Architectural and Urban Planning Features of Ecotopia

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Abstract. This article has been devoted to the analysis of the description of architecture in the works of utopian philosophers, and the identification of the main means by which they tried to ensure the environmental friendliness of their society and connection with nature. Utopian ideas and concepts arise as a result of dissatisfaction with the standard of living and contribute to the active development of society. The models of states described in utopian works serve as a source of ideas for possible scenarios for improving current systems. Ecotopias are a specific type of utopias which describe states with a clear and exclusively ecologically-oriented social order. This article presents an analysis of architectural and engineering means of communication with nature in the works by Plato, T. More, T. Campanella, Cyrano de Bergerac, D. Vairasse and V. Odoyevsky. The work of E. Callenbach, as the first example of ecotopia, is analyzed in detail, and the peculiarities of the architecture and urban structure of the cities of Ecotopia are highlighted.

1. Introduction

Considering the deterioration of the environment and climate change as a result of human activities, the principles of sustainable development are becoming highly important. This concept includes aspects of social policy, economics and ecology. The concept of sustainable development envisages ensuring quality living conditions for people and minimizing the negative impact on the environment to preserve and improve the environment in the future.

Creating a society that ensures social and economic equality of citizens is an integral attribute of utopian concepts. The term "utopia" comes from the title of Thomas More's work "Utopia" and means "a place that does not exist" [1]. As of today, there are a significant number of different types of utopian consciousness, the youngest of which is considered to be ecological [2]. For their part, works that contain descriptions of ideal states, where everyone lives in appropriate and equal conditions and, at the same time, pays considerable attention to ecology and the state of nature are called ecotopias. Ecotopia – is "an ecologically ideal region or form of society, generally viewed as imaginary" [3]. Such works include the works of E. Callenbach, M. Bookchin and others.

Architecture and urban planning in utopias serve as a basis for implementing ideas into reality. This explains the detailed description of the urban environment and modeling the lives of people in it by utopian philosophers.

It should be noted that among the specialized utopias within a particular field of human activity, architectural utopias are also distinguished. Architectural utopias are utopian concepts authored by architects and urban planners. The main task of these utopias is to develop a holistic image of the city and humanize the architectural space, following the social component of utopian ideas, and, as a
consequence, ensure the possibility of their implementation. “Architectural utopias formed from socio-utopian ideals, images-goals realized by architecture” [4, p 4].

Partial implementation of the concept of sustainable development is possible due to the use of environmentally friendly materials, reducing the building area, providing buildings with environmentally friendly energy sources and more. In fact, qualitative transformations are feasible only with significant changes in people’s lifestyles. According to the fact that one of the features of utopias is an attempt to predict the future or demonstrate an alternative version of the present, it is interesting to analyze ecotopias and describe the urban environment and architecture that they envisage.

A large number of scientific articles and books are devoted to the study of utopias. Most researchers analyze them primarily in terms of the socio-political sphere, although there are also works that consider the architectural and urban components.

The problems of coverage of architecture and urbanism in social-utopists’ works have been outlined in works by H. Hradov (1968); S. Khan-Magomedov (2001); M. Chyutin (2006); T. Morrison, M. Rubin (2014); A. Romanova (2015); E. Eylers (2015) and others. For instance, Hradov provides schematic maps of the cities of T. More and T. Campanella, and describes the main aspects of the architecture of these ideal countries. Khan-Magomedov analyzed the images of architecture and urban structure in the works of Plato, T. More, T. Campanella, D. Vairasse and others.

From the architectural perspective, the most interesting part in the works of utopian philosophers is the description of the actual urban structure and the approach to the functional division of the city and buildings. Besides, it is worth mentioning the study by K. Rusiev (2015), who analyzes the images of architectural utopias in environmental science fiction films.

The analysis of the attitude to nature and ecology in utopian works is reduced mainly to the consideration of political laws and behavioral practices of the population. A political theorist Marius de Geus (1999) analyzed aspects of ecology in treatises written by T. More, H.-D. Thoreau, P. Kropotkin, W. Morris, E. Howard, B. F. Skinner, A. Huxley, E. Callenbach, and M. Bookchin [5].

