

EVALUATION OF ECOSYSTEM SERVICES FOR URBAN RESILIENCE: NOTES FROM A
CASE STUDY IN SARDINIA

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ABSTRACT

Prevention of forest fires is a crucial challenge since they deeply affect the multifunctional nature of forest landscapes. This paper synthetically presents the research developed by the DAD/DIST research group of the Politecnico di Torino in the context of the AF3 project (“Advanced Forest Fire Fighting”) – aimed at defining and applying a method to evaluate and map Forest Ecosystem Services (FES) in Sardinia from both a biophysical and economic point of view – and highlights the method’s potentialities to foster an adaptive management and planning approach for resilience.

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1. A method for evaluating Forest Ecosystem Services in Sardinia

Forest fires are constantly increasing across the globe (MEA 2005), especially in Southern Europe (EEA 2008, 2016), due to climate change and to spatial landscape structure changes (namely the growing interface between vegetated land and settlements, the so-called “Wildland-Urban Interface”, Chas-Amil et al. 2013, Modugno et al. 2016).

The resilience (as intended by Carpenter et al. 2005 and Davoudi 2012⁴) of forest landscapes is significantly challenged by fires because of the pervasive environmental and landscape impact of large-scale fires that deeply affect forest capacity to persist, adapt and transform in the face of an event. Forest fire increase is still more alarming, if we consider the typical multifunctional features of forest landscapes (Merlo and Croitoru 2005), that carry out several functions, ranging from an environmental (e.g., watershed protection or climate regulation), socio-economic (e.g., provision of wood and non-wood forest products) and cultural (e.g., connected to tourism, but also to aesthetic and spiritual values) point of view. These functions deeply affect also urban areas, both at a local and territorial scale, depending on the proximity of urban settlements.

The “Advanced Forest Fire Fighting” (AF3) European project (<http://af3project.eu/>) aims at overcoming the current operational gaps in managing forest fires through the development of new technologies and methodologies. In the context of AF3 Project the DAD/DIST research group (Dipartimento di Architettura e Design and Dipartimento Interateneo di Scienze, Progetto e Politiche del Territorio, Politecnico di Torino) focused its activity on defining a method to value and map Forest Ecosystem Services (FES), both from a biophysical and economic point of view. The method aims at highlighting forest landscape values and defining the potential damages caused by fires, in order to support the definition of forest fire risk. Moreover, the method is designed to sensitize social actors and institutions over forest landscape values⁵ and to support the design of policy instruments effectively addressing forest fire risk by targeting FES. Hence, this method is not meant to remain a purely academic exercise, as often forest evaluation studies are (Emerton 2003), but it aims at having an impact on practical planning and management.

The method is conceived to be:

- (i) highly communicative (FES are evaluated not only from a biophysical point of view but also from an economic one; moreover they are georeferenced through Geographic Information System, GIS, procedures to define forest landscape value maps);
- (ii) easily implemented by institutional actors (FES evaluation is developed without using complex digital and mathematical models but only GIS-based indicators). Six indicators related to different FES types (provisioning: 1. Timber, 2. Fuelwood, 3. Cork; regulation and maintenance: 4. Hydrogeological protection, 5. Carbon sequestration; cultural: 6. Tourism) have been defined to catch the complexity and multifunctional features of forest landscapes.

The method was applied to the Sardinia Region, which presents recurring forest fires and where more than 20 per cent of the overall area is covered by forests.

2. Implications for urban resilience

It is widely agreed that incorporating Ecosystem Services (ES) in planning and management of socio-ecological systems can foster resilience (McPhearson et al. 2015). Providing a long-term supply of ES is

⁴ Resilience “is the ability of complex socio-ecological systems to change, adapt and, crucially, transform in response to stresses and strains” (Davoudi 2012).

⁵ Since Ecosystem Service (ES) concept (MEA 2005) effectively translates landscape “values” in terms of “benefits” (also economic benefits), being characterised by a strong anthropocentric perspective (i.e., the benefits provided by ecosystems to *people*), it acts as an effective driver of sensitisation, among social actors and institutions, with respect to landscape values and the related risks.

crucial to ensure territorial and urban well-being (Elmqvist et. al. 2014) and, more generally, a high degree of quality and diversity of territorial and urban contexts.

More specifically, the above-mentioned method for evaluating and mapping FES can be a useful tool in a resilience perspective, since it fosters an *adaptive management and planning approach* that is strongly needed to “operationalise” urban resilience (Crowe et al. 2016, Plummer et al. 2013, Gunderson 1999):

- it supports *community sensitisation*: a local or regional public administration can use FES evaluation and mapping to sensitise social actors, managers and planners to better conserve and enhance forest environments;
- it promotes *institutional learning* (Walker and Salt 2006, Redman 2014), enhancing the capabilities of those who manage fire risk with indicators that can be easily implemented by institutional actors. Simple methods for evaluating and monitoring FES are needed to effectively foster an adaptive approach to fire risk based on institutional learning. To this end, indicators, such as those applied in this study, rather than complex mathematical models, seem to be more appropriate to “build institutions that learn”;
- as a direct consequence of the previous point, it allows monitoring of FES dynamics, fostering a “*learn-by-doing*” approach (Holling 1978) typical of adaptive management, to be applied to territorial and urban planning;
- it strengthens *compensation actions* that, if conceived as a systemic operational framework (i.e., a compensation plan, Voghera and Negrini 2016), are an important tool for adaptive management and planning, promoting the system’s capacity to favourably react to changes that significantly affect the environment (Kuiper 1997, Cowell 2003). FES evaluation and mapping can be used to show the socio-ecological and economic effects of compensation actions that entails reforestation interventions (e.g., recovery of degraded landscapes, such as quarries, caves, industries, or creation of ecological networks in fragmented peri-urban contexts).

FES evaluation can, therefore, support urban resilience, fostering “a more responsive, adaptive government that works in concert with its environment” (Redman 2014).

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