Plan Overview

A Data Management Plan created using DMPonline

Title: ASSESSING THE IMPACT OF URBAN GREEN SPACE ON AIR QUALITY AND HUMAN HEALTH AND WELL-BEING; CASE STUDY OF CENTRAL PARK PLYMOUTH.

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Template: DCC Template

Project abstract:

Urban green spaces play a vital role in enhancing environmental quality and public health, yet their specific impacts require localized assessment. This study examines Central Park Plymouth as a case study to quantify its effects on air pollution mitigation and human well-being. The research employs a mixed-methods approach, combining quantitative environmental monitoring of particulate matter (PM2.5, PM10) and nitrogen dioxide (NO_2) levels with qualitative surveys and interviews assessing park users' health perceptions and usage patterns.

Air quality sensors will be strategically placed throughout the park and surrounding urban areas to measure pollutant concentrations across different seasons and times of day. Simultaneously, park visitors will be recruited through on-site engagement and community partnerships to participate in surveys exploring their physical activity levels, stress reduction, and overall satisfaction with the green space. Special attention will be given to identifying potential disparities in access and benefits among different demographic groups.

The study anticipates demonstrating significant correlations between park visitation and improved air quality indicators, as well as positive health outcomes reported by users. These findings will provide empirical evidence to support urban planning policies that prioritize green space development and maintenance. Furthermore, the research aims to establish best practices for equitable green space design that maximizes environmental and public health benefits for all community members.

Ethical considerations are rigorously addressed through informed consent procedures, data anonymization, and secure information handling compliant with GDPR regulations. The participatory approach ensures community voices directly inform policy recommendations, enhancing the relevance and applicability of the findings. Results will be disseminated through academic publications, public reports, and community workshops to maximize impact.

This investigation contributes to the growing body of evidence on urban green infrastructure's multifunctional benefits while providing specific, actionable insights for Plymouth's sustainable development. The methodology serves as a replicable model for similar assessments in other urban contexts.

ID: 175127

Start date: 11-03-2025

End date: 11-04-2025

Last modified: 04-04-2025

Copyright information:

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Data Collection

What data will you collect or create?

1. Environmental Data (Quantitative)
- Air Quality Measurements:
  - Levels of PM2.5, PM10, NO_2, and O_3 using portable sensors placed at key locations in and around Central Park.
  - Comparative data from **non-green urban areas** (control sites) to evaluate pollution mitigation effects.
- Meteorological Data:
  - Temperature, humidity, and wind speed (to account for weather influences on pollutant dispersion).

- Vegetation Analysis:
  - Tree canopy coverage, plant diversity, and green space density via **GIS mapping** and satellite imagery.

2. Human Health & Well-being Data (Mixed-Methods)
- Survey Responses:
  - Demographics (age, gender, frequency of park use).
  - Self-reported health benefits (e.g., stress reduction, improved mood, physical activity levels).
  - Perceptions of air quality (e.g., "Do you feel the air is cleaner in the park?").
- Behavioral Observations:
  - Park activities (walking, cycling, socializing) recorded at different times to assess usage patterns.
- Optional Follow-ups:
  - Short interviews or focus groups with frequent users to explore deeper qualitative insights.

3. Spatial & Temporal Data
- Time-Stamped Measurements:
  - Hourly/daily fluctuations in air quality linked to park visitation rates.
- Geospatial Mapping:
  - Overlay of pollution data with park infrastructure (paths, seating areas, vegetation zones) to identify hotspots.

4. Secondary Data (For Context)
- Local Health Statistics: Public records on respiratory illness rates in Plymouth.
- Urban Planning Documents: City policies on green space development.

Ethical Considerations
- All participant data will be anonymized (no names/IP addresses stored).
- Environmental sensors will not record personal movements (only aggregate air quality).

- Surveys will include clear opt-out options per GDPR.

Expected Outcomes
This multi-layered dataset will:
1. Quantify the park’s impact on reducing air pollution.
2. Correlate green space use with health/well-being benefits.
3. Inform urban planning to optimize green infrastructure.

How will the data be collected or created?

The study will employ a mixed-methods approach to gather comprehensive data through the following techniques:

Air quality monitoring will be conducted using calibrated portable sensors strategically placed throughout Central Park and adjacent urban areas. These devices will record concentrations of key pollutants including particulate matter (PM2.5 and PM10) and nitrogen dioxide at regular intervals over the study period. Sensor data will be supplemented with meteorological information from local weather stations to account for atmospheric conditions.