A detailed analysis of the architecture of ecological settlements in utopias, both socio-political and architectural, is presented in the thesis by Pandit Silpirekha [6].

The aim of this article is to analyze the description of architecture in the works of utopian philosophers and to identify the main means by which they tried to ensure the environmental friendliness of their society and connection with nature.

2. Research Methodology

The main research method in this study was thematic analysis, which was used for analyzing qualitative data in treatises by Plato, T. More, T. Campanella, Cyrano de Bergerac, D. Vairasse and V. Odoyevsky. These novels were selected, as they are vivid and most common examples of utopian works. These treatises are referred to as “utopia of flight”, they describe the structure of states located in remote areas from real territories. Aspects of architecture and urban planning are analyzed in more detail in the work of E. Callenbach – since this work is considered the first ecotopia.

In the analysis of these works, there were applied general scientific methods, namely empirical methods of operation: the thematic analysis of literature, documents; theoretical methods-operations: generalization, abstraction and comparison.

3. Results and discussions

3.1. Connection with nature in the treatises by Plato, T. More, T. Campanella, Cyrano de Bergerac, D. Vairasse and V. Odoyevsky

The works of utopian philosophers emphasize the perfect social order, which extends to all possible levels of human life, including their interaction with nature. Thus, the utopian authors, even without paying much attention to it, still tried to demonstrate the mechanisms of combining architectural objects and citizens with ecology and nature. Even Plato (354 BC), describing the perfect state noted the need
for equipment of primitive structures to collect rainwater. The proposal to collect precipitation for future use was quite common in the first works of utopian philosophers.

Thomas More in his “Utopia” (1516) described the island state of Utopia, the capital of which is the city of Amaurot. It is a square city with a grid plan with no private property. At the same time, describing the water supply system, the philosopher noted that the cities provide special containers for collecting rainwater. Such tanks allowed residents of those areas where it is not possible to supply water through the terrain through the general water supply network, to receive clean water for their own needs. Thomas More was succeeded by Tomazzo Campanella, who in his philosophical work “The City of the Sun” (1623) described an ideal state on an island in the Indian Ocean. The city of the Sun in plan has the form of a circle, and the street network is formed by a radial-circular scheme. The author points out that all residential buildings are located in a circle (the city itself consists of 7 rings) and have flat roofs. Similar to More, Campanella considers it appropriate to create a network of gutters to save rainwater, which can then be used [7, p 42].

Cyrano de Bergerac in his novel “Comical History of the States and Empires of the Moon“ (1657), describing the imaginary cities on the Moon, mentions the “Ambulatory Towns”. Such cities consist of separate buildings on wheels, which due to the use of wind force can move long distances. [8].

Severambian – a fictional perfect society on an island near Australia, described by Denis Vairasse in the utopia “History Of Sevarambes” (1675). The author emphasizes that all cities are planned according to a single principle, and consist of osmasia – a modular unit of the city, which are multifunctional square buildings. Sevarambes are very caring about nature and believe that the territory should be built only when the number of inhabitants of existing cities exceeds the norm. All cities have a grid plan and are designed as comfortable as possible for people. A large amount of greeneries is provided, both on the patio and the streets. Continuing the theme of collecting rainwater, Vairasse proposes to install rainwater collectors not only on the streets but also on the roofs of buildings. This water enters the fountains, which are in each osmasies, in the bathroom and is used for watering plants. Taking care of the land, the sevarambes dug a large number of water canals to provide dry areas with water and invented a secret way to turn sand into fertile soil [9].

A more futuristic version of utopia was described by Vladimir Odoyevsky in his unfinished novel “The Year 4338: Petersburg Letters” (1835-1840). The described events take place in the year 4338, when high-speed underground trains and “flying aerostaties” became the main transport of cities. Given the significant development of technology, people have learned to have a strong influence on nature. The network of special pipes covers almost the entire surface of the earth, due to which warm air is delivered to residential buildings, gardens, and even to the airways. Scientists have learned to modify nature and the atmosphere through the use of technology (fans) and the mixing of chemical compounds. An artificial environment has been developed on the territory of the research center, which simulates the natural conditions of different parts of the globe, and allows to reproduce the flora and fauna of those regions. Due to the powerful technical development, the work does not pay much attention to the issue of ecology [10].

