# How does Human Impact affect the Biodiversity of Marshland in my local area?

**George Mayes**

**(CRISP Telecom Researcher)**

# Contents

# Abstract

This project studied an area of marshland in order to discover whether there was a significant link between human traffic and biodiversity. Point samples were obtained for 10 sites, each site selected to represent different areas within the marshland. Simpson's equation was used to obtain 10 SDI values, which were then combined with traffic rankings. Spearman's Rank was used to test the link between the two factors. The value obtained was 0.952 for the 10 pairs and it was found that there was less than 1% probability that the link between the two factors was due to chance. This project concludes that there is a strong relationship between human traffic on biodiversity

# Introduction

The aim of my investigation is to discover how humans and their activities can affect biodiversity in an area of marshland near my home. I will look specifically at the plant life and composition in the area.

I have chosen this project as I am keenly interested in biodiversity because over the last few decades it has become an important global issue. As man burns vast quantities of fossil fuels and colonises areas that were once home to a wide variety of flora and fauna, many species are being forced into decline. I was interested to apply this larger issue to my local area in a more simplified form.

I was also inspired by the field work I did on a 6-day A-Level Biology field trip to Aberystwyth I went on with school in the Summer Term. Here I learnt many types of data collection and analysis as well as familiarising myself with many new types of equipment. My enjoyment of this trip led me towards a linked topic when I chose to take part in the Extended Project.

Whilst I would not be able to measure all aspects of human impact, there was a reasonable amount that I could. Therefore I felt my research would be valuable and that I had chosen a good topic to focus my project around.

I have chosen a large area of town-owned marshland just outside the town I live in. This area is both within easy walking distance and is also public access. This meant that whilst it is managed and looked after, many people (and dogs) use the area. It also has a small herd of grazing cattle that live there some of the year and the Kennet and Avon Canal runs through it. This meant that there is a wide variety of types of impact which provides more for my project to investigate than in other local areas.

Being marshland, the area is naturally more biodiverse than other local ecosystems of grassland and woodland. I decided I would try and find somewhere that is, in places, quite biodiverse because it would be easier for me to collect data here than in an environment that naturally has little wildlife. This site was a good choice because there are very distinct micro-ecosystems within it that can be easily distinguished.

I am hoping my investigation will show whether or not certain types of human impact have a significant effect on biodiversity. If my results do show that a certain type of activity is damaging plant life and causing localised extinction of vulnerable species, the management teams (mentioned later) may want to carefully examine them. My research may then be used to help advise future planning decisions on the site to help maintain biodiversity and reduce negative human impact.

My findings may also be of use to other people conducting similar projects so they can see where there results fit in amongst others worldwide. This was of use to me when I researched for my project so it may also be of use to others in a similar position.

My null hypothesis is that:

*"Local marshland biodiversity is not significantly affected by the traffic levels different areas receive"*

I will accept or reject this depending on the results of my fieldwork.

## Freeman's Marsh, Hungerford

Here is some additional information about Freeman's Marsh, the site I am conducting my research on:

The site is 40 hectares in size and lies between the First Great Western railway line and the A4. Both the Kennet and Avon Canal and the River Dun run through the site as well as numerous small footpaths. The site in itself is quite diverse as it incorporates a broad range of natural habitats such as:

- Marshland
- Hedgerows
- Meadows
- Scrub
- Woodland
- Grassland
- Reed beds

However, the site is predominantly a mixture of wet meadows and fertile grassland. The site has been owned by the town since 1343, when it was given to the citizens by John O'Gaunt. It has been carefully managed without the use of fertilisers or pesticides to preserve its rare native species of animals and plants. It is an important attraction for the town and is popular among dog walkers, ramblers, canal boaters and many of the townspeople. Cows graze on the land during the summer months, providing some control of growth without using artificial alternatives.

The area is managed and protected principally by the Town and Manor of Hungerford. This organisation of local people has ensured the preservation of the vulnerable ecosystem by controlling access and managing plant growth. They kindly gave me permission to carry out my research after I had explained what I planned to do and how I intended to go about doing it, as well as providing me with some additional information about the site.

(Using information from: **www.hungerford.uk.net/today**)

## H.E.A.T

This acronym stands for the Hungerford Environmental Action Team. They are a group of dedicated local people who try to protect and improve the environment in and around Hungerford. They run and are involved in many events around the year helping to promote awareness of environmental issues and get local people and organisations involved in schemes to help reduce Hungerford's negative impact on the environment.

