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Refugee Camps [White] 7782 points - 1.57881897
WFP: Salt marshes [Cyan2] 8118 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.58325193
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Dump site [White] 95 points - 1.58856649
WFP: Military camps [White] 9272 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.58897518
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.59697303
WFP: Citrus plantations [Orchid] 12546 points and WFP: Refugee Camps [White] 7782 points - 1.59957851
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Dump site [White] 95 points - 1.60335452
WFP: Construction sites [White] 9368 points and WFP: Sport&leisure facilit [White] 2884 points - 1.61152255
WFP: Dump site [White] 95 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 1.61551964
WFP: Halophytes [Coral] 44716 points and WFP: Natural grass land [Sea Green] 1655893 points - 1.61596241
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Industrial or com.unit [White] 4491 points - 1.62250042
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Salt marshes [Cyan2] 8118 points - 1.62313664
WFP: Palm groves [Green] 6411 points and WFP: Salt marshes [Cyan2] 8118 points - 1.62431275
WFP: Green urban areas [White] 1677 points and WFP: Vineyards [Orange4] 93668 points - 1.62525917

WFP: Citrus plantations [Orchid] 12546 points and WFP: Industrial or com.unit [White] 4491 points - 1.62558055
WFP: Colonies [White] 122694 points and WFP: Water bodies [Blue2] 700 points - 1.62771545
WFP: Refugee Camps [White] 7782 points and WFP: Water bodies [Blue2] 700 points - 1.62855881
WFP: Forest [Green3] 67466 points and WFP: Palm groves [Green] 6411 points - 1.62900382
WFP: Construction sites [White] 9368 points and WFP: Continuous Urban Fabri [White] 13586 points - 1.63044994
WFP: Green urban areas [White] 1677 points and WFP: Mineral extrac. sites [Red2] 18131 points - 1.63120724
WFP: Construction sites [White] 9368 points and WFP: Fruit trees&berry plan [Yellow3] 4603 points - 1.63323888
WFP: Halophytes [Coral] 44716 points and WFP: Industrial or com.unit [White] 4491 points - 1.63688833
WFP: Forest [Green3] 67466 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.63790017
WFP: Construction sites [White] 9368 points and WFP: Olive groves) [Green2] 852222 points - 1.63809142
WFP: Citrus plantations [Orchid] 12546 points and WFP: Dump site [White] 95 points - 1.64114995
WFP: Bare rock [Red] 20454 points and WFP: Industrial or com.unit [White] 4491 points - 1.64116273
WFP: Construction sites [White] 9368 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.64159094
WFP: Industrial or com.unit [White] 4491 points and WFP: Water bodies [Blue2] 700 points - 1.64170047
WFP: Citrus plantations [Orchid] 12546 points and WFP: Construction sites [White] 9368 points - 1.64246062
WFP: Halophytes [Coral] 44716 points and WFP: Others [Black] 3086 points - 1.64508278
WFP: Refugee Camps [White] 7782 points and WFP: Sport&leisure facilit [White] 2884 points - 1.64579165
WFP: Bare rock [Red] 20454 points and WFP: Forest [Green3] 67466 points - 1.64783986
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Refugee Camps [White] 7782 points - 1.65249227
WFP: Colonies [White] 122694 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.65260656
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Irrig. complex cult. pl [Aquamarine] 108085 points - 1.65461402
WFP: Forest [Green3] 67466 points and WFP: Mineral extrac. sites [Red2] 18131 points - 1.65750651
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Drip irrig. Vineyards [Green2] 19238 points - 1.65849242
WFP: Forest [Green3] 67466 points and WFP: Water bodies [Blue2] 700 points - 1.66016545
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Drip irrig. Vineyards [Green2] 19238 points - 1.66325414
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Palm groves [Green] 6411 points - 1.66405931
WFP: Forest [Green3] 67466 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.66473977
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Water bodies [Blue2] 700 points - 1.66517810
WFP: Mineral extrac. sites [Red2] 18131 points and WFP: Olive groves) [Green2] 852222 points - 1.66605822
WFP: Non-Irrigated Arable L [Green3] 284445 points and WFP: Refugee Camps [White] 7782 points - 1.66842068
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Water bodies [Blue2] 700 points - 1.67042107
WFP: Bare rock [Red] 20454 points and WFP: Sport&leisure facilit [White] 2884 points - 1.67184706
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Forest [Green3] 67466 points - 1.67308349
WFP: Bare rock [Red] 20454 points and WFP: Beaches, dunes&sand pl [Orange4] 22395 points - 1.67629513
WFP: Construction sites [White] 9368 points and WFP: Vineyards [Orange4] 93668 points - 1.67982922
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Palm groves [Green] 6411 points - 1.68137257
WFP: Non-irrig. complex cul) [Green3] 237369 points and WFP: Refugee Camps [White] 7782 points - 1.68198448
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.68215015
WFP: Olive groves) [Green2] 852222 points and WFP: Refugee Camps [White] 7782 points - 1.68236360
WFP: Aiports [White] 949 points and WFP: Halophytes [Coral] 44716 points - 1.68310106
WFP: Construction sites [White] 9368 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.68401297
WFP: Green urban areas [White] 1677 points and WFP: Salt marshes [Cyan2] 8118 points - 1.68477094
WFP: Industrial or com.unit [White] 4491 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.68489142
WFP: Industrial or com.unit [White] 4491 points and WFP: Sport&leisure facilit [White] 2884 points - 1.68748143
WFP: Mineral extrac. sites [Red2] 18131 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 1.68865582
WFP: Aiports [White] 949 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.69079944
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Halophytes [Coral] 44716 points - 1.69522944
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Mineral extrac. sites [Red2] 18131 points - 1.69599175
WFP: Aiports [White] 949 points and WFP: Salt marshes [Cyan2] 8118 points - 1.69620343
WFP: Mineral extrac. sites [Red2] 18131 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 1.69981744
WFP: Industrial or com.unit [White] 4491 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.70208442
WFP: Salines [Cyan] 882 points and WFP: Salt marshes [Cyan2] 8118 points - 1.70247286
WFP: Citrus plantations [Orchid] 12546 points and WFP: Vineyards [Orange4] 93668 points - 1.70484396
WFP: Irrig. complex cult. pl [Aquamarine] 108085 points and WFP: Water bodies [Blue2] 700 points - 1.70493448
WFP: Non-Irrigated Arable L [Green3] 284445 points and WFP: Palm groves [Green] 6411 points - 1.70554214
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Water bodies [Blue2] 700 points - 1.70702775
WFP: Sparsely veg. area [Maroon3] 1300202 points and WFP: Sport&leisure facilit [White] 2884 points - 1.70725169
WFP: Bare rock [Red] 20454 points and WFP: Fruit trees&berry plan [Yellow3] 4603 points - 1.71046561
WFP: Pannana Plantation [Sea Green] 377 points and WFP: Refugee Camps [White] 7782 points - 1.71219048
WFP: Bare rock [Red] 20454 points and WFP: Green urban areas [White] 1677 points - 1.71548303
WFP: Construction sites [White] 9368 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 1.71597371
WFP: Natural grass land [Sea Green] 1655893 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.71926388
WFP: Construction sites [White] 9368 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 1.71957887
WFP: Green urban areas [White] 1677 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.72058394
WFP: Refugee Camps [White] 7782 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.72208131
WFP: Bare rock [Red] 20454 points and WFP: Olive groves) [Green2] 852222 points - 1.73315107
WFP: Bare rock [Red] 20454 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.73536149
WFP: Mineral extrac. sites [Red2] 18131 points and WFP: Sport&leisure facilit [White] 2884 points - 1.73542968
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.73764741

WFP: Salines [Cyan] 882 points and WFP: Water bodies [Blue2] 700 points - 1.73966337
WFP: Non-irrig. complex cul) [Green3] 237369 points and WFP: Palm groves [Green] 6411 points - 1.74069518
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Others [Black] 3086 points - 1.74625462
WFP: Olive groves) [Green2] 852222 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.74912681
WFP: Mineral extrac. sites [Red2] 18131 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.74994206
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Discontinuous Urban Fa [White] 498692 points - 1.75233512
WFP: Aiports [White] 949 points and WFP: Water bodies [Blue2] 700 points - 1.75699361
WFP: Citrus plantations [Orchid] 12546 points and WFP: Continuous Urban Fabri [White] 13586 points - 1.75794216
WFP: Sclerophylous vegt. [Maroon] 123131 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.76562261
WFP: Bare rock [Red] 20454 points and WFP: Citrus plantations [Orchid] 12546 points - 1.76945957
WFP: Construction sites [White] 9368 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.77101240
WFP: Military camps [White] 9272 points and WFP: Water bodies [Blue2] 700 points - 1.77228377
WFP: Bare rock [Red] 20454 points and WFP: Salt marshes [Cyan2] 8118 points - 1.77371064
WFP: Refugee Camps [White] 7782 points and WFP: Vineyards [Orange4] 93668 points - 1.77554788
WFP: Aiports [White] 949 points and WFP: Beaches, dunes&sand pl [Orange4] 22395 points - 1.77571745
WFP: Bare rock [Red] 20454 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 1.77833009
WFP: Mineral extrac. sites [Red2] 18131 points and WFP: Salt marshes [Cyan2] 8118 points - 1.77877581
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Continuous Urban Fabri [White] 13586 points - 1.78006762
WFP: Bare rock [Red] 20454 points and WFP: Vineyards [Orange4] 93668 points - 1.78085197
WFP: Palm groves [Green] 6411 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.78161162
WFP: Mineral extrac. sites [Red2] 18131 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.78442979
WFP: Non-Irrigated Arable L [Green3] 284445 points and WFP: Water bodies [Blue2] 700 points - 1.78461697
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Palm groves [Green] 6411 points - 1.78541574
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Halophytes [Coral] 44716 points - 1.78580984
WFP: Sparsely veg. area [Maroon3] 1300202 points and WFP: Vineyards [Orange4] 93668 points - 1.78632825
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Fruit trees&berry plan [Yellow3] 4603 points - 1.78747202
WFP: Bare rock [Red] 20454 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.78868912
WFP: Bare rock [Red] 20454 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 1.78870782
WFP: Citrus plantations [Orchid] 12546 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.78967166
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Mineral extrac. sites [Red2] 18131 points - 1.79110250
WFP: Non-Irrigated Arable L [Green3] 284445 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.79135727
WFP: Salt marshes [Cyan2] 8118 points and WFP: Sport&leisure facilit [White] 2884 points - 1.79349340
WFP: Refugee Camps [White] 7782 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.79361759
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 1.79405561
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Sport&leisure facilit [White] 2884 points - 1.79903140
WFP: Non-irrig. complex cul) [Green3] 237369 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.80074083
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Continuous Urban Fabri [White] 13586 points - 1.80174242
WFP: Citrus plantations [Orchid] 12546 points and WFP: Water bodies [Blue2] 700 points - 1.80174448
WFP: Olive groves) [Green2] 852222 points and WFP: Palm groves [Green] 6411 points - 1.80444087
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Olive groves) [Green2] 852222 points - 1.80458309
WFP: Forest [Green3] 67466 points and WFP: Salt marshes [Cyan2] 8118 points - 1.80589102
WFP: Citrus plantations [Orchid] 12546 points and WFP: Mineral extrac. sites [Red2] 18131 points - 1.80642446
WFP: Others [Black] 3086 points and WFP: Salt marshes [Cyan2] 8118 points - 1.80988092
WFP: Industrial or com.unit [White] 4491 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.81135580
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 1.81197958
WFP: Construction sites [White] 9368 points and WFP: Water bodies [Blue2] 700 points - 1.81380097
WFP: Olive groves) [Green2] 852222 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.81725098
WFP: Halophytes [Coral] 44716 points and WFP: Salines [Cyan] 882 points - 1.82221410
WFP: Halophytes [Coral] 44716 points and WFP: Sport&leisure facilit [White] 2884 points - 1.82232443
WFP: Bare rock [Red] 20454 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.82235287
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Others [Black] 3086 points - 1.82305283
WFP: Pannana Plantation [Sea Green] 377 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.82466541
WFP: Sport&leisure facilit [White] 2884 points and WFP: Water bodies [Blue2] 700 points - 1.82562097
WFP: Dump site [White] 95 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.82634047
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.82645020
WFP: Pannana Plantation [Sea Green] 377 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.82830955
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Water bodies [Blue2] 700 points - 1.83070702
WFP: Citrus plantations [Orchid] 12546 points and WFP: Salt marshes [Cyan2] 8118 points - 1.83083994
WFP: Non-Irrigated Arable L [Green3] 284445 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.83167554
WFP: Dump site [White] 95 points and WFP: Water bodies [Blue2] 700 points - 1.83411232
WFP: Natural grass land [Sea Green] 1655893 points and WFP: Salt marshes [Cyan2] 8118 points - 1.83423491
WFP: Palm groves [Green] 6411 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.83428563
WFP: Palm groves [Green] 6411 points and WFP: Water bodies [Blue2] 700 points - 1.83458503
WFP: Non-irrig. complex cul) [Green3] 237369 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.83552886
WFP: Salt marshes [Cyan2] 8118 points and WFP: Water bodies [Blue2] 700 points - 1.83608202
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Green urban areas [White] 1677 points - 1.83785451
WFP: Green urban areas [White] 1677 points and WFP: Halophytes [Coral] 44716 points - 1.84164983
WFP: Sparsely veg. area [Maroon3] 1300202 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.84181517
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Palm groves [Green] 6411 points - 1.84187230

