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SOCIO-ECOLOGICAL AND ECONOMIC ASPECTS OF ENVIRONMENTAL MANAGEMENT IN AN INDUSTRIAL CITY

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Abstract

When greening industrial centers, an important issue is the environmental and economic rationale for the use of woody plants. One of the important problems is the assessment of the ecological potential and ecological capacity of forest plantations. The management of the urban economy should be focused on the protection, transformation, restoration and formation of forests of increased ecological productivity. The industrial city is considered as a socio-ecological-economic system, with the specificity of the city due to the geomorphological and physico-geographical conditions of the territory. The key characteristics are the features of education, development and formation of cities. Urban forest plantations, sanitary protection plantations and green areas of cities are considered as interrelated structural parts of the socio-ecological-economic systems. In the organization and development of the territories, an important place is occupied by the formation of green areas of cities. Greening cities and suburban areas is one of the most important factors for optimizing the ecological situation. It has been established that under the conditions of the Ufa industrial center (Ufa, Republic of Bashkortostan, Russia) under the conditions of the prevailing petrochemical environmental pollution, the most resistant tree species are: Betula pendula Roth, Populus balsamifera L., Tilia cordata Mill. These gas- and dust-resistant species can be used to create protective forest stands along highways. It is shown that the following tree species are recommended for restricted use: Quercus robur L., Pinus sylvestris L. and Larix sukaczewii Dyl.

Keywords: Socio-ecological-economic system, landscaping, plantings.

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1. Introduction

General patterns of education and urban development are noted. At the same time, in historical terms, the equivalent and necessary conditions are: landscape-ecological aspect - the availability of natural resources; territorial aspect - the location of transport routes; increase in population - labor resources; industrial development - the availability of raw materials, energy, territorial location; continuous development of the infrastructure of the city. The priority is allocated to the economic component of environmental management - the availability of raw materials and energy resources, the availability of labor resources and production capabilities; conditions of consumption and marketing of products.

The socio-ecological component in the development of cities, the living conditions of people in cities in most cases was decided on the residual principle, the last. It should be noted that sanitary standards and regulations provide for the safe life of people in cities and towns.

2. Problem Statement

The peculiarity of the formation of industrial cities on the site of rural settlements was the availability of natural resources (for example, the discovery of mineral deposits) and further the construction of a profile industrial enterprise. Over time, a working-class settlement was formed with its own infrastructure, large-scale industrial and residential construction, and a permanent expansion of the industrial and residential area. Subsequently, the village acquired the status of the city, and agricultural activities were gradually supplanted.

There was an increase not only in the number of cities, but also an increase in the urban population. The population density (people / km²) in cities is very different from the population density in rural areas. Cities are densely populated and are constantly expanding at the expense of suburban areas, which is the reason for the reduction of green areas (both within the city limits and suburbs) and the constant increase in recreational loads in forest plantations (Jacovelli, 2010; Kollár & Donova, 2013; Van Heezik, Freeman, Porter, & Dickinson, 2014; Zheng, Ducey, & Heath, 2013).

In the Republic of Bashkortostan, Ufa is a modern industrial center. About 200 large and medium industrial enterprises are concentrated in the city. The economy is based on the oil refining industry, the petrochemical and chemical industries, engineering and instrument making, the construction industry, the woodworking industry, the food industry, the light industry, the pharmaceutical industry, and the power industry.

The forests of the city of Ufa are used for recreational purposes. The total area of the forest fund of the city of Ufa is 215760000 sq. km, and the number of the population is 1071634 people, respectively, 201 sq.m. in the amount of suburban and urban greenery. The share of plantations is 30% of the total area of the city of Ufa (Kulagin & Tagirova, 2015). The forest area in relation to the number of people living in the city of Ufa does not meet the established standards, and as a result, plantings experience an increased recreational load.

One of the important problems is the assessment of the ecological status of forests and forest plantations. Housekeeping is focused on the protection, transformation, restoration and formation of forests with increased ecological productivity (Kulagin & Shagiyeva, 2005; Kulagin & Zaitsev, 2008; Kulagin &

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Tagirova, 2015). The implementation of a complex of environmental protection and nature management measures ensures a balanced socio-ecological-economic development and functioning of the industrial center infrastructure.

3. Research Questions

Subject of research - woody plants (Pinus sylvestris L., Larix sukaczewii Dyl., Picea obovata L., Populus balsamifera L., Betula pendula Roth, Tilia cordata Mill., Quercus robur L.) of industrial centers and their vital status.

