

Raciti, Antonio; Saija, Laura

## Article

# From ecosystem services to Ecological Devices: The CoPED Summer School experience in the Simeto River Valley, Italy

Journal of Urban Management

## Provided in Cooperation with:

Chinese Association of Urban Management (CAUM), Taipei

*Suggested Citation:* Raciti, Antonio; Saija, Laura (2018) : From ecosystem services to Ecological Devices: The CoPED Summer School experience in the Simeto River Valley, Italy, Journal of Urban Management, ISSN 2226-5856, Elsevier, Amsterdam, Vol. 7, Iss. 3, pp. 161-171,  
<https://doi.org/10.1016/j.jum.2018.04.005>

This Version is available at:

<https://hdl.handle.net/10419/194448>

### Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

### Terms of use:

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

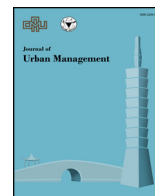


<https://creativecommons.org/licenses/by-nc-nd/4.0/>



Contents lists available at ScienceDirect

## Journal of Urban Management

journal homepage: [www.elsevier.com/locate/jum](http://www.elsevier.com/locate/jum)

# From ecosystem services to Ecological Devices: The CoPED Summer School experience in the Simeto River Valley, Italy<sup>☆</sup>

Antonio Raciti<sup>a,\*</sup>, Laura Saija<sup>b</sup><sup>a</sup> Graduate Program in Urban Planning and Community Development, School for the Environment, University of Massachusetts at Boston, MA, USA<sup>b</sup> City and Regional Planning Department, The University of Memphis, TN, USA

## A B S T R A C T

While limits of natural resources and climate change are forcing communities all over the world to redefine relationships with their own living environments, this challenge can be interpreted in several ways, depending on a broad variety of different values and beliefs. Not all communities worldwide share the same understanding of values such as love for humankind, sensitivity for other forms of life on earth, care for the breathable air and drinkable water, and appreciation for the soil we plough and build upon. As a matter of fact, too often these values are threatened by other social values, such as monetary efficiency and economic growth, which push societies in a quite different direction. For instance, the ecosystem service concept, with its emphasis on how humans can better take advantage of natural ecosystems, is an attempt to address the environmental crisis while maintaining a utilitarian and human-centric perspective.

This paper argues for the need and shows the possibility for planning researchers to address environmental issues while framing the concept of ecosystem services within a broader value-centered framework. Drawing from Complexity Theory, Deep Ecology and a relational approach to Ecology, this paper proposes the use in planning practice of the concept of Ecological Device that is inclusive of the Ecosystem Service one. An Ecological Device is intended as a project for eco-systemic improvements whose emphasis is not on the maximization of benefits for humans but is on the creation of multispecies and multi-actors functional and emotional relationships (entanglements). In particular, this paper presents one effort to shape Ecological Devices by a long-term, community-university partnership in the Simeto River Valley (Sicily, Italy) in the context of an annual, action-research summer school called CoPED (Community Planning and Ecological Design). The authors, who are also the founders and instructors of the summer school, show the possibilities for ecological devices generated through a highly pragmatic and engaged approach to research to address environmental technical issues as deeply interconnected with social and political dynamics.

## 1. Introduction

In recent decades, a large portion of the planning literature has focused on planning approaches that are able to address the increasingly evident effects – such as climate change – of unsustainable lifestyles performed in a limited-resource world. Scholars have searched for effective ways to redefine relationships between communities and their living environments that change the way

<sup>☆</sup> Peer review under responsibility of Zhejiang University and Chinese Association of Urban Management.

\* Corresponding author.

E-mail addresses: [antonio.raciti@umb.edu](mailto:antonio.raciti@umb.edu) (A. Raciti), [saija.laura@gmail.com](mailto:saija.laura@gmail.com) (L. Saija).

<https://doi.org/10.1016/j.jum.2018.04.005>

Received 13 August 2017; Received in revised form 2 February 2018; Accepted 20 April 2018

Available online 31 May 2018

2226-5856/ © 2019 Zhejiang University and Chinese Association of Urban Management. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

they use natural resources or relate to other living human and non-human beings. In this regard, the concept of Ecosystem Services, i.e. the multitude of services that ecosystems provide to humankind, came to the foreground of the disciplinary debate on how human well-being is based on the very same natural ecosystems that are threatened by the environmental crisis. Despite its usefulness in showing the functional relationships between humans and their life environment, the utilitarian human-centric perspective, which is constitutive of the ecosystem service concept, has favored approaches prioritizing the monetary value of natural resources over other types of values (e.g. inter- and intra-species solidarity). Other epistemological approaches, drawing from complexity theory and deep ecology, have counteracted this human-centric utilitarian perspective: humans can learn how to stop destroying the very ecosystems upon which their quality of life depends only if they undertake a broad process of rational, emotional, and cultural rediscovery of their being part of multispecies entanglements. More specifically, these alternative frameworks fundamentally dismiss the idea that planning can only focus on what needs to go into an ecologically respectful plan without looking at the kind of ‘ecological’ relationships that need to be established as a premise for that plan to be produced and implemented.

This article documents the effort made by the CoPED (Community Planning and Ecological Design) Summer School – an annual action-research workshop carried out since 2012 by a long-term community-university partnership in the Simeto River Valley (Sicily, Italy) – to operationalize these alternative perspectives, addressing environmental issues and the need of enhancing ecosystem services within a broader non-utilitarian ethical framework. For this purpose, the school has introduced the concept of ecological device, which is inclusive of the one of ecosystem services, to be defined as a project for eco-systemic improvements that emphasizes the creation of multispecies and multi-actors functional and emotional relationships (entanglements). The authors, who are also instructors of the school, share some of the lessons learned while using the concept of Ecological Device as a working tool in planning practice.

## 2. The ecosystem services debate

In the last four decades, international organizations concerned with the future of the planet have brought to the foreground of various debates on environmental protection emerging problems related to limits of natural resources and the great variety of challenges posed by climate change. Within this discussion, the concept of ecosystem service appeared for the first time in the aftermath of the Earth Summit in Rio de Janeiro in June 1992. A multilateral treaty called *the Convention on Biological Diversity* promoted by the United Nation and endorsed by 168 Countries introduced the protection of biodiversity as a common concern of humankind and defined an ecosystem as “a dynamic complex of plant, animal, and microorganism communities and the nonliving environment, interacting as a functional unit. Humans are an integral part of ecosystems” (Secretariat, 1992). The Convention also established the need for an ecosystem assessment, undertaken in 2001 by several contributors from signing countries, which was published as *Millennium Ecosystem Assessment* (MEA) in 2005. The MEA findings confirm that contemporary societies are depleting earth resources to such an extent that future generations will not be able to obtain as many eco-systemic benefits as current generations have. For this reason, the assessment suggests substantial policy changes aimed at achieving an integrated management of natural resources and/while promoting conservation and sustainable use in an equitable way (Board, 2005, p. 52). Mainly focused on securing human ecosystem benefits for future generations, the MEA introduces for the first time the concept of Eco-System Services (ESS from now on) as the “benefits people obtain from ecosystem” (Board, 2005, p. 49). After gaining popularity from the MEA Report, the ESS concept has become the object of inquiry of many scholars across disciplinary fields, ranging from economics, environmental and social sciences, public policy, and planning. A quick search using the words “ecosystem services” (using Scopus as main source) reports 52 academic articles in 2001 and 2873 in 2017. This large body of academic work mainly focuses on the types of beneficial deliverables that humans can receive from ecosystems.