WFP: Others [Black] 3086 points and WFP: Water bodies [Blue2] 700 points - 1.84790764
WFP: Forest [Green3] 67466 points and WFP: Halophytes [Coral] 44716 points - 1.84808378
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Natural grass land [Sea Green] 1655893 points - 1.85322792
WFP: Industrial or com.unit [White] 4491 points and WFP: Salines [Cyan] 882 points - 1.85442592
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Vineyards [Orange4] 93668 points - 1.85444896
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Natural grass land [Sea Green] 1655893 points - 1.85501330
WFP: Mineral extrac. sites [Red2] 18131 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.85547904
WFP: Bare rock [Red] 20454 points and WFP: Continuous Urban Fabri [White] 13586 points - 1.85723387
WFP: Non-irrig. complex cul) [Green3] 237369 points and WFP: Water bodies [Blue2] 700 points - 1.85792573
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.85952823
WFP: Refugee Camps [White] 7782 points and WFP: Salines [Cyan] 882 points - 1.86546970
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Salt marshes [Cyan] 8118 points - 1.86728883
WFP: Olive groves) [Green2] 852222 points and WFP: Water bodies [Blue2] 700 points - 1.87001269
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.87291542
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.87374320
WFP: Halophytes [Coral] 44716 points and WFP: Water bodies [Blue2] 700 points - 1.87593445
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Water bodies [Blue2] 700 points - 1.87685054
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Halophytes [Coral] 44716 points - 1.87823027
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.88221624
WFP: Citrus plantations [Orchid] 12546 points and WFP: Halophytes [Coral] 44716 points - 1.88597326
WFP: Sclerophylous vegt. [Maroon] 123131 points and WFP: Water bodies [Blue2] 700 points - 1.88702683
WFP: Colonies [White] 122694 points and WFP: Salines [Cyan] 882 points - 1.88766050
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Water bodies [Blue2] 700 points - 1.89017376
WFP: Pannana Plantation [Sea Green] 377 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.89209047
WFP: Transitional wood land [Yellow3] 28869 points and WFP: Water bodies [Blue2] 700 points - 1.89759486
WFP: Construction sites [White] 9368 points and WFP: Salines [Cyan] 882 points - 1.90105620
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Salines [Cyan] 882 points - 1.90189086
WFP: Sparsely veg. area [Maroon3] 1300202 points and WFP: Water bodies [Blue2] 700 points - 1.90592304
WFP: Salines [Cyan] 882 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.90726441
WFP: Mineral extrac. sites [Red2] 18131 points and WFP: Water bodies [Blue2] 700 points - 1.90825267
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 1.91037729
WFP: Olive groves) [Green2] 852222 points and WFP: Salt marshes [Cyan2] 8118 points - 1.91209550
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Salines [Cyan] 882 points - 1.91312743
WFP: Non-Irrigated Arable L [Green3] 284445 points and WFP: Salt marshes [Cyan2] 8118 points - 1.91576066
WFP: Dump site [White] 95 points and WFP: Salines [Cyan] 882 points - 1.91801081
WFP: Non-irrig. complex cul) [Green3] 237369 points and WFP: Salt marshes [Cyan2] 8118 points - 1.91839354
WFP: Pannana Plantation [Sea Green] 377 points and WFP: Vineyards [Orange4] 93668 points - 1.91916631
WFP: Pannana Plantation [Sea Green] 377 points and WFP: Water bodies [Blue2] 700 points - 1.92210653
WFP: Palm groves [Green] 6411 points and WFP: Vineyards [Orange4] 93668 points - 1.92466119
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Salt marshes [Cyan2] 8118 points - 1.92495306
WFP: Natural grass land [Sea Green] 1655893 points and WFP: Water bodies [Blue2] 700 points - 1.92756967
WFP: Halophytes [Coral] 44716 points and WFP: Non-Irrigated Arable L [Green3] 284445 points - 1.93136764
WFP: Military camps [White] 9272 points and WFP: Salines [Cyan] 882 points - 1.93274097
WFP: Irrig. complex cult. pl [Aquamarine] 108085 points and WFP: Salines [Cyan] 882 points - 1.93345076
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 1.93603534
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Beaches, dunes&sand pl [Orange4] 22395 points - 1.93789097
WFP: Halophytes [Coral] 44716 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.93820988
WFP: Pannana Plantation [Sea Green] 377 points and WFP: Salt marshes [Cyan2] 8118 points - 1.93838853
WFP: Salt marshes [Cyan2] 8118 points and WFP: Vineyards [Orange4] 93668 points - 1.93901895
WFP: Bare rock [Red] 20454 points and WFP: Water bodies [Blue2] 700 points - 1.94061588
WFP: Salt marshes [Cyan2] 8118 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.94194047
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Halophytes [Coral] 44716 points - 1.94339566
WFP: Green urban areas [White] 1677 points and WFP: Salines [Cyan] 882 points - 1.94434656
WFP: Halophytes [Coral] 44716 points and WFP: Non-irrig. complex cul) [Green3] 237369 points - 1.94518894
WFP: Halophytes [Coral] 44716 points and WFP: Olive groves) [Green2] 852222 points - 1.94683708
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Forest [Green3] 67466 points - 1.94698088
WFP: Palm groves [Green] 6411 points and WFP: Salines [Cyan] 882 points - 1.94962459
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Sport&leisture facilit [White] 2884 points - 1.95001291
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Vineyards [Orange4] 93668 points - 1.95033521
WFP: Salt marshes [Cyan2] 8118 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.95175371
WFP: Vineyards [Orange4] 93668 points and WFP: Water bodies [Blue2] 700 points - 1.95442715
WFP: Halophytes [Coral] 44716 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.95447308
WFP: Bare rock [Red] 20454 points and WFP: Salines [Cyan] 882 points - 1.95642883
WFP: Mineral extrac. sites [Red2] 18131 points and WFP: Salines [Cyan] 882 points - 1.95677886
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Fruit trees&berry plan [Yellow3] 4603 points - 1.95723343
WFP: Halophytes [Coral] 44716 points and WFP: Vineyards [Orange4] 93668 points - 1.96113232
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Salines [Cyan] 882 points - 1.96395205
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Citrus plantations [Orchid] 12546 points - 1.96539686
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Salines [Cyan] 882 points - 1.96762822

WFP: Aiports [White] 949 points and WFP: Salines [Cyan] 882 points - 1.96917351
WFP: Halophytes [Coral] 44716 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.96962786
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Olive groves) [Green2] 852222 points - 1.97443388
WFP: Salines [Cyan] 882 points and WFP: Sport&leisure facilit [White] 2884 points - 1.98097935
WFP: Non-Irrigated Arable L [Green3] 284445 points and WFP: Salines [Cyan] 882 points - 1.98105107
WFP: Non-irrig. complex cul) [Green3] 237369 points and WFP: Salines [Cyan] 882 points - 1.98167798
WFP: Natural grass land [Sea Green] 1655893 points and WFP: Salines [Cyan] 882 points - 1.98447877
WFP: Others [Black] 3086 points and WFP: Salines [Cyan] 882 points - 1.98593927
WFP: Forest [Green3] 67466 points and WFP: Salines [Cyan] 882 points - 1.98789885
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Salines [Cyan] 882 points - 1.98834083
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.98850455
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.99109780
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Pannana Plantation [Sea Green] 377 points - 1.99242500
WFP: Salines [Cyan] 882 points and WFP: Transitional wood land [Yellow3] 28869 points - 1.99371948
WFP: Citrus plantations [Orchid] 12546 points and WFP: Salines [Cyan] 882 points - 1.99409083
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Salines [Cyan] 882 points - 1.99457513
WFP: Olive groves) [Green2] 852222 points and WFP: Salines [Cyan] 882 points - 1.99502326
WFP: Salines [Cyan] 882 points and WFP: Vineyards [Orange4] 93668 points - 1.99655773
WFP: Sea and ocean [Blue] 200480 points and WFP: Water bodies [Blue2] 700 points - 1.99822883
WFP: Salines [Cyan] 882 points and WFP: Sclerophylous vegt. [Maroon] 123131 points - 1.99852644
WFP: Beaches, dunes&sand pl [Orange4] 22395 points and WFP: Sea and ocean [Blue] 200480 points - 1.99913356
WFP: Salines [Cyan] 882 points and WFP: Sea and ocean [Blue] 200480 points - 1.99970218
WFP: Pannana Plantation [Sea Green] 377 points and WFP: Salines [Cyan] 882 points - 1.99977198
WFP: Green urban areas [White] 1677 points and WFP: Sea and ocean [Blue] 200480 points - 1.99998955
WFP: Colonies [White] 122694 points and WFP: Sea and ocean [Blue] 200480 points - 1.99999576
WFP: Industrial or com.unit [White] 4491 points and WFP: Sea and ocean [Blue] 200480 points - 1.99999705
WFP: Continuous Urban Fabri [White] 13586 points and WFP: Sea and ocean [Blue] 200480 points - 1.99999722
WFP: Non-Irrigated Arable L [Green3] 284445 points and WFP: Sea and ocean [Blue] 200480 points - 1.99999820
WFP: Drip Irrigated Arable [Green] 100227 points and WFP: Sea and ocean [Blue] 200480 points - 1.99999858
WFP: Refugee Camps [White] 7782 points and WFP: Sea and ocean [Blue] 200480 points - 1.99999923
WFP: Discontinuous Urban Fa [White] 498692 points and WFP: Sea and ocean [Blue] 200480 points - 1.99999928
WFP: Irrig. complex cult. pl [Aquamarine] 108085 points and WFP: Sea and ocean [Blue] 200480 points - 1.99999988
WFP: Forest [Green3] 67466 points and WFP: Sea and ocean [Blue] 200480 points - 1.99999994
WFP: Sea and ocean [Blue] 200480 points and WFP: Sparsely veg. area [Maroon3] 1300202 points - 1.99999996
WFP: Non-irrig. complex cul) [Green3] 237369 points and WFP: Sea and ocean [Blue] 200480 points - 1.99999999
WFP: Halophytes [Coral] 44716 points and WFP: Sea and ocean [Blue] 200480 points - 1.99999999
WFP: Military camps [White] 9272 points and WFP: Sea and ocean [Blue] 200480 points - 2.00000000
WFP: Mineral extrac. sites [Red2] 18131 points and WFP: Sea and ocean [Blue] 200480 points - 2.00000000
WFP: Bare rock [Red] 20454 points and WFP: Sea and ocean [Blue] 200480 points - 2.00000000
WFP: Sea and ocean [Blue] 200480 points and WFP: Sport&leisure facilit [White] 2884 points - 2.00000000
WFP: Agr.Land With Nat. Veg [Green] 651772 points and WFP: Sea and ocean [Blue] 200480 points - 2.00000000
WFP: Sea and ocean [Blue] 200480 points and WFP: Vineyards [Orange4] 93668 points - 2.00000000
WFP: Natural grass land [Sea Green] 1655893 points and WFP: Sea and ocean [Blue] 200480 points - 2.00000000
WFP: Drip irrig. Vineyards [Green2] 19238 points and WFP: Sea and ocean [Blue] 200480 points - 2.00000000
WFP: Fruit trees&berry plan [Yellow3] 4603 points and WFP: Sea and ocean [Blue] 200480 points - 2.00000000
WFP: Dump site [White] 95 points and WFP: Sea and ocean [Blue] 200480 points - 2.00000000
WFP: Olive groves) [Green2] 852222 points and WFP: Sea and ocean [Blue] 200480 points - 2.00000000
WFP: Salt marshes [Cyan2] 8118 points and WFP: Sea and ocean [Blue] 200480 points - 2.00000000
WFP: Sclerophylous vegt. [Maroon] 123131 points and WFP: Sea and ocean [Blue] 200480 points - 2.00000000
WFP: Sea and ocean [Blue] 200480 points and WFP: Transitional wood land [Yellow3] 28869 points - 2.00000000
WFP: Construction sites [White] 9368 points and WFP: Sea and ocean [Blue] 200480 points - 2.00000000
WFP: Aiports [White] 949 points and WFP: Sea and ocean [Blue] 200480 points - 2.00000000
WFP: Citrus plantations [Orchid] 12546 points and WFP: Sea and ocean [Blue] 200480 points - 2.00000000
WFP: Palm groves [Green] 6411 points and WFP: Sea and ocean [Blue] 200480 points - 2.00000000
WFP: Others [Black] 3086 points and WFP: Sea and ocean [Blue] 200480 points - 2.00000000
WFP: Pannana Plantation [Sea Green] 377 points and WFP: Sea and ocean [Blue] 200480 points - 2.00000000

Appendix 2 to Land Use/Cover Map of the West Bank

Separability of the newly resampled training areas

Image: Landsat TM, 2002 March 24, atmospherically corrected reflectance images (30m resolution)
ROI Name: (Jeffries-Matusita, Transformed Divergence)
Classes: 33
Class Pair Separability (least to most);