4. Purpose of the Study

The purpose of the study is to study the status of tree plantations of the industrial center, to identify the most sustainable species of woody plants for balanced socio-ecological and economic development and sustainable functioning of the industrial center as a socio-ecological-economic system.

5. Research Methods

Work on the characterization of the species composition and the state of woody vegetation was carried out according to standard methods, which make it possible to most fully characterize the planting (age, species composition, plant damage, etc.) (Andreyeva et al., 2002; Kulagin & Shagiyeva, 2005; Vaganov & Shashkin, 2000).

1. Reconnaissance survey of the Ufa industrial center in order to identify the areas most relevant to the tasks of the research center.

2. Creation of a network of temporary test areas (TTA) and permanent test areas (PTA). Selection of plots for uniformity, for soil edaphic conditions, age and taxation characteristics. On the territory of the city of Ufa in the 7 administrative districts 14 PTA were laid.

3. Geobotanical description of sample plots.

4. Characteristics of the species composition.

5. Determination of taxation indicators of forest stands.

6. Determination of the relative life state of tree stands.

7. Dendrochronological studies were carried out according to generally accepted methods.

6. Findings

The territory of Ufa is characterized by landscape and territorial heterogeneity (Figure). The boundaries of the city have been changed several times and nowadays the urban territories in large fragments are located on former agricultural lands and on the territory of the State Forest Fund.

The forest fund is characterized by uneven age structure for all groups of breeds (young stock is 5.4%; middle-aged - 42.1%; maturing - 20.1%; ripe and overmature - 32.4%). The area of ripening, ripe and overmature stands is 52.5%. Farming in urban forests is oriented on reconstruction and compensatory

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landscaping. The main task is to ensure the biospheric functions of plantations of woody plants under the influence of man-made factors of the industrial center (Kulagin & Tagirova, 2015; Zaytsev et al., 2017).

The current state of the forest stands of the city was assessed with the aim of monitoring the state and justifying measures for the conservation and reconstruction of the forest stands of the city. A network of PTA was created on the territory of Ufa, taking into account the specifics of the location. Characteristic of PTA is shown below.

PTA№1 was laid near oil refineries in the Ordzhonikidze district. 20 Populus balsamifera L trees were examined: average diameter 21 cm, average height 20 m; closeness 0.7. The average age of the trees is 27 years. Betula pendula Roth 20 trees: an average diameter of 24 cm, an average height of 21 m, a fullness of 0.8, an average age of 43 years. Tilia cordata Mill. 20 trees: average diameter 17 cm; average height of 16 m; closeness 0.7. The average age of the trees is 38 years. Quercus robur L. 20 trees: average diameter 19 cm; average height of 18.5 m; closeness 0.7. The average age of the trees is 43 years. Pinus sylvestris L. 10 trees: average diameter of 14.5 cm, average height of 16.4 m, closure of 0.7. The average age of the trees is 50 years. Larix sukaczewii Dyl. 10 trees: an average diameter of 13 cm, an average height of 14 m, closure of 0.7. The average age of trees is 40 years. Picea obovata Ledeb. 10 trees. The average diameter is 12 cm, the average height is 13 m, the closeness is 0.7. The average age of trees is 40 years.

Teens: Populus balsamifera L., Quercus robur L., Fraxinus excelsior L., Tilia cordata Mill. Closeness 0.4.

Underbrush: Sorbus aucuparia L., Padus avium Mill., Euonymus verrucosus SCOP, Corylus avellana L., Acer platanoides L. Projective cover 30%.

Grass cover: Plantago major L., Arctium lappa L., Aegopodium podagraria L., Polygonatum odoratum (Mill.). Druce (Polygonatum officinale All.), Poa angustifolia L., Geum urbanum L., Paris quadrifolia L., Galium odioratum (L.) Scop., Artemisia glauca Pall., Arctium nemorales Lej., Urtica dioica L., Calamagrostis epigeios (L.) Roth., Chelidonium majus L., Poa supine Schrad.. The total projective cover is 35%.

In this area, under conditions of petrochemical pollution, the relative vital state of woody plants falls into the categories of “severely weakened” and “weakened” (44,5-54,5%). There are no completely dried stands. The trees have a poorly formed crown, the trunks are poorly cleaned from dead boughs.

Relative life status of Populus balsamifera L., Betula pendula Roth, Tilia cordata Mill. rated as "weakened." Crown density ranges from 55% to 65%. The presence of dead branches on the trunk of 20% to 45%. The degree of damage to leaves with toxicants and insects is from 30% to 45%.

