

UPLanD

Journal of Urban Planning, Landscape & Environmental Design



Research & experimentation
Ricerca e sperimentazione

REGIONAL POLICIES FOR SUSTAINABLE WATER MANAGEMENT AND IMPACTS ON MUNICIPAL PLANNING

Antonio Nigro

Department of Architecture, University of Naples, Federico II, IT

HIGHLIGHTS

- Sustainable water management plays a key role since water network can be considered the backbone of ecological networks
- Several cities are implementing policies and strategies aimed to enhance the quality of urban water network and increase the liveability of urban spaces
- Campania Region is encouraging sustainable water management through regional acts, rules, policies
- The analysis of Sarno River basin showed that Municipal administrations are not able to translate the principles of sustainable water management into urban planning practice

ABSTRACT

Environmental protection issues are gaining increasing relevance in the framework of regional and local planning. The protection and enhancement of ecological networks is one of the most significant factors, in connection with sustainable urban water management.

Several countries are revising their planning systems, in order to translate into practice the principles of ecological sustainability.

An overview of iconic examples of river ecosystem restoration within some of the most populous European urban areas showed how river restoration could give the spur to urban rehabilitation programs, giving the opportunity to increase urban quality.

This paper presents Campania regional policies regarding water protection and sustainable water management, and their influence on Provincial and Municipal planning practice, using as case study a group of fourteen municipalities located within one of the most critical river basins, i.e. Sarno Valley. A research carried out by the University of Naples Federico II investigated the effects of water protection policies on municipal plans in Campania Region. The study showed that, roughly fifteen years after the regional legislative reform of 2004, the renewal rate of urban plans is still low. A deeper analysis of local planning state of the art, carried out through local plan collection and comparison, interviews and review of municipal databases, underlined the poor consideration put on sustainable water management by local planners.

ARTICLE HISTORY

Received: August 03, 2018
Reviewed: October 29, 2018
Accepted: November 28, 2018
On line: December 23, 2018

KEYWORDS

Water management
Municipal land use planning
Urban risks
Sarno River
Sustainability

1. INTRODUCTION

The influence of ecological issues on urban planning is not just a recent trend. More than one century ago, Patrick Geddes (1915) coined the metaphor of the city as a living organism, even though planners in the following decades used this metaphor as a guide for urban design, rather than enhance the understanding of ecological processes within urban areas. During time, the awareness of detrimental effects of human actions on the natural environment has emerged, and environmental protection is now high on the agenda of urban and regional planning (Davoudi, 2000). Moreover, the “ecological approach” to town and regional planning is sustained by concerns about the effects of climate change (IPCC, 2007; Davoudi, 2009) and the increasing mass of people living in urban areas, approximately amounting to 55% of global population (United Nations, 2018).

Several scholars have faced the ecological question, leading to the emergence of different theories, like “Ecological Restoration” (Keenleyside, Dudley, Cairns, Hall, & Stolton, 2012); “Low-Impact Development” (Van Roon, 2007); sustainable urban drainage system – SUDS (Butler & Parkinson, 1997) only to cite a few.

In the framework of ecological issues, the protection of water networks plays a key role (Marlow, Moglia, Cook, & Beale, 2013) since water cycle can be considered one of the most relevant mechanisms supporting the flows of nutrients, material and energy, connecting different ecosystems and distant places. Therefore, several countries, especially the north-European ones, are currently reforming their planning systems, in order to integrate the safeguard of ecological networks as a key planning criterion.

This paper investigates Campania regional policies in the field of water protection and sustainable water management, and their influence on Provincial and Municipal planning practice, in the light of the recent legislative reforms, using as case study the municipalities located within one the most critical river basins, i.e. Sarno Valley.

The paper is structured as follows. Paragraph 1 introduces the topic and its relevance. Paragraph 2 describes the geographical and environmental context of Campania Region. Paragraph 3 briefly summarises some of the most relevant cases of river restoration in Europe. Paragraph 4 presents an overview of Regional policies in the field of river ecosystems protection, from the Regional Territo-

rial Plan to innovative instruments like River Contracts. Paragraph 5, through the analysis of municipal planning processes within Sarno River basin, looks for possible influences of regional policies on local planning practice, highlighting strengths and weaknesses. Paragraph 6 contains conclusive remarks and possible future research directions.

2. CONTEXT FRAMEWORK

Campania Region is characterised by a strong demographic polarisation, with urban areas and infrastructures huddled around Naples and in its Metropolitan City, where roughly 50% of regional inhabitants live in less than 9% of total territory. This imbalance mirrors the various rates of “human pressure” on natural environment - and particularly on water network - that can be found within Campania Region.

Generally speaking, the streams located in the Volturno Plain, along the Tyrrhenian coast and in the metropolitan area of Naples suffer from strong pollution, loss of ecological features and - in some cases - hydrogeological instability and flood risk. On the other hand, the water network located in inner and mountainous areas show better ecological quality and lower pollution, due to the absence of big urban centres and industrial settlements.

Given this extremely variegated environmental framework, the Campania Regional Administration faces a great variety of challenges. It is worth remembering that, according to the Italian Constitution, State Authorities are in charge of environmental protection, while Regional Authorities have the task of “valorisation of cultural and environmental goods”. In line with the approach required by the Constitution, Campania Regional Authorities are promoting policies and strategies aimed to protect and increase the ecological quality of river and streams.

Beside the issue of river pollution, the relevance of hydrological flows has become dramatically clear during some extreme rain events that marked the recent history of Campania, highlighting the fragility of its territory. Here is presented a list of the major floods/landslides that hit Campania during the last century, listed by date, geographic location and total victims:

- October 24th 1910, Amalfi Coast, Salerno, Ischia, around 200 casualties;
- March 26th 1924, Amalfi Coast;

- October 25th - 26th 1954, Salerno and Amalfi Coast, 318 casualties;
- May 5th 1998, Sarno Valley and Lauro Valley, 159 casualties;
- April 30th 2006, Ischia, 4 casualties;
- September 9th 2009, Amalfi Coast, 1 casualty;
- October 15th 2015, Benevento Province, 2 casualties.