WFP: Discontinuous Urban Fa [Purple1] 498944 points and WFP: Military camps [Maroon2] 9228 points - 0.27996574
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 0.46901606
Forest [Green3] 103124 points and Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points - 0.55742490
WFP: Discontinuous Urban Fa [Purple1] 498944 points and WFP: Green urban areas [Cyan2] 3913 points - 0.59610610
WFP: Discontinuous Urban Fa [Purple1] 498944 points and WFP: Industrial or com.unit [Thistle] 4523 points - 0.60928984
Vineyards [Orange1] 101083 points and Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points - 0.67770234
WFP: Industrial or com.unit [Thistle] 4523 points and WFP: Military camps [Maroon2] 9228 points - 0.68742113
WFP: Green urban areas [Cyan2] 3913 points and WFP: Military camps [Maroon2] 9228 points - 0.69001555
Irrigated Agriculture [Green2] 232640 points and Rainfed Agriculture 1 [Green2] 2524 points - 0.71769958
Irrigated Agriculture [Green2] 232640 points and WFP: Military camps [Maroon2] 9228 points - 0.73978070
Rangeland (grass) [Green3] 62935 points and WFP: Military camps [Maroon2] 9228 points - 0.74494441
Irrigated Agriculture [Green2] 232640 points and WFP: Green urban areas [Cyan2] 3913 points - 0.76083428
Wooded Rangeland [Orange4] 31780 points and Rangeland (grass) [Green3] 62935 points - 0.77760695
Vineyards [Orange1] 101083 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 0.79226794
Irrigated Agriculture [Green2] 232640 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 0.81214040
WFP: Continuous Urban Fabri [Purple2] 13897 points and WFP: Industrial or com.unit [Thistle] 4523 points - 0.88525623
WFP: Dump site [Maroon2] 100 points and WFP: Military camps [Maroon2] 9228 points - 0.91664303
WFP: Green urban areas [Cyan2] 3913 points and WFP: Industrial or com.unit [Thistle] 4523 points - 0.92048393
Rainfed Agriculture 1 [Green2] 2524 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 0.92194119
WFP: Continuous Urban Fabri [Purple2] 13897 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 0.92820878
WFP: Continuous Urban Fabri [Purple2] 13897 points and WFP: Green urban areas [Cyan2] 3913 points - 0.93104122
Mining or Construction Sites [Cyan3] 22203 points and Rangeland (grass) [Green3] 62935 points - 0.93430132
Wooded Rangeland [Orange4] 31780 points and WFP: Military camps [Maroon2] 9228 points - 0.95926082
Vineyards [Orange1] 101083 points and WFP: Military camps [Maroon2] 9228 points - 0.96978276
Forest [Green3] 103124 points and Irrigated Agriculture [Green2] 232640 points - 0.97206886
Wooded Rangeland [Orange4] 31780 points and Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points - 0.99835149
Salt marshes [Cyan2] 8097 points and WFP: Green urban areas [Cyan2] 3913 points - 1.00059032
Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.02385533
Mining or Construction Sites [Cyan3] 22203 points and WFP: Military camps [Maroon2] 9228 points - 1.02772128
WFP: Discontinuous Urban Fa [Purple1] 498944 points and WFP: Dump site [Maroon2] 100 points - 1.03063317
WFP: Dump site [Maroon2] 100 points and WFP: Green urban areas [Cyan2] 3913 points - 1.04933318
Irrigated Agriculture [Green2] 232640 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.05011324
Vineyards [Orange1] 101083 points and Forest [Green3] 103124 points - 1.06277412
Forest [Green3] 103124 points and Wooded Rangeland [Orange4] 31780 points - 1.07278789
Forest [Green3] 103124 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.07417669
Forest [Green3] 103124 points and WFP: Dump site [Maroon2] 100 points - 1.08401496
Mining or Construction Sites [Cyan3] 22203 points and Sparse Rangeland [Sienna2] 67230 points - 1.08585051
Rangeland (grass) [Green3] 62935 points and WFP: Dump site [Maroon2] 100 points - 1.09746276
Irrigated Agriculture [Green2] 232640 points and Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points - 1.09967038
Forest [Green3] 103124 points and Maquis n Woodland [Yellow3] 11068 points - 1.10228493
Forest [Green3] 103124 points and WFP: Military camps [Maroon2] 9228 points - 1.11033571
Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points and WFP: Military camps [Maroon2] 9228 points - 1.11493307
Rangeland (grass) [Green3] 62935 points and Sparse Rangeland [Sienna2] 67230 points - 1.12199072
Rangeland (grass) [Green3] 62935 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.15551948
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Rainfed Agriculture 1 [Green2] 2524 points - 1.15689250
Forest [Green3] 103124 points and WFP: Green urban areas [Cyan2] 3913 points - 1.16652421
Vineyards [Orange1] 101083 points and Wooded Rangeland [Orange4] 31780 points - 1.17971513
Rainfed Agriculture 1 [Green2] 2524 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.18232108
Irrigated Agriculture [Green2] 232640 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.19192395
Rainfed Agriculture 1 [Green2] 2524 points and WFP: Military camps [Maroon2] 9228 points - 1.19240528
Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points and Maquis n Woodland [Yellow3] 11068 points - 1.19841312
Rainfed Agriculture 1 [Green2] 2524 points and Pasture (Grassland) [Green] 9667 points - 1.19901810
Irrigated Agriculture [Green2] 232640 points and Rangeland (grass) [Green3] 62935 points - 1.21165249
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Pasture (Grassland) [Green] 9667 points - 1.21262082
Irrigated Agriculture [Green2] 232640 points and WFP: Dump site [Maroon2] 100 points - 1.23166197
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Irrigated Agriculture [Green2] 232640 points - 1.23592577
Vineyards [Orange1] 101083 points and Irrigated Agriculture [Green2] 232640 points - 1.24501599
Rainfed Agriculture 1 [Green2] 2524 points and WFP: Green urban areas [Cyan2] 3913 points - 1.25577736

Rangeland (grass) [Green3] 62935 points and WFP: Green urban areas [Cyan2] 3913 points - 1.25764527
Wooded Rangeland [Orange4] 31780 points and WFP: Dump site [Maroon2] 100 points - 1.26903633
WFP: Continuous Urban Fabri [Purple2] 13897 points and WFP: Military camps [Maroon2] 9228 points - 1.27097006
Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points and WFP: Dump site [Maroon2] 100 points - 1.28732783
Vineyards [Orange1] 101083 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.29272271
Wooded Rangeland [Orange4] 31780 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.29349615
Salt marshes [Cyan2] 8097 points and WFP: Dump site [Maroon2] 100 points - 1.29367004
Rainfed Agriculture 1 [Green2] 2524 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.30021638
Irrigated Agriculture [Green2] 232640 points and Pasture (Grassland) [Green] 9667 points - 1.31603307
Sparse Rangeland [Sienna2] 67230 points and WFP: Military camps [Maroon2] 9228 points - 1.32010168
Vineyards [Orange1] 101083 points and WFP: Dump site [Maroon2] 100 points - 1.32524996
WFP: Dump site [Maroon2] 100 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.32845175
Irrigated Agriculture [Green2] 232640 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.33156950
Irrigated Agriculture [Green2] 232640 points and Wooded Rangeland [Orange4] 31780 points - 1.33426423
Mining or Construction Sites [Cyan3] 22203 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.34045903
Mining or Construction Sites [Cyan3] 22203 points and Wooded Rangeland [Orange4] 31780 points - 1.34283184
Mining or Construction Sites [Cyan3] 22203 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.35038661
Pasture (Grassland) [Green] 9667 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.36350065
Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points and WFP: Green urban areas [Cyan2] 3913 points - 1.38881095
Irrigated 2 in Jordan River Basin [Green1] 6435 points and WFP: Green urban areas [Cyan2] 3913 points - 1.39069255
Sparse Rangeland [Sienna2] 67230 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.39525356
Rangeland (grass) [Green3] 62935 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.39579072
Vineyards [Orange1] 101083 points and WFP: Green urban areas [Cyan2] 3913 points - 1.42151079
Sparse Rangeland [Sienna2] 67230 points and WFP: Dump site [Maroon2] 100 points - 1.42180214
Mining or Construction Sites [Cyan3] 22203 points and Bare Rock [Red] 34909 points - 1.42343095
Salt marshes [Cyan2] 8097 points and Irrigated Agriculture [Green2] 232640 points - 1.43314393
Riparian Vegetation [Orange4] 18686 points and WFP: Green urban areas [Cyan2] 3913 points - 1.43648790
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and WFP: Green urban areas [Cyan2] 3913 points - 1.43726141
Rangeland (grass) [Green3] 62935 points and Rainfed Agriculture 1 [Green2] 2524 points - 1.44983561
Salt marshes [Cyan2] 8097 points and Sparse Rangeland [Sienna2] 67230 points - 1.45296283
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Forest [Green3] 103124 points - 1.45866928
Salt marshes [Cyan2] 8097 points and WFP: Military camps [Maroon2] 9228 points - 1.46106693
Salt marshes [Cyan2] 8097 points and Rangeland (grass) [Green3] 62935 points - 1.46595713
Mining or Construction Sites [Cyan3] 22203 points and WFP: Dump site [Maroon2] 100 points - 1.47471008
Vineyards [Orange1] 101083 points and Rangeland (grass) [Green3] 62935 points - 1.49366858
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.49441847
Riparian Vegetation [Orange4] 18686 points and Pasture (Grassland) [Green] 9667 points - 1.50030245
WFP: Continuous Urban Fabri [Purple2] 13897 points and WFP: Dump site [Maroon2] 100 points - 1.51118640
Forest [Green3] 103124 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.51152946
Pasture (Grassland) [Green] 9667 points and WFP: Military camps [Maroon2] 9228 points - 1.51544754
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and WFP: Military camps [Maroon2] 9228 points - 1.51572039
Irrigated Agriculture [Green2] 232640 points and Riparian Vegetation [Orange4] 18686 points - 1.51899431
Irrigated 2 in Jordan River Basin [Green1] 6435 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.52020406
Irrigated 2 in Jordan River Basin [Green1] 6435 points and WFP: Military camps [Maroon2] 9228 points - 1.52260833
Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.52445266
Forest [Green3] 103124 points and Rainfed Agriculture 1 [Green2] 2524 points - 1.53160140
Forest [Green3] 103124 points and Rangeland (grass) [Green3] 62935 points - 1.53451531
Bare Rock [Red] 34909 points and Sparse Rangeland [Sienna2] 67230 points - 1.53716367
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Riparian Vegetation [Orange4] 18686 points - 1.54727810
Pasture (Grassland) [Green] 9667 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.54818794
Salt marshes [Cyan2] 8097 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.54856699
Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points and Pasture (Grassland) [Green] 9667 points - 1.54963536
Salt marshes [Cyan2] 8097 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.55068592
Irrigated Agriculture [Green2] 232640 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.55124856
Forest [Green3] 103124 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.55350577
Vineyards [Orange1] 101083 points and Rainfed Agriculture 1 [Green2] 2524 points - 1.55779799
Mining or Construction Sites [Cyan3] 22203 points and WFP: Green urban areas [Cyan2] 3913 points - 1.55879447
Mining or Construction Sites [Cyan3] 22203 points and Irrigated Agriculture [Green2] 232640 points - 1.56728513
Rainfed Agriculture 1 [Green2] 2524 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.56774263
Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points and Rainfed Agriculture 1 [Green2] 2524 points - 1.57171672
Wooded Rangeland [Orange4] 31780 points and WFP: Green urban areas [Cyan2] 3913 points - 1.57585602
Salt marshes [Cyan2] 8097 points and Riparian Vegetation [Orange4] 18686 points - 1.58923305
Wooded Rangeland [Orange4] 31780 points and Maquis n Woodland [Yellow3] 11068 points - 1.58932031
Salt marshes [Cyan2] 8097 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.59240389
Rangeland (grass) [Green3] 62935 points and Riparian Vegetation [Orange4] 18686 points - 1.59484935
Mining or Construction Sites [Cyan3] 22203 points and Vineyards [Orange1] 101083 points - 1.59846175
Riparian Vegetation [Orange4] 18686 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.59883619
Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.59969864
Pasture (Grassland) [Green] 9667 points and WFP: Green urban areas [Cyan2] 3913 points - 1.60698572

Wooded Rangeland [Orange4] 31780 points and Rainfed Agriculture 1 [Green2] 2524 points - 1.61252529
Forest [Green3] 103124 points and Pasture (Grassland) [Green] 9667 points - 1.61369844
Vineyards [Orange1] 101083 points and Maquis n Woodland [Yellow3] 11068 points - 1.62031104
Wooded Rangeland [Orange4] 31780 points and Pasture (Grassland) [Green] 9667 points - 1.62192642
Wooded Rangeland [Orange4] 31780 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.62989990
Rangeland (grass) [Green3] 62935 points and Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points - 1.63205299
Wooded Rangeland [Orange4] 31780 points and Sparse Rangeland [Sienna2] 67230 points - 1.64139934
Pasture (Grassland) [Green] 9667 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.64257589
Sparse Rangeland [Sienna2] 67230 points and WFP: Green urban areas [Cyan2] 3913 points - 1.64830573
Valley Shadow [Black] 3941 points and Beach [Coral] 2933 points - 1.65008918
Rangeland (grass) [Green3] 62935 points and Pasture (Grassland) [Green] 9667 points - 1.65855315
Vineyards [Orange1] 101083 points and Pasture (Grassland) [Green] 9667 points - 1.66258606
Sparse Rangeland [Sienna2] 67230 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.66867824
Greenhouse Agric. [Coral] 390 points and WFP: Green urban areas [Cyan2] 3913 points - 1.67842532
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Vineyards [Orange1] 101083 points - 1.68239140
Riparian Vegetation [Orange4] 18686 points and Rainfed Agriculture 1 [Green2] 2524 points - 1.68263582
Salt marshes [Cyan2] 8097 points and Beach [Coral] 2933 points - 1.68647608
Forest [Green3] 103124 points and Riparian Vegetation [Orange4] 18686 points - 1.68711917
Forest [Green3] 103124 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.69259945
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points - 1.69299639
Rainfed Agriculture 2 [Sea Green] 7363 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.69307099
Rainfed Agriculture 1 [Green2] 2524 points and WFP: Dump site [Maroon2] 100 points - 1.69338837
Irrigated Agriculture [Green2] 232640 points and Maquis n Woodland [Yellow3] 11068 points - 1.69495451
Salines [Cyan1] 866 points and Sparse Rangeland [Sienna2] 67230 points - 1.70593362
Salines [Cyan1] 866 points and Salt marshes [Cyan2] 8097 points - 1.71469641
Water Bodies 2 [Blue2] 3890 points and Waves (Med. Sea) [Blue] 473 points - 1.71609192
Rainfed Agriculture 2 [Sea Green] 7363 points and WFP: Military camps [Maroon2] 9228 points - 1.71812425
Riparian Vegetation [Orange4] 18686 points and WFP: Military camps [Maroon2] 9228 points - 1.72509574
Maquis n Woodland [Yellow3] 11068 points and WFP: Military camps [Maroon2] 9228 points - 1.72611447
Riparian Vegetation [Orange4] 18686 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.73051813
Sparse Rangeland [Sienna2] 67230 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.73137397
Bare Rock [Red] 34909 points and Rangeland (grass) [Green3] 62935 points - 1.73156653
Maquis n Woodland [Yellow3] 11068 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.73170296
Vineyards [Orange1] 101083 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.73433258
Bare Rock [Red] 34909 points and Wooded Rangeland [Orange4] 31780 points - 1.73608418
Mining or Construction Sites [Cyan3] 22203 points and Rainfed Agriculture 1 [Green2] 2524 points - 1.73807651
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Wooded Rangeland [Orange4] 31780 points - 1.74699998
Irrigated 2 in Jordan River Basin [Green1] 6435 points and Greenhouse Agric. [Coral] 390 points - 1.74863663
Forest [Green3] 103124 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.74864340
Rangeland (grass) [Green3] 62935 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.74917228
Irrigated Agriculture [Green2] 232640 points and Sparse Rangeland [Sienna2] 67230 points - 1.75928465
Mining or Construction Sites [Cyan3] 22203 points and Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points - 1.76120195
Mining or Construction Sites [Cyan3] 22203 points and Forest [Green3] 103124 points - 1.76150005
Vineyards [Orange1] 101083 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.76462634
Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.76504851
Vineyards [Orange1] 101083 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.76513694
Irrigated Agriculture [Green2] 232640 points and Fallow2002 [Maroon1] 14469 points - 1.76532868
Irrigated 2 in Jordan River Basin [Green1] 6435 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.77104440
Rainfed Agriculture 2 [Sea Green] 7363 points and WFP: Green urban areas [Cyan2] 3913 points - 1.77198395
Fallow2002 [Maroon1] 14469 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.77418472
Fallow2002 [Maroon1] 14469 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.77709066
Fallow2002 [Maroon1] 14469 points and WFP: Green urban areas [Cyan2] 3913 points - 1.77988537
Mining or Construction Sites [Cyan3] 22203 points and Salt marshes [Cyan2] 8097 points - 1.78019737
Rangeland (grass) [Green3] 62935 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.78253314
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Rangeland (grass) [Green3] 62935 points - 1.78623923
Salt marshes [Cyan2] 8097 points and Forest [Green3] 103124 points - 1.78645509
Salt marshes [Cyan2] 8097 points and Fallow2002 [Maroon1] 14469 points - 1.78690917
Fallow2002 [Maroon1] 14469 points and Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points - 1.78750471
Irrigated 2 in Jordan River Basin [Green1] 6435 points and WFP: Dump site [Maroon2] 100 points - 1.79283682
Salines [Cyan1] 866 points and WFP: Green urban areas [Cyan2] 3913 points - 1.79362858
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.79651597
Fallow2002 [Maroon1] 14469 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.79769894
Bare Rock [Red] 34909 points and Valley Shadow [Black] 3941 points - 1.79786493
Mining or Construction Sites [Cyan3] 22203 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.79975469
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and WFP: Dump site [Maroon2] 100 points - 1.80052565
Salines [Cyan1] 866 points and Beach [Coral] 2933 points - 1.80177956
Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.80225465
Riparian Vegetation [Orange4] 18686 points and WFP: Dump site [Maroon2] 100 points - 1.80434951