Vegetation analysis will utilize satellite imagery and geographic information system (GIS) tools to map and quantify green space characteristics. This will include measurements of canopy cover, vegetation density, and biodiversity distribution across the park.

For human health and well-being data, park visitors will be invited to complete structured surveys administered through both on-site interviews and digital platforms. The survey instrument will incorporate validated scales to assess physical activity levels, mental health indicators, and perceptions of environmental quality. Additionally, systematic behavioral observations will document patterns of park usage through timed interval recording.

A subset of participants will be recruited for in-depth interviews to explore qualitative aspects of their experiences. These conversations will be audio-recorded with consent and later transcribed for thematic analysis.

Secondary data will be obtained from public health records and urban planning documents to provide contextual information about community health trends and existing green space policies.

All data collection procedures will adhere to ethical guidelines, ensuring participant confidentiality through anonymization protocols and secure data storage practices. Equipment will be regularly maintained and calibrated to ensure data accuracy throughout the study period.

Documentation and Metadata

What documentation and metadata will accompany the data?

1. Core Metadata

- Dataset Descriptions:
  - File naming conventions (e.g., `AirQuality_Plymouth_2024.csv`).
  - Variable definitions (e.g., `PM2.5_ugm3 = particulate matter <2.5µm in µg/m³`).
  - Units of measurement (e.g., NO_2 in ppb).
  - Time/date stamps (UTC timezone).
  - Geographic coordinates (WGS84) for sensor locations.
- **Instrumentation Details**:
  - Sensor models (e.g., PurpleAir PA-II), calibration protocols, and precision/error ranges.
  - Survey tools (e.g., Qualtrics questionnaire versions).

2. Methodological Documentation
- Data Collection Protocols:
  - Standard Operating Procedures (SOPs) for field measurements (e.g., sensor placement height, survey administration scripts).
  - Sampling strategies (e.g., random vs. stratified participant recruitment).
- Preprocessing Steps:
  - How raw data were cleaned (e.g., outlier removal, averaging intervals).
  - Software/tools used (e.g., Python Pandas for data wrangling).

3. Ethical & Administrative Records
- Participant Information Sheets:
  - Approved consent forms and debriefing materials.
- Data Governance:
  - Access restrictions (e.g., "Restricted to research team until publication").
  - Anonymization techniques (e.g., pseudonymization keys stored separately).
  - Retention period (e.g., "Raw data archived for 10 years per university policy").

4. Project-Level Metadata
- README Files:
  - Folder structure explanations.
  - Contact person for data queries.
- Codebooks:
  - For survey data (e.g., Likert scale anchor points: 1 = "Strongly disagree").
- **Citation Guidance**:
  - How to credit the dataset in publications.

5. Standards Compliance
- Metadata Schemas:
  - Adherence to FAIR principles (Findable, Accessible, Interoperable, Reusable).
  - Discipline-specific standards (e.g., ISO 19115 for geospatial data).

Example Metadata Entry (for air quality data):
```plaintext
Filename: AQ_CentralPark_Spring2024.csv
Variables: PM2.5 (µg/m³), $NO_2$ (ppb), Temp (°C)
```

