Climate Change and Strategic Adaptation Planning in Mediterranean Insular Territories: Gathering Methodological Insights from Greek Experiences

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Abstract. In the 3rd Millennium, Climate Change (CC) constitutes a huge, multidimensional and largely impacting challenge for society as a whole, rating at the top of the global policy agenda. It is strongly associated with vulnerability of various types of regions and their capacity to cope with predicted but also largely unknown or not yet fully assessed CC repercussions. Insular territories, in this respect, despite their quite small contribution to CO_2 emissions, seem to be cruelly affected by CC impacts in the years to come. This holds especially true for Mediterranean insular territories, since Mediterranean as a whole constitutes a CC hot spot in the global scenery. Coping with the ominous CC impacts on the spatial capital and socio-economic structure of Mediterranean islands implies the deployment and implementation of comprehensive mitigation and proactive adaptation pathways. The latter is the focus of this paper, attempting to: highlight the contribution of contemporary planning approaches in support of proactive strategic planning for setting up CC adaptation plans; and critically comment on methodological aspects for CC adaptation and related deficits in case of two distinct Greek insular territories – Regions of Ionian and Northern Aegean islands – in order for more robust approaches to emerge to the benefit of addressing CC vulnerabilities in such fragile territorial systems.

Keywords: Climate Change (CC) · Spatial planning and Sustainable development · Mediterranean island territories · CC Adaptation planning · Strategic foresight · Governance

1 Introduction

'We are condemned to shape the future in order to survive' [1].

O. Gervasi et al. (Eds.): ICCSA 2021, LNCS 12958, pp. 100–115, 2021.
https://doi.org/10.1007/978-3-030-87016-4_8

Planning endeavours for informing policy making in seeking sustainability objectives in urban and regional contexts are carried out in a rapidly changing and largely unpredictable global decision environment. Among the key policy concerns in such an environment, *Climate Change* (CC) constitutes a *defining challenge*, the multidimensional and multilevel repercussions of which can assort CC to what in the planning terminology is grasped under the term *'wicked problems'* [2–5]. These are perceived as intractable ones due to the highly unknown or incomplete knowledge; their potential to influence ecological, social and economic realms across various spatial scales [6]; and their unstable or rapidly changing state/nature, to name a few; all exerting enormous pressure on the scientific and policy making communities, while testing their strength in proactive planning and risk/crisis management. Balint et al. [4] claim that confrontation of wicked planning problems is fraught with difficulties, mainly due to two types of *uncertainty*, namely the scientific uncertainty entailed in the solutions of these problems; and the uncertainty as to the way these solutions are grasped and accepted by the various societal and stakeholders' groups.

Notwithstanding the over than two decades intense discussions about CC in the global scene [7, 8] and the concrete directions for urgent action [7, 8], no quite tangible results have yet been reached by many national governments which, in many cases, have failed or fallen short to put in place a well-functioning *climate response and adaptation mechanism as well as related plans*. And although the latest articulated Paris Climate Agreement has been ratified by nearly every nation on earth (197 countries), its targets are not legally binding; hence there is no real obligation for countries to meet them or any sanctions when they fail to do so. Meanwhile, CC disastrous repercussions are intensifying, threatening the environment and its ecosystems and species, the human health and settlements as well as the economy.

Speaking of the spatial differentiation of CC repercussions, while CC is predicted to impact all types of regions, these impacts can, according to the IPCC [7], significantly differ, reflecting regions' diversifying vulnerability and adaptive capacity. In the same report, the high vulnerability of the *Mediterranean region* is highlighted – a region home to 500 million inhabitants, heating 20% faster than world average [8]. In fact, Mediterranean is confronted with multiple environmental stresses and systemic failures due to CC [9], which are expected to highly threaten stability of its natural and socio-economic ecosystems, more than in any other sub-region of the world [7]. According to Plan Bleu [10], key sectors that are expected to be considerably affected by the CC impacts in the Mediterranean are agriculture and fishery, marked by a severe reduction of yields; tourism destinations, the attractiveness of which is expected to be beaten by heat waves and water resource scarcity; coastal areas and infrastructures, being at stake due to the action of waves, coastal storms, extreme weather events and the estimated sea level rise; human health as a result of discomfort to heat waves; and energy sector coping with increased consumption and water deficit for hydropower plants. Additionally, species composition, alien species' invasion, loss of biodiversity, land and sea degradation, debasement of forests due to heat waves and drought, fall among the prominent impacts of CC, affecting vulnerability of Mediterranean region [7].