3.2. Features of architecture and urban planning in “Ecotopia” by E. Callenbach

The first version of a truly ecological utopia is Ernest Callenbach’s novel “Ecotopia: The Notebooks and Reports of William Weston” (1975), which describes the structure of the fictional country of Ecotopia. William Weston – an American journalist who went to Ecotopia for 6 weeks to study their standard of living and behavioral habits, social and political system. The book itself consists of an alternation of small magazine columns that the journalist wrote for publication in a newspaper with pages from personal diary.

Callenbach emphasizes that “Ecotopia is not a “futurist” book that simply attempts to project trends. Nor does it portray a utopia—an imaginary country where everything is entirely perfect forever” [11, p 170]. Nevertheless, this work still has clear signs of utopianism, and is an example of an ecological model of an ideal social order, where people are equal to each other, regardless of sex or level of
knowledge, and have a strong connection with nature. “Thus people can be just people, without our symbolic loading on sex roles” [11, p 33].

The country of Ectopia is located in the western United States and consists of Northern California, Oregon and Washington, which were separated from the common territory of the United States and gained their independence as a separate state (Figure 1).

Figure 1. Location of Ecotopia on the map of USA (WA – Washington; OR - Oregon; NorCal - Northern California) [map by author]

At the time of the events described in the novel, Ecotopia has been independent for 19 years. The country is surrounded by a closed border and separated from the rest of America by the Sierra Nevada Mountain. The border is formed of a wooden fence with a large gate, near which is a small stone guard-house [11, p 5]. The author mentions such cities as San Francisco; Alviso; Redwood City; Healdsburg; Marshall city; Punta Gorda; Santa Cruz etc.

Reforms in the country began with the introduction of decentralization; normalization of the number of populations by reducing the birth rate; nationalization of agriculture; bans on the oil industry; and laws on the protection of forests and water [11, p 44]. After the declaration of independence, there was a period when the construction of only wooden buildings was allowed. Archibald Fir was the most famous architect of that period. “He wrote a remarkably influential study of earlier wood building, and helped lay down the specifications that plastics had to meet to be allowable as building materials” [11, p 97].

The main transport connecting different settlements is the train. The developed railway network covers almost the entire territory of the country. Trains have a futuristic design and each one “looks like a wingless airplane” [11, p 7]. In addition to trains and electric cars, they actively use water transport, for which harbors are arranged [11, p 25].

Unlike many utopian countries of its predecessors, the Ecotopia was "built" not on new lands, but on the territory already built up by cities and inhabited by inhabitants. As a result, there is a need to describe not only the mechanism of building new cities, but also the reorganization of the environment of existing cities following the idea of quality and appropriate living space.

Thus, the streets of San Francisco have changed from pedestrian streets to pedestrian, rich in trees, and recreation areas with fountains, sculptures, small gardens with benches and stalls. The carriageway of the main boulevard now consists of only two lanes, which are mostly used by electric taxis, delivery cars and minibuses. Public transport stops look like pavilions with a conical roof, where there are small
shops with a press. The entrance to the vehicle has no steps, so the floor level of the stop corresponds to the floor level of the vehicle. There are no drivers, and all transport is electric and free for the population [11, p 11]. Given the proliferation of public transport, the car-free zone has expanded to almost all densely populated cities: private transport is prohibited for all residents. Public transport is frequent, although most residents have bicycles that are convenient to travel both in and between cities. The streets are clean and not littered with information garbage: not a significant number of street signs on the facades of buildings, and those that are, attached to the corner facades [11, p 14]. The streets are not lit at night, although this does not affect the crime rate.

