# Study on Pollution Due To Runoff to Surface Water and Leaching To Groundwater in Lakes

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## INTRODUCTION

Nutrients from human activities tend to travel from land to either surface or ground water. Nitrogen in particular is removed through storm drains, sewage pipes, and other forms of surface runoff. Nutrient losses in runoff and leachate are often associated with agriculture. Modern agriculture often involves the application of nutrients onto fields in order to maximise production. However, farmers frequently apply more nutrients than are taken up by crop or pastures. Regulations aimed at minimising nutrient exports from agriculture are typically far less stringent than those placed on sewage treatment plants and other point source polluters. It should be also noted that lakes within forested land are also under surface runoff influences. Runoff can wash out the mineral nitrogen and phosphorus from detritus and in consequence supply the water bodies leading to slow, natural eutrophication.

## MATERIAL AND METHOD

## ATMOSPHERIC DEPOSITION

Nitrogen is released into the air because of ammonia volatilization and nitrous oxide production. The combustion of fossil fuels is a large human-initiated contributor to atmospheric nitrogen pollution. Atmospheric deposition (e.g., in the form of acid rain) can also affect nutrient concentration in water, especially in highly industrialized regions.

## OTHER CAUSES

Any factor that causes increased nutrient concentrations can potentially lead to eutrophication. In modeling eutrophication, the rate of water renewal plays a critical role; stagnant water is allowed to collect more nutrients than bodies with replenished water supplies. It has also been shown that the drying of wetlands causes an increase in nutrient concentration and subsequent eutrophication blooms.

## PREVENTION AND REVERSAL

Eutrophication poses a problem not only to ecosystems, but to humans as well. Reducing eutrophication should be a key concern when considering future policy, and a sustainable solution for everyone, including farmers and ranchers, seems feasible. While eutrophication does pose problems, humans should be aware that natural runoff (which causes algal blooms in the wild) is common in ecosystems and should thus not reverse nutrient concentrations beyond normal levels.

## EFFECTIVENESS

Cleanup measures have been mostly, but not completely, successful. Finnish phosphorus removal measures started in the mid-1970s and have targeted lakess and lakes polluted by industrial and municipal discharges. These efforts have had a 90% removal efficiency.Still, some targeted point sources did not show a decrease in runoff despite reduction efforts.

## MINIMIZING NONPOINT POLLUTION: FUTURE WORK

Nonpoint pollution is the most difficult source of nutrients to manage. The literature suggests, though, that when these sources are controlled, eutrophication decreases. The following steps are recommended to minimize the amount of pollution that can enter aquatic ecosystems from ambiguous sources.

## RIPARIAN BUFFER ZONES

Studies show that intercepting non-point pollution between the source and the water is a successful means of prevention. Riparian buffer zones are interfaces between a flowing body of water and land, and have been created near waterways in an attempt to filter pollutants; sediment and nutrients are deposited here instead of in water. Creating buffer zones near farms and roads is another possible way to prevent nutrients from traveling too far. Still, studies have shown that the effects of atmospheric nitrogen pollution can reach far past the buffer zone. This suggests that the most effective means of prevention is from the primary source.

## PREVENTION POLICY

Laws regulating the discharge and treatment of sewage have led to dramatic nutrient reductions to surrounding ecosystems, but it is generally agreed that a policy regulating agricultural use of fertilizer and animal waste must be imposed. In Japan the amount of nitrogen produced by livestock is adequate to serve the fertilizer needs for the agriculture industry.Thus, it is not unreasonable to command livestock owners to clean up animal waste—which when left stagnant will leach into ground water.

