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An Urban Equalisation Strategy for Managing the Transition to Climate Resilience in an Ordinary Italian City

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Abstract

Climate change poses complex challenges that require simple and viable responses, particularly for those small and ordinary cities that are traditionally lacking in financial and human resources. To effectively address climate change responses, adaptation and mitigation strategies imply the understanding of solutions as well as the inclusion of different actors in the decision-making process. Responses to climate change not only depend on the knowledge of the impacts of extreme weather events but also on the inclusion of comprehensive approaches that should consider the availability of areas for spatialising different solutions, the cooperation of stakeholders at different levels, and the disposal of financial resources and institutional capacities. Such approaches face several difficulties and limitations for their real development and management, especially in ordinary cities. This is mainly due to a general lack of areas belonging to municipalities to be used as public spaces for developing new adaptation and mitigation actions and, therefore, to their related economic viability. The implementation would require the public acquisition of private plots, which is often economically unsustainable for local administrations and faces resistance from private landowners. This study proposes an urban equalisation approach that is grounded in the principle of targeting a balanced sharing of benefits and liabilities among those private actors involved in adaptation and mitigation programmes. The case study of Ragalna, a small Italian town, is investigated in the framework of the recent Local Spatial Plan that carried out a tailored transfer of development rights strategy for building a new green infrastructure aimed at pursuing a climate-resilient scenario that can be adopted by other ordinary cities.

Keywords

climate resilience; green infrastructure; ordinary cities; transfer of development rights; urban equalisation

1. Introduction

1.1. Green Infrastructure for Climate-Resilient Strategies

The increasingly evident adverse effects of climate change on cities call for a profound rethinking of urban planning tools and their contents, especially with a view to defining new economic, social, and environmental sustainability objectives that allow for redesigning a more resilient, safer, and higher-quality urban environment. Reviewing spatial planning and management tools, through the introduction of innovation elements in urban policies and the research and adoption of new strategies, represents a fundamental step for re-designing and building settlements that can better adapt to climate change (Martinico et al., 2014). At the local level, cities face significant impacts from climate change because they are home to more than 50% of the world's population, are growing rapidly, and often concentrate economic activities, population, and infrastructure in high-risk locations (Araos et al., 2016). Urban climate change-related impacts include rising sea levels and storm floods, heat islands and heat stress, extreme precipitations, inland and coastal flooding, landslides, drought, increased aridity, water scarcity, and air pollution, with widespread negative impacts on people (and their health, livelihoods, and assets) and on local and national economies and ecosystems (Intergovernmental Panel on Climate Change, 2023). In these urban contexts, adaptation is about planning and building settlements that can adjust better to the consequences of all these changes. Predominantly, urban planning measures can help protect and enhance green spaces that have permeable and evapotranspiring features. This action is specifically related to adaptation, since urban green spaces can provide many relevant functions for coping with climate change. They provide essential ecosystem services such as stabilising the climate through carbon storage and sequestration and regulating the micro-climate features (in terms of air temperature and urban heat island reduction) through tree evapotranspiration processes and shading effects, which also contribute to building energy savings in the summertime (Palme et al., 2019; Privitera et al., 2021), controlling stormwater runoff through soil permeability (Elliot & Trowsdale, 2007), reducing noise through greenery canopy biomass, enhancing air and water quality through air pollutants removal, and providing compost biomass and soil protection (Henneberry et al., 2020; McHale et al., 2007). In addition, urban green spaces are relevant in physical planning since they provide a further layer of cultural ecosystem services such as increasing urban quality and creating more pedestrian-friendly, comfortable, and visually pleasing settlements and sense of place (Daily, 1997).

Accordingly, urban planning and management practices should be based around the multi-functional concept of green infrastructure (Handley et al., 2007), which can be envisioned as a new planning tool for effectively implementing adaptation and mitigation strategies. Nature as infrastructure has the potential to be a transformative concept for development. It goes beyond the idea of nature-based solutions, which are mostly understood as isolated and localised actions to mimic natural processes through green components. Nature-based solutions emphasise a problem-driven and solution-oriented approach that seeks to apply ecological wisdom to solve sustainability challenges (Eggermont et al., 2015) and to address societal challenges rather than just planning (Pauleit et al., 2017). Differently, the concept of green infrastructure is mainly referred to as a network of interlinked green areas, which can also include nature-based solutions. It has been introduced to upgrade urban green space systems, thus forming a coherent planning structure (Sandström, 2002). Indeed, green infrastructure can be made of different kinds of green spaces, connected as networks of multifunctional ecological systems within, around, and between urban areas, and at different

