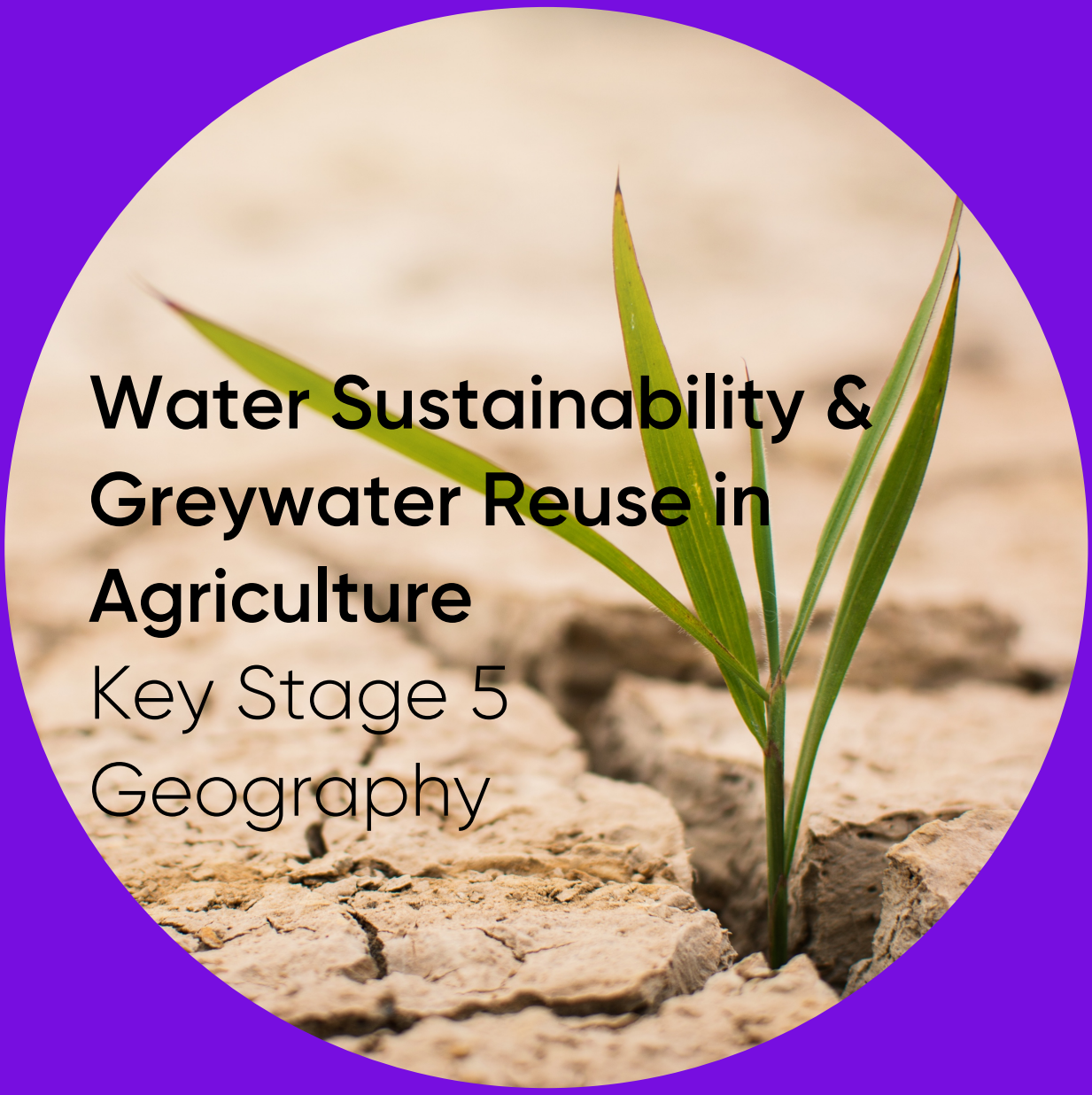
Research Based Curricula



Water Sustainability & Greywater Reuse in Agriculture

Key Stage 5 Geography

2020

University of Reading | AccessEd Research-Based Curricula

Resource One Model Answers

Answers

1. Rivers, lakes, groundwater, frozen ice caps.
2. From Wikipedia: "Evaporation is a type of vaporization that occurs on the surface of a liquid as it changes into the gas phase"; "Transpiration is the process of water movement through a plant and its evaporation from aerial parts, such as leaves, stems and flowers".
3. The amount of water on the planet is constant - it cannot increase or decrease.
4. From WIkipedia: "If land is covered by impermeable surfaces, such as pavement, infiltration cannot occur as the water cannot infiltrate through an impermeable surface This relationship also leads to increased runoff. Areas that are impermeable often have storm drains which drain directly into water bodies, which means no infiltration occurs".
5. -
6. See 'permeable pavement systems', 'artificial wetlands' and 'green roofs' in the data source.

