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Biodeterioration of Historic Parks of UK by Algae

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Abstract : This study investigates the algal genera responsible for biodeterioration, biodegradation, and biological pollution in two historic parks in Milton Keynes, UK: Campbell Park and Great Linford Manor Park. Various sites within these parks were selected to evaluate the morphological, aesthetic, and physical effects of algal growth on park structures and natural features. Specimens and swabs were mechanically collected from the selected sites. Algal specimens were preserved in Lugol's solution and labelled with standard information for subsequent analysis. Using photomicrography and taxonomic keys, researchers identified algal species from aerial, terrestrial, and aquatic habitats. This comprehensive analysis revealed a diverse range of algae, both homogeneously and non-homogeneously mixed across different environments. The qualitative study identified seven classes of algae. Chlorophyceae, the predominant class, was represented by eleven genera: Chlorella, Chlorococcum, Cladophora, Coenochloris, Cylindrocapsa, Microspora, Prasiola, Spirogyra, Trentepholia, Ulothrix, and Zygnema. Charophyceae included four genera: Cosmarium, Klebsormidium, Mesotaenium, and Mougeotia. Xanthophyceae had two genera: Tribonema and Vaucheria. Bacillariophyceae (diatoms) included six genera: Acnanthes, Bacillaria, Fragilaria, Gomphonema, Synedra, and Tabellaria. Dinophyceae had one Dinoflagellate genus. Rhodophyceae included Bangia and Batrachospermum. Cyanophyceae comprised five genera: Chroococcus, Gloeocapsa, Scytonema, Stigonema, and Oscillatoria. Quantitative analysis revealed that Chlorophyceae was the predominant class across the two parks. Coenochloris, a member of Chlorophyceae, was isolated from thirteen sites, while Gloeocapsa from Cyanophyceae was found at twelve sites. These algae impart various shades of green to the surfaces they colonise, forming biofilms that affect the aesthetic and physical integrity of the structures. Certain algae were park-specific. Prasiola, Vaucheria, and Trentepholia were isolated exclusively from Great Linford Park, with Trentepholia imparting a distinctive orange colour to walls and trees due to the pigments chlorophyll, β-carotene, and quinone. Mesotaenium, Dinoflagellate, Gomphonema, Fragilaria, Tabellaria, and two unidentified genera were exclusive to Campbell Park. The study found the highest number of algal genera (25) in Campbell Park's canal, followed by 21 in the canal at Great Linford Manor Park. Algae were also found on walls, wooden fences, metal sculptures, and railings, causing surface erosion, natural weathering, and cracking. These physical changes lead to technical and mechanical instability, resulting in significant damage to building materials. Algal biofilms secrete organic acids that contribute to the biosolubilisation and biodeterioration of these materials. Additionally, aquatic algal blooms identified during the study release toxins that pose health risks, including allergies, skin rashes, vomiting, diarrhoea, fever, muscle spasms, and respiratory infections. This study highlights specific areas within these historic sites that need attention and provides valuable insights into conservation strategies to mitigate the negative impacts of algal biocolonisation. Recommendations include regular monitoring and preventive measures through various treatments to preserve the integrity of these historic parks.

Keywords : biodeterioration, historic parks, algae, UK
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