Chapter 30
The Cultural Ecosystem Services of Mediterranean Pine Forests

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30.1 Introduction

30.1.1 Challenges in Defining the Cultural Significance of an Ecosystem

A tree, in the eyes of the humans who benefit from its existence, is far more than a biological entity. Likewise, a forest means far more to a culture than a collection of trees. Contemporary Mediterranean pine forests are the product of millennia of human–nature interactions in the Mediterranean Basin. They have been shaped by human activities, and in response, they have influenced cultural and historical developments from Spain and Portugal in the west, to Israel and Lebanon in the east. Through the products they provide, such as timber, resin, pine nuts, and mushrooms in their understory, to the refuge they provide visitors from densely populated cities and towns, they have contributed to shaping the lived experience in the region. Like most ecosystems, these forests provide cultural ecosystem services (CES) and catalyze relational values. But they are unique in the intense interaction they have facilitated with human civilizations since the Paleolithic Period. They are dynamic socio-ecological systems par excellence, which implies that the "basket" of cultural services changes and fluctuates in value, intensity, and spatial distribution over time.

In this chapter, I analyze and synthesize the CES provided by Mediterranean pine forests. CES are 'the non-material benefits people obtain from ecosystems' (MA 2005), and they include a range of services, including spiritual and religious values, knowledge and education, inspiration and aesthetic values, mediation of social relations, sense of place, recreation and tourism, mental and physical health,

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cultural and heritage values, and more (MA 2005; TEEB 2017; CICES 2018).[1] The conceptual framework of the International Platform on Biodiversity and Ecosystem Services (IPBES 2013) expanded upon these non-material benefits to include intrinsic values (the worth of nature itself) and the concept of relational values, or "preferences, principles and virtues about human–nature relationships" (Chan et al. 2018). In this chapter, when a pine forest contributes to one's identity formation, for example, I consider the forest to be producing or augmenting a relational value. While relational values are technically not "services", they are richly intertwined with cultural services, and so we consider them here.

CES, by definition, are the outcome of an intricate and dynamic interaction between human society and the natural environment (Tengberg et al. 2012; Fish et al. 2016). The forests' biophysical and ecological characteristics, and their provisioning and regulating services can be studied with a modicum of empirical, quantitative precision (if not completely); studying the cultural significance and benefits of forests, and their associated value(s), is arguably more complex and more fluid. CES assessment is subject to the dynamic changes of both ecosystems and society, varying from group to group and person to person, making their assessment highly context-dependent. CES can be studied and interpreted from multiple perspectives, focusing on different beneficiaries during different historical periods.

The temporal period of the assessment, the informants, the methodology of research, and even the political disposition or values orientation of the researcher will yield different pictures regarding which CES are provided, in what amounts and at what value. The type and value of CES is perceived and determined through the eye of the beholder. A pine forest will mean something different depending on whether you are farmer (on whose fields the trees are encroaching), a modern urban dweller (seeking to get away from the hectic urban lifestyle), a mushroom collector (who knows that their mushrooms flourish in the pine humus), a conservation biologist (who may scorn the perceived lack of biological diversity in the forest) or a forester (who appreciates the economic benefits of pine timber production). In Israel, your political disposition will likely impact your assessment regarding the cultural value of Mediterranean pine forests, most of which were planted as an act of nation building and to reinforce land claims.

Due to these complexities of time and space dynamics and the importance of context, assessing the CES of Mediterranean pine forests requires the use of diverse quantitative and qualitative research tools, drawn from multiple disciplines from the natural and social sciences to the humanities, to account for diverse perspectives. The fluidity of CES assessments makes a definitive and consensual valuation elusive, but also makes the story of human–pine forest relationships richer and more interesting.

[1] Cultural services are one of three types of ecosystem services commonly identified in the ecosystem service conceptual framework. The other two are provisioning services (tangible products, in the form of material or energy, obtained by humans from ecosystems) and regulating services (the contribution of ecosystem processes to moderating conditions of the biotic and abiotic environment for humans).

In the following chapter sections, I begin with a definition and overview of CES and expand upon the challenges of assessing them in dynamic socio-ecological systems and the demand for nuance in our assessments (Sect. 30.1.2). I then inventory the CES provided by Mediterranean pine and mixed-pine forests through a review of the recent academic literature (Sects. 30.2 and 30.3). Because the concept of ecosystem services (ES) is relatively new to the scientific community (the concept became mainstream with the publication of the Millennium Assessment in 2005), most of the literature explicitly discussing CES in Mediterranean pine forests is from the last decade. But there is also a tradition of researching human–nature interactions in the Mediterranean Basin prior to the proliferation of the ES conceptual framework, such as can be drawn from environmental psychology, anthropology, environmental history, landscape architecture and design, ecology and others. Here I focus on the first body of literature, which focuses explicitly on CES, but I include work from the latter group, particularly for historical perspectives.

Section 30.4 focuses on CES from Israel's pine forests, particularly their aesthetic value and preferences. I introduce the long-standing debate among scientists, environmental activists, foresters and the public regarding the ecological (and perhaps the aesthetic) role of pine forests in the region (planted and naturally-occurring), because that debate – I argue – shapes our perception of the cultural value of these forests and their CES. I conclude by considering both the need for a nuanced, contextualized approach to assessing CES in general, and in Mediterranean pine forests in particular, and consider how current and predicted environmental changes in the Mediterranean Basin may impact the future of pine forests and their CES.

A final caveat before beginning: For this chapter, pines will be treated as a collective genus (*Pinus*), and individual species will rarely be specified unless particularly relevant to the services they provide. While different species may provide different levels of services (e.g., shape and extent may affect shade quality, and some species provide higher quality pine nuts), most services are perceived by stakeholders in a generic sense that does not make fine distinctions between species.