In the light of the aforementioned threats, there is an urgent need for re-orienting planning endeavours, by shifting from reactive disaster response to a *proactive risk*

management [11], which grasps spatial/sectoral intensity of CC impacts and develops adaptation plans as supplements of other developmental programs and policy pathways to sustainability and resilience. Of critical importance, in this respect, are *insular territories* as quite *fragile and vulnerable* areas in the Mediterranean [12, 13], in need of immediate adaptation to the risky CC incidents. The extremely strong pressures on the natural and cultural ecosystems of such regions, as a result of both the intensifying residential and tourist development trends and the often unregulated location of activities on land and at sea, alter the land- and seascape morphology, surpass carrying capacity of their territories and dramatically increase their vulnerability.

Thus at the heart of this article lie (Mediterranean) *island regions under CC risk*. More specifically, relevant CC adaptation planning efforts of two Greek island regions (NUTS2 level) – namely the Region of Ionian and the one of Northern Aegean – are explored. The *focus* of this work is on methodological aspects, critically examining steps of related adaptation plans and their deficits in order for more robust approaches to emerge when addressing CC vulnerabilities in such fragile insular territories. The work is structured as follows: Sect. 2 elaborates on planning considerations relevant to CC adaptation; in Sect. 3, CC adaptation strategy of Greece at the national/regional level is shortly presented; Sect. 4 gathers insight and critically comments methodological deficits of regional adaptation actions plans, carried out in the two insular case study regions; finally, in Sect. 5 some key conclusions are drawn.

2 CC Adaptation Planning - Methodological Considerations

Uncertainty and nonlinearity constitute key attributes when future development of socio-economic and spatial systems is concerned, being the outcome of both complex interactions taking place within these systems per se; and interactions between these systems and structures/processes operating in their external environment [14]. The dynamics of this environment are mainly driven by *key driving forces* of global reach, e.g. CC, globalization; with the trajectories of these forces featuring potential future images of this environment and, as a result, the ways this affects distinct spatial and socio-economic systems.

CC, as a key driver of change in the global decision environment, is currently a main and highly rated policy concern, rendering sustainability objectives of spatial and socio-economic systems at stake; and calling for *climate policy* reaction for sustaining resilience of such systems to escalating climate threats. Towards this end, capitalization on planning approaches, capable of capturing and properly handling peculiarities and uncertainties inherent in climate policy making can be of great help. Among them fall *governance*, *foresight* and related tools and studies as well as *strategic planning*, all three having at their core *participatory processes*, i.e. using participation as a bedrock in implementing relative planning endeavours. These approaches, as part of the planning arsenal in confronting with current challenges, are shortly described in the following, based on their high relevance to CC adaptation planning.

Governance is defined by Schmitter [15] as a participatory approach or a mechanism, capable of handling a broad range of *conflicting problems* across and within national, sub-national, and international levels as well as state and non-state actors [14]. It reflects the

view that ability to handle critical societal challenges resides in actors, social networks, and institutions at multiple spatial layers [14]. Actors engaged in this approach – community groups, stakeholders, decision makers etc. – can bring on board valuable distributed knowledge and, through negotiations, reach a mutually satisfactory and binding decision outcome on a certain challenge; while also cooperate with each other for successfully implementing this decision. Governance is currently largely acknowledged as a means for undertaking *collective action* and effectively tackling evolving territories' *challenges and risks* – CC as well [16, 17]. This lies on its potential to establish horizontal and vertical, collaborative governmental schemes and wide societal coalitions for coping with such risks. Such schemes, among others, address: awareness raising and community empowerment to current societal challenges; collection of distributed knowledge for grasping policy options ahead; policy pathways and their prioritization in order for consensus to be built and their effective and efficient implementation to be ensured [18, 19]. As claimed by Lebel et al. [14], managing vulnerability and resilience of regions to CC and/or other challenges raises a number of key issues as to the: desired spatial system (re)configuration, portfolio of fields and sectors where capacity needs to be built/improved, ways the above decisions are made and implemented, to name a few; all raising issues of collective action and thus rendering governance a critical approach.