Whilst HEAT are primarily focused on tackling climate change, they also have a sub-group that is concerned with landscape and biodiversity. Below are some of their main aims:

- To re-establish the connection between Hungerford and the surrounding countryside
- To audit local biodiversity using nationally approved methodology and to identify significant changes
- To encourage and support local landowners and managers in their attempts to increase biodiversity
- To ensure that future developments in the area do not damage biodiversity

- To raise awareness of local biodiversity in Hungerford

Several of these aims would involve the protection of the site I am studying so I have included this small section to offer a specific aim to my research. By showing my findings to this group it may be of great use to them and may give them a focused method on how to audit biodiversity of other sites. Whilst the methods I have used are accurate and mathematical, this does not mean the data collection is that difficult to carry out. My data may also be a good benchmark for the group to compare the biodiversity of other sites to. This would enable the group to identify and focus on sites with the highest biodiversity which would undoubtedly be very useful for what is a fairly small organisation

# Literature Review

In this section I will provide information on some of the terms used and issues raised later in the project.

## SSSI

SSSI stands for **S**ite of **S**pecial **S**cientific **I**nterest and is a designation given to areas of land in the UK. It can be given to any area of land that is either biologically or geologically interesting. Natural England (or other relevant bodies in Wales, Scotland and Ireland) decides whether or not a site should become an SSSI, a process known as "notification", and works with site owners to protect the area of land from losing its special qualities.

SSSIs are legally protected from development, damage and neglect. Local planning authorities must notify Natural England about any development plans that could potentially damage the SSSI, whether or not the plans are for land in the SSSI or not. The reason for this is to prevent any development that could damage these fragile areas of land and *"preserve our remaining natural heritage for future generations".* **(www.sssi.naturalengland.org.uk)**

The landowner(s) must also consult the relevant conservation body if they want to carry out any activities on the land. Any activity that could potentially damage the SSSI is classified as an OLD (**O**peration **L**ikely to **D**amage). The list of OLDS is essentially the same for most sites but there tend to be fewer in geologically interesting sites. If it considered that the effect of the activity will be neutral or beneficial, "consent" will be given and the activity can go

ahead as planned. Sometimes consent is given accompanied by several conditions controlling *"timing, intensity or location of an activity".* **(en.wikipedia.org)**

However, if the activity will cause damage, no consent will be given and the activity must not proceed. If landowners ignore the authority of the conservation organisations, legal action will be taken against the landowner.

Landowners are also given guidelines on how their SSSI should be managed. Sometimes grants are available to financially aid the protection and management of a site. If the landowner is unwilling to comply with the guidelines, conservation authorities can require them to be carried out legally. In general, however, Natural England and the other organisations try to work with landowners rather than force them to do exactly what the authorities want. *"Maintaining goodwill and building upon the enthusiasm, knowledge and interest of owners is vital to successfully manage these nationally important sites."* **(www.sssi.naturalengland.org.uk)**

# Diversity Index

Below are 2 definitions of a diversity index:

- *A diversity index is a statistic which is intended to measure the biodiversity of an ecosystem.* **(en.wikipedia.org)**
- *A diversity index is a mathematical measure of species diversity in a community.* **(www.tiem.utk.edu)**

Later, I will use Simpson's Equation to find a diversity index to use for my data. The diversity index I will obtain from this process is sometimes known as Simpson's Diversity Index, a definition of which is below:

*Simpson's Diversity Index is a measure of diversity. In ecology, it is often used to quantify the biodiversity of a habitat. It takes into account the number of species present, as well as the abundance of each species.* **(www.countrysideinfo.co.uk)**

A diversity index of this size should allow sites of different sizes and types to be compared although one of my sources disagreed and said that:

*"If the index is used to compare diversity among communities, the sample sizes must be equal. If complete census data are used, the areas sampled must be of equal size."* **(www.ucopenaccess.org)**

Whilst it is true that an index from a small sample size may not compare well with an index from a much larger sample size, provided the data collected is representative of the population, a site of 10 hectares can be compared with a site of 10,000 hectares. In essence,

this is the whole point of a diversity index; it allows comparison with data collected from a huge range of sites worldwide. This is why a diversity index is a useful tool in ecological studies.

Simpson's Index specifically is calculated using the following equation:

$$D = \frac{N(N-1)}{\sum n\,(n-1)}$$

*D = Simpson's Diversity Index*

*N = total number of individuals of all species*

*n = number of individuals of a specific species*

# Biodiversity

Below is an extract from the definition of biodiversity given by the Britannica Concise Encyclopaedia:

*Quantity of plant and animal species found in a given environment. Sometimes habitat diversity (the variety of places where organisms live) and genetic diversity (the variety of traits expressed within a species) are also considered types of biodiversity*

**( www.answers.com)**

Biodiversity has a number of benefits to both humans and ecosystems as a whole.