Policy concerning the prevention and reduction of eutrophication can be broken down into four sectors: Technologies, public participation, economic instruments, and cooperation. The term technology is used loosely, referring to a more widespread use of existing methods rather than an appropriation of new technologies. As mentioned before, nonpoint sources of pollution are the primary contributors to eutrophication, and their effects can be easily minimized through common agricultural practices. Reducing the amount of pollutants that reach a watershed can be achieved through the protection of its forest cover, reducing the amount of erosion leeching into a watershed. Also, through the efficient, controlled use of land using sustainable agricultural practices to minimize land degradation, the amount of soil runoff and nitrogen-based fertilizers reaching a watershed can be reduced. Waste disposal technology constitutes another factor in eutrophication prevention. Because a major contributor to the nonpoint source nutrient loading of water bodies is untreated domestic sewage, it is necessary to provide treatment facilities to highly urbanized areas, particularly those in underdeveloped nations, in which treatment of domestic waste water is a scarcity.The technology to safely and efficiently reuse waste water, both from domestic and industrial sources, should be a primary concern for policy regarding eutrophication.

## CONCLUSION

The role of the public is a major factor for the effective prevention of eutrophication. In order for a policy to have any effect, the public must be aware of their contribution to the problem, and ways in which they can reduce their effects. Programs instituted to promote participation in the recycling and elimination of wastes, as well as education on the issue of rational water use are necessary to protect water quality within urbanized areas and adjacent water bodies.

Economic instruments, “which include, among others, property rights, water markets, fiscal and financial instruments, charge systems and liability systems, are gradually becoming a substantive component of the management tool set used for pollution control and water allocation decisions. Incentives for those who practice clean, renewable, water management technologies are an effective means of encouraging pollution prevention. By internalizing the costs associated with the negative effects on the environment, governments are able to encourage a cleaner water management.

Because a body of water can have an effect on a range of people reaching far beyond that of the watershed, cooperation between different organizations is necessary to prevent the intrusion of contaminants that can lead to eutrophication. Agencies ranging from state governments to those of water resource management and non-governmental organizations, going as low as the local population, are responsible for preventing eutrophication of water bodies.

## REFERENCES

Baines, S.B., and Pace, M.L. 1994. Relationships between suspended particulate matter and sinking flux along a trophic gradient and implications for the fate of planktonic primary production. Can. J. Fish. Aquat. Sci. **51**(1): 25–36. doi:10.1139/ f94-005.

Biddanda, B., Ogdahl, M., and Cotner, J. 2001. Dominance of bacterial metabolism in oligotrophic relative to eutrophic waters. Limnol. Oceanogr. **46**: 730–739.

Bremigan, M.T., and Stein, R.A. 2001. Variable gizzard shad recruitment with reservoir productivity: causes and implications for classifying systems. Ecol. Appl. **11**(5): 1425–1437. doi:10. 1890/1051-0761(2001)011[1425:VGSRWR]2.0.CO;2.

Caraco, N.F., Cole, J.J., and Likens, G.E. 1992. New and recycled primary production in an oligotrophic lake: insights for summer phosphorus dynamics. Limnol. Oceanogr. **37**: 590–602.

Caston, C.B., Nowlin, W.H., Gaulke, A.M., and Vanni, M.J. 2009. The relative importance of heterotrophic bacteria to pelagic ecosystem dynamics varies with reservoir trophic state. Limnol. Oceanogr. **54**(6): 2143–2156.

Chen, N.W., Hong, H.S., Zhang, L.P., and Cao, W.Z. 2008. Nitrogen sources and exports in an agricultural watershed in Southeast China. Biogeochemistry, **87**(2): 169–179. doi:10.1007/s10533-007-9175-2.

Clark, D.R., Rees, A.P., and Joint, I. 2008. Ammonium regeneration and nitrification rates in the oligotrophic Atlantic Ocean: implications for new production estimates. Limnol. Oceanogr. **53**: 52–62.

Cole, J.J., Prairie, Y.T., Caraco, N.F., McDowell, W.H., Tranvik, L.J., Striegl, R.G., Duarte, C.M., Kortelainen, P., Downing, J.A., Middelburg, J.J., and Melack, J. 2007. Plumbing the global carbon cycle: integrating inland waters into the terrestrial carbon budget. Ecosystems (N.Y., Print), **10**(1): 172–185. doi:10.1007/s10021-006-9013-8.