The term *"foresight"* is starkly defined by Coates [20: 1428) as *"an image, an insight, a picture, a concept about some future state or condition"*. More specifically, foresight is grasped as a forward-looking approach [21], capable of: exploring alternative future images, gaining important insights into the nature of change these imply, and thinking creatively about shaping desired future end states (Fig. 1). Foresight thus represents a tool for disentangling complexity and guiding, in decision-making processes, action upon a certain future [22]. Potential future images (e.g. scenarios) offer the chance to grasp future developments and incorporate them into the planning endeavour, thus properly featuring relevant (re)actions to emerging problems' solving. As such, they can feed today's policy decisions in order to properly manage forthcoming unpleasant developments or shape desired futures or even cope with emerging threats of potential risky futures, thus rendering these images a valuable ground knowledge for dealing with emerging climate crises. Foresight studies relate to a future thinking that is: *open-minded*, identifying and exploring key driving forces (e.g. CC, digital revolution, societal developments) that can affect world's change; *collective*, engaging stakeholders for gathering distributed knowledge and innovative insights on the ways such driving forces can affect societal, environmental, technological, sectoral, geographical etc. contexts in a medium- to long-term horizon; and *proactive*, being oriented to today's action in order for potential or emerging future challenges/risks to be properly handled. The value of longstanding *foresight tools* (e.g. scenarios, roadmapping, Delphi) in assessing CC evolution and related sectoral, regional, land and marine environment impacts is acknowledged [23, 24]. Such tools offer the chance to feature driving forces, megatrends, wildcards and other disrupting future conditions; and motivate today's robust policy decisions in order for future unenviable circumstances of the repercussions of such developments to be effectively and proactively handled. As such, foresight studies are prevalent in assessing evolution of CC and related impacts for preparing relevant adaptation plans.

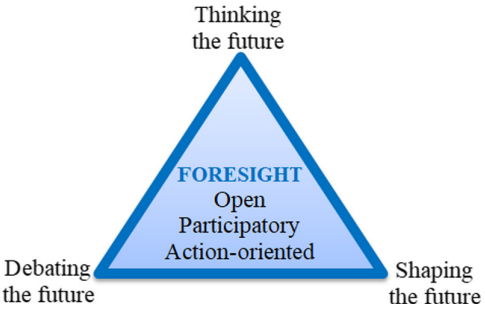


Fig. 1. Milestones of foresight, Source: [25]

Strategic (spatial) planning on the other hand, flourishing in Western countries during the '60s and '70s and witnessing a retreat during the '80s, has been reinstated in late '90s as a response to the need for more strategic approaches in confronting with *dilemmas* and making *intuitive judgments* in the current volatile decision circumstances [3, 26, 27]. For dealing with uncertainty and complexity, *strategic planning* falls into planners' arsenal as a *vision-driven* stepwise approach, viewing planning as a dynamic process of strategic choice; and being firmly oriented, in a structured and systematic way, towards the formulation of policy pathways that can reach this visionary end state [28]. In such a context, strategic planning seeks to identify (Fig. 2): a *desired end state* and *overarching goals* for a certain region/problem at hand; well-structured policy packages that can lead to this end state and are better adjusted to diversified external decision environments; and a proper set of indicators for steadily monitoring targets' achievements [28]. *Key components* of strategic planning are: i) The study of the *external environment* for sketching a distinct future image, within which decision-making at lower spatial scales is adjusted. ii) The study of the *internal environment,* i.e. gaining good insight into the study region/problem at hand, sketching the *current state* or "where we currently stand"; and the *desired future state* or "where we want to be in the future", expressed through a collaboratively defined *vision.* iii) The *policy paths* capable of linking current to visionary state. iv) The linkages of the internal and external environment, mostly grasped through a Strengths - Weaknesses - Opportunities and Threats (*SWOT) analysis* as an integral part of strategic planning exercises.

A critical issue for conducting strategic planning exercises is the exploration and preparation for a set of *plausible futures*, perceived as enablers for producing strategic planning outcomes that best fit in or adjust to them. A systematic exploration of such future states can be achieved by use of *foresight tools*, thus broadening potential of strategic planning endeavours to anticipate and strategically prepare for future changes [29]. Linking strategic planning with foresight tools, i.e. powering strategy deployment with a range of potential future states, establishes the concept of *strategic foresight*, i.e. *a scenario-based approach to strategic planning* [30]. As an innovative step forward, strategic foresight is capable of providing flexibility and openness in featuring strategic options in, among others, varying *climate crisis* circumstances [31]. Its value in CC adaptation studies lies on its potential to [31, 32]: broaden and enrich adaptation planning processes in coping with CC uncertainties; anticipate unexpected or highly risky future

CC circumstances (e.g. wildcards); stimulate creative thinking towards the exploration of and preparation for multiple CC future scenarios; and deeply delve into these scenarios for identifying robust policy options to cope with CC emergencies these scenarios may outline.

