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An Epidemic of Food Poisoning in the U.S.

Introduction:

Salmonella is a common bacterium that lives in the gut of most vertebrate animals. When taken in by eating contaminated food it can cause severe diarrhea, if untreated it can lead to dysentery, a life threatening disease. If Salmonella enters the blood stream, as it does in 1 to 4 percent of cases, it can also be life threatening and requires antibiotics for treatment.

About 50,000 cases of Salmonella food poisoning are reported each year in the U.S. This certainly is an underestimate because most people don't seek medical help for food poisoning. The Centers for Disease Control estimate there are 2 to 4 million cases of food poisoning in the U.S. each year.

Within the last twenty years a new strain of Salmonella has emerged as a leading cause of food poisoning. This new strain comes to us from contaminated poultry. It is not known why it has become prevalent. In a recent *Science* article Bäumlér et al. propose a flock immunity hypothesis to account for the rise of this formerly obscure pathogen¹.

ER: Professor Bäumlér what is your training?

AB: I did my Ph.D. in microbiology in Tübingen, Germany, and then I moved to Portland, Oregon, where I worked for four years. Then in 1996 I accepted

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a position at Texas A&M in the medical school as an assistant professor.

ER: Where does Salmonella come from?

AB: It's a disease causing bacterium in all warm-blooded animals, but it also can be isolated from cold-blooded animals. Disease outbreaks can be traced to all kinds of food sources, most commonly products from livestock and domestic fowl. It lives in the gastrointestinal tract and is then shed with the feces. Typically contamination can be traced back to

domesticated animals which are used for food, and somehow fecal material entered the food chain.

ER: It causes food poisoning doesn't it?

AB: Yes. Salmonella typically causes a severe diarrhea and can develop into dysentery, which means that there is a strong inflammation in the intestinal tract which causes intestinal cramping, abdominal pain; the stool could be bloody or not. This diarrheal disease is usually self-limited. However in about 1 to 4 percent of cases the bacteria may enter the blood stream. This complication, called bacteremia, can become life threatening and requires antibiotic treatment.

ER: Is Salmonella growing or declining?

AB: It is growing. It turns out that food-borne salmonellosis, a diarrheal disease, has increased since World War II, whereas typhoid fever, a severe systemic infection caused by *Salmonella typhi*, has been eradicated in the U.S. during the first half of this century. Currently there are about 50,000 cases of Salmonella food poisoning reported in the U.S. each year. Since most cases of food poisoning are not severe, most people do not seek a physician and these 50,000 cases are certainly an underestimate. The Centers for Disease Control has estimated the actual number of Salmonella food poisonings in the U.S. to be between 2 and 4 million per year.

Most of these are caused by two different types of Salmonella, *Salmonella typhimurium* and *Salmonella enteritidis*. *S. typhimurium* has traditionally been the most frequent serotype and causes around 25 percent of the cases. But within the last two decades *Salmonella enteritidis* has emerged as an important human pathogen; it now causes about one fourth of the cases reported from humans, whereas twenty years ago it was an uncommon serotype to be isolated from humans.

ER: How big a health threat is this?

AB: In theory Salmonella is not a big threat to human health because disease can easily be prevented by properly cooking food. However, the question is whether it is acceptable to have pathogens in our food supply which potentially could cause illness unless food is cooked properly. I think it would be desirable to eliminate pathogens from our food supply altogether. *S. enteritidis* is a problem in particular because it can be present in eggs and therefore in foods prepared with raw eggs, such as Caesar salad or home-made mayonnaise.

ER: Why did *Salmonella enteritidis* emerge as a health problem in the last twenty years?

AB: There are two Salmonella organisms associated with poultry: one is *S. gallinarum*, a pathogen for poultry that is adapted to birds; it causes 10 to 50 percent mortality in outbreaks. At the beginning of the 20th century this pathogen caused big financial losses to the poultry industry.

So in 1935 the U.S. Department of Agriculture started an eradication program. Basically, birds were tested for antibodies against *S. gallinarum* and all birds with antibody titers were then killed. That eradication program was successful, in part because *S. gallinarum* does not have an animal reservoir other than birds. This disease was eradicated in commercial flocks in this country by the mid 1970s.