3. ICONIC EXAMPLES OF RIVER ECOSYSTEM RESTORATION WITHIN URBAN AREAS

Across Europe, several cities and urban areas face the loss of ecological features of river ecosystems, with harmful consequences in terms of reduced adaptation ability to climate changes and a generalised depletion of natural resources. In this paragraph, some iconic examples of European river restoration are presented, spanning both plans focussed on urban districts and programs embracing wider areas.

The Netherlands are, due to their peculiar geographic condition, one of the most skilled countries in the field of water management. In recent years, Dutch authorities implemented the “Room for the River” program, a set of measures able to reduce flood risk and improve ecological condition along the Rhine delta; the plan started in 2006 and is currently in its final phase. Among the taken measures, can be cited flood plain lowering and widening, dyke relocation, “depoldering”, obstacles removing, etc. (Rijke, van Herk, Zevenbergen, & Ashley, 2012).

At the end of the twentieth century, The Ruhr region in Germany stood out as one of the most densely populated and industrialised areas in Europe, heavily relying on coal-mines and steel industries, with inevitable negative consequences on natural environment. In 1980s, after decades of economic crisis and growing unemployment, the International Architecture Exhibition (IBA) program was deployed, with the aim of turning the region into a modern, liveable and ecologically sustainable area.

One of the main actions undertaken was the ecological restoration of the Emscher River, an 80 kilometres-long stream, which had been used, since the early stages of industrialisation in the nineteenth Century, as a wastewater collector. The program resulted into the realisation of new sewers

and wastewater treatment plants, while the Emscher River, with its tributaries, underwent a deep ecological restoration. In combination with landscape refurbishment, river restoration attracted new workplaces, leisure activities and inhabitants, showing the potential of ecological restoration as incentive to urban renewal (Latz, 2003; Lovelady & El-Halwagi, 2009).

The Seine River connects Paris with The English Channel, crossing a territory with around 15 million inhabitants and 7 million workplaces, corresponding to one of the most economically vibrant areas in Europe. In 2015, following some years of debates, the Strategic Director Schema for the Seine Valley development was launched, giving birth in 2016 to the “Reinventing the Seine” program.

This strategy builds up around three key areas: management of space and sustainable development; controlling flows; economic development, higher education, and research. Even though “Reinventing the Seine” could be seen as a plan mainly focussed on economic development and trade increase, it entails several projects aimed to enhance urban quality through the restoration of Seine River. In fact, several projects regard the refurbishment of riverbanks are underway, in order to enhance the offer of spaces for leisure, sport and water-related activities (<http://www.reinventer-laseine.fr/en/>).

In London, the River Thames is the subject of a regional-wide strategy synthesised by The River Thames Scheme, pointing at reduction of flood risk, improvement of resilience of the Thames and surrounding areas, creation of leisure and recreational spaces along the river; the enhancement of environmental quality through the realisation of new wildlife habitats.

Even though not crossed by a major river, Madrid can be cited here due to the outcomes of the Madrid Rio project, an urban regeneration program based upon the restoration of Manzanares River, completed in 2011.

With Madrid Rio project, an urban motorway previously occupying riverbanks was relocated underground, giving the opportunity to turn the banks of Manzanares River into a 650 hectares-wide river park, with sports zones, cultural spaces, leisure activities. Despite the high costs, the project gained immediate consensus among local residents (Fernández-Güell, 2014).

4. WATER PROTECTION POLICIES IN CAMPANIA

It can be said that the main planning document issued by Campania Regional Authorities is the Regional Territorial Plan (PTR), a document that synthesises the regional strategies in different fields, including “environmental valorisation”. Campania approved its Regional Territorial Plan with the Regional Act n. 13 of 2008, containing several references to environmental features, including water network. According to Regional documents, one of the main goals of the Regional Territorial Plan is the “valorisation of riverbanks, essential in the perspective of soil protection and buffer features of riparian vegetation”. Moreover, neglected rural areas should be restored, preventing hydrological instability and orienting agricultural activity towards biodiversity protection; incentives able to reduce environmental fragmentation should be adopted.

The Regional Territorial Plan recognises the water network as the foundation of the regional ecological network, thus building the main ecological corridors upon the main rivers, like Volturno, Sele and Ofanto. Smaller rivers and streams, like Sarno, Regi Lagni, etc., sustain “secondary ecological corridors”, which – despite the classification – play a key role, since they often intersect urban areas, enduring high human pressure.

Following the regional directives, Provincial Authorities, through Territorial Coordination Plans (PTCP), should translate into practice the goal of building the regional ecological network, harmonising planning actions carried out by local municipalities. Provincial Plans often sketch an ecological network, detailing the regional framework, with the goal of encouraging local administrations to protect ecologically sensitive areas, including riverbeds and streams.

In Campania, four out of five Provincial Administrations formally approved their Territorial Coordination Plan during the period 2012-2014, in line with the Regional legislative reform of 2004. Naples Metropolitan City, which - in accordance with the National Act n. 56 of 2014 - replaced the former Provincial administration, is still struggling to complete the legislative procedure needed in order to approve its Territorial Coordination Plan and its Metropolitan Strategic Plan.

