



Mediterranean
Action Plan
Barcelona
Convention



PRIORITY ACTIONS PROGRAMME REGIONAL ACTIVITY CENTRE

SPLIT, KRAJ SV. IVANA 11

INVITATION TO TENDER

PROCUREMENT SUBJECT: Contractor to Test and Validate Upgrade of Methodology for IMAP Candidate Common Indicator on Land Cover Change in the frame of the GEF MedProgramme Child Project 2.1

SIMPLE PROCUREMENT

Reference number 2/GEF MEDPARTNERSHIP Child Project 2.1 /2021

Split, December 2021

1. GENERAL INFORMATION

1.1. Client information:

Name: Priority Actions Programme Regional Activity Centre – PAP/RAC (hereinafter: the Client)

Registered office – address: 21000 Split, Kraj Sv. Ivana 11

Telephone: + 385 21 340470

1.2. Contact person: Questions concerning the tender contents and format can be sent to the person in charge of communicating with Tenderers, Daria Povh Skugor, e-mail: daria.povh@paprac.org.

1.3. Procurement type: Simple procurement

1.4. Estimated procurement value: Procurement value is estimated 10,000 USD with VAT included.

2. INFORMATION ON THE PROCUREMENT SUBJECT MATTER

2.1. Introduction

The Mediterranean Sea Programme: Enhancing Environmental Security (MedProgramme) is a 43 million USD assortment of seven child projects funded by the Global Environment Facility (GEF) over the 2021-2025 period. It aims to kick start the implementation of priority actions to reduce the major transboundary environmental stresses affecting the Mediterranean Sea and its coastal areas, while strengthening climate resilience and water security and improving the health and livelihoods of coastal populations. UNEP/MAP is its executing agency, and partners in execution include UNESCO/IHP, EIB, IUCN Med, GWP Med, WWF Mediterranean and the UNEP/MAP Regional Activity Centres Plan Bleu/RAC, PAP/RAC, SCP/RAC and SPA/RAC. The MedProgramme is articulated around four components, reflecting the priorities adopted by the Contracting Parties to the Barcelona Convention:

- Reduction of land-based pollution in priority coastal hotspots and measuring progress to impacts;
- Enhancing Sustainability and Climate Resilience in the Coastal Zone;
- Protecting Marine Biodiversity;
- Knowledge Management and Programme Coordination.

MedProgramme builds on the GEF MedPartnership and ClimVar & ICZM projects, which enriched the knowledge on the Mediterranean environment and unravelled the implications of climate change and variability; strengthened countries' mutual trust, cooperation and common purpose; consolidated the partnership among countries, UN bodies, civil society organizations, bilateral donors and the European Union; and tested on the ground the feasibility and effectiveness of technical and policy instruments aimed at addressing major present and future threats to environmental sustainability and climate related impacts.

Child project 2.1 (CP 2.1): Mediterranean Coastal Zones: Water Security, Climate Resilience and Habitat Protection is executed by PAP/RAC, Plan Bleu/RAC, GWP Med and the UNEP/MAP. Its nine beneficiary countries are Albania, Algeria, Bosnia and Herzegovina, Egypt, Libya, Lebanon, Morocco, Montenegro and Tunisia. This invitation to tender for contractor to update and adapt the methodology for IMAP Candidate Common Indicator on Land cover change (LCC) is a part of the Activity 1.1.1. Development of the materials for the consultations in support of ICZM Protocol ratification/implementation. Main objective of this activity is to upgrade Candidate Common Indicator on Land cover change of the Integrated Monitoring and Assessment Program (IMAP) of the UNEP/MAP Ecosystem Approach (EcAp) initiative. The LCC indicator aims to support implementation of the ICZM Protocol, particularly related to the balanced allocation of uses, preserving open coastal space,

securing setback zone, avoiding urban sprawl by limiting linear extension of urban development including transport infrastructure along the coast and securing ecosystem health. These objectives are among the most important ones of the ICZM Protocol. Being a Candidate Common Indicator, the land cover indicator is still in a testing phase. The aim of PAP/RAC is to review and update the initial methodology of this indicator developed in 2017 and to assess the possibility to include data on elevation so to adapt this indicator to be used for identification of the coastal flooding risks. Having in mind that the satellite imageries and the open policy has changed since 2017., it is to be assessed whether methodology of calculating the indicators could be upgraded and updated.

This tender is related to testing and validation of the proposed update of the methodology. Interested Contractor is invited to apply with the Proposal of pilot sites and methods for data validation with a brief argument.

This procurement is fully funded by the UNEP budget, GEF project MedProgramme Child Project 2.1, on the basis of Project Cooperation Agreement PCA/20/MAPIA2938 between UNEP and PAP/RAC. This procurement is carried out in accordance with the Article 29 of the Public procurement law.

2.2. Description of the procurement subject matter

The task will consist of the following key components:

- a) identify open/free data sources for land use/cover and elevation available for the whole project area (all Mediterranean sea coastline);
- b) select representative testing sites for the calculation of the extended Land cover change (LCC) indicator 25 using open / free data sources;
- c) calculate the extended Land cover change (LCC) indicator 25 for the testing sites;
- d) validate testing results by comparing with superior data;
- e) documenting data sources, data processing and data analysis.

In more detail:

a) In the framework of the UNEP/MAP the ecosystem approach (EcAp) initiative and under the Decision IG. 22/7 on Integrated Monitoring and Assessment Programme – IMAP at CoP 19 in Athens, 2016 a set of 23 Common Indicators and 4 Candidate Common Indicators, all belonging to 11 Ecological Objectives (EOs), was adopted by the Contracting Parties (CPs) of Barcelona Convention. There are two coastal indicators that belong to the Ecological Objective 8 (EO8) “Coastal ecosystems and landscapes”: Common Indicator 16 “Length of the coastline subject to physical disturbance due to the influence of the man-made structures”, and Candidate Common Indicator 25 LCC. The methodological factsheet for calculation of the LCC Candidate indicator has been developed in 2017. Since than satellite imagery and open data policy, and consequently potentials of the geographical data and mapping, have changed significantly. In addition, more detailed data on elevation has been produced and shared within the open-source data policies, which allows use of these data for identifying coastal areas in risk of marine flooding. Therefore, GEF MedProgramme gave us the opportunity to review this candidate indicator, starting from the review of the initial methodology. Having in mind that we still deal with candidate indicator, timing is still good to review the methodology before this indicator is proposed to all Mediterranean countries as regular one within the IMAP programme.