spatial scales (Mell, 2008). Green infrastructure comprises interconnected natural areas instead of separate parks, recreation sites, and any other nature-based solution scattered around the urban fabric. The concept of green infrastructure emphasises the quality as well as quantity of urban and peri-urban green spaces (Rudlin & Falk, 1999; Turner, 1996), their multifunctional role (Sandström, 2002), and the importance of interconnections between habitats (van der Ryn & Cowan, 1996). Green infrastructure maintains the integrity of habitat systems and provides the physical basis for ecological networks, which has been advocated as a way for alleviating the ecological impacts of habitat fragmentation, even in urban contexts (Bierwagen, 2007). This makes biodiversity conservation an integral part of sustainable landscapes (Opdam et al., 2006). Its design and management should also enhance the character and distinctiveness of an area with regard to existing habitats and landscape types. Green infrastructure also plays a key role in climate change adaptation and mitigation by improving the city's capacity to cope with rising temperatures and extreme weather events associated with climate change (Gill et al., 2008). Furthermore, the connection of urban green spaces increases the overall accessibility of these areas through the creation of cycling and walking paths. The term infrastructure implies a system that is vital to the functioning of a city, whereas green space may be regarded as something merely nice to have. Like other infrastructure typologies, such as transport, food/energy supplies, and water/waste management systems, green infrastructure can significantly contribute to the delivery of other forms of services to communities (Millennium Ecosystem Assessment, 2005). For all these reasons, green infrastructure should be seen as a primary consideration in planning, developing, and maintaining an eco-town. If it is proactively planned, developed, and maintained, it has the potential to guide urban development by providing a framework for economic growth and nature conservation (Schrijnen, 2000; van der Ryn & Cowan, 1996; Walmsley, 2006). Such a planned approach would offer many opportunities for integrating urban development, nature conservation, and public health promotion (Tzoulas et al., 2007).

1.2. Ordinary Cities Between Climate Crisis and Local Action

It is increasingly recognised that the delivery of climate policy ultimately happens through place-based initiatives at the local level (Galarraga et al., 2011; Howarth et al., 2021). It has also been widely argued that effective delivery of actions to promote low-carbon and climate-resilient development will require experiments with new governance arrangements (Bulkeley et al., 2019; Castán Broto, 2020; Jordan et al., 2018; Kivimaa et al., 2017). In particular, processes that engage and harness the combined energies of the public, private, and third sectors are required (Gouldson et al., 2016). The dominant literature traditionally focuses almost exclusively on cities that are represented as key command-and-control centres for globalised social, economic, cultural, and creative processes (Amin & Graham, 1997). Indeed, most academic studies have focused on large forerunner cities, often highlighting how their ambitious and innovative approaches aim to deliver carbon neutrality by 2050 or earlier. Such studies can usually provide positive and inspiring lessons because these places often benefit from favourable conditions, such as higher levels of financial resources, human capacity, and community support for action. Nevertheless, they only represent a small minority of the global population and an even smaller share of the world's cities. Indeed, the number of the world's ordinary cities is definitely higher than the leading ones. To raise awareness of innovative practices that such places might wish to adopt, more research into how lower-profile cities are seeking to tackle climate change is needed. This is because local governments need to address climate change, and, therefore, approaches have to be developed and shared in order to be applicable to a wide range of municipalities rather than just a handful of leaders (Haupt et al., 2022). In the context of local climate action, ordinary cities

can be understood as mostly mid-sized or smaller cities that are not high-profile progressive actors in climate governance (Haupt et al., 2022). Ordinary cities can be best defined by identifying what they may lack: They benefit from neither a particular power of attraction nor their extraordinary size or importance (Amin & Graham, 1997; Robinson, 2020). Robinson (2002, 2008) refers to them as cities off the map and argues that scholars should seek to study wealthy and innovative cities alongside poorer cities to identify and exploit the opportunities to learn from a wide array of diverse urban contexts. Thus, the term ordinary city has been used to deconstruct mainstream urban theory and to formulate a different methodological approach for more cosmopolitan urban research (Gemmiti, 2023). Indeed, given that the vast majority of cities have a much lower profile and are smaller in size than the handful of world cities around the globe, it can be seen how the experiences of such ordinary places are probably much more relevant for a wider range of urban areas. Therefore, if studies and practitioners focus predominantly on high-profile cities, they are probably neglecting the innovations adopted elsewhere that may be much easier to apply in other contexts.

For these ordinary cities, which can be subjected to a lack of financial and human resources, the complex challenges posed by climate adaptation and mitigation strategies may become untenable. The degree to which these strategies can be implemented alongside the cities greatly varies, as does the actual potential to generate public revenues or require government expenditures, which diverges according to the administrative scale at which they are applied (Intergovernmental Panel on Climate Change, 2023). Planning for adaptation and mitigation ultimately will not be effective if resources are lacking (Neufeldt et al., 2021), particularly after decades of austerity and associated chronic underinvestment in social and physical infrastructure (Hinkley & Weber, 2021). Placing green infrastructure at the centre of adaptation and mitigation projects, especially in similar contexts, entails the unpostponable task of exploring new and relevant financial mechanisms that ensure, on the one hand, the economic feasibility of the transformation scenarios and, on the other, guarantee the fair distribution, among public and private stakeholders, of burdens and benefits associated with transformation. Indeed, the first step towards developing the green infrastructure is to make the land available.

