GEOGRAPHY NOTES

SUBJECT: Geography
LEVEL: Higher
TEACHER: Michael Doran

Topics Covered:
- Physical Geography- Human Interaction & River/ Fluvial Processes
- Physical Geography- Plate Tectonics
- Regional Geography- Population Dynamics – Irish Region
- Regional Geography- Socio-Economic Regions – Core Economic Regions

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Michael has been teaching Geography at The Institute of Education since 1995. He is an experienced Leaving Certificate examiner and has written many published articles on the subject. He is also a regular contributor to 2FM's Leaving Certificate programmes. Michael believes that the geography course can be a stimulating learning experience for both student and teacher.

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HUMAN INTERACTION AND RIVER / FLUVIAL PROCESSES

RIVER PROCESSES AND HUMAN INTERACTION

- **River processes** are the natural activities that occur when moving water flows through a river channel. These processes are;
  - Erosion – the removal of material from the bed and sides of a river channel.
  - Transportation – the carrying of all sediment/material (load) downstream.
  - Deposition – the dropping of part of the load when river energy is not strong enough.
- **Human interaction** refers to how humans use rivers. They do so in many ways, i.e., use rivers as a source of drinking water; to transport goods; to generate electricity; leisure and recreation, etc.
  - It is because of the importance of rivers that humans have long attempted to influence or control the flow of water in rivers.

DAMS AND HYDROELECTRICITY POWER STATIONS

- One way in which humans **influence/control** rivers is by the **building of dams** in order generate electricity. This is known as **hydroelectric power** (HEP).
  - A dam is a wall barrier built across a river channel. Modern dams are built from concrete. They extend across the entire width of the channel. They are at a higher level to the water surface.
  - The dam blocks the flow of water. A large artificial lake will build up behind the dam. This is called the **reservoir**.
  - It is possible to control and regulate the water flow. Water is piped through the dam, turns a water turbine and powers a generator. This produces electricity.
  - The building of the dam also provides other advantages for human society. They can be used to reduce flood risk; supply water for irrigation; develop the river for transport and leisure.

EXAMPLES OF HYDROELECTRICITY DAMS

NAME	RIVER	COUNTRY
Aswan High Dam	Nile	Egypt
Three Gorges Dam	Yangtze	China
Hoover Dam	Colorado	USA
Ardnacrusha	Shannon	Ireland

IMPACT ON RIVER PROCESSES

- The building of a HEP dam will disrupt the nature of the river. It stops the river from reaching its natural long profile. It directly affects the river regime, i.e. the annual changes in the river's water flow. It will also directly impact on river discharge, i.e., the volume of water passing a point in the river at any one time. This impacts on the river processes and the morphology of the river channel.

Impact on the Process of Transportation

- A river will **transport material (load) downstream** in the rivers course. This material will be mostly from eroded materials. Lighter materials form the **suspended load** (carried by solution and suspension). Heavier materials form the **bed-load** (carried by saltation and traction).

  - The dam barrier will be large enough to completely stop the flow of water (which builds up behind the dam in the reservoir). **Example** - The Aswan Dam is 3,800 long, 980 metres wide at its base and 110 metres high.

  - **The dam will block the bed-load and much of the suspended load from moving downstream**. The Aswan Dam was estimated to block over 90% of the River Nile's load that point (before overflow channels added). Estimated that the Three Gorges Dam blocks 50% of the 240,000 million tonnes of material carried by the Yangtze River.

Impact on the Process of Deposition

- Deposition will occur when the river loses energy. Natural influences on this include a fall in river volume (low rainfall) or a fall in river speed. Also, most deposition will occur in the middle and lower course of a river. If the HEP dam is built in the middle or upper course of a river, it will **change both the natural location where deposition occurs and the amount deposited**.

  - **The dam will slow down the upstream flow of water behind the dam**. This loss of speed will occur as water nears the dam or the reservoir. This leads to a fall in river energy. **This will lead to a build-up of deposition on the bed of the reservoir**. **It will cause an increase in water levels in the reservoir**. Dredging is necessary. A dam in the upper course can lead to an increase in deposition where naturally there are low deposition levels.

