MEDITERRANEAN BASIN: A MELTING POT OF POPULATIONS IN FRONT OF ENVIRONMENTAL PROBLEMS

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1. Introduction

The countries bordering the Mediterranean have in common a millennia-old history, characterized by economic and continuous cultural exchanges. Despite this, during the most recent decades, those of the post-colonial era, the elements of differentiation have surpassed those of commonality. The need for work for the post-war reconstruction of Europe and the poverty of the countries of the South-East shore represented the factors of the social and economic imbalance that pushed it a large part of the population of South-East Mediterranean shores to move towards the richer Europe. Even if the flows of migrants have so far remained within limited numbers, nature of the different labour markets in industrialized countries (a lot segmented) and internal unemployment in the South-East shore countries have raised the concerns of European countries in the towards immigration, in particular from the Maghreb, from Egypt and from Turkey. Some politicians and a part of public opinion demonstrate the fear that economic and demographic imbalances (the large population growth rate and consequently the massive size of the younger generations in the South-East shore and the marked aging in the North shore due to low fertility), can cause unmanageable flows of South-North migrants.

Another critical point of demographic growth, still relatively large in North Africa and Western Asia, is represented by environmental problems. In 1989, Plan Bleu published a pioneering report on “Futures for the Mediterranean Basin” which recommended a design for the Mediterranean Strategy for Sustainable Development (MSSD). With the issuance of an update in 2005, entitled “A sustainable future for the Mediterranean: The Blue Plan’s environment and development outlook” (Benoit and Cometau, 2005), the report’s recommendations were adopted by the Barcelona Convention Contracting Parties at their 14th conference in Portoroz, Slovenia, 8-11 November 2005. Plan Bleu’s key function as the “Mediterranean Environment and Development Observatory” (MEDO), draws heavily upon its expertise in sustainable development indicators.

Within MEDO, 134 initial indicators were selected and adapted to the follow-up of the implementation of Agenda 21 in the Mediterranean. Of these, 34 priority indicators were subsequently chosen to monitor the progress made by the Mediterranean countries focusing upon the objectives defined for 9 MSSD priority issues including: Improving integrated water resource and water demand management; Ensuring sustainable management of energy; Mitigating and adapting to the effects of climate change. In addition, some composite indicators such as the Human Development Index (HDI), Ecological Footprint (EF) and Environment Performance Index (EPI) were considered to monitor overall progress in terms of sustainable development. The MSSD priority indicators are unable to fully describe the complexity and diversity of sustainable development issues in the Mediterranean regions. Some additional indicators were thus selected and defined in order to tackle priority issues such as: water, energy, tourism, the conservation of rural and coastal areas. These analyses, widely disseminated in Plan Bleu publications (Plan Bleu, 2020) and continuously updated, are nicely complemented by the analysis of EF and bio-capacity trends in the Mediterranean region that is included in this report (Global Footprint Network, 2021a; Global Footprint Network, 2021b). We intend to analyse the association between demographic trend and environmental growth by a gender perspective, focussing on fertility tendency and EF in the Mediterranean countries, comparing Southern and Northern shores.

2. Ecological footprint

The calculation of the ecological footprint is quite complex, as it takes into account several factors: land for energy (forested land necessary to absorb carbon dioxide); farmland; pastures; forests (area devoted to timber production); built-up area (residential settlements, industrial plants, service areas, roads); sea. The different contributions are introduced in a spreadsheet or in specific formulas that reduce the surfaces in common measures, giving them a proportional weight. In this way the "equivalent area" necessary to produce the quantity of biomass exploited by an individual or a group is identified, measured in "global hectares" (gha)[1], starting from the local reality to arrive at the world situation, passing through regions and nations.

