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**From pork to fork: the social experience of bundles of interacting ecosystem services through gastronomy**

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**Highlights**

- Gastronomy is described as bundles of services with synergies and trade-offs;
- Examples are provided to illustrate the co-production of bundles in gastronomy;
- Gastronomy offers an opportunity for an integrated valuation of bundles of services;
- This perspective can support decision-making and the management of natural capital.

**Abstract**

There is an increasing recognition that ecosystem services are inclusive and form bundles of services that deliver multiple contributions to people. Traditionally, the notion of bundles of services is grounded on biophysical assessments and less attention has been paid to the perspective of human experience and valuation of these bundles. Information about the benefits and values of bundles of services is relevant as it provides a common language to decision-makers and general society. In this perspective, we describe gastronomy as bundles of provisioning (e.g. food, energy, water) and cultural (e.g. recreation, aesthetics, inspiration, spiritual fulfilment) services. We discuss how gastronomy, as the co-production of bundles of services, can be enclosed by both the ecosystem and the human system. Examples are provided to illustrate the place-based values and particularities of the individual, communal and society values of gastronomy. We briefly present how gastronomy constitutes an opportunity for an integrated valuation of bundles of services, based on the plurality of gastronomic preferences and attitudes at the individual, social group and society levels. Finally, we highlight that deliberative processes may enable the social learning of shared values, which are useful for the valuation of ecosystem services and for making decisions on natural capital.

**Keywords**

Cuisine; cultural benefit; drinks; food; recreation; social value.

## Main text

Much has been learned from the utilitarian framing of nature that contributes to human well-being. It has been increasingly accepted that ecosystem services form bundles of services that co-occur in space and time and that deliver a plurality of benefits and values. However, most research in this field focuses on the biophysical side of ecosystem services' co-productions (see Cord et al., 2017 for a review). Less attention has been paid to bundles of ecosystem services from the perspective of human experiences and valuation (but see e.g. Daw et al., 2015; Hamann et al., 2016; Martín-López et al., 2012).

There is a growing interest in recognising inclusiveness in decision-making, and in embracing the diversity of human experiences, preferences, attitudes and values. Therefore, focus on the social side of bundles of ecosystem services can represent credible evidences for the valuation of ecosystems and their services in political agendas and decision-making. This focus could complement biophysical assessments of ecosystem services, by including social deliberations about opportunities and risks for human well-being and understanding views, conflicts and priorities when managing ecosystems (Díaz et al. 2018; Kenter et al., 2015, 2016).

Here, we present gastronomy as an opportunity to advance the discussion on the social side of bundles of ecosystem services. This perspective was inspired by the outcomes of a focus group (which included stakeholders, environmental managers, and tourism entities from governmental and non-governmental agencies) that aimed to identify and assess key ecosystem services provided in Peneda-Gerês National Park (northern Portugal). During the meeting, the participants highlighted that beyond dietary benefits (through provisioning services), food also offers cultural benefits through gastronomy (or cuisine). These cultural benefits associated to gastronomy have already been mentioned in other participatory approaches (Barau and Stringer, 2015; Kenter et al., 2011; Lopes and Videira, 2017; Palomo et al. 2013), although without detail. Also, the plurality of cultural contributions from food has been discussed in other disciplines, such as anthropology or tourism (Cohen and Avieli, 2004; Barthes, 2013; Gunkel, 2016). However, cultural aspects of gastronomy from an ecosystem services' perspective have received little attention.

Food and drinks are indeed important to sustain well-being, constituting the basis for human nutrition and sustenance. Nevertheless, food also brings cultural contributions, namely to social relations, living standards, leisure time, connection to nature, spiritual and cultural fulfilment (Fish et al., 2016). Gastronomy, as the art of choosing, cooking, and eating food can be seen as the umbrella term for the co-production of human-nature activities that allow at perceiving and experiencing the provisioning and cultural contributions from food. For instance, throughout human history, gastronomy has been used as a system of communication through which individuals, communities and societies interact with each other, express identities from genders or ethnicity and reveal different perspectives on festivity or heritage (Barthes, 2013). Even in modern space programmes, space food (or cosmic cuisine) is recognised as a way to show cultural identity and facilitate intercultural communication (NASA, 2013). Gastronomy also provides multisensorial moods and actions, provoking feelings and emotions in individuals, which change in time and are generally attached to particular places and regions (Gunkel, 2016).