A concise overview of the four approved Territorial Coordination Plans - and of the draft documents regarding Naples Territorial Coordination Plan -

underlines how these instruments cope with river ecosystems protection and sustainable water management. In general, all the analysed plans contain detailed descriptions of natural environments, ecosystems and landscapes, based upon the study of natural and agricultural land use patterns, morphology, areas protected by European and National Acts – e.g. Natura 2000 sites and national parks. Moreover, provincial plans sketch a provincial ecological network, based on ecological core areas (protected areas, mountain ranges, etc.) and ecological corridors, often corresponding to rivers and their buffer zones. Avellino and Benevento provincial plans report the analyses contained in the Regional Water Protection Plan, regarding ecological quality of rivers and ground water. A more detailed review of provincial plans’ directives regarding river ecosystems is presented as follows:

- Avellino Territorial Coordination Plan, in accordance with Regional recommendations, highlights “river protection buffers” of remarkable size (1000 metres from river banks) around main rivers, in order to build the provincial ecological network;
- Benevento Territorial Coordination Plan defines “Strategic Natural Areas” and “Structural Projects” regarding river ecosystem protection. Some “Strategic Natural Areas” are involved in “Strategic Projects”, corresponding to natural protection and restoration projects;
- Caserta Territorial Coordination Plan describes the “Ecological Provincial System” on the basis of the information coming from natural and agricultural land use patterns. Specific protection measures for Volturno River - the longest river of Campania and Southern Italy - are lacking;
- Salerno Territorial Coordination Plan, beside the usual analysis about natural land use and ecological network, plans to extend Sarno River Park and to establish four new “inter-municipal” river parks;
- Naples Metropolitan City’s Territorial Coordination Plan, even though only at the stage of draft document, points out the relevance of ecological networks and the protection of river network. Accordingly, it establishes the extension of existing parks and the realisation of new ones; in particular, the Agricultural Park of Regi Lagni River aims to restore and protect river and rural ecosystems today highly damaged.

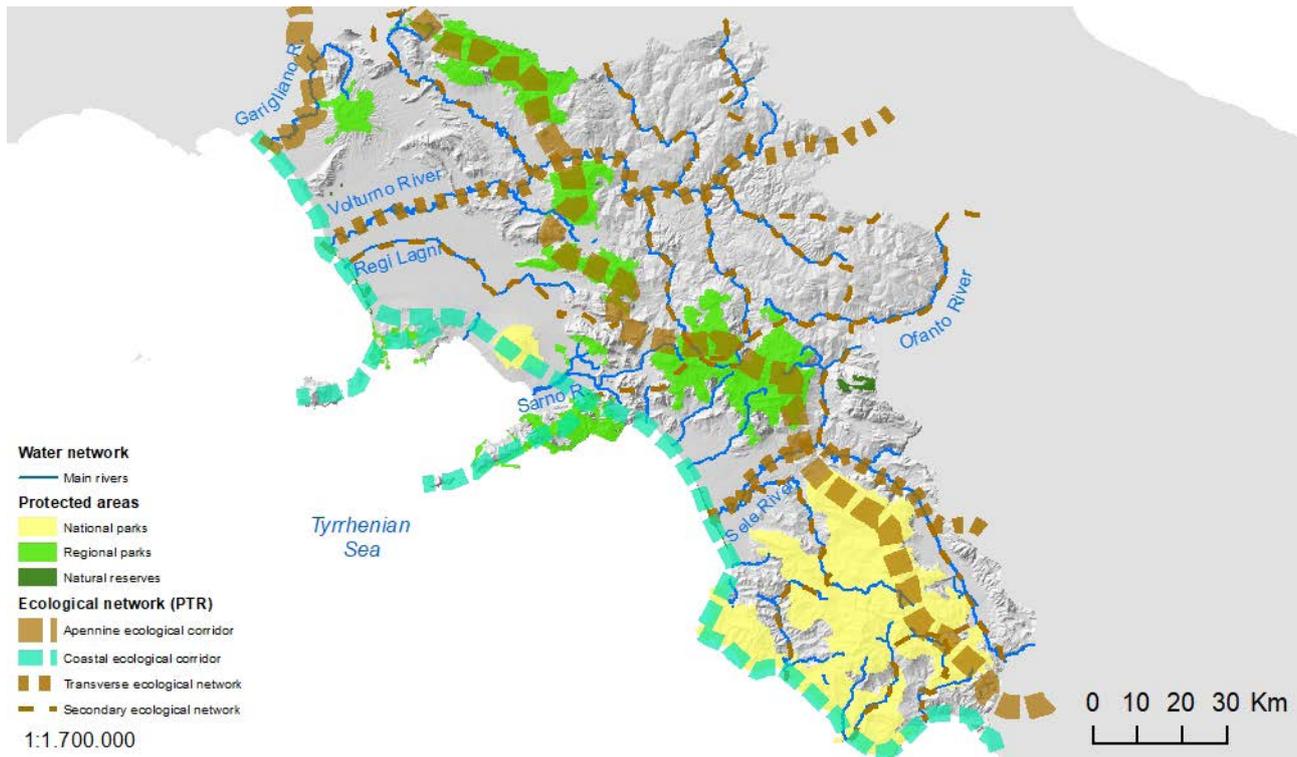


Figure 1: Ecological network of Campania Region. *Source: Authors' elaboration*

4.1 River contracts

Among the policies aimed to protect and valorise water network, the River Contract can be considered one of the most innovative and advanced instruments. The River Contract, as defined by Act n. 152/2006, is a voluntary strategic planning document, regarding a hydrographic basin, pursuing the protection and the sustainable management of water resources, as well as the reduction of hydraulic risk and the promotion of local development. River Contracts are ruled by Italian law according to the European Directive 2000/60/EC (water framework directive). Other relevant European acts in the fields of water protection and reduction of hydrological risks are Directive 2007/60/EC (floods directive), Directive 42/93/CEE (Habitat directive) and Directive 2008/56/CE (framework directive on marine strategy). River Contracts cannot modify planning rules coming from superordinate plans and strategic documents, however they can contribute to integrate and redirect local planning and to improve the contents of superior planning tools (Bastiani, 2011).