The formula used officially indicates the sum of all consumption (E_i is the ecological footprint deriving from the consumption C_i of the $i-$th product and q_i, expressed in hectares / kilogram, is the reciprocal of the average productivity for

[1] One hectare equals 2.47 acres.

the i −th product). To obtain the per capita ecological footprint, the value of EF is divided by the resident population in the area under consideration.

$$F = \sum_{i=1}^{n} E_i = \sum_{i=1}^{n} C_i q_i , \quad i = 1, \dots, n \qquad (1)$$

The EF estimates the biologically productive land and sea area needed to provide the renewable resources that a population consumes and to absorb the wastes it generates -using prevailing technology and resource-management practices- rather than trying to determine how many people a given land area or the entire planet can support. It measures the requirements for productive areas (croplands, grazing lands for animal products, forested areas to produce wood products, marine areas for fisheries, built-up land for housing and infrastructure, and forested land needed to absorb carbon dioxide emissions from energy consumption). One can estimate the EF, at various scales—for individuals, regions, countries, and humanity as a whole. The resulting figures can also be compared with how much productive area -or bio-capacity- is available (Hayden 2019).

Simply stated, the Mediterranean region is running a severe ecological deficit, a situation that will only worsen unless effective resource management becomes central to policy-making. The average EF per capita for the Mediterranean Region increased 37%, from 2.4 gha in 1961 to 3.3 gha in 2007. Population has doubled over the considered period and the overall regional EF has increased 2.6 times. During the same period the bio-capacity available in the Mediterranean Region decreased (-38%) from 2.1 to 1.3 gha per capita.

We see that many of the actions taken by Greece, Italy and other Mediterranean countries to improve the performance of their economies are undermining the health of their ecological assets and mortgaging their long-term security. Never has the situation been so critical: The Mediterranean’s accessibility to essential life-supporting ecological resources and services is strongly increasingly. At a time when the world is going further into ecological overshoot, failure to take action is becoming a fundamental threat.

We examine the nature of and trends in the demand that residents in the Mediterranean region are placing on the earth’s ecological assets. The focus on Greece, Italy, Portugal and Spain offers a particular example of the interplay between ecological constraints and economic performance. Using the EF and bio-capacity measures, we investigate the main drivers of increased human pressure in the region and explore the likely implications of growing ecological deficits for the Mediterranean region’s ecosystems and economies. In 1961, only six countries in the Mediterranean region had more ecological assets available to produce the resources and services, on aggregate, than their residents consumed. All other countries consumed significantly more than their domestic ecosystems produced.

By 2008, the deficit situation had spread to every Mediterranean country apart the possible exception of Montenegro (data set for this country is not sufficiently reliable). The larger the value of EF, the larger the value of consumption of individuals on a certain territory.

If we look at the Italian situation, we see that Italy, for its part, is responsible for a good portion of consumption, so much so that it has a per capita EF of 4.2 gha, a rather large number if we consider that the world one is 2.8 gha, but both are values in continuous growth.

Table 1 – *Ecological footprint in the Mediterranean Basin.*

Country	(A)	(B)	(C)	(D)	(E)	(F)
Albania	1.05	1	0.14	1.91	0.87	-0.86
Algeria	1.18	0.71	0.3	1.59	0.59	-0.41
Arabia	4.39	2.15	1.41	5.13	0.84	-0.74
Croatia	3.21	2.19	1.66	3.75	2.5	-0.53
Egypt	1.29	0.47	0.09	1.66	0.62	-0.37
France	4.27	3.23	2.49	5.01	3	-0.74
Greece	3.94	3.01	1.56	5.39	1.62	-1.45
Jordan	1.18	1.6	0.73	2.05	0.24	-0.87
Iran	2.56	0.29	0.16	2.68	0.81	-0.12
Iraq	1.12	0.44	0.21	1.35	0.3	-0.23
Israel	3.07	2.6	0.85	4.82	0.32	-1.74
Italy	3.08	3.5	1.59	4.99	1.14	-1.91
Lebanon	1.18	2.09	0.37	2.9	0.4	-1.72
Libya	2.4	1.54	0.89	3.05	0.44	-0.65
Morocco	0.93	0.67	0.38	1.22	0.61	-0.29
Mauritania	2.64	0.64	0.67	2.61	5.5	0.03
North Macedonia	2.12	4.29	0.76	5.66	1.43	-3.54
Portugal	2.99	4.08	2.6	4.47	1.25	-1.48
Syria	1.40	0.55	0.42	1.52	0.7	-0.13
Slovenia	3.88	6.95	5.53	5.3	2.61	-1.42
Spain	4.13	3.64	2.35	5.42	1.61	-1.29
OPT	0.4	0.38	0.04	0.74	0.16	-0.34
Tunisia	1.42	1.23	0.75	1.9	0.98	-0.47
Turkey	2.13	1.13	0.56	2.7	1.32	-0.57
UAE	6.22	6.34	1.89	10.7	0.85	-4.45

