EVALUATING ENVIRONMENTAL, ECOLOGICAL, AESTHETIC AND ECONOMIC FUNCTIONS OF GARDENS IN SUBURBAN AREAS

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ABSTRACT

Nowadays in Greece, as in many other countries, gardens are increasingly significant in suburban areas, as suburbanization spreads and dwellings with gardens seem to be an integral part of this urban sprawl. The garden scale may be small in size compared to other semi-natural land uses or un-built environments, but the extensive spread of gardens in suburban areas has important impacts on them and modifies the space functions. This paper aims to propose an integrated method of evaluating environmental, ecological and economic functions of gardens in suburban areas. Through a literature review, these functions are defined and are compared to functions of former land uses (i.e. before the construction of gardens). Findings suggest that the use of an integrated method in which aesthetic, ecological, economic and environmental functions of gardens are included is necessary.

Keywords: multifunctionality, environmental and ecological functions of gardens, integrated method, suburban areas.

1. Introduction

World-wide, a strong trend of urbanization is observed (UNFPA, 2006; UNDP, 2000 et al.), not always connected with population growth (Robinson et al., 2005). This development can be rapid and results in the fragmentation of landscapes, threatening the agricultural landscape (Saunders *et al*.; 1991; Alston, 2006; Armstrong, 2004), causing land cover and land use changes (Marzluff and Ewing, 2001), that can be irreversible (McKinney, 2006), and creating "urbanized villages", the so called suburbs (Anastasakis, 2005; Alston and Richardson, 2006). This "blurring" of this distinction between the city and the countryside, seems to place greater and more intensive effect to the latter (Grafe &Speaks, 2000).

The continuation of this process requires more and more land—including areas which are environmentally valuable—to be converted into housing sites (Misiak 1994). Residential development at the rural fringe steadily attracts new homeowners (Kaplan and Austin, 2004). The main causes of this land consumption are the outward movement of the population from central cities to suburban areas due to; rising income; falling commuting time and cost and dependence on extensive automobile use (Interlandi and Crockett 2003; Robinson *et al*,. 2005; Wilson 2003, Wasilewski and Krukowski, 2004). People move out to the suburbs, as they seek low –density residential areas, freedom of choice and expression and access to nearby natural areas (Schroeder, 1988; Kaplan and Kaplan, 1989; Frumkin, 2001; Kaplan and Austin, 2004; McKinney, 2006). The lack of green-spaces in inner cities (Beer *et al.,* 2003), creates a need for attractive, green settings and favourable location (Luttik, 2000), as idealised with a house with a garden. These settings are important for the quality of life, offer recreation, mental and physical health and enjoyment of the natural environment (Kaplan, 1984, Armstrong, 2000; Beer *et al*., 2003; Syme *et al*., 2004). The garden scale, may be small in size compared to other semi-natural land uses or un-built environments, but the extensive spread of gardens in suburban areas has important impacts as it modifies the functions of space. This paper aims to evaluate, aesthetic, ecological, environmental and economic functions of gardens in suburban areas, through a literature review.

2. Multifunctionality of agricultural landscapes

One of the significant features of urban sprawl is that it converts forestland, agriculture land and wetlands into developed areas such as residential, commercial, industrial, and transportation uses (Robinson *et al*., 2005). In this paper we choose to examine the conversion of agricultural land use to low-density residences with private gardens and the alteration to their functions, as in suburban areas the 'countryside greenspace' is replaced by 'gardens greenspace'.

Many studies bear out that urbanization have led to a loss of agricultural landscapes (Saunders *et al*., 1991; Alston, 2006; Armstrong, 2004; Wasilewski and Krukowski, 2004). The agricultural landscape can be understood as a complex of ecological, economic, and cultural qualities on which human and other life forms depend (Wasilewski and Krukowski, 2004). There is a sizable literature that documents this multifunctionality of agriculture and its landscapes. Several authors have explored the production relationships between commodity and green outputs (Gatto and Merlo, 1999; Romstad et al., 2000) and have discussed and evaluated agriculture's productive and non-productive functions (OECD, 2001;).