Considering the classic model of the ecosystem services' cascade (Haines-Young and Potschin, 2009), bundles of ecosystem services and respective synergies and trade-offs in gastronomy are influenced by the ecosystem and the human system (Figure 1). On the ecosystem side, bundles depend on the biophysical space (including biodiversity and landscapes) to generate the matter and energy needed for food, water and heat provision. They further depend on the non-material information that ecosystems and landscapes produce, e.g. related to colours, smells or taste of food (Plieninger and Bieling, 2012). It is, however, on the human system that the provisioning services (food, water or heat) are physically collected and moulded through cooking. It is also on the human system that cultural services are mentally shaped during “the art” of cooking (e.g. inspiration through cooking and aesthetics through plating) and eating (e.g. spiritual fulfilment through religious compliance or entertainment through taste enjoyment; Braat, 2014).

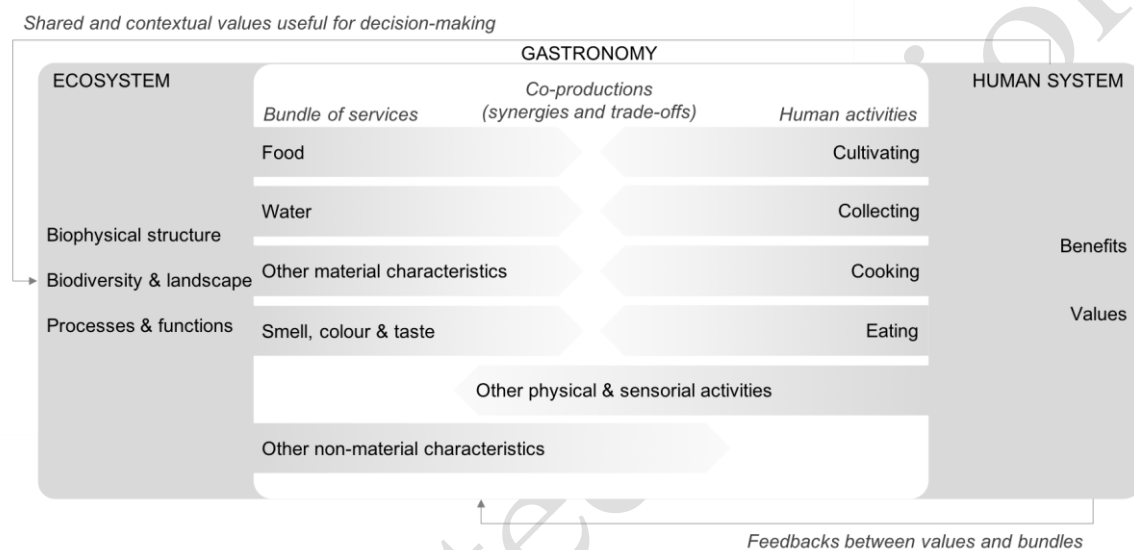


Figure 1. A simplified representation of bundles of ecosystem services inherent to gastronomy, grounded on the ecosystem services' cascade model (inspired by Haines-Young and Potschin, 2009).

The particularities of both the ecosystem and the human system generate different combinations of bundles, with synergies and trade-offs among ecosystem services in space and time (Cord et al., 2017), enabling the co-production of contributions from gastronomy. In this context, gastronomic bundles seem to be more evident in transcultural (e.g. Southeast Asia; Barau and Stringer, 2015) or biodiversity-rich landscapes (e.g. Mediterranean Basin; Lopes and Videira, 2017; Palomo et al., 2013). Examples that are most familiar to us include the underground stews cooked using volcanic heat, in Azores (Figure 2); the specialities of the Barrosã beef, venison and boar in northern Portugal; the wine experiences in the South of France; or the appreciation of the regional variations of sausages and pork products in Spain.

