A Research study on the role of the built environment stakeholders in climate change adaptation

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Contents

Abbreviations and acronyms

AEMET State Meteorological Agency (Agencia Estatal de Meteorología)

AR Academia and research organisations

CC Climate change

CCA Climate change adaptation

CENEAM National Environmental Education Centre (Centro Nacional de Educación Ambiental)

CPO Civil organisations and Professional organisations

DGCM Directorate General for the Coast and the Sea (Dirección General de la Costa y el Mar)

EIA Environmental Impact Assessment

FEMP Spanish Association of Municipalities and Provinces (Federación Española de Municipios y Provincias)

ICZM Integrated Coastal Zone Management

MITECO Ministry for Ecological Transition and the Demographic Challenge (Ministerio para la Transición Ecológica y el Reto Demográfico)

MITMA Ministry of Transport, Mobility and Urban Agenda (Ministerio de Transportes, Movilidad y Agenda Urbana)

NA Community organizations

NbS Nature based solutions

NLA National and local government authorities

OECC Spanish Office for Climate Change (Oficina Española del Cambio Climático)

PIMA Environmental Promotion Plans for Climate Change Adaptation (Plan de Impulso al Medio Ambiente para la Adaptación al Cambio Climático)

PNACC National Climate Change Adaptation Plan (Plan Nacional de Adaptación al Cambio Climático)

PSO Private sector organizations

WWTP Wastewater Treatment plan

1 Introduction

Adaptation to climate change has been a priority objective for Spain, due to the high vulnerability of the Spanish coastline to the effects of climate change. Spain was one of the first European countries to develop an adaptation policy, materialized in 2006 with the approval of the National Climate Change Plan Adaptation (PNACC). The new PNACC 2021-2030 is currently the basic planning instrument to promote coordinated action against the effects of climate change in Spain. Its main objective is to avoid or reduce present and future damage from climate change and to build a more resilient economy and society. The PNACC 2021-2030 has been the result of a collective process of analysis, reflection and public participation. The PNACC was also inspired by the **LIFE SHARA project**, whose general objective is to improve the governance of adaptation to climate change and increase resilience in Spain and Portugal (Sanz et al, 2020).

Additionally, the so-called **PIMA Adapta Plans** (Environmental Promotion Plans for Climate Change Adaptation) are an operational tool since 2015 to support the achievement of the objectives of the PNACC 2021-2030 at regional and local level. PIMA Adapta Plans have become an important instrument for developing the full adaptation cycle in Spain, contributing in all phases (knowledge generation, governance, sectoral integration, actions on the ground, monitoring, etc.) and promoting action at all levels (administrative, academic, private and NGO).

In the coastal area, the main initiative for climate change adaptation is the Strategy for Adaptation to Climate Change on the Spanish Coast (MAPAMA, 2016) launched in 2016 and based on the results of the study entitled "Climate change on the Spanish coast" (MAPAMA, 2014). This Strategy calls for the integration of urban planning and climate change projections. This strategy is complemented by **regional strategies developed to protect the coast** considering the effects of climate change and derived risks in the coastal areas, developed by the national coastal agency.

Law 2/2013, of 29 May, on the Protection and Sustainable Use of the Coast, incorporates climate change aspects into the previous Spanish Coastal Law (Law 22/1988, of 28 July) that regulates the determination, protection, use and policy of the maritime-terrestrial public domain and especially the seashore.

In the urban and built environment, there are initiatives to promote climate change adaptation such as Spanish Network of Cities for Climate that brings together cities and towns committed to sustainable development and climate protection. Its objective is to be a technical support instrument for Spanish local governments, (who have the responsibility of urban planning) providing them with tools that allow them to achieve a sustainable development model, while at the same time serve as a forum in which to exchange knowledge and experiences on the field. Several Spanish cities have carried out analysis of impacts and vulnerability at the local scale and a growing number of municipalities have strategies or plans for climate change, which contain objectives and actions in terms of adaptation. However, regulations related to urban planning and capacities in local institutions need to be strengthened to address climate change adaptation challenges.

2 Built environment stakeholders linked to climate change adaptation

2.1 Description of key stakeholders

Spain is predominantly a coastal country, with almost 8,000 km of coastline, and a long history in managing the coast, due to the environmental and physical problems derived from the rapid urbanization of the Mediterranean coast from the 60´s. Therefore, in Spain there is a range of stakeholders related to the climate change adaptation in the built environment in coastal areas. There is no particular initiative or institution that specifically focuses on this topic, but climate change adaptation, coastal management and urban planning are addressed independently and they converge in the territory.

According to stakeholder consultation, many climate change adaptation initiatives are developed in the framework of environmental conservation, and stakeholders with multidisciplinary and environmental background, such as environmentalists and geographers, have more experience in climate change adaptation and have become more aware of the effects of climate change and the need for adaptation. In general, raising awareness and disseminating climate change adaptation requires more efforts. There are some initiatives to share knowledge in climate change adaptation such as the AdapteCCa platform that collects and presents practical climate change adaptation cases and experiences in Spain and Europe. This initiative, developed by the Ministry for Ecological Transition and the Demographic Challenge (MITECO) in the framework of the LIFE SHARA project, has the collaboration of the Spanish Office for Climate Change (OECC), the Biodiversity Foundation and the Environmental Education Centre (CENEAM).