Campania Region is one of the first Italian Regions by number of River Contracts started, even though only few of them have come to a complete ratifi-

cation. Considering the low number of River Contracts actually in force, Regional Authorities started a legislative reform, with a new Regional Act on River Contracts currently in elaboration.

4.2 Sarno Great Project

Despite its small size, Sarno River basin, since the flood of 1998, became the subject of several studies, debates and planning efforts, aimed to reduce hydrological/flood risk and to fight against water pollution, which reaches extremely high peaks in the lower valley. Sarno River Valley is characterised by high population density, several industrial and productive settlements, it is located at the crossroad of many transportation corridors. Additionally, this area shows a rich historical and cultural heritage - above all Pompeii ruins - and a dispersed urban pattern. All these elements, together with the ungoverned urban growth, environmental degradation and the natural geological instability, expose this area to multiple risks, calling for a strong coordination between water management, environmental protection, land-use planning (Bastiani, 2011).

The dramatic events of 1998 consisted in land-

slides - defined as real lahars - and subsequent floods, which hit the municipalities of Sarno, Quindici, Siano, Bracigliano and San Felice a Cancello. They caused 159 deaths, 360 injured and around 1300 evacuated, highlighting the need for interventions able to reduce the exposure to this kind of risk (Brancaccio, Cinque, Russo, & Sgambati, 1999).

As reaction to those shocking facts, the "Sarno Geat Project" has been implemented, building a system of artificial basins and bridges, deemed able to limit the effects of extreme rain events. The process, started in 2011 with the financial sustain of European Union, is now only partially accomplished, entailing the construction of massive concrete artificial basins, highly criticised due to the strong impact on the landscape and the environment.

4.3 Regional river parks

In line with the regional strategy of building ecological corridors upon rivers and streams, Campania Region established parks and reserves along some of its main rivers, thus representing the backbone of ecological network:

- Regional Park "Roccamonfina - Foce Garigliano" (Garigliano River);
- Regional Park "Sarno" (Sarno River);
- Natural Reserve "Foce Volturno - Costa Licola" (mouth of Volturno River);
- Natural Reserve "Foce Sele - Tanagro" (Sele, Tanagro and Calore Rivers).

These protected areas connect natural "core areas", roughly corresponding to mountain ranges and often involved by Regional or National Parks. However, the protection of river ecosystems has proved to be a hard task to fulfil, especially in the case of rivers crossing urban areas (e.g. Sarno) or intensely cultivated lands (e.g. Volturno and Regi Lagni).

5. IMPLEMENTATION OF REGIONAL POLICIES IN LOCAL PLANS: A CHALLENGE

A research carried out by the University of Naples Federico II investigated the effects of water protection policies on municipal plans in Campania Region. The study closely examined the Sarno Riv-

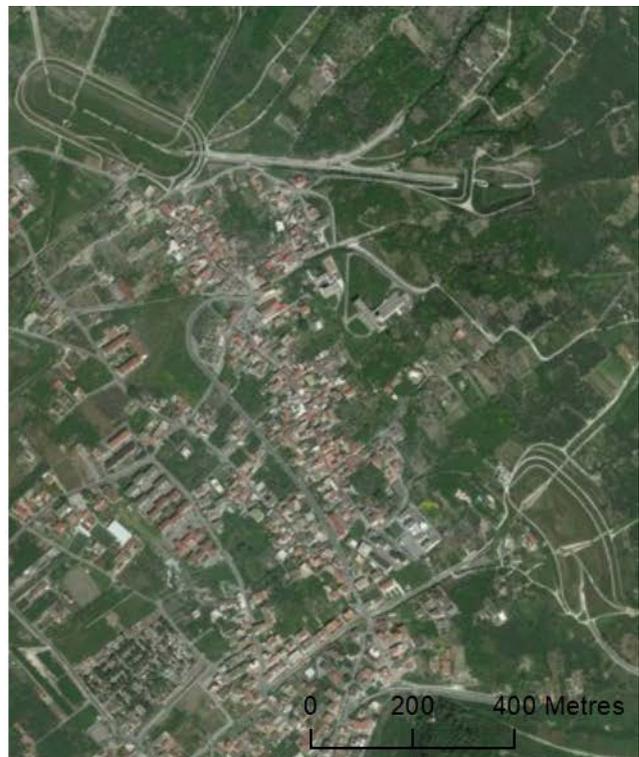


Figure 2: Artificial retention-basins in Quindici (left) and Sarno (right). *Source: Google Earth*

