

Topic: Urban runoff is the most harmful water contaminator.

Task: #6 Outline or Scaffolding the Topic (100 Points)

1. What is the most harmful water contaminator?
2. Urban runoff is the most harmful water contaminator because it carries harmful pollutants into lakes, rivers, streams, and other bodies of water and is shown to cause health problems in humans. On the contrary, agricultural runoff also causes health problems in humans and harms aquatic life.
3. Reason 1- Urban runoff carries harmful pollutants into lakes, streams, rivers, etc.
 - a. Example- Urban runoff is causing fertilizers, sediment, and leaves to flood into the Chesapeake Bay. This pollution is harming oyster beds, underwater grass, and water animals by crushing them with sediment or pouring fertilizers onto them (Bay 101: Stormwater Runoff, 2011). The Chesapeake Bay Program is a reliable, regional partnership that works to restore and protect the Chesapeake Bay with the help of their experienced staff members from federal and state agencies, non-profit organizations, and academic institutions, however they have a very one-sided view when it comes to water pollution because their whole program sprouted from excessive pollution in the Chesapeake Bay and without those contaminators, they would not be an organization today.
 - b. Example- "...we analyzed the role of STPs as a source of metals in the Ripoll River, a heavily urbanized and industrialized watercourse with a long history of anthropogenic disturbance (Maceda-Veiga, A., Monroy, M., & de Sostoa, A., 2011)." In this study, which took place at the Ripoll River in Vallès Occidental, Catalonia, Spain, researchers tested the water for iron, mercury, cadmium, zinc, lead, nickel, and copper by taking samples of metal accumulation in the liver and muscle of Mediterranean Barbels, or *Barbus meridionalis* because these fish rarely leave the area. "The elements determined in the water chemical analyses were also found in all the fish samples, regardless of the site. The liver was the best target organ for all elements determined, except for Hg which also showed significant differences in muscle. To further describe the metal bioaccumulation pattern in *B. meridionalis* related to sampling sites and the type of tissue analyzed, Generalized Additive Mixed Models (GAMMs) were performed. GAMMs explained on average the 62% of variation (R²) in metal levels and considered

significant factors both type of tissue and sampling site. With the exception of Pb, specimens from sites downstream the influence of STPs bioaccumulated higher metal levels than those collected in reference sites (Maceda-Veiga, A., et al, 2011).” Alberto Maceda-Veiga is able to speak on pollution effects to the Mediterranean Barbel because he works for the Department of Animal Biology and Biodiversity Research Institute at the University of Barcelona in Spain, his research spans ecology, conservation, and management of freshwater ecosystems with emphasis on fish populations of Mediterranean rivers, and he has 23 publications all based upon the ideas that he studies, however, Maceda-Veiga has a vested interest in his publications because his career and wealth depends on the popularity of his work.

4. Reason 2- Urban runoff is shown to cause health problems in humans.
 - a. Example- “Water samples (20 L) were collected after storm events and during the dry weather from six sites in Brisbane, Australia. Collected samples were analyzed for fecal indicator bacteria (FIB), and then concentrated using hollow fiber ultrafiltration followed by molecular detection of selected enteric pathogens (Sidhu, J., Hodgers, L., Ahmed, W., Chong, M., Toze, S., 2012).” Researchers tested for numerous microbial contaminants in the water sources of these cities. “Human adenovirus and polyomavirus were frequently detected from all six sampling sites during wet and dry weather conditions suggesting their wide spread presence in the urban aquatic environments.” The results of these samples suggest omnipresent sewage contamination in the water sources of urban cities in Brisbane, Australia. “[This contamination] presents highly significant health risks of >10% gastrointestinal illness with a single exposure (Sidhu, J., et al, 2012).” J.P.S. Sidhu is an employee of CSIRO Land and Water, a group that focuses on measurement and prediction of available water in Australia, a part of the Faculty of Science at the University of the Sunshine Coast, and has over ten publications under the topic of water contamination and its effects, giving him the ability to speak on water contamination in Australia, however, J.P.S. Sidhu has vested interest in his publications because his career depends on the popularity of them and no biology degrees were found in my research.
 - b. Example- A study was done in California in order to test the effect of urban runoff on human health. To do this, researchers interviewed surfers who are in the oceans at least once each week to see what type of symptoms they were experiencing. North Orange County (NOC) was used as the “urban” site because their watershed generates runoff with high amounts of pollution. Santa Cruz County (SCC) was used as the “rural” site due to their quality of water and runoff. “The urban versus rural analysis showed that NOC participants reported almost twice as many symptoms overall as SCC participants...NOC participants reported higher rates of every symptom (Dwight, R., Baker, D., Semenza, J., & Olson, B., 2003).” Ryan H. Dwight, who has a Bachelor of Sciences Degree and a Ph.D. in Health Sciences, has

three publications about coastal water pollution, a topic that he has done extensive research on and has much experience in because he is employed with the University of California-Irvine in the Environmental Health Science and Policy Program under the Department of Environmental Health and was a part of the Coastal Water Research Group in 2004, however, Dwight's research has never expanded beyond the state of California, where he went to school and performed all of his studies for his publications.