The Ministerial Communiqué (OECD, 1998*a*) recognises that agriculture's primary function is supplying food and fibre, but can also shape the landscape, provide environmental benefits such as land conservation, the sustainable management of renewable natural resources and the preservation of biodiversity, and contribute to the socio-economic viability of many rural areas. The key elements of multifunctionality are: *i)* the existence of multiple commodity and non-commodity outputs that are jointly produced by agriculture; and *ii)* the fact that some of the non-commodity outputs exhibit the characteristics of externalities or public goods, with the result that markets for these goods do not exist or function poorly (OECD, 2001, p 7). This plurality of outputs is an admitted fact in European agriculture (Brunstad et al., 2001) and the notion of multifunctionality is used in close relation with sustainable development or rural development (Kroger and Knickel, 2005).

In this context, agriculture is less put into the context of the production of food as commodity outputs that we are used to pay for in the past (classical agricultural products), but rather into the context of resources and biodiversity protection, leisure and open space (non-commodity outputs and functions) which fulfil additional private or societal needs related to the use of land and landscapes (Wiggering et al., 2006; Barkmann et al., 2004). Therefore, agricultural landscapes can offer apart from "conventional" food and fibre products: environmental amenities; opportunities for recreation and tourism; local identity; "natural" and organic food and fiber products; food safety and security; conservation of traditional management practices and cultural landscape heritage (Randall, 2007; Madureira, 2007; Slee, 2007).

Therefore, the multifunctionality of a landscape denotes the phenomenon that it actually or potentially provides multiple material and immaterial goods that satisfy societal needs or meet societal demands by its state, structure or processes (Barkmann et al., 2004). This is not something particularly or exclusively limited to agricultural landscapes only, but, as Guiomar and Fermandes (2007) point out, multifunctionality consists in the integration of different functions in a given spatial and/or temporal unit at a given scale. So, we can consider gardens as multifunctional landscapes.

3. Multifunctionality of gardenscapes

Today research on topics that concern gardens are divided in two large and well discernible approaches: the first, approaches gardens from the perspective of ecology and the second from the perspective of landscape architecture. Moreover, a holistic and integrated view of gardens in suburban areas is absent from the literature, as most studies tend to ignore environmental functions of gardens and deal mostly with gardens in urban areas. Historically, most studies concerning gardens referred to their aesthetic functions. In the last decades, there is a growing concern for the ecological functions of gardens especially in urban spaces (Breuste, 2004).

The functions of gardens in general can be aesthetic-symbolic, ecological, environmental and economic: (a) gardens are made to decorate and enhance the space around the house and they are important for a variety of quality of life variables such as avoidance of stress, recreation and personal and social identity, (symbolic functions); (b) gardens consist a natural or semi-natural habitat for a variety of flora and fauna species (ecological functions); (c) owners can use the whole or a part of their garden, for producing food for sale or for home consumption (economic functions); and (d) gardens also have environmental functions, conserving resources and creating microclimates.

Landscape architects, who traditionally design outdoor spaces incorporating plant materials, have developed their own design theories as to the aesthetic and psychological benefits provided by plants (Thayer and Atwood, 1978; Tsalikidis 1999). Many published works of landscape architects and urban designers such as Garret Eckbo (1950), Robert Zion (1968), Kevin Lynch (1971), and Gary Robinette (1972) attempted to define theories of human response to plants. Plants are used in an open space either for their aesthetic- visual characteristics in a *presentational* level such as: form, flowering effect, colour, texture, complexity, and other qualities or / and in a *referential* or *representational* level on which plants are perceived in terms of recognized function, symbolic associations, or other "attachable" meanings (direction, screening, shade, wall covering, barrier, fruit benefiting, wind or sound protection) (Acar, 2007; Tsalikidis, 1999; Kantartzis, 2000; Thayer and Atwood, 1978; Zagorski et al., 2004). Plants can increase pleasure by *adding, subtracting,* or *interacting* with other landscape elements, and they may accomplish this by altering either the *presentational* or *referential* characteristics of the stimulus field or, more likely, both (Thayer and Atwood, 1978). Kaplan *et al.* (1972), Thayer and Atwood (1978), Wohlwill (1968) found that environments with plants are rated as more pleasurable than similar urban or built landscapes without plants.. Plants can also play positive role on human psychology (Thayer and Atwood, 1978; Kaplan and Kaplan, 1990) and benefit physical or mental health (Kaplan, 2001; Costanza et al., 1997). There is also indication that knowledge of the availability of nature plays an important role whether or not residents actively engage with it (Kaplan, 1984a). There are notable studies about landscape preference and perceptions of urban natural areas, desire for and benefits of having access to nearby natural areas (Kaplan and Kaplan, 1989; Frumkin, 2001; Chiesura, 2004; Ozguner and Kendle, 2006). Moreover, Blauw (1987), found out that moving out of the city in houses with suburban facilities (playing grounds, open air recreation, sporting facilities) promotes the frequency of social contacts and facilitates the social functioning of the community (Dillman and Dillman, 1987).