  - **Downstream areas in the middle and lower courses will have less deposition**. Before, these areas would have higher levels of deposition. It will reduce or **stop the natural formation of deposition landforms** such as floodplains, levees, deltas.

  - On the River Nile, the Aswan Dam has led to **fall in natural deposition on its floodplain** in the middle and lower course located in Egypt. It has led to less deposition in the **Nile Delta**, which has been starved of its natural sediment supply. This has exposed it to coastal erosion.

Impact on the Process of Erosion

- Most erosion will occur naturally in the upper and middle course of a river. Erosional processes such as Hydraulic Action and Abrasion will shape the channel. This occurs through vertical and lateral erosion. A HEP dam, especially if is built in the middle course can lead to an **increase in erosion in the middle/lower course. It could reduce erosion in the river's upper course**.

  - Erosion will be increased downstream when water is released through the dam. This will occur during times of peak electricity demand. The water that passes through the dam will not be carrying a load. It has greater energy and will flow faster. This is called **clearwater erosion**.

  - The released water will lead to **increased vertical erosion**. Much of this is caused by **hydraulic action**. The river channel will be deepened, e.g. the Colorado River has been deepened by 4 metres downstream from the Hoover Dam. Material is provided for **increased abrasion downstream**. It may also **increase lateral erosion** of the channel sides.

2008 – QUESTION 2 B – VULCANICITY SAMPLE ANSWER

- **Explain how the study of plate tectonics has helped us understand the global distribution of volcanoes. [30m]**

ANSWER

- The study of **Plate Tectonics** tells us that the Earth's outer layers are the crust and upper mantle. Together, they form a solid, rock shell around the Earth. This zone is known as the **lithosphere**.
  - The lithosphere is broken into many different parts. Each part is known as a **plate**. Each plate is slowly moving. This movement is driven by powerful natural forces from inside the Earth. It is at the **plate boundaries** or **margins** that the impact of plate movement is greatest.
- A **volcano** is a mountain that has formed from the eruption of volcanic materials onto the surface. These materials include **lava**, ash and cinders. Volcanoes form at a surface opening of the crust. Over time, the erupted materials will build up to form a cone shaped structure (volcano).
  - A volcano will form if **magma** (molten rock) forces its way up through the solid crust. The magma will melt the crustal rocks forming a large **magma chamber**. As the magma moves upwards, gases expand. This propels the magma upwards onto the surface.
- **There is a clear link between Plate Tectonics and volcanoes. Plate movements create the circumstances that allow volcanoes to occur. Over 80% of volcanoes are found at/near plate boundaries. They will form at Constructive and Destructive plate margins.**

CONSTRUCTIVE PLATE BOUNDARIES

- **This is where two plates are being pushed away from each other. The divergent movement is most likely caused by two heat (convection) currents of magma. Both current rise slowly upwards to the surface. They then move laterally (sideways) in two opposite directions. This drags the plates apart.**
  - As the overlying crust is pulled apart, the rocks will experience great stress and tension. The rocks will fracture. Magma will then be able to break through and erupt as lava. This forms new crust.
  - **Fissure eruptions** occur along this boundary. This is where large amounts of lava flow out from long cracks in the ground surface. These cracks are a few metres wide but extend for kilometres.
  - **Basic lava** flows are common. These lavas have a **low silica content**. This allows volcanic gases to easily escape. Eruptions tend to be regular and gentle in nature.
  - **Basic lavas have a low viscosity**. This means that they can flow easily. They can travel long distances before cooling. They can also spread out over a wider area.
  - **Shield volcanoes** form from these types of eruptions. This is a volcanic mountain cone. It has very gentle slopes but extends over a very wide area.
- EXAMPLE – the **Mid-Atlantic Ridge** – this is a great underwater mountain range. It formed from continuous lava eruptions caused by the moving apart of the **North American** and **Eurasian** Plates.
- EXAMPLE – **East Africa Rift Valley** formed by the splitting of the African Plate.