Following sections briefly describe the built environment stakeholders linked to climate change adaptation in coastal areas in Spain, classified in the stakeholder categories defined in Output 4.

2.1.1 Local, Regional and National Governments

The government administration is divided into three levels: national, regional (Spain has 17 Autonomous Communities – regions) and local, with their corresponding functions and competences. In large regions such as Andalusia, there is an additional level: Provinces, which are subdivisions of the Autonomous Community.

Coastal protection and management, and climate change adaptation are mainly managed from the central administration in coordination with the Autonomous Communities. In urban planning, municipalities play an important role in the elaboration of land use plans and the implementation of site-specific measures. The following paragraphs describe the main stakeholders at different administration levels:

At the national level, the agencies with specific functions or a relevant role in climate change adaptation in coastal areas are:

- Spanish Office for Climate Change (OECC), under the Ministry for Ecological Transition and the Demographic Challenge, is responsible for developing policies related to climate change, and developing and implementing the PNACC in coordination with other agencies.
- The Directorate General for the Coast and the Sea (DGCM), under the Ministry for Ecological Transition and the Demographic Challenge, is responsible for the management of the maritime-terrestrial public domain and the development of policies for the conservation of the coast and the sea. Its objective is to protect the coastal and marine environment and to guarantee its public and free use, considering the effects of climate change. It is also responsible for coordinating, together with the regions, local authorities and public bodies, actions or projects that contribute to the protection and conservation of the coast and the sea. The DGCM has regional and province offices; in total, there are 13 Demarcations and 12 Provincial Services.
- It is worth mentioning the **State Meteorological Agency (AEMET).** Within the framework of the PNACC, it coordinates efforts in the field of climate change scenarios research.
- The Ministry of Transport, Mobility and Urban Agenda (MITMA) collaborates in various action lines of the PNACC and in the implementation of Agenda 2030.

At the regional level, the Autonomous Communities have the competencies in urban and regional planning matters and establish strategic lines to be adopted by the municipalities. The Autonomous Communities have different internal structures, but most of them have specific departments focused on environmental issues that address climate change adaptation and planning and departments of land use planning.

At a local level, municipalities have the competencies in land use and urban planning and implement site-specific climate change adaptation and environmental conservation site-specific measures.

2.1.2 Private Sector

The private sector has a relevant role because they contribute with technical solutions and necessary analyses to carry out actions in the built coastal environment. They also implement climate change adaptation measures and mitigation strategies at the organizational level, produce products and provide services to relevant organizations to be used in climate change adaptation and mitigation measures.

Private companies/consultants are usually hired by municipalities to elaborate land use and urban plans.

2.1.3 Community

Community organizations actively promote the dissemination of knowledge, carry out awareness campaigns related to climate change. They also implement climate change adaptation measures and mitigation strategies at local level and agitate to improve the quality of measures employed by government, non-governmental and private organizations.

2.1.4 Civil and professional organisations

The purposes of the professional associations are the regulation of the practice of the professions, the exclusive representation of the professions and the defence of the professional interests of the members. Its role in climate change adaptation is informative and supportive. Professional organizations are involved in updating existing legislation and processes, so they could have an interesting role in mainstreaming climate change adaptation into sectoral regulation. Three professional organisations related to climate change adaptation to climate change adaptation in the built environment have been identified: geographer, arquitectcs and civil engineering professional associations.

Other civil organizations include non-profit associations, mainly related to the environmental and social protection, including some climate change adaptation initiatives.

2.1.5 Academia and research organisations

The research developed by universities and research centres is key to direct actions in the coastal built environment. They also train and conduct research on climate change adaptation and mitigation measures and contribute to the development of national policies on climate change. Some responsibilities associated with these stakeholders are developing and revising the curriculum of courses that explore climate change adaptation and mitigation, dissemination and exploitation of research findings to all social layers and participating in the drafting of policies, national plans and strategies relevant to climate change.

2.2 Primary data collection findings

The primary data collection process in Spain included 16 interviews with key stakeholders related to climate change adaptation in the coastal built environment:

Category	Code	Stakeholder interviewed
Local, Regional and National Governments	NLA_1	DGCM - provincial delegation (Tarragona)
	NLA_2	Santander Port Authority
	NLA_3	Regional Government – Office of Public Works and Urban Planning
	NLA_4	National Port Authority
	NLA_5	Municipality – Environmental department of Chipiona (Cádiz)
	NLA_6	Municipality – Planning Department (Arnuero, Cantabria)
	NLA_7	Spanish Office for Climate Change

Private sector	PSO_1	Red Cambera
	PSO_2	Planea - Medio Ambiente y Urbanismo
Civil and professional organisations	CPO_1	Civil engineers professional organization
	CPO_2	Geographer's professional organization
	CPO_3	Architect professional organization
Academia and research organisations	AR_1	BC3 Basque Centre for Climate Change
	AR_2	University of Cantabria - IHCantabria - Coastal Management and Engineering research group
	AR_3	University of Cantabria - IHCantabria – Climate Change research group
Community organizations	CO_1	MedCities: CCA in urban areas in the Mediterranean cities

These stakeholders identified other agencies and institutions that perform relevant activities and function in climate change adaptation in the built environment, listed in the following table:

Category	**Stakeholder linked to climate change adaptation**	**Main functions/activities developed**
International organizations	Mediterranean Action Plan (MAP) - UN Environment Programme	Setting environmental policies and plans. Capacity building.
	Ocean Climate Platform	Global platform focused on climate change adaptation in coastal areas at the Mediterranean region (https://ocean-climate.org/en/seaties-2/).
	European agencies such as the Environmental Agency	Promoting and funding CCA studies and measures.
	International Financial Organizations (IDB, WB, UNDP, etc)	Funding climate change adaptation studies and measures.
Local, Regional and	MITECO	Environmental policies.
	Fundación Biodiversidad	Funding and channelling funds for implementing CCA options.