Based on literature reviews on ESS, most of the research has been explanatory and descriptive in nature, and mainly concerned with the critical understanding of what ESS are and the assessment of various case studies on ESS. Danley and Widmark (2016), for instance, surveyed the existing literature and offered an overview on differences in conceptualization while identifying three main areas of scholarly interest: i) ESS physical components, ii) the relations among those physical components, and iii) the benefits they produce to human welfare. Fewer publications have a normative approach, focusing on actions that enhance humans’ ability to take advantage of ESS. From the literature, it is clear that various fields – ranging from environmental and social science, design disciplines, and urban studies – have used the ESS framework to suggest new strategies in support of policy-making, landscape planning, and management initiatives (De Groot, Alkemade, Braat, Hein, & Willemsen, 2010). In environmental science, the ESS framework has favored the creation of models designed to evaluate the effectiveness of ESS management practices. In a watershed analysis, modeling tools aimed at predicting water-based services and making better decisions in the management of water uses (Brauman, Daily, Duarte, & Mooney, 2007) succeeded in offering a broad set of tools to quantify ESS that practitioners and community groups can also easily use around the world (Vigerstol & Aukema, 2011).

### 2.1. Limits of the ESS framework, endogenous critiques

Despite the many positive outcomes of the ESS framework based on a utilitarian and anthropocentric perspective, several scholars have assessed not only its strengths but also its weaknesses.

Firstly, economic studies have maintained firm focus on the economization of ESS (Costanza et al., 2014; Naeem et al., 2015) and often tried to determine the best methods to attribute those values (De Groot, Wilson, & Boumans, 2002). Along these lines, some have worked on definitions of units to measure the final services produced by nature for human welfare (Boyd & Banzhaf, 2007). This debate, according to others, has left out the search for other methods capable of taking into account the monetary values associated

with the complex ecological processes that are vital to achieve those very same services (Danley & Widmark, 2016). Some critiques have also raised a broad set of issues related to the lack of attribution of values to ESS that are not only monetary, trying to find innovative indicators to express intangible values (Radford & James, 2013). Secondly, social science studies have explored existing environmental management practices and potential governance innovations. These studies point out the importance of stewardship initiatives from the bottom-up in the regulation of ESS (Connolly, Svendsen, Fisher, & Campbell, 2013). Along these lines, some have explored the link between ecosystems services and social dynamics and pointed out that ESS do not exist outside the social arena but are socially constructed (Ernstson, 2013). The social production of ESS has been used to analyze how these are recognized and collectively generated in different cultural contexts and what types of benefits they potentially produce for the well-being of different communities with a warning that the definition of ESS is embedded in social processes and cannot be constructed by experts (Ernstson, 2013). From this perspective, a generalized definition of ESS, such as the one provided by the MEA, must be counteracted: Ernstson and Sörlin advocate for context-based ESS definitions through the use of ethnographic practices with the purpose of re-politicizing a process that is currently de-historicized and de-ecologized from local dimensions (Ernstson and Sörlin, 2013).

Others point out the inability of ESS to capture the complexity of human-nature relationships (Williams, 1980) and question the possibility for scientists to agree on the very nature of the benefits obtained from ESS (Pataki et al., 2011). Pincetl, for instance, invites the scientific community to build more knowledge on specific “urban biomes”, defined as “co-produced unique artifact[s] driven by humans” (Pincetl, 2015: 4) in order to embed ESS in a typology of distinct ecosystems.

## 2.2. Limits of the ESS framework, exogenous critiques

The previous section contains some of the critiques provided by scholars that keep ESS as their central working framework (endogenous critiques). More deeply, the utilitarian perspective to the production of services fulfilling human needs has been significantly counteracted by other epistemological approaches, which frame the production of services within a more holistic understanding of ecosystems and ecosystem behaviors. Holling’s (1986) famous work on ecosystem behaviors and resilience (1986), for instance, challenges the linearity of the ESS framework. Treating ecosystems services as ‘objects of study’ and not as nodes of complex networks of mutually transformative relationships might generate missteps in the ways normative theories are conceptualized to preserve and manage ESS. He points out, for instance, that ecosystems alternate periods of increasing organization with ones of decreasing organization and re-organization, and the fluidity of such natural rhythms is responsible for system productivity and resilience. Policy design for ecosystem (and their services) should therefore imply a high level of flexibility that allows for recovery and renewal in the face of unexpected events (Holling & Chambers, 1973; Holling, 1986).

An additional critique against the ESS framework comes from the body of literature that is inspired by the work of Arne Naess on what he calls *Deep Ecology* (Naess, 1973), which originated from a critique against the mainstream ecology movement concerned with “the health and affluence of people in developed countries” (Naess, 1973). Deep Ecologists draw from the need to address environmental issues through the construction of a different worldview where humans and non-humans are physically and emotionally connected within a bigger whole. From this perspective, humans and non-human living beings are considered not as individual entities but as relational beings. In other words, it is not possible to give a specific definition of a subject/object unless that is understood by looking at the net of relations that the given subject/object establishes within its own biosphere. This assumption is the basis of the bio-centric equality concept (Devall and Sessions, 1985), which gives equal value to all the entities in an ecosystem. This egalitarian perspective applies not only to the living beings but also to the not-living features of the natural environment such as mountains, rivers, or landscapes. The work of Devall and Sessions in the field of environmental studies recall a plea launched by planning theorists to dismiss the urban/human exceptionalism in order to re-engaging planning theory with the “replacement of the self by a living nexus of multiple inter-connections and alliances that empower the collective. We are all in this together” (Houston, Hillier, MacCallum, Steele, & Byrne, 2017: 10).