DESTRUCTIVE PLATE BOUNDARY

- **This is where two plates move towards and push into each other. The convergence is most likely to be caused by two mantle convection currents moving towards each other. This leads to a collision between the plates.**

  - As the two plates collide, **subduction** occurs. The plate with the heavier crustal rocks is pushed down into the asthenosphere/mantle. It is pushed below the other advancing plate. Subduction will occur at an **oceanic-continental** boundary or an **oceanic-oceanic** boundary. **Only oceanic crust can experience subduction**. Continental crust is not pushed downwards.
  - The subducting oceanic crust is pushed down into much higher temperatures. This leads to the **melting** of the subducting plate. This leads to the formation of large amounts of **magma**.
  - The overlying crust has experienced much stress and pressure. Cracks (faults) and other weaknesses form. These allow the magma to force its way to the surface.
  - **Central vent eruptions** are common at this plate boundary. This is where lava and other volcanic materials erupt at the same location. The magma pushes upwards through a main vent or pipe.
  - **Acidic lava** eruptions are common. These are lavas with a **high silica content** (Over 70%). They trap gases. As the gases cannot easily escape, it leads to violent explosive eruptions.
  - **Acidic lava has a high viscosity**. This means that they flow very slowly. They do not tend to travel far. They cool and harden close to the eruption.
  - **Composite volcanoes** are common at this plate boundary. These are volcanic mountain cones with steep slopes. Examples include Mt. Etna, Mt. Vesuvius, etc.

- EXAMPLE – **Pacific Ring of Fire** – this is a volcanic zone where 70% of active/dormant volcanoes are located. Many plates are in collision with each other, e.g. Nazca Plate (oceanic crust) / South American Plate (continental crust) which causes volcanic activity in the Andes Mountains. **Volcanic island arcs** have formed where oceanic plates collide, e.g. the Phillipines.

HOT SPOTS

- **These are places of intense heat within the mantle. These very high temperatures cause volcanic activity on the surface. There are up to 50 hot spots in the world. Most occur at plate boundaries but some occur far away from plate margins.**

  - It is believed that the intense heat drives currents of magma up towards the surface. These upward rising currents are known as **plumes**.
  - The magma breaks through the crust leading to volcanic eruptions. Over time, a volcanic mountain forms. The overlying plate will move due to tectonics but the hot spot does not move.
  - A series of volcanoes will form over millions of years. A volcano will stop forming once it moves over and past the hot spot location. A new volcano will then begin to form over the hot spot.

- EXAMPLES – **Iceland** is an example of a hot spot formed at a plate boundary. **Hawaii** is an example of a hot spot not formed at a plate boundary.

2010 – QUESTION 2 B FOLDING

- **Explain how the study of plate tectonics has helped us to understand the global distribution of Fold Mountains. [30m]**

ANSWER

- **Plate Tectonics** tells us that the outer layer of the Earth, the **crust**, is divided into many different parts. These parts are known as **plates**. We also know that each of these plates is slowly moving. These movements are caused by the movements of semi-molten rock (magma) below the crust or lithosphere. These movements occur in a zone of the upper mantle, i.e., the **asthenosphere**.
    - The movement of the plates leads to **great pressures on the rocks** of the crust. It is at the **plate boundaries** that these pressures are greatest. The rocks are placed **under great stress**. The rocks will become deformed. One way in which **rock deformation** occurs is **folding**.
    - **Folding is the bending of horizontal rock layers into a variety of curved shapes**. The layers will buckle and bend into a series of wave-like curves. This process will occur underground and within the crust. The **folding rocks can be pushed upwards**.
- **Fold Mountains are mountains ranges that have formed from folding**. The mountains can reach high altitudes of up to 9000 metres. They have formed from the upward movement of folds over millions of years. This process of mountain building is known as **orogeny**.
    - **Examples –** The main mountain ranges of the world are Fold Mountains, e.g. the **Alps** (Europe), **Himalayas** (Asia), **Andes** (South America) and the **Rocky Mountains/Rockies** (North America).
- **The study of plate tectonics has helped us to understand the global distribution of Fold Mountains. They have formed at or close to destructive or convergent plate boundaries**.