The table shows, for different countries of the world, the data (expressed in hectares per person) relating to different types of ecological footprint: (A) Ecological footprint of production: produced directly in the territory; (B) Ecological footprint of imports: deriving from activities and products imported into the territory;(C) Ecological footprint of exports: deriving from activities and products exported to other territories; (D) Ecological footprint of consumption: equal to the sum of the ecological footprint of production and imports, reduced by the share attributed to the ecological footprint of exports (A + B - C). The table, also expressed in hectares, also shows the biocapacity (E) and net export of ecological footprint (F = C - B).
Data source: Ecological Footprint Atlas 2010.

From the Northern shore to the Southern one: we focus on Algeria, that experienced the largest change in per capita ecological deficit, moving from a reserve of +0.7 gha per person in 1961 to an ecological deficit of -1.1 gha per person in 2008. This was due to both consumption increases (causing the total EF to grow) and population growth (which decreased the per capita biocapacity budget). Only Algeria's oil revenues allowed it to maintain its ecological deficit for the first few decades after independence. But by the late 1980s, declining oil prices took a toll on Algeria's petroleum-based economy, diminishing its capacity to pay for importing external ecological resources and services. As revenues and imports declined, Algeria's EF stabilized limiting residents' access to ecological resources and services. Morocco, Libya, Syria, Tunisia and Turkey also shifted from ecological creditor to debtor status during this period, while the other Mediterranean countries saw a worsening of their ecological deficits. Cyprus' ecological deficit grew by 3.1 gha per capita, the largest deficit increase in the region. Jordan reported the smallest deficit increase, at + 0.3 gha per capita.

In table 1 we have reported EF for the Mediterranean countries to compare the two shores of the sea. In the first column of the table, we can outline the difference among different countries. The oil-producer countries have a larger value of the footprint, such as the more developed countries (Italy, Spain, France, Greece), while the less developed countries in the region define a lower consumption of world goods (see for example Morocco and Tunisia).

3. Demographic and gender characteristics

Following data of World Population Prospects, we report in table 2 some demographic parameters: fertility (TFR, Total Fertility Rate), life expectancy (e_0 for males and females), adolescent fertility (F_{15-19}), contraceptive prevalence (Contr. women 15-49) and Gender Global Gap (GGG) to synthetize women's status in order to connect demographic and environmental conditions.

We can look at the ranking of countries according to the different parameters, to see if there is some similarity among different rankings. The values of the parameters in the ranking generally tend to bring together the European countries on the one hand and the countries of the southern and eastern shores on the other. The TFR is lower than 2 for countries on the north shore (excluding Turkey with 1.99) and higher in the Asian and African shores. The situation for adolescent fertility and the GGG is almost identical, with only Israel close to Europe, while the rankings of contraception and those of male and female life expectancy are a little more heterogeneous, although the lowest values are found in the countries of the South and East Shores. Let us try to relate these measures with the environment, also adding the density variable that expresses the overcrowding of a region or state. The concentration of population in coastal zones is the heaviest in western Mediterranean, the western shore of the Adriatic Sea, the eastern shore of the Aegean Levantine region, and the Nile Delta. Overall, the population density in the coastal zone is larger in the southern Mediterranean countries. This is also where the variability of the population density in the coastal zone is maximum, ranging from more than 1000 people/km2 in the Nile Delta to fewer than 20 people/km2 along parts of coastal Libya (UNEP/MAP, 2012).

