



**UNITED
NATIONS**

EP

UNEP/MED WG.471/Inf.3



**UNITED NATIONS
ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN**

19 April 2019
Original: English

**Meeting of the Ecosystem Approach Correspondence Group on Monitoring (CORMON) on
Coast and Hydrography**

Rome, Italy; 21-22 May 2019

Agenda item 4: Candidate Common Indicator 25: “Land-use change”

**Evolution of built-up area in coastal zones of Mediterranean countries between 1975 to
2015 - contribution to the Candidate Common Indicator 25**

For environmental and economic reasons, this document is printed in a limited number. Delegates are kindly requested to bring their copies to meetings and not request additional copies.

Table of contents

Note by the Secretariat	3
Evolution of built-up area in coastal zones of Mediterranean countries between 1975 to 2015 – report	4

Note by the Secretariat

The Candidate Common Indicator 25 – “Land use change”, belonging to the Ecological Objective 8 “Coastal Ecosystems and Landscapes”, is one of the four candidate IMAP indicators. On several occasions (e.g. CORMON meeting on Coast and Hydrography in March 2017, PAP/RAC Focal Points meeting in May 2017) it was indicated that the “Land-use change” indicator is already mature enough to become a common indicator, and to be included in the following revision of the IMAP as well as in the following edition of the Quality Status Report 2023. For the purpose of assessing and testing this indicator at the Mediterranean level, the analysis of land-use changes in Mediterranean coastal zones, entitled “Evolution of built-up area in coastal zones of Mediterranean countries between 1975 to 2015”, carried out by UNEP GRID, can provide a good insight in the evolution of built-up areas in coastal zones, since “urbanization, or land-take, is the most dramatic change of coastal zones given the (almost) irreversibility of the process.

The results of this analysis will also be used in various environmental reports within the Mediterranean Action Plan (MAP) such as the State of Environment and Development in the Mediterranean report (by Plan Bleu), where reporting of the evolution and state of coastal zones will be using, for the first time, the same relevant methodology and data sources (the same resolution, level of precision) for all countries. In this way, comparability of results between countries is ensured.

**Evolution of built-up area in coastal zones of Mediterranean countries between 1975 to
2015 – report**

Evolution of built-up area in coastal zones of Mediterranean countries between 1975 to 2015

12/20/2017



Evolution of built-up area in coastal zones of Mediterranean countries between 1975 to 2015

Introduction

With the aim of monitoring the evolution in the built-up areas on the coastal zones in the Mediterranean area, a set of data processed from the Landsat collection between 1975 and 2015¹ was used. These data were provided by the European Commission, Joint Research Centre (EC-JRC) and are a subset of the collection called Global Human Settlement (GHS) Layer or GHSL.

This analysis is a contribution to the implementation of the ecosystem approach in the Mediterranean and in particular to the implementation of the ICZM Protocol. Both require ecosystem approach to coastal planning and management, regular monitoring and reporting of the state and evolution of coastal zones so as to ensure the sustainable development of coastal zones.

The report will be an important element in the implementation of the ICZM Protocol, since the Protocol highlights the need of a balanced use of coastal zones in its several articles. The objectives of Article 5, for example, call for ensuring that the coastal environment and landscapes are in harmony with economic social and cultural development; preserving coastal zones for the benefit of future generations; sustainable use of coastal natural resources; and preservation of the integrity of coastal ecosystems, landscapes and geomorphology. The Article 6 calls for the allocation of uses throughout the entire coastal zone to be balanced and unnecessary concentration and urban sprawl to be avoided. Furthermore, Article 8 asks for “identifying and delimiting, outside protected areas, open areas in which urban development and other activities are restricted or, where necessary, prohibited”. It also asks for limiting the linear extension of urban development and the creation of a new transport infrastructure along the coast.

The Integrated Monitoring and Assessment Programme (IMAP) is one of the major initiatives of the Barcelona Convention with the aim to achieve a good environmental status of the Mediterranean Sea. IMAP describes the strategy, themes, and products that the Contracting Parties to the Barcelona Convention are aiming to deliver during the implementation of the Ecosystem Approach Process. Its main component is the list of 23 Common Indicators and 4 Candidate Common Indicators that was adopted at the 19th Meeting of the Parties to the Barcelona Convention (COP 19) in February 2016. The Common Indicator 25 – “Land-use Change” is one of the candidate indicators. However, on several occasions (e.g. CORMON meeting on Coast and Hydrography in March 2017, PAP/RAC Focal Points meeting in May 2017) it was indicated that the “Land-use change” indicator is already mature enough to become a common indicator, and to be included in the following revision of the IMAP as well as in the following edition of the Quality Status Report 2023. For the purpose of assessing and testing this indicator at the Mediterranean level, this analysis of land-use changes in Mediterranean coastal zones can provide a good

¹ More details are available in the *Methodology* section

insight in the evolution of built-up areas in coastal zones, since “urbanization, or land-take, is the most dramatic change of coastal zones given the (almost) irreversibility of the process.

The results of this analysis will also be used in various environmental reports within the Mediterranean Action Plan (MAP) such as the State of Environment and Development in the Mediterranean report (by Plan Bleu), where reporting of the evolution and state of coastal zones will be using, for the first time, the same relevant methodology and data sources (the same resolution, level of precision) for all countries. In this way, comparability of results between countries is ensured.

Definitions

Land-use change

Land-use change describes how land cover has been changed by humans and the processes that result in landscape transformation. The Indicator Guidance fact Sheet for IMAP’s indicator 25 “Land-use change” considers five land-use/land cover classes: built-up areas; agricultural areas; forests and semi-natural land; wetlands; and water bodies.

Built-up area

The concept of “buildings” (Pesaresi et al., 2013) concerns enclosed constructions above ground which are intended or used for the shelter of humans, animals, things or for the production of economic goods, and that refers to any structure constructed or erected on the site. This definition is very similar to the standard topographic definition of the “building” class as compiled in the INSPIRE² directive, except for the fact that the condition of the permanency of the structure is not included here.

Land take

Urbanization on previous undeveloped land. Land take represents a proportion (%) of a specific area that changed between two land cover inventories from a non-artificial to an artificial area³.

NUTS

The NUTS classification (Nomenclature of territorial units for statistics) is a hierarchical system for dividing up the economic territory of the EU⁴.

Definition of the geographic extent

Whole analyses were performed working at a resolution of 38 m for the Mediterranean sector (Figure 1). The results were aggregated both at national and for some countries at sub-national level. Statistics on Built-up changes were calculated in three coastal belts of 150 m, 1 km and 10 km width, respectively.

National

² <http://inspire.ec.europa.eu/>

³ From UNEP/MAP Indicator Guidance Fact Sheet on EO8 CCI 25 „Land-use change

⁴ <http://ec.europa.eu/eurostat/web/nuts/overview>

The considered geographic sectors include the coastal areas of all the countries bordering the Mediterranean Basin, comprised in a 10 km thick band (Figure 1).



The boundaries and names shown and designations used on this map do not imply official endorsement or acceptance by the United Nations

Figure 1: Geographic extent (Source : international boundaries: UN Cartographic Section, Eurostat/GISCO)

Subnational (NUTS)

For a number of countries, it was possible to aggregate the results of statistics at the sub-national scale at NUTS 3 level. The countries considered correspond to those included in the dataset provided by Eurostat /GISCO⁵. The list of countries and regions included in the analyses is presented in Figure 2.

Country name	NUTS 3
Albania	
Algeria	
Bosnia and Herzegovina	
Croatia	
Cyprus	
Egypt	
France	
State of Palestine	
Gibraltar	
Greece	
Israel	
Italy	
Lebanon	
Libya	
Malta	
Monaco	
Montenegro	

⁵ <http://ec.europa.eu/eurostat/web/gisco/geodata/reference-data>

Morocco
Slovenia
Spain
Syrian Arab Republic
Tunisia
Turkey



Figure 2: List of countries and regions included in the study

Methodology

Data sources

GHS Built-up grid

The GHS (or GHSL) is a multi-temporal information layer on built-up presence (Pesaresi et al., 2016), which has been derived from Landsat image collections (GLS1975, GLS1990, GLS2000, and ad-hoc Landsat 8 collection 2013/2014).

The data have been produced by means of Global Human Settlement Layer methodology in 2015, by the European Commission, Joint Research Centre (EC-JRC) as open source data (<http://ghsl.jrc.ec.europa.eu/index.php>).

International Boundaries (Level 0)

International boundary resources are prepared by the United Nations Cartographic Section. The dataset at a 1:1 million scale was mainly derived initially from the Vector map level 0 (VMAPO) and successively it has been corrected to better reflect the cartographic practice of UN Cartographic Section (<http://www.ungis.org/>).

The International boundary refers to 2012. A new version is available from the end of November 2017, with reference to 2015. Unfortunately, due to time constraints, it was not possible to use it in this work. However, it is to be noted that there were no changes on the borders in the study area between 2012 and 2015.

Finally, it is important to underpin that this dataset is not released in the public domain and that it has been created for the sole use of the United Nations community.

Subnational Boundaries (NUTS 3)

The official data provider for NUTS is the Geographic Information System of the Commission or GISCO (Eurostat), using data furnished by EuroGeographics. The NUTS level 3 dataset refers to 2013 classification and it is provided at a 1:1 million scale. Data are freely available from the Eurostat website, they can be used only if not intended for commercial purposes and if the source will be acknowledged.

Coastline

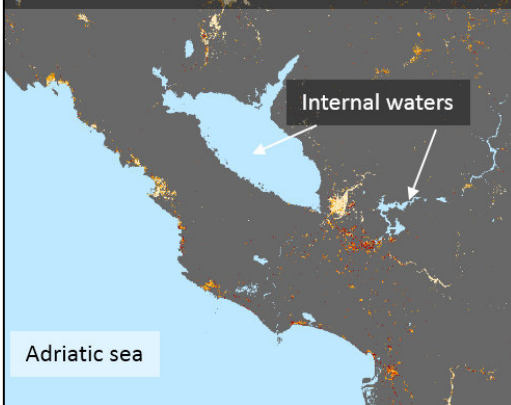
In order to calculate the coastline length, the World Vector Shorelines (WVS) database was employed from the Global Self-consistent, Hierarchical, High-resolution Geography Database (GSHHG), provided by NOAA⁶.

⁶ <https://www.ngdc.noaa.gov/mgg/shorelines/>

Workflow

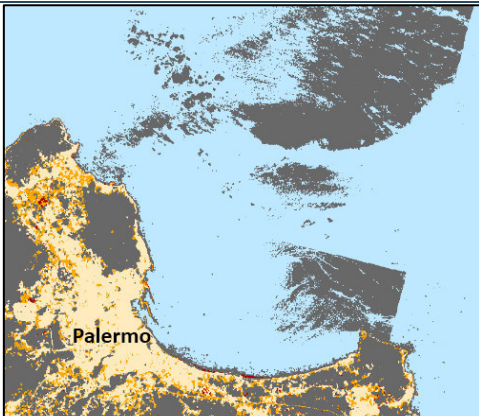
Step1: Pre-processing

Skadar lake (Albania & Montenegro)



- A subset covering the Mediterranean Sea Basin was extracted.
(the GHS data have a worldwide coverage)
- A mask to avoid the internal water was generated.
(the GHS classification does not differentiate seas from internal water)
- Outputs were checked and manual corrections applied.

