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Native versus Exotic Plant Species in the Vacant Land of Four Portuguese Cities: Urban Ecology and Landscape Architecture

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ABSTRACT

The contemporary city has been growing discontinuously, leaving abandoned structures and vacant land in its wake. The current situation has been caused by economic uncertainty, real estate speculation, and continuous suburban development. The existence and relevance of this issue is well-established in the literature, and recent publications have shifted focus toward how to "reuse" vacant land and abandoned structures.

In the scope of the research NoVOID Project – "Ruins and vacant lands in the Portuguese cities: exploring hidden life in urban derelicts and alternative planning proposals for the perforated city", funded by the FCT (PTDC/ATP-EUR/1180/2014) were identified and classified the main vacant and derelict urban spaces in four Portuguese cities: Lisbon, Barreiro, Guimarães, and Vizela.

The research starts from the idea that vegetation is a fundamental structuring element in landscapes. Not only does it dominate most land ecosystems through its biomass, but it also constitutes the habitat for animal populations and is at the heart of the majority of human productive and cultural activities. It is also the element that best integrates a landscape's biological response to environmental factors (physical, biological and anthropic). A botanical research was performed to a sample of twenty sites located in the four cities under study, to the different types selected (ruins, ruins, and yard and vacant lands), including the following phases: construct a floristic inventory with all the taxa found; establish the ratio of native and exotic species and identify the invasive species; identify the presence of RELAPPE species (in Portuguese: rare, endemic, localized, protected (e.g., species in the Habitats Directive), threatened or endangered). In total, 339 different species of plants were identified, 73% of which are native [32% represent synanthropic ruderals species, 1% (4 species) Iberian endemism, and only 1 specie is protected in Portugal] and 27% exotic (being 14% invasive or potentially invasive).

This study furthers the discussion on the ecological, functional, and aesthetic potential that vacant land and ruined spaces have in contemporary cities. Repurposing these spaces through innovative landscape architecture, for either temporary or permanent uses, represents a crucial step toward enriching urban life.

INTRODUCTION

The main aims of this paper are to identify, promote awareness of the importance of and the benefits to be gained from biodiversity and human/non-human interactions in existing ruins, urban hollows, and vacant lands, and developing new methods of working these urban landscapes. The study cases are four Portuguese cities (Lisbon, Barreiro, Guimarães, and Vizela) where in a sample of twenty spaces the botanical inventory was carried out, and a discussion about possible uses of these spaces is elaborated within the project NoVOID – "Ruins and vacant lands in Portuguese cities: exploring hidden life in urban derelicts and alternative planning proposals for the perforated city", funded by the FCT.

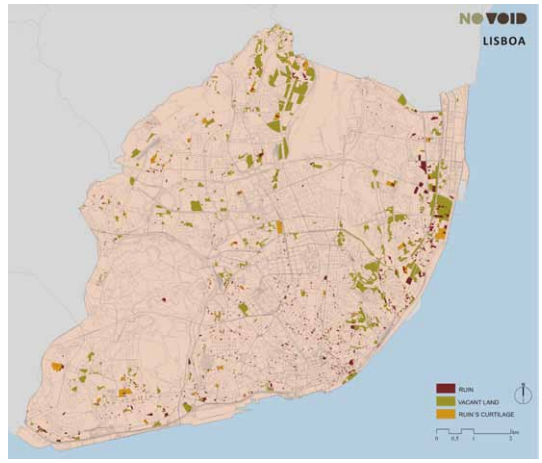

Figure 1. The NoVOID's inventory map of ruins and vacant land in Lisbon, Portugal. Source: NoVOID Project.

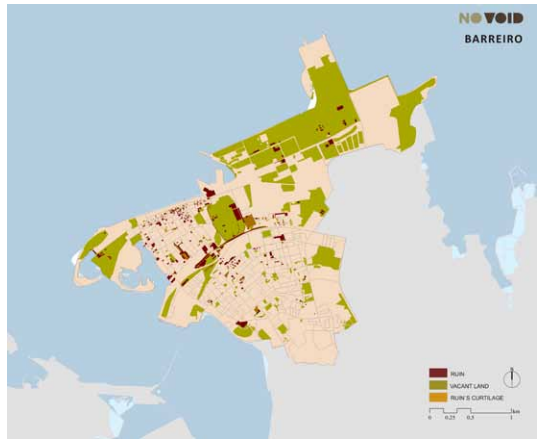

Figure 2. The NoVOID's inventory map of ruins and vacant land in Barreiro, Portugal. Source: NoVOID Project.

