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研究论文

城市工业区绿地生态服务功能的计量评价——以武汉钢铁公司厂区绿地为例

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摘要 城市绿地作为城市生态系统的重要组成部分，在改善城市环境质量上发挥了重要作用。特别是在城市大型工业区，其环境质量的改善更是依赖于绿地生态服务功能。以城市绿地固定二氧化碳、释放氧气、蒸腾吸热、减少污染物、滞尘、减噪等6项生态服务功能作为城市工业区生态效益计量评价的指标体系，在对武汉钢铁公司厂区绿地实地调查的基础上，并结合绿地GIS和各层片叶面积指数，对厂区绿地叶面积绿量进行了定量研究。并通过各层片单位叶面积生态效益值的测定，定量研究了城市工业区绿地的生态服务功能。结果表明，厂区绿地叶面积总绿量是1694.21 hm^2，以乡土乔木树种为主，其中落叶乔木绿量为399.8 hm^2，常绿乔木绿量为409.0 hm^2。城市绿地的生态效益取决于绿地叶面积绿量和植被生态功能，植被生态功能由组成植物本身的冠形、叶表面特性及生理特性决定。单位叶面积日固碳释氧量和蒸腾吸热量均以草本类最大；常绿乔木叶片对SO_2污染物的年吸收量最大，为0.81 $g•m^{-2}•a^{-1}$；而常绿灌木和落叶灌木叶片的滞尘能力较强，草本类滞尘能力最弱。武钢厂区园林绿地生态服务功能的年总货币值为人民币20100.21万元，以夏季蒸腾吸热效益的货币值最高，达16330.56万元。其次是固定二氧化碳效益的货币值为2969.39万元，固定CO_2量为23850.50 $t•a^{-1}$。吸收SO_2量为6563.44 $kg•a^{-1}$，其货币化值所占比重最小，只有0.39万元。厂区园林绿地年释放O_2量为17345.82 $t•a^{-1}$，年滞尘量2884.51 $t•a^{-1}$。在城市工业区绿化中，应根据绿地功能需要，配置适应环境且生态功能强的树种，并通过绿地合理的复层结构来增加单位绿地面积上的绿量水平，以增强绿地的生态服务功能，有效地改善工矿企业的环境质量。

关键词 城市绿地；环境质量；生态服务功能；叶面积指数；计量评价

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Estimation of ecosystem services of urban green-land in industrial areas: A case study on green-land in the workshop area of the Wuhan Iron and Steel Company

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Abstract Green-land is a vital component of an urban ecosystem and plays an important role in purifying the environment. Especially in large-scale industrial districts, the ecological services provided by vegetation are beneficial to protecting local environments. In this study, amounts of CO2 absorbed, O2 released, heat absorbed through transpiration, SO2 reduced, dust retention an

d noise reduction have been selected as main variables of study. These indexes allow qualitative a ssessment of ecological services based on the leaf area during the field work in the workshop are a of the Wuhan Iron and Steel Company. Generally, the identified indexes were calculated from t he observed data collected in field survey.

The green-land leaf area was obtained through investigation of synusia (No.2 synusian devised b y H.Gams in 1918) structure and covering, leaf area index (LAI). All the indexes were calculate d based on the estimated leaf area. This was combined with an assessment of value through broug ht by the ecosystem. The areas of interest included CO2 absorption with the carbon tax, O2 relea se with the value of marketed products, heat absorption by transpiration with the substitution of el ectricity, SO2 absorption and dust retention with the market valuation, noise reduction with the wi ll-paying. The ecological services of green-land in urban industrial areas were estimated by measu ring the ecologic benefit per unit. The results showed:

(1) Most trees planted in the workshop area were native species. Of them, the majority were of a rbor decent. The leaf area was highest in different synusia. The evergreen and deciduous arbors w ere 409.0 hm2 and 399.8 hm2, respectively. And the sum of leaf area in different workshop area s was 1694.21 hm2.

(2) The ecological benefits of green-land mainly depend on the amount of green space. The capac ity of the ecological service of plant was determined by the physiological characteristic of plant an d leaf surface as well as by the structure of tree crown. Since the synusias were composed by vari ous plants with different capacity, their ecological benefits were different. While the SO2 reductio n absorbed by evergreen was the highest at 0.81 g•m-2•a-1of all synusias. And the ability of ever green shrub and deciduous shrub was stronger, while that of the herbaceous plant was the weake st.

(3) In 2001, the total green-land area was 312.38 hm2 in the workshop area of the Wuhan Iron a nd Steel Company. The amount of CO2 absorbed, O2 released and dust retention reduced by gr een-land in the workshop area were 23850.50 t•a-1, 17345.82 t•a-1 and 2884.51 t•a-1, respec tively. The total value of ecological benefits was 201,002,100 Yuan. Among them, the value of he at absorption was the highest at 163,305,600 Yuan, followed next by that of CO2 absorption a t 29,693,900 Yuan. The amount of SO2 reduction was lowest at about 3,900 Yuan. In additio n, the value of O2 released, dust retention and noise reduction were 6,938,300, 490,400 and 57 0,000 Yuan respectively.

In summary, the plants with better adaptation and ecological effect should be strategically chose n and combined in different ways for their diverse benefits in varying ecological environments. Th e leaf area also could increase by combining the arbor, shrub and herb to realize the maximum ec ological benefits, giving greater ecological service for improved environments in industrial districts.

Key words urban vegetation _ environmental quality _ ecosystem services _ leaf area index _ quantitative analysis

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