The second pathogen associated with chickens is not a disease problem in poultry but it's a public health problem. *Salmonella enteritidis* has emerged as a major food-borne pathogen and human cases have been traced back in most instances to uncooked egg products. It appears that healthy laying hens are carrying the organism and introducing it into the food supply. *S. enteritidis* can enter the egg before the shell is formed, so the egg can contain the bacterium even if it is not contaminated at the egg surface.

The increase in *S. enteritidis* cases was first reported in the beginning of the 1980s by public health laboratories in both Europe and the U.S., and scientists didn't connect the eradication of *S. gallinarum* and the emergence of *S. enteritidis* because there was a time gap between them. When we looked at the literature we found there was a continuous increase of *Salmonella enteritidis* since the 1960s, much earlier than people had previously postulated as the beginning of the *Salmonella enteritidis* epidemic.

ER: How could the eradication of *S. gallinarum* have caused the emergence of *Salmonella enteritidis*?

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AB: Well, it turns out that these two bacteria look the same to the host immune system. They have the exact same sugar coat on their surface. The result of this identical surface structure is that exposure to *S. gallinarum* elicits cross-immunity against *S. enteritidis*. We postulate that population immunity generated against *S. gallinarum* kept *S. enteritidis* out of poultry flocks. Then loss of flock immunity caused by eradication of *S. gallinarum* opened an ecological niche which became occupied by *S. enteritidis*.

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It turns out that at the beginning of this century rodents were only known animal reservoir of *S. enteritidis* in the U.S. Since rodents are often present in hen houses, it has been postulated that they are one of the sources to introduce Salmonella serotypes into poultry flocks. After the flock immunity generated by *S. gallinarum* was lost in poultry, *S. enteritidis* then was introduced into poultry flocks and subsequently spread within the poultry industry. The problem was not noticed because most birds infected with *S. enteritidis* do not develop disease. The problem first became apparent when reported human *S. enteritidis* cases reached thousands per year in the 1980s.

ER: You only know *S. enteritidis* cases are increasing; it may be because of your hypothesis or it may be due to something else.

AB: That is absolutely right. This is a hypothesis which needs to be tested. Generating and testing a convincing hypothesis is an important first step to solve this problem. Previously, no single factor had been identified which could convincingly explain the emergence of *S. enteritidis*.

Unless risk factors which lead to the emergence of this pathogen have been identified, it's hard to design effective control measures which target the cause of the problem rather than its symptoms. It's likely that *S. enteritidis* will remain a public health problem until we have identified the origin of the epidemic.

ER: Your idea of flock immunity is also a hypothesis isn't it?

AB: Right. You can't reconstruct the events that happened 100 years ago, but you can estimate how high the

flock immunity was at the beginning of the century. From seroprevalence data recorded by epidemiologists in the 1920s and 1930s it can be estimated that more than 60 percent of the birds were immune to *S. enteritidis*. It is thus likely that at the beginning of the century *S. gallinarum* was able to exclude *S. enteritidis* from poultry. That tells us if it were as prevalent today as it was 100 years ago, *S. enteritidis* would probably not have been able to enter the human population. I think the importance of this conclusion is that perhaps we could end the human epidemic and eradicate *Salmonella enteritidis* from poultry by vaccinating with *S. gallinarum* and reestablishing the flock immunity which was lost during the eradication program.

ER: Is there any experimental work inoculating birds against *S. gallinarum* to knock down *S. enteritidis*?

AB: Yes, this has been done. There is a *S. gallinarum* vaccine licensed, and that has been shown to be as effective against *S. enteritidis* as it is against *S. gallinarum*. The problem is that *S. gallinarum* has been eradicated in the U.S., and there has thus not been a rationale for using the *S. gallinarum* vaccine. Furthermore, vaccination could interfere with the *S. gallinarum* surveillance program which is still in place because this organism could be imported from countries where *S. gallinarum* is still endemic. An introduction of this pathogen would cause significant losses in the poultry industry.

