Clyne River Study

Introduction

Clyne river is a five-mile-long freshwater river located in South Wales, it is sourced via a series of springs on the Fairwood common and flows south-easterly through Clyne Valley before discharging at Blackpill.

The river flows through a diverse landscape of steep gorges, woodland, grassland, and wetlands that provide a sufficient habitat for an abundant amount of different types of vegetation and animals, such as badgers, foxes, woodpeckers and wrens. Though beautiful with its clear waters and luscious valleys, Clyne retains its reputation of being a dark and dangerous, its 16-foot-deep lake often floods during rainy season, creating deep and impassable mud pools and it is easy to get lost in the dense woodlands. (Swansea.gov.uk, 2017)

Second hand results from (RiverLevelsUk, 2017) show the average water level of Clyne river to be anywhere from 0.54M to 1.5M, but has previously reached a high of 2.23M in October 2006. However, first year environmental conservation students from the University of Wales Trinity St David desired to collect their own data first hand and assess whether the river, and surrounding vegetation, are truly as diverse and pollutant-free as suggested. Subsequently, on the 20th of October, students set out to survey a 50M stretch of the river in three separate groups and would then go on to draw their results together to be able to map the river and analyse its processes.

The purpose of the experiment was to be able to accurately map the river bed and study the macro invertebrates living there. Though the students were not given any hypotheses to prove they still had the ultimate goal of studying the river and its processes to decipher if the area was actually as diverse as previously believed.

Methodology

The students were provided with a range of high-tech equipment that they were allowed to use for this experiment. These tools included:

- Data sheets
- 50-meter tape measure
- Meter rule
- Clipboard
- Stopwatch
- Compass
- Surveying poles
- An empty bottle
- Waders
- A net
- Empty tray

The first thing that the students were made to do was establish a baseline 50 m along the river's edge and note the compass bearing, which was 25° NW. From here they establish the perpendiculars and measured the distance to both the closest bank and the one furthest away. Originally it was intended to use a dumpy level to work out the cross-sectional area of the sections, however students, due to a lack of equipment available, instead use a tape measure and a rule to measure the height of the bank and the depth of the water. The cross sectional and other measurements could be worked out by doing some simple mathematics using the data the students had already collected.

Next, the groups plotted the bank profile by placing a graduated pole in the centre of the river and, at different height intervals, made horizontal measurements from the graduated pole to the bank.

To source and identify species living in the river, the groups took a kick-sample and using a net, work their way across the river for approximately 1 minute 30 seconds kicking up any rocks and sediment on the rivers bed, making sure to face downstream with the net in front to catch anything that was loosened by the disturbance. The net was then emptied into a flat, shallow tray filled with clean river water and large sediment was removed to make inspection easier. Invertebrates were identified using a basic chart and then noted on a data sheet. Once this stage was completed students assessed the diversity of the invertebrates found and calculated the cleanliness of the water based on the species abundance and ability to survive in certain conditions.

Finally, visual identification of surrounding trees, vegetation and mammals was conducted using identification charts and the student's own knowledge.