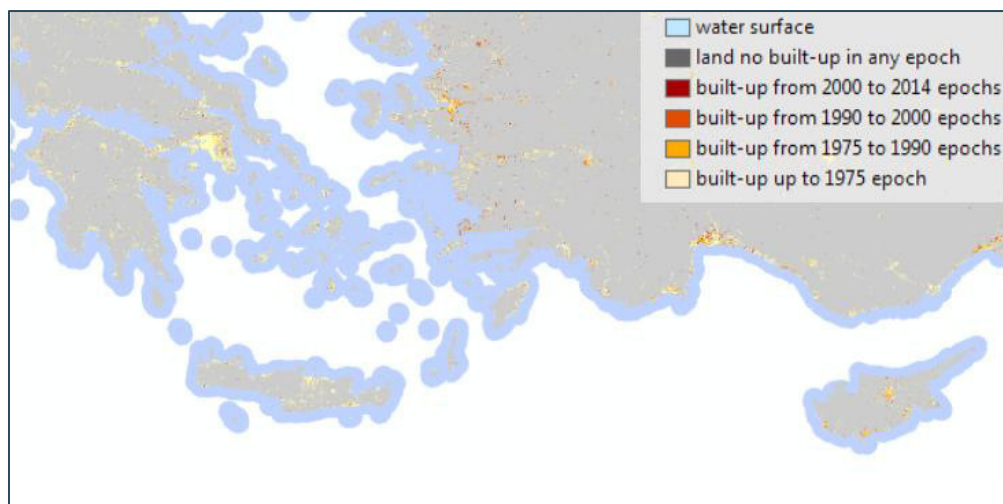
The map on the left shows the GHS layer before any treatment.



- Larger areas have been cleaned automatically, but for many small areas at the land/sea interface a manual intervention was necessary,
(the GHS layer shows several sectors with evident errors, represented by "noise" which results in over-estimation of the land area)

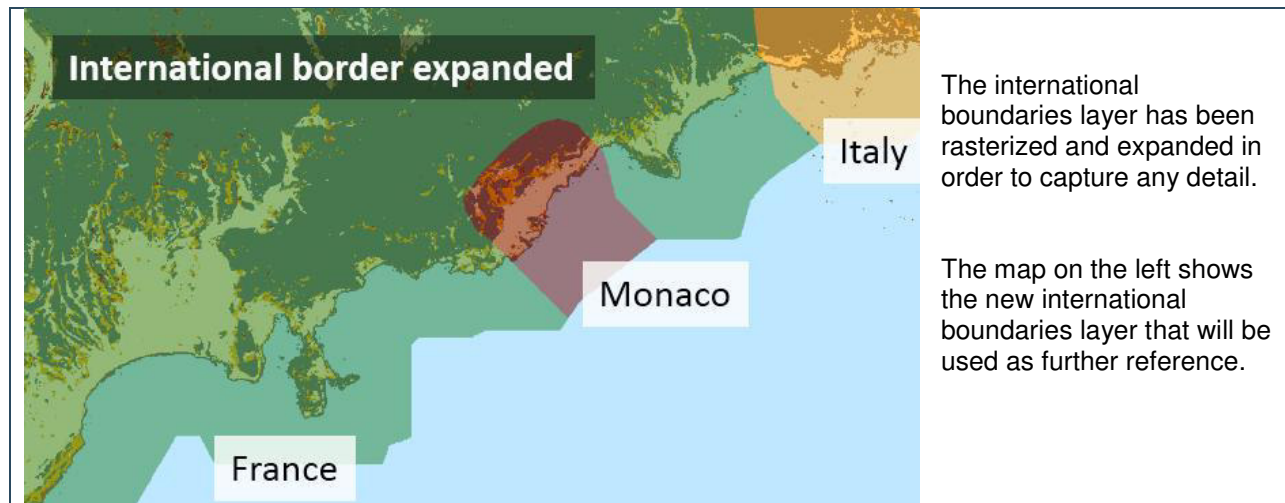
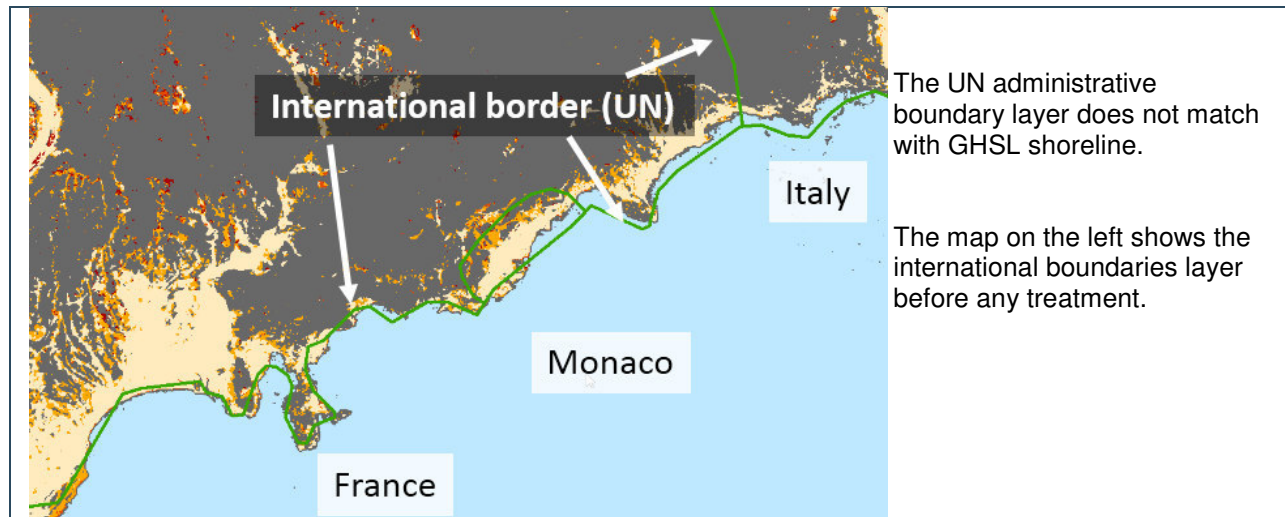
The map on the left shows quite a large sector of "noise" on the GHS layer of the Gulf of Palermo (Sicily, Italy).

The map below shows a portion of the GHSL (Greece and Turkey) after the pre-processing operations.

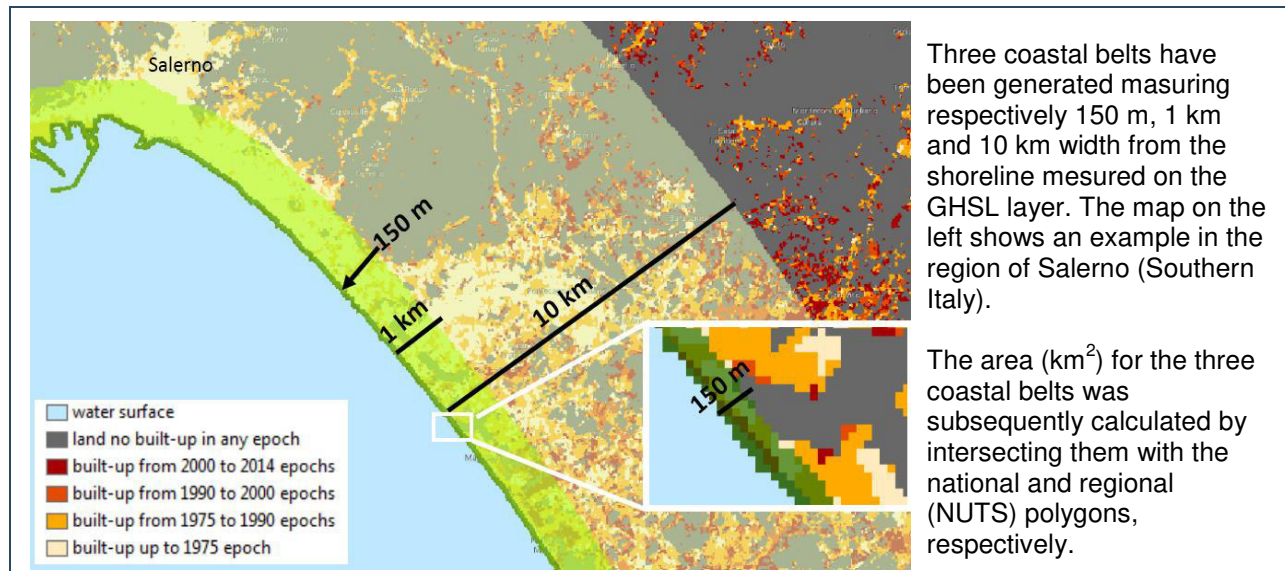


Internal waters have been eliminated, a seawater belt added, and the land-sea interface has been cleaned.

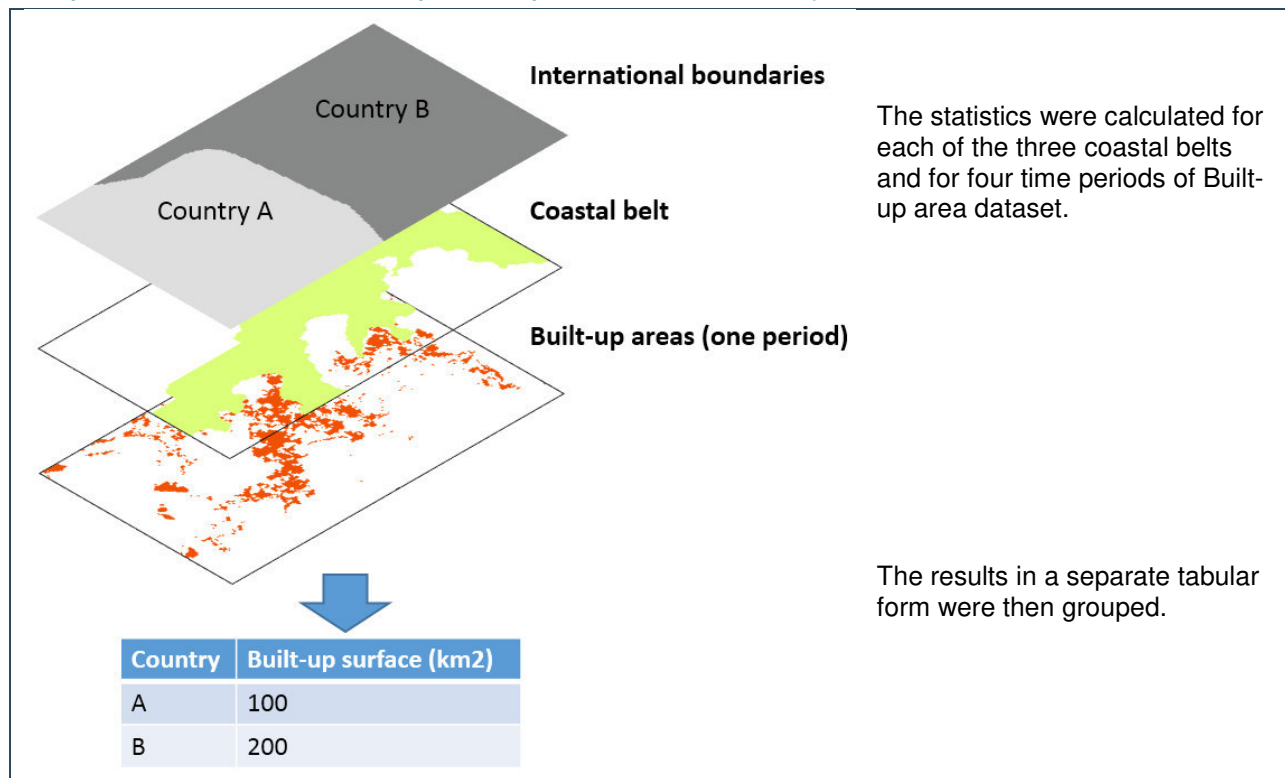
Step2: Matching physical and administrative boundaries