5. Counter-Reason 1- Agricultural runoff causes health problems in humans.

- a. Example 1- In the agricultural areas of Hua-ruea sub-district, Ubon Ratchathani in Thailand, a study was performed to discover the human health effects caused by agricultural contamination to water. "Samples were randomly collected from 12 wells twice in each of the rainy and dry seasons and were analyzed by inductive coupled plasma spectrometry-mass spectrometry (ICP-MS) (Wongsasuluk, P., Chotpantararat, S., Siriwong, W., & Robson, M., 2013)." Many adverse human health effects were detected during this study. "...allergies, hyperpigmentation, and induction of cancer caused by As and Cd, for example, result from their absorption in the gastrointestinal system. Once absorbed, they target the liver, placenta, kidneys, lungs, brain and bones...can lead to bladder, lung and prostate cancer...Ni induced oxidative stress, DNA strand breaks and apoptosis...(Wongsasuluk, P. et al, 2013)." Pokkate Wongsasuluk is experienced in hydrology, hydrogeology, geochemistry, and environmental science after his education at the Chulalongkorn University in Bangkok, and has two publications based on effects of metals in drinking water, giving him the ability to speak on the topic after extensive research on it, however, no degrees were found from Chulalongkorn University that would give Wangsasuluk the ability to perform these studies on metal contamination in water sources.
- b. Example 2- Researchers have begun to test the effects of agricultural pollution on drinking water. Subhash Chand of the Division of Soil Science, Malik Ashif of the Division of Environmental Sciences, Zargar M.Y., Chief Scientist of Environmental Science, and Bhat M. Ayub of the Sher-e-Kashmir University of Agriculture Sciences and Technology of Kashmir have discovered that, "...anthropogenic sources have greatly increased the nitrate concentration...nitrates in groundwater in some instances are above the safe levels proposed by the EPA and thus pose a threat to human health... incidence of methemoglobinemia appears to be the result of high nitrate levels. Methemoglobinemia or blue baby syndrome robs the blood cells of their ability to carry oxygen (Chand, S., Ashif, M., M.Y., Z., Ayub, B., 2011)." Subhash Chand, an assistant professor under the Division of Soil Science at the Sher-e-Kashmir University of Agriculture Sciences and Technology, has done research on balance fertilization, integrated nutrient management, potassium, climate change, soil pollution, soil fertility, soil microbiology, organic farming, and food, giving him the knowledge to speak

on soil pollution and its effects on human health, however, no degrees were found in any subject, such as biology, agricultural science, etc., that would give Chand the expertise to speak on nitrate pollution in soil due to agricultural activities.

6. Counter-Reason 2- Agricultural runoff harms aquatic life.

- a. Example 1- Agricultural fertilizers that are being used around the Mississippi are greening the river and creating “dead zones” up the river and down it. These pollutants are harming the aquatic ecosystems and divers who went down for investigations reported back that they did not see living organisms in the water. Phosphorus and nitrogen are the main elements involved in this pollution of the Mississippi River. Scientists are predicting that the river will be filled with sediment in the next 300 years and it, along with all of its aquatic life, will be gone (Troubled Waters- agriculture and water pollution, 2010). Paul Manly, director, producer, and writer of this film, has twenty-four years of experience in filmmaking and has produced numerous other films, such as, *Footprints*, *Upgrade*, *You, Me, and the SPP*, and many more, however, Manly does not have any expertise in the area of water pollution, giving him no ability to speak on the greening of the Mississippi River specifically, even if he is well-trained in the area of film production.
- b. Example 2- In the Mid-Western Entre Rios Province, located in Argentina, researchers tested the effects of agricultural runoff on the survival, growth and development rates, erythrocytes nuclei aberrations, parasite infection, and brain cholinesterase activity in *Scinax nasicus* tadpoles. “Water samples from the ponds were analyzed for physico-chemical variables and levels of pesticide residues (Peltzer, P., Lajmanovich, R., Sanchez-Hernandez, J., Cabagna, M., Attademo, A., & Basso, A., 2007).” Two ponds were situated in environments near to agricultural activity. Acceso Norte (AN) and La Picada (LP) were the two sites, and both are surrounded by soybean fields, where they receive great amounts of runoff from agricultural lands. Parque Urquiza Nuevo (PUN) was used as the control site because it is located within a native forest, receiving no agricultural runoff. “The two agricultural ponds (AN and LP) showed clear evidence of eutrophication in comparison with the control site (PUN). Concentrations of nitrate and orthophosphate were more than one order of magnitude higher in the agricultural ponds than those in the reference pond...No survivors were found in the LP site...a 60% of mortality was found in the tadpoles caged at the AN site and no dead was recorded in the control site (Peltzer, P. et al, 2007).” Paola M. Peltzer has a Doctorate in Natural Sciences (Zoology) from the University of La Plata in Argentina, sixty-four publications to her name, and was the Associate Editor of Cuadernos de Herpetología-Asociación Herpetológica Argentina, giving her the expertise and knowledge to speak on the effects of agricultural pollution to native tadpoles, however, Peltzer has vested interest when it comes to her sixty-

four publications because her career depends on the selling and popularity of her work.

Reflection:

In researching the harmful effects of polluted runoff, I have found that water pollution is a much greater issue than I had expected. I knew that water pollution had some harmful effects, but was unaware of just how extensive the effects were to not only aquatic life, but humans who swim in and drink the water as well. I believe that enough research has been done to understand the effects of polluted runoff flowing into oceans, rivers, streams, etc., but now, change needs to be made in order to protect our bodies of water and the health of our population, both human and aquatic. I think that more people need to be aware of signs of water pollution and how to prevent it and I think the government needs to become more involved in protecting our water, because soon enough, it will be gone due to excessive amounts of pollution.

Conclusion: Urban runoff has been proven to be the most harmful water contaminator because it carries extremely harmful pollutants into lakes, streams, etc. and it has detrimental effects on human health, however, agricultural runoff is a close competitor for the most harmful contaminator because it also has very negative effects on human health and harms aquatic life.

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