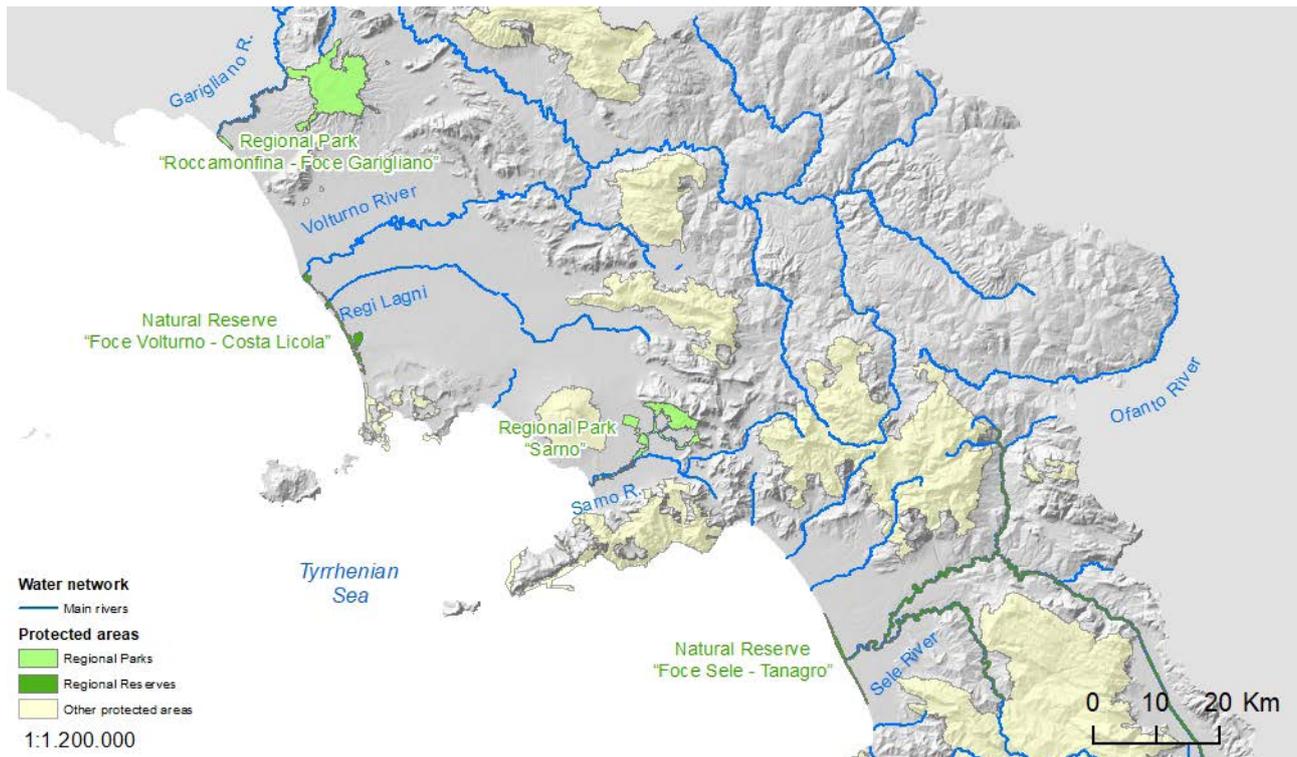


Figure 3: River network and regional parks. *Source: Authors' elaboration*

er Valley, highlighting obstacles and barriers to the implementation of regional policies. Municipal administrations are struggling to fulfil the tasks sketched or required by regional and national authorities.

During the last decades, State and Regional Authorities have deployed remarkable efforts in order to protect and enhance ecological networks, with special focus on rivers and streams. Despite those efforts, and the coordination of municipal planning strategies carried out by Provincial Plans, municipal planning practice often does not seem to convey concerns about the protection of river ecosystems.

It is worth remembering that Campania Region reformed its town planning regulation in 2004, with the Regional Act n. 16 of 2004. This reform brought remarkable innovations in the field of planning instruments, especially municipal land use plans. Before the cited reform, municipal plans were issued according to the national Act n. 1150 of 1942, based upon strict functional principles, and often criticised due to its lack of effectiveness and flexibility, pointed out as the main cause of missed planning at the municipal scale.

Contrary to expectations, the regional legislative

reform did not encourage a new wave of municipal plans. However, especially in recent years, under the push of Regional Authorities, several municipalities formally approved their Municipal Urban Plan (PUC) according to the prescriptions of Regional Act n. 16 of 2004.

5.1 Study case

In this paragraph is presented the state of the art of municipal planning processes within Sarno Valley, characterised by a critical ecological framework, resulting in:

- high pollution level of rivers and streams;
- high urban pressure and loss of ecological and natural features of river ecosystems;
- medium to high hydrological/flood risk.

Another reason of interest of Sarno Valley is connected to the implementation of Sarno Great Project (cf. Paragraph 4), a unique example of intervention, at territorial scale, aimed to reduce hydrological risk.

The analysed area roughly corresponds to Sarno Valley, including the municipalities involved by the "Sarno River" Regional Park and the municipali-