DESTRUCTIVE PLATE BOUNDARIES

- **This is where two plates move towards and push into each other**. **This convergence is most likely to be caused by two mantle convection currents moving towards each other**. **This leads to a collision between the plates**.
    - **Compression of rocks** will occur as two plates collide at destructive plate boundaries. This is the **pushing force** on rocks. This force presses against rocks **from two opposite sides**.
    - **Sedimentary rocks are vulnerable to compression**. This is because they are laid down in a series of horizontal layers. This allows folding to occur in response to compression.
    - **Rocks at lower depths are said to be ductile**. This means that they do not crack or break. Instead, the rock layers will bend into new shapes as they are squeezed and squashed together.
    - **Different types of folds will form** depending on the amount of compression. These include **anticlines** (upward folds), **synclines** (downward folds), **simple folds**, **asymmetrical folds**, etc.
    - **Uplift of rocks will occur** during a long period of intense compression. This is because there is a continuous upward pressure. This leads to the **upward rise of the ground surface**.
    - A series of surface folds will form with anticlines and synclines. The ongoing upward pressure will lead to the formation of a mountain range with high peaks. These are Fold Mountains.

EXAMPLE 1: **Continental – Continental Collision**

- This refers to when two **continental crustal plates are in collision**. The rocks of the continental crust are **old**, **very thick** but **less dense** (heavy) than rocks of oceanic crust. When collision of crustal plates occurs, **the rocks of the plate edges are not pushed downwards** into the mantle.
  - **Oceanic crust** may exist between the two continental plates. This will be made up of **sedimentary rock** layers. It is likely to be the **seabed of an ancient ocean**.
  - **Compression of sedimentary rocks** between the plates will occur. The upper rock layers will be squeezed together. This leads to **folding of the upper layers of sedimentary rock**.
  - **Folding will lead to an uplift** of the rock layers because the on-going compression causes the folded rocks to be pushed upwards. This upwards pressure **continues over millions of years**.
- **The Himalayas have formed in this way from the collision of the Eurasian plate and the Indian plate.** The seabed of the ancient **Tethys Ocean** was pushed upwards. The highest peaks are nearly 30,000 feet high. This process is on-going (the average increase in mountain height is ___ mm.
- This type of collision has also affected areas away from the immediate plate margins. It has led to the formation of the mountain ranges of Ireland. The Wicklow Mountains were formed during the Caledonian Folding when the North American and Eurasian plates collided 400 million years ago. Other mountains, e.g. the MacGillicuddy Reeks and the Galtee Mountains were formed during the Armorican Folding 250 million years when the African and Eurasian Plates collided.

EXAMPLE 2: **Oceanic – Continental Collision**

- This refers to when two plates collide but one plate is made up of **oceanic crust** while the other is made up of **continental crust**. The oceanic crust is heavier and will be pushed downwards into the mantle where it melts. This process is known as **subduction**.
  - The rocks of the lighter but thicker continental crust will be compressed. This causes them to buckle and fold near the plate margin. The on-going compression causes the folds to be pushed upwards.
  - The oceanic plate that is being subducted will also cause an uplift of the overlying continental plate. This will adding to the upward rise of the folding at the edge of the continental plate.
- **This type of collision is occurring where the oceanic crust of the Nazca is colliding and subducting against the continental crust of the South American Plate. This has led to the formation of the Andes Mountains.**

Population Distribution – Irish Region: Greater Dublin Area

Population Distribution – Explanation

Population distribution describes where people are living in a geographical area, e.g., a region, a country, etc. It refers to how population is spread out across that area.

- Population distribution shows how population numbers change across an area. In many regions, **distribution of population tends to be uneven**. This means that within the same region **some areas have a low population** while **other areas have a high population**.
  - The variations and changes in population numbers within a region can be explained by referring to **population density**. This is the average number of people living in an area. It is measured in terms of **square kilometres** (km^2) or square miles (mi^2).
  - Population density can be used to show the contrasts in population distribution within the same region. Areas that have few people are said to have a **low population density**. Areas with a great number of people are described as having a **high population density**.