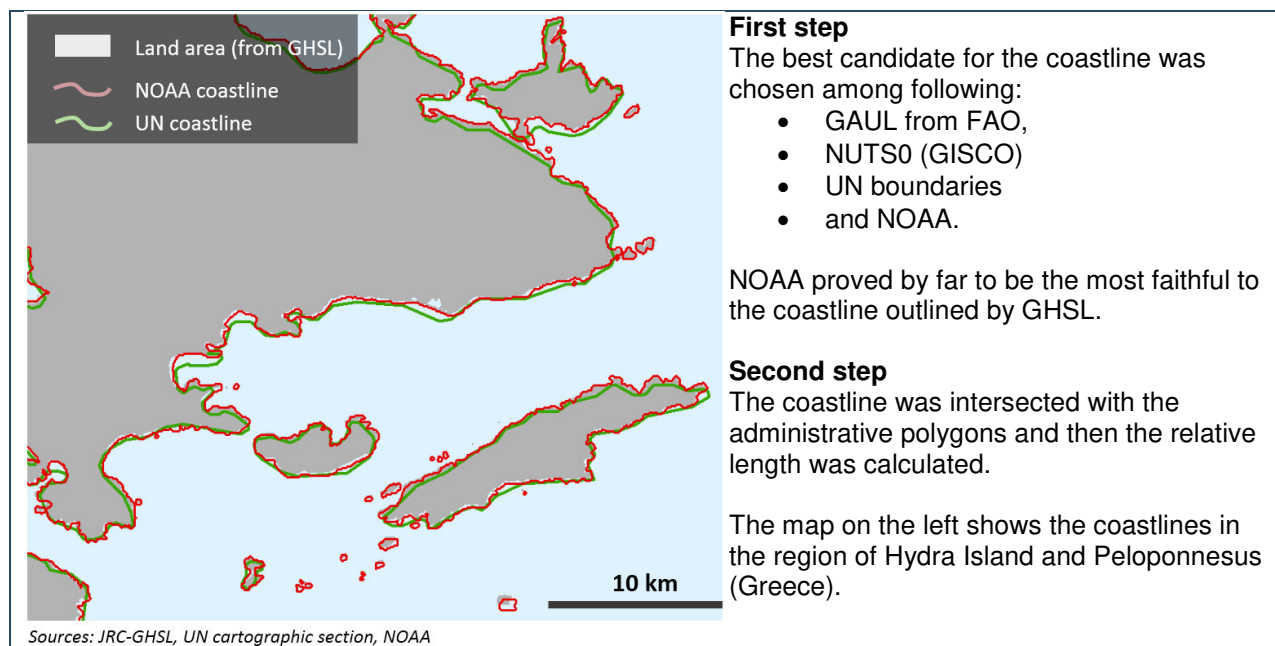
Step3: Generation of coastal belts



Step4: Extraction of built-up areas per costal belt and year



Step5: Calculation of coastline length



Iso3	Country name	Coastline length (km) - this work	Notes (this work)	Coastline length (km) - CIA	Coastline length (km) - WRI
ALB	Albania	715		362	649
DZA	Algeria	1'669		998	1'557
BIH	Bosnia and Herzegovina	21		20	23
HRV	Croatia	6'381		7'368	5'664
CYP	Cyprus	809		648	671
EGY	Egypt	2'519	1	2'450	5'898
FRA	France	2'436	1	4'853	7'330
PSE	State of Palestine	42		40	
GIB	Gibraltar	14		12	
GRC	Greece	16'491		13'676	15'547
ISR	Israel	214		273	205
ITA	Italy	10'043		7'600	9'226
LBN	Lebanon	319		225	294
LBY	Libya	2'174		1'770	2'025
MLT	Malta	214		252	198
MCO	Monaco	7		4	
MNE	Montenegro	325		293	
MAR	Morocco	573	1	1'835	2'009
SVN	Slovenia	45		47	41
ESP	Spain	3'188	1	4'964	7'628
SYR	Syrian Arab Republic	239		193	212
TUN	Tunisia	2'037		1'148	1'927
TUR	Turkey	6'961	1	7'200	8'140

Notes: 1- It only includes the Mediterranean coasts

Figure 3: Coastline comparison between calculated coastlines (using NOAA) and those proposed in the literature (Cia Factbook and World Resource Institute-WRI)

Presentation of the results

Outputs

Tables and related graphs were produced for the whole Mediterranean area (aggregated): for individual countries, as well as at regional scale (NUTS). For each of these geographical subdivisions the following three indicators were calculated:

1. **Percentage of built-up area**, i.e. the area of built-up land in coastal zone as a proportion of the total area in the same unit; and
2. **Land take** as percentage of the initial built-up area on the coastal zone.

The following three tables, organized by coastal belts, display overall results at national scale for the three indicators including 1975, 1990, 2000 and 2015 values. The charts (at national scale), in the subsequent sessions are based on these tables.

10 km belt	Coastline length km	Coastal area km2	Percentage of built-up area				Land take as percentage of initial built-up area			
TERR_NAME			1975	1990	2000	2015	1975- 1990	1990- 200	2000- 2015	1975- 2015
Albania	715	4.335	0,3%	1,8%	3,0%	3,7%	432%	60%	24%	956%
Algeria	1.669	13.065	1,4%	6,1%	7,1%	8,6%	337%	17%	21%	517%
Bosnia and Herzegovina	21	358	0,2%	0,5%	0,5%	0,6%	181%	13%	7%	239%
Croatia	6.381	18.013	1,9%	3,1%	3,3%	3,6%	62%	8%	8%	89%
Cyprus	809	5.689	0,7%	3,1%	3,7%	4,2%	331%	21%	14%	494%
Egypt	2.519	10.819	1,1%	3,3%	4,6%	6,7%	188%	41%	45%	487%
France	2.436	13.434	7,9%	12,7%	13,9%	15,1%	61%	10%	9%	92%
Gibraltar	14	13	37,8%	44,4%	48,3%	49,4%	17%	9%	2%	31%
Greece	16.491	66.543	1,8%	2,8%	3,2%	3,5%	59%	13%	11%	99%
Israel	214	2.058	6,6%	20,6%	24,0%	27,0%	213%	16%	12%	310%
Italy	10.043	60.926	5,7%	9,6%	10,8%	12,2%	68%	12%	13%	112%
Lebanon	319	2.268	9,9%	16,1%	18,1%	21,6%	63%	12%	19%	118%
Libya	2.174	18.569	3,2%	4,6%	5,0%	5,5%	45%	10%	10%	75%
Malta	214	514	9,5%	23,0%	26,5%	32,3%	143%	15%	22%	241%
Monaco	7	24	31,3%	44,5%	45,9%	46,9%	42%	3%	2%	50%
Montenegro	325	1.870	1,3%	2,8%	3,0%	3,3%	117%	8%	9%	154%
Morocco	573	4.618	0,8%	1,6%	1,9%	2,8%	90%	20%	47%	234%
Slovenia	45	442	4,7%	10,6%	11,1%	12,5%	125%	5%	12%	165%
Spain	3.188	22.079	6,4%	9,0%	10,1%	11,3%	41%	12%	11%	75%
State of Palestine	42	434	7,3%	30,3%	32,8%	35,1%	315%	8%	7%	380%
Syrian Arab Republic	239	1.779	4,2%	10,0%	11,7%	15,5%	139%	17%	32%	269%
Tunisia	2.037	12.687	2,8%	5,9%	6,8%	7,6%	113%	15%	11%	173%
Turkey	6.961	39.444	3,2%	5,9%	7,2%	8,2%	84%	20%	14%	153%

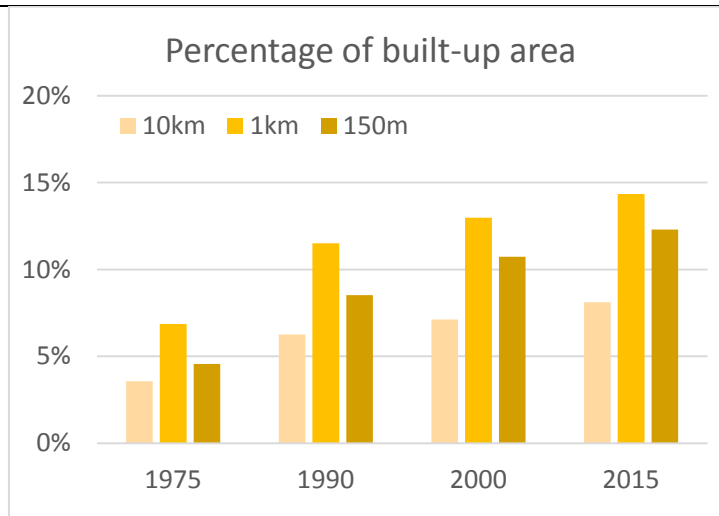
1 km belt	Coastline length km	Coastal area km2	Percentage of built up area				Land take as percentage of initial built-up area			
TERR_NAME			1975	1990	2000	2015	1975- 1990	1990- 200	2000- 2015	1975- 2015
Albania	715	826	0,5%	2,8%	4,6%	5,8%	505%	67%	25%	1164%
Algeria	1.669	2.104	3,1%	12,2%	14,0%	16,3%	290%	15%	16%	422%
Bosnia and Herzegovina	21	24	2,4%	6,8%	7,6%	8,1%	182%	13%	7%	239%
Croatia	6.381	6.143	3,5%	5,7%	6,1%	6,6%	61%	7%	7%	85%
Cyprus	809	1.095	0,9%	4,8%	5,9%	6,8%	418%	23%	14%	628%
Egypt	2.519	1.816	3,0%	7,2%	9,6%	12,7%	138%	34%	32%	321%
France	2.436	2.610	15,5%	23,9%	26,0%	27,4%	54%	9%	5%	77%
Gibraltar	14	12	41,6%	48,8%	53,1%	54,3%	17%	9%	2%	31%
Greece	16.491	17.125	2,9%	4,9%	5,6%	6,2%	71%	14%	11%	115%
Israel	214	300	13,5%	31,4%	35,5%	38,9%	132%	13%	10%	188%
Italy	10.043	11.637	13,7%	21,4%	23,4%	25,5%	56%	9%	9%	86%
Lebanon	319	359	24,2%	35,7%	39,3%	46,1%	47%	10%	17%	90%
Libya	2.174	2.908	5,1%	7,4%	8,2%	8,8%	45%	11%	8%	73%
Malta	214	203	8,1%	19,3%	23,1%	27,6%	138%	20%	20%	242%
Monaco	7	11	60,9%	70,0%	71,3%	71,9%	15%	2%	1%	18%
Montenegro	325	375	4,9%	9,9%	10,5%	11,3%	101%	6%	8%	130%
Morocco	573	757	3,2%	5,2%	6,3%	8,5%	66%	20%	36%	170%
Slovenia	45	69	18,9%	35,9%	38,2%	41,8%	90%	6%	9%	121%
Spain	3.188	4.062	13,8%	19,6%	21,6%	23,5%	42%	10%	9%	70%
State of Palestine	42	69	5,3%	24,6%	27,2%	29,4%	367%	10%	8%	459%
Syrian Arab Republic	239	286	12,3%	26,0%	29,8%	36,7%	112%	14%	23%	198%
Tunisia	2.037	2.377	5,6%	9,9%	11,3%	12,4%	76%	14%	9%	119%
Turkey	6.961	7.927	4,9%	9,8%	12,1%	13,7%	101%	24%	13%	180%