Riparian Vegetation [Orange4] 18686 points and Greenhouse Agric. [Coral] 390 points - 1.81082831
Mining or Construction Sites [Cyan3] 22203 points and Massad Erosion [Yellow] 2992 points - 1.81123036
Wooded Rangeland [Orange4] 31780 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.81332295
Maquis n Woodland [Yellow3] 11068 points and WFP: Green urban areas [Cyan2] 3913 points - 1.81443765
Rainfed Agriculture 2 [Sea Green] 7363 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.81916297
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Greenhouse Agric. [Coral] 390 points - 1.82372729
Riparian Vegetation [Orange4] 18686 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.82565256
Pasture (Grassland) [Green] 9667 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.82670470
Irrigated Agriculture [Green2] 232640 points and Greenhouse Agric. [Coral] 390 points - 1.82969205
Forest [Green3] 103124 points and Fallow2002 [Maroon1] 14469 points - 1.82976194
Fallow2002 [Maroon1] 14469 points and WFP: Military camps [Maroon2] 9228 points - 1.83484690
Riparian Vegetation [Orange4] 18686 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.83602926
Sparse Rangeland [Sienna2] 67230 points and Beach [Coral] 2933 points - 1.83654324
Salt marshes [Cyan2] 8097 points and Rainfed Agriculture 1 [Green2] 2524 points - 1.83796742
Rainfed Agriculture 1 [Green2] 2524 points and Greenhouse Agric. [Coral] 390 points - 1.83811912
Fallow2002 [Maroon1] 14469 points and WFP: Dump site [Maroon2] 100 points - 1.84035250
Vineyards [Orange1] 101083 points and Fallow2002 [Maroon1] 14469 points - 1.84112191
Valley Shadow [Black] 3941 points and WFP: Military camps [Maroon2] 9228 points - 1.84194940
Salt marshes [Cyan2] 8097 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.84380156
Rangeland (grass) [Green3] 62935 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.84750416
Wooded Rangeland [Orange4] 31780 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.84896843
Maquis n Woodland [Yellow3] 11068 points and Pasture (Grassland) [Green] 9667 points - 1.84979399
Salines [Cyan1] 866 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.85575342
Irrigated Agriculture [Green2] 232640 points and Valley Shadow [Black] 3941 points - 1.85690355
Rainfed Agriculture 1 [Green2] 2524 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.85750292
Irrigated 2 in Jordan River Basin [Green1] 6435 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.85766863
Mining or Construction Sites [Cyan3] 22203 points and Pasture (Grassland) [Green] 9667 points - 1.85868162
Bare Rock [Red] 34909 points and WFP: Military camps [Maroon2] 9228 points - 1.85986859
Salines [Cyan1] 866 points and Valley Shadow [Black] 3941 points - 1.85987707
Maquis n Woodland [Yellow3] 11068 points and WFP: Dump site [Maroon2] 100 points - 1.86126149
Wooded Rangeland [Orange4] 31780 points and Riparian Vegetation [Orange4] 18686 points - 1.86305918
Beach [Coral] 2933 points and WFP: Military camps [Maroon2] 9228 points - 1.87320546
Water Bodies 1 [Blue1] 479450 points and Water Bodies 2 [Blue2] 3890 points - 1.87406476
Pasture (Grassland) [Green] 9667 points and WFP: Dump site [Maroon2] 100 points - 1.87732077
Irrigated Agriculture [Green2] 232640 points and Beach [Coral] 2933 points - 1.87913831
Greenhouse Agric. [Coral] 390 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.87964196
Beach [Coral] 2933 points and WFP: Green urban areas [Cyan2] 3913 points - 1.88157034
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.88247312
Irrigated 2 in Jordan River Basin [Green1] 6435 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.88481130
Mining or Construction Sites [Cyan3] 22203 points and Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points - 1.88558520
Mining or Construction Sites [Cyan3] 22203 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.88870380
Greenhouse Agric. [Coral] 390 points and WFP: Military camps [Maroon2] 9228 points - 1.89078673
Maquis n Woodland [Yellow3] 11068 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.89134837
Rainfed Agriculture 2 [Sea Green] 7363 points and WFP: Dump site [Maroon2] 100 points - 1.89377473
Mining or Construction Sites [Cyan3] 22203 points and Riparian Vegetation [Orange4] 18686 points - 1.89408690
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Salt marshes [Cyan2] 8097 points - 1.89766382
Valley Shadow [Black] 3941 points and Sparse Rangeland [Sienna2] 67230 points - 1.89775189
Salines [Cyan1] 866 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.89809416
Salt marshes [Cyan2] 8097 points and Valley Shadow [Black] 3941 points - 1.89918199
Wooded Rangeland [Orange4] 31780 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.90129203
Salines [Cyan1] 866 points and Irrigated Agriculture [Green2] 232640 points - 1.90172147
Salines [Cyan1] 866 points and Rangeland (grass) [Green3] 62935 points - 1.90316919
Beach [Coral] 2933 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.90597541
Rainfed Agriculture 1 [Green2] 2524 points and Sparse Rangeland [Sienna2] 67230 points - 1.90911404
Greenhouse Agric. [Coral] 390 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.91136131
Mining or Construction Sites [Cyan3] 22203 points and Valley Shadow [Black] 3941 points - 1.91234049
Salt marshes [Cyan2] 8097 points and Wooded Rangeland [Orange4] 31780 points - 1.91361962
Salt marshes [Cyan2] 8097 points and Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points - 1.91520995
Vineyards [Orange1] 101083 points and Riparian Vegetation [Orange4] 18686 points - 1.91611108
Valley Shadow [Black] 3941 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.91662201
Water Bodies 1 [Blue1] 479450 points and Waves (Med. Sea) [Blue] 473 points - 1.91681125
Salines [Cyan1] 866 points and WFP: Dump site [Maroon2] 100 points - 1.91767185
Maquis n Woodland [Yellow3] 11068 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.92051377
Salt marshes [Cyan2] 8097 points and Greenhouse Agric. [Coral] 390 points - 1.92228975
Rangeland (grass) [Green3] 62935 points and Valley Shadow [Black] 3941 points - 1.92239823
Forest [Green3] 103124 points and Greenhouse Agric. [Coral] 390 points - 1.92261799
Mining or Construction Sites [Cyan3] 22203 points and Beach [Coral] 2933 points - 1.92399963
Greenhouse Agric. [Coral] 390 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.92709978
Rainfed Agriculture 1 [Green2] 2524 points and Maquis n Woodland [Yellow3] 11068 points - 1.92856024

Salt marshes [Cyan2] 8097 points and Vineyards [Orange1] 101083 points - 1.93006638
Beach [Coral] 2933 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.93016207
Mining or Construction Sites [Cyan3] 22203 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.93034834
Rangeland (grass) [Green3] 62935 points and Beach [Coral] 2933 points - 1.93159025
Rangeland (grass) [Green3] 62935 points and Greenhouse Agric. [Coral] 390 points - 1.93164416
Salines [Cyan1] 866 points and WFP: Military camps [Maroon2] 9228 points - 1.93247052
Beach [Coral] 2933 points and WFP: Dump site [Maroon2] 100 points - 1.93456937
Mining or Construction Sites [Cyan3] 22203 points and Salines [Cyan1] 866 points - 1.93517537
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Maquis n Woodland [Yellow3] 11068 points - 1.93581174
Maquis n Woodland [Yellow3] 11068 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.94022338
Wooded Rangeland [Orange4] 31780 points and Valley Shadow [Black] 3941 points - 1.94063170
Fallow2002 [Maroon1] 14469 points and Beach [Coral] 2933 points - 1.94158347
Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points and Riparian Vegetation [Orange4] 18686 points - 1.94213462
Valley Shadow [Black] 3941 points and WFP: Green urban areas [Cyan3] 3913 points - 1.94445907
Rangeland (grass) [Green3] 62935 points and Maquis n Woodland [Yellow3] 11068 points - 1.94463523
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.94468186
Valley Shadow [Black] 3941 points and Rainfed Agriculture 1 [Green2] 2524 points - 1.94606284
Mining or Construction Sites [Cyan3] 22203 points and Greenhouse Agric. [Coral] 390 points - 1.94914128
Fallow2002 [Maroon1] 14469 points and Rangeland (grass) [Green3] 62935 points - 1.95238679
Mining or Construction Sites [Cyan3] 22203 points and Maquis n Woodland [Yellow3] 11068 points - 1.95248917
Rainfed Agriculture 2 [Sea Green] 7363 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.95282371
Maquis n Woodland [Yellow3] 11068 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.95371236
Mining or Construction Sites [Cyan3] 22203 points and Fallow2002 [Maroon1] 14469 points - 1.95559032
Pasture (Grassland) [Green] 9667 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.95653399
Salt marshes [Cyan2] 8097 points and Pasture (Grassland) [Green] 9667 points - 1.95667568
Vineyards [Orange1] 101083 points and Sparse Rangeland [Sienna2] 67230 points - 1.95940096
Valley Shadow [Black] 3941 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.95995547
Salines [Cyan1] 866 points and Water Bodies 2 [Blue2] 3890 points - 1.96099873
Fallow2002 [Maroon1] 14469 points and Wooded Rangeland [Orange4] 31780 points - 1.96114093
Forest [Green3] 103124 points and Sparse Rangeland [Sienna2] 67230 points - 1.96195734
Pasture (Grassland) [Green] 9667 points and Greenhouse Agric. [Coral] 390 points - 1.96215792
Greenhouse Agric. [Coral] 390 points and WFP: Dump site [Maroon2] 100 points - 1.96342768
Bare Rock [Red] 34909 points and Beach [Coral] 2933 points - 1.96353443
Salines [Cyan1] 866 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.96430718
Fallow2002 [Maroon1] 14469 points and Water Bodies 2 [Blue2] 3890 points - 1.96615240
Vineyards [Orange1] 101083 points and Greenhouse Agric. [Coral] 390 points - 1.97105062
Riparian Vegetation [Orange4] 18686 points and Sparse Rangeland [Sienna2] 67230 points - 1.97168557
Irrigated Agriculture [Green2] 232640 points and Bare Rock [Red] 34909 points - 1.97581655
Riparian Vegetation [Orange4] 18686 points and Maquis n Woodland [Yellow3] 11068 points - 1.97654785
Sparse Rangeland [Sienna2] 67230 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.97730525
Salines [Cyan1] 866 points and Rainfed Agriculture 1 [Green2] 2524 points - 1.97791886
Massad Erosion [Yellow] 2992 points and Sparse Rangeland [Sienna2] 67230 points - 1.97798287
Bare Rock [Red] 34909 points and WFP: Dump site [Maroon2] 100 points - 1.97803937
Salines [Cyan1] 866 points and Fallow2002 [Maroon1] 14469 points - 1.97852049
Vineyards [Orange1] 101083 points and Beach [Coral] 2933 points - 1.97925597
Beach [Coral] 2933 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.97962147
Wooded Rangeland [Orange4] 31780 points and Greenhouse Agric. [Coral] 390 points - 1.97962731
Fallow2002 [Maroon1] 14469 points and Riparian Vegetation [Orange4] 18686 points - 1.98010501
Bare Rock [Red] 34909 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.98105258
Bare Rock [Red] 34909 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.98133686
Valley Shadow [Black] 3941 points and WFP: Dump site [Maroon2] 100 points - 1.98188520
Valley Shadow [Black] 3941 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.98231142
Salines [Cyan1] 866 points and Waves (Med. Sea) [Blue] 473 points - 1.98280862
Salt marshes [Cyan2] 8097 points and Bare Rock [Red] 34909 points - 1.98366627
Sparse Rangeland [Sienna2] 67230 points and Pasture (Grassland) [Green] 9667 points - 1.98430488
Rainfed Agriculture 1 [Green2] 2524 points and Beach [Coral] 2933 points - 1.98511377
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Sparse Rangeland [Sienna2] 67230 points - 1.98524050
Salines [Cyan1] 866 points and Riparian Vegetation [Orange4] 18686 points - 1.98552786
Riparian Vegetation [Orange4] 18686 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.98754431
Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points and Greenhouse Agric. [Coral] 390 points - 1.98785323
Fallow2002 [Maroon1] 14469 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.98807010
Massad Erosion [Yellow] 2992 points and WFP: Dump site [Maroon2] 100 points - 1.98855382
Salt marshes [Cyan2] 8097 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.98893251
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Fallow2002 [Maroon1] 14469 points - 1.98918982
Salines [Cyan1] 866 points and Forest [Green3] 103124 points - 1.98920699
Massad Erosion [Yellow] 2992 points and WFP: Military camps [Maroon2] 9228 points - 1.98953744
Forest [Green3] 103124 points and Valley Shadow [Black] 3941 points - 1.98963229
Wooded Rangeland [Orange4] 31780 points and Beach [Coral] 2933 points - 1.98980462
Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points and Sparse Rangeland [Sienna2] 67230 points - 1.99068509