Within this tender Contractor is expected to identify open/free data sources for land use and land cover, as well as for elevation that are available for the whole project area (Mediterranean coastline of 9 project countries). Due to the PAP/RAC objective to be able to obtain an insight on land cover and the land cover change of the whole of Mediterranean region Contractor is invited to start with the EEA LCC indicator, results from the Copernicus and Sentinel programmes, as well as from the Coastal zone

programme. Contractor is expected to test the upgrade of the methodology proposed for the IMAP Candidate Common Indicator LCC and to validate results obtained. In his/her work, Contractor is expected to collaborate with the Contractor for Upgrade of methodology and with the PAP/RAC team.

2.3. Deliverables and deadlines

The deliverables and tentative deadlines related to the activities/tasks defined in 2.2 are as follows:

Deliverables	Deadlines
a. Report and GIS database with calculation of the LCC indicator for the pilot areas (including detailed description of the selected open/free data sources and calculation of the indicator, report should include testing GIS database and used software functions/scripts)	21 March 2022
b. Data validation report for the calculated LCC indicator in the pilot areas (including detailed description of used data validation methods and results)	20 June 2022

The deliverables shall be written in English. All deliverables should be submitted in an electronic form.

During the development of the methodology progress meetings are foreseen (online/live), in order to ensure that the results will satisfy the needs of the PAP/RAC, GEF MedProgramme and EcAp IMAP initiatives.

3. ELIGIBILITY OF ECONOMIC OPERATORS (SELECTION CRITERIA)

3.1. Technical and professional capacity

The Tenderer shall prove it has the following qualifications:

- Education: higher education in the field of geoinformatics or geography
- Experience: 5 years of experience in GIS
- Expertise: GIS mapping and analysis in the Mediterranean region (5 projects)
- written and oral fluency in English.

For the purpose of establishing the grounds set out in item 3.1. of the Invitation to Tender the Tenderer shall submit the following in his Tender:

- i) **The curriculum vitae (CV), clearly highlighting among others, required technical and professional qualifications.**

4. INFORMATION ON THE TENDER

4.1. Tender contents and format

The Tender proposal should contain the following elements:

- i. **Tender sheet** signed and filled in according to this Invitation to Tender (Annex 1);
- ii. **Curriculum vitae** of the Tenderer, proving required technical and professional capacity;
- iii. **List of projects verifying expertise (see chapter 5) of the Tenderer** (Annex 2);
- iv. **Cost statement** signed and filled in according to this Invitation to Tender (Annex 3); and
- v. **Proposal of pilot sites for testing and methods for data validation with a brief argument** (Annex 4)

4.2. Tender format and submission

Tender offers need to be drafted according to the requirements laid out in the Invitation to Tender.

Offers shall be sent electronically to the following e-mail address: daria.povh@paprac.org with “MedProgramme CP 2.1. Land cover change indicator testing” as the e-mail subject.

4.3. Date, time and place of tender submission

Tender offers must be received **by 13 December 2021, 1 pm CEST.**

All offers received after the bid opening deadline will be marked as late and excluded from the procedure.

4.4 The Tenderer may amend or withdraw his Tender before the Tender submission deadline. The amended Tender shall be submitted in the same manner as the original and clearly marked as amended. The Tenderer may withdraw his Tender by submitting a written statement before the Tender submission deadline. The written statement shall be submitted in the same manner as the original Tender and clearly marked as a statement of Tender withdrawal. Alternative Tenders are not permitted.

4.5 Tender currency: USD The tender is expressed in United States Dollars (USD).

4.6 Language and script: The Tender shall be drafted in English language, using the Latin script.

4.7 Period of validity: 15 days from the tender submission deadline.

4.8. Price setting method

The total tender price consists of price in USD, VAT and all other relevant national financial obligations (all taxes, pay-related social insurance contributions and all other contribution or payments, statutory or otherwise, arising by virtue of performance of the services).

Tenderers registered in any of the project countries (outside the Republic of Croatia or EU) do not express VAT, but indicate “reverse charge” (see Annex 1, 3.).

If tenderers are registered in Croatia the following should be applied:

- if in VAT system, expressed VAT shall be 25%;
- if out VAT system, expressed VAT shall be 0%.

When evaluating the tenders, the Client will take into account the above indicated VAT.

5. AWARD CRITERIA

The Tender will be awarded according to the **most economically advantageous tender (MEAT) criteria.**

The following table sets out the criteria, units of measure, labels and their relative importance. They will be applied to Tenderers who satisfy technical and professional capacity criteria set in chapter 3.1. The MEAT award criteria are the following:

- expertise of the Tenderer;
- proposed price; and
- quality of the Proposal of pilot sites for testing and methods for data validation with a brief argument.

Determining the MEAT according to the above criteria for selecting the MEAT will be done as follows: after the Client has determined the score value by individual criteria for each Tenderer, the points awarded to Tenderer according to each of the criteria will be summed in order to obtain the total number of points for each Tenderer. The most favourable Tenderer will be the one who has earned the highest total score according to all the above criteria.

At that, the MEAT is equal to the highest total score resulting from the ranking of the Tenders; the total maximum number of points is 100.00 with the total points being calculated in two decimal places. In case that two or more Tenders achieve equal number of points, the one received earlier will be chosen. As a proof, data will be used on the order in which tenders have been received.