150 m belt	Coastline length km	Coastal area km2	Percentage of built-up area				Land take as percentage of initial built-up area			
TERR_NAME			1975	1990	2000	2015	1975- 1990	1990- 200	2000- 2015	1975- 2015
Albania	715	131	0,4%	1,7%	3,0%	4,0%	310%	74%	32%	842%
Algeria	1.669	297	3,4%	9,6%	12,0%	14,0%	184%	26%	16%	315%
Bosnia and Herzegovina	21	5	2,9%	9,8%	10,1%	10,5%	239%	3%	5%	264%
Croatia	6.381	1.097	2,8%	5,1%	5,8%	6,4%	80%	14%	10%	125%
Cyprus	809	149	0,5%	3,7%	5,2%	5,7%	635%	41%	9%	1023%
Egypt	2.519	293	0,6%	2,5%	3,9%	5,6%	295%	54%	45%	783%
France	2.436	404	9,8%	17,7%	21,4%	23,4%	80%	21%	9%	138%
Gibraltar	14	3	27,2%	36,4%	48,0%	49,6%	34%	32%	3%	83%
Greece	16.491	2.800	2,5%	4,9%	6,2%	7,0%	98%	26%	13%	182%
Israel	214	42	5,5%	11,3%	16,2%	19,8%	105%	44%	22%	260%
Italy	10.043	1.957	8,6%	15,2%	18,8%	21,5%	77%	24%	15%	151%
Lebanon	319	48	14,2%	22,2%	30,2%	38,3%	56%	36%	27%	170%
Libya	2.174	385	2,2%	3,7%	4,9%	5,3%	66%	34%	8%	141%
Malta	214	34	3,0%	11,7%	18,1%	25,5%	285%	55%	41%	738%
Monaco	7	2	17,4%	24,5%	28,8%	30,8%	40%	18%	7%	77%
Montenegro	325	51	4,9%	12,0%	12,9%	14,1%	145%	7%	9%	187%
Morocco	573	117	2,9%	4,6%	5,8%	7,6%	62%	24%	31%	164%
Slovenia	45	14	4,9%	13,6%	17,4%	25,1%	176%	28%	44%	409%
Spain	3.188	614	9,4%	14,1%	17,6%	19,9%	49%	25%	13%	111%
State of Palestine	42	8	2,1%	10,4%	15,1%	17,1%	406%	45%	13%	729%
Syrian Arab Republic	239	40	5,9%	13,0%	17,8%	26,4%	122%	37%	48%	350%
Tunisia	2.037	387	4,1%	6,3%	7,8%	8,6%	55%	25%	10%	113%
Turkey	6.961	1.219	2,9%	7,3%	10,0%	11,6%	149%	37%	16%	295%

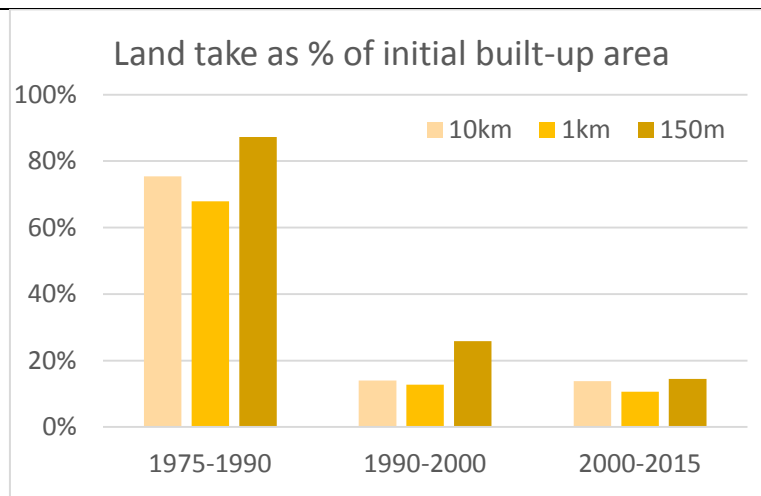
Charts

The charts have been realized for each analytical belt (150 m, 1 km and 10 km width), and for the periods 1975, 1990, 2000, and 2015.

Whole Mediterranean area

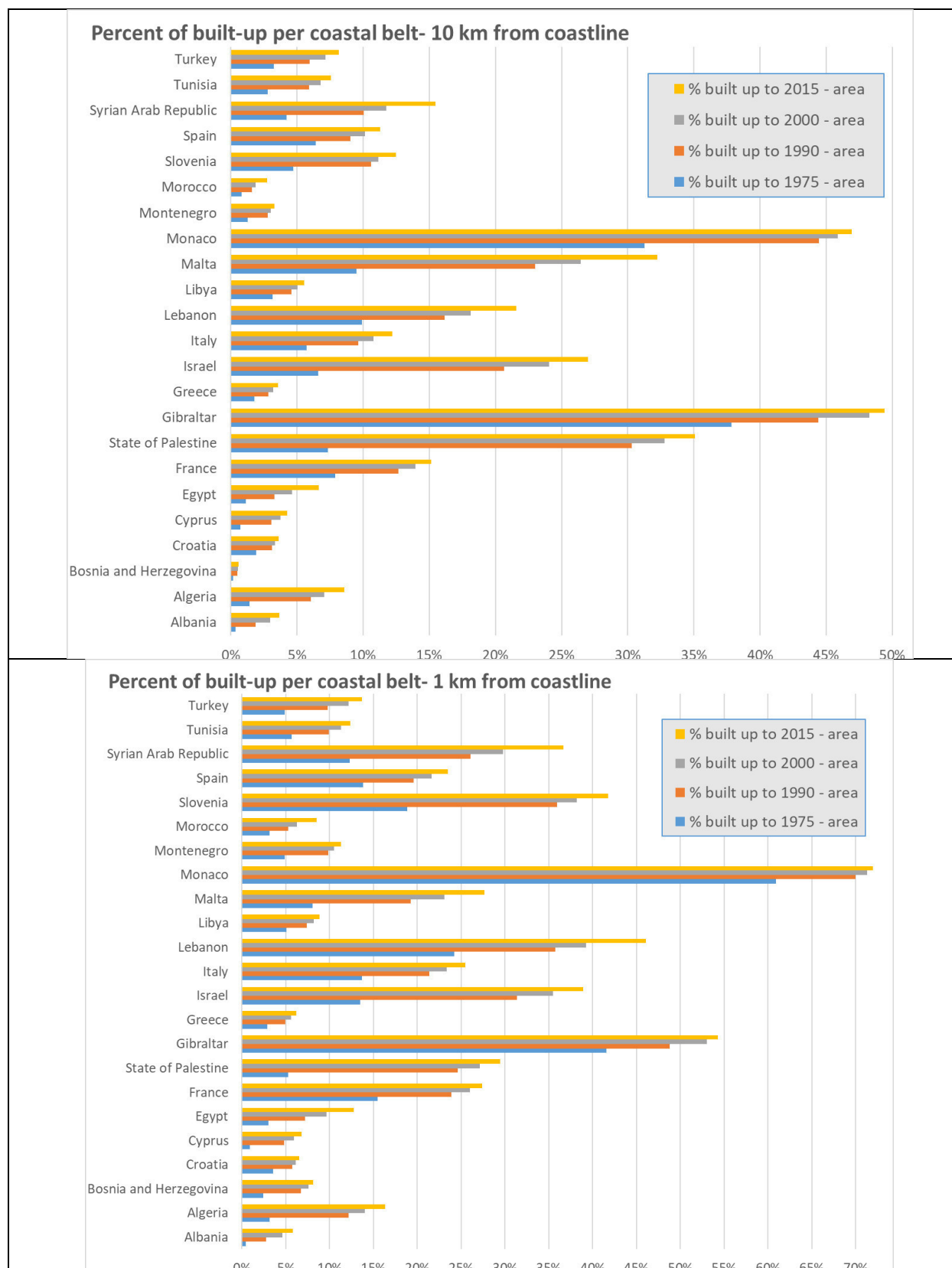


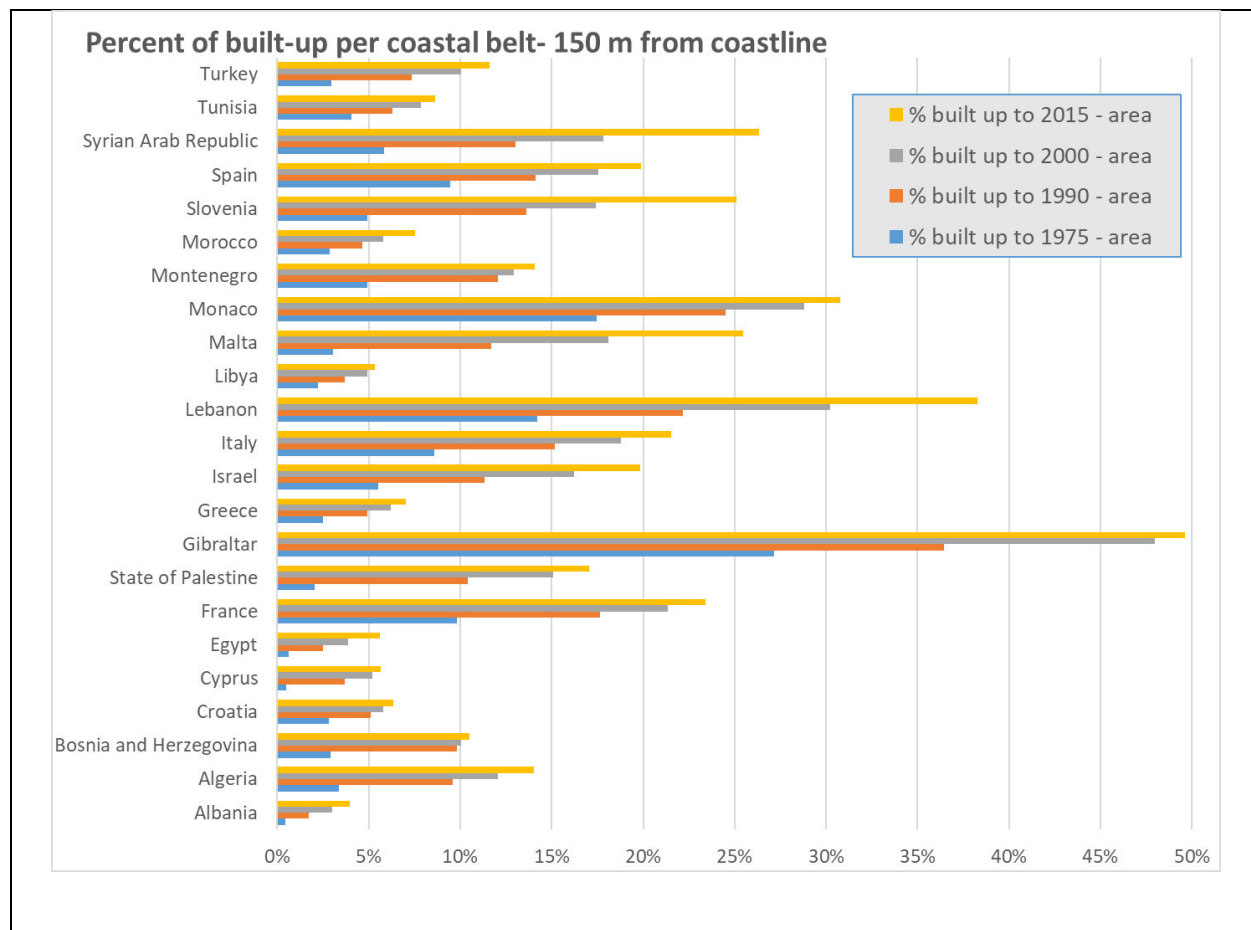
The whole Mediterranean area shows a constant and regular increase of the built-up area during the entire period of observation. The graph also shows that the development appears relatively homogeneous within the three different coastal belt areas.



This graph shows quite clearly how the greatest coastal development occurred between 1975 and 1990, with a land take between 65 and 80%, depending on the coastal belts. In the following two periods the urbanization on previous undeveloped land remains clearly more limited.

