

UPSCALING OF AIR AND CLIMATE PLANNING IN A MULTI-LEVEL GOVERNANCE PERSPECTIVE: INSIGHTS FROM TUSCANY, ITALY

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ABSTRACT

Scientific literature has shown that air quality and climate change are like two sides of the same coin. Greater integration of air–climate policies is increasingly seen as a priority on the European political agenda even though, from a regulatory point of view, they are still managed separately. The analysis of air and climate plans can reveal good practices that exploit the potential of a synergistic approach, showing a degree of integration beyond the regulatory framework. This study aims to analyse air–climate integration in a multi-level governance context and to highlight good practices in an upscaling perspective, oriented to broaden and sustain their replicability to achieve a wider impact. This requires supporting knowledge transfer between cities (horizontal upscaling). Furthermore, it is necessary to inform regional governments with the dual aim of acting on the factors that favour replicability of best practices (vertical upscaling) and to set binding standards for all municipalities (hierarchical upscaling). This work focuses on an Italian case study, the Tuscany region, which is particularly relevant due to its well-structured regulatory planning system for both climate and air quality components, with multiple and effective interactions between different levels of governance.

Keywords: air quality, climate mitigation, climate adaptation, planning, upscaling, multi-level governance, sub-national governments, regions, Italy.

1 INTRODUCTION

Although there is a political demand for greater integration of air–climate policies, they are mostly addressed separately. Understanding how to pursue this in the complexity of multi-level governance is a research topic that deserves further investigation.

In Europe, the main reference for air quality (AQ) is the Directive 2008/50/CE. It entrusts Member States with the drafting of the national plan and the definition of responsibilities between sub-national levels. On the climate side, the Member States' commitments are set out by the European Climate Law, in force since July 2021. As far as mitigation is concerned, it sets the framework for actions to be taken to progressively reduce greenhouse gas (GHG) emissions and ultimately achieve EU climate neutrality by 2050.

Each Member State must adopt a national plan describing policies and measures to be implemented to meet its obligations under the effort-sharing agreement. Regarding climate change (CC) adaptation, the law contains requirements for national adaptation strategies and plans. It also provides for the Commission to regularly assess the progress achieved and make recommendations where improvement of adaptive capacity and reduction of vulnerability are not adequate.

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For both AQ and CC, Member States retain their autonomy in establishing responsibilities at the sub-national scales while leaving room for voluntary initiatives. In the context of climate planning, a valuable body of research focuses on understanding the contributions of different levels of governance to climate challenges, enhancing the dynamics that foster engagement, and identifying gaps to make the entire multi-level governance system more climate proof.

With the rise of local scale voluntary initiatives and the recognition of their importance in achieving the Paris Agreement [1], a promising research strand focuses on the upscaling of local climate policies [2], [3] as a way to replicate and multiply successful governance strategies. In the absence of an agreed definition [3], this study referred to the one provided by the World Bank [4], which defines ‘upscaling’ as the process of ‘expanding, adapting and sustaining successful policies, programs or projects in different places and over time’.

In multi-level governance systems, there are several types of upscaling [5]: horizontal upscaling involves the exchange of experience and knowledge transfer between cities [3]; vertical upscaling requires actions at supra-municipal levels to support and eventually finance the spread of voluntary initiatives [6]; hierarchical upscaling requires the higher levels of government to exert their authority to harmonise policies and set binding standards for all municipalities [2].

The objectives of this work are twofold: first, to assess the current air–climate integration at different (regional and municipal) planning scale; second, to investigate potential upscaling dynamics. To this end, the case study selection fell on the Italian region of Tuscany, characterised by air and climate planning structured on multiple governance levels and an integrated air–climate approach at the regional scale, as highlighted by Pilogallo et al. [7].