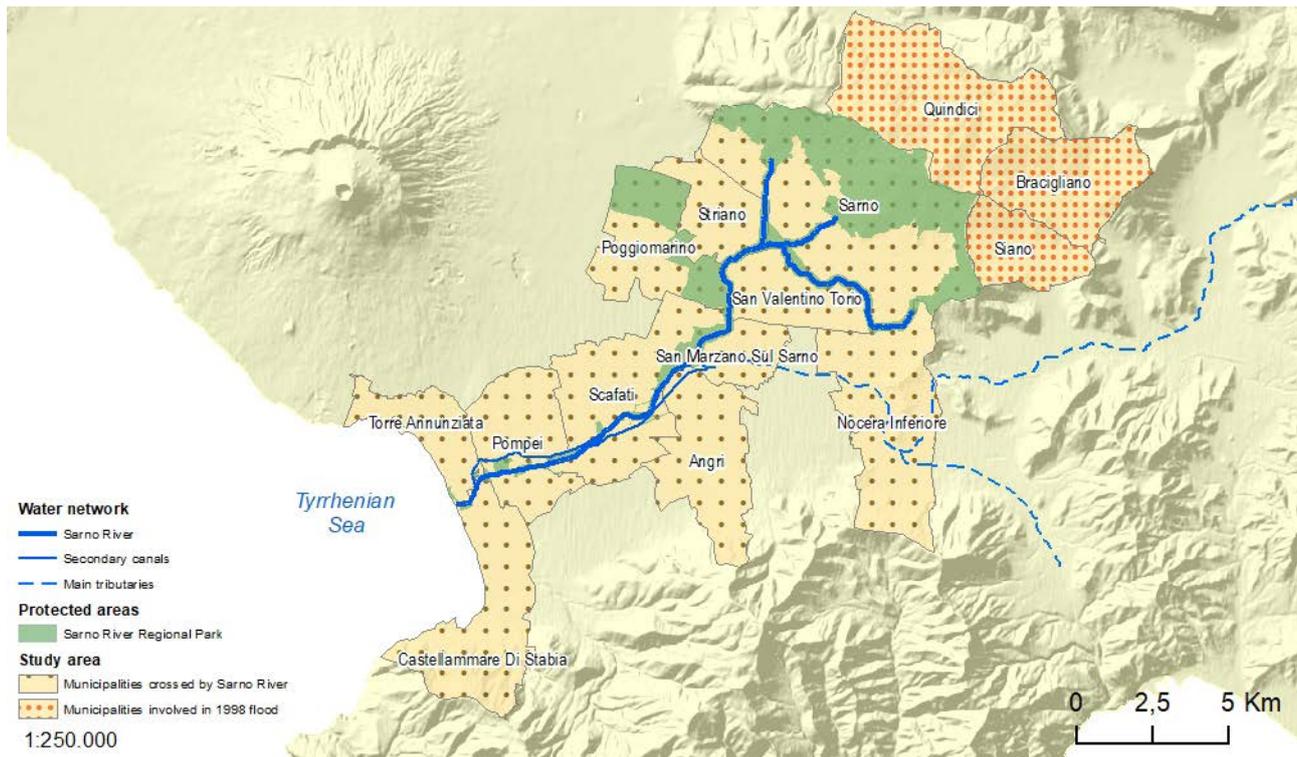


Figure 4: Study area. *Source: Authors' elaboration*

ties of Bracigliano, Quindici and Siano, hit by 1998 landslides and involved by Sarno Great Project. The study regarded fourteen municipalities, underlining that five of them have not started the renewal process of urban plans, thus basing their planning choices on documents predating the regional legislative reform of 2004. Regarding the remaining nine municipalities, four of them are at a preparatory stage of planning renewal, corresponding to the ratification of the Preliminary draft of urban plan, while only five municipalities have completed the renewal of their urban plan; therefore, they comply with the Regional Act n. 16 of 2004.

Among the innovations brought by the cited Regional Act, one of the most relevant is the bi-partition of urban plan into two parts: a “structural” section and an “operative” section. The “structural” section contains prescriptions able to protect local values and qualities (e.g. historical heritage, natural areas, etc.), not susceptible to frequent variations in time. The “operative” section has the task to implement transformative planning choices, coherent with financial resources, prone to be easily and frequently updated. The cited innovation is expected to ease the introduction of envi-

ronmental protection rules in local plans.

The study showed that, roughly fifteen years after the regional legislative reform of 2004, the renewal rate of urban plans is still low (five out of fourteen analysed municipalities). A deeper analysis of local planning state of the art, carried out through local plan collection and comparison, interviews and review of municipal databases, underlined the poor consideration put on sustainable water management by local planners. By way of example, San Marzano urban plan sketches a local ecological network, but with unclear effects on land-use regulations; Bracigliano municipality, with the Preliminary draft, defines an ecological corridor along its main stream, involved by the “Great Sarno Project”, planning parks and open spaces along the riverbanks. Poggiomarino Preliminary draft contains specific analyses and rules regarding sustainable water management, also focussing on the protection of ecological networks.

However, despite some positive exception, the enhancement of river ecosystem, as well as the introduction of sustainable systems of urban water management, hardly plays a role in the framework of local planning actions. Urban plans recently issued like Scafati – whose urban centre is in direct

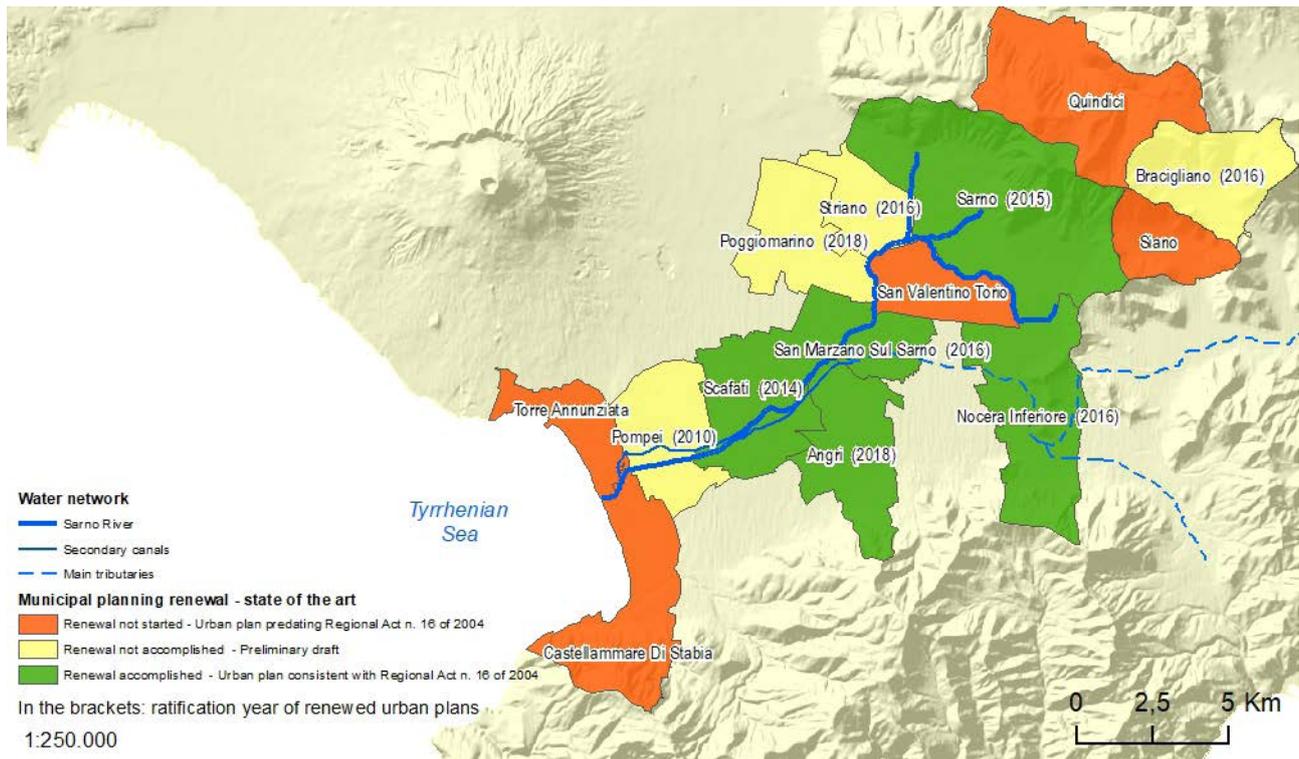


Figure 5: Municipal planning renewal. *Source: Authors' elaboration*

contact with Sarno River – do not contain specific measures in the direction of river valorisation. In the same way, the infrastructures built by the “Sarno Great Project” do not show a real integration with municipal planning strategies and local communities’ desires.