Criteria	Criteria label	Description and measuring unit	Methodology	Number of points	Maximum
Price	P	The Tender price, i.e. the financial Tender amount in USD including VAT, if applicable	$C = (\text{lowest bid price/bid price being evaluated}) \times 40$	40	40
Expertise	E	Number of projects related to GIS mapping and analysis in the Mediterranean region , in which the tenderer was involved as the expert/coordinator	1 – 3	10	30
			3 - 4	20	
			5 or more	30	
Proposal	PR	Quality of Proposal for pilot sites for testing and methods for data validation	To be assessed by the PAP/RAC election commission	30	30

Selection of the most economically advantageous Tenders (ENP) will determine the basis for evaluating the criteria for each individual Tender according to the delivery of the requested Tenderer's documentation, in the appropriate form: **ENP = P + E+ PR.**

For the purposes of establishing the grounds set out in item 5. of the Invitation to Tender the Tenderer shall submit the following in his/her Tender:

- i. **List of projects verifying expertise of the Tenderer** (Annex 2);
- ii. **Cost statement** (Annex 3); and
- iii. **Proposal of pilot sites for testing and methods for data validation with a brief argument** for the upgrade of the methodology for LCC indicator Factsheet (Annex 4)

6. DUE DATE, CONTRACT AND TERMS OF PAYMENT

The Contract will be made in USD currency.

If selected contractor is a legal person established in the Republic of Croatia, payment/s will be in kuna (HRK), using the exchange rate of the OTP Bank d.o.o. valid on the date of payment.

The Client shall make the payment to the Tenderer in two instalments i.e.:

- 50% upon submission and clearance by PAP/RAC of the deliverable a.
- 50% upon submission and clearance by PAP/RAC of the deliverable b.

All legal persons (in or out of VAT system) and natural persons which are in VAT system conducting financial transactions with the Client are required to issue invoice/s.

An advance payment by the Client is not permitted.

Envisaged duration of the Contract is 6 months.

Annex 1

Tender sheet

Tender date: _____

Contracting Authority: Priority Actions Programme Regional Activity Centre (PAP/RAC), Kraj Sv. Ivana 11, 21000 Split, Croatia

Subject of procurement: Contractor to Test and Validate Upgrade of Methodology for IMAP Candidate Common Indicator on Land Cover Change in the frame of the GEF MedProgramme Child Project 2.1

Tenderer information:

Tenderer's name and registered seat	
PIN¹	
Bank name	
IBAN	
SWIFT	
The economic operator is VAT registered (select)	YES NO
Name, family name and position of a person / persons authorised to sign the public procurement contract	
Name and title of the contact person:	
Mail address:	
E-mail address:	
Telephone number:	

Tender price:

Tender price, excluding VAT (USD)	
VAT (25%) ²	
Total price USD (including VAT or any other national financial obligations)	

Bid validity date: (at least 15 days after the bid submission deadline)

For Tenderer:

(Signature of the legal representative)

¹ Or national identification number according to the economic operator's country of establishment, if applicable

² Economic operators registered in any of the project countries in the place of VAT have to put "reverse charge". Economic operators registered in Croatia that are not in VAT system, do not fill in the column (or put 0).

Annex 2

Practical experience verifying expertise of the Tenderer

Relevant experience of the tenderer- consultant (*Name and Surname*) _____
_____, relevant to the main activity fields of this project, preferably related to GIS mapping and analysis in the Mediterranean region, in which the Tenderer was involved as an expert/coordinator:

No ³ .	Experience (name of the project or other type of engagement)	Role of the expert	Year
1.			
2.			
3.			
4.			
5.			

In _____, _____ 2021

(Full name of the applicant or legal representative)

(Signature of the applicant or legal representative)

³ Add rows, as necessary

Annex 3

Cost statement

Technical description and cost statement for the Consultant to test and validate update of methodology for IMAP Candidate Common Indicator on land cover change in the frame of the GEF MedProgramme Child Project 2.1					
No.	Deliverable description	Unit	Approx. amount	Unit price in USD	Total USD
1.	Report and GIS database with calculation of the LCC indicator for the pilot areas	1			
2.	Data validation report for the calculated LCC indicator in the pilot areas	1			
Tender price in USD without VAT (total item amount)					
VAT amount (25%)					
Tender price in USD (including VAT or any other national financial obligations)					

In _____, _____ 2021

(Full name of the legal representative)

(Signature of the legal representative)

¹ Economic operators registered in any of the project countries in the place of VAT have to put “reverse charge”. Economic operators registered in Croatia that are not in VAT system, do not fill in the column (or put 0).

Annex 4

Initial proposal of Pilot sites for testing and methods for data validation

with brief argument

for Upgrade of methodology for IMAP Candidate Common Indicator on Land Cover Change in the frame of the GEF MedProgramme Child Project 2.1

(Summary proposal up to 3000 words)

Indicator guidance factsheet for EO8 Coastal Ecosystems and Landscapes Common Indicator 25 “Land cover change”

Ecological Objective	The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved	
Indicator Title	<i>Land cover change</i>	
Relevant GES definition	Related Operational Objective	Proposed Target(s)
<ul style="list-style-type: none"> - <i>Linear coastal development minimised, with perpendicular development being in balance with integrity and diversity of coastal ecosystems and landscapes.</i> - <i>Mixed land-use structure achieved in predominantly man-made coastal landscapes</i> 	<i>Integrity and diversity of coastal ecosystems, landscapes and their geomorphology are preserved.</i>	<p><i>Proposed targets should be considered as general recommendations to be adapted to regional/local specificities and knowledge.</i></p> <ul style="list-style-type: none"> - <i>No further construction within the setback zone</i> - <i>Change of coastal land use structure, dominance of urban land use reversed</i> - <i>Keep, and increase where needed, landscape diversity</i>
<p>GES, targets and measures cannot be expressed quantitatively (as a threshold value) but due to country specific circumstances (socio-economic, cultural, historical) should be defined by the countries themselves. In doing so the CPs should take their spatial development and planning policies into account, as well as the legal obligations of the Barcelona Convention, in particular the ICZM Protocol. The above GES definition and Proposed target(s) are just examples.</p>		
Rationale		
Justification for indicator selection		
<p><i>The UNEP/MAP’s Correspondence Group on Monitoring (CORMON) on Coast and Hydrography agreed, in May 2013, on a specific candidate common indicator for the Mediterranean region addressing land cover change.</i></p> <p><i>Identifying and understanding the processes of land cover change (i.e. how land cover has been changed by humans and the processes that result in landscape transformation) is especially relevant</i></p>		

Ecological Objective	The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved
Indicator Title	Land cover change

for critical and vulnerable areas such as coastal zones, where several competitive uses are pressing. In this context urbanization, or land take, is the most dramatic change given the (almost) irreversibility of the process. The associated impacts could be listed as follows (Figure 1):

- Habitat loss with the associated impact on related ecosystem functions like C sequestration, regulation of water cycle, or biomass production.
- Fragmentation. The division of natural habitats in smaller parcels contributes to the isolation of number of species and also compromises its viability.