Collection: Hourly averages, 1 Mar–31 May 2024
Location: Lat/Long (50.3708°N, 4.1425°W)
Instrument: PurpleAir PA-II (calibrated 5 Feb 2024)
Missing Data: "NA" (blanks due to sensor maintenance 12–14 Apr)
License: CC-BY-NC 4.0
```

## Ethics and Legal Compliance

### How will you manage any ethical issues?

Ethical Issues Management Plan

This study will adhere to rigorous ethical standards through the following protocols:

Informed Consent Process
All participants will receive clear written and verbal information about the study's purpose, their rights, and data handling procedures before agreeing to participate. Consent forms will be available in both digital and paper formats, with alternative options (such as verbal consent) available for participants with literacy challenges. For participants under 18 years old, parental consent will be obtained alongside assent from the minor.

Participant Rights Protection
Participants will be explicitly informed of their right to withdraw from the study at any point without penalty or consequence. A straightforward withdrawal process will be established, including a dedicated email contact and simple opt-out procedures for digital participation. Those who choose to withdraw will have their data immediately removed from the study dataset unless it has already been anonymized and aggregated.

Privacy and Data Protection
All collected data will be pseudonymized by replacing personal identifiers with unique codes. Personal information will be stored separately from research data in password-protected files. Digital data will be stored on secure university servers with encrypted backups, while physical copies will be kept in locked filing cabinets accessible only to the research team. All data will be retained for the minimum period required by institutional policies before secure deletion.

Risk Assessment and Mitigation
Potential risks to participants have been identified as minimal, primarily relating to possible discomfort during interviews about health and environmental experiences. To address this, interviewers will be trained to recognize signs of distress and will have information about support services available. The research design excludes collection of particularly sensitive personal information, and participants will be reminded they can skip any questions they prefer not to answer.

Vulnerable Populations
Special consideration will be given to potentially vulnerable participants, including children, elderly individuals, or those with cognitive impairments. Additional safeguards will include simplified consent
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forms, the option to have a support person present during interviews, and extended time for decision-making about participation.

Ethical Oversight and Compliance

The study will operate under the approval of the University of Plymouth's Research Ethics Committee, with all procedures regularly reviewed for compliance. An ethics log will be maintained throughout the project to document any concerns, participant queries, and how they were resolved. This log will be available for review by the ethics committee upon request.

Community Engagement and Transparency

Regular updates about the study's progress and findings will be shared with community stakeholders through public forums and accessible summary reports. A feedback mechanism will be established for participants and community members to ask questions or raise concerns about the research process.

Data Sharing and Publication

Any public sharing or publication of research data will use fully anonymized formats. When presenting findings, particular care will be taken to ensure no individual or small group could be identified through the reported information. Aggregate data will be made available to support open science initiatives while protecting participant confidentiality.

How will you manage copyright and Intellectual Property Rights (IPR) issues?

This study will implement the following measures to properly manage copyright and intellectual property rights:

For research outputs including publications, reports, and datasets:

All original materials created for this study will remain the intellectual property of the University of Plymouth, in accordance with standard institutional policies. However, where appropriate, research outputs will be published under Creative Commons licenses to facilitate knowledge sharing while protecting authorship rights.

For participant-generated content:

Written consent forms will include clear provisions regarding ownership of any materials participants contribute (such as interview responses or survey answers). Participants will retain copyright of their original expressions while granting the research team permission to analyze, anonymize, and include their contributions in research outputs.

For third-party materials:

Any copyrighted materials used in the research process (such as survey instruments, software, or archival documents) will be properly licensed or used within fair dealing provisions for academic research. Proper attribution will be given for all third-party content.

For data collection instruments:

Original questionnaires, interview protocols, and other research tools developed specifically for this project will be clearly marked with copyright notices and licensing terms when shared externally. These materials may be made available for reuse by other researchers under appropriate open licenses.

For collaborative works:

Any joint publications or outputs created with partner organizations will include written agreements specifying authorship order, copyright ownership, and permitted uses of the materials prior to publication.

For digital assets:

Photographs, videos, or audio recordings created for the study will include embedded metadata identifying copyright ownership and usage rights. Where such materials feature identifiable individuals, model release forms will be obtained.

For long-term preservation:

All copyrighted materials associated with the study will be properly documented in the project's metadata records, with clear indications of ownership and permitted uses to guide future access and reuse.

All research team members will receive training on intellectual property rights relevant to their roles in the project, including proper handling of copyrighted materials and procedures for protecting the study's own intellectual outputs.

The project will maintain a central register of all copyright and IP considerations, including licenses obtained, permissions granted, and attribution requirements for third-party materials. This register will be reviewed regularly to ensure ongoing compliance.