Forest [Green3] 103124 points and Beach [Coral] 2933 points - 1.99087903
Fallow2002 [Maroon1] 14469 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.99094995
Valley Shadow [Black] 3941 points and Riparian Vegetation [Orange4] 18686 points - 1.99117671
Bare Rock [Red] 34909 points and Rainfed Agriculture 1 [Green2] 2524 points - 1.99138151
Massad Erosion [Yellow] 2992 points and Beach [Coral] 2933 points - 1.99149166
Salines [Cyan1] 866 points and Wooded Rangeland [Orange4] 31780 points - 1.99183953
Beach [Coral] 2933 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.99220935
Fallow2002 [Maroon1] 14469 points and Rainfed Agriculture 1 [Green2] 2524 points - 1.99250585
Fallow2002 [Maroon1] 14469 points and Sparse Rangeland [Sienna2] 67230 points - 1.99277356
Fallow2002 [Maroon1] 14469 points and Maquis n Woodland [Yellow3] 11068 points - 1.99289550
Sparse Rangeland [Sienna2] 67230 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.99290427
Salt marshes [Cyan2] 8097 points and Maquis n Woodland [Yellow3] 11068 points - 1.99316547
Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points and Beach [Coral] 2933 points - 1.99335036
Riparian Vegetation [Orange4] 18686 points and Beach [Coral] 2933 points - 1.99375466
Salines [Cyan1] 866 points and Bare Rock [Red] 34909 points - 1.99409256
Salines [Cyan1] 866 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.99414490
Water Bodies 2 [Blue2] 3890 points and Valley Shadow [Black] 3941 points - 1.99431379
Valley Shadow [Black] 3941 points and Pasture (Grassland) [Green] 9667 points - 1.99450800
Valley Shadow [Black] 3941 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.99512754
Salines [Cyan1] 866 points and Massad Erosion [Yellow] 2992 points - 1.99539785
Salines [Cyan1] 866 points and Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points - 1.99562614
Forest [Green3] 103124 points and Water Bodies 2 [Blue2] 3890 points - 1.99572148
Irrigated Agriculture [Green2] 232640 points and Water Bodies 2 [Blue2] 3890 points - 1.99610235
Water Bodies 2 [Blue2] 3890 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.99629822
Valley Shadow [Black] 3941 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.99646155
Water Bodies 2 [Blue2] 3890 points and WFP: Dump site [Maroon2] 100 points - 1.99653294
Massad Erosion [Yellow] 2992 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.99654234
Vineyards [Orange1] 101083 points and Valley Shadow [Black] 3941 points - 1.99655104
Salines [Cyan1] 866 points and Vineyards [Orange1] 101083 points - 1.99657800
Sparse Rangeland [Sienna2] 67230 points and Greenhouse Agric. [Coral] 390 points - 1.99663427
Bare Rock [Red] 34909 points and WFP: Green urban areas [Cyan2] 3913 points - 1.99670987
Beach [Coral] 2933 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.99697117
Fallow2002 [Maroon1] 14469 points and Pasture (Grassland) [Green] 9667 points - 1.99697498
Salines [Cyan1] 866 points and Pasture (Grassland) [Green] 9667 points - 1.99703323
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Salines [Cyan1] 866 points - 1.99705378
Water Bodies 2 [Blue2] 3890 points and WFP: Green urban areas [Cyan2] 3913 points - 1.99716848
Maquis n Woodland [Yellow3] 11068 points and Greenhouse Agric. [Coral] 390 points - 1.99758493
Salines [Cyan1] 866 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.99770316
Rangeland (grass) [Green3] 62935 points and Massad Erosion [Yellow] 2992 points - 1.99792192
Fallow2002 [Maroon1] 14469 points and Valley Shadow [Black] 3941 points - 1.99798656
Salines [Cyan1] 866 points and Greenhouse Agric. [Coral] 390 points - 1.99799501
Vineyards [Orange1] 101083 points and Bare Rock [Red] 34909 points - 1.99813292
Water Bodies 2 [Blue2] 3890 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.99822777
Pasture (Grassland) [Green] 9667 points and Beach [Coral] 2933 points - 1.99846159
Bare Rock [Red] 34909 points and Massad Erosion [Yellow] 2992 points - 1.99852338
Forest [Green3] 103124 points and Bare Rock [Red] 34909 points - 1.99880382
Bare Rock [Red] 34909 points and Riparian Vegetation [Orange4] 18686 points - 1.99880624
Bare Rock [Red] 34909 points and Pasture (Grassland) [Green] 9667 points - 1.99895076
Water Bodies 2 [Blue2] 3890 points and Beach [Coral] 2933 points - 1.99898566
Salt marshes [Cyan2] 8097 points and Massad Erosion [Yellow] 2992 points - 1.99904065
Fallow2002 [Maroon1] 14469 points and Greenhouse Agric. [Coral] 390 points - 1.99904906
Water Bodies 2 [Blue2] 3890 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.99907163
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Valley Shadow [Black] 3941 points - 1.99913481
Greenhouse Agric. [Coral] 390 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.99930989
Valley Shadow [Black] 3941 points and Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points - 1.99934138
Salines [Cyan1] 866 points and Water Bodies 1 [Blue1] 479450 points - 1.99947479
Bare Rock [Red] 34909 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.99954666
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Beach [Coral] 2933 points - 1.99961019
Valley Shadow [Black] 3941 points and Greenhouse Agric. [Coral] 390 points - 1.99969824
Bare Rock [Red] 34909 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.99970862
Irrigated Agriculture [Green2] 232640 points and Massad Erosion [Yellow] 2992 points - 1.99971894
Water Bodies 2 [Blue2] 3890 points and Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points - 1.99972291
Beach [Coral] 2933 points and Greenhouse Agric. [Coral] 390 points - 1.99972888
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Bare Rock [Red] 34909 points - 1.99977721
Water Bodies 2 [Blue2] 3890 points and Rangeland (grass) [Green3] 62935 points - 1.99978456
Bare Rock [Red] 34909 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.99979450
Wooded Rangeland [Orange4] 31780 points and Massad Erosion [Yellow] 2992 points - 1.99979986
Vineyards [Orange1] 101083 points and Water Bodies 2 [Blue2] 3890 points - 1.99980332
Water Bodies 2 [Blue2] 3890 points and WFP: Military camps [Maroon2] 9228 points - 1.99985382

Valley Shadow [Black] 3941 points and Waves (Med. Sea) [Blue] 473 points - 1.99985534
Massad Erosion [Yellow] 2992 points and WFP: Green urban areas [Cyan2] 3913 points - 1.99986203
Salt marshes [Cyan2] 8097 points and Water Bodies 2 [Blue2] 3890 points - 1.99986434
Massad Erosion [Yellow] 2992 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.99987183
Bare Rock [Red] 34909 points and Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points - 1.99988550
Fallow2002 [Maroon1] 14469 points and Waves (Med. Sea) [Blue] 473 points - 1.99988707
Mining or Construction Sites [Cyan3] 22203 points and Water Bodies 2 [Blue2] 3890 points - 1.99989699
Valley Shadow [Black] 3941 points and Massad Erosion [Yellow] 2992 points - 1.99992074
Irrigated Agriculture [Green2] 232640 points and Waves (Med. Sea) [Blue] 473 points - 1.99994326
Water Bodies 2 [Blue2] 3890 points and Sparse Rangeland [Sienna2] 67230 points - 1.99994570
Water Bodies 2 [Blue2] 3890 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 1.99995571
Beach [Coral] 2933 points and Waves (Med. Sea) [Blue] 473 points - 1.99995824
Forest [Green3] 103124 points and Waves (Med. Sea) [Blue] 473 points - 1.99997278
Waves (Med. Sea) [Blue] 473 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.99997912
Waves (Med. Sea) [Blue] 473 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.99998139
Water Bodies 1 [Blue1] 479450 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.99998486
Sparse Rangeland [Sienna2] 67230 points and Maquis n Woodland [Yellow3] 11068 points - 1.99998544
Water Bodies 2 [Blue2] 3890 points and Wooded Rangeland [Orange4] 31780 points - 1.99998948
Water Bodies 2 [Blue2] 3890 points and Riparian Vegetation [Orange4] 18686 points - 1.99999224
Water Bodies 1 [Blue1] 479450 points and Valley Shadow [Black] 3941 points - 1.99999379
Fallow2002 [Maroon1] 14469 points and Bare Rock [Red] 34909 points - 1.99999518
Massad Erosion [Yellow] 2992 points and WFP: Continuous Urban Fabri [Purple2] 13897 points - 1.99999582
Water Bodies 1 [Blue1] 479450 points and WFP: Industrial or com.unit [Thistle] 4523 points - 1.99999605
Irrigated Agriculture [Green2] 232640 points and Water Bodies 1 [Blue1] 479450 points - 1.99999605
Waves (Med. Sea) [Blue] 473 points and WFP: Green urban areas [Cyan2] 3913 points - 1.99999628
Massad Erosion [Yellow] 2992 points and Rainfed Agriculture 1 [Green2] 2524 points - 1.99999685
Water Bodies 1 [Blue1] 479450 points and Fallow2002 [Maroon1] 14469 points - 1.99999743
Sparse Rangeland [Sienna2] 67230 points and Waves (Med. Sea) [Blue] 473 points - 1.99999751
Waves (Med. Sea) [Blue] 473 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.99999773
Water Bodies 2 [Blue2] 3890 points and Maquis n Woodland [Yellow3] 11068 points - 1.99999807
Bare Rock [Red] 34909 points and Greenhouse Agric. [Coral] 390 points - 1.99999811
Salines [Cyan1] 866 points and Maquis n Woodland [Yellow3] 11068 points - 1.99999836
Water Bodies 1 [Blue1] 479450 points and WFP: Discontinuous Urban Fa [Purple1] 498944 points - 1.99999894
Forest [Green3] 103124 points and Massad Erosion [Yellow] 2992 points - 1.99999907
Water Bodies 1 [Blue1] 479450 points and Beach [Coral] 2933 points - 1.99999922
Water Bodies 1 [Blue1] 479450 points and WFP: Green urban areas [Cyan2] 3913 points - 1.99999956
Water Bodies 2 [Blue2] 3890 points and Rainfed Agriculture 1 [Green2] 2524 points - 1.99999965
Vineyards [Orange1] 101083 points and Waves (Med. Sea) [Blue] 473 points - 1.99999972
Waves (Med. Sea) [Blue] 473 points and WFP: Dump site [Maroon2] 100 points - 1.99999976
Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points and Waves (Med. Sea) [Blue] 473 points - 1.99999976
Waves (Med. Sea) [Blue] 473 points and WFP: Military camps [Maroon2] 9228 points - 1.99999978
Water Bodies 2 [Blue2] 3890 points and Greenhouse Agric. [Coral] 390 points - 1.99999983
Water Bodies 1 [Blue1] 479450 points and Sparse Rangeland [Sienna2] 67230 points - 1.99999985
Forest [Green3] 103124 points and Water Bodies 1 [Blue1] 479450 points - 1.99999989
Water Bodies 1 [Blue1] 479450 points and Rangeland (grass) [Green3] 62935 points - 1.99999994
Massad Erosion [Yellow] 2992 points and Riparian Vegetation [Orange4] 18686 points - 1.99999995
Rangeland (grass) [Green3] 62935 points and Waves (Med. Sea) [Blue] 473 points - 1.99999996
Valley Shadow [Black] 3941 points and Maquis n Woodland [Yellow3] 11068 points - 1.99999996
Water Bodies 2 [Blue2] 3890 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.99999996
Mining or Construction Sites [Cyan3] 22203 points and Waves (Med. Sea) [Blue] 473 points - 1.99999997
Massad Erosion [Yellow] 2992 points and Pasture (Grassland) [Green] 9667 points - 1.99999997
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Water Bodies 2 [Blue2] 3890 points - 1.99999999
Vineyards [Orange1] 101083 points and Massad Erosion [Yellow] 2992 points - 1.99999999
Maquis n Woodland [Yellow3] 11068 points and Beach [Coral] 2933 points - 1.99999999
Water Bodies 2 [Blue2] 3890 points and Pasture (Grassland) [Green] 9667 points - 1.99999999
Massad Erosion [Yellow] 2992 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 1.99999999
Water Bodies 1 [Blue1] 479450 points and WFP: Military camps [Maroon2] 9228 points - 1.99999999
Mining or Construction Sites [Cyan3] 22203 points and Water Bodies 1 [Blue1] 479450 points - 2.00000000
Massad Erosion [Yellow] 2992 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 2.00000000
Rainfed Agriculture 2 [Sea Green] 7363 points and Waves (Med. Sea) [Blue] 473 points - 2.00000000
Vineyards [Orange1] 101083 points and Water Bodies 1 [Blue1] 479450 points - 2.00000000
Water Bodies 1 [Blue1] 479450 points and WFP: Dump site [Maroon2] 100 points - 2.00000000
Salt marshes [Cyan2] 8097 points and Waves (Med. Sea) [Blue] 473 points - 2.00000000
Bare Rock [Red] 34909 points and Maquis n Woodland [Yellow3] 11068 points - 2.00000000
Wooded Rangeland [Orange4] 31780 points and Waves (Med. Sea) [Blue] 473 points - 2.00000000
Water Bodies 1 [Blue1] 479450 points and Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points - 2.00000000
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Massad Erosion [Yellow] 2992 points - 2.00000000
Water Bodies 2 [Blue2] 3890 points and Bare Rock [Red] 34909 points - 2.00000000
Riparian Vegetation [Orange4] 18686 points and Waves (Med. Sea) [Blue] 473 points - 2.00000000