The paper is organised as follows: Section 2 presents the case study with a focus on both air and climate planning; Section 3 describes the research methods developed to assess the current air–climate integration and to investigate the upscaling dynamics; Section 4 illustrates the main results obtained, while Section 5 critically discusses the findings to highlight which upscaling drivers can contribute most to achieving greater air–climate integration. Finally, Section 6 provides the conclusions of the research work, outlining its main limitations and future developments.

2 CASE STUDY

The analysed case study is the region of Tuscany, located in central Italy and covering approximately 23,000 km². It includes 273 municipalities, 11 of which are the capitals of the following ten provinces: Arezzo, Florence (regional capital), Grosseto, Livorno, Lucca, Massa-Carrara, Pisa, Pistoia, Prato and Siena.

It is characterised by an overall stable demographic trend (in the period 2019–2024, there was a decrease of approximately 1%), and a marked variability in population density between coastal, metropolitan and mountain areas. Furthermore, it is characterised by a very heterogeneous morphology and climate [8]. In recent decades, the region has been experiencing significant changes in local climatic conditions with an increase in average annual temperature of about 1.7°C (considering the period 1955–2002) with a much steeper warming in spring (+1.9°C per century) and summer season (+3.2°C per century) [9]. The intensification of heatwaves [10] and the reduction of water resources [11] expected at medium and long-term risk negatively affecting important segments of the regional economy such as agriculture and tourism [12]. The effects of CC also negatively impact on the liveability of urban centres: in 2022 Massa-Carrara was among the Italian provinces that



recorded a greater increase in the average annual temperature and the number of tropical nights [13].

Tuscany was selected among the Italian region as a case study for its exemplary planning system [7], which provides for the articulation of several levels for both the air and climate components, as described in the following two subsections.

2.1 Air planning

The Italian legislative framework on AQ (Legislative Decree 155/2010 transposing the European Directive 2008/50/CE) assigns the regions and autonomous provinces the responsibility of drawing up their own air quality plan (AQP), which must provide the measures, the timeframe, the resources allocated and the authorities responsible for implementing the planned actions. Regions may implement the plan directly, eventually relying on the support of regional environmental protection agencies or provide for the development of municipal AQP. In Italy, only two regions (Tuscany and Friuli Venezia Giulia) have chosen this second option, as highlighted by Pilogallo et al. [7].

The Regional Ambient Air Quality Plan (RAAQP), provided for by Regional Law 9/2010, is the act by which Tuscany pursues the improvement of AQ in order 'to preserve its quality for future generations', in accordance with the Regional Environmental and Energy Plan (REEP) and the Regional Development Program (RDP). Based on the monitoring reports regularly drawn up by the Tuscany region in compliance with the RAAQP, areas of exceedance were identified, i.e., areas where pollutant concentrations exceed the thresholds set by the regulations.

Municipalities falling within these exceedance areas are required to adopt a Municipal Action Plan (MAP) containing interventions of two main types: (i) structural, i.e., of a permanent nature and aimed at improving and maintaining ambient AQ through the reduction of anthropogenic emissions; and (ii) contingency, to be adopted to limit the risk episodes. In addition, these municipalities are required to adapt their building codes, urban mobility plans and urban traffic plans to the contents of their MAPs. It is up to the region to update the identification of exceedance areas at least every 5 years.

2.2 Climate planning

In Italy, climate policies still address CC mitigation and adaptation separately. The current legislative references are the Integrated National Energy and Climate Plan (INECP), which aims at the complete decarbonisation of energy sector by 2050, and the National Climate Change Adaptation Plan (NACCP), approved at the end of 2023. Neither requires sub-national authorities to develop their own sub-national scale plans.

In this frame, Tuscany has voluntarily approved its regional strategy, called 'Toscana Carbon Neutral', which aims at reaching carbon neutrality by 2050. It is structured into two main actions: the reduction of GHG emissions through a development plan more oriented towards the circular economy model, and the increase of emission absorption through the enhancement of green areas. The strategy is implemented through the adoption of 10-year action plans targeting the main emission sectors. The 10-year 2020–2030 action plan currently in force is developed around five main themes: (i) reduction of energy consumption; (ii) increase in energy production from renewable sources; (iii) promotion of a geothermal energy development plan; (iv) development of a circular economy model; and (v) transformation of the current transport system and promotion of sustainable mobility. In

addition, the action plan includes a forestation project with the goal of offsetting emissions and achieving a zero-emission balance before 2050.