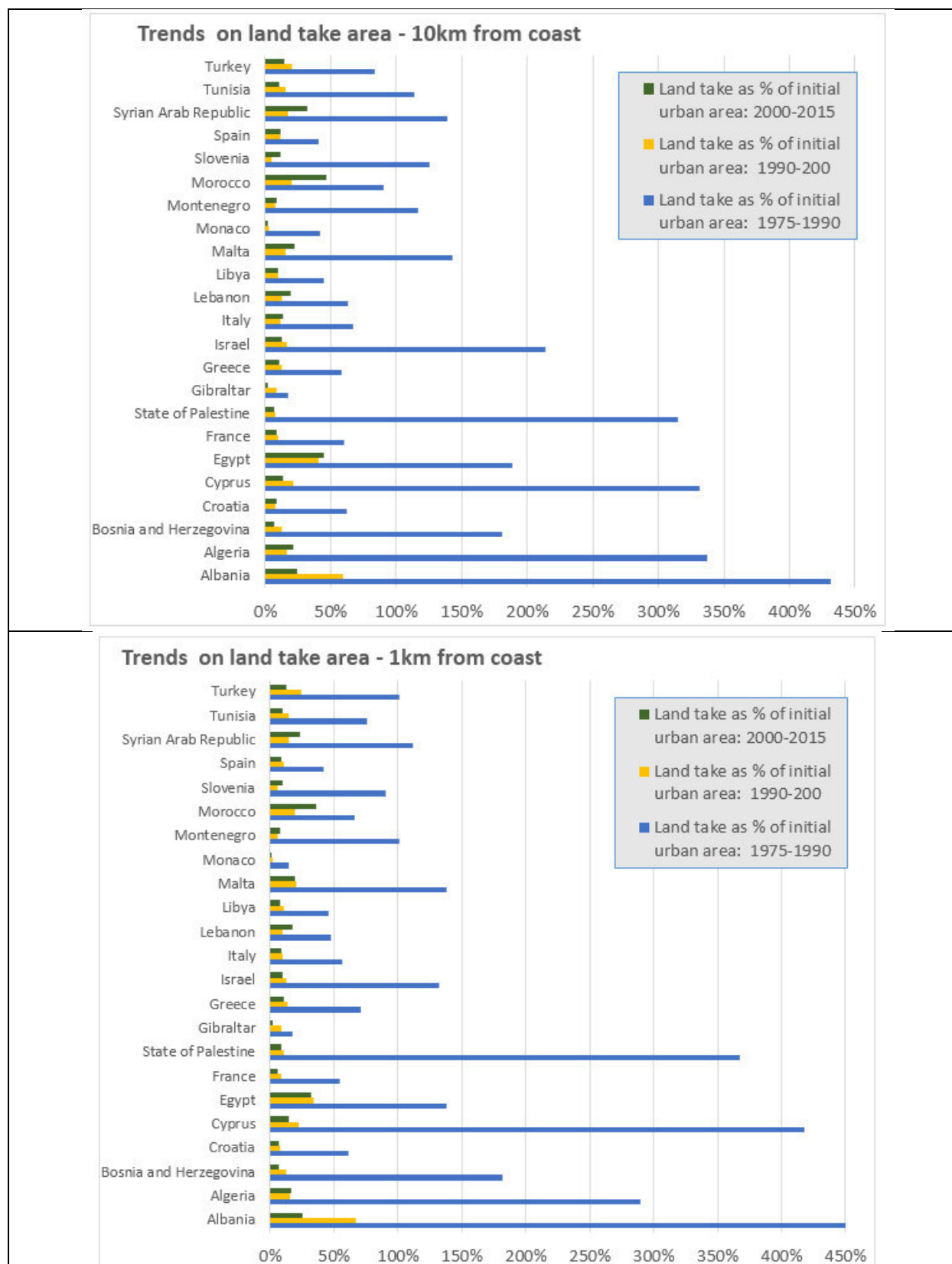
National

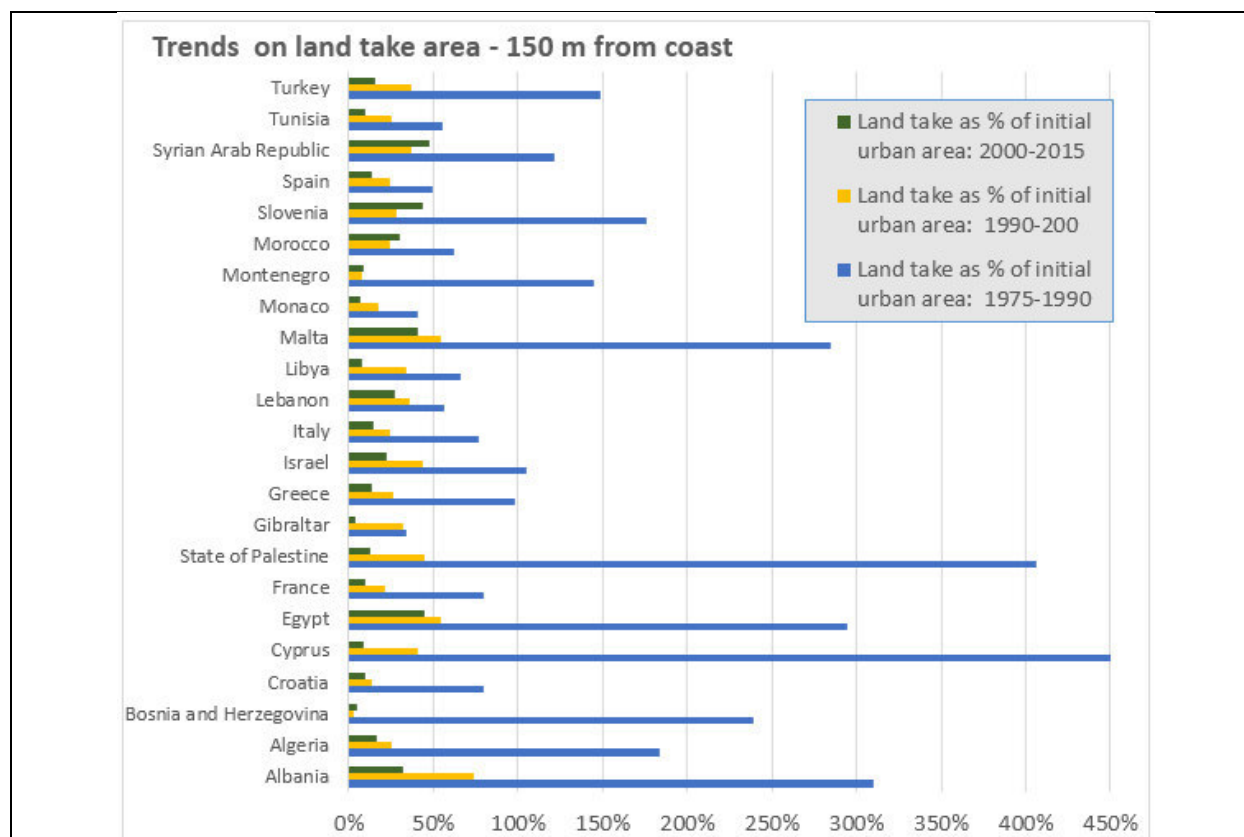




Considering these three charts as a whole, it is evident that the countries with a small area and small coastline length are those that show a higher percentage of built-up cover. These include Gibraltar, Malta, Monaco and the State of Palestine. Monaco in particular reaches a built-up rate of over 70% for the 1 km coastal belt. Bosnia and Herzegovina, and Slovenia, which have a very short coastline compared to the total area of the country, show a percentage of built-up between 10 and 20%.

With regard to the countries that have a relatively wide costal surface France, Italy and Spain are around 25% (2015, 1 km belt), while in the southern and Eastern side of the Mediterranean, Algeria, Egypt, Libya, Tunisia and Turkey remain among 10% and 15%. Croatia and Greece show relatively small percentages of built-up cover, with just over 5%. This could be due to a long coastline compared to other countries, and a number of islands and indented coastline.