In addition to the reconstruction of the street network, rivers - which years ago had sunk underground to form a sewer and water supply network, -were also raised. Ecotopians cleaned such reservoirs and raised them to the street level, arranging landscaped promenades, and forming attractive urban spaces. [11, p 12].

Urban space is actively used by all segments of the population, regardless of age. In addition, various fairs are held in the city squares, where you can buy farm products, etc. And on the stairs of the old town hall, for example, various performances can be held [11, p 88]. Most of the buildings of historic cities have become multifunctional: combined residential and public functions (shops, offices, catering establishments, etc.) [11, p 14]. Part of the housing stock was demolished to restore natural conditions: increase the area of forests [11, p 29].

Thus, it can be argued that urban spaces and the street network of existing cities are undergoing significant transformations and becoming people-oriented. In part, this resonates with ideas that were prevalent among architects and urban planners in the 1970s. The theme is "new urbanism" and reducing the use of cars by increasing the number and frequency of public transport, landscaping of urban spaces and the introduction of a mixed function of districts.

In Ecotopia, new settlements are emerging next to historic cities, which were immediately designed according to the ideology of sustainable development. The street network of such cities is formed not by a grid plan, but by narrow and winding streets. Public functions (shops, libraries, bakeries, grocery stores, workshops) - are mixed with residential buildings, which are built mostly of wood. “Though these structures are old-fashioned looking, they have pleasant small balconies, roof gardens, and verandas—often covered with plants, or even small trees. The apartments themselves are very large by our standards—with 10 or 15 rooms, to accommodate their communal living groups” [11, p 24]. The city has a very large number of greeneries and mini parks, relatively high population density. Each new small town is located next to a train stop, which allows to form a network of connected cities. “Ideal number of citizens for an urban constellation is 40 - 50,000 – total number of people in satellite mini cities” [11, p 62].

This idea of small green rural settlements is reminiscent of Ebenezer Howard’s idea of the Garden City. Due to decentralization and the formation of autonomous settlements with a large number of greenery, which should be of a fixed size, residents would have to live in comfortable conditions and be in constant contact with nature.

The main building materials are wood and stone. In line with ecotopians desire to move to zero waste generation at the legislative level, many materials that cannot be plugged have been replaced by natural analogues and reduced use of paint, etc. [11, p 20].

Plastic produced in Ecotopia is plant-based and contains biological sources - is light and cheap, and recyclable. In this case, part of the plastic decomposes itself within a month. In addition to this type of plastic, more solid plastic is also made, which is not a subject to rotting or self-decomposition. It is used “for minibus bodies, “extruded houses,” coins, bottles, and mechanical objects of many kinds” [11, p 78].

“Extruded houses” are modular houses made from plastic which are easily transported due to their size. Each module has the form of a pipe, approximately 3 m high and 4 m wide, with a flat floor. Such modules form larger houses of different shapes, with different sets of windows and doors, thus very rarely repeated, even though they consist of manufactured solid elements. Such modular housing is much faster and easier to implement than wooden buildings, and more cost-effective. In addition, ecotopians
sometimes build the main part of the building from wood or stone, and the required number of rooms is selected by such modules. Each module has special gutters and pipes, so such housing units can be equipped with everything you need. Instead of foundations, modules of such buildings are fastened by means of “large adjustable corkscrew devices which anchor each corner but leave the earth surface undisturbed” [11, p 125].

In addition, small factories even produce separate bathroom modules, equipped with environmentally friendly drainage of water and sewage. “A companion unit, a large plastic tank, is buried outside and connected by two flexible hoses. This, it turns out, is a septic tank, which not only digests sewage but produces methane gas in the process, which in turn operates the heater! The effluent that runs out the other end is not at all repulsive, but clear and excellent for watering gardens, so that ordinarily the garden is placed adjacent to the bathroom” [11, p 124].

These buildings are fully compliant and ensure all the needs of the residents, if necessary, it is possible to add or subtract rooms, carry the buildings on another site and so on. The massive spread of the production of such modules has affected the lack of the profession of an architect as such, because everyone can form a building for themselves, according to their own needs. So, “The community governments have design staffs for public buildings” [11, p 134].