Fig. 2. Components of strategic planning, Source: [33]

Finally, *public participation (PP)* is a key pillar in confronting with CC. Its role has been early enough recognized by the United Nations Framework Convention on Climate Change [34: 17], which in Article 6 stresses participation potential in *"… addressing CC and its effects and developing adequate responses"*. The value of public participation in coping with CC was also recently confirmed by the Intergovernmental Panel on Climate Change Special Report on the impacts of global warming of 1.5 ^{o}C above pre-industrial levels, identifying PP in adaptation planning as a means to broaden *capacity* to cope with CC risks [35]. Since the beginning of the 3rd millennium, PP and its critical importance for *CC governance* has also been the subject of scientific discourse, resulting in a rich body of scholarly literature [36–38]. Public participation is actually perceived as an 'umbrella' term, enclosing various types of interaction forms among relevant actors (planners, decision makers, people, stakeholders, academia, etc.). It also serves a variety of goals, ranging from the pure provision of information for awareness raising to the gathering of insights out of a creative dialogue, debate and analysis as well as the adoption of participatory planning schemes towards co-deciding and co-designing CC policy pathways [5, 36, 38]. Furthermore, public participation seems to cross-cut a variety of spatial contexts, from the global to the very local one. However, it seems that a number of issues with regards to best practices, methodologies, enabling conditions etc. [37] for unfolding full potential of participatory approaches to climate governance and sketching efficient climate policy still need to be addressed.

3 Climate Change Adaptation Policy in Greece

Under the current severe CC circumstances, it is commonly acknowledged that featuring of comprehensive adaptation strategies at the national level, further scrutinized

and implemented at subsequent spatial levels, is crucial as part of the global endeavour. Europe is an active global player in this respect and has taken the lead in climate neutrality initiatives by targeting to become the first carbon-neutral continent by 2050. Currently, however, only 15 EU member states have already adopted national climate laws and another 7 are preparing to do so. Greece is yet lacking a climate law, while has already set up a *CC National Adaptation Strategy* [39]. This has fuelled the, currently in progress, Regional Adaptation Action Plans (RAAPs) at NUTS2 level for implementing the national strategy. Questions rising in such a context are how this national strategy can, as part of the global and European, policy decision context: function, taking into account the environmental, spatial and sectoral planning system peculiarities; and allow flexibility so that general guidelines can be effectively adapted to local specificities and needs at lower spatial levels.

In setting up a *national CC adaptation strategy* in the Greek state, territorial peculiarities are of particular interest, namely: the *rough topography*, which, coupled with the prevailing weather system, generates acute climate contrasts, varying from Mediterranean to Alpine over short distances; the *extensive coastline* (16200 km) – 12 out of 13 regions of Greece dispose a coastal front – which, combined with the topography, gives rise to a variety of local micro-climatic conditions; the moderate to high *vulnerability* of coastal areas to the sea level rise, placing under pressure these highly productive, complex and vulnerable ecosystems that offer important ecosystem services and goods to communities; the large *number of islands*, with *insularity* drawbacks as well as diversification of islands' vulnerability and capacity to handle resilience and adaptation to CC issues being, in many cases, unbeatable barriers; and the, through centuries, growing interest in the development of *coastal urban fronts* – both in mainland and islands – with massive infrastructures of supralocal reach (e.g. transport, culture, leisure, tourism), being sited at a short distance from the sea.

3.1 CC Adaptation Strategy - The National Context

Seeking to develop the Greek CC adaptation strategy, a scientific venture, perceived as the first formal *"impulse"* of the CC debate in Greece, is conducted by the relevant Impacts Study Committee [40]. This is a principally *sector-oriented, multi- and interdisciplinary study of CC impacts and vulnerability assessments*, focusing on the macroeconomic cost of CC adaptation under the extreme scenario A2 of the IPCC scenarios. Emphasis is placed on the use of proper climate indicators and assessment methods to unveil potential CC impacts on the Greek territory. Their use has revealed that CC is expected to negatively impact all those production sectors (e.g. agriculture, fisheries, tourism), the performance and competitiveness of which depend mainly on the quality of land and biodiversity, water resource availability, mild climatic conditions and current sea level.