Risk Assessment

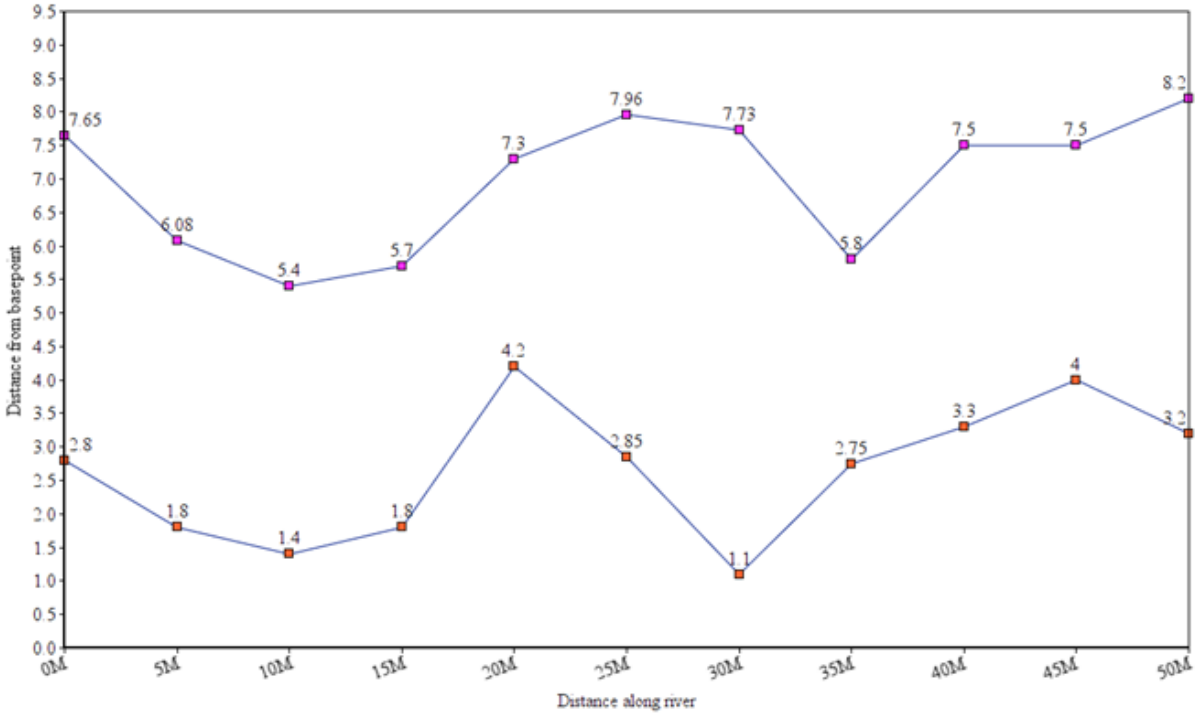
- Students can slip on rocks and mud.
- Water speeds may be dangerously fast
- Waders can fill with water
- Getting wet can cause hypothermia
- Risk of drowning
- Water or food borne infections

Risk rating = 2

It is not likely that any of the above will occur and if they do they will have minimum severity.

Results and Analysis

Figure 1: Mapping the river Clyne, (completed with https://www.onlinecharttool.com/graph)



The graph provided above was mapped using the data collected by the students. It is intended to recreate the exact course of the river and replicate precisely each meander, and it does. Despite using straight lines which skew the curve of the river, each plot gives an accurate physical representation of how the river would look from a bird's eye view.

This graph does a lot more than just map the river, it also provides an easy way to view the student's initial data and allows to work out the width of the river at each point, even though width was not specifically measured. This can be done by subtracting bank A (bottom line) from bank B (top line).

From the data, compacted in to a more visual form, a clear example of erosion and deposition can be seen, at 15m the river hits denser soil on the inner bank forcing the water to erode the outer edges of the bank where the soil is softer and can be worn away faster. With this mass erosion comes a lot of sediment which is then transported by the fast-flowing waters on the outer edge of the river. At a point the sediment gets wedged and begins catching more of the debris that is stuck in the flow of water, it begins to build up, creating a point bar that emerges from this and then is strong enough to force the river around it, creating a new meander. This can be seen at 35m.

In many cases rivers start as a small spring and widen as they reach the end of their course and hit the ocean, and this is something that can easily be studied usually. Since this is not a large section of river it is difficult to conclude a hypothesis that suggests that rivers widen as they reach their discharge point, there is a 15cm difference from measurements at 0m to measurements at 50m however these are extremely subject to anomalies and is not sufficient enough data to prove or disprove a hypothesis based on this.

For all following analysis, data collected from 40m will be used.

Figure 2: Table of averages at 40m

Channel Width	*4.2m*
Bank Full Width	*7.15m*
Channel Depth	*0.46m*
Cross sectional area	*1.93m*

When studying a river, the above are all results that can be measured using equipment, however some can be completed using simple mathematics. The cross sectional area, for example can be calculated by multiplying the width and the average water depth.