There is a growing body of recent research on ecological functions of gardens and parks, especially in urban areas (McHarg, 1992, Hough, 2004; Breuste, 2004; Parsons et al., 2006; Pickett et al., 2001; Snep et al., 2006). The biodiversity value of gardens is an issue of debate for many ecologists (Gaston *et al*., 2005a; Thompson et al., 2003; Thompson et al., 2004) and two main groups of researchers are encountered: the one supports that gardens contribute to biodiversity conservation in urban and suburban areas (Greater London Council, 1984; Adams and Dove, 1989; Nassauer, 1997; Mason, 2000; Cannon *et al.,* 2005; Gaston *et al.,* 2005a; Rudd *et al.,* 2002; Thompson *et al.,* 2005; Whelan *et al.,* 2006; Helfand *et al.,* 2006; Acar *et al*., 2007; Mathieu *et al*., 2007; Ozguner *et al.,* 2007), while the other considers gardens as threats to native flora and fauna (Reichard and Hamilton, 1997; Hodkinson and Thompson, 1997; Czech *et al*., 2000; Reichard and White, 2001; Baskin, 2002; Raloff, 2003; Richardson *et al*. 2003; Moffatt *et al*,. 2004; Arevalo *et al*., 2005; DeStefano *et al.,* 2005; Smith *et al*,. 2006; McKinney, 2006; Alston and Richardson, 2006; Duguay *et al,* 2007).

In more detail, the first approach to the link between gardens and biodiversity recognizes that private gardens represent the largest single proportion of greenspace in many urban areas (Gaston et al., 2005b). The yard scale, the property occupied by a single residential dwelling, is relatively small, but constitute a substantial part of the vegetated space within a city and a mosaic of environmentally beneficial gardens can contribute to ecological health (Nassauer, 1997, Mathieu et al., 2007) as it can be a valuable tool regarding detecting and monitoring urban landscape biodiversity and cultural changing (Acar *et al.,* 2007). Gardens contribute to the biological integrity of the city by enhancing the survival of wildlife (Goode and Smart,

1986), by increasing species richness, by providing sources of food and shelter for wildlife (habitats for insects, birds and small mammals) (Ozguner *et al.,* 2007) and they are considered as important refuges and food sources for indigenous species (Mathieu *et al.,* 2007). They can also act as corridors between habitats (Adams and Dove, 1989) and thus they are important contributors to a wider biological network which can enhance connectivity between vegetation communities and support the dispersion or survival of meta-populations (Drinnan, 2005, Mathieu *et al*., 2007). Within this context, many research findings indicate that the above functions are best served when native plants are used in gardens (Whelan *et al.,* 2006, Helfand *et al*., 2006; Terres, 1968; Dunnet and Stokes, 1998; Hitchmough *et al*., 2004), as native fauna is best adapted to utilize native plant communities (Batten, 1972).

In the other approach, researchers support that the floras of private gardens are among the most unusual forms of botanical assemblages (Arevalo *et al*., 2005; Smith *et al.,* 2006; Duguay *et al.,* 2007). Therefore, when compared to most naturally developing floristic communities, domestic garden floras can threaten local species (Hodkinson and Thompson 1997; Moffatt et al. 2004, Smith *et al*., 2006). such harmful effects due to non-native species are now regarded as one of the greatest threats to biological diversity worldwide (IUCN, 2000) and ornamental plants comprise more than 40% of widespread invasive plant species, far exceeding the share of plants introduced for other purposes (Reichard and White, 2001; Richardson et al., 2003; Weber, 2003; Reichard and Hamilton, 1997; Baskin, 2002; Raloff, 2003; Alston and Richardson, 2006).