When local authorities have no land for specific purposes, they can basically operate through the expropriation of private land property. Even if considered an important tool for reducing the public burden of climate exposure (Dreyzin, 2018; Mach et al., 2019), expropriation may only be delivered for public goals or in the public interest, and economic compensation must be paid to landowners deprived of their own property. In countries with well-developed real estate markets and property rights institutions, land expropriation may be politically and economically unfeasible for local administrators (Eakin et al., 2022). Reversely, land-based taxes, including property and land-value taxes, are largely applied by the municipal authorities. Land-based taxes are often seen as an appropriate and relatively equitable mechanism for adaptation financing (Levy & Herst, 2018; Woodruff et al., 2020), given that adaptation is considered a public good and taxes are required proportionally with property values. However, linking adaptation funding to property-based revenue can result in a perverse incentive for urban development and soil sealing, which exacerbates climate change risks (Shi & Varuzzo, 2020). A large number of incentive-based policies have also been developed and implemented in recent decades, such as the development of impact fees, infill and redevelopment incentives, right-to-farm laws, and agricultural districts (Bengston et al., 2004).

More interestingly, other approaches have been developed to protect open spaces through the acquisition of development rights severed from land that is near urban areas and threatened by development. These

approaches include the transfer of development rights (TDR) and the purchase of development rights or conservation easements. They are based on the idea that ownership of land involves a bundle of rights, such as mineral rights, surface rights, air rights, and development rights, that can be separated (Wiebe et al., 1997). The TDR allows the sale of development rights from a specific parcel of land to other properties. Future use of the original parcel is then protected from development by a permanent conservation easement or deed restriction prohibiting development. A TDR programme defines an area to be protected from development (the sending area) and one where development will be allowed to occur (the receiving area). Landowners can transfer the rights to develop one parcel of land to another. As a consequence, the parcel from which the development rights are being transferred can no longer be developed or developed only in a limited way (Brabec & Smith, 2002). As a result, landowners are compensated for regulatory restrictions that reduce property values (Porter, 1997). TDR programmes allow more development than the one that might otherwise occur at the receiving site. The acquisition of the development rights is funded not by grants or taxes but by the developers of the receiving sites who acquire greater development potential, and therefore potential profit, by voluntarily using the TDR option. The sending sites are the areas that a community or municipal administration has identified as worthy of permanent preservation, and the receiving sites are the areas that are capable of accommodating additional development (Kaplowitz et al., 2008). TDR offers a planning policy that essentially redirects development rather than simply preventing it and thus recognises that there are areas where development must be allowed and even encouraged (Millward, 2006). These mechanisms have been described as promising for addressing sea level rise and flood exposure (McGuire & Goodman, 2020; Williams, 2014). To some extent, TDR programmes can be addressed as land value capture strategies, which refer to a suite of related mechanisms for the public sector to capture a share of the improved value of land that has been achieved in part through public and community contributions to development (Dunning & Lord, 2020). Instruments include betterment fees, district improvement financing, tax increment financing, developer contributions, and direct land sales (Levy & Herst, 2018). The land value capture approach allows for public revenues from high-value urban development and thus generates funds to finance infrastructure improvements and adaptations (Dunning & Lord, 2020).

In Italian cities, which are mostly characterised by a congenital deficit of public green spaces, local governance practices frequently fall short or are disregarded when it comes to addressing adaptation and mitigation methods, which are primarily distinguished by an inherent lack of public green areas (Molinaro, 2020; Serra et al., 2022). The reasons for this failure can be attributed to a lack of human resources and, more especially, to the scarcity of public land, which is necessary for the successful implementation of climate-resilient measures. On the other hand, acquiring land for putting into practice and spatialising new solutions via expropriation for public purposes implies public financial expenses and faces resistance from private landowners. That was often abandoned due to the reduced cash availability of most local authorities. Private investors also contributed to carrying out, within a real estate market devoid of significant economic investments, a very poor urban development in terms of public open spaces and green infrastructure. Moreover, since 1968, the Italian Ministerial Decree No. 1444/68 has enacted private developers to provide publicly accessible land and services (18 m^2 per inhabitant moving to the new residential area) in terms of green spaces, parking lots, schools, and other public facilities. However, as a result of this norm, thousands of small and unplanned fragments of land were randomly scattered around the urban peripheries of Italian cities. Consequently, these places are determined to be unfit for use as public green spaces and even unsuitable for conversion into new potential green infrastructure in the future.