Figure 3: Table of BH and WD at 40m

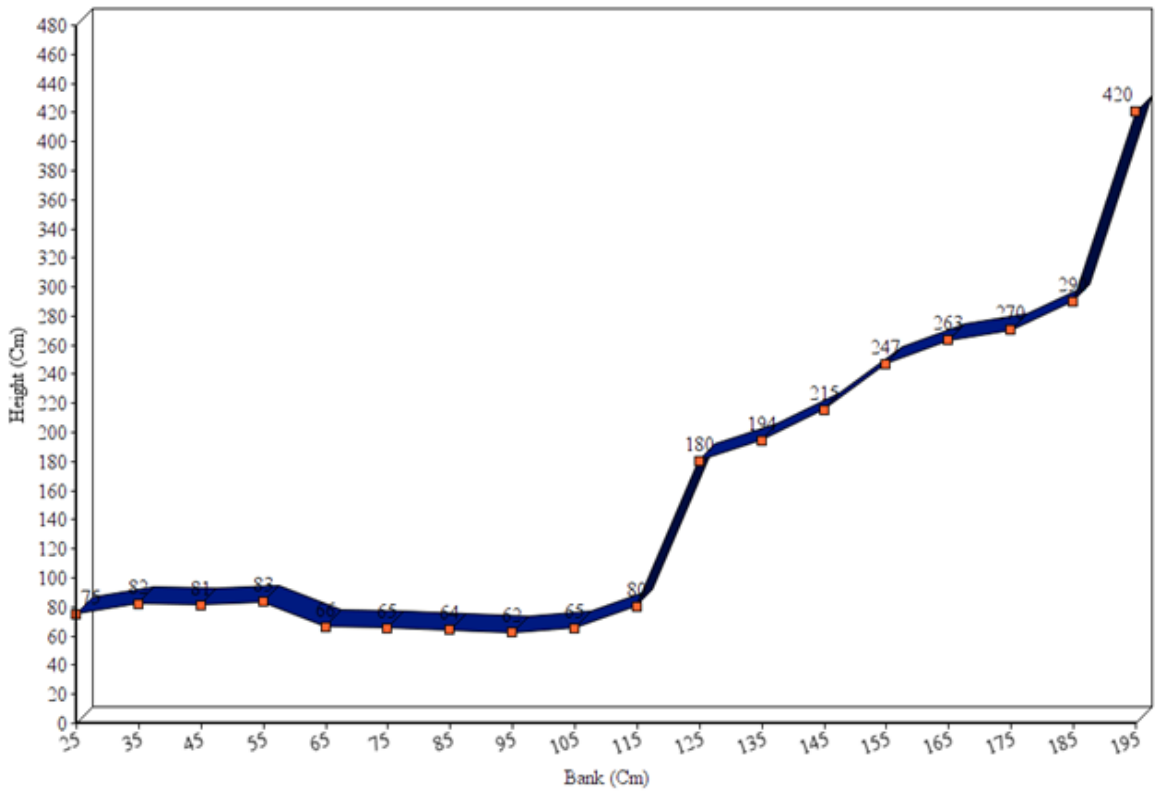
Bank Height	Water Depth
15cm	0cm
25cm	0cm
27cm	0cm
42cm	0cm
47cm	0cm
152cm	39cm
167cm	40cm
167cm	40cm
168cm	40cm
166cm	41cm
166cm	41cm
164cm	38cm
163cm	37cm
166cm	39cm
165cm	43cm
174cm	47cm
182cm	54cm
187cm	59cm
183cm	64cm
196cm	66cm
157cm	68cm
153cm	62cm
186cm	55cm
80cm	0cm
80cm	0cm
75cm	0cm
75cm	0cm
73cm	0cm
56cm	0cm
48cm	0cm
36cm	0cm
23cm	0cm
15cm	0cm
10cm	0cm

This table shows the bank height and water depth every 20cm at 40m along the baseline. The first and last few points each have a value of 0cm, this is due to sediment build up on the edges of the river, creating miniature point bars. The data also shows that the water gets deeper as it reaches the center of the river and gradually decreases in depth from the center outwards both ways. These results are obviously standard for most rivers despite

potentially having a few anomalies from human error and provide evidence that suggests this particular river moves the fastest in the middle where the water is deepest.