Cotner, J.B., and Biddanda, B.A. 2002. Small players, large role: microbial influence on biogeochemical processes in pelagic Domine et al. 285 Published by NRC Research Press aquatic ecosystems. Ecosystems (N.Y., Print), **5**(2): 105–121. doi:10.1007/s10021-001-0059-3.

Davies, J.M., Nowlin, W.H., and Mazumder, A. 2004. Temporal changes in nitrogen and phosphorus codeficiency of plankton in lakes of coastal and interior British Columbia. Can. J. Fish. Aquat. Sci. **61**(8): 1538–1551. doi:10.1139/f04-092.

Dickman, E.M., Vanni, M.J., and Horgan, M.J. 2006. Interactive effects of light and nutrients on phytoplankton stoichiometry. Oecologia (Berl.), **149**(4): 676–689. doi:10.1007/s00442-006-0473-5.

Dore, J.E., and Karl, D.M. 1996. Nitrification in the euphotic zone as a source for nitrite, nitrate and nitrous oxide at Station ALOHA. Limnol. Oceanogr. **41**: 1619–1628.

Downing, J.A., Cole, J.J., Middelburg, J.J., Striegl, R.G., Duarte, C.M., Kortelainen, P., Prairie, Y.T., and Laube, K.A. 2008. Sediment organic carbon burial in agriculturally eutrophic impoundments over the last century. Global Biogeochem. Cycles, **22**(1): GB1018. doi:10.1029/2006GB002854.

Duce, R.A., LaRoche, J., Altieri, K., Arrigo, K.R., Baker, A.R., Capone, D.G., Cornell, S., Dentener, F., Galloway, J., Ganeshram, R.S., Geider, R.J., Jickells, T., Kuypers, M.M., Langlois, R., Liss, P.S., Liu, S.M., Middelburg, J.J., Moore, C.M., Nickovic, S., Oschlies, A., Pedersen, T., Prospero, J., Schlitzer, R., Seitzinger, S., Sorensen, L.L., Uematsu, M., Ulloa, O., Voss, M., Ward, B., and Zamora, L. 2008. Impacts of atmospheric anthropogenic nitrogen on the open ocean. Science (Washington, D.C.), **320**(5878): 893–897. doi:10.1126/science.1150369. PMID: 18487184.

Dugdale, R.C., and Goering, J.J. 1967. Uptake of new and regenerated forms of nitrogen in primary productivity. Limnol. Oceanogr. **12**: 196–206.

Eppley, R.W., and Peterson, B.J. 1979. Particulate organic matter flux and planktonic new production in the deep ocean. Nature (London), **282**: 677–680. doi:10.1038/282677a0.

Fee, E.J. 1990. Computer programs for calculating in situ phytoplankton photosynthesis. Can. Tech. Rep. Fish. Aquat. Sci. No. 1740 [revised 1998].

Harrison, J.A., Maranger, R.J., Alexander, R.B., Giblin, A.E., Jacinthe, P.A., Mayorga, E., Seitzinger, S.P., Sobota, D.J., and Wollheim, W.M. 2009. The regional and global significance of nitrogen removal in lakes and reservoirs. Biogeochemistry, **93**(1–2): 143–157. doi:10.1007/s10533-008-9272-x.

Hudson, J.J., and Taylor, W.D. 2005. Phosphorus sedimentation during stratification in two small lakes. Arch. Hydrobiol. **162**(3): 309–325. doi:10.1127/0003-9136/2005/0162-0309.

Hudson, J.J., Taylor, W.D., and Schindler, D.W. 1999. Planktonic nutrient regeneration and cycling efficiency in temperate lakes. Science (Washington, D.C.), **400**: 659–661.