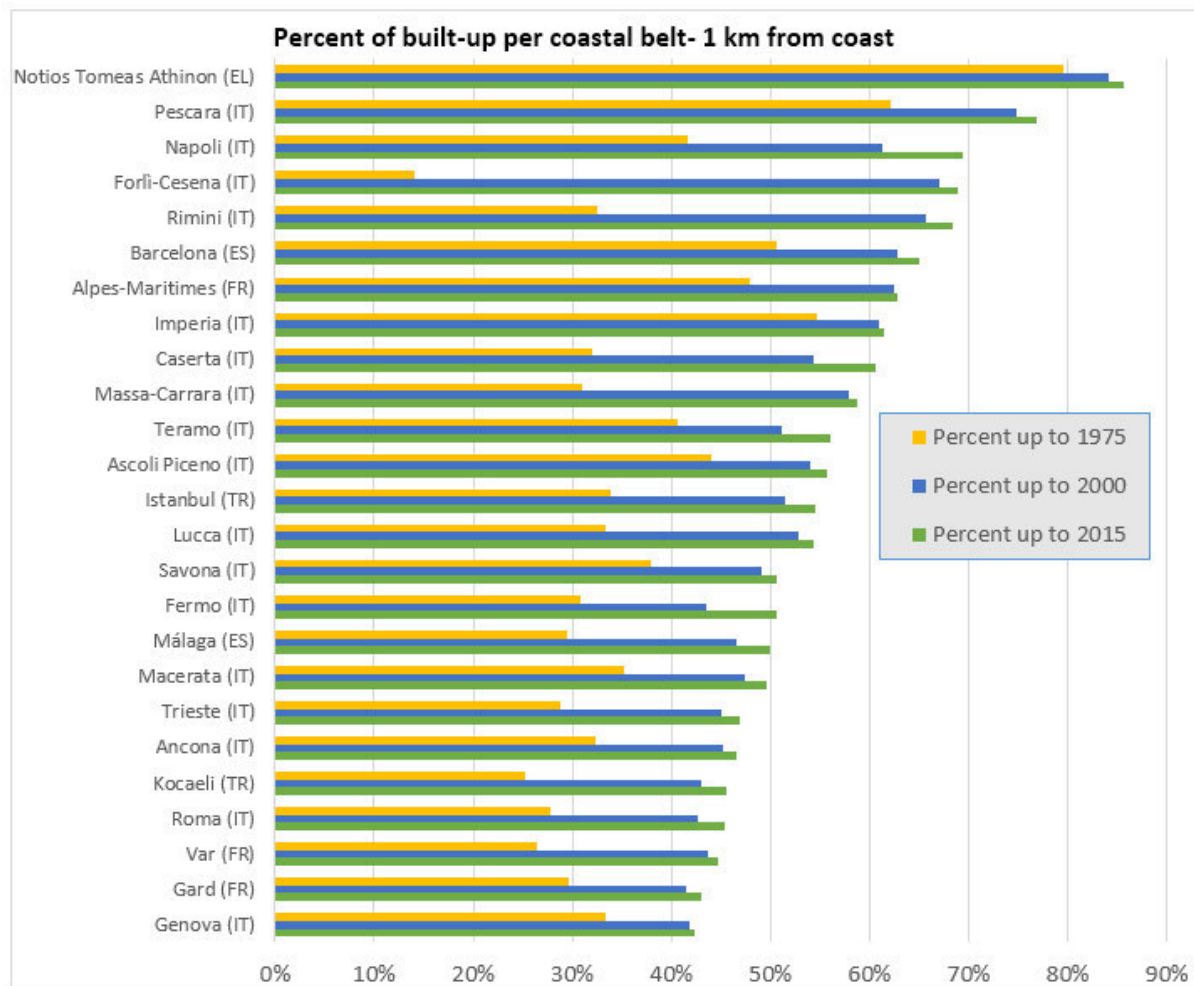




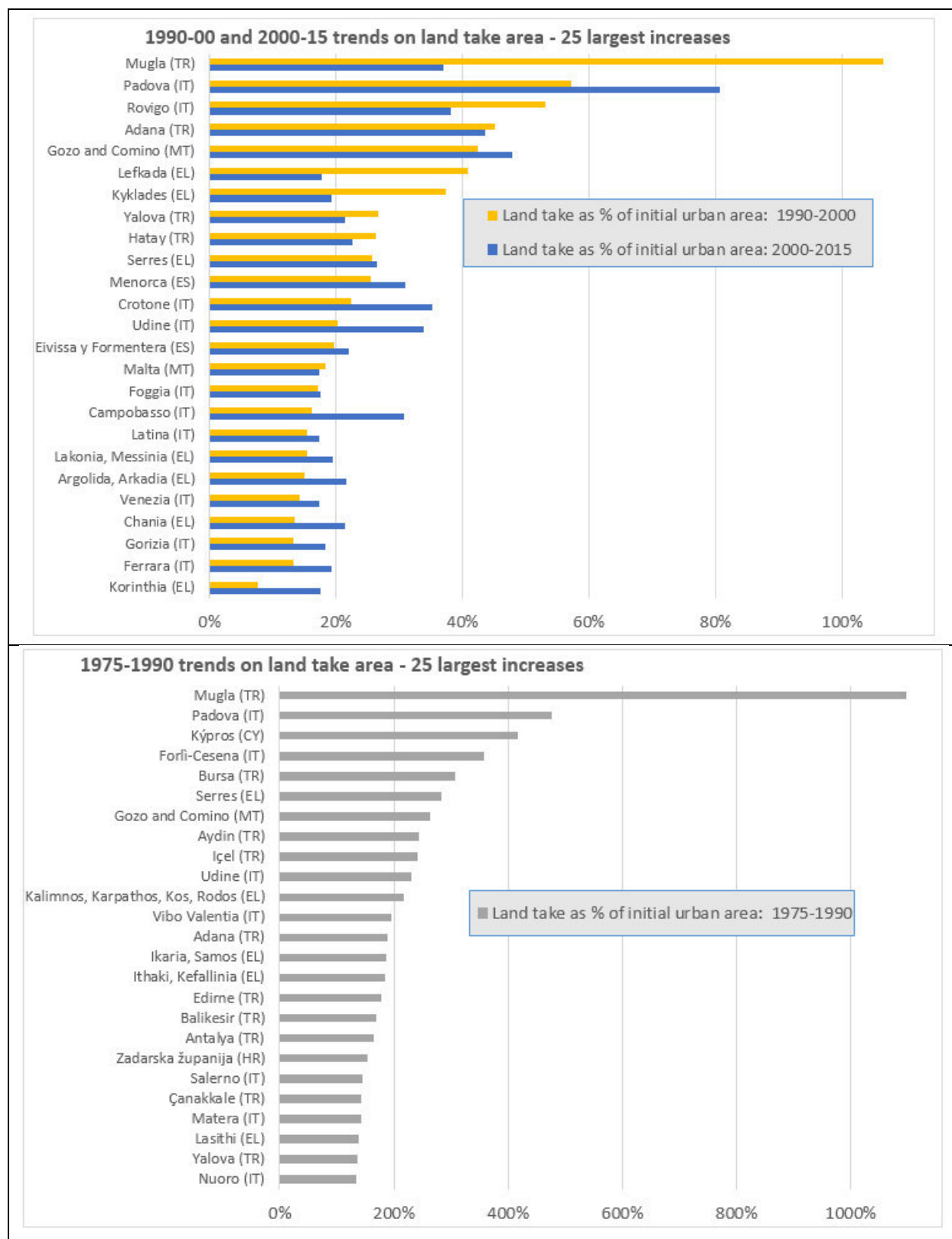
The observation of the trends of the land take allows to distinguish the various phases of the costal urbanization. It is clear that the 1975-1990 period was the maximum expansion of the built-up for all countries and belts. It is interesting to note that some countries (such as Albania, Algeria, Cyprus), although showing a relatively moderate increase in built-up (5-15%), have very high land take values.

Sub-national

The charts inherent to the sub-national level are limited only to the 25 regions having the highest value of the parameter taken into consideration. The complete list of values is presented in the table containing all the data included in the annexes. The analyses were performed only for the belt of 1 km from the coastline.



This chart displays the 25 regions with higher percent of coastal built-up area (1 km from the coast). Considering the whole 150 analyzed regions, 16 have a percentage of coastal urbanization above 50%. Notios Tomeas Athinon (EL), for example, which has almost 90% of built-up areas, is an urban region, which includes the Athens airport.



The charts above show that, no matter which period is considered (1975-1990 or 1990-2000 and 2000-2015), many regions show similar “behavior” regarding the increase of land take. In other words, coastal regions that had high increase in land take in 1975-1990 also had it in later time periods.

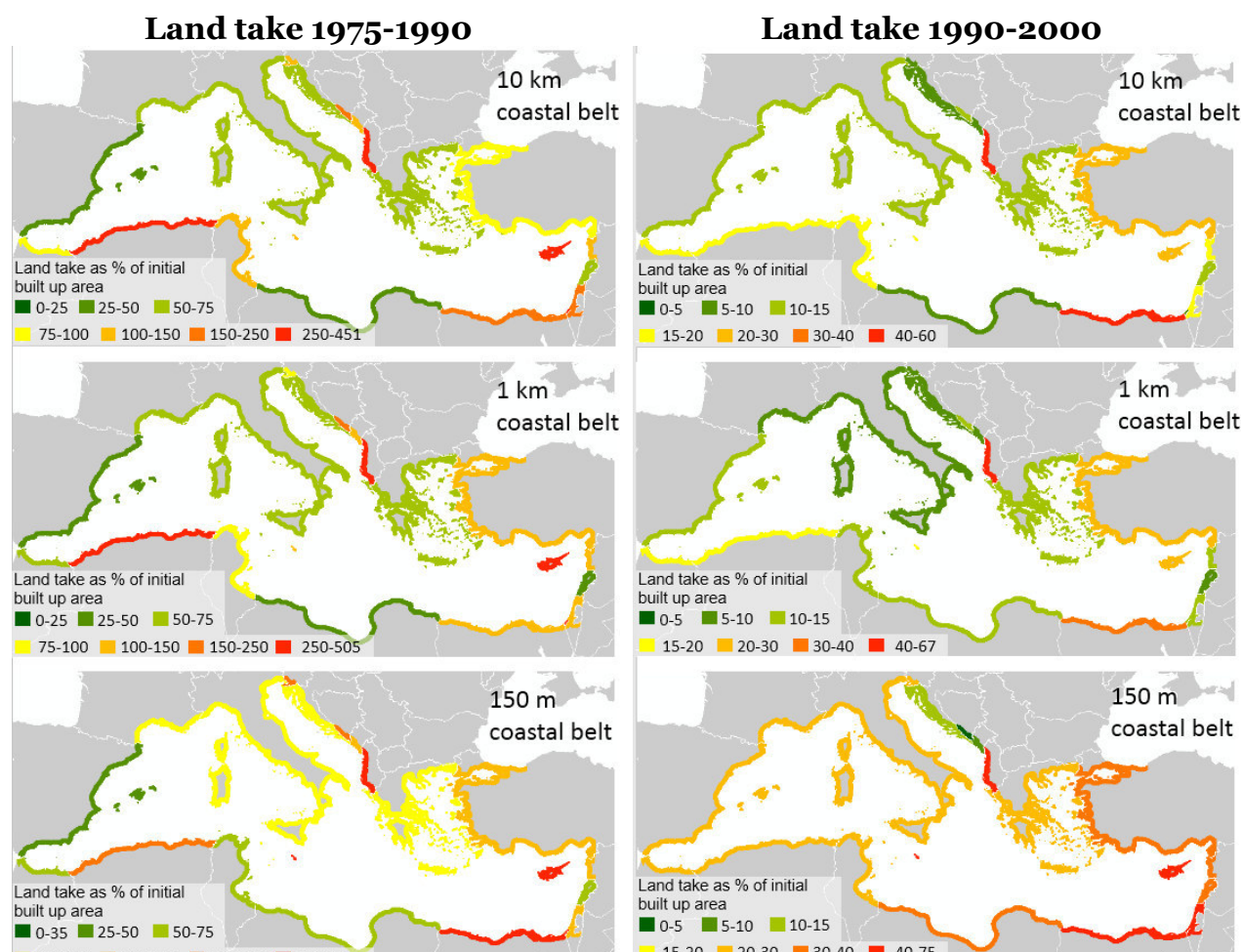
The percentage of the built-up areas seems to be increasing in similar manner for the two considered periods (1990-2000 and 2000-2015) according to the regions in the charts above.

At the regional level, the bulk of the urbanization also took place in the 75-90 period, as shown in the last graph.

The case of the Mugla region (TR) which had an 11-fold increase of its built-up area between 1975 and 1990, is documented later through a more detailed map (see *Detailed maps* section).

Maps: aggregated by national administrative boundaries

A first set of maps includes land take at national scale for the 10 km, 1 km, and 150 m coastal belts, over the period 1975-2015



The boundaries and names shown and designations used on this map do not imply official endorsement or acceptance by the United Nations.

Sources: JRC-GHSL, UN cartographic section

The greatest built-up developments are observed between 1975 and 1990.

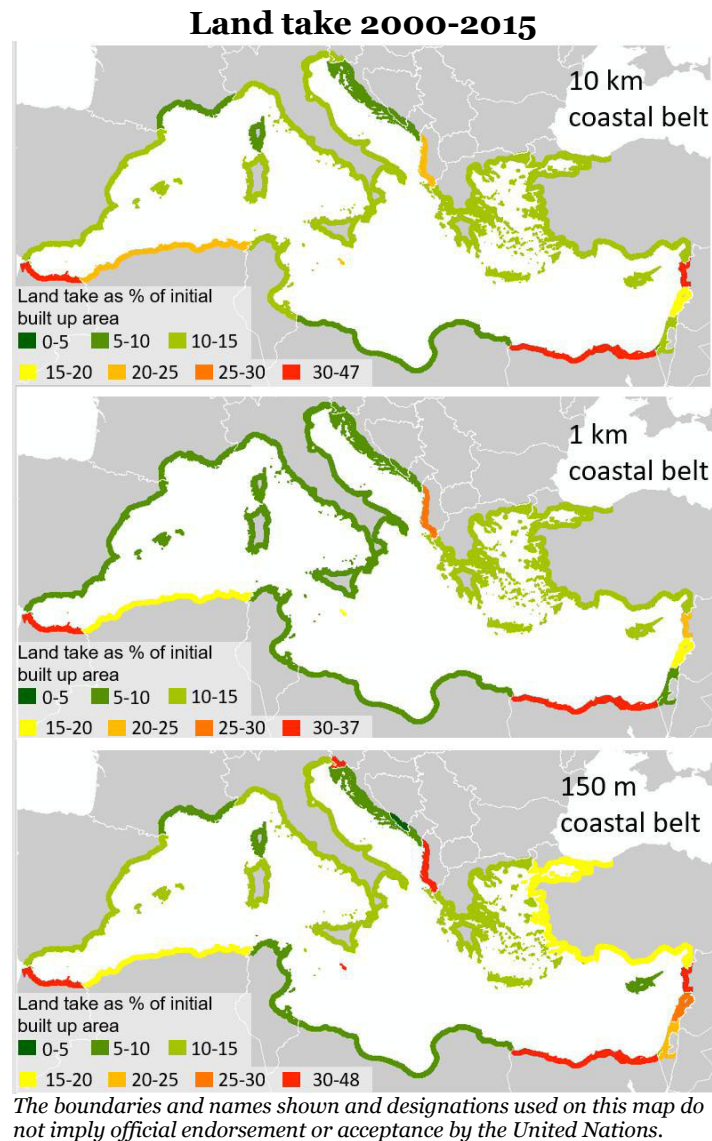
The results from 10 km coastal belt indicate that only two countries, Libya and Spain, had a relatively modest land take in the 1975-1990 period, between 25% and 50%. Algeria, Albania, Cyprus and the State of Palestine showed very high values, above 250% with Albania having increased its initial values by 450%.

Considering the 1 km belt, Turkey increased its rates of land take compared to the 10 km belt, while several countries such as Egypt, Israel, Morocco, Slovenia and Tunisia show values below those of the 10km belt. The percentage rates of increase in Algeria, Albania Cyprus, and State of Palestine remain substantially unchanged when compared to the 10 km coastal belt.

In the 150 m coastal belt, excluding Monaco and Gibraltar (not visible on the map) only Spain had a land take below 50%. In Algeria, it slightly decreases while Croatia, Egypt, Greece, Italy and Malta increase their land take. Albania, Malta, the State of Palestine and above all Cyprus remain the countries with the greatest built up area increase.

Considering the second period analyzed (1990-2000), the percentages of land take are distinctly lower than those measured for 1975-1990 period.

Regarding the 10 km coastal belt, the countries with the highest percentages of land take are Albania and Egypt - between 40 and 60%, followed by Turkey and Cyprus (20%). The 1 km coastal belt does not show substantial variations. In the coastal strip of 150 m only Bosnia and Herzegovina, Croatia and Montenegro remain at values below 15%. All other countries instead show a substantial increase in land take, with maximum values recorded in Albania (74%), Malta (55%) and Egypt (54%).