ER: If you developed a vaccine for *S. enteritidis*, would that interfere with the surveillance program also?

AB: Part of the problem is that *S. enteritidis* does not cause a very good immune response in birds. *S. enteritidis* is not a strong pathogen, it's almost a commensal for poultry. [*Commensals are parasites that don't cause disease. Ed*] If you have a commensal, a non-virulent organism in your intestine, the immune system does not mount a strong response. That was a problem for detecting *S. enteritidis* because birds which carry this bacterium do not react in the haemagglutination test. So since there is no economical test for *Salmonella enteritidis* the spread of the organism was not even detected after its initial introduction into poultry. In fact, the first indication of the spread of *S. enteritidis* within the poultry industry came from increasing numbers of human cases, not from seroprevalence data in chickens.

ER: Should we be thinking about immunizing people against *Salmonella*, or is that not feasible?

AB: It's not. It wouldn't be very effective because the human immunity against *Salmonella* is short-lived. Vaccination would have to be performed probably every two years. That is not a big problem during vaccination of poultry because laying hens are usually used for only one laying period (one year). If vaccination were performed at the beginning of each laying period, birds would be protected at a sufficient level until they retire.

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Tracing the origins of *Salmonella* outbreaks. AJ Bäumler, BM Hargis, RM Tsois 2000 *Science* 287:50-52



Disaster Assistance As Political Patronage

Introduction:

Modern federal disaster assistance began with the 1950 Disaster Assistance Act. According to this law, a state governor requests a presidential declaration of a disaster which then triggers the federal disaster assistance. Earlier, the number of presidential declarations averaged about twelve per year, but during the Bush and Clinton administrations the number has gone up to about sixty per year. Federal disaster assistance has become a form of political patronage earning the name of *nouveau* pork.

In his book, *Disasters and Democracy*, Rutherford Platt uses three case studies to examine the strengths and weaknesses of our disaster assistance

programs. He examines the politics of coastal erosion on Fire Island, New York, a summer retreat for affluent New Yorkers. In this case Fire Islanders have been very successful in extracting funds from the government for beach replenishment and repairs of storm damage to private property while resisting government efforts to mitigate coastal hazards such as minimum setbacks for beach houses.

In the second case study the authors examine the federal response to the Mississippi floods of the summer of 1993. They focus on St. Charles County, Missouri, the region around St. Louis that was hard hit by

the floods. The total federal cost in disaster assistance to the nine state region affected by the 1993 flood was estimated at 4.2 billion with little or no local contributions. It appears that a well intentioned assistance program has evolved into an entitlement.

In the third case study, the authors look at the response to the Loma Prieta earthquake of 1989 and the East Bay Hills fire of 1991. The Loma Prieta earthquake collapsed a 1.5 mile section of the Nimitz freeway in Oakland, killing forty-one people, and a 50 foot section of the Bay Bridge. Stanford University suffered \$160 million in damage, but public schools were generally not badly damaged due to earthquake construction codes adopted in 1933. The earthquake damaged more than 22,000 residential structures, 1567 commercial buildings,

nine hours. Damage amounted to at least \$1.5 billion. Minimal efforts were made for mitigating future fire hazards and maximal efforts were made for rapid rebuilding of new and bigger structures in the same, fire prone hills. We spoke with Rutherford Platt about how to improve federal disaster assistance.

ER: Professor Platt, what is your training?

RP: I've done a fair amount of research and writing and teaching on various problems relating to urban planning and urban open space, and I've benefitted from a long association with the University of Colorado Natural Hazards Research Center in Boulder which holds an annual workshop in July which provides a wonderful chance for interaction.

ER: Is your book a result of that work?

RP: The book is the result of a five-year project that was funded by the National

Science Foundation. That project grew out of my involvement with the University of Colorado meetings, a number of other conferences, my own research, student research and my own freelance work. It was also based on consulting I've done from time to time with the Federal Emergency Management Agency in which I was asked to provide some outside advice on the Flood Insurance Program.