This idea is reminiscent of an improved and more environmentally friendly version of the manufacture of prefabricated elements for residential buildings, which became popular in the 1920s. Standardized and unified construction of such buildings in the last century, though provided housing for a significant number of people, but created a monotonous urban space with its problems. The variant of production of standard modules described by E. Callenbach in “Ecotopia” recognizes individuality; after all, each inhabitant will have an opportunity to define where and how the module will stand. Thus, the author believes that all buildings will have a different look, although they consist of the same elements. An approximate view of “Extruded houses” is shown on Figure 2.

![Figure 2](image-url)

Figure 2. Image of “Extruded houses”. A – typical module, and an example of possible variations in the location of windows and doors; B - Plan of a house built of standard tube modules; C - Axonometric image of “Extruded houses”. 1. Entrance; 2. Kitchen-living room; 3. Tree; 4. Bedroom; 5. Bath room; 6. Cabinet; 7. Sliding doors; 8. Typical module; 9. Central part, made of stone; 10. Translucent dome [drawn by author]
The interiors of ecotopians residential buildings are very minimalist: there are no beds in residential buildings, residents sleep either directly on the floor or on a mattress; all wooden furniture, etc [11, p 81]. Lighting, although electric, but minimized, so if necessary, residents use candles [11, p 124]. Some houses have indoor green gardens. Spaces in public buildings also do not differ in rich decor: in the cabinets of ministers there are no tables for conferences or fashionable furniture, but only comfortable pillows on the floors and large windows. A similar principle is followed in the design of public transport. Each train consists of three cars, which do not have classic seats, but purely pillows on the floor, where you can comfortably sit or lie down, looking out the large windows.

Given that recycling is mandatory in the Ecotopia, all residents and businesses are required to sort their waste by appropriate categories. Yes, even in a hotel room or a train car there are three special pipes for different garbage [11, p 20].

Despite the first impression, ecotopians do not reject technical development, although meticulously select the technologies used in everyday life. One of these types of equipment is videophones, which are equipped with all houses and hotel rooms, and household appliances (refrigerators, dryers, etc.) are made as quiet as possible so as not to create noise pollution. In addition, the entire country, except for a few isolated rural areas, is covered by a network of cable that provides communication and television [11, p 38].

The energy here is exclusively ecological. The largest source of energy, at the time of the story, is a massive thermal-gradient power plant at Punta Gorda [11, p 102]. There were several gas and oil power plants in Ecotopia, but all of them were closed after the declaration of independence. Due to decentralization, smaller power stations are being built, which will supply energy exclusively where it is needed.

One of the acceptable sources of energy for them is the source of geothermal power and solar or wind energy. These sources of electricity are renewable and have less impact on nature than any other. For example, hydroelectric power plants, of which there is a significant number in the country, are not considered completely environmentally friendly, as they have a negative impact on water bodies and their inhabitants [11, p 103]. Ecotopians enjoy windmills and wind turbines on the roofs of buildings, which are common in both cities and remote areas. Solar panels are also attached to the roofs of buildings - silvered parabolic mirror about 30 feet in size.

Also, there is very common a massive photo-cells system. Solar energy is collected in special underground containers, from where it is supplied to residential premises for heating. Devices that provide this process are attached to the walls of buildings, which allow covering a larger area for the absorption of radiation [11, p 105].

Among the public buildings, the book mentions hotels [11, p 14], administrative institutions [11, p 24]. In many large public buildings, train stops are located underground, which allows you to easily get from one point to another in adverse weather conditions [11, p 24]. There are almost no workshops in Ecotopia, because things are made durable and reliable, and in case of minor issues, residents can fix them themselves [11, p 40]. The factories that operated before the country's secession have been modified since independence, although the buildings still perform their production functions [11, p 87]. However, the areas adjacent to the factories have been cleared and their natural appearance restored as much as possible.