This epistemological shift entails another major critique against the ESS framework, which relates not to the content but to the way such content is produced (research methodology); a critique mirroring social scientists’ critical arguments against the possibility for experts to find a universal and/or general set of eco-systemic values (Ernstson and Sörlin, 2013). The idea of humans making sense only within multispecies entanglements implies that all human dimensions, including human knowledge, is generated through learning processes that engage all the entities that are in relationship with one another within an ecosystem. This means the abandonment of the idea that knowledge is only ‘produced by’ humans and ‘used for’ human purposes. This notion is related to the one developed by Bateson’s (1972) in his “ecology of mind” and by complexity theorists (see Bocchi & Ceruti, 2007 for a good overview), which have looked at the transformative potential embedded into the unexpected discoveries emerging from new relational encounters.

Complexity theorists have pointed out that researchers interested in exploring ecosystems are always an integral part of them and their ‘positionality’ influences the research process (Rose, 1997). This echoes the debate on the importance of developing eco-systemic knowledge through approaches, such as community-based research or action-research, that dismiss the idea that conducting research is an act of mastery conducted by the expert researcher who crafts a narrative of his/her object of research. On the contrary, the emphasis should be on ways to enhance not only relationships between humans, non-humans and the biosphere, but also between researchers and ‘the researched’ until such a difference begins to disappear (Coghlan & Brydon-Miller, 2014; Saija, 2017). In Stengers’ (1997) words, in approaching the fieldwork, knowledge production becomes a ‘co-fabrication’ between the researcher and the “others” engaged in the research process – whatever or whoever these are.

In environmental planning and design research, more than a decade ago, Pizziolo and Micarelli (2003) used the word ‘ecological design’ referring to design approaches able to connect researchers with “others” (living and not living beings) in the planning arena to

answer research questions raised by new encounters. From this perspective, design is not an outcome of an expert-led process but acquires the meaning of a ‘device’ (Decandia, 2000), something that facilitates and encourages new encounters (Pizzolo & Micarelli, 2004) while contributing, for instance, to the collective awareness on context-related environmental issues (Raciti, 2016).

This article draws from the assumption that a new approach to ecosystemic planning can take full advantage of the lessons learned within the ESS debate but should also take into account both its endogenous and exogenous critiques. For this purpose, in our own work, we have traded the concept of “Ecosystem Services” with the one of “Ecological Devices”. While the first still maintains a human exceptionalism and a focus on the production of services to fulfill humans’ needs, the second is focused on the possibility, through design and planning, to generate new relationships while enhancing existing mutually beneficial relationships among elements of the ecosystem. In other words, ecological devices are highly intentional actions enabling the strengthening of existing relationships and the establishment of new relationships among living and not living beings in the planning arena. Ecological Devices have an intrinsic reciprocal nature inasmuch they focus on the mutual benefits that can be produced, experienced and worked upon within the complex web of connections of the biosphere, where planning researchers also find themselves deeply entrenched. This is the fundamental idea on which we based the Community Planning and Ecological Design Summer School, an action-research service-learning workshop, located in the Simeto Valley (Eastern Sicily).

### 3. Why the Simeto River Valley?

Since 2012, the Summer School has taken place every summer in the Simeto River Valley, an area located along the central stretch of the main Sicilian river, a few kilometers west of the Catania Metro Area. In the valley dwell approximately 150,000 people distributed in ten small towns of various sizes immersed in a highly productive rural environment: the largest community is the city of Paternò with 50,000 residents, while the smallest is Ragalna with less than 4,000. The Valley is located on the south-western slope of the largest active volcano in Europe, Etna, and is therefore characterized by quite unique natural features: the river, almost like a ‘ecological backbone,’ marks the encounter between two unique geomorphological and ecological systems, the volcanic one on the north-east and the clay hills on the south-west (Fig. 1). The Valley is an ideal place for human settlements and agriculture due to many ecological factors, such as: the unique type of soil, that locals call ‘*saurra*,’ generated by periodical river flooding along its meandering sections; the richness of natural water springs that are located at the base of the volcano on the left bank of the river, and from which water drains down in lava tunnels from the top of the mountain; and the high fertility of the lava soil, on the left bank. Humans have called the Valley ‘home’ since the first communities settled, building a significant variety of urban and rural artifacts that today compose a very rich and layered historic heritage. Such a complex socio-ecological system (borrowing Holling’s words), which flourished for centuries thanks to virtuous interaction between humans and the biosphere, has significantly declined under modern blows in the name of “progress”.

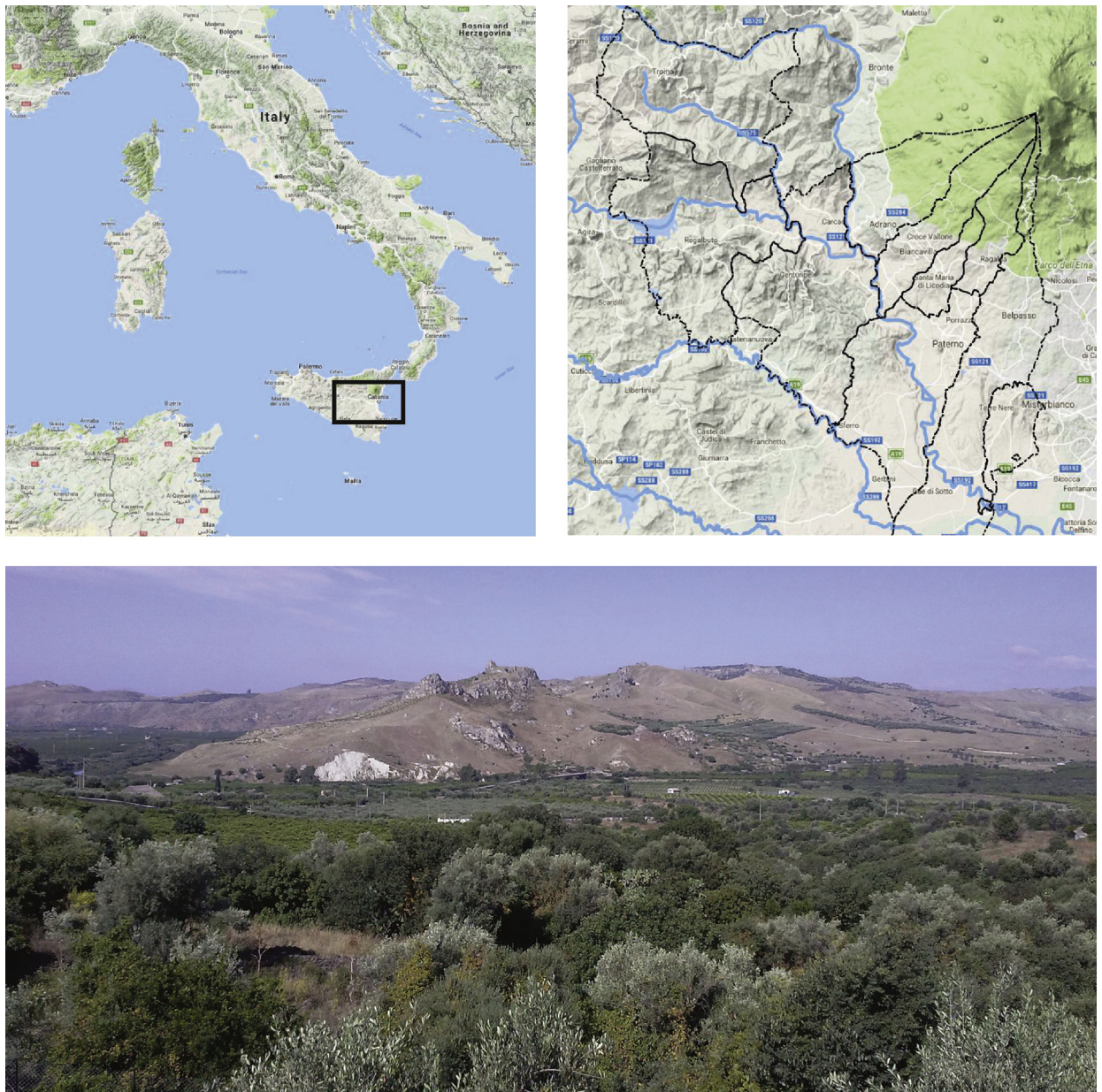
Even though many physical signs of the “old alliance” still exist, they have been threatened by modernization plans and policies implemented since the 50s. The pursuit of economic growth (intense urbanization, mechanization of agriculture, promotion of industrial activities, etc.) has inflicted irreversible damage to local man-made/natural ecosystems. In many locations, the old countryside water-delivery system, built by the Arabs in the Middle Age using natural topography and surface streams, has been modified through the intensive use of reinforced concrete and buried channels, which has also caused changes in the natural topography. The natural flow of the river has been significantly modified by the construction of anti-flooding and hydroelectric power facilities, which, in the summer, compromise its *minimum vital flow*. These facts, together with the high level of pollution caused by large volumes of untreated waste-water streaming directly into the river from public and private factories have drastically reduced biodiversity. In addition, significant, irreversible damage has been done to the local highly valuable historic heritage: the Valley’s many urban and rural historic assets (churches and convents, mills and farms, villas, fountains, water-towers, archeological sites, prehistoric and historic villages and tombs, etc.) have been either forgotten or destroyed to make way for modern structures and infrastructures. In many ways, the Valley represents a perfect example of a community that, for centuries, has strongly benefited from the services provided by a particularly rich ecosystem, but that has almost completely lost an appreciation for it: a number of development choices have significantly compromised the ability of the local ecosystem to keep the provision of the same level of services, both in terms of quantity and quality.