Irish Region – Greater Dublin Area

The Greater Dublin Region (GDA) is located in the mid-east part of Ireland. It is made up of the Dublin Region and the neighbouring counties of Kildare, Meath and Wicklow.

- The 2016 census recorded that the Greater Dublin Area had a population of ____**million**. This is equal to % of Ireland's population even though the region only covers 10% of its area.
- (**Most of the GDA's population lived in the Dublin Region** with _______ million people. _______ people in Co. Kildare; 184,000 people in Co. Meath; 136,000 people in Co Wicklow).

Factors Influencing Population Distribution in the Greater Dublin Area

The GDA has an uneven population distribution. There are **great contrasts in population densities** across the region. Some parts have a very high population density. Other places have a very low population density. This is because of the influence of physical and human factors.

Factor 1 – Relief

The **height and gradient of land varies across the GDA**. This will directly impact on population distribution. In some places, it will restrict settlement. In other places, it allows settlement.

High Relief – Low Population Density

- The main upland/mountain area in the GDA region is the **Wicklow Mountains** (located in the centre of Co. Wicklow). It is the largest continuous upland area in Ireland. It extends for an area of **500 km^2** (at a height of 300 metres). It reaches heights over 900 metres (3,000 feet).

  The higher altitudes restrict settlement for the following reasons;

- **Harsher weather conditions** – Temperatures are lower in winter with snow cover and ice in many parts. The area is exposed to high rainfall up to 2000mm) and strong winds.
- **Steep Slopes** – Much of the upper parts is made up of mountains such as Kippure and Lugnaquilla. The **steep slopes restrict access** (fewer roads) and **limits house building**.
- **Lack of economic activity** – Much of the upland/mountain area is made up of **blanket bog**. This is often **waterlogged**. A lot of this land is used for sheep grazing or forestry.

- These restrictions mean that much of the area of the Wicklow Mountains has **no or a very low population settlement**. Overall, the population density in County Wicklow is **67 per km^2**.

Low Relief – Higher Population Density

- Most of the GDA is part of the **Central Plain of Ireland**. This is a mainly flat/gently sloping landscape. Co. Meath, Co. Kildare and most of Co. Dublin is part of this physical region.

  The lower altitudes allow settlement for the following reasons;

  - **Better weather conditions** – This ensures better living conditions. Moderate temperature levels occur (16° average in July/5° average in January). Rainfall levels are also moderate.
  - **Low gradient** – The low slopes of much of the GDA are an advantage for building houses and expansion of settlement. They also allow for easy access and transport infrastructure.
  - **Economic Activity** – The low altitudes of much of the GDA have benefited the development of a successful agricultural sector. This is a major land use within the region.

- This physical advantage has allowed most settlement to occur across the areas of lowland relief. This is where the largest urban centres are located, i.e., Dublin City, Navan, Naas, etc.

Factor 2 – Economic

The GDA is an economic **core region**. It accounts for **50% of economic activity** in Ireland. This means that it is a major location for employment. This has led to inward migration to the GDA. This contributes to population growth. The urban area of Dublin City has expanded. This rise in the overall population has directly impacted on population distribution across the GDA.

- **Dublin City** – This includes the older part of the city (in and around the city centre). In 2011, it had a population of 527,000. It has a **high population density** of 4,500 per km^2. Many people live in high density residential areas so as to be close to work and services.
- **Dublin Suburbs** – Population density declines further out from the city centre. There is more space for housing, e.g., South Dublin has a population density of 1200 per km^2.
- **Commuter Belt** – Housing costs and congestion in Dublin have led many people to move to the surrounding counties. The population of these areas has risen quickly. In 1981, Kildare had a population of 104,000. In 2011, it had risen to 210,000. Most of the growth has occurred in towns in these counties, e.g. Navan, Naas, Greystones, etc.
- **Rural Areas** – In the rural areas of the GDA, **agriculture** is the main economic activity. This land use limits settlement in the outer areas of the GDA. It explains why areas counties such as Co. Meath have a lower population density, i.e., 78 per km^2.