National Governments	Working Group on Impacts and Adaptation (GTIA)	GTIA brings together technicians and officials of the General State Administration and the Autonomous Communities in adaptation matters. The GTIA has the general objective of coordinating the development of strategic frameworks and adaptation actions that are carried out at the regional and central levels, and meets regularly to exchange information and monitor progress and results of projects and initiatives which are developed under the framework of the PNACC and the adaptation planning frameworks of each Autonomous Community.
	FEMP	Promotion of CCA options at municipal level. Development of training and online workshops, such as adaptation of cities through renaturation.
	Public administration officials	Contributions to EIA.
	Municipalities	Competence in urban planning. Implementation of local CCA measures. Agreements for land stewardship.
	Regional governments (17 Autonomous Communities)	Finance and decide priorities for developing NbS on the territory.
	Regional government - Urban planning departments	Regional land use planning.
	Regional government - CCA departments	Elaboration of strategies and plans for CCA and integration into land use planning.
Regional government – Andalucia*	Coastal provinces, such as Cadiz Province Government	Elaboration of the CCA Strategy for Cadiz province that defines CCA measures for the coastal area of Cadiz..
	Sustainable development delegation	Idem
	Cantabria Government	Agenda 2030 and SDO. Finance and decide priorities for developing NbS on the territory.

Regional government – Cantabria*	General Direction of Urban Planning	Regional land use planning.
	GESVICAN	Promotion and management of social housing.
Regional government – Basque Country*	Bilbao Municipality	Sectoral activities related to environmental conservation, sustainability and CCA in the Basque Country.
	Basque Country Governm.	
	IHOBE (Environmental Dept.)	
	URA Basque Water Agency	
	Bilbao Water Company	
	Bilbao Port Authority	
	Plentzia Marine Institute	
Private sector	Companies specialized in EIA	EIA including climate change aspects.
	Companies specialized in urban planning	Urban planning.
	Environmental educators	Capacity building in CCA.
	TRAGSA	Company made up by public companies to elaborate technical studies.
	Ecovidrio	Glass recycling https://www.ecovidrio.es/.
	Ecoembes	Promotion of environmental and climate change actions.
Civil and professional organizations	SEO Bird Life	Birds and biodiversity conservation. Elaboration of the “Guide for climate change adaptation in schools”.
Community	Neighbourhood boards	Implementation of CCA options in residential buildings.

	Local communities	Beneficiaries/impacted by CCA initiatives. Provide inputs and ideas for the design, development and implementation of CCA measures.
	Volunteers in environmental/social initiatives	Implement actions as environmental monitoring and identify climate change effects on the territory.
	Local associations	Support to implement projects.
Academia and research organisations	Universities	Elaboration of CC studies.
	Universidad de Málaga - ETC	Leads "Biodiversity Community project" and works in the field of forestry and climate change adaptation.
	Universidad de Cantabria - IHCantabria	Analyses climate change impacts and adaptation measures in the coastal environment.
	IFCA	See: https://ifca.unican.es/en-us/research/meteorology-and-climate-change
	National Environmental Education Centre (CENEAM)	Collection and dissemination of specialized information on environmental education, design and development of citizen awareness and participation programs; elaboration of educational materials and exhibitions; organization of seminars and forums; development and execution of environmental training actions; cooperation with other public and private entities for the promotion of environmental education, including climate change adaptation.

** three examples of Autonomous Communities government (regional level).*

3 Role and Responsibilities of the built environment stakeholders in climate change adaptation

No	Stakeholder Description	Key role in climate change	Responsibilities related to climate change adaptation				Any remarks on the current status
			Planning and designing	Construction	Occupancy /Usage	Retrofitting	
NLA_1	DGCM - Tarragona provincial delegation (Organisational contribution). Provincial delegation of DGCM that has the competence for the protection and management of the coastal area.	Elaboration of studies on the effects of the climate change on the coastal morphology and processes. Planning and implementing coastal protection works, such as definition of setbacks, breakwater in Cambrils and Ebro delta.	Design of coastal protection works. Elaboration of flood and regional adaptation plans. Ensuring urban planning consider the requirements of the Spanish Coastal Law and of the Coastal Protection Strategy.	Implementation and/or construction of planned coastal protection measures.	Definition of setbacks Definition and licensing coastal uses and activities in the public domain. Consideration of the concept: "living with climate change".	Emergency works (repairs) and elaboration of maintenance and conservation plans to prevent extreme and damaging events.	
	(Personal contribution)		Concern and personal commitment (applied in all phases) from the 90´s. Early publication of scientific papers related to ACC in Ebro delta. Promotion of the first urban setback in the Spanish coast.				

