ZOO Creating the Nation's first BioPark

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Letter from the Desk of David Challinor
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For every action there is an equal and opposite reaction. This well-known law of physics is not generally considered when we invent a new machine, exploit a new energy source, or move to a place previously uninhabited or sparsely occupied. This letter is about how whole landscapes have changed as a result of a new technology. Physical alteration of the countryside occurs continually so that unless you are reminded by old photos or paintings, you quickly forget the previous conditions.

In North America the landscape began to change with the arrival of the first humans as they purposely set fires, introduced new animals, such as dogs, and selectively hunted special animals. By the time the first Europeans arrived, the New World was no longer an unspoiled wilderness; local Native Americans had well-established villages and raised crops. But the Native Americans' alteration of the landscape, however, paled in comparison to that wrought by the Europeans who felled whole forests for farms and pastures. Their introduction of plants from other parts of the world and of domestic livestock resulted in the loss of many native plants that were ill-adapted to such a broad assault.

At the Smithsonian's Environmental Research Center (SERC) on the Chesapeake's Rhode River estuary, scientists have investigated for the past 20 years how the landscape has been changing since pre-Columbian times. The Chesapeake's watershed was originally a mixed hardwood/pine forest that was cleared for farming by the end of the 18th century. Tobacco was a major export crop. Within the next 100 years only about one-fifth of the Chesapeake's watershed was left forested, and this condition had a profound effect on the Bay. For example, clearing the forests increased the sediment load in the water running into the estuaries by a factor of at least four, compared to when the watershed was fully forested. Within the past 150 years this silt load has filled the Rhode River estuary at SERC by about four feet. We know this from a dated oil painting of an anchored sailing ship; research in ship design of the times tells us how much water it drew. Today this ship and others that picked up local cargo for Annapolis and Baltimore could no longer carry on their business in the present shallow water of the Rhode River.

Clearing vegetation along the shore to improve the view of local residences has increased shoreline erosion and has thus added to silt being spread over the Bay bottom. Understandably, this muddy water has made it hard for oysters to thrive, and this once famous local industry is rapidly failing. Not only is the increased silt load affecting the Bay fauna, but with fewer forests to soak up the rain and more roads, houses, shopping centers and other paved areas to move the rain water quickly to the Bay, the water has probably become less salty. We cannot be certain of the degree of freshness, however, because there are no records of salinity measurements over the centuries. In 1974 hurricane Agnes filled the Bay with so much fresh water that its northern half was virtually fresh. The rapid drop in salinity resulted not only in massive die-offs of a commercially valuable clam, but fortunately for swimmers, it temporarily eliminated stinging jellyfish. They remained in the cyst stage of their reproductive cycle and settled on the Bay bottom until the salinity content rose enough two or three years later to stimulate their reproduction again.

Landscape changes elsewhere in the United States have been just as dramatic due to European practices of farming being employed in America. The hills of early 19th century New England were cleared for sheep pasture to furnish wool for the mills along the Connecticut and Merrimac Rivers. The pastures were abandoned before the century was over because the mills shifted from wool to cotton from the South and the railroads by then had opened the fertile midwest to the densely populated eastern markets. The abandonment of the New England farms resulted in the return of the forests so that the countryside has double the forested area it had a century ago.

I have shown how the introduction of European farming has changed the landscape, but perhaps the most significant alteration of what we see today is a result of the arrival of the petroleum age. Convenient suburban hayfields which fueled the predominantly horse-drawn vehicles have vanished. Tons of hay, which were seldom baled, were delivered daily by boat and barge via Long Island Sound and the Hudson River to New York City. Our nostalgic memory of horse-drawn wagons is far removed from the often brutal and smelly reality of living with horses. City stables generated enormous amounts of manure that had to be disposed of regularly. Manhattan, as an island, was fortunate to have adjacent rivers into which the horse waste was dumped to be flushed away by the strong tides. How this heavy load of nutrients affected the fish populations of these waters can only be imagined because virtually no systematic fish studies of this area were made in the 19th century.

In addition to reducing the need for hay fields, the gasoline-powered vehicles were seen as the answer to the problem of horse-generated pollution. It is ironic that today, far from being a pollution eliminator, the car has become a major source of nitrous oxides from its exhausts. This gas is the principal culprit for smog that plagues Los Angeles and Denver, as well as for contributing to the greenhouse effect in the stratosphere.

With the automobile have come superhighways, shopping centers, and fuel tanks farms, all of which serve and are dependent on cars. The presence of such features in the landscape must surely be more stressful to people now than the hay fields were in the 19th century. Nonetheless, I think we would all agree that we live better now than we did then.

The petroleum age, however, is finite and there are predictions that at the rate the world is consuming oil, its reserves will be depleted by 2050. The auto is an inefficient and expensive way to move individuals, but its value in allowing us to go from point A to point B at a moment's notice is so high that until recently the essentiality of cars has not been seriously challenged. However, a limit to their numbers and the lack of feasibility of building new roads for them is facing us. Urban highways already exceed their capacity, and most new construction consists of improving (widening) existing roads, an exercise which seldom solves traffic problems for very long.

A new major energy source is hard to predict, but burning hydrogen gas or using more efficient batteries or direct solar power are all possibilities. Whatever the source, landscape alteration will be inevitable, particularly for solar power. Huge arrays of solar collectors might be constructed in the relatively cloud-free southwest and the resultant energy would be distributed to the cloudier parts of the country. What will replace the car as a people mover is harder to imagine. A simple, safe, airborne vehicle would take advantage of another dimension -- the vertical one. Boats can travel two-dimensionally as long as there is enough water under their keels, moving horizontally in any direction they wish. Cars, being confined to roads, essentially travel one-dimensionally. Airborne, we would travel three-dimensionally, like birds or fish, and think what a beautiful view of the landscape we would have. It might even raise our consciousness enough so that we would consider how our new technologies might alter the landscape <u>before</u> seemingly irreversible damage is wrought by our new inventions. "Think before you leap" would be a wise motto for us to adopt.