Regarding the implementation of the regional strategy, the region does not envisage the direct involvement of municipalities, except for specific actions on the energy efficiency of buildings.

On the adaptation side, Tuscany does not have a regional strategy or a plan.

At the municipal level, in Tuscany, as in the rest of Italy [14], climate plans are drawn up on a voluntary basis, mainly under the umbrella of the Covenant of Mayor for Climate and Energy. These plans may include mitigation targets, in the case of the Sustainable Energy Action Plans (SEAPs), or both adaptation and mitigation targets, in the case of the most recent Sustainable Energy and Climate Action Plans (SECAPs).

3 METHODS

The methodological approach used for this study was guided by the two main research questions. It allowed, therefore, to assess the current air–climate integration in sub-national planning and, subsequently, to investigate upscaling dynamics with the aim of amplifying the impact and achieving a higher degree of air–climate integration. This two-fold research method was tested and applied to the case study of Tuscany region.

A preliminary activity consisted in searching and archiving in a repository AQPs and climate plans at different scales for the region of interest. We proceeded with the analysis of their contents to bring out the air–climate integration features considering the specificities of each plan at its own scale:

- At the regional scale, the climate plan was examined to assess whether its objectives included improving AQ or whether this was at least recognised as a co-benefit of mitigation actions. To this end, the content analysis mainly analysed the description of the objectives and measures set out in the plan. A reference to the Regional Ambient Air Quality Plan (RAAQP) was also sought.
On the other hand, the RAAQP was examined to understand the role played by GHG abatement. In particular, the analysis focused on the objectives of the plan, the criteria that guided the selection of emission abatement measures, and the possible systematic GHGs monitoring. In addition, a textual search was conducted to identify possible references to the regional mitigation strategy.
- At the municipal scale (limiting the analysis to provincial capitals only), climate plans were examined to understand to what extent AQ influenced the plan drafting process. With regard to mitigation, the measure descriptions were analysed in order to assess whether the improvement in pollution conditions was recognised as a valuable benefit. Regarding adaptation, the analysis focused on the risk and vulnerability assessment section. It was geared towards determining the role of AQ as a competing risk factor to other natural hazards (e.g., heatwaves) related to CC. In each SE(C)AP, the reference to MAP was also sought.
On the AQ side, MAPs were investigated to evaluate if GHGs reduction is recognised as a co-benefit of AQ improvement measures and whether these benefits played a role in the selection/prioritisation of measures. In addition, a reference to SE(C)AP was also searched for in each MAP.

Table 1 summarises the English translation of the keywords (originally in Italian) used to carry out the textual analysis of regional and municipal scale plans.



Table 1: Summary of keywords used in the content analysis of the plans.

Content analysis of CC plans	Content analysis of AQ plans
Regional scale (Tuscany)	
<i>[air] / [atmospheric] + [quality] and/or [pollution] + plan / [RAAQP]</i>	<i>[GHG(s)] / [greenhouse gases] / [carbon dioxide] / [methane] / [nitrous oxide] + [regional] [mitigation] [strategy]/ [Toscana Carbon Neutral]</i>
Municipal scale (Arezzo, Carrara, Florence, Grosseto, Livorno, Lucca, Massa, Pisa, Pistoia, Prato, Siena)	
<i>[air] / [atmospheric] + [quality] and/or [pollution] / [MAP]</i>	<i>[GHG(s)] / [greenhouse gases] / [carbon dioxide] / [methane] / [nitrous oxide]/ [SEAP] / [SECAP]</i>

To investigate upscaling dynamics, membership and/or involvement in the following European initiatives/networks were considered:

- Global Covenant of Mayors for Climate and Energy (GCoM), the largest international initiative to promote climate action at local level [15]. Originally launched in 2008 to boost mitigation objectives, in 2015 it expanded to also include the topic of adaptation [16];
- Eurocities, one of the most important trans-European city networks [17];
- EU Mission ‘Climate-Neutral and Smart Cities’ (also known as ‘Cities Mission’), an initiative involving local authorities, citizens, businesses, investors as well as regional and national authorities to shape 100 climate-neutral and smart cities by 2030 [18]. Adopting a demand-driven, cross-sectoral approach, the initiative is precisely geared towards upscaling, acting to make the selected cities hubs of experimentation so that all European cities can follow suit by 2050;
- European Energy Award, an international non-profit association organised on three different levels (international, national and municipal level) supporting local governments in establishing interdisciplinary planning approaches and implementing effective energy and climate policy measures [19];
- Local Governments for Sustainability (ICLEI), a global network working with both local and regional governments active in over 125 countries to influence policy towards low emission, nature-based, equitable, resilient and circular development [20];
- Climate Emergency Declarations (CEDs), which represent a strong stance by local and national governments triggered mainly by civil society pressure [21].

At the national level, it was also investigated the participation of Tuscany region to the Green City Network, promoted by the Foundation for Sustainable Development to support cities to improve their ecological quality, climate mitigation and adaptation efforts, in a sustainable development perspective [20]. In addition, a web search was conducted to assess the presence of climate regional or sub-regional alliances or networks.

4 RESULTS

In this section, we first describe the results obtained in terms of integration between air and climate plans within the sectoral and multi-level governance system envisaged in the



Tuscany region case study. Then, we provide a framework describing the involvement of regional and sub-regional governments in climate networks and initiatives.

4.1 Assessment of air–climate integration in the Tuscany multi-level planning

From the content analysis of the archived plans, it emerged that at the regional scale there are two main plans: the RAAQP and the Toscana Carbon Neutral Plan. At the municipal scale there are, on the AQ front, six MAPs (Florence, Livorno, Lucca, Pistoia, Prato Siena) (as already mentioned, the municipalities required to draw up the MAPs are only those included within the exceedance areas) and, on the climate front, four SEAPs (Grosseto, Lucca, Massa, Pisa) and five SECAPs (Florence, Arezzo, Livorno, Pistoia, Prato). Table 2 provides an overview of the current integration among these plans, as revealed by our analysis. It shows that, on a regional scale, there is good air–climate integration in Tuscany’s planning system. The RAAQP is, in fact, defined as an ‘integrated regional strategy on the protection of ambient AQ and the reduction of climate-altering gas emissions’. It provides multiple measures with positive effects on GHG emissions, energy consumption and production from renewable sources. Specifically, the main GHGs considered (carbon dioxide, methane, nitrous oxide) are among those regularly monitored within the regional emissions inventory. As far as regional climate plan is concerned, pollution reduction plays an important role in the ‘Tuscany Carbon Neutral’ strategy. It aims to maximise synergic actions to reduce air pollutants and achieve climate neutrality, promoting development models oriented towards circular economy and adopting a regional forestation plan to improve AQ in urban settings and absorb GHGs.

Table 2: Availability and assessment of air–climate integration in Tuscany’s regional and municipal plans.

Content analysis	CC plans			AQ plans	
Regional scale					
	Does the plan ‘Toscana Carbon Neutral’ consider the AQ co-benefits of GHGs abatement actions?			Is the RAAQP developed as an integrated air–climate strategy?	
Tuscany	Yes			Yes	
Municipal scale					
	AQ as a co-benefit of mitigation actions	AQ as a risk factor in adaptation actions	Reference to MAP	GHGs reduction as a co-benefit of AQ actions	Reference to SE(C)AP
Arezzo	Yes	No	No		
Carrara					
Florence	Yes	Yes	No	Yes	Yes
Grosseto	Yes		No		
Livorno	Yes	Yes	Yes	Yes	Yes
Lucca	Yes		Yes	Yes	No
Massa	Yes		No		
Pisa	Yes		Yes		
Pistoia	Yes	Yes	Yes	Yes	Yes
Prato	Yes	Yes	No	Yes	Yes
Siena				Yes	Yes