Therefore, the accumulated impacts of urbanization highly compromise ecosystem integrity. Since impacts are dependent on the scale and pace of changes it is important to consider these aspects when monitoring land cover changes.

Beyond the process of urbanization there are other changes that are less irreversible and also have important consequences:

- Conversion from forest to agricultural use. This results in habitat loss, habitat fragmentation and, consequently, loss of biodiversity. There is also a decrease on the degree of soil coverage by vegetation which in turn determines the risk of erosion. Also this type of change results in a net loss of soil carbon.
- Conversion from agriculture to semi-natural. The impact strongly depends on the conditions at the time of abandonment. If conditions are favorable, land abandonment can lead to a recovery of natural vegetation. However, in case of unfavorable conditions like low vegetation coverage and/or steep slope, agricultural abandonment could lead to further land degradation.
- Conversion from agricultural land to forest (forestation). This change involves tree plantation and it has a positive impact on land stability by increasing the vegetation cover of the soil and the increase of C sequestration. In terms of biodiversity it strongly depends on the species used for plantation. Native species definitely increase diversity and connectivity.

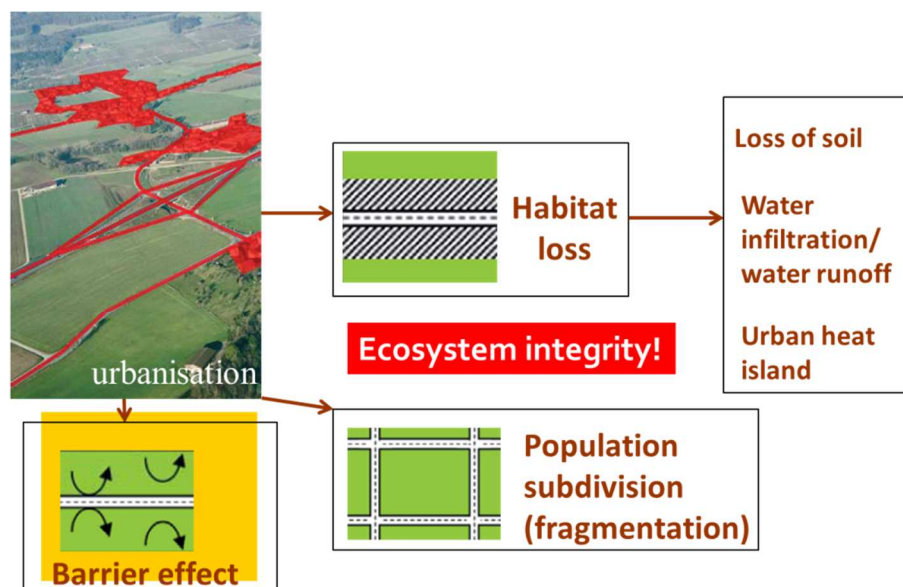


Figure 1. Overview of major impacts on land take

Scientific References

References are grouped by the topic addressed. Within each section references are sorted by relevance (the first ones are more relevant to the current indicator)

Ecological Objective	The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved
Indicator Title	<i>Land cover change</i>
<p><u><i>Land use/land cover change and related impacts:</i></u></p> <ul style="list-style-type: none"> • Bajocco, S., De Angelis, A., Perini, L., Ferrara, A. i Salvati, L., 2012, 'The Impact of Land Use/Land Cover Changes on Land Degradation Dynamics: A Mediterranean Case Study', <i>Environmental Management</i>, 49(5), p.980-989. • Dale, V. H. , Brown, S. , Haeuber, R. A. , Hobbs, N. T. , Huntly, N. , Naiman, R. J. , Riebsame, W. E. , Turner, M. G. and Valone, T. J., 2000. Ecological principles and guidelines for managing the use of land. <i>Ecological Applications</i> 10:639–670. • Gibbs, H. K., Helkowski, J. H., Holloway, T., Howard, E. A., Kucharik, C. J., Monfreda, C., Patz, J. A., Prentice, I. C., Ramankutty, N., Snyder, P. K., Foley, J. A., DeFries, R., Asner, G. P., Barford, C., Bonan, G., Carpenter, S. R., Chapin, F. S., Coe, M. T. i Daily, G. C., 2005. Global Consequences of Land Use. <i>Science</i>, 309(5734), p.570-574. • Haines-Young, R., 2009, 'Land use and biodiversity relationships', <i>Land Use Policy</i>, 26, p.S178-S186. <p><u><i>Methodology to compute land use change indicator:</i></u></p> <ul style="list-style-type: none"> • Breton, F., Ivanov, E., Morisseau, F., Nowell, M. 2014. <i>D4.2 Report, accompanying database and supporting materials on LEAC Methodology and how to apply it in CASES</i>. PEGASO 06/Deliverable. URL: http://www.pegasoproject.eu/images/stories/WP4/D4.2%20LEAC_UAB_140401.pdf • EEA, 2006. The changing faces of Europe's coastal areas, EEA report. European Environment Agency ; Office for Official Publications of the European Communities, Copenhagen, Denmark : Luxembourg. • Feranec, J., Jaffrain, G., Soukup, T. and Hazeu, G., 2010, 'Determining changes and flows in European landscapes 1990–2000 using CORINE land cover data', <i>Applied Geography</i>, 30(1), p.19-35. • V. Perdigao i S. Christensen, 2000, <i>The LACOST atlas: Land cover changes in European coastal zones</i>, Joint Research Centre, Milan. • Serra, P, Pons, X., Saurí D. 2008. Land-cover and land-use change in a Mediterranean landscape: A spatial analysis of driving forces integrating biophysical and human factors. <i>Applied Geography</i>, 28(3): 189-209. • Weber, J.-L., 2007, 'Implementation of land and ecosystem accounts at the European Environment Agency', <i>Ecological Economics</i>, 61(4), p.695-707. • EC - DG.ENV, 2013. Mapping and assessment of ecosystems and their services an analytical framework for ecosystem assessments under action 5 of the EU biodiversity strategy to 2020: discussion paper - final, April 2013. Publications Office, Luxembourg. URL: http://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/pdf/MAESW orkingPaper2013.pdf 	
Policy Context and targets	
Policy context description	