30.1.2 Assessing Cultural Ecosystem Services: From the General to the Specific

According to the major ES assessment frameworks, there is a common repertoire of CES humans derive from ecosystems in general which are summarized in Table 30.1. These frameworks are also used to identify CES of Mediterranean pine forests (see below). However, a finely detailed and quantified assessment of CES, which includes identification, characterization, and valuation of services, is elusive for at least five reasons:

1. CES are, by definition, **intangible benefits**, which are often difficult to define and value monetarily, or in any quantitative terms. While there are economic tools for directly and indirectly assessing CES, some researchers note that those

Table 30.1 Categories of cultural ecosystem services according to comprehensive conceptual and assessment frameworks

MA 2005	Spiritual and religious values
	Knowledge and educational values
	Inspiration and aesthetic values
	Social relations
	Sense of place
	Cultural diversity, culture, and heritage values
	Recreation and tourism
UKNEA 2014	Cultural values
	Shaping identities
	Wellbeing, mental and physical health
	Obtaining skills and capabilities
IPBES 2016	Spiritual services
	Recreation
	Tourism
TEEB 2017	Recreation
	Mental and physical health
	Tourism
	Aesthetic appreciation and inspiration
	Spiritual experience and sense of place
CICES 2018	Scientific investigation
	Education and training
	Culture, heritage, and aesthetic experiences
	Symbolic and religious meaning
	Entertainment

From Teff-Seker and Orenstein (2019)

CES that are easily quantifiable receive a disproportionate emphasis in the literature (Milcu et al. 2013).

2. CES are often benefits **derived from a holistic system or landscape** rather than a single species or organism (consider, for example, spirituality, aesthetics, and recreation). As such, they cannot be linked to a particular species, and different species and assemblages of species could provide similar baskets of CES. This is especially relevant regarding Mediterranean pine forests, where we can delineate specific CES, but we cannot always attribute them specifically to pine trees (i.e., other tree species may be able to provide the same service).
3. CES are intimately **integrated with other ES types**, such as provisioning services (e.g., the cultural value of mushroom collection (Marini Govigli et al. 2019) or resin tapping (Soliño et al. 2018) in Mediterranean pine forests), and regulating services, (e.g., threat of fire and flood can also degrade the sense of psychological wellbeing provided by forests, and therefore assessed cultural values are inseparable from other services).

4. CES reflect the **complex interactions between two dynamic systems** – social and biophysical. As such, CES vary in time and between demographic groups and even individuals.
5. Measurements of CES value may be heavily influenced by factors unrelated to social or ecological characteristics, but rather be affected by **accessibility, physical proximity, or awareness** (Fleischer et al. 2014).

The fourth reason, linked to the characteristics of socio-ecological systems, demands further explanation. The Mediterranean pine forest is a socio-ecological system, par excellence (Naveh and Carmel 2004). In such a system, social (human) and bio-physical systems are interconnected, with changes in one impacting the other. Humans directly and indirectly alter biophysical systems, which are also impacted by global changes outside of the system, and their changes are perceived by humans via the change in ES provision (Fig. 30.1; Collins et al. 2011). As socio-ecological systems, the CES produced by ecosystems and/or perceived by humans are thus dynamic in time and space. As such, four characteristics of this socio-ecological system challenge our capacity to assess CES. These are:

1. **Temporal dynamics of ecosystems**: Ecosystems change due to natural and/or human-driven causes and this will affect the provision of ES. For example, Mediterranean forests were cleared throughout history for agricultural and grazing lands. Some of these lands have since returned to forest following rural

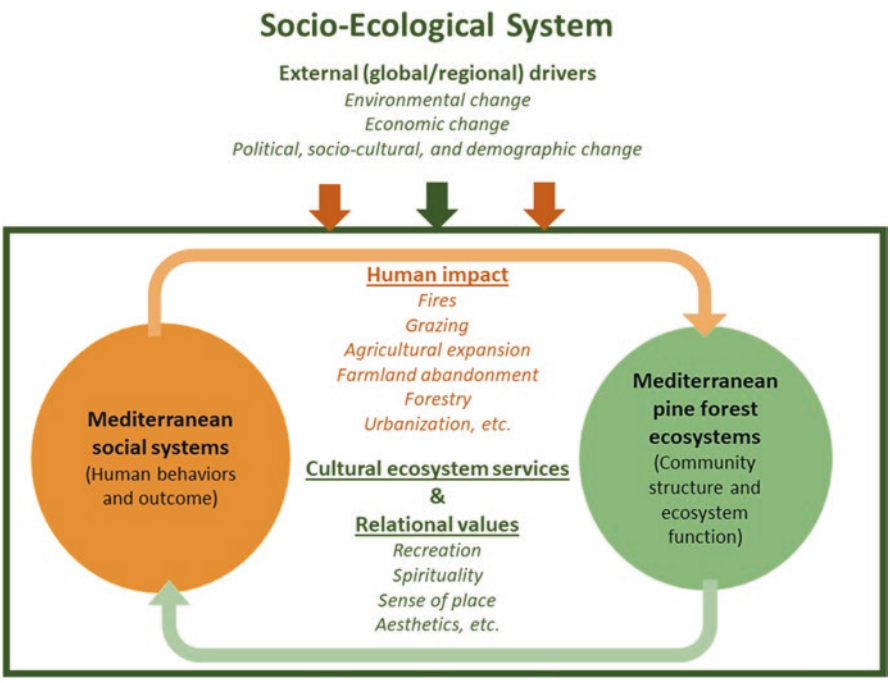

Fig. 30.1 Socio-ecological system. (Adapted from Collins et al. 2011)

abandonment. Each condition provides a unique set of CES to a specific population group. These changes may be welcomed by various segments of society, and not by others.