At the municipal scale, all the five SE(C)APs found in the ten provincial capitals consider AQ improvement as a co-benefit of the mitigation actions, especially regarding buildings and transport sectors. Four SE(C)AP consider forestation interventions strategic to AQ and CC objectives while two SECAPs (Arezzo and Livorno) emphasise the importance of illustrating the co-benefits of climate actions as part of training, awareness and environmental education measures. From an adaptation perspective, content analysis showed that four out of five SECAPs include poor AQ as one of the risk conditions for human and ecosystem health along with heatwaves. Air pollution is also explicitly mentioned in the risk and vulnerability assessment sections of the SECAPs. In three cases, the AQ co-benefit is highlighted in the description of adaptation measures planned to cope with extreme temperatures (Florence, Livorno, Prato), hydrogeological instability (Florence), and wildfires (Livorno). These measures consist mostly of forestation activities and the implementation of nature-based solutions into the urban environment. The degree of integration between planning instruments at the municipal scale is quite variable: Florence and Arezzo do not mention MAP at all; Prato does the same while illustrating in the context description all the climatic variables affecting AQ in the urban area; Livorno and Pistoia's SECAPs show a high degree of integration with the air component (MAPs are in fact included in the SECAP and their potential synergies are illustrated). On the AQ side, all MAPs consider the co-benefits in terms of CO₂ reduction achievable with measures targeting pollutants that share the same GHG emission sources. Florence and Prato also quantify the expected effects in terms of CO₂ saved. All MAPs, except that of Lucca, also refer to the synergies that air plans can develop with climate plans for both mitigation and adaptation. The sectors that stand out for their potential to develop synergies are buildings, forestation and greening activities.

4.2 Involvement in climate networks and initiatives

Membership in climate networks and initiatives is a key factor to have a complete picture of the efforts made by sub-national governments to address CC challenges from an upscaling perspective. Table 3 provides a summary of the main networks and initiatives involving Tuscany authorities at different levels of governance (i.e., region, province and municipalities).

Table 3 shows that 82 municipalities (that is, 30%) in Tuscany are signatories of GCoM (as of January 2024). Among these, 34 municipalities (i.e., 41% of regional signatories) have not yet submitted a climate plan, while 40 SEAPs and eight SECAPs have been delivered and approved [22]. Focusing on the provincial capitals, Florence, Arezzo, Livorno, Pistoia and Prato approved a SECAP, while Grosseto, Lucca, Massa and Pisa approved a SEAP. Carrara and Siena have no climate plan. It is worth emphasising that the provinces of Arezzo, Livorno, Massa-Carrara, Siena and the region of Tuscany also play the role of Covenant coordinators, committed to support signatories in their territorial area, providing technical and/or financial support to develop and implement sustainable energy and climate action plans and supporting networking activities. The GCoM also provides for the role of 'supporters' for non-profit organisations, i.e., associations of local and regional authorities, networks, municipal and regional energy agencies. In the study area, the regional section of the National Association of Italian Municipalities (namely 'ANCI Toscana'), the Energy Agency of the province of Livorno, as well as the Unions of Municipalities of Versilia and Valdichiana Senese serve as Covenant supporters. The cities of Arezzo, Pisa and Florence share membership to Eurocities [17] with the mayor of



Table 3: Membership of the multi-level governance of Tuscany in climate alliances.