Such a paradox has been the focus of a long action-research project carried out by a long-term community-university partnership. The partnership started in 2007 between researchers of the LabPEAT (*Laboratorio per la Progettazione Ecologica e Ambientale del Territorio*, laboratory for community-based environmental and ecological planning and design) at the University of Catania and Simeto grassroots groups that, at that time, were engaged in a campaign against the construction of an incinerator in the Simeto River Valley. The initial goal of the partnership was to parallel the anti-incinerator campaign – that was eventually successful – with the shaping of a collective vision on how to “change direction.” The partnership was aimed at producing a development framework able to discourage decision-makers from embracing “environmentally bad” development choices (see Saija 2014 for a more detailed account of the work of the partnership).

Since 2007, the partnership has generated several accomplishments while significantly evolving in terms of both goals and actors involved. The largest accomplishment has been the preparation, through a highly participatory methodology, of a strategic development plan for the Simeto Valley called the Simeto River Agreement (SRA) whose overall development goal is:

“Enhancing the quality of life of anthropic communities, seen as inter-dependent from other living species and from natural resources of the Valley, while increasing opportunities (employment, culture, social and emotional relationships) for old and new inhabitants, through:





**Fig. 1.** Clockwise from the top left: the Simeto River Valley location on the east side of the Sicilian Region; boundaries of the ten Municipalities of the valley; the view of the valley with the reach volcanic soil facilitating agricultural productions (on the foreground) and the arid clay hills (on the background).

- The re-discovery of past values and the acknowledgement of past errors;
- The re-shaping of the way people live in places on the basis of the establishment of a new alliance between individuals, society and the environment;
- The implementation of the principle of circular economy (re-use, re-cycle, social inclusion, equity, empowerment, legality);
- The regeneration of the relationship between local communities and the Simeto River to be intended not just as a water stream but as socio-ecological system that includes an entire region with its environmental, socio-cultural, productive, ecological components;
- The establishment of a socially-recognized system of rules”.

(Attachment B to the SRA, p. 25, translated by the author, available at <http://pattosimeto2013.wixsite.com/pattodelsimeto/downloads>).

Some passages of the text refer to an ethical background for action that is progressively moving away from utilitarianism and

contain the first seeds of a new framework that challenges the ontological exceptionalism of humanism in planning (Houston et al., 2017). This vision explicitly refers to a sort of “multispecies entanglement” that, somehow, needs to be considered in the way humans ‘plan to act’ in the world (Houston et al., 2017). The Simeto River, in particular, is a sacred venerated entity whose value goes way beyond the services it is able to provide (Naess, 1973).

Throughout the SRA, which is a collective document and, therefore, lacks a fully coherent theoretical reference, the seeds of inter- and intra-species solidarity values are constantly intertwined with utilitarian ones. However, it is clear that, overall, the document represents a systematic attempt to make sure that the need to maintain or enhance local ecosystem services is framed within a larger conceptual framework, one that sees the river ecosystem as the central signifier of the Simeto community identity and local residents as deeply connected – not only functionally, but also culturally and emotionally – to the air they breathe, to the sounds they hear, and to the non-humans souls are part of their daily life. The SRA vision is organized around five specific areas of implementation: agriculture, mobility, historic heritage and culture, solid waste management, and water and natural resources. The articulation of each one of these reveals specific ways of reframing – through a relational and emotional lens – the concept of ecological services.

In the “agriculture” chapter, for instance, food production is not only considered for its economic relevance, but also as a fundamental aspect of the Simeto identity, following the idea that “people are what they eat.” (Lambert-Pennington & Saija 2017). Moreover, the agreement plans for enhancing the relationships between local farmers through the establishment of an “Agro-District”. The District is designed for farmers willing to embrace a peer-reviewed ethical code, which pairs environmental aspects, like the ones that are usually considered in official organic certification procedures, with ethical ones, such as employment opportunities for disadvantaged individuals, refusal to benefit from mafia-connected commercialization mechanisms, and strategies for the enhancement of the quality of life of non-human living species. In the “water & natural resources” chapter, for example, the River and the Mountain are described as “living beings” from which every aspect of community life depends – the river revitalization is a way to restore natural habitats not just for the wild species but also for local residents. More importantly, throughout the document, every project and action is conceived to regenerate an evolutionary understanding of the Simeto identity – something rooted in history and tradition but also able to evolve through lessons learned along the way.