2. **Spatial dynamics of ecosystems**: As the perceived benefits from ecosystems reflect the interaction between people and nature, when moving from place to place across the Mediterranean Basin, we would expect the "basket" of services and the value of the benefit to also change according to social and ecological context.
3. **Temporal dynamics of social systems**: Societal values and behaviors change over time. "Nature" does not mean the same to today's citizens what it did for past generations. Major economic changes, such as movement from agrarian to urban industrial and post-industrial societies, change the way we value and use forests.
4. **Demographic dynamics of social systems**: Different demographic groups coexist with different value systems. Perceived benefits vary from group to group and between individuals at a single location or between locations. Differences in CES perceptions are observed between groups with varying occupations, level of formal education (and type of education), gender, income, nationality, ethnicity, etc. All of these can impact the type, value, and intensity of various CES received from pine forests.

To summarize, social and ecological systems are both dynamic, and they respond to one another in cyclical processes with feedbacks. Historical changes in society (agricultural and industrial revolutions, urbanization processes, developments in religion and politics) change the way humans perceive and interact with the natural environment. At the same time, the natural systems themselves are dynamic and change in response to human and non-human drivers, leading to a shifting "basket" of services. To further complicate the picture, at any given time in history, the perceptions of benefits from ecosystems differ among different demographic groups depending on, for example, where an individual works, what their underlying views are regarding human–nature interactions, etc. This is evident in CES assessment of forests in general (Holmgren and Scheffer 2017), and in Mediterranean pine forests in particular (Lopez-Santiago et al. 2014; Almeida et al. 2016; Maestre-Andrés et al. 2016; Martínez-Sastre et al. 2017; Negev et al. 2019).

For these reasons, CES assessments should be offered with the caveat that any given assessment is relevant for only the specific time, place, and social context in which it is conducted. Nonetheless, we can also find broad recurring themes across the recent literature with reference to Mediterranean pine forests and their associated CES. We review these CES below, focusing on (1) recreation; (2) aesthetics, and; (3) cultural identity and relational values. But first I consider the historical cultural role of pine forests in the Mediterranean Basin, and then explore broad, recurring CES appearing across the Mediterranean Basin.

30.2 Mediterranean Pine Forests and Their Cultural Significance in History

In this section we consider the historical significance of pine forests in the Mediterranean Basin. By doing so, we not only understand how the range of CES has changed throughout history, but we also begin to consider how modern perceptions regarding the "naturalness" of *Pinus* species in the region influence perceptions of CES received from a forest comprised of these trees.

Although pine forests (including mixed forests, where pines were a significant part) may have been a distinct component of Mediterranean ecosystems in the Paleolithic Period when hunter-gatherers reached the region (Peñuelas et al. 2017, studying the Iberian peninsula), several researchers suggest that pines were a relatively minor component of Mediterranean biota, and that they later proliferated due to human activities (Blondel and Aronson 1995).[2] Hunter-gatherers may have burned, or otherwise cleared, naturally occurring forests to ease hunting constraints and increase grasslands for targeted species, supporting a hypothesis that humans have an innate preference for savanna habitats, since humans had evolved in these ecosystems and had grown accustomed to them (Falk and Balling 2009).

Widespread deforestation of the Mediterranean Basin followed the arrival of humans, particularly during the Neolithic Period and the establishment of permanent settlements, resulting in greater landscape patchiness and desiccation of the region, where reduced vegetative cover resulted in greater water runoff, stream flow, and erosion (Blondel 2006). Following the first agricultural revolution and the rise of cities, the demand for timber and grazing lands led to rapid deforestation of the region, and along with it, crucial regulating ES, such as soil and moisture retention, were also degraded (Blondel 2006; Hughes 2011). Through a combination of natural climate change and human activities, the Mediterranean ecosystem was greatly altered, with one of the prominent results being the decline in prevalence of forests in general, and pine forests in particular. Some of the maquis we recognize today may be a direct result of historical deforestation and the proliferation of husbandry, agriculture, and urbanization.

In the Hebrew Bible, the pine makes four possible cameo appearances (in English translations), although the Hebrew word for pine (*oren*) appears only once, where a pine is planted and raised and eventually used for fuel for cooking and for warmth. While the pine was considered by some as common in Levant forests during the Biblical era, its general absence in the Bible is a quandary, and this fact – along with additional evidence – led Liphschitz and Biger (2001) to conclude that the region of Israel/Palestine was actually not home to *P. halapensis* Mill., which is so prolific in the region today due to afforestation activities (see below).

[2] In one comprehensive volume on Mediterranean-type ecosystems, there is only a single reference to naturally-occurring pine species in the Mediterranean Basin, with the remaining references to pines referring only to the negative ecological impacts of pine plantations in Australia and South Africa (Davis and Richardson 1995).

Further north, in Lebanon, pines (*P. brutia* Ten.) were a historical component of the cedar forests exploited by Sumerians, Babylonians, and Israelites, among others (Abu-Izzeddin 2000). Following three millennia of deforestation, Roman Emperor Hadrian implemented what Abu-Izzeddin considered to be the first nature conservation law – a command to preserve remaining pine and cedar forests in Lebanon as an Imperial Domain (Abu-Izzeddin 2000). The author goes on to describe nineteenth century re-forestation efforts that featured stone pines (*P. pinea* L.), valued not only for their wood and pine nuts, but also for their "sweet scent and cool shade" that attracted locals and tourists alike (a CES). Due to ongoing destruction of the forests of Lebanon into the twenty-first century, multiple efforts are underway to preserve the integrity of its remaining forested areas (Abu-Izzeddin 2000). The Romans are also credited with initiating pine afforestation for dune stabilization on the Antalya coastline of Turkey, and pine continues to be a target genus for afforestation by the Turkish Forest Service today (Çaliskan and Boydak 2017).

The Aleppo pine (*P. halepensis*) was a dominant tree on the forested landscape across the central and western Mediterranean (France, Spain, Morocco, Italy, and Algeria), and in Tunisia, according to one study, the tree had important social roles, alongside its environmental and economic importance (Jaouadi et al., 2019). In particular, its pine nut is described as a cultural icon due to its use, unique taste and role in local cuisine (Jaouadi et al. 2019).