No	Stakeholder Description	Key role in climate change	Responsibilities related to climate change adaptation				Any remarks on the current status
			Planning and designing	Construction	Occupancy /Usage	Retrofitting	
NLA_2	Santander Port Authority	No specific works or approaches related to CCA. Other regional Port Authorities have CCA Plans.	-	-	-	-	
NLA_3	Regional Government – Office of Public Works and Urban Planning	CC is a transversal issue in territorial planning. Urban environmental assessment of projects, including CC considerations.		Environmental impact statements	Control of the use of rural land	-	
	(Personal contribution)		Promotion of plans and regulations in all phases of the regional land use plan (implementation and creation)				
NLA_4	National Port Authority. Dept. related to CCA: - Port infrastructure (PI) - Physical environment (PE)	PI: Coordinate/review port infrastructure projects. PE: Monitoring wave climate and elaboration of the report *Vulnerability of Spanish ports to climate change.*	Ensuring that studies and reports related to the port infrastructure include a CCA annex.				
	(Personal contribution)		Enforcement of the requirement (CCA annex of the port infrastructure projects)				

No	Stakeholder Description	Key role in climate change	Responsibilities related to climate change adaptation				Any remarks on the current status
			Planning and designing	Construction	Occupancy /Usage	Retrofitting	
NLA_5	Chipiona municipality	Collaborate in the elaboration and implementation of the CCA strategy at provincial level.	Regulatory compliance. Spatial planning. Promoting circular economy and CC mitigation actions.	Regulatory compliance. Working with Innovative equipment and sustainable materials.	Regulatory compliance.	Regulatory compliance. Rehabilitation of dunes.	The municipality has no funds to conduct specific CCA activities and technicians find many difficulties to get EU and external funding.
NLA_6	Arnuero municipality	No direct work on CCA, but the municipality works on environmental protection and creation of territorial models of sustainable tourism.	Urban planning. Design of a sustainable territorial model.	Development of environmental protection projects			
			Management	Coordination			
NLA_7	OECC (Organisational contribution).Two main working areas:	Mitigation and adaptation responses to climate change.	Mainstream CCA into sectoral policies and strategies. Incorporate CCA into laws.				

No	Stakeholder Description	Key role in climate change	Responsibilities related to climate change adaptation				Any remarks on the current status
			Planning and designing	Construction	Occupancy /Usage	Retrofitting	
	1) Carbon markets 2) a) Mitigation and b) adaptation	Elaboration of the PNACC.	Implement the PNACC in coordination with competent agencies.				
PSO_1	Red Cambera	Design and implementation of nature based solutions, environmental conservation and citizen science actions with a climate change adaptation approach. Association: 4 people, horizontal structure. https://redcambera.org/	Design and implement site-specific NbS with CCA approach to the territory				
	(Personal contribution)		Mainstream CCA and citizen science into the association´s activities, such as R4C project, including dissemination and participatory approaches.				
PSO_2	Planea - Medio Ambiente y Urbanismo	Transversal to all activities performed: in urban planning, land use planning, civil works and environmental impact assessment.	Drafting of plans, projects and programs.	Related to environmental impact assessments: environmental monitoring and construction management	Environmental monitoring	Drafting the database of degraded areas of Cantabria and priorities for rehabilitation.	

No	Stakeholder Description	Key role in climate change	Responsibilities related to climate change adaptation				Any remarks on the current status
			Planning and designing	Construction	Occupancy /Usage	Retrofitting	
				(construction monitoring)			
	(Personal contribution)		Total involvement in all the project phases				
CPO_1	Civil engineers professional organization	A committee works on CC and urban planning.	Environmental and CC related variables shall be incorporated in all the phases of engineering projects. To follow existing codes and regulations when developing engineering projects and plans.				
CPO_2	Geographer's professional organization		Participation in public information and issuance of EIA reports.	NA	NA	NA	
	(Personal contribution)		Work with multidisciplinary teams. Integration of environmental aspects into land use planning.	NA	NA	NA	

No	Stakeholder Description	Key role in climate change	Responsibilities related to climate change adaptation				Any remarks on the current status
			Planning and designing	Construction	Occupancy /Usage	Retrofitting	
CPO_3	Architect professional organization (COACAN)	COACAN does not work directly in ACC. Indirectly, through education and training and adaptation of current legislation to emerging issues such as climate change.	Dissemination and tools training.	NA	NA	NA	
	(Personal contribution)		Promotion of sustainable drainage management, which is not compulsory.	NA	NA	NA	
AR_1	BC3	Four main research lines: Low Carbon; Climate and Natural Environment; Health and Climate; and Climate Policy. Specific research related to adaptation in urban areas.	Contribution as a research centre, at pre-phase to support, decision-making, and studies prior to planning and design.	NA	NA	NA	
	(Personal contribution)		Scientific and other publications, e.g.: guide to uncertainty	NA	NA	NA	

No	Stakeholder Description	Key role in climate change	Responsibilities related to climate change adaptation				Any remarks on the current status
			Planning and designing	Construction	Occupancy /Usage	Retrofitting	
			management in decision making for WWTP design.				
AR_2	IHCantabria - Coasts	CCA approaches are embedded in all studies carried out such as studies os coastal morphology, design of coastal protection measures, disaster risk assessments and elaboration of coastal management plans under ICZM principles.	Development of tools and methodologies to support coastal engineering and management. Elaboration of coastal diagnosis and management plans. Design of DRM and CCA measures in coastal areas.	Monitoring and follow-up plans to monitor responses of the coastal environment due to the implementation of CCA and coastal protection measures.		Design of reconstruction of coastal protection infrastructures .	
AR_3	IHCantanria - CC	Climate change risk analysis	Analysis of the possible effects of CC on the built elements and providing tools for CC-adapted design.				
	(Personal contribution)		Analysis of the possible effects of CC on the built elements.				