Especially *coastal regions*, both in mainland and islands, are extremely exposed to CC, with warming being considered to threaten the residential, tourist, forestry and agricultural use of land; and being further worsened by the intense urbanization and mass tourism activities, deployed in coastal ecosystems. Indeed, vulnerability of Greek coastal areas is high for the 32% of coastal areas and very high for the 58%, while only 10% demonstrate a moderate vulnerability to CC impacts [41]. At the same time, the rise in the average sea surface temperature is expected to affect professional *fishing* due to the

decline in species' populations, with the majority of islands running the risk of losing up to 100% of their current catch. Changes are also foreseen in islands' *forests and wetlands*, with many of their valuable ecosystems being threatened by shrinkage or extinction. Furthermore, ominous are the *coastal zone* forecasts, designating a gradual shrink due to sea level rise. According to the EMEKA study [40], coastal landscapes but also existing recreational, cultural, tourist, technical etc. infrastructure are anticipated to alter or being lost in the long run. This is expected to further exacerbate due to the noticeable coastalization trends in Mediterranean coast; and gives rise to the issue of *resilience* and the need for immediate spatial redesign/reorganization of human activities/functions by transferring or modifying infrastructures/activities in affected coastal areas; and applying protection measures to minimize impact. In accomplishing these tasks, co-assessment of the *spatial dimension* of the CC adaptation process, by means of spatial data management and assessment/monitoring indicators, is required.

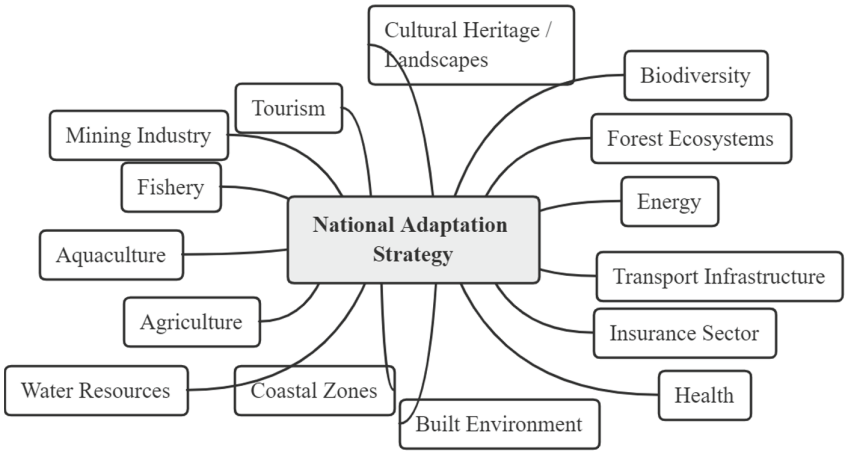


Fig. 3. Sectors addressed by NAS and related regional plans in Greece, Source: Adapted from [39] and [40]

Based on the above mentioned vulnerability assessment, identifying all types of spatial capital and socio-economic sectors threatened by CC in the Greek territory, the CC *National Adaptation Strategy* (NAS) was underpinned and announced in 2016. NAS, as a ten years strategic plan, demarcates the general *goals, principles and sectoral priorities* for an effective and developmental CC adaptation strategy (Fig. 3); and outlines relevant adaptation measures in Greece as a whole, in line with global and European concerns, as articulated by e.g. the UNFCCC [34] and the CC adaptation strategy of EU [42]. It establishes the ground for more informed science- and data-based adaptation policy making; while also articulates general adaptation measures with a special focus on the most vulnerable sectors and on mechanisms for assessing/monitoring their performance. In addition, it provides directions for the deployment of Regional Adaptation Action Plans (RAAPs); and targets raising of societal awareness with regard to CC risks and challenges ahead. Compatibility with other national policies, scientific soundness, public

participation and consultation, social consensus and developmental perspective are NAS key attributes.

Taking into account that severity but also type of CC impacts vary among regions, and ability to cope with and adapt also differs across populations, economic sectors and regions, it seems plausible adaptation planning initiatives for strengthening resilience to extreme CC events to be undertaken at the *regional/local level*. In line with this view, NAS predicts detailed CC adaptation plans and articulation of respective policy measures at the regional level (NUTS2 level), by means of respective *RAAPs*. Each single RAAP will end up with a range of potential *adaptation measures*, addressing spatially- and sector-defined CC impacts of each single regional context; and informing or framing other spatial, sectoral/developmental plans at this specific level. RAAPs are to be delivered for each single region of the Greek territory, displaying a 7-years planning horizon (2020–2026) and being subject to revision in 2026. Although originally planned to be ready by the end of 2019, many are still in progress.