Several studies on cultural landscapes and ES note the relatively recent arrival of pines in the Mediterranean Basin. Gragson et al. (2015) note that the increasing presence of pines in the western French Pyrénées was a phenomenon of the last 500 years. Martínez-Sastre et al. (2017) note in their analysis of the Sierra Morena mountain range in Spain that mixed pine forests (mostly *P. pinaster* Ait.) arrived with plantation programs in the 1960s and are currently being phased out in favor of native woody Mediterranean species of oaks and strawberry trees. Sacchelli (2017), assessing forest ES in a silver fir forest in central Italy, refers to artificial stands of black pine forest, which was not included in his ES assessment.

30.3 A Contemporary Survey of Cultural Ecosystem Services Around the Mediterranean Basin

Many CES drawn from the generic list (Table 30.1) can be intuitively attributed to Mediterranean pine and mixed-pine forests, and they are indeed noted in introductory sections for research on various aspects of Mediterranean ecosystems (e.g. MA 2005; Peñuelas et al. 2017; Gauquelin et al. 2018).

Using several research methods in a comprehensive ES assessment of a natural park (characterized as containing mixed oak-pine forests) in the Mediterranean north-east of Spain, Maestre-Andrés et al. (2016) found that when asked to identify ES offered by the park, stakeholders most often identified cultural services (alongside habitat services) in comparison to provisioning and regulating services.

Through these interviews, coupled with a broader survey-based inquiry, they identified the most highly valued ES to include spiritual experience, information for cognitive development, mental recreation, aesthetic information, physical recreation, gene pool protection (a habitat service) and distraction and leisure. Several of these were positively or negatively correlated with various demographic factors such as age, place of residence, educational level, and environmental values. Additional studies have focused on assessments of CES, either through open interviews with stakeholders, literature surveys, and/or questionnaires for the general population. I expand upon the most predominant assessment results including recreation, tranquility and relaxation, aesthetic benefits, and relational values.

30.3.1 Recreation, Tranquility, and Relaxation

One of the prominent global trends of the twentieth and twenty-first centuries is the increasing detachment of humans from the natural environment as the result of urbanization, which has physically distanced humans from natural areas, and changes behaviors (Soga and Gaston 2016). But with less access to natural open spaces and growing populations, there is also increased demand for open, natural areas for recreation and leisure use. Pine forested areas offer several qualities to fulfil this demand, including shade, refuge from noise and wind, and pleasant qualities such as sound, scents, and clean air. Multiple studies note that Mediterranean pine and mixed-pine forest provide recreational value (Maestre-Andrés et al. 2016; Jucker Riva et al. 2018) and tranquility and relaxation (Lopez-Santiago et al. 2014; Maestre-Andrés et al. 2016).

In Tuscany, Italy (Bernetti et al. 2019), pine forests are so popular with local tourists that they are subject to overload. A survey of Italian managers of National and Regional Parks revealed that the most relevant ES provided by forests was "improvement of tourism and recreational concerns" (Vizzarri et al. 2015). On Greek Ionian Islands, pine forest cover was positively associated to recreational services individually and in conjunction with other land cover types, such as olive groves (i.e., landscape mosaic; Lorilla et al. 2018).

According to Campos et al. (2019), the monetary value of recreational use of ecosystems, like regulating services and other cultural services, is often undervalued in standard national accounting, especially when recreational access is provided for free. These researchers used contingent valuation willingness-to-pay surveys to estimate the value of two CES, namely recreation and private amenity (expressed as the amount of money farmers would be willing to accept to give up their property) in the Andalusian Forests of Spain (where six *Pinus* species are present). They found that that these two CES account for 59% of the total value of the Andalusian forest ES, making recreation one of the most prominent ES provided by these forests. Since forest CES, and recreational use in particular, are prominent among Mediterranean pine and mixed-pine forests, it is logical that other researchers have

found that forest CES are strongly and positively correlated to proximity to roads (Bernetti et al. 2019) and to major population centers (Roces-Díaz et al. 2018).

30.3.2 Relational Value

Like other ecosystems, Mediterranean pine forests contribute towards shaping the identity of those who live and work in them. Relational values are thus frequently noted as important with respect to these forests, and they can be defined in various ways, for example local identity and cultural heritage (Maestre-Andrés et al. 2016) or traditional cultural and emotional values (Peñuelas et al. 2017). We consider the forest to be contributing to relational values when some biological or landscape characteristic of the ecosystem contributes to an individual's or group's sense of attachment to the forest or contributes to defining the identity of the person or group. This is why provisioning or regulating services are often interlinked with cultural services and relational values. The act of collecting mushrooms, for example, is at once a provisioning service (something we eat), a cultural service (a recreational activity) and a relational value (it has defined my family identity for generations). When a pine forest helps retain soil and prevent erosion, it is providing a regulating service that also may increase one's sense of wellbeing with nature and security from environmental degradation.[3]

Soliño et al. (2018) note that in Spain's Castilla y León region, "the virtual disappearance of resin tapping in Spain [from *P. pinaster* forests] caused the abandonment of traditional forest activities and the subsequent losses of ecosystem forest services", and that "abandonment of this traditional forestry activity would lead to a loss of social welfare beyond the economic activity." In this way, the authors connect a provisioning service (resin) to relational values by noting that the implications of the decline of resin tapping resulted in the abandonment of rural settlement and the loss of cultural and natural heritage. Resin tapping was not only an economic activity, but a cornerstone supporting a way of life. In Cyprus, pine forests provide the ideal conditions for mushrooms and pine cones, which are both considered provisioning services (food and decoration, respectively; Ciftcioglu 2018). But as I and others suggest (e.g. Marini Govigli et al. 2019), activities such as hunting and mushroom collection overlap with CES and relational values, such as recreational activities and sense of place, respectively.

Scientists may, in subtle or not-so-subtle ways, introduce their own biases into their research and this may affect how pine forests are assessed with regard to relational values. Ecologists, for example, are particularly sensitive to land uses that reduce biodiversity. If they are studying processes that they know are causing damage to biodiversity, this may weaken their sense of attachment to a place.