Biodiversity contributes majorly to the following:

- Nutrient storing and recycling
- Recovery from unpredictable events
- Maintaining climate stability
- Recreation and tourism for the local community
- Biological resources:
    - Food
    - Medicinal resources and pharmaceutical drugs
    - Wood products
    - Breeding stocks, population reservoirs
    - Future resources – i.e. resources that are not recognised as useful currently
- Culture
- Economic development

To maintain a high biodiversity requires the maintenance of a wide variety of plant and animal species. Extinction of species of organisms reduces biodiversity, and therefore has a negative effect on the items in the list above. Low genetic diversity often leads to extinction as inbreeding leads to offspring with more genetic defects which are less likely to survive to pass on their own genes. This low diversity is often caused by human encroachment on animal territory or overhunting. It is therefore becoming increasingly hard for ecosystems to maintain a high biodiversity due to the challenges of the modern world.

The following quote highlights the importance of biodiversity in human success:

*At least 40 per cent of the world's economy and 80 per cent of the needs of the poor are derived from biological resources. In addition, the richer the diversity of life, the greater the opportunity for medical discoveries, economic development, and adaptive responses to such new challenges as climate change.* ***(www.nhm.ac.uk)***

# Human Impact

Below is a concise definition of human impact (sometimes more specifically called environmental impact):

*The indirect and direct consequences of human actions on the natural environment*

**(encarta.msn.com)**

Human impact and biodiversity are inextricably linked. A reduction in biodiversity is almost always due to human activity damaging the ecosystem. Over the past 200 years or so, many more species have become extinct than when the human race inhabited only small areas of the world. The success of the human species has been at the expense of the majority of other species. It is likely that over the time that I work on this project, at least one species of plant or animal has become extinct, perhaps without even being recognised by science.

That is not to say that human impact is always negative. For example, conservation work by charities and organisations has helped to save many species from extinction and maintained a high level of biodiversity in fragile ecosystems. This has happened due to the work of groups such as WWF on a worldwide scale and on a more local scale here in the south of England by the Berkshire Buckinghamshire and Oxford Wildlife Trust who protect areas of land around the marshland studied in my project.

However, when I refer to 'human impact' in my project I will be referring to negative impact. I also use the term 'human traffic', which is how often the site is used by humans and domestic animals and is therefore linked to how much stress the environment is subjected

to. It cannot be automatically assumed that all environments and ecosystems are affected by types of human impact in the same way. For example, in some ecosystems controlled deforestation can be beneficial to biodiversity but in others, any loss of plant life can be very damaging.

Examples of negative human impact are:

- Uncontrolled deforestation
- Overfishing
- Pollution by transport and power stations
- Monoculture crops
- Intensive agriculture
- Loss of habitats due to human expansion
- Tourism
- Increased raw material extraction

This provides a reason for my project; to discover the effect of human traffic, if any, on the biodiversity of Freeman's Marsh.

# Wetlands

A definition of what a wetland is:

*A lowland area, such as a marsh or swamp, that is saturated with moisture, especially when regarded as the natural habitat of wildlife*. **( www.thefreedictionary.com)**

The marshland I am studying is an example of a wetland. Common examples of wetlands include:

- Marshes
- Bogs
- Swamps
- Fens

The main feature of a wetland is that the water table is very near to the soil surface. The different types of wetlands differ in the plant life surrounding them, the way they become water saturated and the 'soil' they are made up of. More specifically a **marsh** is defined as:

*A type of wetland ecosystem characterized by poorly drained mineral soils and by plant life dominated by grasses.* **(www.personal.ceu.hu)**

Wetlands are very fragile environments that rely upon poor drainage to remain waterlogged. A change in drainage will, therefore, totally change the ecosystem. Many of the organisms that inhabit wetland environments can only survive in very specific conditions and if their environment is changed even slightly they will die out in that area. As wetlands

are generally home to a wide variety of species, it is important to protect and manage these environments to maintain biodiversity worldwide.

In 1971, the Conservation of Wetlands of International Importance was established in Ramsar, Iran. The agreement was signed by many countries, among them the UK. Approximately 100 Ramsar sites exist in England comprised mostly of rivers and estuaries. Under the terms of the treaty, if any piece of land that is under protection is damaged, it must be replaced with an equivalent habitat.

Over the course of the 20$^{th}$ century, approximately 40% of English wetlands have been lost. The vast majority of sites lost were drained and converted for agriculture. This shows how important wetland conservation is, as what is left must be protected to ensure the survival of many native species. The fact that a large international agreement has been signed on the issue shows this a worldwide problem and therefore an issue of great international importance.

My research hopes to provide a reasonable picture of the variety and abundance of plant species at the site I am investigating. This information would be valuable to conservation groups locally, nationally and worldwide as it is difficult to protect a site from damage if you do not know what you are protecting. My information would help groups managing the site to introduce effective measures to prevent damage because certain types of management will benefit some species more than others.