The Dublin Region – A Core Economic Region

- A core economic region is the wealthiest and most developed economic area in a country. It has a concentration of industry, is mainly urban and a high population density.
  - An Irish example of a core economic area is the **Dublin Region**. This region covers the area of Dublin County and is dominated by Dublin city. (The three neighbouring counties of Meath, Kildare and Wicklow combine with Dublin to form the Greater Dublin Area).
  - In 2014, the Dublin Region accounted for about **40%** of the value of the Irish economy.

Factors Influencing Development

The Dublin Area, like other core regions, benefits from a wide range of natural (physical) and human factors that have been and continue to be advantages for economic development.

- **Natural Advantages** – The region's physical environment helps economic development.
  - **Relief** – The region is a lowland area with much of the land gently sloping or undulating. The only upland is found on the southern edge, i.e. the Dublin Mountains. The landscape benefits economic development as it is ideal for settlement and transport. The land also benefits agriculture as much of it is covered with fertile brown earths.
  - **Climate** – The climate is the same as the rest of Ireland (**cool, temperate**, **oceanic**) but receives less rainfall (800mm), milder temperatures (summer average of 16C°) and higher sunshine levels. This is a pleasant environment for settlement and farming.
  - **Geographical Location** – Its location on the east coast gives the region easier access to Northern Ireland, Britain and mainland Europe. This benefits industrial location.

- **Human Advantages** – The human environment also benefits economic development.
  - **Capital City** – Dublin is the centre of government and administration in Ireland. This means that it is the main **centre of political and economic decision making**.
  - **Population** – The region's population was ___ _million in 2011. This is ____28% of the entire national population. The population is mainly urbanised with a high population density (over 1200 per km). **This provides a large market**.
  - **Average Incomes** – The region had an average disposable income of €________in 2012. This was about 20% higher than the national average. This **higher purchasing power will attract business to the region**.
  - **Labour** – The region benefits from a strong **supply of skilled labour**. Nearly 50% of third level students are in Dublin while over 35% of the population has a third level qualification. This is an advantage for many secondary and tertiary industries.

- **Infrastructure** – Dublin is the **centre (nodal point) of the national road and rail network**. All key routes, e.g. the M1, M7, etc., converge upon the city. It also has the main international links with Dublin Airport and Dublin Port. Important utilities such as broadband, electricity, water supplies, etc., are easily accessed.

- The combination of natural and human factors has allowed a **huge range of economic activities to develop**. Many activities are closely inter-related allowing economies of scale to develop. This concentration of industry in urban centres is known as **agglomeration**.

Economic Sectors

Primary Activities

- This is the smallest sector of the economy with only about 1% of the workforce directly employed in this sector. It still makes an important contribution, especially farming.
- Farming is intensive in nature. Farm size is the highest in Ireland. The emphasis is on high levels of production. The main activities are market gardening, dairying and cereal growing (10% of national crop) in the north of County Dublin.

Secondary Activties

- It is the most important manufacturing region in the state with about 1/3 of all secondary activities located there. It accounts for 15% of all employment (around 80,000) workers.
- Traditional industries have declined, e.g., construction, printing, etc. but some important examples remain. These include brewing (Guinness) and printing.
- The focus in recent decades has been on the new, highly skilled industries. Many of these involve MNC's locating in the region. Examples of this include pharmaceuticals, medical equipment and ICT. These industries account for most manufacturing activity. Much research and development is linked to this sector, e.g., biotechnology (**quaternary** industry).

Tertiary Activities

- This is the largest sector (over 80% employed). There are over ________businesses in this sector from small shops to large MNC's. Examples include;
  - Tourism – 6 million visitors arrived in Dublin in 2015. This was worth €5 billion to the local economy. Many jobs created in the hospitality sectors, i.e., hotels, bars, etc.
  - Financial Services – many are employed in locations such as the IFSC where many banking, insurance, etc., operations are centred.
  - ICT Services – many leading international companies have located in Dublin, e.g., Google, Ebay, Microsoft, etc.
  - Retail – The busiest shopping areas are located in the Dublin Area, e.g., Grafton Street.