Relative life status of Quercus robur L., Pinus sylvestris L., Larix sukaczewii Dyl., Picea obovata Ledeb. rated as “very weak”. The density of the crown is from 20% to 50%. The presence of dead branches on the trunk from 45% to 65%. The degree of damage to the leaves and needles with toxicants and insects is from 45% to 60%.

In this trial area, woody plants have trunks of entomosis (egg laying, stem colonization), phytopathological damage (formation of fungi on the stem of fruit bodies) and dry top.

PTA№2 was laid on the territory of Park Pobedi in the Ordzhonikidze district of the city of Ufa. 20 Populus balsamifera L. trees were examined: average diameter 18.5 cm, average height 21 m, closure 0.8. The average age of the trees is 27 years. Betula pendula Roth 20 trees: average diameter 28 cm, average

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height 23 m, fullness 0.8, age 44 years. Tilia cordata Mill. 20 trees: average diameter 18 cm; the average height is 15 m. The average age of the trees is 38 years. Quercus robur L. 20 trees: average diameter 23 cm; average height of 22 m; closure 0.7. The average age of the trees is 55 years. Pinus sylvestris L. 20 trees: average diameter 17 cm, average height 19 m, closure 0.7. The average age of the trees is 50 years. Larix sukaczewii Dyl. 20 trees: average diameter 22 cm; average height of 23 m; closure 0.7. The average age of the trees is 50 years. Picea obovata Ledeb. 20 trees: average diameter 20 cm; average height of 19.5 m; closure 0.8. The average age of the trees is 60 years.

Teens: Populus balsamifera L., medium; Quercus robur L., rare.

Underbrush: Acer platanoides L., Frangula alnus Mill., Rosa L., Rubus caesius L., Padus avium Mill.; rare.

Grass cover: Urtica dioica L., Aegopodium podagraria L., Poa annua L., Tanacetum vulgare L., Heracleum sibiricum L., Rumex confertus WILLD., Tussilago farfara L., Taraxacum oridinalis Wigg., Capsella bursa-pastoris L., Arctium nemorales Lej., Paris quadrifolia L., Polemonium caeruleum L., Poa supine Schrad., Plantago major L., Leonurus quinquelobatus Gilib., Carex ovalis Good., Campanula trachelium L., Scrophularia nodosa L., Geranium L., Víola trícolor L., Polygonum aviculare L., Taraxacum tenebricans (Dahlst.) Dahlst., Polygonatum multiflorum (L.) All., Agrimonia pilosa Lebed., Achillea millefolium L., Geum urbanum L., Chelidonium majus L., Trifolium repens L. The total projective cover is 75 %.

In this area, the relative vital status of tree species is classified as “healthy” (87-91%). The density of the crown is 85-95%. The presence of dead branches on the trunk of 1% to 10%. The degree of leaf damage by toxicants and insects is 0-10%. Vertex in these areas is not pronounced, phytopathological damage is absent, damage to the trunks and entomopausation (egg laying, stem settlement) is insignificant.

PTA№3 was laid in the park named after Kalinin in Kalininsky district of Ufa. 20 Populus balsamifera L trees were examined: average diameter 19 cm, average height 20 m, closure 0.8. The average age of the trees is 28 years. Betula pendula Roth 20 trees: average diameter 26 cm, average height 24 m, fullness 0.8, age 46 years. Tilia cordata Mill. 20 trees: average diameter 17 cm; the average height is 15 m. The average age of the trees is 40 years. Quercus robur L. 20 trees: average diameter 21 cm; average height of 20 m; closure 0.8. The average age of the trees is 50 years. Pinus sylvestris L. 20 trees: average diameter 17.5 cm; average height of 18 m; closure 0.8. The average age of the trees is 50 years. Larix sukaczewii Dyl. 20 trees: average diameter 22 cm; average height of 22 m; closure 0.6. The average age of the trees is 45 years. Picea obovata Ledeb. 20 trees: average diameter of 15 cm, average height of 16 m, closure of 0.6. The average age of trees is 40 years.

Teens: Populus balsamifera L., Tilia cordata Mill., Acer platanoides L., Ulmus glabra Huds.

Underbush: Padus avium Mill., Acer platanoides L., Frangula alnus Mill., Sorbus aucuparia L., Rubus caesius L., Lonicera tatarica L.