[3] Alternatively, when a pine forest is viewed as a threat due to its flammability (a regulating disservice), it can degrade one's attachment to the forest (Depietri and Orenstein 2019).

Mediterranean pine forests, particularly pine plantations, are often, though not always (Pedley et al. 2019), assumed to have lower biodiversity potential than other natural ecosystems, and this affects opinions regarding the desirability of pine forests (see Rothschild 2019 for an example of opposition to pine afforestation in Israel). There may also be ambiguity regarding the "naturalness" of pine forests in the Mediterranean Basin, and many of the references to pine forests in the literature are to plantations and agro-forestry, which are implicitly less desirable than the "natural" forest or other vegetative structure.

30.3.3 Aesthetic Value: The Eye of the Beholder or Shape over Species?

CES assessments often focus on the aesthetic value of a landscape, which opens the topic to a long history of landscape aesthetics research predating the proliferation of the ES conceptual framework. There are two broad schools of thought regarding landscape aesthetics drivers and preferences, although both garner empirical support and they are not necessarily mutually exclusive. Some suggest that there are universal and consensual commonalities regarding landscape tastes, or *sensus communis* (Kant 1791, cited in Stamps 1997). A variation of this is the hypothesis from evolutionary psychology that savannas constitute the most preferred human landscape due to access to resources and the evolutionary advantage early humans had against both prey and predator when living in savannas (Falk and Balling 2009). On the other hand, landscape preferences have been shown to be distinct among different demographic groups (Zube and Pitt 1981; Buijs et al. 2009) and most landscape preference assessments are thus structured to investigate these differences.

Several studies have been conducted to assess the aesthetic value of Mediterranean pine forests, usually assessing the forests relative to other landscape alternatives, such as agricultural landscapes, shrublands, or forests with different structures or biological composition, such as the Montado of Portugal, which is dominated by cork oak. Results suggest that preferences for pine forests depend heavily on the landscapes to which the forest is being compared. Almeida et al. (2016), for example, measured landscape appreciation in a region of diverse landscape types in southern Portugal, including pine forests. Using photographs of 16 landscape types, they asked respondents to record their preferences. Pine forests ranked relatively low in preference in comparison to the other 15 possible landscapes, while mixed forests ranked slightly higher, but still much lower than Montado, olive groves, or vineyards. However, the authors showed that pine forests were preferred by individuals expressing an overall preference for productive landscapes (also including vineyards, irrigated agriculture, and intensive olive groves; Almeida et al. 2016). Pine forests were disliked by respondents with a preference for traditional agricultural landscapes. Lopez-Santiago et al. (2014) found that stakeholders in a transhumance landscape in Spain ranked pine forests higher in aesthetic value than

croplands, which they attribute to a more general preference of people for green, forested landscape than to more arid ones.

Rosário et al. (2019) suggest that the Montado forest, with its sparser density and wide-canopy trees, is considered more aesthetic than forests dominated by the conical or columnar structures of some pines, which further supports the theory of preference for savanna landscapes over forested and other landscapes. Bernetti et al. (2019), analyzing big data in the form of Flickr social network photographs, showed that Mediterranean pine forest species (particularly the Italian umbrella pine, *P. pinea*, with their wide canopies) are among the more appreciated tree types in Tuscany, Italy, compared to lower-canopy oaks and broad-leaved species. Both studies suggest that dendrometry and forest density have greater importance than species when assessing tree aesthetics.

30.3.4 Cultural Services in Mediterranean Pine Forests Relative to Other Landscape Types

As with the measure of aesthetic value, cultural services in pine forests in general are also assessed relative to other land-cover types, such as rangeland, other forest types, or agricultural landscapes. In Spain, Lopez-Santiago et al. (2014) asked stakeholders to compare the perceived ES in agricultural and pine forest landscapes. CES in forests scored high among stakeholders relative to provisioning and regulating ES. Pine forests were perceived to provide four out of five cultural services, including aesthetic value, tourism, hunting and tranquility/relaxation. Furthermore, pine forests were perceived to provide more of these services than cropland. For cultural identity, cropland and pine forests were not significantly different.

In a second study in the Sierra Morena mountain range in Spain, the ES of pine forests were assessed using both social and biophysical measures and these forests were found to contribute less to traditional and local knowledge than alternative forest types (Martínez-Sastre et al. 2017). Nonetheless, the authors of this study also found that future land-use scenarios that included pine forests within a mosaic of multi-functional land uses were deemed optimal from a biophysical and social perspective (as opposed to landscapes dominated by olive plantations or livestock production). A cross-country comparison in the Mediterranean Basin found that stakeholders noted that various forms of pine forests supply CES (recreation or maintenance of traditional landscapes) more than alternative landscapes such as diversified shrubland or extensive grazing areas (Jucker Riva et al. 2018). In central Portugal, researchers concluded that forests (including pine forests) provided a higher amount of CES than both urban and agricultural landscape types (Leitão et al. 2019).

Perceptions of CES from different landscapes are often found to differ between demographic groups. In almost every empirical study of the CES provided by Mediterranean pine forests reviewed here, different demographic groups were

shown to hold difference perceptions regarding forest CES. López-Santiago et al. (2014), for example, found that perceptions of ES differed between rural and urban inhabitants, herders and non-herders, younger and older respondents, genders, and groups with different formal educational achievement.

Differences in perceptions of CES provision can sometimes lead to conflict. For instance, conflicts arise between various groups regarding access to cultural services. In a natural park in Spain, conflicts arose between park managers, who sought to increase access to the park and its CES, and conservationists who advocated limiting public use (Maestre-Andrés et al. 2016).