# Data Presentation

In this section I have provided the data that will be discussed in the Data Analysis section so will likely need to be referred to later. Below is a map of Freeman's Marsh with the 10 sampling sites labelled:

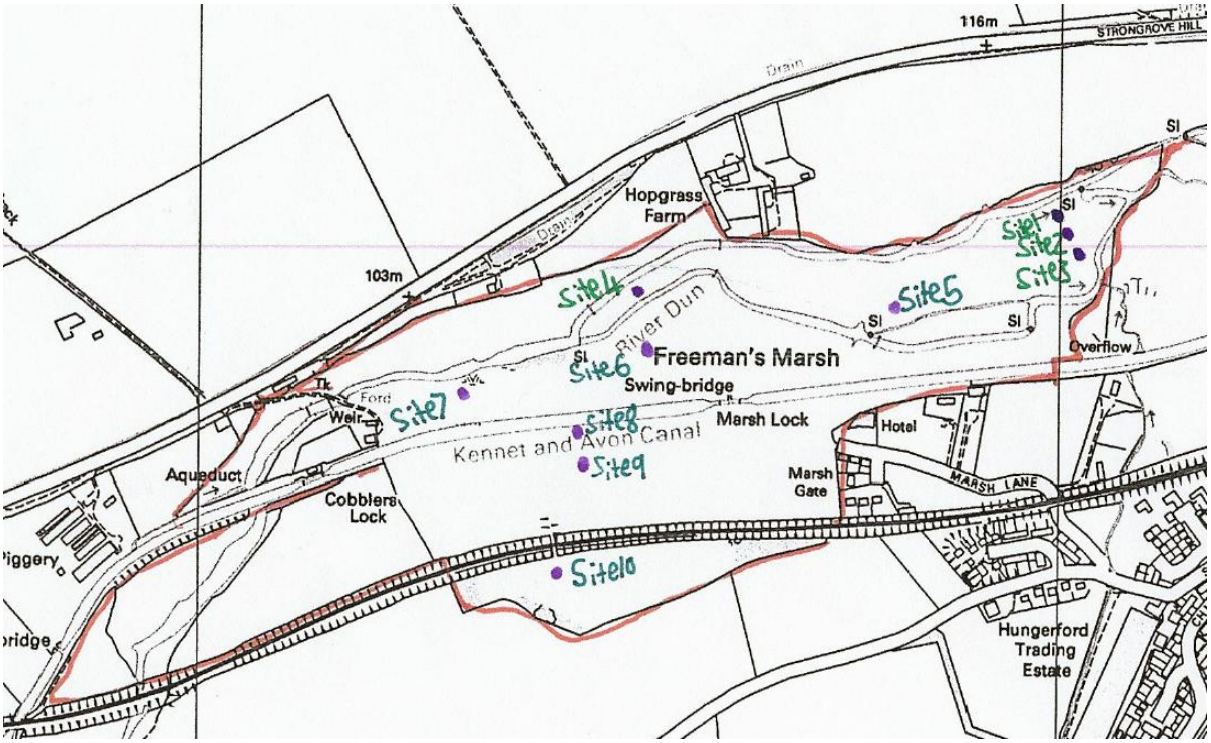


Table 1 shows all my raw data condensed in one table:

***Table 1 : Table showing the abundance of each plant species at each of the 10 sample sites***

| | **Site Number** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Species** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| Couch Grass | 190 | 200 | 200 | 200 | 200 | 200 | 200 | 195 | 200 | 200 |
| Oat Grass | 12 | | 1 | | | | | | | |
| Marsh Foxtail | 11 | | | | | | 13 | | 1 | |
| Sedge | 45 | | 56 | 37 | 67 | 119 | 148 | | | |
| Silverweed | 30 | | | 49 | 96 | | | | | |
| Rush | 3 | 60 | 70 | 22 | 23 | | 73 | | | |
| Dock | 6 | 10 | 4 | 2 | 6 | 6 | 2 | | | 2 |
| Ribwort Plantain | 2 | 76 | 51 | 7 | 11 | 7 | 24 | | | 4 |
| Buttercup | | 27 | 21 | 23 | 118 | 110 | 41 | | 2 | 2 |
| Pink Clover | | 13 | 4 | 7 | 18 | 4 | 25 | 135 | 76 | 25 |
| Stitchwort | | 5 | | 6 | | | 4 | 1 | 1 | 1 |
| Dandelion | | 12 | 12 | | | | 3 | | | 2 |
| Celandine | | 19 | 46 | | | 7 | 3 | | | |
| Thistle | | 4 | 2 | 36 | 62 | 4 | 4 | 3 | 31 | 78 |
| Horsetail | | 2 | 2 | | | | | | | |
| Birdsfoot Trefoil | | 2 | | 33 | | | | | | |
| Marsh Ragwort | | 2 | 3 | 5 | 2 | | | 1 | 8 | 17 |
| Marsh Woundwort | | | | 84 | 3 | | | | | |
| Spindly | | | | 45 | | | | | | |
| Goose Grass | | | | 43 | | | | | | |
| Meadowsweet | | | | 8 | | | | | | |
| Nettle | | | | 4 | 4 | | | | | 25 |
| Figwort | | | | 14 | | | | | | |
| Cow Parsley | | | | 3 | | | | | | |
| White Clover | | | | 2 | | | | | | |
| Coltsfoot | | | | | | | 4 | | | |
| Yarrow | | | | | | | | 60 | 5 | |

Table 2 shows the Species Diversity Indexes that I calculated using my raw data and Simpson's Equation. A high Species Diversity Index value equates to high biodiversity on that site.