Grass cover: Urtica dioica L., Aegopodium podagraria L., Poa annua L., Tanacetum vulgare L., Heracleum sibiricum L., Rumex confertus Willd., Tissilago farfara L., Taraxatum oridinalis Wigg., Galium odioratum (L.) Scop., Agrimonia pilosa Lebed., Achillea millefolium L., Polygonatum multiflorum (L.) All., Artemisia glauca Pall., Geum urbanum L., Scrophularia nodosa L., Stachys sylvatica L., Erodium

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cicutarium L., Inula hirta L., Carex ovalis Good., Carex silvatica Huds., Asarum europaeum L., Calamagrostis epideios (L.) Roth. The total projective cover is 70%.

In this area, the relative vital status of the studied rocks belongs to the categories “weakened” and “healthy” (74,5-82%). There are no completely dried breeds. The relative vital status of Populus balsamifera L., Betula pendula Roth was rated as “healthy”. Crown density ranges from 85% to 90%. The presence of dead branches on the trunk of 1% to 15%. The degree of damage to the leaves with toxicants and insects is from 1% to 10%. Relative life status Tilia cordata Mill., Quercus robur L., Pinus sylvestris L., Larix sukaczewii Dyl., Picea obovata Ledeb. rated as “weakened”. The density of the crown is from 60% to 80%. The presence of dead branches on the trunk from 15% to 30%. The degree of damage to the leaves and needles with toxicants and insects is from 10% to 20%. There are damage to the trunks of entomoprotections (egg laying, stem settlement), phytopathological damage (formation of fungi on the trunk of fruit bodies). Marked damage to man-made.

PTA№4 was laid near the Ufa engine-building production association of the Kalininsky district of the city of Ufa. 20 Populus balsamifera L. trees were examined: average diameter 21 cm, average height 22 m, closure 0.6. The average age of the trees is 28 years. Betula pendula Roth 20 trees: average diameter 26 cm, average height 21 m, fullness 0.8, age 43 years. Tilia cordata Mill. 20 trees: average diameter 16 cm; average height of 14 m. The average age of trees is 38 years. Quercus robur L. 10 trees: average diameter 19.6 cm, average height 19 m, closure 0.8. The average age of the trees is 45 years. Picea obovata Ledeb. 5 trees: an average diameter of 16 cm, an average height of 16 m, closure of 0.6. The average age of trees is 40 years.

Teens: Populus balsamifera L., Acer platanoides L., Ulmus glabra Huds., Fraxinus excelsior L. Closure 0,3.

Underbrush: Padus avium Mill., Acer negundo L.. The total projective cover is 30%.

Grass cover: Cirsium vulgare (Savi) Ten., Cynoglossum officinalis L., Achillea millefolium L., Geum urbanum L., Aegopodium podagraria L., Artemisia vulgaris L., Polygonatum multiflorum (L.) All., Agrimonia pilosa Lebed., Dryopteris lilix-mas (L.) Schott, Veronica chamaedrys L., Asarum europaeum L., Urtica dioica L., Arctium nemorales Lej., Plantago major L., Campanula trachelium L., Taraxacum oridinalis Wigg., Linaria vulgaris Mill. The total projective cover is 70%.

In this area, the relative vital status of all the rocks studied is classified as “weakened” (75,7-79%). The density of the crown is 60-80%. The presence of dead branches on the trunk from 15% to 30%. The degree of damage to leaves by toxicants and insects is 10-20%. On this test plot, there are damage to the trunks by entomosis (egg laying, stem settlement), phytopathological damage (formation of fungi on the trunk of fruit bodies). The dieback is not pronounced.

PTA№5 was laid in the park M. Gafuri Oktyabrsky district of Ufa. 20 Populus balsamifera L trees were examined: average diameter 20 cm, average height 19 m, closure 0.7. The average age of the trees is 29 years. Betula pendula Roth 20 trees: average diameter 25 cm, average height 22 m, fullness 0.8, age 45 years. Tilia cordata Mill. 20 trees: average diameter 14 cm; average height of 15 m; closure 0.7. The average age of the trees is 37 years. Quercus robur L. 20 trees: average diameter of 23 cm, average height of 22 m, closure of 0.7. The average age of the trees is 55 years. Pinus sylvestris L. 20 trees: average diameter 17 cm; average height of 19 m; closure 0.7. The average age of the trees is 50 years. Larix sukaczewii Dyl. 10

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trees: average diameter of 13.5 cm; average height of 14 m; closure 0.6. The average age of the trees is 35 years. Picea obovata Ledeb. 10 trees: average diameter 21 cm; average height of 20 m; closure 0.7. The average age of the trees is 50 years.

Teens: Populus balsamifera L., Quercus robur L., Tilia cordata Mill. Closure 0,1.