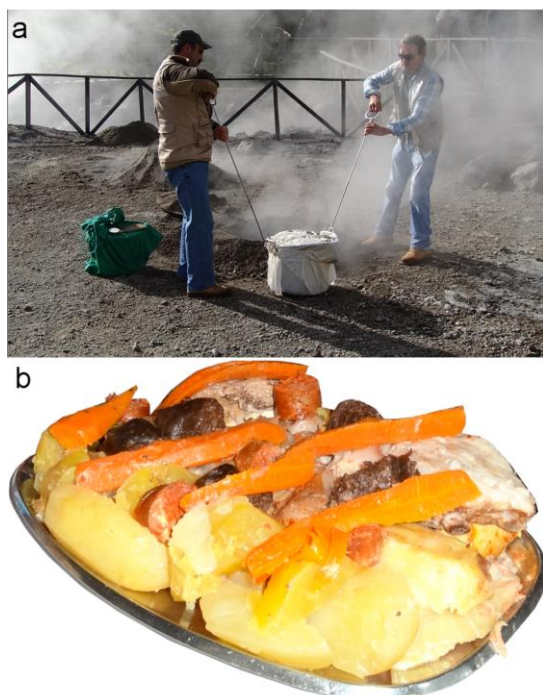


Figure 2. The underground stews cooked using volcanic heat in São Miguel island, Azores (Portugal): cooking ritual (human-ecosystem co-productions) (a) and gastronomic result (the dish: “cozido das Furnas”) after five hours (b).

These examples illustrate how the relation between biophysical spaces (or service providing units) and cultural practices, in certain social-ecological contexts, may lead to particular livelihoods, sense of place, aesthetics and social relations (Kenter et al., 2015). For instance, the dish “cozido das Furnas” is co-produced by the volcanic heat from São Miguel island (biophysical space), following a traditional rite (cultural practice), translating a unique social-ecological contribution to people (e.g. sense of place and recreation; Figure 2). Therefore, many people tend to visit certain regions for their gastronomy (“gastronomic tourism”; Hall and Mitchell, 2005). Yet, the worth of gastronomy goes beyond its touristic value (Barthes, 2013; Gunkel, 2016).

The emergence of religious food laws (e.g. Hindu, Islamic or Jewish) and other dietary practices (e.g. vegetarianism or veganism) contributes to identity formation across (groups of) individuals, communities and societies. However, in some cases it might raise issues related to social stigmatisation, since religious or social-economic backgrounds may limit or favour the access to certain types of food (Barthes, 2013). Providing information about the beneficial or detrimental contributions from nature in a common language to policymakers, researchers and general society is perhaps the most relevant opportunity in ecosystem services for designing sustainable options (following TEEB (*The Economics of Ecosystems and Biodiversity*) or IPBES (*Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*) goals; Díaz et al., 2018).

Since most human decisions are made considering self- and other-regarding desirable ends (in the causal chain of value production), an integrated valuation (monetary or not), could be useful for stakeholders and decision-makers (Braat, 2014; Kenter et al., 2015). Gastronomy, therefore, offers an opportunity for an integrated valuation of bundles of ecosystem services based on the preferences of consumers at the individual, social group and society level. These social preferences can support decision-makers in their management options towards food resources. For instance, the gastronomic demand for Barrosã beef in northern Portugal has implications for subsidy attribution to local producers by mainstream decision-makers.

Nevertheless, gastronomy is bounded by the plurality of values assigned by individuals, based on their personal experiences and preferences (e.g. self-comfort or personal taste enjoyment of food). Thus, a deliberative value process, such as the one proposed by Kenter et al. (2016), could help in identifying shared values regarding the bundles of gastronomic services, by decoding transcendental (such as social bonding or spiritual enrichment) into contextual (e.g. improved social bonding or spiritual enrichment through food) values. Accordingly, focus on human-nature co-productions through bundles of services, such as the one here discussed for gastronomy, could enable more effective social learning on the valuation and management of natural capital.

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