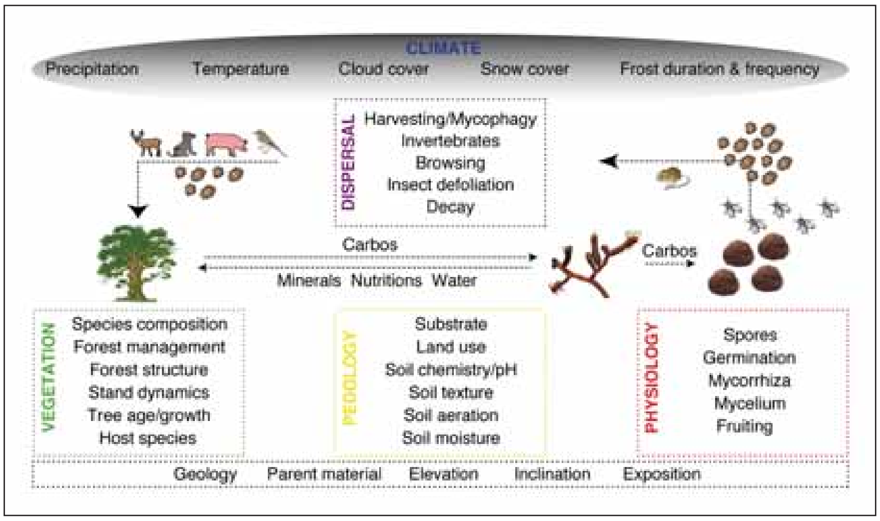

Figure 2. *Holistic perspective of the numerous, interrelated biotic and abiotic factors that drive truffle productivity and phenology.*

fle findings as far north as Gotland (a Baltic island off the southeast Swedish coast) further suggest a close link to environmental change (Wedén *et al.* 2005). Assessment of high-resolution climatic data (Mitchel and Jones 2005) revealed spatial differences of ~0.5˚C between mean temperatures in Burgundy and our study site, which corresponded with temporal changes in mean temperatures observed in Europe between the early and late 20th century. An average warming trend of 0.5˚C per century, depending on seasonal, regional, and methodological constraints, would translate in an isothermal upward (northward) shift of ~100 m (~110 km). Various model simulations forecast a substantially warmer 21st century (Fischer and Schär 2009), which would likely continue to alter the geographical, ecological, and physiological range of mycorrhizal fungi and their host plants.

Projected environmental changes across the Mediterranean truffle foci – where future temperature and precipitation rates are expected to rapidly increase and decrease, respectively (Giorgi 2006) – will be critical for truffle species with limited dispersal capabilities, such as *T melanosporum* or *T magnatum*. Likewise, declining harvests will boost the economic value of truffles. Understanding different ecosystem responses to projected climate change (ie with opposing signals south and north of the Alps), as well as the complex interplay of biotic and abiotic factors (Figure 2), is thus of enormous scientific, economic, and gastronomic importance (Hall *et al.* 2003; Trappe and Claridge 2010).

Our findings encourage rethinking the distribution and dynamics of European truffle populations, provide insight into the dark world of hypogeous fungi, and appear relevant to truffle cultivation efforts. Formerly time-consuming, expensive, and with little guarantee of success, truffle plantations may become more promising for *T aestivum* and even feasible for *T melanosporum* in a warmer climate north of the Alps.

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Plastic: matching material with usage

We are in the midst of a global plastic pollution crisis. Plastic consumption has doubled over the past three decades (Thompson *et al.* 2009) and, as a result, large areas of our terrestrial and aquatic environments are now overrun with discarded plastic. Although plastic pollution in the environment is an issue that must be addressed, the substance plays an integral role in human lives and technology. For example, in automobiles, plastic replaces metal parts to increase fuel efficiency by decreasing weight (see www.bpf.co.uk). Thus, a total ban on plastic would be impractical. How, then, should we try to curb global plastic consumption? A sensible way to alleviate consumption would be to identify those products for which its usage is unnecessary.