The twentieth- and twenty-first-century proliferation of pine plantations is often referred to in the context of research on other Mediterranean cultural landscapes such as deciduous oak woodlands in Greece (Schaich et al. 2015), or transhumance cultural landscapes in Spain (Oteros-Rozas et al. 2014). While the plantations are often not the focal ecosystem of the research, references to pine plantations focus on their potentially negative impacts on biodiversity or CES, or their positive contribution to provisioning services (timber). On the other hand, Derak and Cortina (2014) compared the ES provided by *P. halepensis* plantations used for landscape restoration to ES provided by unrestored landscapes (grasslands, steppes, shrublands and abandoned agricultural fields) and found that, according to stakeholders, the pine forests enhanced the aesthetic value of the landscape.

Aesthetic perceptions are not only comparable between different landscape units, but also to landscape change over time. Human activity (forestry, agriculture, grazing, urban development) or inactivity (e.g. farmland abandonment), coupled with natural processes, such as forest fires and pest outbreaks, shape our familiarity and cultural affinity with certain landscapes (Holmgren and Scheffer 2017). The dynamic nature of Mediterranean landscapes leads to a dynamic character of cultural valuation of those sites. The phenomenon of how landscape flux impacts aesthetic perceptions of those landscapes differently in time and between demographic groups was described by López-Santiago et al. (2014), who compared aesthetic preferences between pine forests and agricultural landscapes among various stakeholders in Mediterranean Spain (Cuenca province).

The general picture that emerges is that Mediterranean pine forests provide the suite of CES common to many natural ecosystems, including recreational activities, rest and relaxation, activities associated to resource use (mushrooms, resin, timber, pine nuts), cultural landscapes and sense of place. The perception of their CES value is high relative to degraded landscapes, agricultural landscapes, and landscapes featuring sparser vegetation (e.g. urban areas), but low relative to other forest types and sometimes low relative to what are considered to be more "natural" landscapes. Within those generalities, there is also some diversity of opinion between different demographic groups – particularly depending on their economic attachment (or lack thereof) to the forest, their desire for recreational space, and their predispositions regarding the "naturalness" of the pine forest.

30.4 Cultural Ecosystem Services and Aesthetic Preferences in Israel's Pine Forests

Israel's pine forests, like those across the Mediterranean Basin, offer a familiar suite of CES. These include recreation, relaxation, mushroom collecting, physical activities, aesthetic landscapes, pensive activities, religious and spiritual meaning, relational values, and more (Ginsberg 2000, 2006; Naveh and Carmel 2004; Amir and Rechtman 2006; Tal 2013; Eid and Haller 2018; Negev et al. 2019). However, Israel's Mediterranean pine forests also have a tumultuous socio-ecological history.

30.4.1 The Politics and Ecology of Israel's Pine Forests

Pine forests are considered politically contentious in Israel because the story of forestry is tightly intertwined with the history and mythology of nation building. Until the beginning of the twentieth century, pine stands were reportedly rare in the region (Liphschitz and Biger 2001). Though not without its ecological and political critics, for the past century tree planting – particularly pine planting – has been considered a national mission (Amir and Rechtman 2006). One of Israel's most senior forestry experts, Dr. Gabriel Schiller, in the introduction to his self-published tome about afforestation, suggests that the history of forestry in Israel is analogous to the process of nation building itself. Range ecologist Prof. Avi Perevolotsky, who was chief scientist of Israel's Nature and Parks Authority, concurred with this view, writing in his introduction to Schiller's book "The act of forestry in Israel is not fundamentally different from the other aspects related to founding the state." (Schiller 2012). Thus, one's predisposition to the country in general may inform, or correlate with, one's predisposition to its forests (compare, for example, the narratives of Tal 2013 and Braverman 2009, for starkly contrasting views regarding afforestation in Israel).

The ecological debate focuses on the "naturalness" of the planted pine forests and their implications for biodiversity, ES, and ecosystem integrity. Critics suggest that the selected species, mostly pines, are not only foreign to the Israeli landscape, but that their presence is ecologically harmful (see Rotem et al. 2014 and Rothschild 2019 for a critical perspective, and Tal 2013 for an overview of the ecological critique). Recalling that CES are the product of the dynamic interaction between human society and the natural environment within socio-ecological systems, the relevance of these underlying ecological and political debates becomes evident. Political and ecological perspectives and values can, in fact, have a profound influence on perceptions of CES from Israel's pine forests.

30.4.2 Socio-ecological Dynamics and Israel's Pine Forests

The socio-ecological development of the landscape as co-produced by human and natural forces was well conceptualized in the context of Israel's Mediterranean ecosystem in the oeuvre of Professor Zeev Naveh and his colleagues (Naveh and Lieberman 1994; Naveh and Carmel 2004). Israelis often construct their individual, group, and national identities based on the aesthetic landscape of the country – real or imagined (Ben-David 1997; Naveh and Carmel 2004; Eid and Haller 2018). The dynamic nature of this interaction emphasizes the two aspects of change introduced previously, namely ecological and demographic, and their feedbacks (Fig. 30.1). Natural and human-driven processes, such as tree planting, agriculture, grazing, urbanization, and fire, change the landscape over time. These changes can affect the aesthetic value of the landscape (Misgav and Amir 2001; Tal 2013) – for better or for worse, depending on the beholder.

Concurrent with ecological changes, values also change over time, including those regarding the human–nature relationship. Such changes in modern Israel include, for example, a shift from the dominant desire for human control over nature, to an ideology of protection of nature, to a desire to co-exist with nature (Arieli 1997; Schwartz 2009; Orenstein and Silverman 2012; Tal 2013). These changes in value systems may also impact perspectives regarding the perceptions and valuation of CES of pine forests and how management agencies and the public at large assess the aesthetic landscape. Forest fire can impact relational values with the pine forest both positively and negatively (Fig. 30.2). Increasing exposure to fire risk can weaken one's identity with the forest (Depietri and Orenstein 2019), but citizen responses to forest fires in Israel's Carmel Forest in the past reflected an affirmation of stakeholders' identity with the forest, which has been measured by assessing donations to post-fire recovery programs (Shechter et al. 1998).