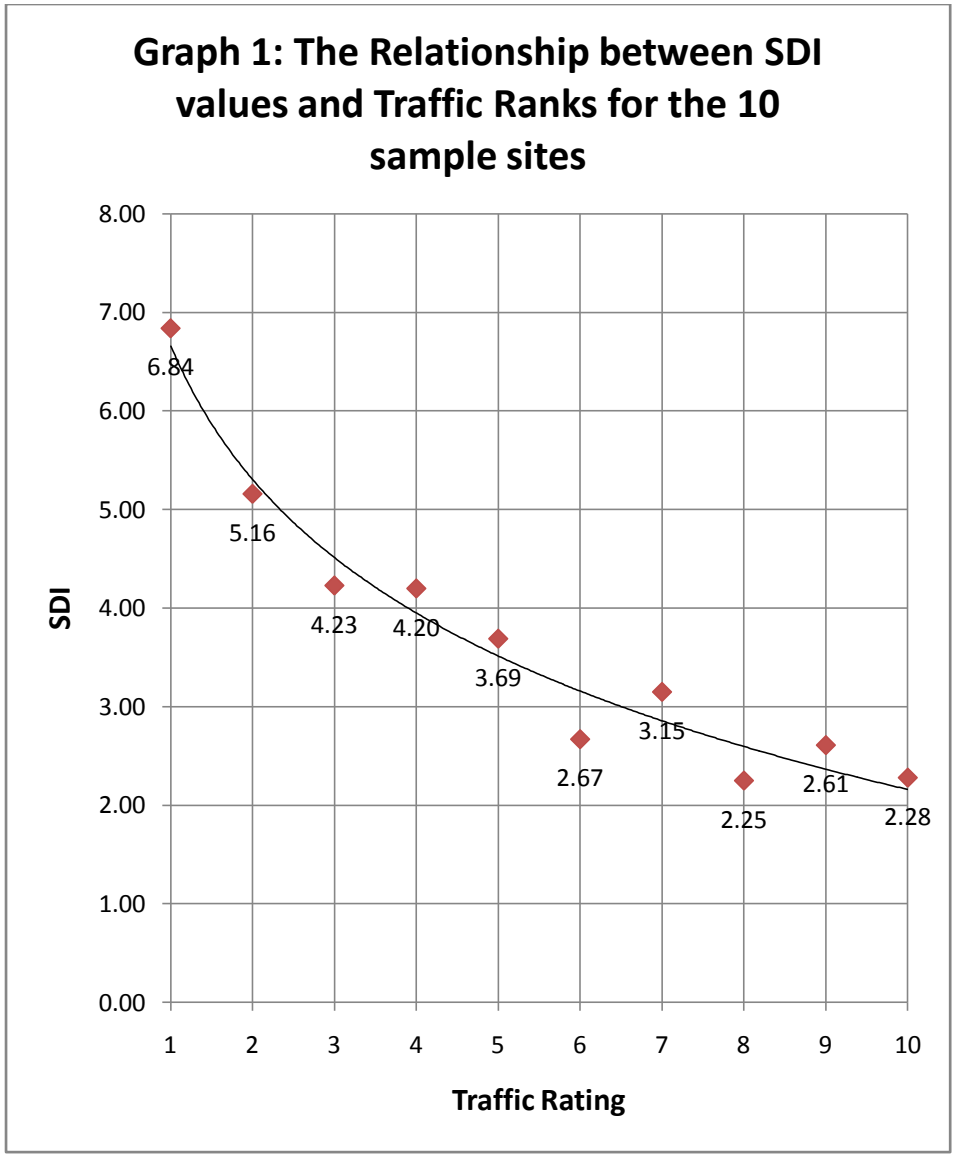
***Table 2:***

| Site | Species Diversity Index (3.s.f) |
|---|---|
| 1 | 2.28 |
| 2 | 3.69 |
| 3 | 4.20 |
| 4 | 6.84 |
| 5 | 5.16 |
| 6 | 3.15 |
| 7 | 4.23 |
| 8 | 2.61 |
| 9 | 2.25 |
| 10 | 2.67 |

Table 3 shows the traffic rank I gave each site. A high traffic rank relates to a high level of traffic on the site.