Ecological Objective	The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved
Indicator Title	<i>Land cover change</i>
<p><i>After agreeing on including the candidate common indicator on Land use change in CORMON on Coast and Hydrography in 2013, it was decided that this candidate common indicator would need further testing, pilot implementation (including during the initial phase of IMAP), before the Contracting Parties could agree to its regional usage as a common indicator.</i></p> <p><i>In order to follow-up on this CORMON Coast and Hydrography recommendation, an EcAp pilot project took place in the Adriatic to test the feasibility of this candidate common indicator on the sub-regional level, in the framework of an EU funded project on the “Implementation of the Ecosystem Approach in the Mediterranean by the Contracting Parties in the context of the Barcelona Convention for the Protection of the Marine Environment and the Coastal region of the Mediterranean and its Protocols (EcAp-MED project 2012-2015)”. The main conclusions of the Pilot project suggest that by using the common remote data and a common method for processing and presenting the results are feasible and a very positive step forward as far as monitoring the processes, the state and evolution of the coastal zones.</i></p> <p><i>The results of this pilot are presented in document UNEP(DEPI)/MED WG.420/Inf.18.</i></p> <p>As for the protocols of the Barcelona convention, The ICZM protocol identifies the need of balanced use of coastal zones in several articles.</p> <p>For example, the Article 5 sets the objectives of integrated coastal management:</p> <p>(a) to facilitate, through the rational planning of activities, the sustainable development of coastal zones by ensuring that the environment and landscapes are taken into account in harmony with economic, social and cultural development;</p> <p>(b) preserve coastal zones for the benefit of current and future generations;</p> <p>(c) ensure the sustainable use of natural resources, particularly with regard to water use;</p> <p>(d) ensure preservation of the integrity of coastal ecosystems, landscapes and geomorphology;</p> <p>In Article 6, where general principles of ICZM are discussed, it is highlighted that the formulation of land use strategies, plans and programs covering urban development and socioeconomic activities, as well as other relevant sectoral policies, shall be required (f). In addition, 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(h).</p> <p>The Article 8 calls to Contracting Parties to ensure that their national legal instruments include criteria for sustainable use of the coastal zone. Some of such criteria ask for “identifying and delimiting, outside protected areas, open areas in which urban development and other activities are restricted or, where necessary, prohibited” (a). In addition, it asks for limiting the linear extension of urban development and the creation of new transport infrastructure along the coast(b).</p> <p>In addition, the EU’s Habitats Directive (92/43/EEC), Birds Directive (2009/147/EC), as well as Convention of Biological Diversity can also be relevant for policy context regarding land cover change.</p>	
<p>Targets</p> <ul style="list-style-type: none"> - <i>No further construction within the setback zone</i> - <i>Change of coastal land use structure, dominance of urban land use reversed</i> - <i>Keep, and increase, where needed, landscape diversity</i> <p><i>Interpretation of targets and setting the measures to achieve them should be left to the countries. The reason is the strong socio-economic, historic and cultural dimensions in addition to specific geomorphological and geographical conditions in each country. In other words: although the indicator</i></p>	

Ecological Objective	The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved			
Indicator Title	<i>Land cover change</i>			
<p><i>is a simple tool to show trends in land-cover changes for interpretation purposes, additional criteria should be taken into account i.e. due to strong socio-economic, historic and cultural dimensions in addition to specific geomorphological and geographical conditions the interpretation should be left to the countries.</i></p> <p><i>These targets should be taken as general guidelines that need to be considered in light with the local knowledge. Given the relevance of the socio-economic, historic and cultural dimension, in addition to specific geographical conditions, local experts will provide the needed input in support to this indicator.</i></p>				
Policy documents				
<p>ICZM Protocol (available in different languages at http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A22009A0204(01)))</p> <p>Convention on Biological Diversity (www.cbd.int)</p> <p>Habitats Directive (92/43/EEC) http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31992L0043</p> <p>Birds Directive (2009/147/EC) http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009L0147</p>				
Indicator analysis methods				
Indicator Definition				
<p><i>Land use/land cover change is the change of purpose to which land is profited by humans (e.g., protected areas, forestry for timber products, plantations, row-crop agriculture, pastures, or human settlements). Different parameters can be considered for evaluation of indicator on land use/land cover change. The parameters are summed in Table 1. The combined analysis of these parameters entails an inventory of the urbanization pressures on coastal ecosystems. In practice the parameters can identify: (i) where pressures are higher (by amount of change and by pace of the process); (ii) spatial trends (along the coast and landwards); and (iii) areas for priority action. However, responsible (local) institutions are necessary to correctly interpret these processes and to understand the drivers behind them.</i></p>				
Table 1. Description of the parameters calculated for the indicator Land Cover Change				
Parameter	Units	Data required	Reporting units	Meaning
<i>Area of built-up land in coastal zone as a proportion of the total area in the same unit</i>	<i>% of artificial areas</i>	<i>Artificial surfaces at a single time shot</i>	<i>Coastal zone as defined by the country</i> <i>Also coastal strips (<300m*, 300m-1km, 1-10 km).</i>	<i>State of urban areas at a particular time. This is used as a baseline, i.e. initial condition for the analysis of changes.</i>