Fig. 30.2 Spontaneous regeneration of pines in the Carmel Forest following the 2010 fire; in focus group discussions, respondents appreciated the view, and few noted which trees were growing in the foreground. One ecologist appreciated the appearance of life after the fire, "despite the fact that they are pine trees". (Photo credit: Haim Zinger)

30.4.3 Landscape Perceptions and Aesthetic Preferences in Israel's Pine Forests

Research suggests that there is a broad consensus regarding the high aesthetic value of Mediterranean (and other natural) landscapes in Israel, though the preferred characteristics of this landscape can change over time and between groups. Of all of the various aspects of the natural environment, research has shown that landscape (Negev et al. 2019 for the mixed-pine Carmel Forest), scenery (Koniak et al. 2011 for Mediterranean landscapes) and landscape viewpoints (Becker and Choresh 2007 for pine forests), all synonymous with one another, are the most highly valued characteristic of open spaces. According to Becker and Choresh (2007), who applied a travel cost model to visitations in Biriya Forest, recreational visits to the forest (valued at 331 NIS per visit) were most positively affected by landscape view, followed by access to picnic facilities, walking paths, and access for automobiles. In their analysis of approximately 27,000 geotagged photos of landscapes in Israel uploaded to a photo sharing service over an 11-year time period, Lotan et al. (2018) found that planted (primarily pine) forests in close proximity to urban areas were one of two of the most commonly photographed natural environments in Israel.

Researchers of Israeli landscape preferences also focus on the differences in landscape aesthetic preferences among demographic groups, as will be discussed in the following sections.

30.4.4 Vegetation Composition and Structure Contributing to the Most Preferred Aesthetic Landscapes

Israel's Mediterranean landscapes are a patchwork of vegetative compositions and structures. They are a rich mosaic of maquis (*horesh*) and garrigue, combined with orchards, field crops, planted forests (Naveh and Carmel 2004), and, increasingly, urban development. In addition, the landscapes are grazed at various intensities by cattle, sheep, and goats. So, although planted forests are treated in this book as a unique ecosystem, from the perspective of the Israeli public, particularly when assessing landscape preferences, boundaries between landscape types are not so clearly delineated or they are perceived as a mosaic of landscapes (Fig. 30.3). As shown in Spain (Martínez-Sastre et al. 2017) and Greece (Lorilla et al. 2018), public aesthetic preferences may lean towards a mosaic of landscape types, including pine forests, rather than a single land-cover type.

Israel's Mediterranean forested ecosystems provide aesthetic benefits for Israelis and tourists alike (Ginsberg 2000; Amir and Rechtman 2006; Tal 2013; Negev et al. 2019). This aesthetic benefit co-occurs with other benefits and is valued in multiple ways, including health (vegetated landscapes promote health), economic (residences with green views are more highly valued than without; visitors are willing to

Fig. 30.3 A landscape mosaic at the southern edge of the Mediterranean zone in Israel, including olive groves and planted pine forests. (Photo credit: Daniel Orenstein)

pay for landscape and recreation), and social benefits (vegetated landscapes provide the backdrop for social gatherings) (Orenstein et al. 2015).

Vegetative composition and structure may impact the aesthetic value of Mediterranean landscapes in Israel. Misgav (2000) studied public aesthetic preferences for particular vegetation structure and composition, asking whether the public could distinguish between vegetation groups, and according to what physical properties. She identified 44 different vegetation compositions, which varied according to dominant species and general structure (e.g., forest, maquis, garrigue or scrub) and queried respondents regarding their aesthetic preferences. The most preferred landscapes were cultured landscapes, including planted and managed forests and olive groves, while scrub and garrigue were least preferred, giving a feeling of exposure, on the one hand, and blocking the field of vision, on the other.

Koniak et al. (2011), received quite different responses in their survey of landscape preferences in the Ramat HaNadiv nature park on Israel's northern Mediterranean coast. They surveyed hikers and picnickers in the park regarding their preferences for different landscapes, including garrigue, forested and dense shrub, and came to distinctly different conclusions. They found that hikers preferred, from most to least, open garrigue, dense shrub, and pine forest, concluding that hikers preferred "natural" landscapes. For picnickers, on the other hand, garrigue and pine forests were most highly preferred, while dense shrub was less preferred (Koniak et al. 2011). Among the most positively assessed elements of the landscape, scenery, flowers, native trees, and deer/gazelle were the most highly valued landscape features, while reptiles, insects and cattle were the lowest valued (although still positive). Using photographs and a paycard method, Divinski et al. (2018) concluded that planted pine forests were the least valued landscape according

to respondents queried while riding a commuter train, who preferred woodland landscapes, followed by garrigue, grassland and only then, planted forests.

In their survey of 703 visitors and residents of the Carmel Forest, Raviv et al. (2020) reported that 89% of their respondents liked or very much liked maquis landscapes and 45% reported visiting them more frequently than any other local landscapes. The percentage of respondents liking or very much liking the pine forests was 70%, but only 12% reported that they visited pine forests more frequently than any other landscape. However (as reported by Itzhaki pers. comm.), when respondents specified the locations they visited, the top five places visited were either pine or mixed-pine forest areas. This might suggest that while the *idea* of pine forests is viewed somewhat with disfavor, in practice, pine forests remain the most popular areas for recreational visits either due to revealed (actual) preferences or due to the presence of recreational infrastructures within and around the pine forests (Raviv et al. 2020).

Zimroni et al. (2017), in their study of landscape aesthetic preferences, in which 70+ diverse stakeholders were queried in a focus-group setting about 16 different landscapes in the Carmel Forest (natural and built environments; pine forested and "natural" landscapes), which were projected on a high-definition large screen in a visualization theater. They documented contradicting opinions regarding aesthetic preferences. Results suggested that planted forests and olive orchards were highly valued aesthetically by most, though not all, respondents (Orenstein et al. 2015; Zimroni et al. 2017; Eizenberg et al. 2018). Some respondents, primarily ecologists and environmentalists who perceived the pine as a "foreign" or "invasive" plant, responded negatively to the presence of pine trees in the landscape. Upon identifying pine species in the landscape photographs, these respondents expressed their disdain for the landscape or the trees themselves, or expressed their approval, as one ecologist did, "despite the presence of pine trees".