***Table 3:***

| Site No. | Traffic Rank |
|---|---|
| 1 | 10 |
| 2 | 5 |
| 3 | 4 |
| 4 | 1 |
| 5 | 2 |
| 6 | 7 |
| 7 | 3 |
| 8 | 9 |
| 9 | 8 |
| 10 | 6 |




Graph 1 shows how each sites SDI value is related to its traffic ranking. I have electronically drawn a line of best fit on the graph to give an indication of the overall pattern. From this graph alone it is clear that there is at the very least, moderate correlation between the two sets of data. The data will be further scrutinised in the Data Analysis section though this is a useful visual representation of my findings. It would therefore be a useful tool for people who may not be familiar some of the more complicated mathematical and statistical methods of presenting the data. A simple graph like this, however, makes the findings fairly straightforward for the majority of people to understand

# Data Analysis

Hypothesis Recap

As mentioned previously, my **null hypothesis** for my investigation is:

*"Local marshland biodiversity is not significantly affected by the traffic levels different areas receive"*

Therefore my **alternative hypothesis** is:

*"Local marshland biodiversity is significantly affected by the traffic levels different areas receive"*

At the end of my data analysis I expect to accept one of these hypotheses and reject the other.

Why I chose Species Diversity Index (SDI)

I chose to use Simpson's Equation to calculate an index for species diversity that allows me to compare my data with that from other projects and studies to compare to mine if it is in a commonly used format. The index also allows areas of any size and type to be compared. It will therefore allow me to compare a wide variety of areas provided there was data gathered for them.

Because SDI is recognised worldwide, it would also be easy for other people who wished to use or study my data to understand how I have presented my findings. Therefore it is a

statistical method that benefits both me, the “author”, and other people interested in using my results.

How I analysed my results

I analysed my data using Spearman’s Rank equation to calculate a correlation coefficient and thereby determine significance. This is because correlation coefficients allow you to see how closely two sets of data are related. It is also a pretty well known method so has the same advantages as SDI in this way.

The other set of data I was relating my SDI values with was the impact/traffic rating I had given each site. This was because I was trying to find out whether there is a relationship between human impact and biodiversity (measured by the SDI values). I based this rating on the following criteria ranked roughly in order of importance from top to bottom (most important at the top; least important at the bottom):

- Whether or not the site was on or near a major footpath
- Whether access to the site is controlled/reduced in any way
- Whether the site is frequented by canal users
- How popular the site is with dog walkers
- Whether the site was regularly frequented by cows

Upon taking all these factors into account, I put the sites in order of traffic/impact and came up with the rating rank of the 10 sites. I then used Spearman’s Rank Equation to see how

closely related biodiversity rank and traffic rank were. This gave me a value of **0.952** to 3 significant figures.

I then used statistical significance tables to see how significant this value was. Below is an extract of the data from the table I used:

| **N (the number of pairs of scores):** | **0.05** | **0.02** | **0.01** |
|---|---|---|---|
| 7 | 0.786 | 0.893 | 0.929 |
| 8 | 0.738 | 0.833 | 0.881 |
| 9 | 0.683 | 0.783 | 0.833 |
| **10** | **0.648** | **0.746** | **0.794** |
| 12 | 0.591 | 0.712 | 0.777 |
| 14 | 0.544 | 0.645 | 0.715 |

From the data in the table, the probability of my results being due to chance is less than 1%. Therefore I can reliably infer that my results are due to the relationship between human impact and biodiversity.

## Evaluation of my data

Whilst my data is very significant it must be remembered that like most scientific studies, there could have been improvements to the way I obtained and analysed my data.

When I collected my data, it was impossible for me to sample all the sites at the same time due to scheduling/timing constraints. All the fieldwork was carried out within a 6 week period but this is still quite a long time period for the results to come from. This is because at this time of year (August – September) some plants die out or lose much of their size in

preparation for harsh months ahead. It could therefore be said that some of the earlier sites would be expected to have had more plants due to the time of year that the sample was taken. However, the vast majority of plants do not change a huge amount during this time other than in terms of flowering and seed dispersal. As I was measuring the relative area each plant species covered my results are not affected by the size or life stage of individual plants. Furthermore, when some plants were receding towards the end of the fieldwork, the dead parts of the plant were still standing so it was easy to see what the little leaves on the ground had been earlier in the summer. Therefore the length of the sampling period had a negligible impact on my work.

Another possible limitation to my study was that I only sampled 10 sites. On one hand, this may not be enough sites so therefore the data may not be representative of the marshland as a whole. On the other hand, the sites I chose have a lot of variety and between them they represent all the different types of land on the marsh. I also think that 10 well picked sites like these are far more valuable than 50 sites that only cover half the distinct areas within the marshland. If I were to have done more sites I feel it is unlikely I would have come across anything dramatically different to what I have found with my data because the sites sampled were carefully selected in so the data collected could encompass the whole of the marshland being studied. I selected sites subjectively rather than randomly so in this case the sample size and accurate representation of the plant community are not necessarily positively correlated.