I've long been both a critic and a constructive loyal opposition to FEMA and particularly to the National Flood Insurance Program. I very much admire the people who work there; I think they've done a tremendous job

The federal government talks a good game about hazard mitigation, but when the property values are high and the political voices are loud, it's a pussycat.

and 137 public buildings. In spite of the damage inflicted, the Loma Prieta earthquake was not the "big one" comparable to the 1906 San Francisco earthquake. The best guess is the "big one", magnitude 7 or greater, will probably occur in the next thirty years and probably be centered in the densely populated East Bay area.

The East Bay Hills fire of 1991 was the third worst urban fire disaster in U.S. history, after the 1906 San Francisco fire and the Chicago fire of 1871. Although the area burned was only 1700 acres, twenty-five people died, and 2,621 homes and 758 apartments were destroyed in about

under the Clinton administration in bringing hazard mitigation to public attention and into practice in many ways. However, having said that, I wrote the book as an independent and somewhat new look at the whole arena of federal disaster policy, of which flood insurance and the disaster assistance program are two important components.

ER: When did the federal government begin disaster assistance?

RP: Initially the government left disasters to state and local and charitable organizations to deal with, notably the 1900 Galveston flood, where the federal government did practically nothing. The general idea was that disasters were acts of God, or when the disaster was a human-caused event like the sinking of the *Titanic*, the view was that government should stay out of regulating private enterprise.

The 1950 Disaster Assistance Act began the modern federal disaster assistance program, and then a number of other programs came along, like the Small Business Administration Disaster Loan Program in 1953. During the fifties and sixties we had quite a bit of congressional activism, culminating with the National Flood Insurance Program of 1968. So by the early 1970s the federal government was very much involved in the disaster world and in many cases justifiably. I don't think anybody would question that federal aid is needed for truly major disasters.

ER: How does disaster assistance work?

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RP: Most kinds of federal assistance are triggered by a presidential declaration. A governor would request a presidential declaration for all or part of the state and then the president would respond, usually favorably, and would award disaster assistance to a specified county. For a long time this was a fairly limited process. During the sixties and seventies the number of presidential declarations was about a dozen a year, and they could be justified as truly serious natural disasters or in some cases technological ones. But under the Bush and Clinton administrations the number of declarations went up to as many as sixty a year. Some of these relate to the same natural event because each declaration applies to a different state. So if a hurricane sweeps through five states, there may be five declarations relating to that hurricane.

But while the number of declarations has increased significantly, so also has the geographic reach of the declarations, both in terms of states and counties included in it. It appears to be becoming easier to be eligible for disaster assistance under a declaration, especially if it's an election year and the state is crucial to the prospects for an incumbent. This is a new aspect of

disaster assistance which has been widely questioned.

ER: Is this what you call nouveau pork?

RP: Definitely. Disaster assistance is real money. It's a 75 percent federal share, and the non-federal share is usually in-kind services. It's a good deal. In some disasters, like Andrew and the Northridge earthquake, the federal share may go up to 90 or 100 percent. So this really spreads around a lot of money.

Now, just to be clear, disaster declarations are not part of the process for flood insurance or agricultural crop insurance losses. Those are contractual, like other insurance programs, and so there may be flood losses due to a disaster that's not declared by the president.

ER: Flood insurance is a different program isn't it?

RP: Yes. The Flood Insurance Program came out of some very well informed advice to Congress back in the 1960s that said you must tie the availability of flood insurance to willingness of a local government to reduce future vulnerability. So flood insurance was only to be made

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available in communities which adopt floodplain management measures, zoning and building codes and so forth, that satisfied federal criteria. We now have about 20,000 communities, including counties, in the Flood Insurance Program which in one way or another have satisfied these criteria on paper.

Having said that, there's been a tendency during the last decade or so to move away from regulation — state, federal, and local — and this is not just for flood matters but for many aspects of land and water management. There is now a tendency to try to avoid regulation if possible and to use incentives and cost sharing and other means to try to promote mitigation and reduce vulnerability.