Ecological Objective		The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved		
Indicator Title		<i>Land cover change</i>		
<i>Area of built-up land in coastal units as a proportion of the area of built-up land in the wider coastal unit</i>	<i>% of artificial areas</i>	<i>Artificial surfaces at a single time shot</i>	<i>Narrower coastal strips within the wider ones (or even within the whole coastal unit).</i>	<i>This parameter shows to what extent the process of urbanization has been more intense on the coast than on the inland. It also reflects the relevance of economic activities on the coast as a driver of urban development.</i>
<i>Land take as % initial urban area on the coastal zone</i>	<i>% of increase of urban areas</i>	<i>Artificial surfaces at t_0 and t_1</i>	<i>Coastal zone as defined by the country. Also coastal strips (<300m*, 300m-1km, 1-10 km)</i>	<i>Intensity of the process of urbanization in a given period of time.</i>
<i>Change of forest and semi-natural areas</i>	<i>% of change of forest and semi-natural areas</i>	<i>Forest and semi-natural land at t_0 and t_1</i>	<i>Coastal zone as defined by the country. Also coastal strips (<300m*, 300m-1km, 1-10 km)</i>	<i>This parameter would reflect to what extent management is leading to an increase, maintenance or decrease of forest and semi-natural areas. This represents the land cover closer to "natural land" excluding wetlands (specific indicator).</i>
<i>Change of wetlands</i>	<i>% of change of wetlands</i>	<i>Wetlands at t_0 and t_1</i>	<i>Coastal zone as defined by the country. Also coastal strips (<300m*, 300m-1km, 1-10 km)</i>	<i>This parameter will indicate how effective is the protection of wetlands, in terms of coverage. The indicator could reflect and increase, maintenance or a decrease of wetlands.</i>
<i>Change of protected areas</i>	<i>% of change of protected areas</i>	<i>Protected areas at t_0 and t_1</i>	<i>Coastal zone as defined by the country. Also coastal strips (<300m*, 300m-1km, 1-10 km)</i>	<i>This parameter shows how the extent of protected areas changes in time.</i>

**the 300m wide coastal strip is proposed as relevant representation of the coastal setback (also considering the resolution issues)*

Methodology for indicator calculation

1. Data compilation - Land cover classes are typically mapped from digital remotely sensed data through the process of a supervised digital image classification or, alternatively, determined by in situ monitoring. Land cover classes needed for the indicator are listed in the Table 2. If more detailed classification is available, then it could be provided making the clear link with Table 2.

Table 2. Land cover classes for the Land Cover Change indicator

LU/LC class	Definition
-------------	------------

Ecological Objective	The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved
Indicator Title	<i>Land cover change</i>
<i>Artificial surfaces (also referred as built-up areas)</i>	<p><i>Surfaces with dominant human influence but without agricultural land use.</i></p> <p><i>These areas include all artificial structures and their associated non-sealed and vegetated surfaces.</i></p> <p><i>Artificial structures are defined as buildings, roads, all constructions of infrastructure and other artificially sealed or paved areas. Associated non-sealed and vegetated surfaces are areas functionally related to human activities, except agriculture.</i></p> <p><i>Also, the areas where the natural surface is replaced by extraction and / or deposition or designed landscapes (such as urban parks or leisure parks) are mapped in this class.</i></p> <p><i>The land use is dominated by permanently populated areas and / or traffic, exploration, non-agricultural production, sports, recreation and leisure.</i></p>
<i>Agricultural</i>	<i>It includes: arable land, permanent crops, pastures and heterogeneous agricultural areas (complex cultivation patterns, land principally occupied by agriculture, with significant areas of natural vegetation).</i>
<i>Forest and semi-natural land</i>	<i>It includes: forests, scrub and/or herbaceous vegetation associations, open spaces with little or no vegetation</i>
<i>Wetlands</i>	<i>Inland marshes, peatbogs, salt marshes, salinas, intertidal flats</i>
<i>Water bodies</i>	<i>Water courses, water bodies, coastal lagoons, estuaries, sea and ocean.</i>
<i>Protected areas</i>	<i>Surfaces with any of the protection status (such as Natura 2000, IUCN or national-specific categories with the objectives to protect biodiversity, habitats, species, landscapes and alike in the coastal zone)</i>

2. Data processing

Data processing includes the following steps (Figure 2):

(i) Pre-processing

Land cover data could be available in two formats: vector data (polygons) or raster data (grid). For practical reasons, and to simplify the computing process, the first step is to ensure that all the data is in a grid of 1 ha. Conversion of vector data to a grid, or raster, is a common procedure in GIS techniques. Most of the GIS software provides different options to convert vector data into a grid. Here the 'Maximum area' criterion is suggested as one of the most standard methods.

(II) Combining data

Once the data is available in 1 ha grid, the different layers are combined. This process is automatically done by any GIS software and creates an associated table with all the information available for each cell in the grid. The layers to be combined are listed as follows:

- 1. Baseline land cover data (y0).*
- 2. Land cover change data (y0-y1)*
- 3. Delimitation of coastal zone*

Ecological Objective	The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved
Indicator Title	<i>Land cover change</i>
<p>4. <i>Administrative unit where the coastal zone belongs (NUTS3 or equivalent)</i></p> <p>Therefore the minimum information that the resulting table should contain is as follows:</p> <ol style="list-style-type: none"> 1. <i>Grid ID. Unique identifier for each cell in the grid of 1 ha</i> 2. <i>Coastal zone. Yes/No. Boolean parameter that indicates if the cell is within the coastal zone, as defined by the country</i> 3. <i>Administrative unit. Code that identifies the administrative unit where the cell is located (NUTS3 of equivalent).</i> 4. <i>Land cover class at t₀. Code for the land cover class of the cell.</i> <p>(iii) <u>extracting statistics</u></p> <p>As a result of the previous step a table should be available with the unique code of each cell of the 1 ha grid and all related parameters. Therefore the extraction of the statistics for the calculation of the indicator could be done in a spreadsheet and does not require any GIS processing (see Data analysis and assessment outputs section for the details).</p>	
<p>The diagram illustrates the data processing workflow for the Land Cover Change indicator. It is divided into three main stages, each represented by a gear icon and a corresponding data visualization:</p> <ul style="list-style-type: none"> Pre-processing data: This stage involves the rasterization of vector data and data alignment. The visualization shows a green polygon being overlaid on a grid to create a raster. Combining data: This stage involves combining land cover data and reporting units with a geographic scope. The visualization shows a multi-colored grid being combined with a blue grid. Extracting statistics: This stage involves extracting statistics from the data. The visualization shows a database icon and a table with columns for 'Aggregate Totals', 'Ratios', and 'Group by Sum %'. 	
<p>Figure 2. Data processing for the Land Cover Change indicator</p>	
<p>Indicator units</p> <p>The first monitoring will focus on the base line. The indicator units are indicated below:</p> <ol style="list-style-type: none"> 1. <i>km² of built-up area in coastal zone</i> 2. <i>%of built-up area in coastal zone</i> 3. <i>%of other land cover classes in coastal zone</i> 4. <i>% of built up area within coastal strips of different width (see Table 1) compared to wider coastal units</i> 5. <i>% of other land cover classes within coastal strips of different width (see Table 1) compared to wider coastal units</i> 6. <i>km² of protected areas within coastal strips of different width</i> <p>For second monitoring the following units will also be relevant:</p>	