Water Bodies 1 [Blue1] 479450 points and Riparian Vegetation [Orange4] 18686 points - 2.00000000
Massad Erosion [Yellow] 2992 points and Tree Crops (mainly Olive+Cherry+Fig) [Yellow] 857787 points - 2.00000000
Salt marshes [Cyan2] 8097 points and Water Bodies 1 [Blue1] 479450 points - 2.00000000
Massad Erosion [Yellow] 2992 points and Greenhouse Agric. [Coral] 390 points - 2.00000000
Maquis n Woodland [Yellow3] 11068 points and Waves (Med. Sea) [Blue] 473 points - 2.00000000
Rainfed Agriculture 1 [Green2] 2524 points and Waves (Med. Sea) [Blue] 473 points - 2.00000000
Water Bodies 1 [Blue1] 479450 points and Rainfed Agriculture 2 [Sea Green] 7363 points - 2.00000000
Fallow2002 [Maroon1] 14469 points and Massad Erosion [Yellow] 2992 points - 2.00000000
Water Bodies 1 [Blue1] 479450 points and Wooded Rangeland [Orange4] 31780 points - 2.00000000
Bare Rock [Red] 34909 points and Waves (Med. Sea) [Blue] 473 points - 2.00000000
Water Bodies 1 [Blue1] 479450 points and Rainfed Agriculture 1 [Green2] 2524 points - 2.00000000
Water Bodies 1 [Blue1] 479450 points and Maquis n Woodland [Yellow3] 11068 points - 2.00000000
Water Bodies 1 [Blue1] 479450 points and Pasture (Grassland) [Green] 9667 points - 2.00000000
Massad Erosion [Yellow] 2992 points and Waves (Med. Sea) [Blue] 473 points - 2.00000000
Massad Erosion [Yellow] 2992 points and Maquis n Woodland [Yellow3] 11068 points - 2.00000000
Greenhouse Agric. [Coral] 390 points and Waves (Med. Sea) [Blue] 473 points - 2.00000000
Pasture (Grassland) [Green] 9667 points and Waves (Med. Sea) [Blue] 473 points - 2.00000000
Water Bodies 1 [Blue1] 479450 points and Greenhouse Agric. [Coral] 390 points - 2.00000000
Water Bodies 1 [Blue1] 479450 points and Irrigated 2 in Jordan River Basin [Green1] 6435 points - 2.00000000
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Waves (Med. Sea) [Blue] 473 points - 2.00000000
Irrigated 2 in Jordan River Basin [Green1] 6435 points and Waves (Med. Sea) [Blue] 473 points - 2.00000000
Water Bodies 2 [Blue2] 3890 points and Massad Erosion [Yellow] 2992 points - 2.00000000
Water Bodies 1 [Blue1] 479450 points and Massad Erosion [Yellow] 2992 points - 2.00000000
Water Bodies 1 [Blue1] 479450 points and Bare Rock [Red] 34909 points - 2.00000000
Irrigated Mixed Fruits (Banana+Citrus) [Thistle] 1692 points and Water Bodies 1 [Blue1] 479450 points - 2.00000000

Verification Report (Confusion Matrix)

Confusion Matrix Report
Data: 2002Mar24-LC-36MaxClassif06042010-Comb24-Final-9MMU

Overall Accuracy = (2004663/2114339) 94.8128%
Kappa Coefficient = 0.9330

Ground Truth (Percent)

Class	Mining or Con	I. Mixed Frui	Salines	Vineyard	Irrigated Agr
Unclassified	0.00	0.00	0.00	0.00	0.00
Mining or Con	49.33	0.00	0.00	0.09	0.00
I. Mixed Frui	0.27	79.02	0.26	0.00	35.21
Salines	0.07	0.00	71.66	0.00	0.02
Vineyard	0.68	0.00	0.00	90.91	0.00
Irrigated Agr	0.05	14.95	0.35	0.00	46.23
Water Bodies	0.00	0.00	0.10	0.00	0.00
Fallow	0.00	0.00	0.00	1.01	0.80
Bare Rock	0.00	0.00	0.18	0.00	0.00
Rangeland	20.62	1.60	5.86	7.15	6.69
Built-Up	18.87	1.77	0.00	0.56	2.83
Riparian Vege	0.00	1.77	7.77	0.00	0.00
Rainfed Agric	1.61	0.00	0.00	0.00	5.72
Sparse Rangel	6.91	0.00	6.06	0.16	0.00
Maquis and Wo	0.94	0.00	0.00	0.00	0.00
Beach	0.00	0.00	7.77	0.00	0.00
Greenhouse Ag	0.00	0.89	0.01	0.00	0.87
Tree Crops	0.59	0.00	0.00	0.11	0.00
Forest	0.04	0.00	0.00	0.01	1.65
Total	100.00	100.00	100.00	100.00	100.00

Ground Truth (Percent)

Class	Water Bodies	Fallow	Bare Rock	Rangeland	Built-Up
Unclassified	0.00	0.00	0.00	0.00	0.00
Mining or Con	0.00	0.00	0.00	0.18	0.00
I. Mixed Frui	0.00	0.22	0.00	1.90	0.00
Salines	0.18	0.90	0.06	1.55	0.00
Vineyard	0.00	0.65	0.00	0.15	0.00
Irrigated Agr	0.00	0.14	0.00	0.31	0.00
Water Bodies	99.77	0.00	0.00	0.00	0.00
Fallow	0.00	94.00	0.00	0.15	0.00
Bare Rock	0.00	0.00	96.49	1.92	0.00
Rangeland	0.00	0.70	1.36	80.52	0.00
Built-Up	0.01	2.01	0.00	0.58	99.69
Riparian Vege	0.00	0.13	0.00	0.25	0.00
Rainfed Agric	0.01	0.19	0.00	2.00	0.00
Sparse Rangel	0.02	0.00	2.09	6.78	0.00
Maquis and Wo	0.00	0.68	0.00	1.98	0.01
Beach	0.01	0.00	0.00	0.00	0.00

Class					
Greenhouse Ag	0.00	0.00	0.00	0.00	0.00
Tree Crops	0.00	0.27	0.00	1.68	0.29
Forest	0.00	0.13	0.00	0.06	0.00
Total	100.00	100.00	100.00	100.00	100.00

Ground Truth (Percent)

Class	Riparian Vege	Rainfed Agric	Sparse Range	Maquis and Woodl	Beach
Unclassified	0.00	0.00	0.00	0.00	0.00
Mining or Con	0.00	0.00	0.45	0.00	0.00
I. Mixed Frui	6.78	0.82	0.06	0.00	0.00
Salines	1.20	0.00	6.03	0.00	0.10
Vineyard	0.00	0.00	0.00	0.00	0.00
Irrigated Agr	1.01	6.10	0.00	0.01	0.00
Water Bodies	0.00	0.00	0.00	0.00	0.00
Fallow	0.00	0.38	0.00	0.04	0.00
Bare Rock	0.00	0.00	6.11	0.00	0.00
Rangeland	2.96	7.30	13.12	4.55	0.00
Built-Up	0.00	0.81	0.23	0.01	0.00
Riparian Vege	87.13	0.00	0.00	0.00	0.00
Rainfed Agric	0.07	81.98	0.04	0.15	0.00
Sparse Rangel	0.72	0.09	73.68	0.00	0.00
Maquis and Wo	0.00	0.87	0.00	90.98	0.00
Beach	0.00	0.00	0.27	0.00	99.90
Greenhouse Ag	0.12	0.00	0.00	0.00	0.00
Tree Crops	0.00	1.65	0.02	2.73	0.00
Forest	0.00	0.00	0.00	1.54	0.00
Total	100.00	100.00	100.00	100.00	100.00

Ground Truth (Percent)

Class	Greenhouse Ag	Tree Crops	Forest	Total
Unclassified	0.00	0.00	0.00	0.00
Mining or Con	0.00	0.11	0.00	0.55
I. Mixed Frui	3.85	0.00	0.00	0.39
Salines	0.00	0.00	0.00	0.69
Vineyard	0.00	0.29	0.11	0.44
Irrigated Agr	1.28	0.00	0.00	0.25
Water Bodies	0.00	0.00	0.00	22.83
Fallow	0.00	0.15	0.00	0.68
Bare Rock	0.00	0.00	0.00	21.14
Rangeland	0.00	14.33	1.37	7.91
Built-Up	3.85	0.18	0.15	34.70
Riparian Vege	0.00	0.00	0.00	0.83
Rainfed Agric	2.56	0.28	0.00	1.24
Sparse Rangel	0.00	0.00	0.00	3.50
Maquis and Wo	0.00	1.92	12.21	1.87
Beach	0.00	0.00	0.00	0.18
Greenhouse Ag	88.46	0.00	0.00	0.02
Tree Crops	0.00	82.34	0.36	1.75
Forest	0.00	0.40	85.81	1.03
Total	100.00	100.00	100.00	100.00

Class	Commission (Percent)	Omission (Percent)	Commission (Pixels)	Omission (Pixels)
Mining or Con	5.70	50.67	662/11615	11250/22203
I.Mixed Frui	83.76	20.98	6898/8235	355/1692
Salines	56.22	28.34	8249/14672	2540/8963
Vineyard	6.65	9.09	625/9393	877/9645
Irrigated Agr	49.91	53.77	2657/5324	3102/5769
Water Bodies	0.00	0.23	9/482682	1100/483773
Fallow	3.93	6.00	566/14390	883/14707
Bare Rock	1.68	3.51	7486/446881	15971/455366
Rangeland	18.68	19.48	31238/167210	32887/168859
Built-Up	0.85	0.31	6261/733648	2234/729621
Riparian Vege	6.66	12.87	1162/17444	2404/18686
Rainfed Agric	16.69	18.02	4366/26154	4788/26576
Sparse Rangel	31.49	26.32	23273/73909	18086/68722
Maquis and Wo	19.24	9.02	7613/39574	3170/35131
Beach	24.15	0.10	933/3863	3/2933
Greenhouse Ag	23.84	11.54	108/453	45/390
Tree Crops	17.89	17.66	6623/37017	6521/36915
Forest	4.33	14.19	947/21875	3460/24388

Class	Prod. Acc. (Percent)	User Acc. (Percent)	Prod. Acc. (Pixels)	User Acc. (Pixels)
Mining or Con	49.33	94.30	10953/22203	10953/11615
I. Mixed Fruit	79.02	16.24	1337/1692	1337/8235
Salines	71.66	43.78	6423/8963	6423/14672
Vineyard	90.91	93.35	8768/9645	8768/9393
Irrigated Agr	46.23	50.09	2667/5769	2667/5324
Water Bodies	99.77	100.00	482673/483773	482673/482682
Fallow	94.00	96.07	13824/14707	13824/14390
Bare Rock	96.49	98.32	439395/455366	439395/446881
Rangeland	80.52	81.32	135972/168859	135972/167210
Built-Up	99.69	99.15	727387/729621	727387/733648
Riparian Vege	87.13	93.34	16282/18686	16282/17444
Rainfed Agric	81.98	83.31	21788/26576	21788/26154
Sparse Rangel	73.68	68.51	50636/68722	50636/73909
Maquis and Wo	90.98	80.76	31961/35131	31961/39574
Beach	99.90	75.85	2930/2933	2930/3863
Greenhouse Ag	88.46	76.16	345/390	345/453
Tree Crops	82.34	82.11	30394/36915	30394/37017
Forest	85.81	95.67	20928/24388	20928/21875

Appendix 4 to Land Use/Cover Map of the West Bank
ARIJ-WFP Land Use Map

WFP Land Use Legend

- Agr.Land With Nat. Veg
- Aiports
- Bare rock
- Beaches, dunes&sand pl
- Citrus plantations
- Colonies
- Construction sites
- Continuous Urban Fabri
- Discontinuous Urban Fa
- Drip Irrigated Arable
- Drip irrig. Vineyards
- Dump site
- Forest
- Fruit trees&berry plan
- Green urban areas
- Halophytes
- Industrial or com.unit
- Irrig. complex cult. p
- Military camps
- Mineral extrac. sites
- Natural grass land
- Non-Irrigated Arable L
- Non-irrig. complex cul
- Olive groves
- Others
- Palm groves
- Pannana Plantation
- Refugee Camps
- Salines
- Salt marshes
- Sclerophylous vegt.
- Sea and ocean
- Sparsely veg. area
- Sport&leisure facilit
- Transitional wood land
- Vineyards
- Water bodies