3.2 CC Adaptation Planning - The Regional Context

The methodological approach adopted for RAAPs' deployment in Greek regions and articulation of policy recommendations for CC adaptation is depicted in Fig. 4. Decisions on the specification of RAAPs' content sets out their purpose and the modules included therein, in accordance with NAP. More specifically, RAAPs *vulnerability assessments* as to CC are assessed according to IPCC emission scenarios and are grounded on: i) The *decision environment*, as this is grasped by the CC knowledge, national CC adaptation strategy and other policy directions at the national/regional level, within which strategic CC adaptation plans in the 13 administrative Greek regions (NUTS2) are conducted. ii) The EMEKA study [40], providing high spatial resolution climate projections of regional climatic models for assessing CC impacts at the regional level. iii) An exhaustive insight into the current state of each region at hand, delving into socio-economic, environmental, natural/cultural, etc. aspects and their spatial counterparts. iv) The combination of knowledge gathered in the previous steps, in order for indicator-based CC threats, in both sectoral and spatial contexts, to be identified; and assessments of CC impacts to be conducted. v) Deployment of the CC RAAP, featuring policy recommendations for priority sectors/areas in order to prevent, mitigate and remediate impacts, coupled with an estimation of the likely costs of measures and possible bodies in charge of their implementation. vi) RAAP validation for compliance and synergies' creation with other plans. vii) Assessment of targets' achievement by means of an indicator-based monitoring system. viii) A loose consultation process during the RAAP deployment; while prior to the implementation and monitoring stage, RAAP is opened to *public consultation* in order for stakeholders' views to be gathered and assessed and the final RAAP to emerge.

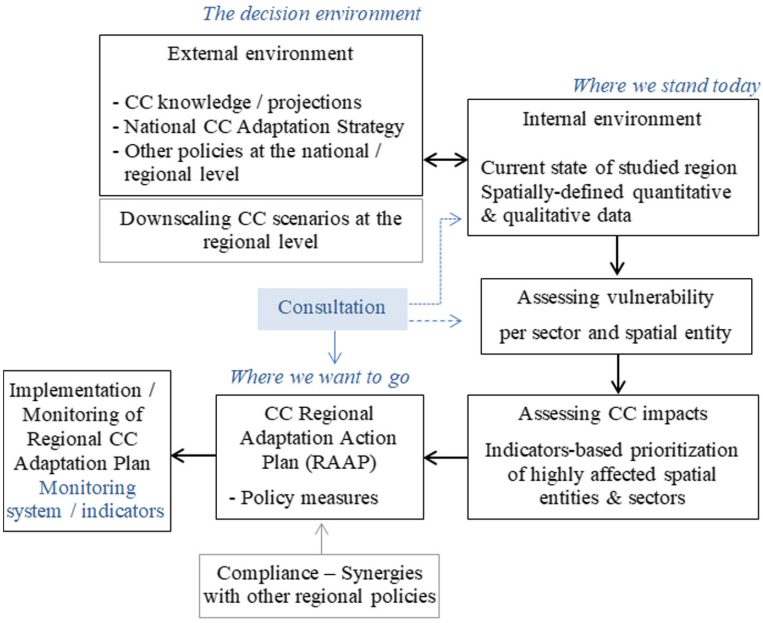


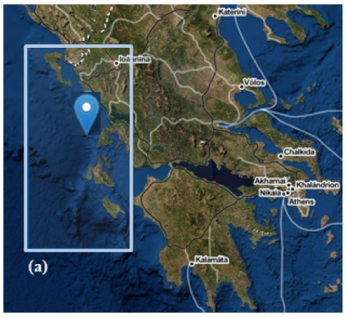
Fig. 4. Steps of the methodological approach for deploying RAAPs in Greece at the NUTS2 level. Source: Adapted from [43]

4 Critically Assessing Methodological Aspects of CC Regional Adaptation Plans – Case Study Insular Territories

This section attempts to critically comment on RAAPs' outcomes, produced by the implementation of the methodological steps of Sect. 3.2 in relevant insular case studies. The emphasis is on *methodological concerns/deficits* identified by the authors, which blur/impede ascertainment of concrete spatially- and sectoral-defined CC impacts and related policy recommendations in these highly vulnerable regions. Commenting on these deficits from a planning perspective can add value to future endeavours or even future revisions of these RAAPs.