Compared to the yearly averages for Clyne river, (around 54 – 150cm) these results are well within the average range and can provide a small amount of creditability to the students and their data collection. Since their results comply with professionally collected ones, it becomes a lot easier to trust future results provided.

Figure 4: Plotting bank profiles at 40m, facing upstream from river, head on view (completed with [https://www.onlinecharttool.com/graph.)](https://www.onlinecharttool.com/graph.)



Plotting a banks profile using a graphing programme can provide an easy to read representation of how the bank looks from a head on position. Though the graph does not accurately represent the angle of the bank, it does show all the indents.

At other points on the bank, small cave systems would be formed by the pressure of water, however at this point there are no cave systems and instead a steep and jagged bank is formed by flooding and water reaching its bank full point. The bank is average and slowly increases in height as it moves out of the river, climbing significantly at 115cm and again, at 195cm. These sharp increases are most likely due to erosion from flooding or weather conditions that specifically hit these spots more and cause a landslide effect of sediment, creating sharp and jagged drops in the bank.

Figure 6: Species found from kick samples at 40m.

Group	Original Score
Stone Flies	10
Shrimps	6
Caddis Flies	5
Mayflies	4
Worms	1
Total:	23

An obvious study for finding out whether Clyne river is as truly diverse as stated online, is to take a kick sample of the river, students completed this by identifying the species found and marking them on a chart, which listed a large variety of freshwater species, next to a number which described how pollutant-free water had to be for that species to survive. The most diverse kick sample of all the groups provided students with a total score of 23, which meant that the water was not very diverse at all and slightly polluted. Around 3 species dominate the waters and despite being an abundant amount of these species, there's not much else to be found in Clyne. However, it can be argued that the study was unfair due to numerous varying factors such as it being late in the year, the water temperatures being cooler than usual, the kick sample only being taken once and not repeated, and finally the fact that the kick sample was taken near a large fallen tree which blocked water flow and could have had an impact.

Figure 7: Species of vegetation found at 40m.

Species found:
Japanese knotweed
Sycamore
Goat willow
Hazel
Eldes
Nettles
Fern
Ivy
Brambles
Ash
Moss
Lichen
Grass
Fungi

Identification of vegetation was largely orientated by one knowledgeable student but also specialised charts were used by students who needed additional help. A large variety of the plants identified are common British countryside plants, things like brambles and ferns can often be found in areas like Clyne and thrive in harsh conditions. However, there is again not much evidence of real diversity in the vegetation or evidence of plants that require softer conditions to grow. This could, again, be due to the time of year that the students chose to study Clyne, but could also be due to and invasive species known as Japanese knotweed. Japanese knotweed grows very quickly and can survive almost any attacks, it can grow and spread from a piece the size of a fingernail and quickly control an area. The problem with this fast growth is that the soils nutrients, growing space, and sunlight are all consumed by this plant and so any species that is not as resilient will die under it.

Conclusion

A clear conclusion cannot be drawn from many of these results due to the fact there are far too many variables. Being the students first field trip and first experience with collecting data professionally the data is subject to many anomalies and it cannot be sure that every student completed the task correctly or even documented the results correctly. Additionally, the time of year is very likely to influence the results as plants and species do not produce and can die more easily in the winter seasons. Finally, the students only completed each task once which again, leaves room for error.

To improve this experiment in the future the students could improve on these variables by gaining more experience and repeating all of their data collection multiple times. It would also be beneficial to visit the site again during the Spring or Summer seasons to record variations in species and abundance, and compare it to their Winter results to get a more concise composition of data.

References

https://www.onlinecharttool.com/graph - Used for graphing and data compostion

Excel – Used for table making

Swansea.gov.uk - Used for tourist information on the river Clyne

RiverLevelsUk – Used for previous average river levels