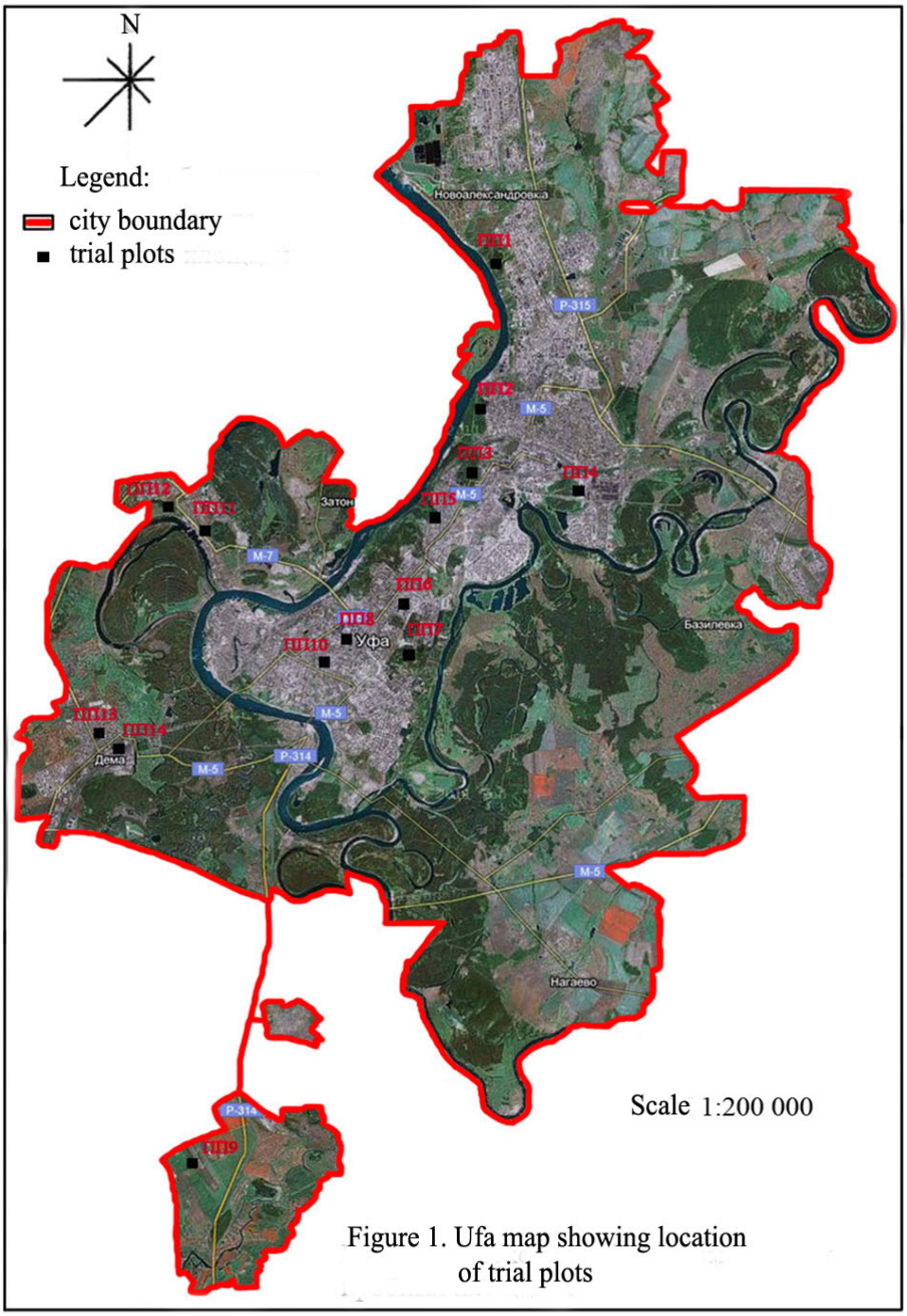

Figure 1. Ufa map showing location of trial plots

Figure 01. Ufa map showing location of trial plots

Underbrush: Acer platanoides L., Acer negundo L., Padus avium Mill., Sorbus aucuparia L., Corylus avellana L., Frangula alnus Mill., Lonicera tatarica L., Caragana arborescens LAM., Berberis vulgaris L. The total projective cover is 30%.

