

problems such as storage, disposal and prevention of accidents must be solved first.

The unpublished chapter on recycling stresses the need for incentives for reusing many items that become trash. The unpublished case study of the Delaware River Basin is critical of industry and land development plans along the shore, but praises the Delaware law that bars new substantial industry along the state's coastline.

The report estimates that it will cost about \$287 billion in the decade of the 1970's to clean up the environment—an estimated 2.2 percent of the gross national product. This includes expenditures by business as well as government. The report concludes: "Neither this year nor next will we be able to provide a general statement about whether environmental quality has improved or deteriorated. The environment encompasses too many factors to be so easily characterized." □

Australia yields possible oldest vertebrate print

Footprints of an extinct genus of animal thought to be the oldest trace of a vertebrate yet found on the planet have been discovered in southeastern Australia by scientists at Monash University, Melbourne. Geologic and plant-fossil evidence puts their age in Devonian times—possibly more than 350 million years—says James Warren, professor of zoology at Monash.

Warren and his colleagues are linking the prints, made in igneous rocks, with the wedge-shaped prints of the *ichthyostega*, fossilized remains of which were found in Greenland before World War II. Spaces between the footprints and the rolling method of motion suggested the Australian creature fitted the pattern of the *ichthyostega*—a fresh-water animal about three feet long, with gills, a blunt head, long thin tail and up to four or five toes on each of the four feet.

The footprints were discovered by Norman Wakefield of Monash during a botanical survey in the upper reaches of the remote Genoa River area of East Gippsland in Victoria. The fossil evidence there indicates the creature was living in a now-vanished swampland area and made the prints when it was forced to cross new soft rock during geologic upheaval to search for fresh water and food. Announcement of the find was delayed until the print-bearing rocks were removed to safety.

Warren says the evidence associating the prints to the Greenland *ichthyostega* is fairly strong and so has implication in linking Australia to the Northern Hemisphere land mass in the Devonian Age—or previously. □

U.S. crops: Genetically vulnerable to disease

Agricultural research and modern methods of farming have greatly increased the yield of crops in the United States. Corn yield per acre has risen threefold in the past four decades. But we pay a price for the greater efficiency. The price is uniformity and with uniformity comes the constant threat of blights or epidemics that may wipe out an entire year's crop.

The severity of the corn blight of 1970, which wiped out 15 percent of the nation's corn crop for that year, can be directly traced to the genetic uniformity of the corn, says the National Academy of Sciences' Committee on Genetic Vulnerability of Major Crops, in a report issued this week. The committee, headed by James G. Horsfall of Connecticut Agricultural Experiment Station, reviewed the causes of recent crop epidemics and assessed the vulnerability of the major crops in the United States.

The corn plants of America had been inbred and crossbred until they were "as alike as identical twins." When a pathogen evolved that could attack that strain of corn, virtually all corn in the nation was susceptible.

A review of 14 major U.S. crops showed that most are "impressively uniform genetically, and impressively vulnerable." For example, 96 percent of the pea crop is devoted to only two varieties of peas.

The uniformity of crops is the result of pressures from all sectors. Consumers want uniform, inexpensive produce. To squeeze the most out of each acre, the farmer resorts to the highest-yield varieties and uses machines to

Crop	Value (millions of \$)	Major Varieties	Acreage (percent)
Bean, dry	143	2	60
Bean, snap	99	3	76
Cotton	1,200	3	53
Corn	5,200	6	71
Millet	-	3	100
Peanut	312	9	95
Peas	80	2	96
Potato	616	4	72
Rice	449	4	65
Sorghum	795	-	-
Soybean	2,500	6	56
Sugar beat	367	2	42
Sweet potato	63	1	69
Wheat	1,800	9	50

NASA

A few strains dominate some crops.



NASA

Uniformly bred, uniformly blighted.

plant and harvest. To plant by machine he needs seeds that are uniform in size. Such crops as tomatoes must ripen at the same time, since the machine used to pick them cannot distinguish between ripe and green tomatoes. "And so it goes," says the report, "uniformity—always uniformity."

Breeders try to develop strains resistant to disease and have succeeded to a certain extent. But there is always the danger that a parasite will evolve or be imported for which the plants have no defense.

Most of the great epidemics of the past century have been caused by exotic pests that originated far from the crop they ultimately destroyed. French grapes were attacked by parasites from North America; chestnut blight and Dutch elm disease came from the Orient. It must be assumed that a pest anywhere in the world is a potential threat to a large and uniform crop.

The committee recommends a "watchdog system" to guard against future epidemics. Overseas laboratories could be used to test plants such as cotton and sorghum against insects and parasites at breeding stations in the tropics where these plants originated. Offshore laboratories could study the susceptibility of American crops to exotic pests. The last defense would be a quarantine at the borders.

The United States should not depend entirely on these measures, however. "If uniformity be the crux of genetic vulnerability, then diversity is the best insurance against it." The report calls on scientists to maintain a backup system in the form of gene pools, collections of plants and seeds with a wide variety of genetic characteristics. Breeders should be constantly on the lookout for new sources of genes in mutations and wild varieties.

National efforts to maintain a gene