6. CONCLUSIONS AND RESEARCH PERSPECTIVES

In recent years, ecological issues have become one of the main pillars of urban and regional planning, in order to harmonise planning choices with environmental safeguard.

In the past decades, urban planners usually considered streams and rivers as obstacles to urban development, without considering their landscape value and ecological potential, transforming them into sewer or road infrastructures.

Today, an alternative approach is emerging, based on sustainable management of water resources (Pahl-Wostl, 2007), an issue that becomes particularly critical within the areas of the planet where the effects of climate change are more evident (Ig-

lesias, Garrote, Flores, & Moneo, 2007).

Sustainable management of urban water could entail several measures, as the reuse or recycle of wastewater, the increase of natural surfaces, the restoration of river ecosystems - enhancing ecological features of streams and rivers or rehabilitating them - taking the opportunity to refurbish neglected or underused urban spaces.

Those operations entail several advantages, e.g. they could attenuate the impact of extreme weather events like heat waves or heavy rains, reduce the consumption of water resources, increase the adaption ability of urban areas facing climate changes, absorb polluting substances, etc. (Larsen, & Gujer, 1997). Moreover, urban renewal project based on river restoration often contribute to increase urban quality, providing pleasant urban spaces for open-air activities, leisure, sport. Therefore, in the field of ecosystem protection and ecological enhancement, policies regarding water network are emerging as some of the most relevant ones, due to the importance of water cycle as backbone of wider ecosystems.

Several European countries, in accordance with European Union directives, are struggling to integrate water network protection into their planning

system. Accordingly, some European cities and metropolises, recognising the relevance of water network within urban context, are implementing urban renewal projects based on the restoration of river ecosystems, as shown by the cases of Ruhr, Madrid, etc. The success of such practices - in terms of urban and ecological quality, high public acceptance - proves that water network can be a founding factor on which urban renewal actions can be built.

Focussing on Campania Region, several policies and strategies in the direction of sustainable water management are underway. However, as highlighted by the analysis of municipal planning in Sarno Valley, a critical area from different points of view - e.g. water pollution, hydrological instability, flood risk, urban pressure - the transfer of region-

al directives about water management in urban planning practice appears inadequate. Municipal administrations do not seem to recognise the relevance of the topic, not being able to translate the tenets of sustainable water management into practice. This difficulty adds to the persistent lack of efficiency of municipal planning process, as confirmed by the low renovation rate of urban plans. Future research could systematically compare successful water management experiences with local planning practices, highlighting strengths and weaknesses.

Upcoming investigations can contribute to sketch suggestions and directives for municipal authorities, in order to facilitate the integration of sustainable water management into local planning practice.

REFERENCES

- Arena, A., & Nigro, A. (2017). Strategie per le aree interne: integrare i servizi ecosistemici e le azioni di tutela e sviluppo nel Puc di Volturara Irpina in M. Carta & P. La Greca (a cura di), *Cambiamenti dell'urbanistica. Responsabilità e strumenti al servizio del paese*. (pp. 155-158). Roma, IT: Donzelli.
- Bastiani, M. (2011). *Contratti di fiume. Pianificazione strategica e partecipata dei bacini idrografici. Approcci, esperienze, casi studio*. Palermo, IT: Dario Flaccovio Editore.
- Brancaccio, L., Cinque, A., Russo, F., & Sgambati, D. (1999). Osservazioni geomorfologiche sulle frane del 5-6 maggio 1998 del Pizzo d'Alvano (Monti di Sarno, Campania). In G. Orombelli (Ed.), *Studi geografici e geologici in onore di Severino Belloni* (pp. 81-123). Genova, IT: Glauco Brigati.
- Butler, D., & Parkinson, J. (1997). Towards sustainable urban drainage. *Water Science and Technology*, 35(9), 53-63. doi: 10.1016/S0273-1223(97)00184-4
- Davoudi, S. (2000). Sustainability: a new vision for the British planning system. *Planning Perspectives*, 15(2), 123-137. doi: 10.1080/026654300364056
- Davoudi, S., Crawford, J., & Mehmood, A. (Eds.). (2009). *Planning for climate change: strategies for mitigation and adaptation for spatial planners*. London, UK: Earthscan.
- Di Baldassarre, G., Kemerink, J. S., Kooy, M., & Brandimarte, L. (2014). Floods and societies: the spatial distribution of water-related disaster risk and its dynamics. *Wiley Interdisciplinary Reviews: Water*, 1(2), 133-139. doi: 10.1002/wat2.1015
- Elliott, A. H., & Trowsdale, S. A. (2007). A review of models for low impact urban stormwater drainage. *Environmental modelling & software*, 22(3), 394-405. doi: 10.1016/j.envsoft.2005.12.005
- Ellis, J. B. (2000). Infiltration Systems: A Sustainable Source-Control Option for Urban Stormwater Quality Management?. *Water and Environment Journal*, 14(1), 27-34. doi: 10.1111/j.1747-6593.2000.tb00222.x