FEMA has now embarked on a program which it's promoting strongly across the country called Project Impact, which is a community by community attempt to enlist a variety of partners in reducing the threat of natural disasters, including earthquakes and hurricanes and floods. Partners include states, local governments, businesses, non governmental organizations and other stakeholders. It's fine on paper. But it requires enormous effort to nurture local partnerships one at a time. It is a retail approach not wholesale. There are 20,000 communities in the Flood Insurance Program, and the Flood Insurance Program has regulatory authority, which is a sort of wholesaling mechanism for dealing with large numbers of communities and floodplains. Shouldn't we be utilizing that power, which is still available, as effectively as possible, together with whatever partnerships are developed

through this Project Impact? We cannot afford to abandon large-scale "wholesale" approaches in favor of community-by-community retailing of hazard mitigation.

But I think the Clinton administration in particular has wanted to be very agreeable to state and local governments and not exercise much leverage or impose strings on various federal benefits, including disaster assistance and flood insurance. So there's this tendency for various forms of federal assistance to become more readily available, with the constraints on rebuilding to become weaker particularly on the coast, in my opinion. This is what the book is about.

The book consists primarily of three case studies. One is on coastal erosion at Fire Island; one is on the

down the Atlantic coast on barrier island shorelines, as well as on the cliffs of the Pacific coast and the bluffs of the Great Lakes, there has been a lot of new development over the last twenty-five years. Twenty-five years would take you back to the Coastal Zone Management Act of 1972, as well as the Clean Water Act section 404 requirements relating to wetlands, and the Flood Insurance Program hit its stride about 1973. So that quarter century is a good timeline to look at what's happened.

There's plenty of evidence that inland floodplains are less built up than they might have been without the Flood Insurance Program and its state counterparts. It's a lot easier to restrain development in the floodplains because the property values tend to be

much less than on the coast, and comparable or better building sites are often available in safer locations. So I think the Flood Insurance Program generally is having a beneficial effect in

inland areas. But along the coast it is struggling to get its message across, as are the state programs, like North Carolina, South Carolina, New York, Rhode Island, and even Washington state.

There's a lot of rhetoric about building more safely, moving back from eroding shorelines, but the politics as at Fire Island are very, very strong. The political influence and also the legal climate of the 1990s has contributed to this apprehension on the part of federal, state, and local authorities. They are very sensitive that these property owners have property rights and they can't tamper with them or else they're going to sue and the government will be out a lot of money.

... inland floodplains are less built up than they might have been without the Flood Insurance Program...

recovery of St. Charles County, Missouri after the 1992-93 floods; and the third one is the recovery, rebuilding, of the hills in Oakland after the earthquake and particularly the fires of 1991.

ER: I was amazed at the density of housing on Cape Hatteras. Someone must be subsidizing these expensive homes that are right in the path of every season's hurricanes.

RP: Yes, and North Carolina has one of the better and older coastal management laws. It's Coastal Act is cited as a poster child in terms of imposing setbacks on new construction. My friends down there say it isn't all that effective. But you're right, all up and

That's an important pressure particularly on local government.

ER: Where is Fire Island?

RP: Fire Island is along the south shore of Long Island; it's a true barrier island. It's separated from mainland New York state by Great South Bay and it has an inlet at either end. It's about thirty miles long, and it has a series of summer communities. Parts of it are state parks but there are fifteen or so summer communities scattered along the length of the island. It is connected to the mainland by passenger ferries, there are no roads. There are essentially no cars and it has a character of its own.

These communities maintain quite a bit of isolation from each other, but they have banded together politically through the Fire Island Association, which has been around for some thirty years and has proved to be a pretty active political lobbying force and a spokesman for their interests. These are wealthy communities. They're closely tied to New York City and the whole region and include a lot of lawyers amongst the wealthy homeowners.

The chapter in the book on the politics of erosion at Fire Island deals with the hypocrisy of, on the one hand, homeowners demanding flood insurance for ocean front as well as all other properties that are on the island and not having any limitations on the availability of insurance along eroding shorelines and the right to rebuild after a disaster occurs, which has happened frequently there. So that's one side that they have been actively arguing in Washington and in Albany.

The other side of the hypocritical

stance is that they are demanding that Congress fund an Interim Beach Nourishment project for 60 million dollars, to be built by the Corps of Engineers. The Corps district office indeed wants to do this and has been planning it since 1960 and has done bits and pieces of it. This is part of a larger plan for all of the south shore of Long Island.