The way in which I decided the traffic rankings for each site could also be called into question. Whilst I feel I took into account all the major factors, the rankings were done on

my knowledge and subjective observations rather than numerical data. Ideally it would be better to have come up with objective numerical values that would have helped me order the sites more accurately. I feel, however, that the rankings are quite fair and I don't think it could be argued that any site is more than 1 place away from what it should be. The fact that I got such a positive value for my correlation goes some way to removing the concern over this aspect of my results. Even if a couple of the rankings were changed slightly there would still be very strong positive correlation. On balance, I would say that whilst that this aspect of the results has been put together in a relatively unscientific way it does not really weaken the results very much because it is hard to measure human traffic and impact to any great detail in a small scale study like mine.

# Conclusions

Because my value is significant, I am able to reject my null hypothesis:

*"Local marshland biodiversity is not significantly affected by the traffic levels different areas receive"*

Therefore, I am able to accept my alternative hypothesis:

*"Local marshland biodiversity is significantly affected by the traffic levels different areas receive"*

I can therefore reliably say that the biodiversity of an area of local marshland is greatly affected by the amount of traffic and human impact upon that particular area. This has importance on both local and global scales.

Locally, this means that this site is very important in maintaining a wide range of species in Hungerford and the surrounding areas. For example, the marsh is home to several species of birds that require its vegetation and insect life food to thrive. The Reed Bunting is one of these species that is generally quite rare around much of Britain and is often confused with sparrows as it looks reasonably similar. These birds often visit local gardens (including my own) to eat seed from feeders put out for the birds. They do not, however, roost in the town and always return to the marsh once they have visited. This is just one example of a

species enjoyed by many in the town that is very reliant on this marshland area and my project has confirmed how species rich the area of land is.

Something which I have not mentioned until now is that there are plans to build a marina for canal users on land neighbouring Freeman's Marsh. As yet there has been little actual construction but some preparation work has apparently begun. The project was only given the go ahead after:

" a 12-year battle waged by local wildlife campaigners". **(www.newburytoday.co.uk)**

Whilst the developer said "we have moved the slow worms that were there and put bat boxes up" in an effort to reduce damage to local wildlife, the marina will almost certainly have a negative effect on the marshland. Whilst Freeman's Marsh itself will not be developed there may be several indirect effects of the marina if it is completed (although currently it would appear to be behind schedule). These include:

- Increased traffic – the marina is supposed to attract people to the area and encourage canal users to stop off in Hungerford. As the marsh is considered quite an attraction to tourists, this will mean more people visit the marsh once they stop off at the marina. This means the effects of human impact already witnessed will be greatly increased such as trampling of plants, littering and soil erosion.
- Reduced rule enforcement – whilst there is a well-advertised list of rules prohibiting behaviour which damages the marshland they are not always adhered to. When I did my research I found a large area of scorched and trampled ground where people had camped and had a barbecue (the disposable barbecue had been left behind). Whilst most people obey the rules there are people who don't and it is very hard on an area

of land like Freeman's Marsh, which has many entrances, to police behaviour. An increased number of people on the site may mean more rules are broken which will end up with more marshland damaged in the short term. As a lot of these new visitors may only be passing through Hungerford they may not show it the same respect they show land near to where they live. Therefore it is quite possible that a few of the visitors to the marshland will cause trouble.

- Local canal pollution – the waters of the Kennet & Avon Canal are polluted, as most canals, because they are bodies of still water. However, they are still home to a wide variety of wildlife including water birds, water rats and various fish species. Increased usage of the canal will worsen the state of the water because canal barges are powered by motor engines which stir up sediment from the bottom of the canal. Different species of animals have different tolerances for water pollution and an increase in pollution may mean that certain species can no longer survive in the conditions. It is therefore important that canal traffic is considered when building the marina.
- Destruction of local habitats – as the developer said himself, they have had to clear the marina land of certain species that inhabit it. This is reducing the territory of these species and will inevitably reduce the numbers of these species as shown by many research studies. The reason animals have territories is to reduce competition over limited food sources. By staying apart they can maximise the numbers of their species. If new land is given back to nature to make up for the land that was taken the effects will be relatively small. However, if the organisms are put on to land which already has an established food web, the newcomers may disrupt the web on the new site. Therefore the marina could damage the local environment by

overpopulating other fragile ecosystems such as Freeman's Marsh by either introducing or forcing organisms on the marina site to these other sites.