4.1 The Case Studies

The Regions of Ionian and Northern Aegean islands (Fig. 5) are distinct insular territories due to the: particular geographical, spatial and socio-economic attributes as well as geopolitical significance (west and east insular border regions); climatic specificities; regional inequalities in terms of intra- and inter-linkages to other insular and mainland parts of the country; adequacy/quality of infrastructure (technical, social, productive); natural resource scarcity; limited size and scope of local economies; extended coastline (1056 km and 1311 km respectively), spread in a number of islands; intense coastalization pattern and degree of tourism seasonality; and habitation aspects of their islands. Of critical importance is also vulnerability addressed due to their insular nature and CC risks associated with their coastal compartments.



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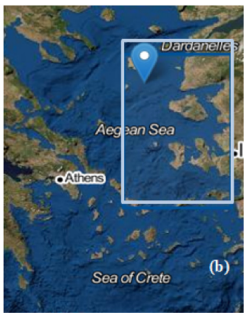

Source: [47]

Fig. 5. Insular regions explored – (a) Ionian Islands [46] and (b) Northern Aegean Islands [47]

Key resources, forming the ground of work in this section, are the RAAPs of Northern Aegean (already finalized) [44] and Ionian Islands (still in progress) [45]. Although RAAPs of both island regions are at different maturity levels, their study presents great interest from a *methodological* and *spatial analysis* perspective, highlighting crucial issues to be addressed during their implementation.

4.2 Key Issues Emerging from RAAPs' Insights in Case Studies

Deep insight into RAAPs of the North Aegean and Ionian Islands unveils a range of *weaknesses* that are summarized as follows:

- *Generality of targets.* This is partly justified by the ambiguity of the overarching NAS objectives, preventing their further specialisation in RAAPs; and is a serious omission, confining RAAPs' value and affecting CC assessments as well as articulation of more concrete CC adaptation recommendations.
- *RAAPs' work is based on often out-dated data.* Main data sources for regional analysis are often drawn from previous regional developmental/spatial plans, most of which are, in the meantime, revised or under revision. Thus assessment of current state developments and updates, as part of RAAPs, is questioned.
- *Generality of proposed measures/actions***.** While mitigation is a more global long term endeavour, adaptation seeks to entrench regions to a rather medium term towards unenviable CC repercussions. General description and the flaccid spatial and sectoral specialization confines RAAPs' usefulness in the studied regions.
- *Loose or non-existent interconnection between RAAPs and other spatial plans.* Although a number of spatial plans are explored, relevant linkages were generic, not really informing RAAPs or ensuring their compliance to these frameworks.
- *Limited orientation to social infrastructures in sectoral recommendations.* Adequacy/quality of social infrastructure, especially in education and health sectors, for building capacity and ensuring resilience of locales is largely missing. Their role is exceptional, especially in insular – isolated from mainland – contexts.
- *Insufficient consideration of the spatial dimension.* Peculiarities of regional contexts (e.g. coastal areas, built environment) are to large extent underestimated, simply

treated through the lens of general CC sectoral recommendations. Lack of a broader perspective of the spatial/functional linkages/dynamics both within and between islands at studied regions [48, 49] enfeebles CC vulnerability assessment, lacking the spatial dimension of socio-economic processes as well as the multiple and diverse pressures these exert on land and at sea. Lack of spatially-defined recommendations diminishes efficiency of RAAPs' CC adaptation measures.

- *Identification of "geographical areas" of reference with administrative ones* (regional/local government bodies). Emphasis on the administrative structure, regardless of climatic areas or spatio-functional specificities (e.g. siting of infrastructure), weakens management of intermunicipal/interregional climate adaptation issues. Redefining "geographical areas" by the use of e.g. climatic, geomorphological, functional attributes could broaden understanding of vulnerability of such areas.