The study aims at exploring and arguing about the urban equalisation approach and the TDR programmes as tools for managing the issue of the economic feasibility of adaptation and mitigation strategies in cities. This research objective is particularly conducted from the perspective of understanding how ordinary cities, which are characterised by insufficient financial and human resources, can plan and manage the climate and energy transition according to those tools. To achieve this aim, the article investigates the case study of Ragalna, an ordinary Italian city that implemented the new Local Spatial Plan according to urban equalisation and TDR principles. The proposed investigation method is structured into three parts: (a) a description of the case study; (b) urban equalisation and TDR principles; and (c) a presentation of the tailored urban equalisation method as delivered in Ragalna. Afterwards, opportunities and limitations are discussed in order to assess urban equalisation based on the TDR as an approach to be transferred to other ordinary cities for dealing with local climate action.

2. Materials and Method

2.1. Case Study

A recent urban planning practice in Ragalna (Southern Italy) stood out for its aim to project the new Local Spatial Plan around the idea of building a large green infrastructure for adaptation and mitigation strategies while protecting geomorphological specificities and exploiting local cultural identities. In 2015, according to Regional Act 71/1978, the Municipality of Ragalna started the process of drafting the Local Spatial Plan with the scientific support of the Department of Civil Engineering and Architecture, University of Catania (Italy). This Plan was aimed at exploring new economic feasibility for implementing green infrastructure through a tailored TDR programme. Ragalna is a very small town located between the south-west slope of Mount Etna and the large conurbation of the main city of Catania (Sicily, Italy). With approximately 4,000 residents and over 13,000 seasonal inhabitants, the municipality covers an area of around 39 km^2, and 2/3 falls within the Etna Regional Natural Park. The municipal land is characterised at the lowest altitudes by olive orchards and vineyards and gradually evolves into a high mountain environment, with slopes exceeding 10%, where large forest fragments are interspersed with pear and apple orchards and chestnut groves between volcanic cones and lava flow caves, which represent the icons of the Etna volcanic landscape. These semi-natural and agricultural lands represent the only economic sources for the local population. Moreover, the relevant natural Rosario Creek runs down through the urban centre of Ragalna from north to south, and due to its morphological and orographic features, it has resisted the processes of both agriculture and urban development, and today it represents the main natural distinctive constituent of the town (see Figure 1).

The urban fabric, which is divided into two halves by the stream, runs from 1,000 to 500 meters above sea level along the same path. It is a settlement made up of four urban clusters characterised by low-density residential fabrics closely located near small, widespread historical aggregates, agricultural areas, including abandoned ones, and isolated portions of the Etna Forest. Outside the urban centre, the agricultural land is covered by farmlands and rural buildings, as evidence of long-lasting anthropogenic processes.

2.2. Urban Equalisation

Preserving natural resources and implementing new public facilities and green spaces was a critical issue for Ragalna's local decision-makers because they had to deal with the land acquisition of open spaces and

Figure 1. The Rosario Creek, Ragalna (Sicily, Italy).

private plots that were definitely economically unsustainable, as well as facing resistance from private landowners. In the framework of the new Local Spatial Plan, a way for managing the issue of the economic feasibility of public intervention for putting on the ground adaptation and mitigation strategies has been addressed through an urban equalisation approach that is intended as a planning tool, usually integrated into the local spatial plans, which distributes development rights across the municipal land (Micelli, 2002; Scattoni & Falco, 2011). It is a form of agreement among private landowners and developers, the third sector, and public bodies (mainly municipalities), which focuses on equal treatment of private and public interests, somehow aimed at capturing land value to finance the public city (Gerber et al., 2018; Oppio et al., 2019). Urban equalisation is extremely complex, but the underlying principle of equalisation remains simple, which is to simultaneously burden the property with the benefit of buildability and the burden of contributing to the general elevation of the urban quality of the city (Fiale, 2003). These strategies, aimed at reducing the disparity in treatment between owners, are essentially based on the tool of granting development rights that can be spent in other areas of the municipal land through different methods (Urbani, 2010). Equalisation stands for an equity principle that supports a uniform and balanced recognition of private land tenure rights with key matters of public interest (Ave, 2018; Falco, 2016). In particular, urban equalisation allows to pursue, on the one hand, distributive justice of the benefits (among the landowners) deriving from urban transformations as envisaged by the Local Spatial Plan and, on the other hand, a fair distribution (between the landowners and the public actor) of the burdens when delivering public facilities and services. An urban equalisation approach is based on a TDR programme, which first defines areas to be protected from future development and others where development will be allowed to occur. The TDR programme assigns development rights to those private land parcels that local authorities plan to protect and exploit for future green public facilities. Development rights are assigned in response to a request for transferring the property of those parcels to the public realm in proportion to the development rights received. Development rights are understood as an equalisation ceiling and expressed in terms of the amount of development (building

volume) to be assigned to the land parcel (sending area) for being transferred to other parcels where urban development is allowed to occur (receiving area). As a consequence, the parcel from which the development rights are being transferred can no longer be developed and is transferred to public local property, and landowners are compensated with new development rights to be sold to future developers. The transfer of land property to the public realm can be understood as a planning obligation. Indeed, in order to make an urban transformation proposal acceptable in planning terms, the cost of any works to mitigate its impact, as defined in the associated planning obligation, had to be met by that proposal (Henneberry, 2016).