Decentralization encourages citizens to build a large number of small hospitals and schools [11, p 62]. Schools occupy large areas, including streams and landscaping, parks. However, they do not have any permanent buildings, and all classes are held outdoors, or in small, temporary wooden houses for a maximum of 10 students [11, p 116]. A network of universities is widespread across the country, next to which are smaller research institutes [11, p 129]. There are also pharmacies in Ecotopia that sell prescription drugs only [11, p 96].

Due to the clear legislation and the "ideality" of society, there is no special need for prisons, although the author mentions that there are prisons, and prisoners are obliged to work there.

The main idea of all transformations of residential and public buildings and the urban structure was the desire of citizens to get as close as possible to nature, and minimize own negative impact on it. "But
what matters most is the aspiration to live in balance with nature, “walk lightly on the land,” treat the earth as a mother” [11, p 29].

The life in the communes described by Callenbach echoes the idea of “utopian communities” popular in the United States since the 18th century. Separating themselves from the world around them by certain borders, they sought to create their own state where all residents would feel comfortable living among like-minded people. Such communities were formed mostly on the religious or ideological community and failed due to the lack of a clear vector of economic development [12]. Thus, in contrast, Callenbach develops a clear model, detailing all levels of human life. The ideas of "Ectopia" have a significant impact on the perception of the ideas of ecological utopias, and on eco-cities and stable cities.

Although the Ecotopia society looks stable, it is constantly improving and changing: new laws are being adopted, technology is being improved, new nature reserves are being restored, and so on. This qualitatively distinguishes this work from the classical utopias, which exist in a timeless mode and do not involve any transformations.

Close to ecotopia is arcology - the development of urban concepts based on the relationship between architecture and ecology. The author of the arcology is Paolo Soleri (1969), who developed the project of the ecological city of Arcosanti. This project provides for a compact layout of the territory due to the construction of hyperstructures. According to the idea of arcology, cities should be built on the banks of rivers, lakes near forests, making it easier for people to access natural resources. The cities are a vertical city-commune, which would be located in a small area, with minimal interference in nature [13, 14].

Due to the deterioration of the environment, in modern architectural utopias, the issue of environmental stability is much more acute than it was a decade ago. As an example, the thesis of a Spanish architect Manuel Dominguez “Very Large Structure” is a city project located on a special platform that ensures its movement. At the same time, the city is fully self-sufficient in electricity and has waste processing stations, thus being a completely self-sufficient structure [15].

**Conclusions**

Ecotopia is a model of a socio-political system, which takes into account the postulates of sustainable development, and a clear connection with nature. Utopias, as models of an ideal system, are characterized by attention to natural conditions and the established mechanism of functioning of all systems. With the development of science in general, the vision of utopians on how to properly interact with nature has changed.

The utopian works of Plato, T. More, T. Campanella and Denis Vairasse are focused on good natural conditions and soil fertility, which allows states to prosper economically. In cities, the number of which as well as the population is limited, special rainwater collectors are provided to collect precipitation for future use. The common thing to these works on the concept of sustainable development in general - is the control over population growth and development of the territory. The population must be equal to the capabilities of natural resources and the economy, only then will harmony be achieved in development.

In his utopia, Cyrano de Bergerac proposes to use the force of the wind to move his wandering cities. And Vladimir Odoyevsky, who is trying to predict the future – in 4338, considers it more appropriate to try to tame nature, and use technical development to reproduce and simulate natural conditions where it is needed.

A more detailed and comprehensive model of the state described by E. Callenbach in “Ecotopia” is a striking example of the introduction of environmental friendliness in design: a well-established public transport network, waste processing stations, renewable energy sources, and construction of exclusively environmentally friendly materials. The author describes in detail all spheres of life: from politics to agriculture. Ecotopia is a striking example of a well-established system that focuses on quality interaction between man and nature. Cities and buildings are designed according to the concept of sustainable development: green, pedestrian, and focused primarily on people, not transport. At the same time, the author emphasizes the importance of appropriate behavior of residents, because without "confessors" it is impossible to achieve the implementation of such a system.
Thus, ecological utopias involve the design of settlements taking into account the impact of architecture and urban planning on nature and ecology, which will be inhabited by conscious people willing to profess the idea of connection with nature.

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