Table 2 – *Demographic characteristics for the Mediterranean Basin, firstly east-southern shores and then northern shores, recent years.*

Country	TFR	e_0^F	e_0^M	F_{15-19}	Contr.	GGG
Algeria	2.79	78.76	76.3	37.7	57.1	0.634
Egypt	3.13	74.95	70.23	50.2	58.5	0.629
Libya	2.11	76.46	70.61	5.5	27.7	n.a.
Morocco	2.3	78.66	76.17	29.3	70.8	0.605
Tunisia	2.1	79.34	75.37	7.9	62.5	0.644
Cyprus	1.3	83.45	79.55	4.4	n.a.	0.692
Israel	2.93	84.9	81.99	7.5	68	0.718
Jordan	2.58	76.82	73.28	25.7	51.8	0.623
OPT	3.36	76.38	72.92	48.4	57.2	n.a.
Syria	2.64	79.1	73.13	25.4	53.9	0.567
Turkey	1.99	81.21	75.57	21.5	73.4	0.635
Albania	1.54	80.48	77.48	19.3	79.7	0.769
Bosnia	1.22	80.32	75.48	7.2	n.a.	n.a.
Croatia	1.41	82.02	75.95	6.6	69	0.72
France	1.85	85.82	80.32	4.7	92	0.784
Greece	1.26	85.07	80.51	5.8	76.2	0.701
Italy	1.3	85.97	81.91	4.6	65.1	0.707
Malta	1.51	84.68	81.37	11	85.8	0.693
Montenegro	1.74	79.77	74.99	6.7	39.4	0.71
N. Macedonia	1.46	78.32	74.26	12.9	40.2	0.711
Portugal	1.35	85.28	79.8	6.5	73.9	0.744
Serbia	1.42	79.05	73.89	11.9	58.4	0.736
Slovenia	1.64	84.44	79.25	3.2	78.9	0.743
Spain	1.39	86.68	81.26	6.6	70.9	0.795

Source: United Nations, 2019; World economic forum, 2021; United Nations, Department of Economic and Social Affairs, Population Division (2019). Contraceptive Use by Method 2019: Data Booklet (ST/ESA/SER.A/435).

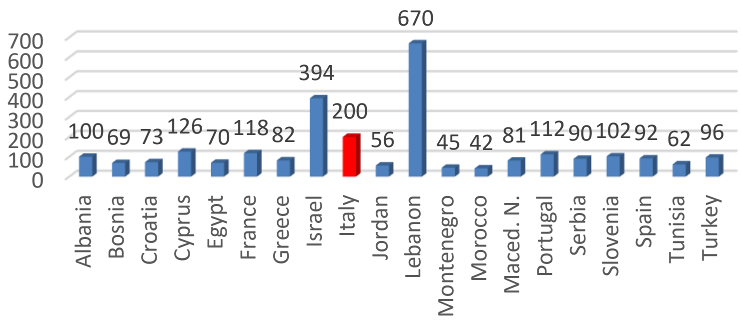
Density is shown in Figure 1; European countries are much more "crowded" with respect to Asian and African regions. Overall, more than half the population lives in countries of the southern shores of the Mediterranean, and this proportion is expected to grow to three quarters by 2025 (UNEP/MAP/MED POL 2005). The Mediterranean region's population is concentrated near the coasts. More than a third live in coastal administrative entities totalling less than 12% of the surface area of the Mediterranean countries. The population of the coastal regions grew from 95 million in 1979 to 143 million in 2000. It could reach 174 million by 2025. (United Nations, 2019a).

The concentration of population in coastal zones is heaviest in the western Mediterranean, the western shore of the Adriatic Sea, the eastern shore of the Aegean-Levantine region, and the Nile Delta. Overall, the concentration of population in the coastal zone is higher in the southern Mediterranean countries. This is also where the variability of the population density in the coastal zone is highest, ranging from more than 1000 people/km2 in the Nile Delta to fewer than 20 people/km2 along parts of coastal Libya and obviously in the deserted areas. Today, the average density of the Mediterranean countries exceeds 100 inhabitants/km². The 70% of these countries have a density between 60 and 130 inhabitants/km². Only Libya (3.6 inhabitants/km²), Algeria (15.3 inhabitants/km²) and Montenegro (45 inhabitants/km²) fall below this range.

Looking at the state of the Mediterranean Marine and Coastal Environment, we observe that the Mediterranean Action Plan (MAP) was established in 1975 as a coherent legal and institutional framework for cooperation through which all Mediterranean countries decided to jointly address common challenges of environmental degradation while linking sustainable resource management with development. It was soon followed by the Barcelona Convention and seven Protocols addressing issues relevant to the conservation and sustainable use of marine and coastal resources as well as to many policies and measures aiming to improve its management.