2.3. A Tailored Urban Equalisation Method

The method proposed for the Ragalna Local Spatial Plan was based on a three-step urban equalisation approach to allow public authority to acquire the land for green infrastructure with no economic expenses, as well as to target a balanced sharing of benefits and liabilities among those private actors involved in urban transformation: (a) The Rosario Creek was identified as the leading geomorphological component from which to build a larger green infrastructure through connecting the green ridge of the stream to all the most valuable green and open spaces; (b) the green infrastructure implementation included all the new foreseen public facilities; and (c) a targeted TDR programme was proposed in order to make the implementation of the green infrastructure viable.

The Ragalna Local Spatial Plan aimed at closely connecting the future development process to the new public facilities provision programme. The new green infrastructure was expected to include different public facilities such as urban and suburban parks, green spaces, small urban gardens, playgrounds, indoor and outdoor sports equipment, parking lots with high permeable pavements and tree cover, and cycling and pedestrian lanes. To this end, the primary objective was to transfer to the public realm at least the green areas strictly contiguous to the Rosario Creek for the development of a wider green infrastructure at the municipal scale around this green ridge. Secondly, other non-contiguous areas mostly characterised by abandoned or uncultivated agricultural fields, native vineyards, orchards, and shrubby vegetation could be converted to new forms of urban agriculture and connected to the green infrastructure through cycling and pedestrian paths across sprawled residential settlements. As a third phase, a tailored TDR programme was then developed for the Ragalna Local Spatial Plan and delivered in four steps:

1. Development rights are assigned both to the land parcels to be acquired (sending area) for implementing the green infrastructure (0.15 m^3 of building volume over a land parcel area unit of 1.00 m^2) and the land parcels (receiving areas) where the development will occur (0.35 m^3 of building volume over a land parcel area unit of 1.00 m^2).
2. Development rights take off from the sending area and land on the receiving area. These development rights are added to the rights generated by the same receiving area itself, allowing an increase of the building volume ratio (0.15 m^3/m^2 + 0.35 m^3/m^2 = 0.50 m^3/m^2) in the receiving area.
3. Private landowners of receiving areas buy and pay the economic value of the development rights to the private landowners of sending areas.
4. Property of sending areas is transferred to the public local authority property with no financial expenses from the public side.

Figure 2 shows how the Ragalna targeted TDR programme works.

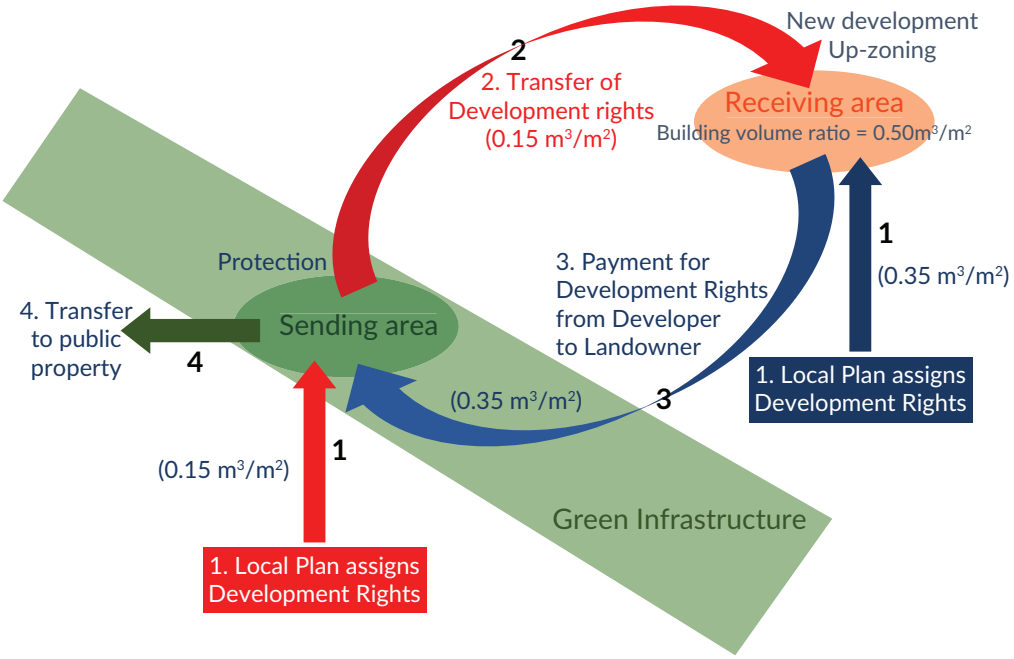

Figure 2. The TDR programme in the framework of the Ragalna Local Spatial Plan.