Sources: JRC-GHSL, UN cartographic section

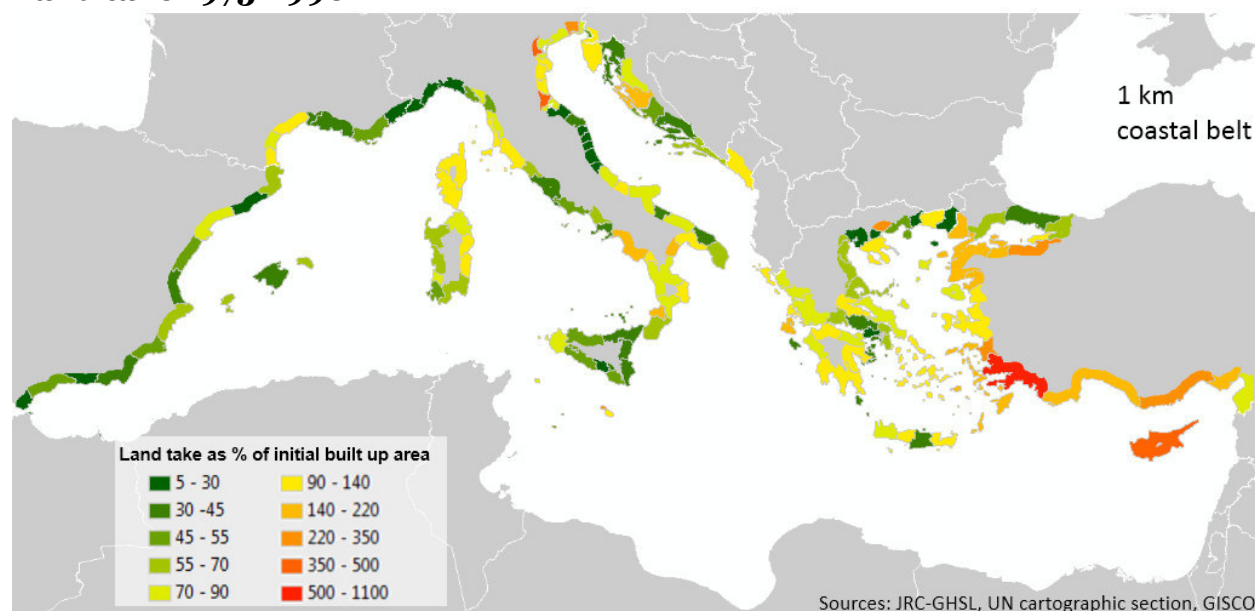
The most recent calculated land take, between 2000 and 2015, shows on average slightly lower values than those of the previous periods.

The countries with the greatest development of the built-up areas for that period are Albania, Egypt, Malta, Morocco, Slovenia and Syria. None of them exceeds the 50% land-take threshold in all three coastal belts examined.

Maps: aggregated by sub-national administrative boundaries

A second set of maps aggregated by administrative units includes land take at sub-national scale (NUTS 3). Statistics have been calculated for the coastal belt of 1 km only.

Land take 1975-1990

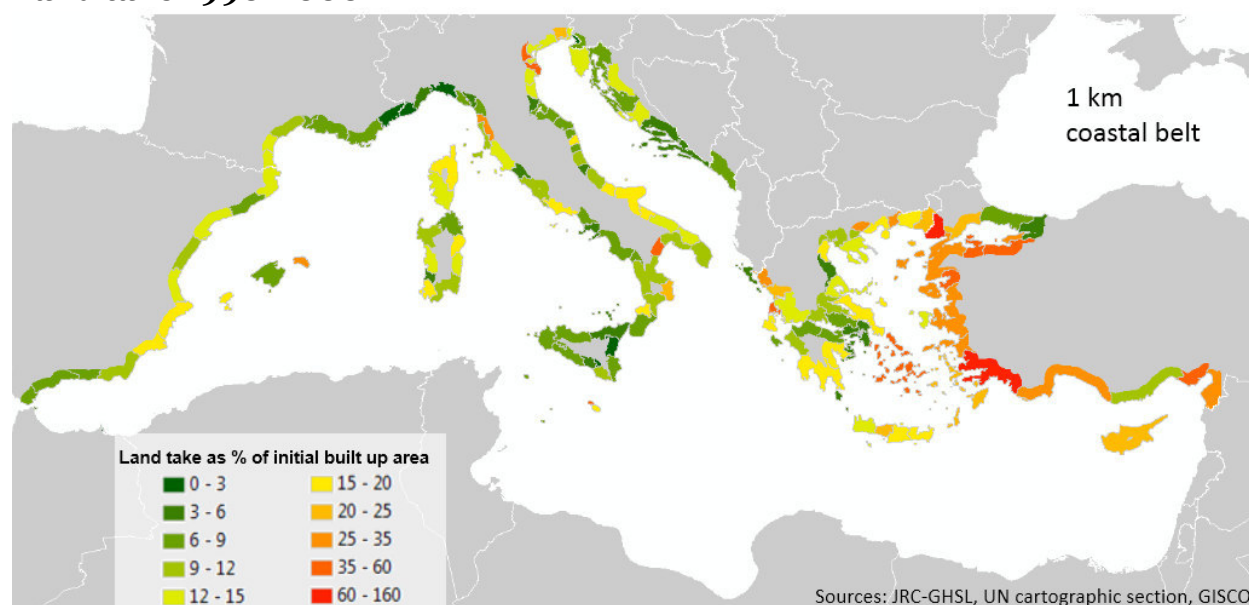


The boundaries and names shown and designations used on this map do not imply official endorsement or acceptance by the United Nations.

The analysis at the regional level (NUTS 3) allows to focus more precisely on those sectors where the increase in land take is significantly higher than the national average. For the period between 1975 and 1990 this is quite evident for some regions of North-Eastern Italy, some sectors in Greece, a large part of Turkey, and the whole Cyprus. For these areas a more detailed analysis would be necessary to explain and understand the causes of this type of evolution.

It is also interesting to note that some classic tourist regions such as the "Côte d'Azur" in France, the "Costa Brava" in Spain or the Italian Adriatic coast, do not show evident signs of an excessive development of built-up areas in this period, due to the fact that the bulk of the development occurred in earlier times.

Land take 1990-2000

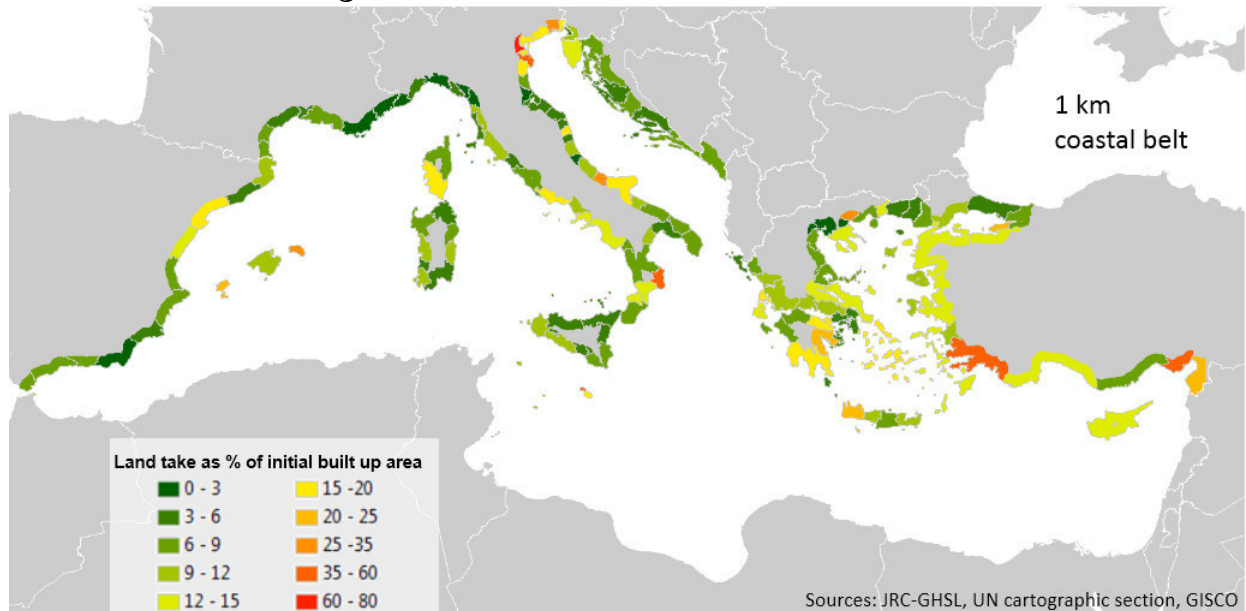


The boundaries and names shown and designations used on this map do not imply official endorsement or acceptance by the United Nations.

Although much lower in percentages than the previous period, even for the 1990-2000 range, different regions of Turkey together with some Italian regions continue to show rather high increases in land take.

Cyclades islands in Greece and the Minorca Island in Spain also show relative high percentages.

Land take 2000-2015



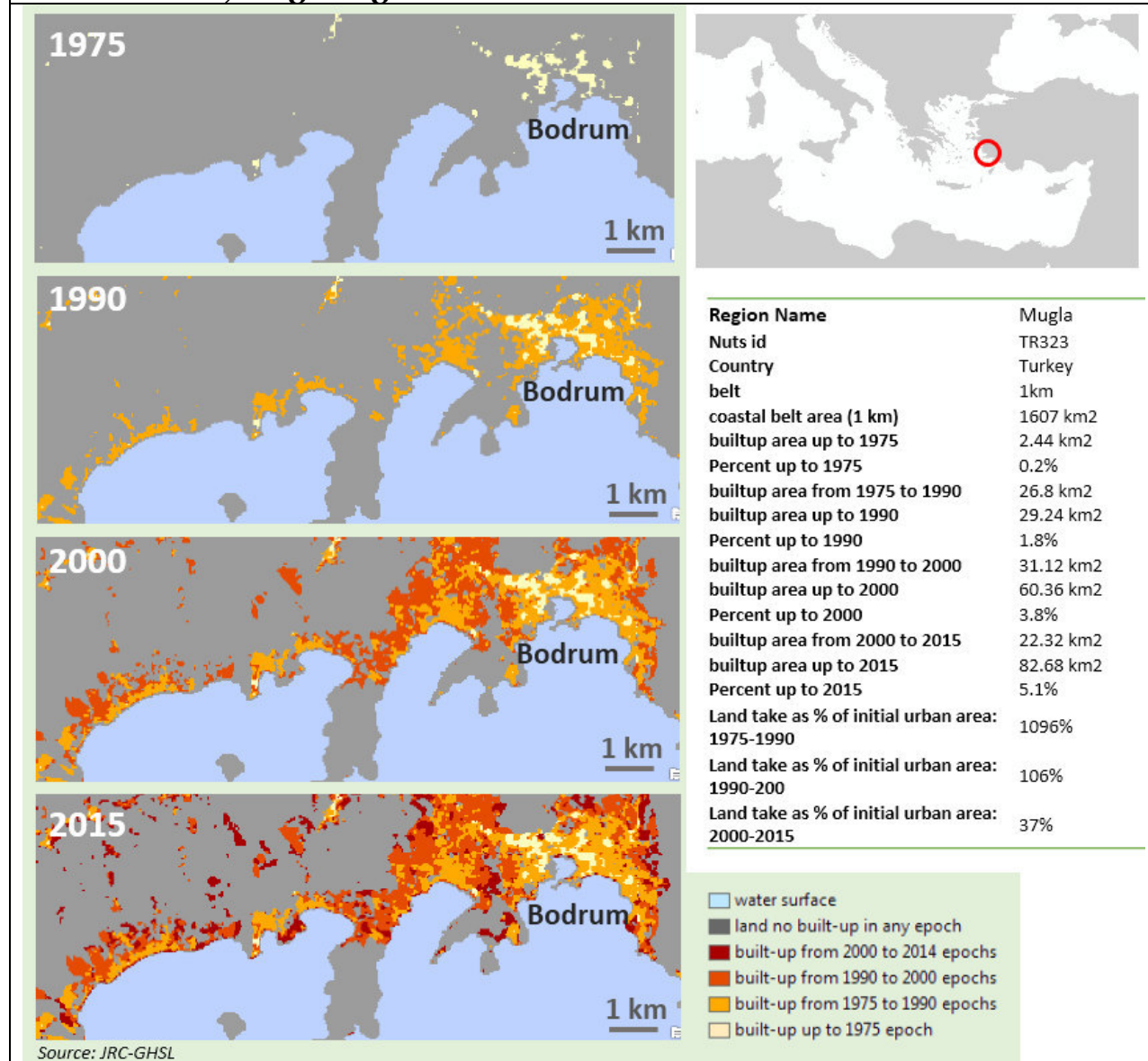
The boundaries and names shown and designations used on this map do not imply official endorsement or acceptance by the United Nations.

