

Letter From the Desk of David Challinor
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The rampaging floods that devastated central Honduras a year ago and similar ones that occurred more recently along coastal Venezuela made evident the tenuous conditions under which millions of impoverished people live in close proximity to our country. Scientists had predicted that as a result of steady global warming, storms might not be more numerous, but those that did occur would be more violent. Sadly, we can expect even more death and destruction not only in neighboring countries where ever increasing numbers of poor people continue to build on unstable river banks near cities, but also in affluent North America where fragile flood plains are still being developed for farms and housing. This month's letter will consider to aspects of this problem: first, why people continue to risk living in such perilous riverine sites; and second, how wetlands throughout the world, which once controlled flooding, are no longer present to absorb and mitigate the noxious depositions from runoffs onto the plains of major river systems.

The world's urban population is expanding disproportionately fast in relationship to the rural population as country folk flock to cities, where they perceive the opportunities lie. They move there despite the dangers and discomforts of slum living, as well as the long-term risks from natural disasters. The predictable, distant costs of this lifestyle pale in comparison with their anticipated short-term gains from city living. It is unlikely that there will be a satisfactory solution to the problem of mass urban housing even in our own country. We have all watched in awe as huge, relatively new but decrepit apartment complexes implode to clear the way for yet another form of subsidized mass housing. We have learned that the social cost of cramming so many families into such culturally sterile conditions is prohibitive, but a satisfactory alternative has yet to be found.

We are witnessing today some of the unanticipated societal costs of rapid population growth. During my lifetime (1920-2000), the US population has grown from 106 million to 275 million. It is still increasing slowly, but due to immigration rather than birth rate. The immediate effect of ever more people living increasingly closer together is evident everywhere, including Washington, D.C. and its environs, where traffic congestion, for example, is exceeded only by the Los Angeles area. Despite a growing local anti-sprawl sentiment, the inexorable spread of housing developments is unlikely to slow. Loudoun County, Virginia, just southwest of Washington, recently set aside about one million dollars of taxpayers' money to meet the expected legal challenges from powerful developers opposed to the county's proposed restrictions on new building permits. In adjacent Fairfax County, the state of Virginia was forced by frustrated citizens to control development around an artificial eight-acre lake being rapidly filled with sediment from upstream housing projects. The state instructed the county to stop all

construction projects on the lake's 384-acre watershed. Streambeds were to be widened and silt dredged from

the lake. Now there is the inevitable delay while the county determines whether it has the authority to carry out the state's instructions and thereby control the watershed's developers. Meanwhile, the lakeside residents can only wait and watch as their lake turns to swamp. There the matter rests.

There are hundreds of such artificial lakes in new communities around Washington, all constructed to help sell houses. The new landowners, however, soon realized the ephemeral nature of such an amenity. In Howard County, Maryland, on the other side of Washington, a 15-year-old county-built lake is already so silted that its benefit to the lakefront owners has dropped precipitously. The cost of dredging these lakes is so high that county officials have delayed plans for two new artificial lakes until they decide whether a 15- to 20-year lake life is worth the investment. This represents a remarkable change in local, long-range landscape planning. If nothing is done, these artificial lakes will eventually fill in and may become more efficient in handling stream overflows than the original lakes.

On a much larger scale we can watch what is happening to the Chesapeake Bay--runoff from all the small watersheds of the bordering counties eventually empty into it. Of the six states that are members of the Chesapeake Executive Council (a body formed to control excessive sediment and nutrient runoff), only Virginia has opposed the Council's goal of reducing land-based discharge by 30 %. Virginia argues that land use controls are a local responsibility rather than the state's. With such a mindset, it is hard to be optimistic that the county and its incorporated towns have the necessary political clout to remedy the runoff problem. Meanwhile, the volume of sediment from all sources continues to grow slowly and to fill the east coast's largest and most productive estuary.