The Agreement is made of multiple documents that have been produced over time by the partnership. Most of these were written with the use of multiple languages: the use of a more or less traditional planning language, for the purpose of generating a dialogue with the institutional framework, is systematically intertwined with the use of a romanced language, that aims to explore possible actions within the realm of the community’s emotional attachment to the river ecosystem. This ‘special’ plan has been officially endorsed by 10 Simeto Municipalities and is in the process of being implemented (Saija, 2015a). During the process, the community component of the partnership, which was composed mainly by members of two grassroots associations from only two of the ten cities, evolved into a large umbrella organization called *The Participatory Presidium of the Simeto River Agreement* (*Presidium*, from now on) that today engages more than 50 organizations representative of all 10 municipalities. The University side of the partnership has evolved as well, mainly through the institution of the yearly interdisciplinary summer school called CoPED, which engages two other Higher Ed institutions: The University of Memphis (TN, USA) and the University of Massachusetts at Boston (MA, USA).

The SRA has impacted the nature and, therefore, the main goals of the Simeto community-university partnership: most of the responsibilities that University researchers had carried out for years were ‘theoretically’ transferred to a new organism, the SRA Laboratory, whose members are to be both university researchers and municipal professionals from the planning and community development offices. In practice, even after the official endorsement of the SRA in 2015 by the 10 municipalities, this organism has not been established yet.

The birth of CoPED in its current format, which occurred in 2015 right after the legal birth of the SRA, has had a lot to do with the fact that the Lab never came into existence. At that time, the University of Memphis<sup>1</sup> had already organized in partnership with the University of Catania, three sessions of a study abroad program offered as a class within the Master in City and Regional Planning and as a ‘special pedagogical activity’ for Architecture/Civil Engineering students at the University of Catania. The program was, since the beginning, meant to generate a pedagogical experience able to combine the benefits of both the service learning approach and study abroad. In 2015, the study abroad program became CoPED, with the intention of taking over some of the action-research responsibilities that used to be housed at the University of Catania in the absence of a fully functioning SRA laboratory.

#### 4. The CoPED methodology

Scholars have been exploring, for several decades, the benefits and the challenges of “service learning” in planning education. Service learning is an approach that draws from the pedagogical turn that is often labeled with the expression of *experiential learning*, which refers to the idea that *true learning* occurs only when learners overcome the traditional gap between theory and practice through a real, practical experience through which students reflect critically on theory. In this approach ‘experience’ is intended as a life activity made by a complexity of actions, theories, and interpretations (Dewey, 1938). Along these lines, educators engage students in experiences of ‘service’ for the benefit of a community needing ‘expert’ assistance in a way that students learn their craft

<sup>1</sup> This was technically possible because of the transfer of the two authors from Catania to Memphis: Laura Saija, who at that time used to be a research associate at the University of Catania and one of the founding members of the LabPEAT, has spent two years (between 2011 and 2012) at the University of Memphis as a Marie Curie Fellow and has initiated the study abroad program in 2012. Antonio Raciti, who obtained his Ph.D. in Urban Planning and Community Design with a thesis focused on the Simeto Project, was hired as an Assistant Professor at the University of Memphis the same year and became the UoM instructor of record of the study abroad. Today, Laura Saija is currently serving as an assistant professor in the City and Regional Planning Department at the University of Memphis; Antonio Raciti is an assistant professor at the University of Massachusetts at Boston.



while applying it (see Rhoads and Howard, 1998 for a good overview). The exposure to situations where technical knowledge is intertwined with highly controversial social and/or environmental issues can allow students to develop ethical awareness together with technical skills. Moreover, when this type of pedagogical experience is fully inspired by an action-research approach, service learning allows students to develop a different kind of technical knowledge that is socially-sensitive, that comes from self-critical reflection instead of just instrumental rationality, and that is inclusive of tacit knowledge and emotions (Schön, 1987).

In many ways, the service learning approach seemed to be the best one for the purpose of shaping an annual summer school aimed at advancing the SRA development objectives. Traditional planning education approaches focused on “content” – i.e. the identification of the correct way to use resources and shape our cities – are suitable for teaching students about ecosystem services, but they can hardly be used for the purpose of teaching students how to facilitate the enhancement of people’s relationship with other living beings and their life environment. For this purpose, a pedagogical approach is needed to be able to reach outside the realm of rational humans behaviors and to touch the emotional and tacit dimensions of knowledge. For instance, while traditional planning education can teach students how to identify the kind of technology that should be used to channelize water for human purposes, it is less successful in teaching them how to encourage people to change their emotional attitude toward water: i.e. developing an emotional attachment to a body of water like a river, a lake, or the sea, in order to rediscover that such a body can be seen as a fundamental contributor to territorial identity. For these reasons, CoPED was established with the goal of engaging students in practical experiences of emotional change toward natural resources and ecosystems. The underpinning idea is that the students can learn how to deal with community emotional change only through undergoing the same type of community experience.

From a practical point of view, every year the CoPED faculty ask the *Presidium* to identify a precise scope of service that is instrumental to the advancement of their agenda and, at the same time, fits with the broad pedagogical planning goals and students’ skillset. This method allows the school to deal with the specific contingencies faced by the Simeto River Valley community during each session of the school. Moreover, before the twelve days of intense field work, faculty work closely with *Presidium*’s leaders to collect existing data helpful for the selected scope of service. In the weeks preceding the fieldwork, faculty prepare a series of pre-trip meetings with students with the purpose of introducing them to Sicilian culture, the Simeto River Agreement and its history, and the scope of service. During the pre-trip meetings students are also asked to conduct case study research on specific planning initiatives carried out in other parts of the world that might be helpful for their scope of service.

While in Sicily, one of the main challenges to be addressed is the constant presence of language barriers between US and Italian participants. The large majority of US planning programs abroad see American students working *in* a foreign environment and, sometimes, *for* a foreign ‘client’ (an organization, a community, a city, etc.), but they operate mostly among US classmates and instructors with no need of using a foreign language (Smith, Warner, Fioretti, & Meschiari, 2014). On the contrary, during CoPED, US participants – both faculty and students – are expected to work *in* a foreign environment *with* (not *for*) the local community (Fig. 2). In particular, students and faculty from US Universities (mostly University of Memphis and UMass Boston, but occasionally individuals from other US Universities apply) work side-by-side with local community members and local peers (faculty and students) from Italian universities (mostly the University of Catania, but occasionally individuals from other Italian Universities apply). All activities are designed to be conducted by groups characterized by an equal number of students, faculty, and community members, with at least 2 or 3 fully bilingual individuals – who are almost always Italian (either faculty or students) who act as translators during group-led field activities. Expert translators translate plenary events and activities. US students have repeatedly shared in their reflection papers (which are part of their class requirements) the fact that their Italian peers are not just English translators, but act as cultural mediators, capable of reducing, as much as possible, the cultural gaps existing between the different cultures. This system does not provide a way to eliminate entirely the existing language and cultural barriers, since many things get lost in translation; however, it does provide a prolific space for discussion and group self-reflection over meanings, even in the course of complex actions. From this



Fig. 2. Graziella Ligresti, Participatory Presidium Assembly Representative, shares the story of the Simeto River Agreement at one of the opening events of the 2015 CoPED Summer School.



perspective, translation is exactly one of the devices that is used to advance learning and self-reflection in the course of action.