Such a programme implies that private landowners of receiving areas start the building process only after buying the development rights from the landowners of sending areas, who, in turn, get revenue from the buyers and leave their own land to the local public authority. Without those supplementary development rights, no urban development is allowed to occur in receiving areas. This mutual dependency allows to finally link private urban transformation with the public acquisition of land for future green infrastructure.

3. Results and Discussion

The Local Spatial Plan of Ragalna was officially approved by the Town Council in June 2023, and it came into effect at the beginning of 2024. The urban equalisation approach, as proposed by the Plan, will determine a gradual green infrastructure implementation through a parcel-by-parcel acquisition of land, which is strictly related to the private interventions in receiving land parcels. The land acquisition process will start with private land parcels nearby the Rosario Creek and will expand into other parcels mostly characterised by agricultural, abandoned, or uncultivated lands and spontaneous vegetation. These supplementary land parcels can be turned into suburban parks, equipped neighbourhood green areas, but also as parking lots with high permeable pavements and vegetation cover, which can sustain the future implementation of a wider green infrastructure around the Creek (see Figures 3 and 4, patches in green). In order to better manage the prioritisation of land parcels to be transferred to the public realm, a supplementary Green Infrastructure Priority Programme has been developed in the framework of the Spatial Plan to provide a clearer map of all parcels suitable to be part of the Green Infrastructure. Taking into account their size, land cover, and location (in terms of proximity to the city centre and public facilities), parcels have been labelled according to the three priority levels (P1, P2, P3—Figure 3).

On the other hand, urban development will only occur in those land parcels that are still undeveloped and are located within already urbanised areas (see Figure 4, patches in orange bounded by red dots). This approach

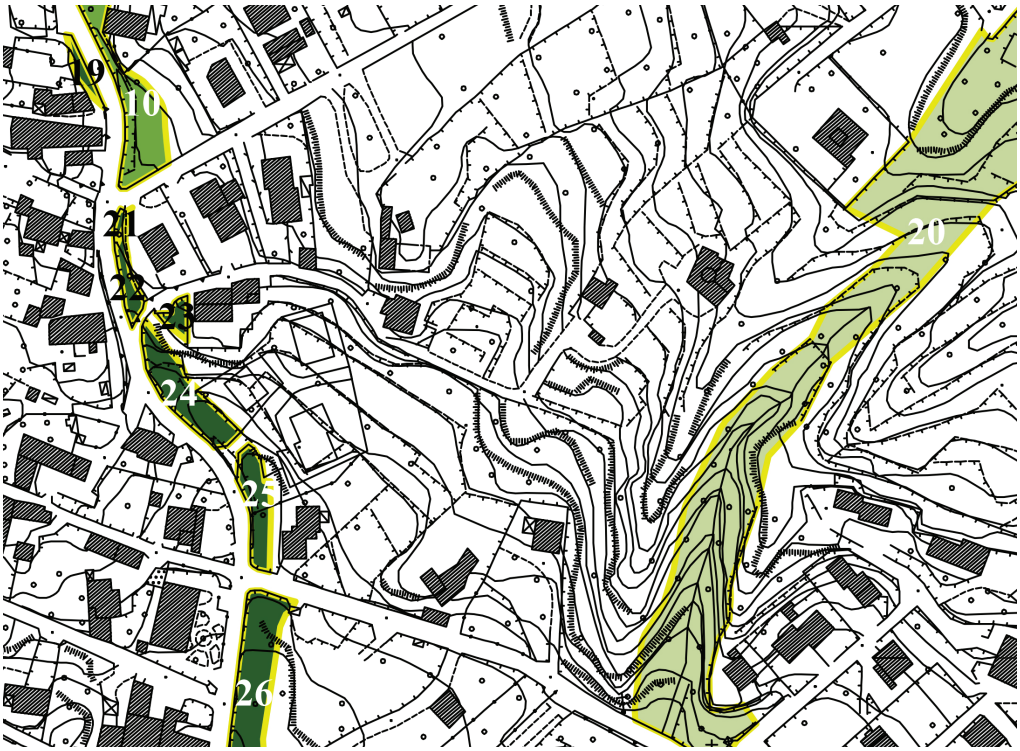

Figure 3. The Green Infrastructure Priority Programme. In dark green the highest priority level (P1); in intermediate green the medium level of priority (P2); in light green the lowest priority level (P3); number tags identify each sending area patch.

will allow to minimise land intake and preserve agricultural areas because only small vacant plots, surrounded by built-up areas, will be involved in the new development process. As a result of that, current urban fabrics will be up-zoned, compacted, and even shaped into more regular morphological structures. The resulting building volume ratio = 0.50 m^3/m^2 (as described in step 2 of the methodology; see Sub-Section 2.3) will permit the building of detached houses and/or semi-detached houses, and/or terraced houses within a 2,000 m^2 minimum plot area. Interestingly, the proposed urban equalisation approach has been aimed at balancing 1 m^2 of new built-up area (in terms of land parcel area) with 1 m^2 of new green area (in terms of land parcel area within the green infrastructure). In other terms, each new built-up land parcel (which includes the building and its open front and back yards) will be compensated by an equal-sized green area, and this will finally deliver, across the years, a public green infrastructure of over 50 hectares in size.