Resource Two Model Answers

Answers

1. Physical: where surface and groundwater resources are inadequate to supply the region's water demands
2. Economic: due to a lack of water infrastructure or to the poor management of water resources where infrastructure is in place
3. Hidden water usage is water used to produce products we use or consume such as the amount of water used in processing beef from farm to table
4. Agricultural Sector
5. Growing populations consume more consumer products including food produce. As shown above the agricultural industry are responsible for ~65% of global freshwater usage. Table 1 shows that many forms of food have very high hidden water usage associated to them.
6. We can replace high water usage produce in our diet (eg: Beef and Chicken) with lower water usage produce such as Pulses and Vegetables

Resource Three Model Answers

Answers

1. Growing concerns over carbon footprint and water consumption attributed to food production is driving more communities to look to sourcing locally grown produce.
2. An aquaponics system is one where fish and plants are essential in each other's growth. In an aquaponics system the waste produced by the farming of fish or other aquatic creatures supply the nutrients for the grown of plants. The growing plants then in turn purify the water supply for the fish.
3. Any three of the following (or any other independently researched example) : Camp Green (Kampala, Uganda), Ciades Sem Fome (São Paulo, Brazil), City Farm Project (Bangkok, Thailand), Economics and Sustainability (ESTA) (Milan, Italy), Gaza Urban and Peri-Urban Agriculture Project (Gaza)
4. Climate, Humidity, Water and Light
5. In less favourable climates CEA agriculture may result in more energy consumption and CO2 emissions due to the increased amount of heating and artificial light that is needed to be supplied. Compared to traditional soil-based farming in more favourable climates where optimal growing temperatures and sunlight may already be available.

Resource Four Model Answers

Answers

1. Hydroponics is planting without the use of soil but instead with nutrient rich water
2. Faster growth, Water efficient (reduces water loss to absorption), Fertiliser/Nutrient water is distributed to all plants without need for individual plant maintenance, Plants can be grown at many locations regardless of soil suitability, Allows for growth in urban areas.
3. It reduces loss of water via absorption into the soil.
4. Wick: Passive system, the nutrient solution is drawn into the growing medium from the reservoir with a wick. Disadvantage: plants that are large or use large amounts of water may use up the nutrient solution faster than the wick(s) can supply it. Water Culture: A platform holds the plants which floats directly on the nutrient solution. An air pump supplies air to the air stone which bubbles the nutrient solution and supplies oxygen to the roots of the plants. Disadvantage: doesn't work well with large plants or with long-term plants. EBB & FLOW: A grow tray is temporarily flooded with nutrient solution which is then drained back into a reservoir. This action is normally done with a submerged pump that is connected to a timer. When the timer turns the pump on nutrient solution is pumped into the grow tray. Drip System (Recovery or non-Recovery): A timer turns a pump on and nutrient solution is dripped onto the base of each plant. In a Recovery Drip System, the excess nutrient solution that runs off is collected back in the reservoir for re-use. The Non-Recovery System does not collect the run off. Disadvantage: sensitive to power/pump failure. Recovery systems require more maintenance non-recovery waste nutrient solution through run-off. N.F.T. (Nutrient Film Technique): A constant flow of nutrient solution is pumped into a growing tray (usually a tube) and flows over the roots of the plants and drains back into the reservoir. Disadvantages: Very susceptible to power outages and pump failures. The roots dry out very rapidly when the flow of nutrient solution is interrupted. Aeroponics: Roots hang in the air and are misted with nutrient solution every few minutes. Disadvantages: Roots will dry out rapidly if misting is interrupted, Susceptible to power and timer malfunctions.
5. Set up costs, maintenance and very sensitive to technical malfunctions. (any other valid suggestions)

Resource Five Model Answers

Answers

1. Greywater is wastewater from households that does not contain faecal contamination
2. 50 – 80% water saving (based upon average use)
3. rapid deterioration occurs because greywater is often warm and rich in organic matter such as skin particles, hair, soap and detergents. This warm, nutrient-rich water provides ideal conditions for bacteria to multiply, resulting in odour problems and poor water quality
4. Showering/ Bathing – 35%, Toilet Flushing – 30%, Laundry – 20%, Kitchen and Drinking – 10%, Cleaning – 15%
5. Greywater is a nutrient rich and so can offer fertilisation for plant and crop growth in agriculture.

Resource Six Model Answers

Answers

1. The ability to grow the business over time in order to generate more of your product.
2. In an urban setting, agricultural businesses can often struggle to scale due to the inability to acquire enough city space in order to scale up their production.
3. urban agriculture can be a highly productive use of land, with each square meter put under cultivation equivalent to nearly twice that area of rural farmland.
4. Vertical Farming
5. increased crop yield that comes with a smaller unit area of land requirement.

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