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Grass cover: Asarum europaeum L., Aconitum excelsum RCHB., Aegopodium podagraria L., Arctium lappa L., Stachys annua L., Capsella bursa-pastoris L., Geum urbanum L., Trifolium repens L., Chelidonium majus L., Achillea millefolium L., Tussilago farfara L., Polygonum aviculare L., Urtica dioica L., Taraxacum oridinalis Wigg., Cirsium vulgare (Savi) Ten., Tussilago farfara L., Arctium nemorales Lej., Galium odioratum (L.) Scop., Urtica dioica L., Polygonatum multiflorum (L.) All., Taraxacum oridinalis Wigg., Poa supine Schrad., Cirsium heterophyllum (L.) Hill., Hieracium umbellatum L., Arctium tomentosum Mill., Convallaria majalis L., Víola trícolor L., Calamagrostis epigeios (L.) Roth, Plantago major L. The total projective cover is 85%.

In this area, the relative vital status of the studied species belongs to the categories “healthy” and “weakened” (68,2-94%). There are no completely dried breeds. The relative life status of Populus balsamifera L., Betula pendula Roth, Larix sukaczewii Dyl., Picea obovata Ledeb. rated as “healthy.” Crown density ranges from 85% to 95%. The presence of dead branches on the trunk from 0% to 15%. The degree of damage to the leaves with toxicants and insects is from 0% to 10%. The relative life status of Tilia cordata Mill., Quercus robur L., Pinus sylvestris L. was rated as "weakened". The density of the crown is from 60% to 80%. The presence of dead branches on the trunk of 15% to 40%. The degree of damage to the leaves and needles with toxicants and insects is from 10% to 20%. There are damage to the trunks of entomosis (egg laying, stem settlement). Marked damage to man-made.

PTA№6 was laid near the Ufa instrument-making production association of the Oktyabrsky district of the city of Ufa. 20 Populus balsamifera L. trees were examined: average diameter 19.5 cm, average height 20 m, closure 0.5. The average age of the trees is 27 years. Betula pendula Roth 20 trees: average diameter 24 cm, average height 21 m, fullness 0.8, age 40 years. Tilia cordata Mill. 20 trees. The average diameter is 15 cm; average height of 14.5 m; closure 0.6. The average age of the trees is 37 years. Larix sukaczewii Dyl. 10 trees: average diameter 17 cm, average height 18 m, fullness 0.8. The average age of 45 years. Picea obovata Ledeb. 10 trees: average diameter of 17.5 cm, average height of 18 m, fullness of 0.8. The average age of 45 years.

Teens: Populus balsamifera L.

Grass cover: Urtica dioica L., Aegopodium podagraria L., Poa annua L., Heracleum sibiricum L., Tussilago farfara L., Taraxacum oridinalis Wigg., Urtica dioica L., Plantago major L. The total projective cover is 35%.

In this area, the relative vital status of the studied species is classified as “healthy” and “weakened”. There are no completely dried breeds. Relative life status of Populus balsamifera L., Betula pendula Roth, Tilia cordata Mill, Picea obovata Ledeb. rated as “healthy” (85-89.5%). Crown density ranges from 85% to 90%. The presence of dead branches on the trunk of 1% to 10%. The degree of damage to the leaves is from 0% to 10%. At the same time, Larix sukaczewii Dyl. rated as “weakened” (79%). Crown density ranges from 60% to 70%. The presence of dead branches on the trunk from 15% to 20%. The degree of damage to the needles ranges from 10% to 15%. Marked damage to man-made.

PTA№7 was laid on the territory of the park Lesovodov Bashkirii Octyabrski district of Ufa. 20 Populus balsamifera L trees were investigated: average diameter 19 cm, average height 18 m, closure 0.8. The average age of the trees is 26 years. Betula pendula Roth 20 trees: average diameter 22 cm, average height 23 m, fullness 0.7, age 40 years. Tilia cordata Mill. 20 trees: average diameter 17 cm; average height

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of 15.5 m; closure 0.8. The average age of the trees is 38 years. Quercus robur L. 20 trees were investigated: average diameter of 18.60 cm, average height of 18 m, closure of 0.8. The average age of the trees is 50 years. Pinus sylvestris L. 20 trees: average diameter 17.60 cm; average height of 19 m; closure 0.8. The average age of the trees is 50 years. Larix sukaczewii Dyl. 20 trees: average diameter of 18.6 cm, average height of 18 m, closure of 0.8. The average age of the trees is 55 years. Picea obovata Ledeb. 20 trees: average diameter of 18.6 cm, average height of 19 m, closure of 0.8. The average age of the trees is 47 years.

Teens: Tilia cordata Mill., Populus balsamifera L., Acer platanoides L., Ulmus glabra Huds. Closure 0,3.