Annex 2. Stations used for spatial interpolation of the 80% probability minimum annual precipitation

Country	St_Name	Lati	Longi	Alti	Year	NoYears	Begin	End	PrecYr	DecChg%	No_Decad	PrecYr_adj	Ratio_80%	P_80%
ISRAEL	BEER-SHEVA	31.23	34.78	280	Average	19	1979	2002	179	0		179	0.661	118
ISRAEL	BEN-GURION-INT.-AIRPORT	32.00	34.90	49	Average	25	1977	2007	503	0		503	0.653	329
ISRAEL	BET-DAGAN	32.00	34.82	35	Average	27	1970	2000	538	0		538	0.753	405
ISRAEL	EILAT	29.55	34.95	13	Average	21	1972	2002	36	0		36	0.232	8
ISRAEL	HAIFA	32.77	34.95	10	Average	17	1977	2002	409	0		409	0.613	251
ISRAEL	HAR KNAAN/ZEFAT	32.97	35.50	934	Average	27	1970	1999	671	0		671	0.798	535
ISRAEL	JERUSALEM	31.78	35.22	809	Average	24	1972	2002	494	0		494	0.716	354
ISRAEL	OVDA	30.00	34.83	445	Average	15	1984	2002	30	0		30	0.175	5
ISRAEL	TEL AVIV PORT	32.10	34.78	10	Average	20	1979	2002	360	0		360	0.763	275
JORDAN	AMMAN-AIRPORT	31.98	35.98	768	Average	25	1972	2002	245	0		245	0.677	166
JORDAN	AQABA-AIRPORT	29.63	35.02	51	Average	19	1979	2002	41	0		41	0.096	4
JORDAN	DEIR-ALLA	32.20	35.62	-224	Average	19	1952	1970	271	-0.94	5	258	0.807	208
JORDAN	GHOR EL SAFI	31.03	35.47	-350	Average	13	1984	2002	64	0		64	0.453	29
JORDAN	IRBID	32.55	35.85	619	Average	25	1972	2002	432	0		432	0.723	312
JORDAN	MAAN	30.17	35.78	1070	Average	25	1972	2002	39	0		39	0.477	18
JORDAN	MAFRAQ	32.37	36.25	687	Average	13	1984	2002	136	0		136	0.078	11
JORDAN	QUEEN ALIA AIRPORT	31.67	35.98	721	Average	13	1984	2002	153	0		153	0.385	59
PALESTINE	Anabta	32.31	35.12	160	Average	17	1957	1988	654	-0.83	3	638	0.802	512
PALESTINE	Betunia	31.83	35.21	810	Average	20	1975	1997	649	0		649	0.667	433
PALESTINE	Bir Zeit	31.97	35.20	780	Average	17	1975	2001	517	0		517	0.696	360
PALESTINE	Deir Dibwan	31.91	35.27	850	Average	21	1976	1996	496	0		496	0.670	332
PALESTINE	Gaza	31.30	34.30	16	Average	24	1923	1967	320	-2.81	6	266	0.650	173
PALESTINE	Hebron	31.53	35.10	1005	Average	30	1976	2008	555	0		555	0.705	391
PALESTINE	Jenin	32.46	35.30	138	Average	29	1975	2008	433	0		433	0.656	284
PALESTINE	Jericho	31.86	35.46	-260	Average	30	1978	2008	147	0		147	0.666	98
PALESTINE	Nablus	32.34	35.26	533	Average	28	1978	2008	617	0		617	0.728	449
PALESTINE	Tammun	32.28	35.38	340	Average	12	1971	1985	289	-0.75	3	282	0.808	228
PALESTINE	Tubas	32.32	35.37	375	Average	20	1970	1989	411	-0.71	3	402	0.798	321
PALESTINE	Tulkarm	32.31	35.03	65	Average	30	1975	2008	622	0		622	0.679	422
SYRIA	BEIT_JIN	33.32	35.87	1150	Average	16	1978	1996	811	0		811	0.716	581
SYRIA	DAMASCUS INT.AIR	33.42	36.52	609	Average	40	1951	1996	188	0		188	0.701	132
SYRIA	DOREEN	33.25	35.97	925	Average	13	1978	1995	372	0		372	0.665	248
SYRIA	HADAR	33.28	35.82	1400	Average	17	1978	1996	1013	0		1013	0.581	588
SYRIA	NABA_ELSAKHR	33.08	35.95	1050	Average	15	1978	1996	398	0		398	0.751	298
SYRIA	QONETRA	33.12	35.82	941	Average	16	1955	1996	712	0		712	0.622	443
SYRIA	RAKHLEH	33.52	35.97	1600	Average	13	1978	1996	874	0		874	0.672	588
SYRIA	TEL_SHEHAB	32.70	35.98	399	Average	16	1978	1995	328	0		328	0.681	223
SYRIA	TESEEL	32.83	35.97	580	Average	17	1978	1995	428	0		428	0.613	262
LEBANON	Beirut	33.87	35.43	33	Average	27	1960	1990	807	-1.56	3	770	0.767	590
LEBANON	Ksara	33.82	35.82	918	Average	30	1961	1990	638	-1.62	3	607	0.810	491

Notes:

<table>
<tr><td style="background-color:#7fc241">   </td><td>No need for adjustment of precipitation total</td></tr>
<tr><td style="background-color:#ffff00">   </td><td>Precipitation total adjusted with results of trend map</td></tr>
<tr><td style="background-color:#ffaa00">   </td><td>Precipitation total adjusted for missing data between May-October</td></tr>
</table>

column headers:

St_Name: name climatic station

Lati: latitude (in decimal degrees); Longi: longitude (in decimal degrees); Alti: station elevation (in m)

NoYears: number of years with recorded data

Begin: begin year for the record; End: end year for the record

PrecYr: mean annual precipitation, based on the available record

Dec_Chg%: percentage change (+ or -) of the annual precipitation per decade (10 year period)

No_decades: number of decades difference with the reference period (1978-2007)

PrecYr_adj: annual precipitation for the reference period, adjusted for the trend

Ratio_80%P: ratio between the 80% minimum probability annual precipitation and the mean annual precipitation

P_80%: adjusted 80% minimum probability annual precipitation

ANNEX 3. LIST OF MAPS

ANNEX 4. MAPS OF WATER HARVESTING POTENTIAL

WEST BANK

Micro-catchment water harvesting system S11
contour ridges - range shrubs

"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

Legend

Suitability score
- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100

Soil Constraints
- R Bare Rock
- B Beach
- U Built-Up
- F Forest
- W Maquis and Woodland
- M Mining or Construction Sites
- V Riparian Vegetation
- S Salines

- ★ Capital
- ● Towns
- AL_QUDS
- ---- International boundary
- -·-· Armistice Demarcation Line

Roads
- Motorway With junction
- Expressway
- Dual carriageways
- International and national
- Important connecting road
- Other road

- Rivers
- Lakes

0 5 10   20 km

Map prepared by GIS Unit, ICARDA, 2010
Author: E. De Pauw
GIS handling: M.F.Tulaymat, L. Atassi, R. Shabekalyeh

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WEST BANK

Micro-catchment water harvesting system S12
contour ridges – field crops

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World Food Programme

WEST BANK

Micro-catchment water harvesting system S13
contour ridges – tree crops

"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

ICARDA

MEDITERRANEAN SEA

Yamun
Jenin
Ya'bad
Al_Maghayyet
Arabe
Qabatiya
Judeida
Tubas
Tul_Karm
Anabta
Nablus
Qalqilya
Ari'el
Taibe
Modi'in Ilit
Al_Bira
Ramalla
Tira
Al_Ram
Beit_Hanina
Jericho
AL QUDS (JERUSALEM)
Al_Za'im
Ma'ale_Adumim
Abu_Dis
Bayt_Jala
Bethlehem
Bayt_Sahur
Beitar_Ilit
Tarqumiya_Halhul
Idhna
Hebron
Bani_Na'im
Dura
Yata
Carmel
Dahriya
Samu'a

Legend

Suitability score
- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100

Soil Constraints
- R Bare Rock
- B Beach
- U Built-Up
- F Forest
- W Maquis and Woodland
- M Mining or Construction Sites
- V Riparian Vegetation
- S Salines

★ Capital
• Towns
AL_QUDS

Rivers
Lakes

- - - - International boundary
-·-·- Armistice Demarcation Line

Roads
- Motorway With junction
- Expressway
- Dual carriageways
- International and national
- Important connecting road
- Other road

0   5   10   20 km

Map prepared by GIS Unit, ICARDA, 2010
Author: E. De Pauw
GIS handling: M.F.Tulaymat, L. Atassi, R. Shabekalyeh

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WEST BANK

Micro-catchment water harvesting system S21
semi-circular bunds – range shrubs

"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

MEDITERRANEAN SEA

Legend

Suitability score **Soil Constraints**

0 - 10	R	Bare Rock
10 - 20	B	Beach
20 - 30	U	Built-Up
30 - 40	F	Forest
40 - 50	W	Maquis and Woodland
50 - 60	M	Mining or Construction Sites
60 - 70	V	Riparian Vegetation
70 - 80	S	Salines
80 - 90		
90 - 100		

★ Capital   ～ Rivers
● Towns   Lakes
⬡ AL_QUDS

–·– International boundary
– – – Armistice Demarcation Line

Roads
Motorway With junction
Expressway
Dual carriageways
International and national
Important connecting road
Other road

0   5   10   20
                      km

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Author: E. De Pauw
GIS handling: M.F.Tulaymat, L. Atassi, R. Shabekalyeh

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WEST BANK

Micro-catchment water harvesting system S22
semi-circular bunds – field crops

"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

MEDITERRANEAN SEA

Legend

Suitability score
- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100

Soil Constraints
- R Bare Rock
- B Beach
- U Built-Up
- F Forest
- W Maquis and Woodland
- M Mining or Construction Sites
- V Riparian Vegetation
- S Salines

- ★ Capital
- ● Towns
- AL_QUDS
- Rivers
- Lakes
- International boundary
- Armistice Demarcation Line

Roads
- Motorway With junction
- Expressway
- Dual carriageways
- International and national
- Important connecting road
- Other road

0 5 10 20 km

Map prepared by GIS Unit, ICARDA, 2010
Author: E. De Pauw
GIS handling: M.F.Tulaymat, L. Atassi, R. Shabekalyeh

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WEST BANK

**Micro-catchment water harvesting system S23
semi-circular bunds – tree crops**

"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

WFP
World Food
Programme

ICARDA

35°0'E
35°30'E

32°30'N
32°30'N

32°0'N
32°0'N

31°30'N
31°30'N

MEDITERRANEAN SEA

Yamun
Jenin
Ya'bad
Al_Maghayyel
Araba
Qabatya
Judeida
Tubas
Tul_Karm
Anabta
Nablus
Qalqilya
Ari'el
Taibe
Modi'inlllit
Al_Bira
Ramalla
Tira
Al_Ram
Beit_Hanina
AL QUDS (JERUSALEM)
Al_Za'im
Ma'ale_Adumim
Abu_Dis
Jericho
Bayt_Jala
Bethlehem
Bayt_Sahur
Beitar_lllit
Tarqumiya_Halhul
Idhna
Hebron
Bani_Na'im
Dura
Yata
Carmel
Dahrlya
Samu'a

Legend

Suitability score | **Soil Constraints**
R	Bare Rock
B	Beach
U	Built-Up
F	Forest
W	Maquis and Woodland
M	Mining or Construction Sites
V	Riparian Vegetation
S	Salines

0 - 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 70
70 - 80
80 - 90
90 - 100

★ Capital
• Towns
AL_QUDS
Rivers
Lakes

— · · — International boundary
— · — Armistice Demarcation Line

Roads
Motorway With junction
Expressway
Dual carriageways
International and national
Important connecting road
Other road

0 5 10 20 km

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GIS handling: M.F.Tulaymat, L. Atassi, R. Shabekalyeh

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WEST BANK

Micro-catchment water harvesting system S31
small pits – range shrubs

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World Food
Programme

ICARDA

MEDITERRANEAN SEA

35°0'E
35°30'E
32°30'N
32°0'N
31°30'N

Yamun
Jenin
Ya'bad
Al_Maghayyel
Araba
Qabatiya
Judeida
Tubas
Tul_Karm
Anabta
Nablus
Qalqilya
Ari'el
Mod'i'illit
Talbe
Al_Bira
Ramalla
Tira
Jericho
Al_Ram
Beit Hanina
AL QUDS (JERUSALEM)
Al_Za'im
Ma'ale_Adumim
Abu Dis
Bayt_Jala
Bethlehem
Bayt_Sahur
Beitar_Illit
Tarqumiya_Halhul
Idhna
Hebron
Bani_Na'im
Dura
Yata
Carmel
Dahriya
Samu'a

Legend

Suitability score **Soil Constraints**

Suitability score		Soil Constraints	
0 - 10		R	Bare Rock
10 - 20		B	Beach
20 - 30		U	Built-Up
30 - 40		F	Forest
40 - 50		W	Maquis and Woodland
50 - 60		M	Mining or Construction Sites
60 - 70		V	Riparian Vegetation
70 - 80		S	Salines
80 - 90			
90 - 100			

★ Capital
● Towns
AL_QUDS
— · — · — International boundary
— · · — · · Armistice Demarcation Line

～～ Rivers
Lakes

Roads

Motorway With junction
Expressway
Dual carriageways
International and national
Important connecting road
Other road

0 5 10 20 km

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Author: E. De Pauw
GIS handling: M.F.Tulaymat, L. Atassi, R. Shabekalyeh