- Geddes, P. (1915). *Cities in evolution. An introduction to the town planning movement and the study of civics*. London, UK: Williams & Norgate.
- Iglesias, A., Garrote, L., Flores, F., & Moneo, M. (2007). Challenges to manage the risk of water scarcity and climate change in the Mediterranean. *Water resources management*, 21(5), 775-788.
- IPCC - Intergovernmental Panel on Climate Change (2007). *Climate Change 2007 – Mitigation of climate change*. Retrieved from https://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4_wg3_full_report.pdf
- Keenleyside, K., Dudley, N., Cairns, S., Hall, C., & Stolton, S. (2012). *Ecological restoration for protected areas: principles, guidelines and best practices*. Gland, CH: IUCN
- Larsen, T. A., & Gujer, W. (1997). The concept of sustainable urban water management. *Water Science and Technology*, 35(9), 3-10.
- Latz, P. (2003). Landscape Park Duisburg-Nord: the metamorphosis of an industrial site. In Kirkwood N. (Ed.), *Manufactured Sites. Rethinking the Post-Industrial Landscape* (pp. 150-161). London, UK: Spon Press
- Lovelady, E. M., & El-Halwagi, M. M. (2009). Design and integration of eco-industrial parks for managing water resources. *Environmental Progress & Sustainable Energy: An Official Publication of the American Institute of Chemical Engineers*, 28(2), 265-272. doi: 10.1002/ep.10326
- Marlow, D. R., Moglia, M., Cook, S., & Beale, D. J. (2013). Towards sustainable urban water management: A critical reassessment. *Water research*, 47(20), 7150-7161. doi: 10.1016/j.watres.2013.07.046
- Miguel Fernández-Güell, J. (2014). Madrid: A Tale of an Ambitious City that Failed to Fulfill its Global Vision. *disP-The Planning Review*, 50(1), 6-15. doi: 10.1080/02513625.2014.925715
- Miller, J. D., Kim, H., Kjeldsen, T. R., Packman, J., Grebby, S., & Dearden, R. (2014). Assessing the impact of urbanization on storm runoff in a peri-urban catchment using historical change in impervious cover. *Journal of Hydrology*, 515, 59-70. doi: 10.1016/j.jhydrol.2014.04.011
- Moccia, F.D., & Sgobbo, A. (2013). Flood hazard: planning approach to risk mitigation. *WIT Transactions on the Built Environment*, 134, 89-99. doi:10.2495/SAFE130091
- Moccia, F.D., & Sgobbo, A. (2016). Flood hazard: planning approach to risk mitigation and periphery rehabilitation. In S. Syngellakis (ed.), *Management of Natural Disasters* (pp. 129-144). Southampton, UK: WIT Press. doi: 10.2495/978-1-84566-229-5/012
- Moccia, F.D., & Sgobbo, A. (2017). Città Metropolitana di Napoli. In F.D. Moccia & G. De Luca (eds.), *Pianificare le città metropolitane in Italia. Interpretazioni, approcci, prospettive* (pp. 289-326). Roma: INU Edizioni.
- Nigro, A., & Vitale, C. (2017). Fabbisogno insediativo in Campania. In F.D. Moccia (ed.), *Metropoli senz'auto* (pp. 16-28). Roma, IT: INU edizioni.
- Pahl-Wostl, C. (2007). Transitions towards adaptive management of water facing climate and global change. *Water resources management*, 21(1), 49-62. doi: 10.1007/s11269-006-9040-4
- Rijke, J., van Herk, S., Zevenbergen, C., & Ashley, R. (2012). Room for the River: delivering integrated river basin management in the Netherlands. *International journal of river basin management*, 10(4), 369-382. doi: 10.1080/15715124.2012.739173
- Sgobbo, A. (2018). The Value of Water: an Opportunity for the Eco-Social Regeneration of Mediterranean Metropolitan Areas. In F. Calabrò, L. Della Spina, C. Bevilacqua (Eds), *New Metropolitan Perspectives. Local Knowledge and Innovation Dynamics Towards Territory Attractiveness Through the Implementation of Horizon/E2020/Agenda2030. vol 2* (pp. 505-512). Cham, CH: Springer. doi:10.1007/978-3-319-92102-0_53
- Sgobbo, A. (2018). Water Sensitive Urban Planning. Approach and opportunities in Mediterranean metropolitan areas. Rome, IT: INU Edizioni.

United Nations, Department of Economic and Social Affairs, Population Division (2018). World Urbanization Prospects: The 2018 Revision, Methodology. Working Paper No. ESA/P/WP.252. New York, US.

Van Roon, M. (2007). Water localisation and reclamation: Steps towards low impact urban design and development. *Journal of environmental management*, 83(4), 437-447. doi: 10.1016/j.jenvman.2006.04.008

Travis, Q. B., & Mays, L. W. (2008). Optimizing retention basin networks. *Journal of Water Resources Planning and Management*, 134(5), 432-439.

Wheeler, S. M., & Beatley, T. (Eds.). (2014). *Sustainable urban development reader*. Abingdon, UK: Routledge.

Yilmaz, A. G., Hossain, I., & Perera, B. J. C. (2014). Effect of climate change and variability on extreme rainfall intensity-frequency-duration relationships: a case study of Melbourne. *Hydrology and Earth System Sciences*, 18(10), 4065.

Yang, H., Dick, W. A., McCoy, E. L., Phelan, P. L., & Grewal, P. S. (2013). Field evaluation of a new biphasic rain garden for stormwater flow management and pollutant removal. *Ecological engineering*, 54, 22-31. doi: 10.1016/j.ecoleng.2013.01.005

Zhou, Q., Mikkelsen, P. S., Halsnæs, K., & Arnbjerg-Nielsen, K. (2012). Framework for economic pluvial flood risk assessment considering climate change effects and adaptation benefits. *Journal of Hydrology*, 414, 539-549. doi: 10.1016/j.jhydrol.2011.11.031