Underbrush: Acer negundo L., Ribes aureum Pursh., Euonymus verrucosus SCOP., Caragana arborescens LAM., Sorbus aucuparia L.. The total projective cover is 30%.

Grass cover: Cirsium vulgare (Savi) Ten., Cynoglossum officinalis L., Achillea millefolium L., Geum urbanum L., Sonchus oleraceus L., Galium odioratum (L.) Scop., Aegopodium podagraria L., Artemisia vulgaris L., Viola mirabilis L., Polygonatum multiflorum (L.) All., Fragaria vesca L., Agrimonia pilosa Lebed., Dryopteris lilix-mas (L.) Schott, Veronica chamaedrys L., Asarum europaeum L., Paris quadrifolia L., Urtica dioica L., Arctium nemorales Lej., Plantago major L., Campanula trachelium L., Taraxacum oridinalis Wigg., Chelidonium majus L., Linaria vulgaris Mill., Rumex confertus Willd., Dactylis glomerata L. The total projective cover is 70%.

In this area, the relative vital status of all the species studied is classified as “healthy” (82-92,5%). The density of the crown is 85-95%. The presence of dead branches on the trunk from 0% to 15%. The degree of leaf damage by toxicants and insects is 0-10%. Vertex is not pronounced, phytopathological damage is absent, damage to trunks by entomopathies (egg laying, stem settlement) is insignificant.

PTA№8 was laid near the Ufa aggregate enterprise “Hydraulics” on the territory of the Soviet district of the city of Ufa. 20 Populus balsamifera L. trees were examined: average diameter 19 cm, average height 19 m, closure 0.3. The average age of the trees is 26 years. Betula pendula Roth 20 trees: average diameter 25 cm, average height 22 m, fullness 0.8, age 45 years. Tilia cordata Mill. 20 trees. The average diameter is 16 cm; average height of 14 m. The average age of trees is 38 years. Pinus sylvestris L. 10 trees: an average diameter of 14 cm, an average height of 16.5 m. The average age of the trees is 40 years. Picea obovata Ledeb. 10 trees: average diameter 16 cm; average height of 16.5 m. The average age of trees is 40 years.

Grass cover: Aegopodium podagraria L., Poa annua L., Tussilago farfara L., Taraxacum oridinalis Wigg., Geum urbanum L., Plantago major L., Artemisia vulgaris L. The total projective cover is 25%.

In this area, the relative vital status of all the species studied is classified as “healthy” (82-89,5%). The density of the crown is 85-90%. The presence of dead branches on the trunk of 1% to 15%. The degree of leaf damage by toxicants and insects is 0-10%. Vertexes in these areas are not pronounced, phytopathological damage is absent, damage to the trunks by entomopathies (egg laying, stem settlement) is insignificant.

PTA№9 was laid near The Ufa International Airport in the Kirovsky district of Ufa. 20 Populus balsamifera L. trees were examined: average diameter 18 cm, average height 21 m, closure 0.7. The average age of the trees is 28 years. Betula pendula Roth 20 trees: average diameter 22 cm, average height 21 m,

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fullness 0.6, age 40 years. Tilia cordata Mill. 20 trees: average diameter of 18 cm, average height of 16 m, closure of 0.7. The average age of trees is 40 years. Quercus robur L. 20 trees: average diameter 17 cm, average height 17.5 m, closure 0.8. The average age of trees is 40 years. Pinus sylvestris L. 10 trees: average diameter 17.0 cm, average height 19 m, closure 0.7. The average age of the trees is 50 years. Larix sukaczewii Dyl. 5 trees: average diameter of 17 cm, average height of 18 m, closure of 0.6. The average age of the trees is 50 years. Picea obovata Ledeb. 5 trees: average diameter of 17.0 cm, average height of 18 m, closure of 0.6. The average age of the trees is 43 years.

Teens: Tilia cordata Mill., Acer platanoides L., Populus balsamifera L. Closure 0,4.

Underbrush: Padus avium Mill., Caragana arborescens LAM., Frangula alnus Mill. The total projective cover is 30%.

Grass cover: Vicia cracca L., Filipendula ulmaria L., Urtica dioica L., Urtica urens L., Galium bortale L., Viola mirabilis L., Geum urbanum L., Cirsium heterophyllum (L.) Hill., Lathyrus sylvestris L., Stellaria nemorum L., Trifolium repens L., Trifolium pratense L., Achillea millefolium L., Prunella vulgaris L., Arctium nemorales Lej., Artemisia glauca Pall., Artemisia vulgaris L., Stellaria holostea L., Lysimachia nummularia L., Lamium album L., Lamium purpureum L., Cynoglossum officinalis L., Polygonatum multiflorum (L.) All., Polygonatum odoratum (Mill.). Druce (Polygonatum officinale All.), Paris quadrifolia L., Linaria vulgaris Mill., Veronica chamaedrys L., Cirsium vulgare (Savi) Ten. The total projective cover is 60%.