No	Stakeholder Description	Key role in climate change	Responsibilities related to climate change adaptation				Any remarks on the current status
			Planning and designing	Construction	Occupancy /Usage	Retrofitting	
NO_1	MedCities, association of Mediterranean cities, buils capacities and helps empower Mediterranean local governments to achieve their strategic prioritiesand to meet the challenges of local governance in a sustainable way.	Mitigation is addressed more than adaptation. Promotion of non-conventional water uses.	Awareness raising and trainings to strengthen institutions and citizens.				
	Personal contribution		Participation in Barcelona City Council debates to rethink the future of the coastal front, from the point of view of governance.				

4 Challenges faced by built environment stakeholders in implementing climate change adaptation

4.1 Challenges in Spain for climate change adaptation

- Energy rehabilitation (for winter and summer), especially in most vulnerable neighbourhoods. Case study in Barcelona: climate shelter network programme to offer thermally comfortable public space.
- Rehabilitation of buildings built from the 50´s-60´s.
- Increased climate-related risks in coastal areas (such as those related to sea level rise, coastal erosion, extreme events)
- Understanding the uncertainty of climate-related risks in coastal areas.
- Specific training of professionals in climate change adaptation and develop specific curricula.
- Adaptation of the coastal front, including the relocation or resettlement of activities and uses on this area.
- Adaptation to warmer temperatures.
- Adequacy of traditional profiles and studies to new demands related to climate change adaptation.
- Raising awareness of professionals, society and politicians.
- Adapt urban and land use plans to sea level rise.
- Elaborate and disseminate risk maps useful for supporting decision-making.
- Capacity building in re-naturalization.
- Increased land use planning (to avoid unplanned development)
- Increased management capacity of neighbourhoods (building managers).
- Facilitate access of local authorities to climate change adaptation funds.
- Rethinking new urban models, considering population trends and social and environmental approaches.
- Reuse spaces for green and blue infrastructure.
- Open minds to implement more sustainable approaches.
- Analyse and understand vulnerability of coastal and port infrastructures.
- Adaptation/adjustment of national regulation to local characteristics and the capacities of local authorities.
- Strengthening participatory governance: success of CCA actions relies on their acceptance by the society.

4.2 Organisational Challenges

No	Stakeholder Description	Challenges	Reasons for the challenges	Possible solutions
NLA_1	DGCM - provincial delegation (Tarragona)	Raising public awareness of the risks of CC.	-	Design and implement communication strategies, information campaigns, establish action protocols, promote pedagogy approaches for communication and raising awareness.
		Implementation of the plans, considering the different stakeholders.	-	Coordination at all administrative levels.
		Raising awareness in the private sector.	-	Develop and disseminate CCA studies.
NLA_2	Santander Port authority	General port infrastructure reconfiguration and pontoons in marinas.	-	-
NLA_3	Regional Government – Office of Public Works and Urban Planning	Consider CC effects in the planning phase		Pedagogy. Demand for compliance with regulations. Creation of normative tools.
		Lack of scientific information and cartography reflecting CC risks and effects; and dissemination of this information.		Conducting studies and producing associated cartography. Financial resources are needed.
		Approval of the regional land use plan of Cantabria (associated with political changes).	-	A matter of time

No	Stakeholder Description	Challenges	Reasons for the challenges	Possible solutions
		Change in transportation/mobility.	-	Outreach for public transport use
NLA_4	National Port Authority	Identification of the critical CC variables that most affect the infrastructures.		Updating variables according to monitoring and evaluation results.
		Quantify the impact of critical variables over the useful life of the project.		
NLA_5	Chipiona municipality	Reducing carbon footprint		Installation of photovoltaic panels. Creation of energy communities. Programmes for reforestation of forests.
		Funding CCA measures (staff, studies, etc.). there are many funding opportunities such as EU programs but most of the municipalities are not skilled and have no human resources to apply for these funding opportunities.		
NLA_6	Arnuero municipality	Not enough knowledge about the effects of CC.		Being part of a network of continuous training: participation in courses, forums and working groups.
		Improve the qualification of professionals in relation to CC.		Policy implementation at national and/or regional level.
NLA_7		Raising awareness to consider climate risks and adaptation.		Updating management systems to incorporate CCA issues.