Any commercialization of research outputs would follow University of Plymouth policies on technology transfer and intellectual property management, with benefits shared according to institutional guidelines and any prior agreements with funding bodies or partners.

Storage and Backup

How will the data be stored and backed up during the research?

The research data will be managed through a secure, multi-tiered storage system designed to ensure both accessibility and protection of all project information throughout the study duration and beyond.

Primary data storage will utilize the University of Plymouth's enterprise-level, password-protected servers for all digital files. These institutional systems provide enterprise-grade security including firewalls, intrusion detection, and regular security updates. All research team members will access data through secure university login credentials with role-based permissions appropriate to their involvement in the project.

Field-collected data from mobile devices or portable sensors will be transferred to secure servers within 24 hours of collection using encrypted transfer protocols. Original files on collection devices will be retained temporarily as an additional backup before being securely wiped according to university data sanitization standards.

For physical data such as signed consent forms or paper surveys, these will be digitized using secure departmental scanners and stored on the protected servers. Original paper copies will be kept in

locked filing cabinets in university-approved secure spaces, accessible only to authorized research personnel.

A structured backup regime will be implemented with three key components:
1) Daily incremental backups to university-managed storage
2) Weekly full-system backups to both on-site and geographically separate off-site locations
3) End-of-phase archival backups prior to major project milestones

All backups will maintain the same encryption and access controls as primary storage. Backup integrity will be verified monthly through test restoration procedures. The backup system includes version control to allow recovery of previous file versions if needed.

Cloud storage solutions may be used for collaborative work, but only university-approved platforms with adequate security certifications (such as Microsoft OneDrive for Business through institutional accounts) will be employed. No research data will be stored on personal devices or unauthorized cloud services.

For long-term preservation following project completion, a curated dataset will be prepared for deposit in the university's research data repository. This will include comprehensive documentation, anonymization where required, and appropriate metadata to facilitate future access while maintaining confidentiality commitments.

All storage and backup procedures comply with University of Plymouth data protection policies and UK data legislation including GDPR. The system is designed to maintain data availability throughout the research process while protecting against loss, corruption, or unauthorized access. Regular audits will verify compliance with these storage protocols.

How will you manage access and security?

Data Access and Security Management Plan

Access to research data will be strictly controlled through a multi-layered security approach. All digital files will be stored on the University of Plymouth's secure servers, which are protected by enterprise-grade firewalls and intrusion detection systems. Access to these servers requires university credentials with two-factor authentication.

The research team will implement role-based access controls. Only authorized personnel will be granted permissions appropriate to their responsibilities. Principal investigators will have full access, while research assistants may be limited to specific datasets needed for their tasks. All access attempts will be automatically logged and reviewed monthly.

Physical data such as consent forms will be kept in locked filing cabinets in secure university offices. Access to these areas requires keycard authorization, and all visitors must sign in. Digital data transfers will use encrypted protocols only, with email prohibited for sharing sensitive information.

All devices used for research will employ full-disk encryption and automatic locking when idle. Field devices like tablets will be configured to remotely wipe data if lost or stolen. Cloud storage will be restricted to university-approved platforms with adequate security certifications.

A comprehensive incident response plan has been developed covering data breaches, including immediate reporting procedures and containment measures. The research team will complete mandatory data protection training before accessing any materials.

Regular security audits will verify compliance with all protocols. Backup systems maintain the same security standards as primary storage. When the project concludes, data will be archived following university retention policies while maintaining all security protections.

This approach ensures compliance with GDPR, UK data protection laws, and institutional policies while protecting participant confidentiality throughout the research lifecycle.

Selection and Preservation

Which data are of long-term value and should be retained, shared, and/or preserved?

The research will identify several datasets with enduring value that warrant long-term preservation. Primary among these are the processed and quality-controlled environmental measurements, including calibrated air quality data showing pollutant levels across different park locations and seasons. The geospatial datasets mapping vegetation distribution and park infrastructure also hold significant future research potential.

Anonymized versions of the survey responses containing park users' health and wellbeing assessments should be preserved, with all direct identifiers removed but retaining key demographic variables for analysis. These will provide valuable longitudinal insights when compared with future studies.

The study's methodological documentation, including detailed protocols for data collection, survey instruments, and analysis procedures, should be maintained to enable replication. Summary datasets of aggregated findings and statistical analyses have lasting value for policy development.

All preserved data will be archived in secure university repositories with appropriate access controls. Sensitive raw data containing personal information will be securely destroyed after analysis completion, following ethical guidelines. Metadata will be comprehensive enough to support future reuse while protecting participant confidentiality. Retention periods will align with institutional policies and research best practices.