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WEST BANK

Micro-catchment water harvesting system S33
small pits – tree crops

"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

WEST BANK

World Food Programme

ICARDA

Micro-catchment water harvesting system S41
small run-off basins – range shrubs

"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

32°30'N   32°30'N

MEDITERRANEAN SEA

32°0'N   32°0'N

Yamun
Jenin
Ya'bad
Al_Maghayyel
Araba
Qabatiya
Judeida
Tubas
Tul_Karm
Anabta
Nablus
Qalqilya
Ari'el
Mod'in'llit
Talbe
Al_Bira
Ramalla
Tira
Jericho
Al_Ram
Beit_Hanina
AL QUDS (JERUSALEM)
Al_Za'im
Ma'ale_Adumim
Abu_Dis
Bayt_Jala
Bethlehem
Bayt_Sahur
Beitar_llit
Tarqumiya_Halhul
Idhna
Hebron
Bani_Na'im
Dura
Yata
Carmel
Dahriya
Samu'a

Legend

Suitability score   **Soil Constraints**

0 - 10	R Bare Rock
10 - 20	B Beach
20 - 30	U Built-Up
30 - 40	F Forest
40 - 50	W Maquis and Woodland
50 - 60	M Mining or Construction Sites
60 - 70	V Riparian Vegetation
70 - 80	S Salines
80 - 90	
90 - 100	

★ Capital
● Towns
AL_QUDS
—·—·— International boundary
—·· —·· Armistice Demarcation Line

～ Rivers
Lakes

Roads
Motorway With junction
Expressway
Dual carriageways
International and national
Important connecting road
Other road

0   5   10   20
km

Map prepared by GIS Unit, ICARDA, 2010
Author: E. De Pauw
GIS handling: M.F.Tulaymat, L. Atassi, R. Shabekalyeh

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31°30'N   31°30'N

360

35°0'E   35°30'E

WEST BANK

Micro-catchment water harvesting system S43
small run-off basins – tree crops

"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

Legend

Suitability score
- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100

Soil Constraints
- R Bare Rock
- B Beach
- U Built-Up
- F Forest
- W Maquis and Woodland
- M Mining or Construction Sites
- V Riparian Vegetation
- S Salines

- ★ Capital
- ● Towns
- AL_QUDS
- International boundary
- Armistice Demarcation Line

- Rivers
- Lakes

Roads
- Motorway With junction
- Expressway
- Dual carriageways
- International and national
- Important connecting road
- Other road

0 5 10   20 km

Map prepared by GIS Unit, ICARDA, 2010
Author: E. De Pauw
GIS handling: M.F.Tulaymat, L. Atassi, R. Shabekalyeh

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MEDITERRANEAN SEA

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ICARDA

Micro-catchment water harvesting system S51
runoff strips – range shrubs

"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

35°0'E
35°30'E

32°30'N
32°30'N

32°0'N
32°0'N

31°30'N
31°30'N

MEDITERRANEAN SEA

Yamun
Jenin
Ya'bad
Al_Maghayyel
Araba
Qabatiya
Judeida
Tubas
Tul_Karm
Anabta
Nablus
Qalqilya
Ari'el
Modi'illit
Talbe
Al_Bira
Ramalla
Tira
Jericho
Al_Ram
Beit_Hanina
AL QUDS (JERUSALEM)
Al_Zaim
Ma'ale_Adumim
Abu_Dis
Bayt_Jala
Bethlehem
Bayt_Sahur
Beitar_Ilit
Tarqumiya_Halhul
Idhna
Hebron
Bani_Na'im
Dura
Yata
Carmel
Dahriya
Samu'a

Legend

Suitability score
- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100

Soil Constraints
- R Bare Rock
- B Beach
- U Built-Up
- F Forest
- W Maquis and Woodland
- M Mining or Construction Sites
- V Riparian Vegetation
- S Salines

- ★ Capital
- ● Towns
- AL_QUDS
- Rivers
- Lakes
- ‑‑‑ International boundary
- — ‑ Armistice Demarcation Line

Roads
- Motorway With junction
- Expressway
- Dual carriageways
- International and national
- Important connecting road
- Other road

0   5   10   20 km

Map prepared by GIS Unit, ICARDA, 2010
Author: E. De Pauw
GIS handling: M.F.Tulaymat, L. Atassi, R. Shabekalyeh

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WEST BANK

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Micro-catchment water harvesting system S52
runoff strips – field crops

"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

MEDITERRANEAN SEA

35°0'E
35°30'E

32°30'N
32°30'N

32°0'N
32°0'N

31°30'N
31°30'N

Yamun
Jenin
Ya'bad
Al_Maghayyel
Araba
Qabatiya
Judeida
Tubas
Tul_Karm
Anabta
Nablus
Qalqilya
Ari'el
Taibe
Modi'in Illit
Al_Bira
Ramalla
Tira
Jericho
Al_Ram
Beit_Hanina
AL QUDS (JERUSALEM)
Al_Za'im
Ma'ale_Adumim
Abu_Dis
Bayt_Jala
Bethlehem
Beitar_Ilit
Bayt_Sahur
Tarqumiya_Halhul
Idhna
Hebron
Bani_Na'im
Dura
Yata
Carmel
Dahriya
Samu'a

Legend

Suitability score Soil Constraints

0 - 10	R Bare Rock
10 - 20	B Beach
20 - 30	U Built-Up
30 - 40	F Forest
40 - 50	W Maquis and Woodland
50 - 60	M Mining or Construction Sites
60 - 70	V Riparian Vegetation
70 - 80	S Salines
80 - 90	
90 - 100	

★ Capital
● Towns
AL_QUDS
Rivers
Lakes

International boundary
Armistice Demarcation Line

Roads
Motorway With junction
Expressway
Dual carriageways
International and national
Important connecting road
Other road

0   5   10   20
km

Map prepared by GIS Unit, ICARDA, 2010
Author: E. De Pauw
GIS handling: M.F.Tulaymat, L. Atassi, R. Shabekalyeh

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WEST BANK

Micro-catchment water harvesting system S6
contour bench terraces

"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

MEDITERRANEAN SEA

Legend

Suitability score
- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100

Soil Constraints
- R Bare Rock
- B Beach
- U Built-Up
- F Forest
- W Maquis and Woodland
- M Mining or Construction Sites
- V Riparian Vegetation
- S Salines

- ★ Capital
- ● Towns
- AL_QUDS
- ---- International boundary
- -·-· Armistice Demarcation Line

- Rivers
- Lakes

Roads
- Motorway With junction
- Expressway
- Dual carriageways
- International and national
- Important connecting road
- Other road

0   5   10   20
km

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GIS handling: M.F.Tulaymat, L. Atassi, R. Shabekalyeh

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Potential for Water Harvesting
Macro-Catchment System
1. Precipitation Suitability

"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

WFP World Food Programme

ICARDA

MEDITERRANEAN SEA

35°0'E
35°30'E

32°30'N
32°0'N
31°30'N

Yamun
Jenin
Ya'bad
Al Mughayyir
Araba
Qabatiya
Judeida
Tubas
Tul Karm
Anabta
Nablus
Qaqiliya
Ar'iel
Medinliit
Taibe
Al Bira
Ramalla
Bira
Al Ram
Jericho
Beit Hanina
AL QUDS (JERUSALEM)
At Zarim
Ma'ale Adumim
Abu Dis
Bayt Jala
Bethlehem
Beitar Ilit
Bayt Sahur
Tarqumiya Halhul
Idhna
Hebron
Bani Na'im
Dura
Yata
Carmel
Dahiriya
Samu'a

Legend

Suitability score
- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100

Landuse/Land Cover Constraints
- R Bare Rock
- B Beach
- U Built-Up
- F Forest
- W Maquis and Woodland
- M Mining or Construction Sites
- V Riparian Vegetation
- S Salines

★ Capital
● Towns
  AL_QUDS
— Rivers
  Lakes
-·-·- International boundary
-··-··- Armistice Demarcation Line

Roads
- Motorway With junction
- Expressway
- Dual carriageways
- International and national
- Important connecting road
- Other road

0 5 10 20 km

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GIS handling: M.F.Tulaymat, L. Atassi, R. Shabekalyeh

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WEST BANK

Potential for Water Harvesting
Macro-Catchment System
2. Slope Suitability
corrected for soil hydrological class
"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

Legend

Suitability score
- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100

Landuse/Land Cover Constraints
- R Bare Rock
- B Beach
- U Built-Up
- F Forest
- W Maquis and Woodland
- M Mining or Construction Sites
- V Riparian Vegetation
- S Salines

- ★ Capital
- ● Towns
- AL_QUDS
- Rivers
- Lakes
- — · — · — International boundary
- — · · — Armistice Demarcation Line

Roads
- Motorway With junction
- Expressway
- Dual carriageways
- International and national
- Important connecting road
- Other road

0   5   10   20 km

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GIS handling: M.F.Tulaymat, L. Atassi, R. Shabekalyeh

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WEST BANK

Potential for Water Harvesting
Macro-Catchment System
3. Suitability for catchment use

"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

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ICARDA

35°0'E
35°30'E

32°30'N
32°30'N

32°0'N
32°0'N

31°30'N
31°30'N

MEDITERRANEAN SEA

Yamun
Ya'bad
Jenin
Al_Maghayyir
Araba
Qabatiya
Judeida
Tubas
Tul_Karm
Anabta
Nablus
Qalqilya
Am'el
Madinat
Taibe
Al_Bira
Ramalla
Bira
Al_Ram
Beit_Hanina
AL QUDS (JERUSALEM)
Al_Zaiim
Ma'ale_Adumim
Abu-Dis
Jericho
Bayt_Jala
Bethlehem
Beitar_Ilit
Bayt_Sahur
Tarqumiya_Halhul
Idhna
Hebron
Bani_Na'im
Dura
Yata
Carmel
Dhahriya
Samu'a

Legend

Suitability score
- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100

★ Capital
● Towns
AL_QUDS
—·—·— International boundary
—··—··— Armistice Demarcation Line

Rivers
Lakes

Roads
- Motorway With junction
- Expressway
- Dual carriageways
- International and national
- Important connecting road
- Other road

0 5 10 20 km

Map prepared by GIS Unit, ICARDA, 2010
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GIS handling: M.F.Tulaymat, L. Atassi, R. Shabekalyeh

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World Food
Programme

WEST BANK

Potential for Water Harvesting
Macro-Catchment System
4. Suitability for agricultural use: Tree Crops

"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

ICARDA

35°0'E 35°30'E

32°30'N

32°0'N

31°30'N

MEDITERRANEAN SEA

Yamun
Ya'bad
Jenin
Al_Mughayyer
Araba
Qabatiya
Judeida
Tubas
Tul_Karm
Anabta
Nablus
Qalqilya
An'el
Talbe
Modi'inIlit
Al_Bira
Ramalla
Tira
Jericho
Al_Ram
Beit_Hanina
AL QUDS (JERUSALEM)
Al_Zaim
Ma'ale_Adumim
Abu_Dis
Bayt_Jala
Bethlehem
Bayt_Sahur
Beitar_Ilit
Tarqumiya Halhul
Idhna
Habron
Dura
Bani_Na'im
Carmel
Yata
Dahriya
Samu'a

Legend

Suitability score
- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100

Landuse/Land Cover Constraints
- R Bare Rock
- B Beach
- U Built-Up
- F Forest
- W Maquis and Woodland
- M Mining or Construction Sites
- V Riparian Vegetation
- S Salines

★ Capital
● Towns
AL_QUDS
— International boundary
—·— Armistice Demarcation Line

Roads
— Motorway With junction
— Expressway
— Dual carriageways
— International and national
— Important connecting road
— Other road

— Rivers
Lakes

0   5   10   20 km

Map prepared by GIS Unit, ICARDA, 2010
Author: E. De Pauw
GIS handling: M.F.Tulaymat, L. Atassi, R. Shabekalyeh

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WEST BANK

Potential for Water Harvesting
Macro-Catchment System
5. Suitability for agricultural use: Field Crops

"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

Legend

Suitability score
- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100

Landuse/Land Cover Constraints
- R Bare Rock
- B Beach
- U Built-Up
- F Forest
- W Maquis and Woodland
- M Mining or Construction Sites
- V Riparian Vegetation
- S Salines

- ★ Capital
- ● Towns
- AL_QUDS
- — — Rivers
- Lakes
- — · — International boundary
- — · · — Armistice Demarcation Line

Roads
- Motorway With junction
- Expressway
- Dual carriageways
- International and national
- Important connecting road
- Other road

0   5   10   20 km

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MEDITERRANEAN SEA

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WEST BANK

Potential for Water Harvesting
Macro-Catchment System
6. Area with high suitability for
catchment use and tree crops within 1km proximity

"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

MEDITERRANEAN SEA

Legend

Highly suitable for catchment and agricultural use
Tree crops

Highly suitable for catchment use

Highly suitable for agricultural use, Tree crops

**Landuse/Land Cover
Constraints**

R   Bare Rock
B   Beach
U   Built-Up
F   Forest
W   Maquis and Woodland
M   Mining or Construction Sites
V   Riparian Vegetation
S   Salines

★   Capital   —— Rivers
•   Towns   Lakes
     AL_QUDS

-·-·-   International boundary
- - -   Armistice Demarcation Line

Roads

      Motorway With junction
      Expressway
      Dual carriageways
      International and national
      Important connecting road
      Other road

0   5   10   20
                         km

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WEST BANK
Potential for Water Harvesting
Macro-Catchment System
7. Area with high suitability for
catchment use and field crops within 1km proximity
"Increasing Resilience to Climate Variability in the Occupied Palestinian Territories"

Legend

Highly suitable for catchment and agricultural use
Field crops

Highly suitable for catchment use

Highly suitable for agricultural use, Field crops

Landuse/Land Cover Constraints

R Bare Rock
B Beach
U Built-Up
F Forest
W Maquis and Woodland
M Mining or Construction Sites
V Riparian Vegetation
S Salines

★ Capital
● Towns
     AL_QUDS

‒ ‒ ‒ International boundary
‒ · ‒ Armistice Demarcation Line

Roads
Motorway With junction
Expressway
Dual carriageways
International and national
Important connecting road
Other road

0 5 10 20 km

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