It is clear that the marina is likely to have at least some negative effect on Freeman's Marsh. Therefore my research shows that this local marshland is indeed very biodiverse and, as a result, is worth protecting. The findings of my project may act as a prediction of what will happen if human impact/traffic on the site is increased by a factor such as the marina. If not carefully managed and monitored, biodiversity at Site 4 (a richly diverse area of the marsh) could look much like biodiversity at Site 1 (an area with low plant diversity) in my project.

My project could be extended to monitor the effects of the construction of the marina. Extra sites could be monitored around the marina area alongside the current sites. If these sites were regularly sampled for biodiversity in a similar fashion as I did, it would be possible to observe and record any changes in biodiversity over the test period. This would show if there was any major impact of the marina on Freeman's Marsh and nearby land and aid the protection of the land as factors that damage biodiversity can be kept in check and monitored more closely.

On a global scale, research suggests that marshland is negatively affected by human impact. This agrees with other theories and research, including those that would have informed the drawing up of the RAMSAR treaty. However, it also shows that less famous and celebrated areas of marshland, such as in the UK, are also at risk of damage as a result of human activity. It is often assumed that British countryside is lacking in species diversity but a stable environment when compared to extreme ecosystems such as rainforests and deserts. Whilst there is some truth in this, it must not be forgotten that

Britain is home to a wide variety of species of plants and animals thanks partly to scattered patches of valuable habitats, including marshland. The fact that the Reed Bunting is not as impressive as a tiger or a panda does not make it any less valuable biologically and morally.

# Evaluation of Project

Over the course of producing my project I have built on my previous skills and gained some new ones as well. Some of the most prominent and memorable examples include:

- Learning to write an Abstract – before I started the project I didn't even know what an abstract was. Now I realise that they are a useful tool in selecting which research papers and reports are relevant to the area you are interested in. I have also learnt what to include in an abstract and how important it is to keep to the designated word limit so others can read it quickly and decide whether or not your findings are of interest to them.
- Improving my statistical skills – by using Simpson's Equation and Spearman's Rank I was able to improve my understanding of these two useful formulae. When I began the data analysis section of my project it took me time to become confident with using them and I had a few calculation problems before I reached my final values. Now I am much more confident with using the formula and better understand what they represent.
- Improving my research skills – taking on the Extended Project has given me an opportunity to improve how I search and select information when writing a report. These skills are invaluable in a scientific profession, which I hope to gain when I'm older. I don't often get a chance to practice researching because of the subjects and specifications that I have chosen so this experience has been especially important in developing my skills in these areas.

- Being in charge of my own work – unlike the majority of the work and studying I do, I have organised and produced this project with minimal guidance. It has therefore given me a chance to exercise some freedom with when and how I work but also the responsibility to get on with the project without regular reminder. I have enjoyed this aspect of the project and feel I have coped well with a piece of work that has only one major final deadline and few short term deadlines like I'm used to. As a result of this, I have developed better time management skills.
- Keeping records – the project requires both a bibliography and an activity log for completion. These are two tools I did not normally use when I began the project so it took some time to get used to them. However, now I have had some experience using them, I have realised how useful it is to keep a detailed log of everything you've achieved so far and all the resources you used to help yourself along the way. I think I will make better records of work in future as it has helped me make a detailed and flowing project that is subsequently a better end result.
- Enhanced my presentation skills – I presented and explained the findings of my project to a group of around 30 people at my school. A few of the people had also done the Extended Project, a few more were teachers and the rest were students considering taking up the Extended Project. I was not anticipating such a large group but I managed to adapt my presentation by explaining a bit about the Extended Project in general throughout the presentation for the benefit of those who have not yet been involved in it. The presentation itself went fairly smoothly and I was complimented by many people afterwards on how professional it had been.

I gave out feedback forms to the teachers and students involved in the Extended Project to obtain their views and comments on my presentation skills. The results were, overall, very positive with nobody giving me less than satisfactory in any of the criteria I asked for feedback on. The general areas for improvement as suggested by the audience were:

- Make more of visual aids – I skipped over pictures quite quickly but I could have explained their relevance.
- Engagement with the audience – this was good in general but I could have shown my enthusiasm a bit more.
- Body Language – also good on the whole but at the start I did feel fairly tense and this must have shown a little to the audience which is not really desirable when presenting information.

My plans for the future involve completing a degree in Veterinary Medicine at university and pursuing a related career. The skills I have obtained from my Extended Project will be invaluable in projects I complete at university as they have many of the same features. Higher education requires responsibility for your own work and mastery of skills that enable you to produce work of the highest standard. I think my project has really helped me realise and develop these skills and I hope to have plenty of chances to use them throughout my life.

# Bibliography:


## Personal Communication

- Meeting with Robert James, Trustee of Freeman's Marsh and member of Hungerford Town & Manor, on **01/08/09**

## Books

- Collins New Generation Guide "Wild Flowers of Britain and Northern Europe" by Alistair Fitter
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