The 2020 Environmental Performance Index (EPI) provides a data-driven summary of the state of sustainability around the world. Using 32 performance indicators across 11 issue categories, the EPI ranks 180 countries on environmental health and ecosystem vitality. These indicators provide a gauge at a national scale of how close countries are to established environmental policy targets. The EPI offers a scorecard that highlights leaders and laggards in environmental performance and provides practical guidance for countries that aspire to move toward a sustainable future (Wendling *et al*., 2020; Hsu *et al*., 2013). A relationship between countries' EPI performance and economic development emerges. For instance, countries located in Europe tend to have higher EPI scores in relation to their Gross Domestic Product (GDP) per capita compared to other regions, in particular sub-Saharan Africa, which tends to have the poorest results, including Somalia. This tendency implies that countries with more financial resources can better implement policies to protect human health and the environment. However, this is not always the case. China and India, for instance, both have high GDP per PPP but receive low scores on the overall EPI. This result suggests the role of something other than economic development alone (e.g., governance or political investments) that may also be critical in achieving environmental results. For example, Armenia has relatively low economic development ($3,716 USD) and a relatively high EPI score (81.5), compared to other countries with similar GDP per capita (Yale University, World Economic Forum and CIESIN 2016).

Figure 1 – *Density of population in Mediterranean countries per km^2.*



Source: Wikipedia, 2021; Statista, 2019.

Table 3 – *Environmental Performance Index in the Mediterranean Basin, 2020.*

Country	Rank	EPI Score	Decennial % variation
Albania	62	49	10.2
Algeria	84	44.8	0.5
Bosnia	78	45.4	10.9
Croatia	34	63.1	13.4
Cyprus	31	64.8	6.3
Egypt	94	43.3	7.7
France	5	80	5.8
Greece	25	69.1	3.4
Israel	29	65.8	5.2
Italy	20	71	1.1
Jordan	48	53.4	11.2
Lebanon	78	45.4	1.1
Malta	23	70.7	11.6
Montenegro	74	46.3	7.3
Morocco	100	42.3	13.3
N. Macedonia	43	55.4	2.2
Portugal	27	67	4
Serbia	45	55.2	7
Slovenia	18	72	4.6
Spain	14	74.3	8.6
Tunisia	71	46.7	6.4
Turkey	99	42.6	2.1

Source: EPI, 2020, in https://epi.yale.edu/epi-results/2020/component/epi.

Density and Environmental Indexes (that are multidimensional indexes and consequently take into account many variables measuring environment) describe the countries we focus on. Nevertheless, density for southern and eastern shores are influenced by deserted zones. For example, the low values of density relative to Egypt, Morocco and Tunisia imply large, deserted zones in the Sahel region and relative to Asiatic Desert, such as Wadi Rum in Jordan. Low values of density are characteristics also for the states of ex-Jugoslavia (Serbia, Croatia, Montenegro) while Italy, France and Portugal have larger density. Consequently, density is not a good parameter for deserted countries, that present high density only on coastal and urban zones.

Environmental index instead tells us the grade of pollution in a multidimensional way. In the following analysis we use the EPI score and EF to understand firstly the correlation between demographic and environmental variables and then to synthesize through factorial analysis the variables looking for the factor that explain the variability of the variables (Table 3).

4. Results of models

The correlation between fertility and GGG (gender parity index) is large: the link is negative and significant, while are positive those with life expectancy, showing that the greater the development in survival, the larger women's status.