Kitchell, J.F., O'Neill, R.V., Webb, D., Gallepp, G.W., Bartell, S.M., Koonce, J.F., and Ausmus, B.S. 1979. Consumer regulation of nutrient cycling. Bioscience, **29**(1): 28–34. doi:10.2307/1307570.

Knoll, L.B., Renwick, W.H., and Vanni, M.J. 2003. Phytoplankton primary production and photosynthetic parameters in reservoirs along a gradient of watershed land use. Limnol. Oceanogr. **48**: 608–617.

Laurich, L.M. 2005. The role of detritivorous fish in supporting new phosphorus and primary production in reservoir ecosystems. M.Sc. thesis, Department of Zoology, Miami University, Oxford, Ohio. Mehner, T., Ihlau, J., Do¨rner, H., and Ho¨lker, F. 2005. Can feeding of fish on terrestrial insects subsidize the nutrient pool of lakes?

Limnol. Oceanogr. **50**: 2022–2031.

Melack, J.M. 1978. Morphometric, physical and chemical features of the volcanic crater lakes of western Uganda. Arch. Hydrobiol. **84**: 430–453.

Nowlin, W.H., Evarts, J.L., and Vanni, M.J. 2005. Release rates and potential fates of nitrogen and phosphorus from sediments in a eutrophic reservoir. Freshw. Biol. **50**: 301–322.

Renwick, W.H., Vanni, M.J., Zhang, Q., and Patton, J. 2008. Water quality trends and changing agricultural practices in a Midwest U.S. watershed, 1994–2006. J. Environ. Qual. **37**(5): 1862–1874. doi:10.2134/jeq2007.0401. PMID:18689748.

Schaus, M.H., and Vanni, M.J. 2000. Effects of gizzard shad on phytoplankton and nutrient dynamics: role of sediment feeding and fish size. Ecology, **81**: 1701–1719.

Schaus, M.H., Vanni, M.J., Wissing, T.E., Bremigan, M.T., Garvey, J.E., and Stein, R.A. 1997. Nitrogen and phosphorus excretion by detritivorous gizzard shad in a reservoir ecosystem. Limnol. Oceanogr. **42**: 386–397.

Schaus, M.H., Vanni, M.J., and Wissing, T.E. 2002. Biomassdependent diet shifts in omnivorous gizzard shad: implications for growth, food web, and ecosystem effects. Trans. Am. Fish. Soc. **131**(1): 40–54. doi:10.1577/1548-8659(2002) 131<0040:BDDSIO>2.0.CO;2.

Schindler, D.E., and Scheuerell, M.D. 2002. Habitat coupling in lake ecosystems. Oikos, **98**(2): 177–189. doi:10.1034/j.1600-0706.2002.980201.x.

Shapiro, J., and Carlson, R. 1982. Comment on the role of fishes in the regulation of phosphorus availability in lakes. Can. J. Fish. Aquat. Sci. **39**: 364. doi:10.1139/f82-051.

Shostell, J., and Bukaveckas, P.A. 2004. Seasonal and interannual variation in nutrient fluxes from tributary inputs, consumer recycling and algal growth in a eutrophic lakes impoundment. Aquat. Ecol. **38**(3): 359–373. doi:10.1023/B:AECO.0000035167.67399.63.

Stein, R.A., DeVries, D.R., and Dettmers, J.M. 1995. Food-web regulation by a planktivores: exploring the generality of the trophic cascade hypothesis. Can. J. Fish. Aquat. Sci. **52**(11): 2518–2526. doi:10.1139/f95-842.

Vander Zanden, J.M., and Vadeboncoeur, Y. 2002. Fishes as integrators of benthic and pelagic food webs in lakes. Ecology, **83**(8): 2152–2161. doi:10.1890/0012-9658(2002)083[2152:FAIOBA]2.0.CO;2.

Vanni, M.J. 2002. Nutrient cycling by animals in freshwater ecosystems.