Another major point of debate in the study by Zimroni et al. (2017) related to evidence of human presence in the landscape, such as roads, picnic tables, residential neighborhoods, or garbage bins. Here, too, ecologists and respondents associated to environmental organizations had a strong, negative opinion regarding such elements and their aesthetic impact. Many other respondents, on the other hand, saw these elements as positive, as they facilitate easy access to nature and a clean and orderly environment. In a survey of visitors at Biriya Forest, respondents were asked to choose their most and least favored landscapes between 16 different pine forest scenes. In some scenes, the forest floor was covered with woody debris that had fallen from the trees in a snowstorm, while the others were cleaned of debris. Results indicated that respondents (primarily picnickers in the forest) preferred a defined set of physical parameters, including green, orderly, and shady nature (Orenstein et al. 2018), echoing the findings of Misgav and Amir (2000, 2001).

30.4.5 Cultural Ecosystem Services in Israel's Pine Forests – Conflict and Compromise

The pine forests of Israel provide crucial CES for diverse populations. While they are criticized on ecological and political grounds, they also serve a much-needed function of providing recreational space, aesthetic landscapes, and spaces for reflection, meditation, research, and sporting activities. But, as we have shown here for the entire Mediterranean Basin, the type and value of CES provided by these forests are a subjective matter, depending on when and where they are being assessed and by and for whom. The value of CES, as we have seen with aesthetic preference, is a relative concept – depending on what other landscape options exist. In a country with rapidly depleting open spaces and a growing population, open spaces are increasingly in demand (Tal 2008). Pine forests are currently one of the major providers of CES in Israel. This has been supported in a number of studies using a variety of methodological tools, although it is also somewhat intuitive, considering the high demand for such landscapes for recreational and other intangible benefits (Tal 2008, 2013).

Where there is less consensus regarding the best vegetation constitution and structure of these landscapes, there remains a diversity of opinion regarding whether pine forests are the best alternative for providing CES. Factors affecting CES perceptions include the recreational goals of the respondent (Koniak et al. 2011; Negev et al. 2019), gender (Negev et al. 2019), type and level of formal education (Eizenberg et al. 2018; Negev et al. 2019), income (Becker and Choresh 2007), and/or ethnicity (Zimroni et al. 2017; Negev et al. 2019).

Misgav and Amir (2001) pointed out the potential conflict between the aesthetic value of cultured landscapes and the ecological value of restored "natural" landscapes, and recommended that land use managers take into account both objectives when designing landscapes and designate spatially explicit areas where cultural (aesthetic) value should be considered. Orenstein et al. (2018) made a similar recommendation, advocating a zoning approach to public space management, where high visitation pine forests are managed to facilitate intensive use, while pine planting and regeneration is discouraged in less visited areas or those that are more ecologically sensitive. These recommendations are commensurate with the new management doctrine adopted by Israel's forest service (Osem et al. 2012).

30.5 In Conclusion: A Holistic Assessment of CES in Mediterranean Pine Forests

Mediterranean pine forests provide a rich set of CES to contemporary societies across the Mediterranean Basin. But assessments of CES must be appraised with nuance and context because they will change from community to community, over time, and relative to what they are being compared. Two crucial management

questions resulting from this review are (1) what is the basket of CES being provided by pine forests in specific places and for specific beneficiaries? and (2) is this the best way to provide these services with the least amount of negative ecological impacts?

While perceptions of Mediterranean pine forest CES depend largely on the landscape to which it is being compared and who is being asked, there are also some consistent themes that emerge from this review, including:

1. Mediterranean pine forests invoke relational values and a strong sense of place among some sectors of the societies who inhabit and utilize them.
2. Mediterranean pine forests provide large populations of stakeholders with recreational services, which are becoming increasingly important with the loss of open spaces near urban centers.
3. Mediterranean pine forests are green and productive – two qualities that rank highly in landscape preference surveys.
4. Many respondents across countries prefer trees with wide canopies and not densely distributed, which allow for both shade and a wide field of view. Only some *Pinus* species have wide canopies.

30.5.1 Changing Perceptions with Changing Climate

We conclude with a crucial third management question: (3) how will the provision of these CES be affected by climate change and other environmental changes in the Mediterranean Basin? The convergence of global and regional environmental challenges, from climate change to urbanization and population growth to biodiversity loss will negatively impact the provision of CES from Mediterranean pine forests. Studies suggest that the region will be increasingly drier (IPCC 2014), leading to a greater frequency and extent of forest fires (Piñol et al. 1998), desertification (IPCC 2014; Peñuelas et al. 2017), and loss of regulating services, including water and soil retention (Anaya-Romero et al. 2016). All of these will further degrade the provision of CES, including touristic and recreational value (Peñuelas et al. 2017), aesthetics, and relational values. Greater fire risk brings greater demand to mitigate the risk through forestry practices, including thinning pine stands (Depietri and Orenstein 2019), which, in the proximity of human settlement, may reduce the CES that the trees provide, or increase the demand for domestic grazing, which has been shown to reinvigorate relational values in pine forests (Eid and Haller 2018). Under conditions of predicted environmental change, some continue to recommend pine species as tools to counteract the impacts of desertification (Peñuelas et al. 2017), while others suggest that the continued use of pines for afforestation increases vulnerability to drought and fire (Jucker Riva et al. 2018; Depietri and Orenstein 2019). Somewhat ironically, nature may soon make our landscape management decision for us: climate trends may lead to a reduction in the cover of pine and mixed pine-oak forests and to greater dominance of oaks (Peñuelas et al. 2017). Whether oak

forests, or whatever eventually replaces them, will provide CES equivalent to those provided by pines is a question for future researchers.

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