This conflict was discussed in 2003 at the the 10th annual conference of The Wildlife Society, in a a symposium focused on suburban, rather than urban, landscapes (although there is often broad overlap between these two). Conclusions included that the type of development currently dominant in the western world (single-family homes with the support services [roads, power, water, sewerage] that go along with them) qualifies these areas as landscapes that mix the built environment with remnant wildlife habitats and newly created habitats such as backyards. These habitats attract or retain many wildlife species that can lead to high rates of human-wildlife conflicts, which demand large amounts of attention, time, and resources from local natural resource management agencies (Destefano *et al.,* 2005).

Concerning the environmental functions of gardens, there are two different dimensions: the first dimension refers to the use of resources for the maintenance of gardens (water, fertilisers and plant protection from diseases products). Obviously, the type of garden and the type of plants used in it, affects the amount and the type of resources used at gardens (ALSPAC Team, 2006; Bormann *et al.*, 1993; Templeton *et al.*, 1999; Helfand *et al*., 2006). One of the most important of these resources used is irrigation water, with studies reporting that as much as 56% of total domestic usage of water is used outside the house (e.g. on lawns, gardens or swimming pools) in semi-arid climates such as the Mediterranean (Loh and Coghlan, 2003). The second dimension refers to the microclimates (temperature, humidity, noise) that gardens create (Tsalikidis, 2001; Kantartzis, 1999; Morancho, 2003).

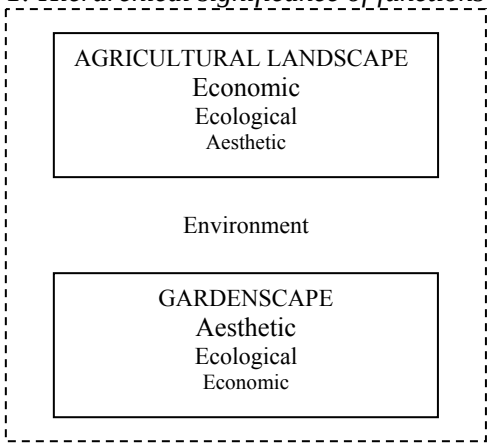
Finally, concerning the economic functions of gardens, some owners use parts of their garden for producing food for sale or for home consumption Daniels and Kirkpatrick, 2006; Mavridou and Kizos, 2007).

4. Discussion:

The review of the different functions of agricultural landscapes and gardenscapes in this paper has revealed that the construction of a conceptual framework is feasible, in order to study the changes of land use and landscape that take place. Such a framework can be based on the identification of the different functions for each landscape. It seems that there is a hierarchy of functions for each land use. Land use changes from agricultural landscapes to gardenscapes, alters the hierarchy of these functions. While in agricultural landscapes the most impotant and accepted function is the economic followed by the ecological and the aesthetic functions, in gardenscapes this range changes as the main function is considered the aesthetic.

This initial and exploratory conceptual frame is depicted in Figure 1.

Figure 1: Hierarchical significance of functions



Apart from this conceptual framework, the review presented here, shows that gardens remain the least studied and understood habitat in urban and suburban areas. In part this omission has been due to the difficulties inherent in obtaining ecological data on gardens and the lack of a methodology for classifying and analysing garden data (Mathieu et al. 2007). Very few studies have been conducted, among which the 'Urban domestic gardens research project' funded under the URGENT programme of the Natural Environment Research Council in the UK (Smith et al., 2006).

Moreover, unifying concepts and methodologies that integrate the different research approaches are also missing. As the review of the relevant literature in this paper has demonstrated, most of the approaches deal with either the aesthetic functions or the ecological functions of gardens. Also, most studies refer to urban greenspaces such as parks and private gardens and not to suburban greenspaces that are currently more in number and rapidly increasing (an exception is Marzluff *et al.*, 2001 and Destefano *et al.,* 2005).

This paper has investigated current approaches to the study of the different functions of gardens. The literature review reveals that an integrated method in which aesthetic, ecological, economic and environmental functions of gardens will be included is still missing. Such an approach is required in order to evaluate the changes that take place in the urban fringes of modern cities in the western world. Especially in semi-arid climates such as the Mediterranean basin, such as approach will be very useful, as on one hand suburban gardens increase in number and space they cover, while on the other hand, issues of the resources that the management of different land uses requires and ecological functions of space are gaining ground. An exploratory study undertaken recently (Mavridou and Kizos, 2007), highlights these issues in different scales and identifies the theoretical and research gaps..

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