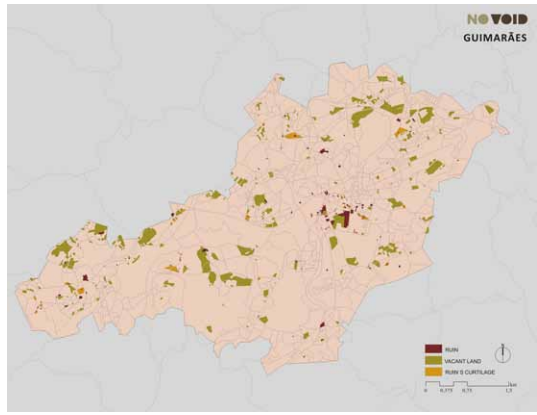

Figure 3. The NoVOID's inventory map of ruins and vacant land in Guimarães, Portugal. Source: NoVOID Project.

MATERIAL AND METHOD OF THE APPROACH

The four cities studied are located in two urban areas of mainland Portugal (PT): Lisbon and Barreiro in Lisbon Metropolitan Area (AML), in west south central, and Guimarães and Vizela in Ave Intermunicipal Community (AVE), in northwest Portugal. To study these cities were defined in this research project three categories ruin, ruin yards and vacant land:

Ruins –structures produced by technology and intended for human use or for other purposes that have reached an advanced state of dilapidation, being therefore incapable of performing the function for which they were originally designed;

Ruin yards –non-built lands surrounding dilapidated buildings that visually can be considered as integral parts of the same property;

Vacant land – is defined in this study as unutilized, non-cultivated, non-landscaped, and non-built upland, with shrub and herbaceous covering showing signs of neglected and lack of maintenance, or presenting bare soil, rubble, and vestiges of razed buildings.

Project NoVOID will build on interdisciplinary work at the confluence of Human Geography, Ecology, Landscape Architecture, and Architecture. A multi-method approach was adopted: combining quantitative methods (statistical analysis of census data, remote sensing and vertical aerial photography interpretation, fauna and flora sampling, and inventories), with archival work and ethno-geographical qualitative methods (observation and interviews) in order to respond to the various components of the research. Fieldwork is very important since significant data was collected or confirmed with field surveys. The research of NoVOID project is focused on a sample of four cities representative of different shrinking urban contexts: Lisbon, Barreiro, Guimarães, and Vizela. The methodology developed in this

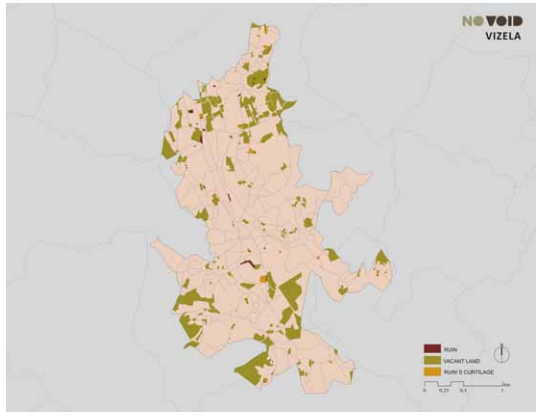

Figure 4. The NoVOID's inventory map of ruins and vacant land in Vizela, Portugal. Source: NoVOID Project.

research project could be applied in the future to other cities.

For the cities studied were identified and quantified by way of geographical information systems the areas corresponding to the typologies establish.

In the urban area of Lisbon (figure 1), were identified 2 173 buildings in ruins (91, 8ha, with ruined backyards), corresponding to 1.08% of the area of the city and 772 vacant lands (336.4 ha), which correspond to 3.98% of the area of the city. In the urban area of Barreiro (figure 2), there were identified 377 polygons in ruins (15 ha) corresponding to 2.2% of the area of the city and 169 vacant lands (194.8 ha), which occupy almost one third (29.2%) of the city's perimeter. In the urban area of Guimarães (figure 3) were identified 210 buildings in ruins (a total of 14 ha), which corresponds to 0.6% of the urban area and 218 land polygons (124.7 ha) that correspond to 5.31% of the area of the city. In the urban perimeter of Vizela (figure 4), a total of 70 polygons corresponding to ruins (2.1 ha) were identified, which covers 0.31% of the area of the city, and 139 vacant lands (91.2 ha) that correspond to 13.4% of the area of the city.

From a sample of twenty places identified a floristic inventory was done to characterize their biodiversity value (figure 5). This methodology followed the main steps:

1) identification of all the taxa found in the target areas (plants);
1) construction of a floristic inventory;
1) establishing the ratio of native and exotic species and identify the invasive species;
1) identification of the presence of RELAPE species (rare, endemic, localized, threatened or endangered) and of species in the Natura 2000 network.

Thus, we can observe the coexistence of many species with a characteristic of strong invasiveness coexisting with some species of interest for protection and conservation. Species that occur habitually in the ruins and old walls of the studied cities which belong to the autochthonous flora and which are favored by the urban environment (specialists in urban ruins). In vacant areas, some grasslands could present other interesting species (like orchids). Despite the interest for the protection and conservation of some species associated to the urban ruins most of the flora is exotic, and much of it is invasive and is favored in its expansion by urban voids and urban ruins.