Once a landscape has been modified by humans – such as straightening a river, building a dam, or strip mining coal – the long-term consequences have to be offset by even more modifications in the future until such attempts to correct past errors become economically unfeasible. A good example of how time is running out on a once popular landscape alteration is that of the river alterations made by the greatest modifier of all -- the U.S. Army's Corps of Engineers (CoE). For almost a century the CoE, at the behest of Congress, has straightened river beds and built dams and levees throughout the country, especially in the Mississippi drainage basin. In the past few decades, in large part from the CoE's efforts, so much toxic nutrient material has flushed from this enormous watershed (40% of the entire lower 48 states) that an area of about 75,000 sq. miles (the size of New Jersey) in the Gulf off the mouth of the Mississippi is hypoxic. Hypoxia is a deficiency in the amount of oxygen reaching an organism. Thus at the sea bottom, no oxygen-dependent life -- i.e. no fish, no invertebrates and no plants – can exist. Until a few years ago this was one of the richest shrimping grounds in the entire Gulf. Its “death” resulted primarily from the excessive nitrogen (N) fertilizer used on crops, lawns and golf courses, as well as feed lot runoffs, all carried to the Gulf by the “improved” river system. During warm weather the nutrient-rich water encourages algal growth, which cold weather eventually kills, letting it sink to the bottom when the current ceases to carry it. Under normal

conditions, aerobic bacteria would attack the dead algae on the bottom and decompose it. However, with too much dead algae, the bacteria deplete the oxygen needed for them to do their job, thus creating a zone of hypoxia. The size of the present zone continues to expand. The problem of controlling this spread is compounded by the fresh water that pours from the river's mouth, particularly during floods. Fresh water being lighter than salt, tends to stay on the surface, thereby adding another barrier to oxygen reaching the Gulf's bottom where it is so badly needed.

How can the excessive N load being carried by the Mississippi ever be controlled? With a watershed shared by 27 states, it seems that only federal intervention can work. Under the overall direction of the National Oceanographic and Atmospheric Administration (NOAA), a plan is being prepared to cut the N load of the river's runoff by 40%. The technology is available to do so if enough individuals and organizations cooperate. A 20% reduction would take us back to where we were in the 1970's. Farmers often use more N than is really needed on crops and if 20% less N were applied to the grain fields of the watershed, the total yield would be determined more by the weather conditions during the growing season than by the precise amount of N applied. We should also remember that the bulk of the wheat, corn and soybeans produced in the nation's breadbasket is used to fatten livestock rather than for direct human consumption. Meat is an inefficient way for people to take in protein, yet encouraged by cheap grain from the US, meat eating is increasing rapidly in the Far East, especially in China and Japan. With such new and potentially enormous markets, even a small reduction in grain crop yield from fertilizer limitations is unlikely to be tolerated by the grain producers.

There are alternative ways to cut the N load of runoff water. One is to slow the pace at which it flows so that it has time to permeate the soil. This can be done by mandating buffer zones at least 10 meters wide along all stream banks. Natural vegetation growing there would intercept up to 80% of the N not used by the crops adjacent to the buffer zones. Another way is to increase wetland areas. When N-loaded water stays inert in flooded forests or swamps, the N has time to escape as a gas to the atmosphere. A 40% reduction in N reaching the Gulf could be gained if we restored or created 5 million new acres of bottomland forest. This is a big order and would represent about 0.7% of the entire Mississippi Basin, and an additional 19 million acres of buffer zones (2.7% of the Basin) would have to be established. To illustrate how far we have yet to go, only 230,000 acres have been restored as wetlands through 1997, which means that 100 times the area already converted would still be needed.

Is this goal to reduce N loading in the Mississippi Basin achievable? Probably not in my lifetime, but it is certainly worth the effort and subsequent generations will recognize the necessity of doing so better than the majority of us living today. There are some downsides to carrying out this plan, however. First, some productive, but vulnerable to flooding cropland would be pulled from production. Second, there could be an increase in the emission of nitrous oxide (a greenhouse gas) to the atmosphere from the significant expansion of wetlands. The scale for the Mississippi Basin project is so large that the Everglades restoration project pales in

comparison. Should the latter, however, become a reality, the nation might take heart and be encouraged to
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begin the much larger effort whose upside could be spectacular: more wildlands, less flooding, better fishing, etc. Most Midwesterners are now city dwellers and would welcome such amenities.

The next 50 years represent a narrow window during which the earth's population is expected to jump from about 6 billion to 9.5 billion, before slowly leveling off at just under 11 billion around 2200. Before this population increase occurs, we still have the chance to set aside the necessary land to ameliorate the toxic components of the nutrient runoffs from our farms and factories. The earth can repair the damage done to it by human activity, but the sooner we start the remedies, the better the odds of slowing extinctions and of beginning the recovery of an incredibly flexible and self-repairing global environment.

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