No	Stakeholder Description	Challenges	Reasons for the challenges	Possible solutions
	Spanish Office for Climate Change	Change minds and ways of working.		Raising awareness and creation of forums and multidisciplinary working groups to discuss on CCA.
		Restoration of the coastal front considering the increase of frecuency of extreme events.		
PSO_1	Red Cambera	Involve citizens in decision –making.		Improving direct contact with people, instead of the use of digital methods such as online tools and Apps. Involving other sectors as arts and sociology in participatory processes. Bringing the territory closer to the people.
		Funding.		-
PSO_2	Planea - Medio Ambiente y Urbanismo	Availability of reliable CC prediction models for planning.		Investment in resources for model creation.
		Forecasting tool for estimated sea level rise.		Investment in resources for the creation of the tool.
CPO_1	Civil engineers professional organization	Make it easier to understand the CC to professionals, general public and public administrations.		Translating CC into an easy-to-understand language: approaching it from a less scientific level.
		Addressing medium- and long-term planning (so far it is all at the project level, specific actions).		To address long-range strategies to include CC effects

No	Stakeholder Description	Challenges	Reasons for the challenges	Possible solutions
		Creation of a culture to address CC.		Disclosure in general. Generation of strategies, directives, guidelines.
CPO_2	Geographer's professional organization	Promote in-depth knowledge of the territory.		Analyse the territory and the planning alternatives; public participation.
		Protection of soil resources, water resources and coastal territory.		
CPO_3	Architect professional organization	Low awareness and dissemination of other CCA initiatives.		Increased dissemination of other CCA initiatives.
		There is a lack of outreach, especially among building architects (urban planners are somewhat more aware). The implementation of urban furniture such as benches "sells" more than green initiatives, such as those that improve biodiversity, in urban design.		Raising awareness at all levels.
AR_1	BC3	Reducing the uncertainty of climate change scenarios for planning purposes.		
		Reducing the gap between scientific knowledge and practice at the planning level.		
		Lowering institutional barriers: knowledge vs. legal bases.		Promoting know-how.
AR_2	IHCantabria - Coasts	Be updated on data, tools, policies related to coastal engineering.		Constant updating with training and research.

No	Stakeholder Description	Challenges	Reasons for the challenges	Possible solutions
AR_2	IHCantabria - CC	Keeping up to date with the state of the art at the global level.		Studying/training.
		Improve the methodologies used		Application of what has been studied/learned
CO_1	MedCities	Cities seek traditional and short-term solutions, rather than more sustainable long-term NbS.		Accompanying cities to develop strategic development and knowledge exchange.

4.3 Personnel / individual Challenges faced by the Professionals

No	Stakeholder Description	Challenges	Reasons for the challenges	Possible solutions
NLA_1	DGCM - provincial delegation (Tarragona)	Dissemination of climate change with a realistic perspective, carrying out demonstrative actions.	-	-
NLA_2	Santander Port Authority	-	-	-
NLA_3	Regional Government – Office of Public Works and Urban Planning	-	-	-
NLA_4	National Port Authority	Ensure that all dyke, dock and dredging projects include the CCA annex.		Perseverance for the day-to-day work in coordination with local port authorities and consultants.
NLA_5	Chipiona Municipality	Empathy and awareness of the team members.		Raising awareness campaigns.
NLA_6	Arnuero Municipality	Improving the qualification and training in CC-related topics		Being part of a network of continuous training: participation in courses, forums and working groups.
NLA_7	Spanish Office for Climate Change	To go more deeply into the issues affected by the CC. Have time for discussion among team members, organisations, and stakeholders		Create fora and open spaces for dialogue.

		with different backgrounds and experiences.		
PSO_1	Red Cambera	Do not fall into pessimism	-	Read and listen to new proposals and alternatives, and knowledge people.
PSO_2	Planea - Medio Ambiente y Urbanismo	-	-	-
CPO_1	Civil engineers professional organization	To address the issues raised at the organizational level.	-	Training.
CPO_2	Geographer's professional organization		-	-
		Contribute to the energy transition without transforming the territory.		Analyse existing alternatives.
AR_1	BC3	Address both mitigation and adaptation schemes.		Considering co-benefits of mitigation-adaptation. Considering mitigation in advance.
		Do not forget the global context when analysing scientific studies: climate change has negative impacts.		Not limiting oneself to scientific knowledge, looking beyond it.
AR_2	IHCantabria - Coasts	Training and capacity building in tools for the analysis of climate change effects. Develop studies that are easily understood by the authorities.		Training.
AR_3	IHCantabria – CC	Keeping up to date with the state of the art at the global level.		Studying/training.

		Improve the methodologies used		Application of what has been studied/learned.
CO_1	MedCities	Consider CCA as a priority in urban agendas.		Raising awareness.

5 Educational Training Framework

5.1.1 Training required to become a professional

In Spain no specific training is required to become a "climate change adaptation professional". Experts in climate change adaptation include different professionals, backgrounds and experiences.

Environmentalists and geographers interviewed stated that their background studies, with a multidisciplinary view, holistic understanding of the complex territorial problems and an "open mind" have facilitated awareness and learning in climate change adaptation. Other professional, such as civil engineers have applied their technical knowledge of the physical processes to the design of climate change adaptation measures. In general, architects (who usually elaborate land use plans), layers and other professionals are less aware of climate change adaptation and therefore, we found less learning opportunities for these sectors in Spain.

On the other hand, climate change adaptation is poorly addressed under the existing university degrees, according to stakeholder consultation. However, there are some institutional incipient initiatives to update study plans to address climate change aspects.