The prospected 50 hectares-wide green infrastructure will support the town of Ragalna in contrasting the negative effects of climate change over the next few years. Basically, the Rosario Creek and its basin zone will be totally moved to public property, and this will allow to mitigate the flood risk through implementing new interventions aimed at removing waste and other obstacles from the stream and restoring the permeability of embankments and floodplain areas. Other relevant green corridors will penetrate urban fabrics and, thanks to new tree plantations and increasing greenery strategies, will contribute to regulating micro-climate and reducing urban heat island effects through the shadow effect of tree canopies and the evapotranspiration potential of leaves and soil. Urban gardens and urban and suburban parks, as hubs of green infrastructure, will provide, through their biomass, other fundamental provisioning and regulating ecosystem services such as air and water purification, carbon storage and sequestration, water runoff, and

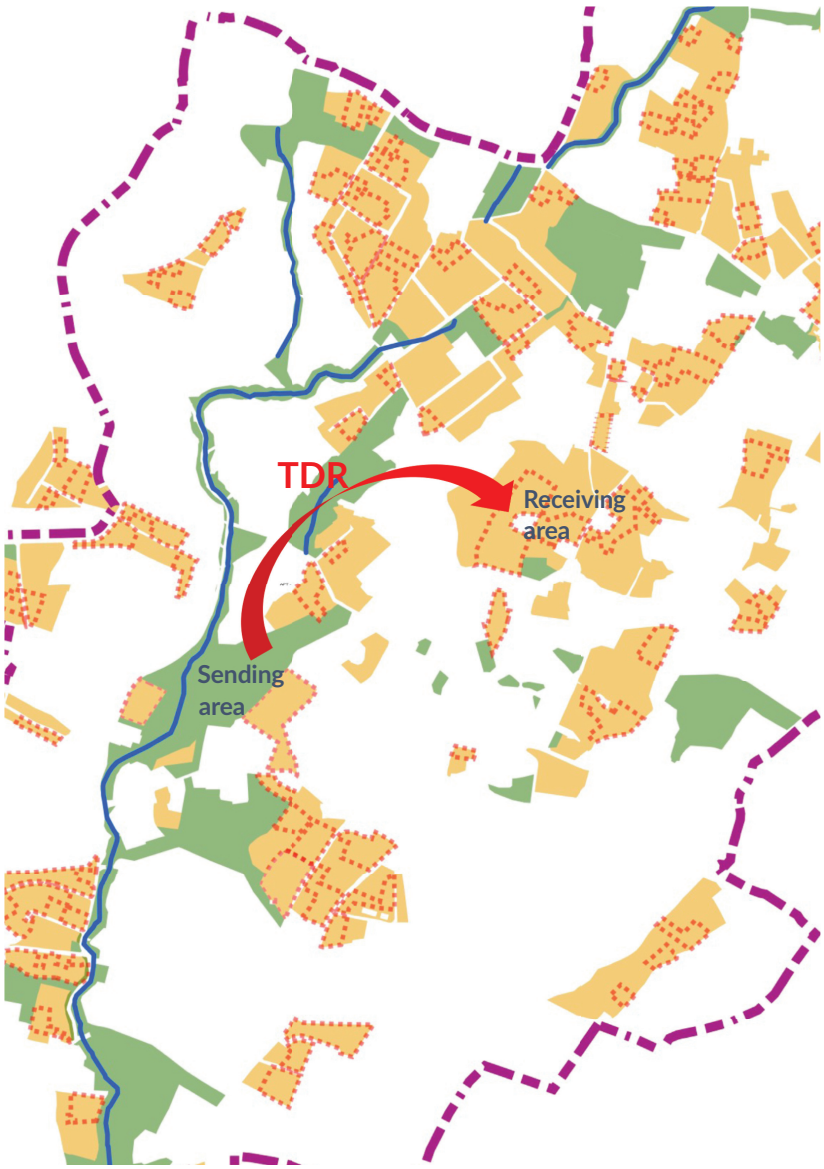

Figure 4. A frame of Ragalna's Local Spatial Plan: sending areas (in green), receiving areas (in orange bounded by red dots), densification areas (in orange), Rosario Creek (in blue), municipality boundaries (in violet).

noise reduction. At the same time, green infrastructure will increase accessibility to public green spaces, playgrounds, outdoor sports facilities, and public services through cycling and pedestrian routes, thus enhancing the overall well-being and health of residents and visitors. Even if promising, this implementation mechanism shows a noticeable limitation due to its strong dependency on the private initiative to undertake the urban transformation. Indeed, urban development processes could take a long time, consequently affecting and slowing down the implementation of green infrastructure. However, as an alternative option, the Ragalna Local Spatial Plan includes expropriation procedures for local public authorities to acquire private land parcels for implementing urgent and unpostponable green interventions for mitigating potential natural risks and securing built-up stock and residents.