The second and probably most important challenge to be addressed every year relates to the need to enable individuals with little pre-existing knowledge of the context and almost no experience on the matters to carry out a genuine action-research experience, i.e. developing something *experientially* meaningful for them and the community in only 10 days. Some of what the literature identifies as the most difficult challenges of action-research, issue such as reciprocity, trust, and accountability, can be addressed within CoPED's restricted time frame only thanks to the fact that the school is only one of the many initiatives carried out by a decade-long partnership. Additionally, the series of activities to be performed in the 10-days window is organized with the purpose of maximizing the sharing of all research responsibilities with community partners.

Research questions are co-produced, every year, between December and the actual beginning of the school, in June, through a series of interactions between the instructors and the community leaders (via mail, e-mail, web-based group calls, and video conferences). The scope of service is transformed into a detailed program during the month of May, a time where the two authors – who are also two of the various instructors<sup>2</sup> – can be physically present in the Simeto Valley and participate in person in the *Presidium's* activities. The main structure is based on alternating:

- Many 'Targeted' Research activities, during which mostly CoPED participants (community members are always free to participate and often do) collect and interpret data;
- Few 'Relational' research activities, during which CoPED participants (and eventually community members) share the work carried out during the targeted research activities in order to have as many community members as possible follow and provide feedback.<sup>3</sup>

This structure allows community members to engage with very different levels of interest and time availability in the process of data collection and analysis. The school final product takes the form of a report, which is produced only after the "school outcomes" are publicly presented and detailed community feedback is collected in order to engage the community also in the research formalization phase.

## 5. Ecological Devices for the Simeto Valley

In 2015, the scope of service of the first CoPED session was to prioritize the very high number of actions included in the Simeto River Agreement in order to facilitate implementation. Within the ESS framework, priority usually depends on project feasibility and sustainability, especially from a financial point of view. CoPED 2015 coupled these important criteria with an evaluation of another indicator: how recurrent were certain projects ideas in community discourses and testimonies. In creating an effective balance between these criteria, the final report identified priority development actions within the five SRA development objective areas of interest: mobility, culture, agriculture, water, and waste. Amongst these, two actions have received the most attention and are, currently, in the process of being implemented.

The first action, called at that time *Simeto Agro-Hub*, was the most urgent one to be undertaken in the agriculture area. The Hub was an entity designed to enhance collaboration and provide support to 'virtuous farmers' across the Valley. The CoPED Summer School worked on the idea that:

- On one side, agriculture is the most important economic sector of the Valley and its enhancement is one of the few options for young people to build their future without being forced to move somewhere else following better opportunities;
- On the other, certain 'bad' practices in agriculture have significantly damaged humans, other living species, and the very essence of the local identity.

The School set up targeted and relational research activities aimed at digging into the meaning of 'virtuous farmer' through focus groups, interviews, and specific activities on the criteria to be used to label quality products (Fig. 3). The research showed an interest to escape the lobby of national certifications for organic products and rely on community-based, peer-reviewed systems of quality recognition with a focus on pairing environmental criteria with ethical principles. Amongst these, a particular emphasis was on the employment conditions in the agricultural business with particular reference to the mafia's involvement in the exploitation of rural workers (Saija, 2015b). The Agro-Hub project served as a 'ecological device' in the sense that it started as a device for promoting high quality agriculture but immediately embraced a larger number of people and a broad spectrum of issues crossing other SRA thematic areas: the cycle of agricultural production, for instance, was tied to the water and waste cycles through conversations on the quality of riverine water and discussions on the potential of *Simeto Agro Hub* to activate wise strategies for the disposal of organic waste. Conversations on the enhancements of technology (new systems for agricultural production, resource management, etc.) and human behaviors (changes in how residents relate food production and consumption) also shed some light on the emotional and tacit

<sup>2</sup> The number and identity of the instructors varies every year, depending on the new partnerships that CoPED and the Simeto community develops, as well as on the specificity of the scope of service. The two authors are the two initiators of the UofM study abroad in 2012 and have been instructors of the school faculty in every edition of it since then. The actual stable core of faculty includes also prof. Katherine Lambert-Pennington from the Anthropology Department at the University of Memphis.

<sup>3</sup> This structure is inspired by a methodology that both the authors of this paper have learned from one that their mentor - Prof. Kenneth Reardon - has applied in various action research experiences in East St. Louis (Reardon 2003, 2006) and Memphis (Lambert-Pennington et al. 2011, Raciti et al. 2016).



Fig. 3. CoPED 2015 students' workshop on the Simeto River Agro-Hub Project.

dimensions of participants' knowledge. These included, for instance, the joy of using agriculture to re-discover the forgotten riverine system, not only responsible for the most exclusive agricultural products, but also as a fundamental feature of the local cultural identity and the fear of dealing with illegal activities and organized crime. The hub was officially formalized in 2015 with the name of Simeto Bio-District and today counts 65 members – including 25 farming businesses, 15 farmers, 11 agronomists, 8 professors, 6 students and professionals – who are engaged in a community-based process to formalize the “quality certification” criteria.

The second action that is in the process of being implemented is the creation of the San Marco Community HUB Station. The genesis of this project can be found in the 2015 CoPED report, which saw the opportunity of advancing mobility through the revitalization of the historic *Ferrovia delle Arance* (Orange Railroad<sup>4</sup>), an abandoned railway running along the river and connecting all the Simeto towns with the Catania Metro Area and the Catania-Palermo major railway. The revitalization project aimed at converting the railway into a soft infrastructure, able to combine various mobility options (walking, biking, horse riding, electric mobility) and included the rehabilitation of various facilities along the abandoned track, especially the stations. Right after the 2015 session, a group of local activists gave birth to a grassroots group called *SUDS – Stazioni Unite del Simeto* (Simeto United Stations) aimed at taking the lead in implementation. *SUDS* immediately began working on a pilot project focusing on the Paternò section of the railroad and one of its abandoned stations: San Marco. This very project, then, was selected to be the focus of the 2016 CoPED Summer School edition. The school was, indeed, designed to push the community conversation further, moving away from the emphasis on physical transformation toward one on the potential for the revitalization station to enhance functional, financial, environmental, and emotional relationships around it. The school supported *SUDS* in the exploration of the collective memories of the historic role of the station in the community as well as actual residents' perceptions of its future potential. As a matter of fact, a special focus was placed on the potential engagement of local farmers already members of the Simeto Bio-District in the activities to be eventually carried out at the Station. During the School, *SUDS* became a formal non-profit and was able to successfully request the temporary gratuitous use of the Station from local authorities. In the aftermath, *SUDS* volunteers renovated the Station through crowdfunding and self-funding initiatives, and have initiated several cultural and recreational activities. The Station's main function today is the facilitation of a network amongst local farmers through the establishment of a zero-kilometer market where products of the surrounding bio-farms are sold every week (Fig. 4).