Climate change is mainly addressed in postgraduate programs: MSc and PhD. The following link (https://www.educaweb.com/masters-oficiales-de/cambio-climatico/) presents a selection of master programs focused on different aspects of climate change. In the coastal areas, the MSc and PhD programs of the University of Cantabria in coastal engineering and management and in Disaster Risk Management are interesting programs addressing climate change adaptation approaches.

No	Professionals	Formal Education in Climate Change Adaptation	Educational Institute / Provider	Link	Strengths acquired from Formal Education Received on Climate Change Adaptation	Challenges and Gaps Experienced due to lack of Formal Education in Climate Change Adaptation	How would you address these challenges and gaps through formal education?
1	Architect	No	-		During formal education, there is no specific CCA training, but there are various aspects that contribute to the implementation of the CCA measures, e.g. such as construction, materials, logistics, etc.	Unawareness of climate change impacts. Climate change adaptation is not a priority topic to be addressed. Water management.	
2	Civil engineers	There is no specific CCA training in formal education. Only CCA approaches in	University of Cantabria	MsC Coastal and Ports Engineering Phd IH2O	In postgraduate programs: - analysis of effects of climate change on met-ocean variables	Dissociation between coastal planners and managers: territorial planning needs to be taken into account	Understanding of the physical basis. E.g.: relationship between emissions and air temperature.

No	Professionals	Formal Education in Climate Change Adaptation	Educational Institute / Provider	Link	Strengths acquired from Formal Education Received on Climate Change Adaptation	Challenges and Gaps Experienced due to lack of Formal Education in Climate Change Adaptation	How would you address these challenges and gaps through formal education?
		postgraduate programs: - MSc and PhD related to hydraulic and coastal engineering and management - Environmental PhD			- disaster risk assessment (coastal erosion, flooding) - design and analysis of infrastructures and their vulnerability, such as coastal protection measures - analytical analysis and methodologies.		
3	Law graduates	No. Experts working in CCA usually have experience in	-			Architecture, engineering and urban planning.	Attendance to seminars and conferences, not only to formal training.

No	Professionals	Formal Education in Climate Change Adaptation	Educational Institute / Provider	Link	Strengths acquired from Formal Education Received on Climate Change Adaptation	Challenges and Gaps Experienced due to lack of Formal Education in Climate Change Adaptation	How would you address these challenges and gaps through formal education?
		ICZM, land-sea interactions and EbM approaches					Incorporating experts in projects (outsourcing)
4	Geographers	No	-	-	Holistic understanding of territorial problems Environmental knowledge	Lack of information re CC Engineering aspects for implementing CC adaptation measures	-
5	Biologists Environmentalist	There is no CCA in formal education. Only in recent postgraduate programs: diplomas, MSc and PhD	Universidad de Valencia	Diploma of specialization in climate change and environmental sustainability	Open minds to face complex challenges as CCA	Learn to analyse where it is feasible to implement the actions	

5.1.2 Continuing Professional Development Opportunities

Public institutions and private entities offer diverse courses on climate change. For instance, MITECO compiles a selection of short training courses on climate change for professionals including MOOCs developed by Spanish universities, CENEAM, international financial organizations and other entities (see: www.miteco.gob.es/es/ceneam/recursos/mini-portales-tematicos/Cclimatico/formacion-cambio-climatico.aspx*).* These courses, and those developed by private entities (for instance: https://geoinnova.org/curso/cambio-climatico/) are open to different students and professionals, but are not compulsory for any professional in the field of climate change adaptation.

These courses are not intended for any specific profession. Results in the table must be considered as general results, applicable to different professionals.

No	**Professionals** **(Provide where applicable and additional)**	**CPD in Climate Change Adaptation**	**Educational Institute / Provider**	**Link**	**Strengths acquired from CPDs Received on Climate Change Adaptation**	**Challenges and Gaps Experienced due to lack of CPDs in Climate Change Adaptation**	**How would you address these challenges and gaps through CPDs?**
1	Architecture	Not specific in CCA. Other or related CPD: Passive house, legislation updates. Training courses and events (round tables,	Architecture professional association.	-	-	Lack of awareness of climate change impacts in the profession.	-

No	Professionals (Provide where applicable and additional)	CPD in Climate Change Adaptation	Educational Institute / Provider	Link	Strengths acquired from CPDs Received on Climate Change Adaptation	Challenges and Gaps Experienced due to lack of CPDs in Climate Change Adaptation	How would you address these challenges and gaps through CPDs?
		presentations...) are planned based on specific needs.					
2	Civil engineering	Short courses on climate change impacts and tools for designing CCA measures.	MITECO Private entities Civil Engineer's Professional organization (not specific in CC) Universities and	See above	-	Communication to general public and institutions.	Training on effective communication and dissemination of results. Courses on tools to assess flood risks in spatial planning and decision-making. Awareness-raising/outreach workshops/lectures/courses that emphasize the need to incorporate CC into processes and projects, for

No	Professionals (Provide where applicable and additional)	CPD in Climate Change Adaptation	Educational Institute / Provider	Link	Strengths acquired from CPDs Received on Climate Change Adaptation	Challenges and Gaps Experienced due to lack of CPDs in Climate Change Adaptation	How would you address these challenges and gaps through CPDs?
			research centres				decision-makers and society in general. Courses of scientific communication of CC.
3	Law	Not specific	EuroMed Academy	https://www.interreg-euro-med-academy.eu/			
4	Geography	Invasive species course (includes CC). Forum and discussion panels.	-	-	-	-	Personal/self-taught training,
5	Biology/environment	Courses on climate change	OECC		Multidisciplinarity	Monitoring and assessment of the actions	

No	Professionals (Provide where applicable and additional)	CPD in Climate Change Adaptation	Educational Institute / Provider	Link	Strengths acquired from CPDs Received on Climate Change Adaptation	Challenges and Gaps Experienced due to lack of CPDs in Climate Change Adaptation	How would you address these challenges and gaps through CPDs?
		for MITECO staff.				already implemented.	