Ecological Objective	The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved
Indicator Title	<i>Land cover change</i>
	<p>7. % of increase of built-up area, or land take</p> <p>8. % of change of other land cover classes</p> <p>9. % of change of protected areas</p>
List of Guidance documents and protocols available	<p><i>Pilot project in the Adriatic on testing the candidate common indicator 'Land use change' in the Mediterranean</i>, by: Anna Marín. Raquel Ubach. and JaumeFons-Esteve. Coordinated by: Marko Prem, PAP/RAC. URL: http://www.pap-thecoastcentre.org/pdfs/Pilot%20Adriatic_Final_Sep2015.pdf</p>
Data confidence and uncertainties	<p><i>Production of land use/land cover data from remote sensing is always a compromise between precision and efforts required to derive the information from satellite images. The data sources listed below (see Available data sources) have been validated by the responsible institutions or providers of the data. Additionally, if analogue maps from official institutions are available they could be digitalised and used accordingly.</i></p> <p><i>Quality assurance/control always involve a selection of percentage of points where the derived information is checked against "ground truth" –usually ancillary information like official maps, cadastre,... but also field inspections.</i></p>
Methodology for monitoring, temporal and spatial scope	
Available Methodologies for Monitoring and Monitoring Protocols	<p><i>The most elaborated guidelines are available from the Corine Land Cover programme (currently integrated in the Copernicus Programme).</i></p> <p>http://www.eea.europa.eu/publications/technical_report_2007_17</p>
Available data sources	<p>The data sources listed below are transnational data bases (the first one only European, the rest global). Existing national data (official) is also suitable for this indicator.</p> <p>- <i>Corine land Cover (only European coverage)</i> http://land.copernicus.eu/pan-european/corine-land-cover</p> <p>- <i>GlobCover. Global land cover dataset at 300m resolution from the MERIS sensor on the ENVISAT satellite.</i> http://due.esrin.esa.int/page_globcover.php</p> <p>- <i>Climatge Change Initiative Land Cover map. Global land cover dataset at 300m resolution, for 1998-2002, 2003-2007, 2008-2012.</i> http://maps.elie.ucl.ac.be/CCI/viewer/index.php</p> <p>- <i>GLC-SHARE: Global Land Cover data combined from 'best available' national land cover maps. 1km resolution.</i> http://www.fao.org/geonetwork/srv/en/main.home?uuid=ba4526fd-cdbf-4028-a1bd-5a559c4bff38</p>

Ecological Objective	The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved
Indicator Title	<i>Land cover change</i>
Spatial scope guidance and selection of monitoring stations	
<p><i>The exact territorial extent (coastal area for the analysis) of the monitoring should be defined. The Mediterranean ICZM Protocol defines the landward limit of coastal zone as the “limit of the competent coastal units as defined by the Parties (Article 3).” In other words, the landward limit will be country-specific, e.g. dependant on definition given by certain Contracting party when ratifying the Protocol.</i></p> <p><i>As for the resolution of the source data it is a „compromise between precision and efforts needed in processing the satellite images. The following indications could be considered minimum requirements:</i></p> <ul style="list-style-type: none"> • <i>Minimum mapping unit of 25 ha and 100 m of linear elements</i> • <i>Minimum change detection 5 ha</i> 	
Temporal Scope guidance	
<i>The temporal scale should be 5 years, in order to be effective on the counteracting negative effects and taking early actions on problematic areas.</i>	
Data analysis and assessment outputs	
Statistical analysis and basis for aggregation	
<p><i>The statistics can be computed as follows:</i></p> <ol style="list-style-type: none"> 1. <i>Percentage of built-up area in coastal zone.</i> <ol style="list-style-type: none"> a) <i>Filter the data by the grids belonging to the coastal zone</i> b) <i>Calculate total area by counting the total number of cells. This is the area in km².</i> c) <i>Filter, within the coastal zone, by land cover “artificial areas” (see Table 1 for the definition of land cover classes).</i> d) <i>Calculate area of “artificial areas” by counting the number of cells. This is the area in km².</i> e) <i>Divide 1d by 1b in order to obtain the percentage of artificial area on the coastal zone.</i> 2. <i>Percentage of other land cover classes on the coastal zone. As complementary to “Percentage of built-up area in coastal zone” the same procedure could be applied to each land cover class as defined in Table 1. In that case the procedure described in 1 will be replicataed by changing “artificial areas” with the other land cover classes</i> 3. <i>Area of built-up land in coastal units as a proportion of the area of built-up land in the wider reference region.</i> <ol style="list-style-type: none"> a) <i>Filter the data by the grids belonging to the entire administrative unit where the coastal zone belongs (NUTS3 or equivalent).</i> b) <i>Filter by land cover “artificial areas” (see Table 1 for the definition of land cover classes).</i> c) <i>Calculate area of “artificial areas” by counting the number of cells. This is the area in km².</i> d) <i>Sum 1d with 3c.</i> 	