What is the long-term preservation plan for the dataset?

Long-Term Preservation Plan

The research datasets will be preserved for future access through a tiered approach. Processed environmental measurements, anonymized survey responses, and geospatial data will be deposited in the University of Plymouth's institutional repository, which provides persistent digital identifiers and secure storage. These materials will be saved in sustainable file formats including CSV for numerical

data, GeoJSON for spatial information, and PDF/A for documentation.

Metadata will be created following disciplinary standards to ensure proper contextualization and discovery. Publicly shareable data will be made available under a Creative Commons license, while sensitive materials will have controlled access with approval processes. All datasets will be retained for a minimum of 10 years with regular integrity checks.

Supporting documentation will include detailed methodology descriptions, variable definitions, and any necessary usage restrictions. The complete package will enable future researchers to understand, evaluate, and potentially replicate the study while maintaining ethical commitments to participant confidentiality throughout the preservation period.

This preservation strategy aligns with funder requirements and best practices for responsible data management in environmental health research.

Data Sharing

How will you share the data?

The research data will be shared through multiple channels while maintaining ethical and legal protections. Processed datasets with long-term value will be deposited in the University of Plymouth's institutional repository, which provides persistent access via digital object identifiers (DOIs). This includes:

1) Anonymized survey responses (with all personal identifiers removed)
2) Calibrated environmental measurements (air quality data)
3) Geospatial maps of vegetation distribution

Publicly shareable data will be released under a Creative Commons Attribution-NonCommercial (CC BY-NC) license, allowing reuse with proper attribution. Sensitive data requiring additional protections will be made available through controlled access - researchers must submit formal requests justifying their need for the data.

All shared datasets will include comprehensive documentation explaining:
- Collection methods
- Variable definitions
- Quality control procedures
- Any usage restrictions

Project summaries and key findings will be shared through community workshops and plain-language reports for Plymouth stakeholders. Raw data containing personal information will never be shared; only fully anonymized or aggregated data will be released.

This tiered sharing approach maximizes research impact while protecting participant confidentiality.

Are any restrictions on data sharing required?

Data Sharing Restrictions

Certain datasets from this study will have controlled access due to ethical and legal considerations. Raw survey responses containing potentially identifiable information, even after anonymization, may be restricted if there is any possibility of participant re-identification. Interview recordings will only be shared in fully transcribed and redacted text formats.

Data obtained through partnerships, such as air quality measurements from local government sensors, may be subject to additional sharing limitations as specified in our data use agreements. All shared data will include non-commercial use clauses to prevent unauthorized commercial exploitation.

An embargo period of up to two years may apply to some datasets to allow for complete analysis and publication of primary research findings. International data sharing will comply with UK GDPR requirements, which may necessitate additional safeguards for transfers outside the UK/EU.

The metadata for each dataset will clearly document any applicable restrictions. Researchers seeking access to restricted data may submit formal requests through the University of Plymouth's ethics committee, with access granted based on legitimate research needs and compliance with all ethical requirements.

Responsibilities and Resources

Who will be responsible for data management?

The research team will implement a shared responsibility model for data management throughout the project lifecycle. The Principal Investigator (PI) will bear overall accountability for ensuring compliance with ethical and institutional requirements. They will approve the Data Management Plan and oversee its implementation.

A designated Data Manager from the research team will handle day-to-day operations including:
- Organizing and documenting file structures
- Implementing version control procedures
- Managing access permissions
- Coordinating regular backups
- Preparing datasets for archiving

Individual researchers will be responsible for:
- Properly collecting and recording data according to protocols
- Immediately transferring field data to secure storage
- Maintaining confidentiality of participant information
- Flagging any data quality issues

The University of Plymouth Research Data Service will provide support with:
- Repository deposition

- Metadata standards
- Long-term preservation
- Access control systems

Regular team meetings will review data management practices, with annual audits conducted to ensure ongoing compliance. This distributed approach ensures expertise is applied appropriately while maintaining clear accountability at all stages.

What resources will you require to deliver your plan?

To successfully execute this study, you will need:

1. Equipment:
   - Portable air quality sensors (e.g., PurpleAir or AQMesh units) for pollutant monitoring.
   - Weatherproof enclosures and mounting hardware for field deployment.
   - Tablets or smartphones for digital data collection in the park.

2. Software:
   - Statistical analysis tools (e.g., R, Python, or SPSS licenses).
   - GIS software (e.g., QGIS or ArcGIS) for spatial mapping.
   - Secure data storage platforms (university-provided cloud or servers).

3. Personnel:
   - Research assistants for fieldwork (sensor maintenance, surveys).
   - Technical support for sensor calibration/data processing.

4. Institutional Support:
   - Ethics review and compliance oversight.
   - Access to the university’s data repository for archiving.

5. Budget:
   - Sensor purchase/rental, travel costs for field visits, and participant incentives (if applicable).

6. Time:
   - Allocation for data collection (seasonal variations), analysis, and stakeholder engagement.