The range of ruins, vacant land, and abandoned ventures will be selected to propose meanwhile or permanent rehabilitation/reconversion programmes for those spaces as reference examples. The next stage aims is to create new urban areas that play a vital role as ecological, aesthetical and social in order to improve the urban comfort. Many of the proposals will involve the re-appropria-tion of public space or the occupation of terrains vague or abandoned land.

RESULTS AND DISCUSSION

The results show 339 different species identified, 73% are native [32% represent synanthropic ruderals species, 1% (4 species) Iberian

Figure 5. Examples of vacant land in four cities Lisbon (a), Barreiro (b), Guimarães (c) and Vizela (d), were the floristic inventory was done. Source: NoVOID Project, © Estevão Portela-Pereira.

Figure 6. Native species: *Antirrhinum linkianum* Boiss. & Reut. (a), *Ulex europaeus* subsp. *latebracteatus* (Mariz) Rothm. (b), *Sedum album* L. (c), and *Carex elata* subsp. *reuteriana* (Boiss.) Luceño & Aedo (b). Source: Flora-on.pt, © M Porto, A J Pereira.

endemism, and only 1 specie is protected in Portugal] and 27% exotic (being 14% invasive or potentially invasive).

In the overall list, almost 3/4 of taxa are interpreted as natives versus 1/3 exotic species. Some species have value for protection and conservation, aesthetic or because they are Iberian endemism's: *Antirrhinum linkianum* Boiss. & Reut*., Ulex europaeus subsp. latebracteatus* (Mariz) Rothm., *Sedum album* L*., and Carex elata subsp. reuteriana* (Boiss.) Luceño & Aedo (figure 6).

None of these endemism's are, however, infrequent or rare, and are therefore not threatened species. However, some exotic species are invasive and are a risk for the balance of natural and urban ecosystems, for example, *Ipomoea acuminate* (Burm.) Merr., *Tropaelum majus* L*, Ricinus communis* L., *Cortaderia selloana* (Schult. & Schult.f.) Asch. & Graebn. (figure 7).

Figure 7. Exotic species that are invasive: Tropaelum majus L (a), Ipomoea acuminate (Burm.) Merr. (b), Ricinus communis L. (c), Cortaderia selloana (Schult. & Schult.f.) Asch. & Graebn (d). Source: Flora-on.pt, Invasoras.pt © F Clamote, J D Almeida, Invasoras.pt.

Our research has shown that vacant land in the cities studied is full of native plants that are born spontaneously. The inventory of about 250 species of native flora, i.e., about 2/3 of the total of 335 plants, is relevant data for landscape architects to study their potential for use in green spaces without watering. Since irrigation of green areas is a significant cost, and water being scarce, it is essential to study solutions of native vegetation that is well adapted to the urban context.

The use of native's plants in urban green spaces contributes to sustainability and the increase of biodiversity. The use of native species with ornamental value should be increased in urban areas, because they are more resilient (requiring less watering and treatments for pests and diseases). Landscape architects can create interesting plans that combine native species with exotic species (not invasive species), respecting the ecologic functionality, promoting the recreation potential and the increasing of the aesthetic value.

The vacant spaces with native flora may be the stage for the following temporary uses:

— The accomplishment of Environmental Education actions with schools for in situ observation of native vegetation;
— Temporary exhibitions with themes that cross the Art to Science;
— Workshops with the exploration of medicinal, aromatic and dye plants;
— Establishment of community gardens and gardens;
— Availability of the botanic inventory data of the 335 species in open databases so that they can be created an app for the discovery of the native and exotic flora of the vacant spaces of the city.

This research project, where the multidisciplinary team consists of geographers, architects, landscape architects, urban planners, botanists and other specialists, aims at looking into and discuss the value and potential of vacant and abandoned land in four cities and present solutions that enhance their value through meanwhile and permanent projects.

FINAL REMARKS

The dissemination of the results of this project NoVOID is intended to set criteria to the designers (landscapes architects, architects, urban planners) and authorities that act upon the environment and landscape, as well as the decision-makers and those who propose solutions and regulations. This methodology could be applied to other cities. Sustainable urban planning by valuing these vacant spaces and integrating them into the various types of green areas play a crucial role in the Ecology, biodiversity, urban resilience, aesthetic appreciation, and urban comfort.

The methodology and the proposals for temporary and permanent uses of this research can be applied to other cities.

The conflict between native versus exotic plant species in urban landscapes can be minimized by merging the knowledge of fields such as Landscape Architecture, Ecology, Botany, and Horticulture.

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