Despite the significant expected benefits, the urban equalisation approach has provoked, since the very first proposal, some resistance from local residents, professionals (engineers and architects), and developers,

which emerged during participatory procedures and several community involvement events. Most of these local actors understood urban equalisation as a much more complicated and expensive mechanism for undertaking new urban development compared to the traditional one. The previous planning system was based on a traditional zoning strategy that identified urban development zones to be directly transformed by private landowners through applying the building volume ratio and public facilities and services zones to be managed through the public expropriation of private land parcels. Differently, the current equalisation approach implies a negotiation between landowners for selling or purchasing development rights from sending to receiving areas and then transferring the property of sending areas to the public realm. It must be said that this procedure represented a true novelty not only for this small town but also for the whole Catania metropolitan area, and it inevitably generated several objections. In order to overcome these uncertainties, the Town Council has recently implemented a further urban equalisation regulation to provide clearer and more flexible rules and procedures. This document also established a dedicated development rights inventory for monitoring the TDR and determining the market value of these rights for a more equitable management of the development process among private landowners and developers.

Ragalna's Local Spatial Plan has just started, and the local authority is aware of the challenges that will be posed by this innovative planning tool. To prevent potential critical issues, a monitoring programme has been set up for checking the efficiency and effectiveness of the urban equalisation model through controlling and adapting over time the priority levels as identified in the Green Infrastructure Priority Programme and the development rights market values as evaluated within the urban equalisation regulation. Both aspects will be subject to periodic reviews and updates to allow the municipal authority to adjust the land acquisition priorities according to the needs of any future project or external financing opportunity and to adapt the values of development rights to the local real estate market fluctuations.

4. Conclusion

To shorten the distance between private interests and public needs, current tools to finance the transition to climate resilience may need substantial revision to reprioritise the public and rebalance the needs of the different urban constituencies (Eakin et al., 2022). The urban equalisation approach as proposed by the Local Spatial Plan of Ragalna allowed to outline a scenario that envisaged the gradual construction of a public green infrastructure that grows through subsequent additions in relation to private urban transformation interventions in the expected receiving areas. This is an approach that pursues the right balance between the economic feasibility of private interventions and benefits for the community by permitting new urban development in specific already urbanised areas and developing a wide public green infrastructure alongside the Rosario Creek. Even though the relevant results were expected, the proposed approach inevitably clashed with the cultural resistance of an ordinary context not familiar with dealing with issues of environmental and economic sustainability in urban development. Indeed, the application of this approach in the framework of the Local Spatial Plan faces the challenge of undermining the traditional approach of local urban development practices, often characterised by a few limited rules between public and private actors. Reversely, more complex mechanisms can appear to be rather complicated, difficult to implement, and not yet sufficiently explored. Despite these difficulties, equalisation approaches in Italy have been gradually introduced in many regional acts aimed at regulating urban planning practices. Some Italian municipalities, such as Milano, Bologna, Padova, Arezzo, and Prato, have also started to deliver and experience the application of TDR programmes to manage the new sustainable urban transformations (Falco & Chiodelli, 2018).

Investigating the Local Spatial Plan of an ordinary city like Ragalna finally allowed to shed light on these urban equalisation approaches and TDR programmes, which resulted in viable tools for managing the issue of the economic feasibility of adaptation and mitigation strategies. For these reasons, the proposed urban equalisation approach can be understood as a promising strategy to be transferred to many other ordinary cities to help local authorities plan and manage the climate transition despite their insufficient financial and human resources. As shown by the Ragalna Local Spatial Plan, the transition to climate resilience can be possible for all ordinary cities just because the equalisation approach is based on the principle of relying only on one's own resources, which are made up of municipal land to be negotiated with the private sector.

Nevertheless, it is precisely the complexity of the implementation mechanisms that represents the great challenge of these innovative practices, which call for a profound renewal of the technical and management skills of companies in the construction sector to manage more complex urban transformation projects. And even more urgent is the need for public administrations to develop skills to govern the new market of development rights through the assignment of the economic market values of these rights and the establishment and management of a specific inventory for monitoring the take-off and landing of such rights. A strong public direction of urban transformation and effective policy instruments creating appropriate incentives for private support of climate transition (Bisaro & Hinkel, 2016; Tompkins & Eakin, 2012), if well designed, could help ordinary cities overturn a long-term trend: not involving urban developers to create high-value properties at the public expense, but attracting private investors to help cities transition into more equitable and liveable urban environments.

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Conflict of Interests

The author declares no conflict of interests.

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