The 2000-20015 period retains essentially the same trend of the previous period, although with a more moderate increments in the land take.

Detailed maps

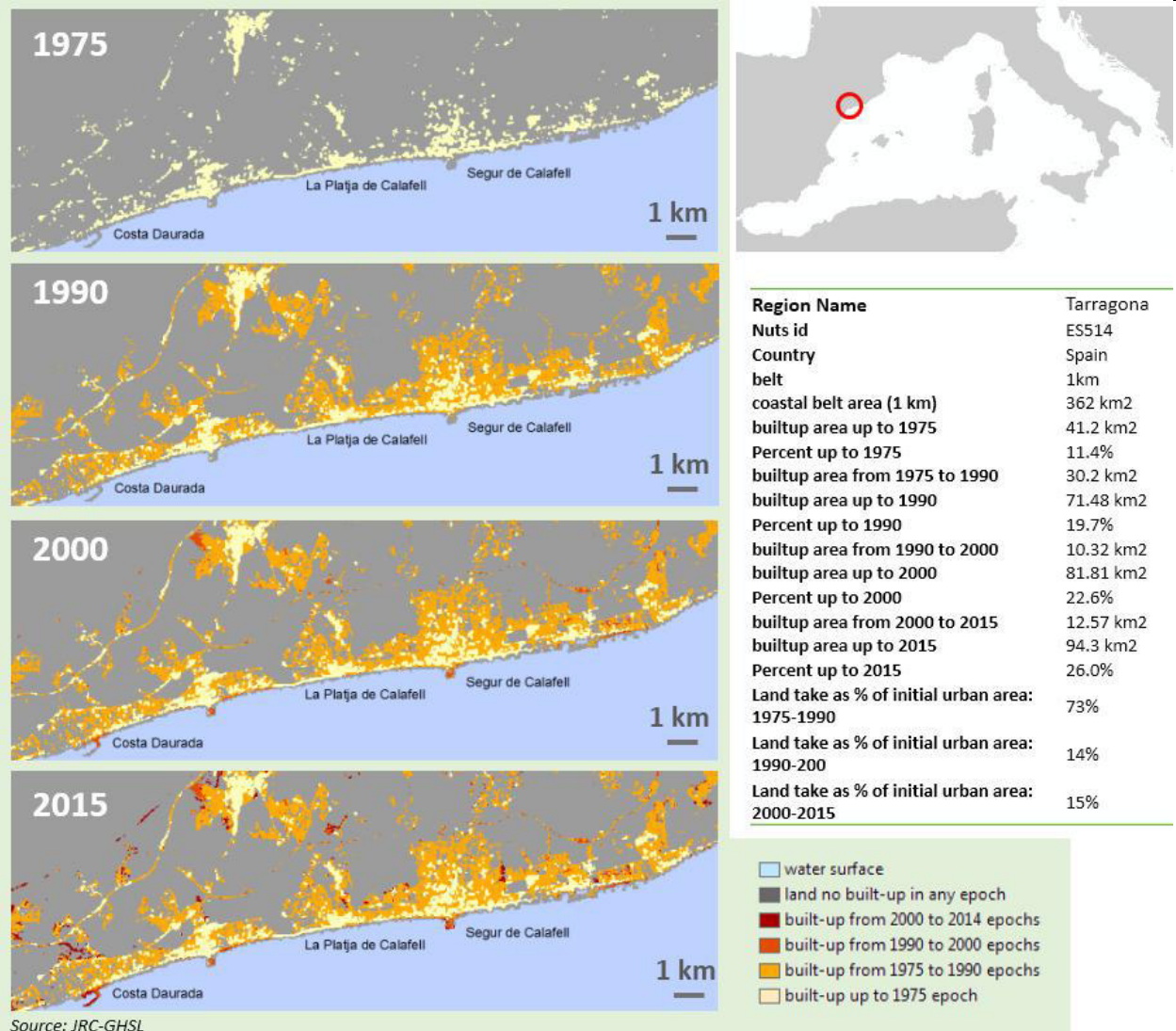
Detailed maps were realized for three different countries Turkey, Spain and Albania, focusing in that area of the country with most dramatic urban change.

Turkish coast, Mugla region: Bodrum



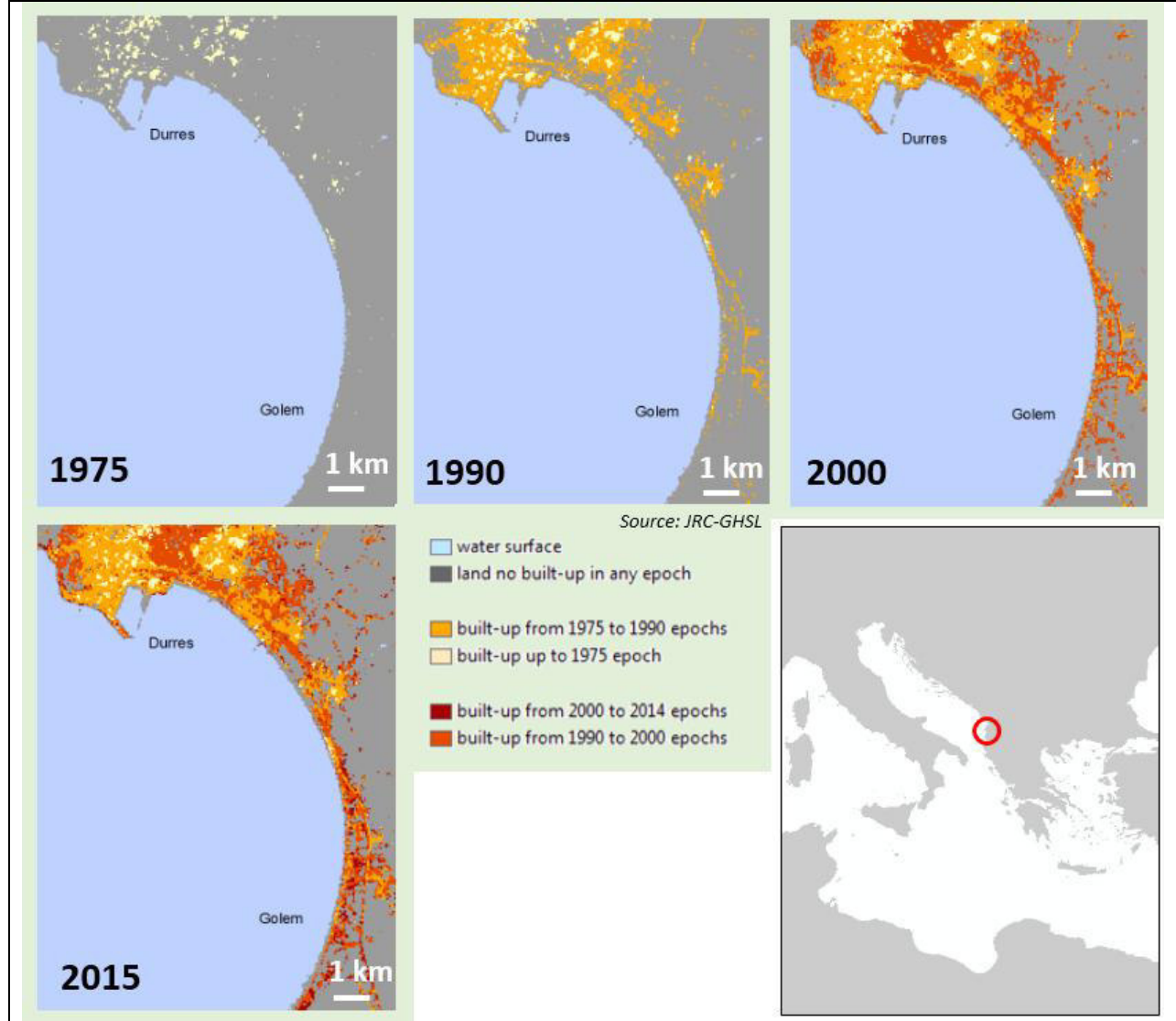
The Mugla region in Turkey has turned out to be one of the sectors that has undergone the greatest increase in land take. For this reason we have created a detailed map of this coastal area. The map shows very clearly the growth of the built-up areas with an impressive increase between 1975 and 1990 of about 10 times. Between 1975 and 2015 the built-up area has gone from 2.4 km² to 82 km², thus multiplying the initial area by 32-fold.

Spanish coast, Tarragona region



Although the Tarragona region is not one of those that shows the largest increases of land take, the map, located at a subset of the region, clearly shows how urbanization developments have fully spread across the littoral and hinterland.

Albanian coast: Durres



In the case of Albania, during the analysis we did not have the data at regional level (NUTS 3) for which it was not possible to calculate the statistics for the Durres region; therefore, it is only possible to offer a qualitative meaningful sets of images.

Conclusions:

- The whole Mediterranean coastal zone clearly shows a constant increase in the built-up area since 1975;
- The period that shows a major built-up increase is between 1975 and 1990; the most affected areas are the coastal belts of 1 km width;
- Considering land take between 1975 and 1990, and a coastal belt of 10 km, Algeria, Albania, Cyprus and State of Palestine show very high values of land take (above 250%), with Albania which has increased its initial values by 450 %;
- Considering the most recent period (2000-2015), the countries with the greatest development of the built-up areas are Albania, Egypt, Malta, Morocco, Slovenia and Syria. None of them exceeds the 50% land-take threshold in all three coastal belts examined;
- Several regions (NUTS3) show an increase in land take that is significantly higher than the national average. These regions are mainly located in Greece, Italy and Turkey;
- For these regions a more detailed analysis within a local knowledge would be necessary to explain and understand the causes of this type of evolution.

Annexes

Tables and chart:

All tables and charts are included in the Excel file named *MediStats_Build-up.xlsx*

Figures and maps

All figures and maps are included in the file named *figMedBuilt.pptx*

Access

The annexes can be downloaded at:

<https://owncloud.unepgrid.ch/index.php/s/xonWxUoVDpUvIO7>

References

- Pesaresi M., Guo H., Blaes X., Ehrlich D., Ferri S., Gueguen L., Halkia M., Kauffmann M., Kemper T., Lu L., Marin-Herrera M.A., Ouzounis G.K., Scavazzon M., Soille P., Syrris V. and L. Zanchetta (2013) A Global Human Settlement Layer from Optical HR/VHR RS Data: Concept and First Results. IEEE J. Sel. Top. Appl. Earth Obs. Remote Sens. 6(5):2102–2131, 2013. doi:10.1109/JSTARS.2013.2271445.
- Pesaresi M., Ehrlich D., Ferri S., Florczyk A.J., Freire S., Halkia S., Julea A.M., Kemper T., Soille P. and V. Syrris (2016) Operating procedure for the production of the Global Human Settlement Layer from Landsat data of the epochs 1975, 1990, 2000, and 2014. Publications Office of the European Union, EUR 27741 EN, 2016. doi: 10.2788/253582.