Additionally to the aforementioned weaknesses and taking into account appropriate planning tools/approaches for mid- to long-term studies as a means for handling complex CC repercussions (see Sect. 2), the following concerns are noticed:

- Despite the very nature of a RAAP as a planning exercise, RAAPs studied in this work hardly reflect a *planners' rationale* in the sense of: technical linkages between stages of RAAPs approach and the way these are featured; use of outcomes of each single stage for enriching context of the rest ones; more spatial and developmental focus; and use of substantial participation schemes, all reflecting the lack of a planning expertise in the synthesis of the respective RAAPs' working groups.
- *Governance* in building up the studied RAAPs is *loose*, lacking vertical/horizontal interaction among all types of societal players. The latter are placed at a rather passive position, instead of actively engaging in all stages of RAAPs' deployment.
- The value of *public awareness raising and engagement* throughout the process of RAAPs has not been given relevant attention. The principles of public participation have not been adequately brought to RAAPs endeavours. Thus participatory processes lack a broad and substantial engagement and inclusiveness; and follow a rather RAAPs' legitimation approach. They are confined to information diffusion and collection of views of local and regional as well institutional decision makers through questionnaires (local/regionals administration, representatives of ministries, technical and commercial chambers etc.), largely ignoring community's perspective. RAAPs were mainly deployed by pure a team work of respective working groups, with the final product being opened for public e-consultation. Information on the way outcomes of these consultations have enriched RAAPs is not provided, a fact that is also indicative of the importance attached to the participatory processes in RAAPs and the benefits that can be reaped out of it.
- A *strategic view* of studied regions and a future *vision* to be reached is missing. This brings on board a certain inconsistency, namely while mean values of a range of CC-related indicators are calculated according to IPCC emission scenarios till 2100, vulnerability assessments take for granted the current state of the study regions, leaving behind their dynamics and goal-based future states, emerging by long term planning frameworks at the national and/or regional level.

5 Conclusions

Irrational use of natural resources through decades has changed the world's climate, making *tomorrow's climate a huge today's challenge*. Evidence of CC is already strong and indisputable; and calls for glocal (global-local) mitigation action but also adaptation response, both targeting long term sustainable futures and confining short- and mid-term damages of extreme and intense CC incidents. Such damages are currently fully grasped by a variety of glocal actors, setting forward efforts to prepare CC national and regional adaptation action plans. Planners and policy makers, in this respect, are in front of new challenging duties with regard to the: design of proper CC adaptation recommendations, enabling sustainability and resilience of local ecosystems; handling of imbalances of CC impacts; and entrenching of the most vulnerable regions, as the case of Mediterranean island territories.

Coping with challenges of CC impacts is a multi- and inter-disciplinary field of work. Planning discipline provides proper approaches for medium to long term studies and can thus constitute an *'umbrella' framework*, capable of: integrating the diversifying knowledge needed for recording, assessing and monitoring the evolution and impacts of CC; and linking this knowledge to decision-making, in alignment with local specificities and developmental prospects. Such an effort currently lies at the heart of the scientific and policy discourse. Against this backdrop, the assessment of the mid- and long-term effects of CC on the natural and built environment as well as on socio-economic activities acquires a new criticality for ensuring resilience and sustainable development of diversifying spatial contexts. This brings on board both predictive and preventive actions, being the outcome of collaborative processes at multiple layers and a broadened planning perspective, embracing environmental, spatial and sectoral dimensions as well as peculiarities of administration systems (centralized or decentralized). As such, CC adaptation plans cannot and should not be drawn up independently of spatial/sectoral policies linked to urban/regional development and the current institutional framework on environmental and spatial planning on the one hand; and the local conditions and needs on the other. Further on, vulnerability assessments have to be enriched and definitely be related to changes in the non-climate drivers of change, e.g., economic, social, governance, technological drivers.

Governments are currently deeply engaged in delivering national/regional adaptation plans as distinct CC initiatives that address, in a systematic way, CC preparedness. RAAPs, studied in this work, are part of the Greek nation's effort to entrench its regions against CC threats. Regions studied, i.e. Mediterranean insular territories, seem to be highly affected by CC repercussions in both their maritime as well as coastal and mainland parts; and respective RAAPs, apart from their focus on minimizing CC vulnerability, have additionally to be accomplished in consistency with goals of equity/cohesiveness of localities and their population; and as part of wider awareness and consensus building processes in these fragile though natural and cultural remarkable spatial contexts. Insights into RAAPs studied in this work, according to authors, seem to be *much more than before though less than needed* in such highly threatened Mediterranean insular complexes. Future research needs to focus on more robust CC adaptation approaches in fragile insular territories by strengthening linkages between the deployment of relevant plans and planning discipline's developments.

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