## 6. Conclusions

Looking at how our work evolved over the course of the past three years of Summer School, we will share some outcomes and lessons learned, which we think contribute to the debate on how to enhance planning in the face of ecosystemic challenges. Despite the various critiques against the EES framework, we think that ESS is still a very helpful concept. It brings attention to the fact that humans' quality of life functionally depends on their ability to learn how to not destroy the very 'plate they feed themselves from.' We think this concept carries some the risk of reinforcing the cultural 'commodification' of nature, which is the very issue behind environmental decay. These risks can be avoided if ESS is framed within a larger framework, one that merges lessons from both the ESS debate and the paradigm shift emerging from Complexity theory, Deep Ecology, and more-than-human planning theory. In particular, we propose the use of ecological devices instead of ecosystem services. We have exchanged the concept of *service with device* to emphasize the fact that in order to learn (or re-learn) how to survive in a resource-limited world, projects aimed at improving the quality of life of communities cannot be defined only in terms of planning prescriptions, but must also simultaneously

<sup>4</sup> The name derives from the fact that, during the 50s and 60s, its main function was to transport citrus fruits, especially oranges, which were the main produce of the entire valley.



Fig. 4. On the left: community members participating in open house to re-envision the future of the San Marco Station; on the right: some of the Simeto River Valley products sold every week at the San Marco Station.

be instruments for technological innovation and change in behaviors. Moreover, this device is defined as ecological because of its potential capacity to create learning opportunities through the facilitation of new and unexpected encounters during and after the completion of the project. With this function, the ecological device acquires also a co-evolutionary nature (Lewin, Long, & Carroll, 1999), constantly modifying and being modified by the actors involved in the learning discoveries that occur along the way.

From an ESS perspective, the Simeto Agro-Hub, for instance, served the enhancement of provisioning services, such as food production; supporting services, such as the increase of water quality; regulating services, such as the enhancement of the waste management system; and cultural services, such as food and eating habits. Most importantly though, from a perspective of the establishment of mutually beneficial relationships between all living and not-living elements of the valley, a drastic change in the nature of rural practices – which is the overall goal of the Bio-District – would benefit not only farmers but also the local fauna, flora, soil, water, landscape, among others. Moreover, from a pedagogical perspective, reflection papers and community outcomes show how our ‘ecological devices,’ i.e. the projects identified by CoPED’s *community of learners* – including students, faculty, community members, and various other participants – have paired social justice values with those of environmental protection, giving birth to powerful actions based on strong community support. In fact, the Agro-Hub project embeds strategies to improve the organic production while discouraging the involvement of criminal interests in the management of rural workers, a topic that is too often banished from the shaping of community development projects.

In the San Marco Community HUB Station project, the *community of learners* have learned that their different visions for the valley may come together in the very tiny sliver of a conceptual map drawn to plan for the future of the Simeto Valley, and that working on that sliver might reveal physical and emotional connections between people, and people and places as the backdrop of collective community strategies. In this case, the ecological device was designed to drift away from the ‘safe territory’ of producing a rehabilitation project aimed at delivering just a cultural service (i.e. the renovation of an old station dedicated to recreational activities), and was able to open up an ‘unsafe territory’ in which long-term advocates of this project confronted the entanglements of their place-based ideas, perspectives, and emotions with ‘others’, who historically have never been involved, nor interested, in the redesign of the San Marco Historic Station or its architectural renovation.

On one side, these results are derived from specific context-based research questions; on the other, this experience offers the opportunity to draw some more general reflections on the use of ecological devices in planning practice. Firstly, the added value of using a relational framework along with the ESS one expands the potential of planning practice to produce outcomes that are mutually beneficial for humans and other living and not living beings of the ecosystem. This intertwined framework might be a conducive approach to implement new experimentations in planning practice, and more research in this direction can be beneficial to generate useful insights to contribute to theory in planning for ecosystems. Finally, we believe that authentically transformative ecological devices can be generated only through action-research as a methodological approach. If the main goal is, in fact, to activate and change mutual relationships in ecosystems, planning researchers must be an active part of such relationships so that they can actively co-produce change. In other words, in order to have an impact in how ecosystem elements relate to each other, researchers cannot prescribe what needs to be done from the outside on the base of a-priori knowledge. They can best directly impact existing human-nonhuman relationships if involved in a process of co-fabrication of knowledge and projects for political, social, cultural, emotional, and physical change.

#### Acknowledgments

We would like to thank all the community members, students, and colleagues who have participated in the last five editions of the

COPED Summer School. They have built relationships that today link the Simeto River Valley to many other places in the world. We would also like thanking our colleague and friend Dan Harper for helping us in editing this paper.