Table 4 – *Pearson correlations among variables used in the analysis.*

	TFR	e_0^F	e_0^M	F_{15-19}	Contr.	GGG	EPI Sc.	EF
TFR	1							
e_0^F	-0.51*	1						
e_0^M	-0.382	0.948§	1					
F_{15-19}	0.739§	-0.736§	-0.638§	1				
Contr.	-0.234	0.642§	0.626§	-0.263	1			
GGG	-0.603§	0.658§	0.54*	-0.664§	0.358	1		
EPI Score	-0.428	0.86§	0.791§	-0.65§	0.543*	0.705§	1	
EF	-0.59	0.788§	0.64§	-0.73§	0.382	0.627§	0.804§	1

Note: the indicators represent the mean value of the following variables: Total Fertility Rate, Life expectation for females and males, Rate of adolescent fertility, Contraception Prevalence, Gender Parity Index, Environmental index and Ecological Footprint. * Correlation significant at level 0.05 (two tails). § Correlation significant at level 0.01 (two tails). Our elaborations on data cited in source of tables 2 and 3. The correlation is calculated on valid cases, excluding missing values.

The other strong significant negative relationships are between adolescent fertility and life expectancy (clearly an indirect relationship), such as those between contraception and life expectancy. Indirect relationships mean that both the variables are influenced by other factors, such as modernization and female empowerment (Bongaarts, 1978; Easterlin and Crimmins, 1985).

Table 5 – *Mean values of the variables used in the analysis.*

	TFR	e_0^F	e_0^M	F_{15-19}	Contr.	GGG	EPI Sc.	EF
Mean value	1.82	81.714	77.377	13.867	66.296	0.7	58.2	2.729
# obs.	21	21	21	21	19	20	21	22
St. Dev.	0.596	3.41	3.29	12.525	13.881	0.056	12.302	1.166

Note: the indicators are as in Table 4. Source: Our elaborations on data cited in source of tables 2 and 3.

Table 6 – *Factor analysis: explained variance.*

	Initial Eigenvalues			Extraction sum of squared loadings			Rotation sum of squared loadings		
Comp.	Total	% var.	% cum.	Total	% var.	% cum.	Total	% var.	% cum.
1	5.48	68.46	68.46	5.48	68.46	68.46	3.5	43.7	43.7
2	1.06	13.2	81.66	1.06	13.2	81.66	3.04	37.96	81.66
3	0.5	6.2	87.86						
4	0.4	4.93	92.8						
5	0.28	3.51	96.31						
6	0.16	1.99	98.3						
7	0.11	1.42	99.72						
8	0.02	0.28	100						

Source: Our elaborations on data cited in source of tables 2 and 3.

In Tables 6 and 7 we report the results of factor analysis. The factors may be interpreted looking at the correlation with the original variables. Factor 1 may be interpreted as “modernization” and “sensitivity to the environment”: the values of coefficient are very high and negative with TFR and adolescent fertility, positive with life expectancy and contraception, such as GGG, environmental performance index and ecological footprint. Factor 2, that explains a much lower level of variance, shows a negative value of correlation with GGG and a positive value with TFR, and this may be explained with “delay of modernization and empowerment of women”, that is a characteristic of poor countries.

Table 7 – *Factor analysis results: component Matrix.*

Variables	1	2	Variables	1	2
TFR	-0.689	0.53	Contraceptive prevalence	0.603	0.646
e_0^F	0.954	0.196	GGG	0.8	-0.267
e_0^M	0.868	0.322	EF	0.885	-0.068
F_{15-19}	-0.845	0.362	EPI	0.916	0.097

Source: Our elaborations on data cited in source of tables 2 and 3.

In conclusion, we may synthesize that the first factor refers to European countries while the second to Eastern-Southern ones. The key stone of our analysis is represented by GGG, meaning female empowerment, and EPI score and EF, measures of environment, that present large correlations with the first factor.

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SUMMARY

Mediterranean basin: a melting pot of populations in front of environmental problems

Environmental problems are becoming increasingly important around the world and the Mediterranean basin is no exception. In this contribution we focus our attention on some environmental aspects such as the ecological footprint. We intend to analyse the association between demographic trend and environmental growth by a gender perspective, focussing on fertility tendency and EF in the Mediterranean countries, comparing Southern and Northern shores.

Correlation between demographic and ecological variables is analysed through factor analysis. The factors may be interpreted looking at the correlation with the original variables. Factor 1 may be interpreted as “modernization” and “sensitivity to the environment”: Factor 2, that explains a much lower level of variance, shows a negative value of correlation with Gender Global Gab and a positive value with TFR, and this may be explained with “delay of modernization and empowerment of women”, that is a characteristic of poor countries.

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