Level of governance	Transnational						National	Regional/ sub-regional
	GCoM	Euro cities	Cities Mission	European Energy Award	ICLEI	CED	Green City Network	Siena Provincial Alliance
Regional								
Tuscany	Yes					Yes		
Provincial								
Arezzo	Yes							
Carrara	Yes							
Florence					Yes			
Grosseto								
Livorno	Yes							
Lucca								
Massa	Yes							
Pisa					Yes			
Pistoia								
Prato								
Siena	Yes							Yes
Municipal								
Arezzo	Yes	Yes					Yes	
Carrara								
Florence	Yes	Yes	Yes	Yes			Yes	
Grosseto	Yes							
Livorno	Yes					Yes		
Lucca	Yes					Yes		
Massa	Yes							
Pisa	Yes	Yes				Yes		
Pistoia	Yes					Yes		
Prato	Yes		Yes	Yes		Yes	Yes	
Siena								Yes

Florence being member of the executive leaders. The cities of Florence and Prato are two of the 100 cities in EU-27 (and nine Italian cities) selected to participate in the EU Cities Mission. The city of Arezzo is among the local authorities acting as signatories of the EU Mission on Adaptation to CC committed to pursuing climate resilience by 2030 by encouraging adaptation efforts as possible interconnected with mitigation actions [23].

The province of Siena and the metropolitan city of Florence have joined the Local Governments for Sustainability (ICLEI) while the cities of Prato and Florence and 11 municipalities (one in the province of Prato and ten in the province of Florence) are also beneficiaries of the European Energy Award. Finally, following a general trend that started in Australia and quickly spread all over the world, also in Italy more than one hundred governing authorities have declared a climate emergency (CED) as of 2019 [24]. In addition to the region of Tuscany, which submitted its CED in June 2019, nine municipalities of the study area, including five provincial capitals (Livorno, Lucca, Pisa, Pistoia and Prato), submitted a CED [25].

Finally, the municipalities of Arezzo, Calenzano (Florence), Follonica (Grosseto), Florence, Livorno, Lucca, Prato and San Giovanni Valdarno (Arezzo) have joined the Italian Green City Network.

Concerning climate initiatives and networks established at regional or sub-regional scale, it is worthy of attention the Territorial Alliance for Carbon Neutrality of Siena Province whose provincial territory constitutes the first vast area in Europe certified ISO 14064-1 [26]. Since 2011, when the carbon neutrality target was achieved, the Alliance has consistently worked to involve citizens, institutions, businesses, and non-profit organisations according to a participatory approach focused on active citizenship and sustainable development [27].

5 DISCUSSIONS

Looking at the picture of air–climate integration in Tuscany’s multi-level governance system through the lens of upscaling provides some interesting considerations. In the complex and fragmented Italian planning framework for AQ and CC mitigation and adaptation, the region of Tuscany can be considered a good example of integration. In fact, it proposes its RAAQP as a joint strategy addressing the issue of AQ on a local scale and CC on a global scale. The CC mitigation plan ‘Tuscany Carbon Neutral’ pursues an integrated air–climate approach and points out the key role of forestation program to improve AQ in urban environments. In the perspective of this work, we argue that vertical upscaling from the regional level in Tuscany is effective since it seems to have contributed to the mainstreaming of air–climate integration on a municipal scale. In all MAPs, in fact, the co-benefit in terms of CC mitigation of planned pollution reduction actions is recognised.

Focusing on the municipal level and searching for horizontal upscaling, following the approaches proposed by Kern [3], we can distinguish between ‘leader’ cities, where integration is greater, and ‘laggard’ cities where updated planning instruments do not reach high integration degrees. In the middle are the ‘follower’ cities which, despite showing a certain commitment to climate challenges, have not updated their municipal climate plans, therefore not pursuing air–climate integration objectives. Taking this classification into account Florence, Livorno, Pistoia and Prato can be considered ‘leaders’ in the integration of air–climate planning. In fact, their municipal climate plans consider AQ both as a co-benefit of mitigation actions and as a risk factor concomitant with heat waves and prolonged drought periods on the adaptation front. Arezzo, on the opposite, can be considered ‘laggard’ because it approved a SECAP in 2022 in which pollution reduction is recognised as a co-benefit of mitigation actions but is not included at all in the evaluations concerning adaptation strategies. The ‘follower’ cities are Grosseto, Lucca, Massa and Pisa: they all have a SEAP approved between 2012 and 2016, all recognise AQ improvement as a secondary benefit of mitigation strategies but only two of them (Lucca and Pisa) refer to the MAP. Carrara and Siena constitute two particular cases. Carrara became a provincial capital only in January 2024 within the province of Massa and Carrara. Exemplary is the vertical upscaling implemented by the city of Siena. It has undertaken a path aimed at fully enhancing its role as provincial capital, neglecting municipal planning in favour of a territorial alliance for climate neutrality on a provincial scale. The municipalities in the province join the alliance on a voluntary basis and sign a formal commitment to pursue the set goal.