Ecological Objective	The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved
Indicator Title	<i>Land cover change</i>
<p>e) <i>Divide 1d by 3d. This value is the percentage of built-up area within the administrative unit that is located on the coastal zone.</i></p> <p>4. <i>Land take as % of initial urban area on the coastal zone. This parameter will start to be computed on the second monitoring since the first monitoring focus only on the baseline (state at t_0).</i></p> <p>a) <i>Filter the data by the grids belonging to the coastal zone.</i></p> <p>b) <i>Calculate total area by counting the total number of cells. This is the area in km^2.</i></p> <p>c) <i>Filter, within the coastal zone, by land cover "artificial areas" (see Table 1 for the definition of land cover classes) for t_0.</i></p> <p>d) <i>Filter, within the coastal zone, by land cover "artificial areas" (see Table 1 for the definition of land cover classes) for t_1.</i></p> <p>e) <i>Calculate 4d-4c and then divide by 4c. This provides the percentage of land take compared to the initial built-up area.</i></p> <p>5. <i>Change of forest and semi-natural land. This parameter will start to be computed on the second monitoring since the first monitoring focus only on the baseline (state at t_0).</i></p> <p>a) <i>Filter the data by the grids belonging to the coastal zone.</i></p> <p>b) <i>Calculate total area by counting the total number of cells. This is the area in km^2.</i></p> <p>c) <i>Filter, within the coastal zone, by land cover "Forest and semi-natural land" (see Table 1 for the definition of land cover classes) for t_0.</i></p> <p>d) <i>Filter, within the coastal zone, by land cover "Forest and semi-natural land" (see Table 1 for the definition of land cover classes) for t_1.</i></p> <p>e) <i>Calculate 5d-5c and then divide by 5c. This provides the percentage of change of forest and semi-natural areas for the given period.</i></p> <p>6. <i>Change of wetlands. This parameter will start to be computed on the second monitoring since the first monitoring focus only on the baseline (state at t_0).</i></p> <p>a) <i>Filter the data by the grids belonging to the coastal zone.</i></p> <p>b) <i>Calculate total area by counting the total number of cells. This is the area in km^2.</i></p> <p>c) <i>Filter, within the coastal zone, by land cover "Wetlands" (see Table 1 for the definition of land cover classes) for t_0.</i></p> <p>d) <i>Filter, within the coastal zone, by land cover "Wetlands" (see Table 1 for the definition of land cover classes) for t_1.</i></p> <p>e) <i>Calculate 6d-6c and then divide by 6c. This provides the percentage of change of wetlands for the given period.</i></p> <p><i>The above mentioned analysis can be complemented with the following ones that provide additional insight on the land cover indicator.</i></p> <p>7. <i>Additional analytical units</i></p> <p>a) <i>Setback zone (if defined by country). Given the relevance of this part of the coastal area, as referred on the ICZM protocol, the indicators on % of built-up and land take can be analysed for this specific zone.</i></p> <p>b) <i>Elevation breakdown within the coastal area. Distance to the coast and elevation are elements that configure different habitat distribution and patterns. With available local knowledge 3 to 5 elevations classes could be considered to be analysed</i></p>	

Ecological Objective	The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved
Indicator Title	<i>Land cover change</i>
<p><i>independently within the coastal area in order to better link the pressure of land take to specific habitats. An example follows: < 50 m asl, 50 – 300 m, >300 m).</i></p> <p>8. <i>Additional parameters</i></p> <p><i>What has been lost by urbanization?</i></p> <p>a) <i>Filter the data by the grids belonging to the coastal zone.</i></p> <p>b) <i>Calculate total area by counting the total number of cells. This is the area in km².</i></p> <p>c) <i>Develop a pivot table with land cover classes at t₀, on rows, and land cover classes at t₁ on columns. Cells in this matrix will contain the area that has changed from certain land cover class at t₀ to a new class in t₁.</i></p> <p>d) <i>Select the column for “Built-up areas”.</i></p> <p>e) <i>Values on the rows indicate the different land cover classes at t₀ that have been converted into built-up area.</i></p> <p>f) <i>Values from 5 can be divided by the corresponding area of the same class at t₀. This will provide the percentage of certain land cover class that has been converted into built-up.</i></p>	
<p>Expected assessments outputs</p> <p><i>The outputs are detailed below:</i></p> <ul style="list-style-type: none"> • <i>Digital map with the land cover classes for the coastal area. Land cover classes should follow the classification provided in Table 1. If more detailed classification is available, then it could be provided making the clear link with Table 1. The following specifications will ensure the interoperability of the maps provided by different institutions/countries:</i> <ul style="list-style-type: none"> ○ <i>Format: raster GeoTIFF (Geographic Tagged Image File Format) 1 ha</i> ○ <i>Metadata:</i> <ul style="list-style-type: none"> ▪ <i>Title of the map</i> ▪ <i>Geographic reference.</i> <ul style="list-style-type: none"> • <i>Bounding box.</i> • <i>Coordinate reference system</i> ▪ <i>Temporal reference (year)</i> ▪ <i>Responsible organisation</i> • <i>Spreadsheet with the calculated indicators as described in the methodology.</i> • <i>Starting with the second monitoring, additional maps will be provided indicating areas of land take (new urbanization). The specifications for these maps are the same as indicated above.</i> 	
<p>Known gaps and uncertainties in the Mediterranean</p> <p><i>The definition of the analytical units of the coastal zone could be revised in view of more detailed data on habitats distribution, or input from national experts. In any case it is important to take into account the implications of the different delineations on the interpretation of the results.</i></p> <p><i>The use of remote sensing and the selected resolution is the main constrain when analysing the outcomes</i></p> <ul style="list-style-type: none"> • <i>Not all changes are observed since there is minimum change detection. Therefore, the patterns observed indicate that changes are underestimated. In any case the proposed approach is still relevant since it provides an idea of the magnitude of the processes of urbanization.</i> • <i>Given the resolution and processing, linear elements are not well captured; therefore, linear</i> 	

Ecological Objective	The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved	
Indicator Title	<i>Land cover change</i>	
<p><i>elements perpendicular to the coast, for example, are not detected.</i></p> <ul style="list-style-type: none"> <i>The information currently available does not allow identifying built-up on the territorial waters.</i> <p><i>Since these limitations arise from the definition of the resolution, there is space for improvement if it is needed. However, there is always a trade-off between resolution and efforts required to obtain the information.</i></p> <p><i>In addition, countries may obtain data from different sources (different resolution, different level of precision) which may make comparability of data difficult.</i></p>		
Contacts and version Date		
Key contacts within UNEP for further information		
Version No	Date	Author
V.1	27/6/16	PAP/RAC
V.2	20/07/16	UAB
v.3	01/04/19	PAP/RAC