## References

- Bateson, G. (1972). *Steps to an ecology of mind: Collected essays in anthropology, psychiatry, evolution, and epistemology*. Chicago, London: University of Chicago Press.
- Board, M. A. (2005). *Millennium ecosystem assessment*. Washington, DC: New Island13.
- Bocchi, G., & Ceruti, M. (Vol. Eds.), (2007). *La sfida della complessità: 65*. Milano: Pearson Italia Spa.
- Boyd, J., & Banzhaf, S. (2007). What are ecosystem services? The need for standardized environmental accounting units. *Ecological Economics*, 63(2), 616–626.
- Brauman, K. A., Daily, G. C., Duarte, T. K. E., & Mooney, H. A. (2007). The nature and value of ecosystem services: An overview highlighting hydrologic services. *Annual Review of Environment and Resources*, 32, 67–98.
- Connolly, J. J., Svendsen, E. S., Fisher, D. R., & Campbell, L. K. (2013). Organizing urban ecosystem services through environmental stewardship governance in New York City. *Landscape and Urban Planning*, 109(1), 76–84.
- Costanza, R., de Groot, R., Sutton, P., van der Ploeg, S., Anderson, S. J., Kubiszewski, I., ... Turner, R. K. (2014). Changes in the global value of ecosystem services. *Global Environmental Change*, 26, 152–158.
- Coghlan, D., & Brydon-Miller, M. (2014). *The SAGE encyclopedia of action research*. Los Angeles, London, New Delhi, Singapore, Washington DC: Sage.
- Danley, B., & Widmark, C. (2016). Evaluating conceptual definitions of ecosystem services and their implications. *Ecological Economics*, 126, 132–138.
- De Groot, R. S., Alkemade, R., Braat, L., Hein, L., & Willemen, L. (2010). Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision-making. *Ecological Complexity*, 7(3), 260–272.
- De Groot, R. S., Wilson, M. A., & Boumans, R. M. (2002). A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecological Economics*, 41(3), 393–408.
- Decandia, L. (2000). *Dell'identità. Saggio sui luoghi. Per una critica della razionalità urbanistica*. Catanzaro: Rubbettino.
- Devall, B., & Sessions, G. (1985). *Deep ecology: Living as if nature really mattered*. Salt Lake City: UT: Peregrine Smith.
- Dewey, J. (1938). *Education and experience*. New York: Macmillan.
- Ernstson, H. (2013). The social production of ecosystem services: A framework for studying environmental justice and ecological complexity in urbanized landscapes. *Landscape and Urban Planning*, 109(1), 7–17.
- Ernstson, H., & Sörlin, S. (2013). Ecosystem services as technology of globalization: On articulating values in urban nature. *Ecological Economics*, 86, 274–284.
- Holling, C. S. (1986). The resilience of terrestrial ecosystems: Local surprise and global change. *Sustainable Development of the Biosphere*, 14, 292–317.
- Holling, C. S., & Chambers, A. D. (1973). Resource science: The nurture of an infant. *BioScience*, 13–20.
- Houston, D., Hillier, J., MacCallum, D., Steele, W., & Byrne, J. (2017). Make kin, not cities! Multispecies entanglements and 'becoming-world' in planning theory. *Planning Theory*.
- Lambert-Pennington, K., Reardon, K. M., & Robinson, K. S. (2011). Revitalizing South Memphis through an interdisciplinary community-university development partnership. *Michigan Journal of Community Service Learning*, 17(2), 59–70.
- Lambert-Pennington, K., & Saija, L. (2017). *Because we are what we eat, paper presented at the 16th AAA Annual Meeting November 29-December 3*. DC: Marriott Wardman Park Hotel Washington.
- Lewin, A. Y., Long, C. P., & Carroll, T. N. (1999). The coevolution of new organizational forms. *Organization Science*, 10(5), 535–550.
- Naehm, S., Ingram, J. C., Varga, A., Agardy, T., Barten, P., Bennett, G., ... Ching, C. (2015). Get the science right when paying for nature's services. *Science*, 347(6227), 1206–1207.
- Naess, A. (1973). The shallow and the deep, long range ecology movement. A summary\*. *Inquiry*, 16(1–4), 95–100.
- Pataki, D. E., Carreiro, M. M., Cherrier, J., Grulke, N. E., Jennings, V., Pincetl, S., ... Zipperer, W. C. (2011). Coupling biogeochemical cycles in urban environments: Ecosystem services, green solutions, and misconceptions. *Frontiers in Ecology and the Environment*, 9(1), 27–36.
- Pincetl, S. (2015). Cities as novel biomes: Recognizing urban ecosystem services as anthropogenic. *Frontiers in Ecology and Evolution*, 3, 140.
- Pizzio, G., & Micarelli, R. (2003). *L'arte delle relazioni, 1*. Firenze: Alinea Editrice.
- Pizzio, G., & Micarelli, R. (2004). *Dai margini del caos. L'ecologia del progettare, 2*. Firenze: Alinea Editrice.
- Radford, K. G., & James, P. (2013). Changes in the value of ecosystem services along a rural–urban gradient: A case study of Greater Manchester, UK. *Landscape and Urban Planning*, 109(1), 117–127.
- Raciti, A. (2016). Building Collective Knowledge Through Design: The Making of the Contrada Nicolò Riparian Garden Along the Simeto River (Sicily, Italy). *Landscape Research*, 41(1), 45–63.
- Raciti, Antonio, Lambert-Pennington, Katherine A., & Reardon, Kenneth M. (2016). The struggle for the future of public housing in Memphis, Tennessee: Reflections on HUD's choice neighborhoods planning program. *Cities*, 57, 6–13.
- Reardon, K. (2003). Ceola's vision, our blessing: The story of an evolving community/university partnership in East St. Louis, Illinois. *Story and sustainability: Planning, practice and possibilities for American cities* (pp. 114–142).
- Reardon, K. M. (2006). Promoting reciprocity within community/university development partnerships: Lessons from the field. *Planning, Practice Research*, 21(1), 95–107.
- Rhoads, R. A., & Howard, J. P. F. (1998). *Academic service learning*. San Francisco: Jossey-Bass Publishers.
- Rose, G. (1997). Situating knowledges: Positionality, reflexivities and other tactics. *Progress in Human Geography*, 21(3), 305–320.
- Saija, L. (2017). *Autobiography as a Method of Inquiry. Encounters in Planning Thought: 16 Autobiographical Essays from Key Thinkers in Spatial Planning*, 8.
- Saija, L. (2014). Proactive conservancy in a contested milieu: from social mobilization to community-led resource management in the Simeto Valley. *Journal of Environmental Planning and Management*, 57(1), 27–49.
- Saija, L. (2015a). 'Questa politica parla di noi!'. Breve storia dell'autocandidatura della comunità della Valle del Simeto. *Territorio*, 74, 108–114.
- Saija, L. (2015b). *Un progetto a Contrasto del Caporalato Rurale nella Valle del Simeto*. In *Atti della XVIII Conferenza nazionale SIU, Italia 45-45, Venezia 11-13 giugno 2015*. Roma-Milano: Planum Publisher.
- Schön, D. A. (1987). *Educating the reflective practitioner: Toward a new design for teaching and learning in the professions*. San Francisco: Jossey-Bass.
- Secretariat, C. B. D. (1992). *Convention on biological diversity*.
- Smith, G., Warner, M. E., Fioretti, C., & Meschiar, C. (2014). Rome undergraduate planning workshop: A reflexive approach to neighborhood studies. *Planning Theory Practice*, 15(1), 9–25.
- Stengers, I. (1997). *Power and invention: situating science, 10*. Minneapolis, London: U of Minnesota Press.
- Vigerstol, K. L., & Aukema, J. E. (2011). A comparison of tools for modeling freshwater ecosystem services. *Journal of Environmental Management*, 92(10), 2403–2409.
- Williams, R. (1980). *Problems in materialism and culture: Selected essays*. London and New York: Verso.