It is now a common practice to use millennia-lasting plastics for everyday items, such as bags or disposable

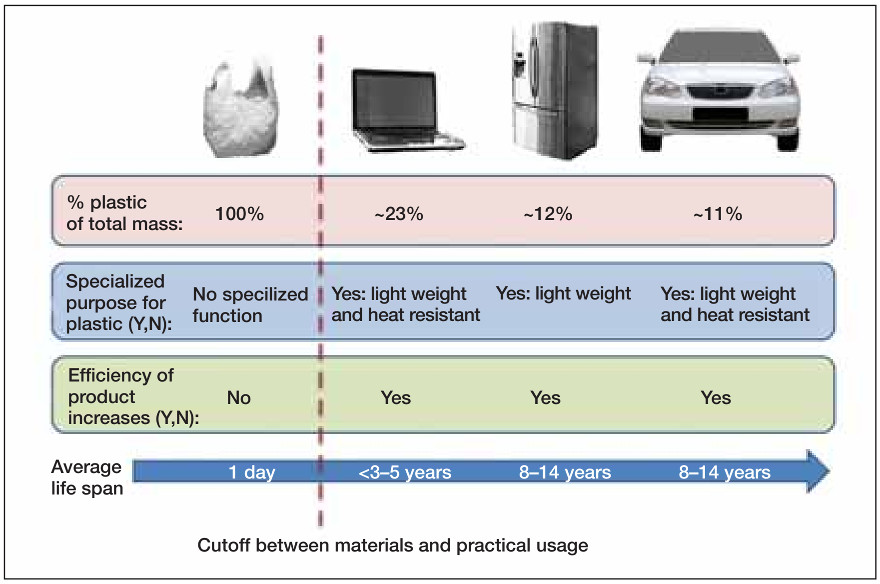

Figure 1. *The global plastic pollution crisis is largely caused by overusing dispensable plastics. Overuse of dispensable plastics is primarily caused by mismatching materials with usage. Paradoxically, items with the highest plastic content for no specific usage (ie to the left of dashed threshold line) have the shortest life span. This paradigm must be reversed if plastic pollution is expected to be reduced. All values were calculated or derived from the following sources: http://repair2000.com/lifespan.html, www.eoearth.org/article/Computer_recycling, www.epa.gov/ozone/title6/608/disposal/household.html, www.bpf.co.uk/Innovation/Automotive.aspx.*

drinking cups. Approximately 7–8% of the world's petroleum and natural gas resources are used for plastic production; over one-third of these plastics are for short-term usage and are discarded within a year of being manufactured (Hopewell *et al.* 2009). However, if used sustainably, the plastic used would serve a specialized function, such as heat-resistance or weight efficiency, and the total percentage of plastic would reflect the life span of the product. For example, most dispensable items (eg bags) consist entirely of plastic, whereas items with longer life spans tend to use less plastic (eg an automobile consists of approximately 11% plastic and lasts on average 8–14 years; Figure 1). Hence, it is sensible to set a threshold, where all dispensable products with a short life span and high plastic content by mass are targeted for reduction.

Reduction mechanisms, such as taxes on plastic bag use and promotion of reusable cloth bags, are now more common in developed countries such as Singapore, Germany, and Australia. While these initiatives deserve praise, more drastic measures are likely needed to substantially curb plastic consumption. Gradual reduction measures that eventually lead to complete bans on the production and distribution of dispensable items with high plastic content and no specialized functions are needed, particularly by nations with high plastic consumption such as the US, China, and Canada. Support of biodegradable materials (eg chitin packaging) by developed nations will promote more inexpensive non-plastic alternatives, which can then be adopted by developing countries. Immediate regulations on dispensable plastics that promote their replacement with environmentally responsible materials are a pressing issue to curb gratuitous plastic pollution.

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Does habitat heterogeneity increase farmland biodiversity?

Promoting landscape-scale habitat heterogeneity – for instance, by enhancing diversity of cover types – has been suggested as a method to enhance farmland biodiversity (Benton *et al.* 2003). Here, we caution against generalizing the potential biodiversity benefits of this approach. We argue that the type and history of agricultural land use must be considered, because introducing habitat heterogeneity can be harmful for specialist (often endangered) species in low-intensity agricultural landscapes.

High-intensity, long-established agricultural landscapes are characterized by substantial inputs of fertilizers and pesticides. Typically, their biodiversity value has declined sharply since 20th-century agricultural intensification. In such landscapes, increasing habitat heterogeneity will indeed typically benefit farmland and landscape-wide biodiversity, especially if historical landscape elements are reinstated (eg hedgerows; Benton *et al.* 2003). For example, in intensive cropland landscapes of the midwestern US, long-term regional declines of songbirds associated with agricultural intensification were partly ameliorated by the re-establishment of semi-natural grasslands (Veech 2006).

In contrast, the role of heterogeneity should be viewed differently in low-intensity agricultural landscapes, such as calcareous grasslands in Western Europe (Steffan-Dewenter and Tscharntke 2002) or extensively managed grasslands in Central Europe (Batáry *et al.* 2007). Landscapes supporting such tradi-