Since most provincial capitals share membership of the GCoM network, we highlight this as a potential opportunity to exchange knowledge and approaches aimed at achieving air–climate integration, considering adaptation (and, therefore, air pollution) as a multiplier risk during heat waves and prolonged drought periods. Furthermore, we can envisage that, similarly to what was found in climate planning [28], the membership of most city ‘leaders’



to transnational networks and initiatives has favoured policy learning, also paving the way for a bottom-up air–climate integration on the adaptation front [29].

The upscaling perspective also emphasises the role of the intermediate level of governance between the regional and municipal ones. It coincides with the vast area or supra-municipal scale, that often correspond to the provincial territory or the metropolitan city area. In fact, four provincial capitals (Arezzo, Livorno, Massa and Carrara, Siena) turn out to be provincial coordinators of the GCoM, playing a key role in the dissemination of good practices and, in this specific case, in mainstreaming air–climate integration in municipal mitigation and adaptation plans. The territorial alliance for climate neutrality established by the province of Siena confirms this approach based on a key role of the provincial capital as a leader and supporter of the implementation of best practices.

Both climate and pollution challenges require a joint effort by all levels of governance. The potential of this work is linked to its capacity to inform policy makers by providing a comprehensive picture of the levers that can potentially be activated to foster greater air–climate integration. The results showed, in fact, that this integration can be pursued both by focusing on replicability dynamics of good practices, i.e., by promoting horizontal and vertical upscaling in CC planning, and by acting on mandatory regulatory standards for all municipalities, i.e., promoting hierarchical upscaling in the context of AQ planning.

From a methodological point of view, this research work also offers a methodological approach that can be transferred to other contexts and scalable on the basis of regulatory frameworks structured on different levels.

6 CONCLUSIONS

Although the integration of policies on AQ and CC is supported by the scientific community and advocated at the European level, from a regulatory point of view these issues are still addressed separately. In this context, an in-depth analysis of multi-level planning instruments can be useful not only to reveal ‘good practices’ already in place regarding the implementation of plans at different sub-national scales that pursue an integrated approach, but also to promote their replicability in other governmental contexts.

This research is part of a broader strand aimed at identifying good practices and understanding which factors drive upscaling to enhance its effect in terms of diffusion and impact among different levels of governance. This work presents the methodological approach and the preliminary results obtained on a very interesting regional case study, the Tuscany Region, which can count on AQ and CC (mitigation and adaptation) planning instruments that are articulated on several levels.

The main results obtained from this case study show that regional and sub-regional governments play a key role in mainstreaming municipal climate plans developed with an integrated air–climate approach. In this perspective, the regional government is the authority in charge of hierarchical upscaling while the provinces emerge as key players in vertical upscaling, i.e., as support structures for the drafting of SE(C)AP and the spreading of best practices.

Future developments of this work will be geared towards overcoming its main limitation, i.e., extending the application of the proposed methodology to the approved SE(C)APs of all the municipalities in the region, and investigating the role that upscaling dynamics have played in determining the current air–climate integration picture. Furthermore, this type of study will be extended to the entire Italian territory in order to collect an extensive and in-depth knowledge base on the complete vertical mainstreaming of the state–regions–provinces–municipalities.



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