6 Assessment of the regulatory framework for built environment professionals related to climate change

In Spain, the regulatory framework for professionals follows the European framework (see: https://ec.europa.eu/growth/tools-databases/regprof/home). There is a set of regulated professions that include, among others, professions related to health, architecture and engineering, closely related to climate change adaptation in the built environment. However, many professions related to this topic, such as geographers, biologists, or environmentalists are not regulated in Spain, or if regulated, these professions do not correspond to a specific background or university degree. Therefore, other professionals such as civil engineers can perform climate change adaptation measures related to geography or environmental protection without the necessary background.

In any case, climate change adaptation is not considered in this regulatory framework.

According to the information provided by interviewees, Fundacion Biodiversidad is currently working on the analysis of professions in the field of climate change adaptation to identify needs and proposals to improve the curriculum of certain courses and degrees.

No	Professionals	*Is there a regulatory framework for the professionals related to climate change?*	*Licensing Requirements*	*Mutual Recognition Framework*	*Number of Registered Professionals*	*Employment Statistics*[1]
1	Architecture	The regulatory framework for architecture does not address climate change. Professionals (or their companies) must be associated to the professional association for building design, urban planning and for the elaboration of technical studies. Legislation available at: https://www.cscae.com/index.php/modulo-	Building requires licensing.		≈ 50,000	78.7% employment rate

[1] National Statistics Institute. mployment situation in 2014 of university graduates in the academic year 2009-2010. Relative figures: https://www.ine.es/jaxi/Datos.htm?path=/t13/p100/2014/p02/&file=06009.px

		arquitectos/293-ejercicio-profesional/7266-legislacion-sobre-la-profesion				
2	Civil Engineering	The regulatory framework for architectures does not address climate change. Professionals (or their companies) must be associated to the professional association to design of engineering projects (i.e. breakwaters) and for the elaboration of technical studies. These projects can be related to CCA in coastal areas, specificalaly in the design of coastal protection measures.	Construction works require licensing, including EIA in some cases.		25,127 (2021)[2]	83% employmet rate ≈ 3% unemployment[3]
3	Law	Not directly	Not for CCA			71% employmet rate
4	Geographer	No	Not for CCA		1,329 (2019)	60.4% employmet rate 19.20% unemployment[4]
5	Biologist / Environmentalist	No	Not for CCA		Madrid (2021): 1,801	63% employmet rate
6	Agriculture engineers	No, it is a regulated profession but regulation do not cover climate change adaptation	Yes, but not CCA activities			82% employmet rate
7	Economist	No	No			77.4% employmet rate

[2] Source: http://www3.ciccp.es/wp-content/uploads/2022/06/CICCP-Memoria-2021-Con-Auditoria-2.pdf
[3] Source: http://www3.ciccp.es/el-colegiado/#:~:text=M%C3%A1s%20de%203.000%20ingenieros%20de,construcci%C3%B3n%20de%20todo%20el%20mundo.
[4] https://www.geografos.org/geografia-entre-las-20-titulaciones-con-menores-tasas-de-empleo-en-espana/

7 Identification of skill gaps

7.1 Anticipation of skills needed for climate change adaptation

According to stakeholder consultation, at least the following skills are necessary for climate change adaptation in the built environment in coastal areas:

- Communication and dissemination to professionals, institutions, general public, etc. (This issue has been highlighted by many stakeholders.)
- Sustainable water management.
- Hazard, exposure and vulnerability assessments.
- Impacts identification and assessment.
- Definition and design of climate change adaptation measures (all typologies).
- Land use planning considering DRM and climate change adaptation.
- Methodologies and tools for renaturalization.
- Obtaining funding for climate change adaptation.
- Environmental and physical processes.

7.2 Actions to avoid labor shortages

No labour shortages have been identified by stakeholders. However, it is necessary to raise awareness of climate change adaptation and to integrate climate change adaptation into university studies.

7.3 Incentives in training for climate change adaptation

N/A

7.4 Skill shortages

From the skills needs identified, the following aspects have been identified as the more challenging skill shortages, that could be addressed by improving capacity building in climate change adaptation and university study plans.

- Communication and dissemination to professionals, institutions, general public, etc. (This issue has been highlighted by many stakeholders.)
- Climate change impacts and consequences on the built environment.
- Sustainable water management.
- Preparation of proposals to obtain funding from national and European sources.

In general, professionals feel a shortage of awareness of climate change adaptation, dissemination of existing studies and background knowledge.

8 References

APA style references are to be used. All references should be listed in alphabetical order at the end of the report. See below for examples.

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