In this area, the relative vital status of the studied species belongs to the categories “healthy” and “weakened” (76-89,5%). There are no completely dried breeds. Relative life status of Populus balsamifera L., Betula pendula Roth, Tilia cordata Mill., Quercus robur L., Pinus sylvestris L., Picea obovata Ledeb. rated as “healthy.” Crown density ranges from 85% to 90%. The presence of dead branches on the trunk of 1% to 15%. The degree of damage to the leaves with toxicants and insects is from 1% to 10%. Relative vital status of Larix sukaczewii Dyl. rated as “weakened”. Crown density ranges from 60% to 70%. The presence of dead branches on the trunk from 15% to 20%. The degree of damage to the leaves and needles with toxicants and insects is from 10% to 20%. There are damage to the trunks of entomosis (egg laying, stem settlement).

PTA№10 was laid near Pharmstandard - UfaVita on the territory of the Kirovsky district of the city of Ufa. 20 Populus balsamifera L. trees were investigated: average diameter 17.5 cm, average height 21 m, closure 0.6. The average age of the trees is 27 years. Betula pendula Roth 20 trees: average diameter 23 cm, average height 21 m, fullness 0.8, age 43 years. Tilia cordata Mill. 20 trees: average diameter of 17.5 cm, average height of 15.5 m, closure of 0.6. The average age of trees is 39 years. Picea obovata Ledeb. 5 trees: average diameter of 9 cm, average height of 10 m, closure of 0.4. The average age of the trees is 25 years.

Grass cover: Aegopodium podagraria L., Poa annua L., Rumex confertus WILLD., Tussilago farfara L., Taraxacum oridinalis Wigg. The total projective cover is 25 %.

In this area, the relative vital status of the studied species belongs to the categories “healthy” and “weakened” (63- 86,5%). Of the fully dried species in this area, there is one Picea obovata Ledeb tree. Relative life status of Populus balsamifera L., Betula pendula Roth, Tilia cordata Mill. rated as “healthy.” Crown density ranges from 85% to 90%. The presence of dead branches on the trunk of 1% to 15%. The

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degree of damage to the leaves with toxicants and insects is from 1% to 10%. The relative life status of Picea obovata Ledeb. rated as “weakened” (Kulagin & Tagirova, 2015, p. 46). The density of the crown is from 60% to 80%. The presence of dead branches on the trunk from 20% to 30%. The degree of damage to the leaves and needles with toxicants and insects is from 10% to 20%.

7. Conclusion

Each individual modern industrial city represents a specific socio-ecological-economic system, which is characterized by a unique history of development and environmental management. The urban agglomeration of the city of Ufa is characterized by territorial heterogeneity, uneven distribution of industrial enterprises, specificity and environmental problematic location of the residential zone. The growth of the city was due to the annexation of rural areas with settlements located on them. In recent decades, the construction of cottage settlements and the formation of holiday villages and garden arrays has been developed. The development of existing and construction of new enterprises continues. Over time, with the development of the city and the expansion of the boundaries of the city, the problem of re-forming the functional significance of individual territories arises. Initially planned, designated and existing sanitary protective forest stands, water intake areas, landfill waste areas have now turned out to be urban.

Urban forest plantations should be considered as a single landscape-natural complex, and its structural and functional state should be optimized taking into account natural and climatic features, man-made load characteristics, and the state of existing natural and artificial forest ecosystems.

A comparative characteristic of the stability of individual tree species has made it possible to establish that the relative vital status of Populus balsamifera L., Betula pendula Roth, Tilia cordata Mill. and Picea obovata Ledeb. estimated to be “healthy,” and the relative vital status of Quercus robur L., Pinus sylvestris L., and Larix sukaczewii Dyl. rated as "weakened." More than 50% of forest plantations in Ufa belong to the categories of ripening, ripe and overripe. When reconstructing forest plantations, it should be taken into account that the least resistant tree species are Quercus robur L., Pinus sylvestris L. and Larix sukaczewii Dyl. The most resistant tree species in the conditions of the Ufa industrial center are Betula pendula Roth, Populus balsamifera L., Tilia cordata Mill.

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