This is a hot political issue. They want their Beach Nourishment project at federal expense in addition to the national seashore that was established through Fire Island intervention. That was a good outcome, and they pre-

Fiscal responsibility at the state and local level needs to be promoted rather than the opposite...

served some important natural areas along the island. There are a number of federal benefits already available that both nurture the private use of the beach and the continuation of these communities and the economic feasibility of owning property there. They want federal money to include a Beach Nourishment Project, but they won't accept any limits on building or rebuilding at the water's edge. This has national significance because they have lobbied successfully against legislation in Congress that would have placed limits on the flood insurance availability within an area subject to erosion within the next thirty years.

In my view, this absolutely crystallizes what's wrong with our federal policies: we are fostering and reinforcing private development and, in this case, rather expensive private development. This is not an area that's very accessible to the general public

because there are no roads, except by boat to the national seashore.

ER: What is the natural life span of a barrier island? These are works in progress aren't they?

RP: They are always changing. They tend to rearrange themselves. New inlets open up, some older inlets close. And here and there all along the Atlantic coast, maybe out your way as well, sometimes an inlet will open up during a storm and then there's strong interest in keeping that inlet open for the benefit of boating, fishing, and so that then involves federal dredging and maintenance of that inlet and navigational markers.

There's a huge issue on that at Oregon Inlet at North Carolina right now. It's not in my book, but that's a related argument about what the federal government should be doing: letting the beach go its natural way as the Park Service would rather do, or battling with erosion and filling in of inlets as the Corps of Engineers says. So you have different agencies in the federal government with different views of how the shore should be managed, and they each have their own committees in Congress and their own lines of funding. Orrin Pilkey has written numerous books on the way barriers operate and the way beaches migrate and the prevalence of erosion and the tendency for sand to want to move into inlets.

I'm not saying, nor is he, that you can't build on barriers. But certainly a prudent approach has to recognize ongoing erosion and particularly the force of major storms like Floyd and Fran and Bertha, and going back to the 1938 hurricane up in this part of New

England. That was a tremendously devastating storm, but to most people they've never heard of it or at least it's something that couldn't possibly occur again.

ER: Coastal communities use disaster assistance as well as flood insurance don't they?

RP: Yes. There have been several declared disasters involving Fire Island and Suffolk County, Long Island, of which it is a part. We documented the general magnitude of federal disaster assistance spent at Fire Island after the 1992-93 declarations and the winter storms. They caused a lot of damage and there was a lot of flood insurance paid out.

But with these, and beach nourishment, and other forms of federal involvement such as federal tax casualty losses or tax deductions, what's the quid pro quo in the rebuilding process? How does the federal government, the state of New York, and the local towns, what did they do to produce a more sensible, safer pattern of building? The answer is, practically nothing.

The state did not implement its erosion-management law. The federal government basically said, we would like you to do set backs, but we're not going to force you to. And the mainland towns were primarily interested in the taxes from the houses out there and they didn't want to make trouble for Fire Islanders. So basically government just let them rebuild, and the shore became lined again with even more and bigger houses.

I'm oversimplifying of course. There were some locally-funded

erosion control projects, and that's part of the story. But this is generally true at Fire Island, this is true at Cape Hatteras, this is true in Florida. But this is particularly true for the high-energy coasts like North Carolina and Long Island, which are exposed to hurricanes. In the case of Long Island, winter Northeasters are often more damaging than hurricanes because they stay around longer and there are more of them.

So the federal government talks a good game about hazard mitigation, but when the property values are high and the political voices are loud, it's a pussycat. My concern is not chiefly with FEMA. I think FEMA is doing the best it can. It's with Congress and the president. That's where the real power lies and FEMA answers to them. Congress created these aid

programs. Why isn't Congress concerned that there is not more effective limitation on rebuilding after a declared disaster?

ER: What are the dollar amounts involved? How does this fit into the grand scale of pork?

RP: That's a tough question because it's hard to get a handle on the actual costs of disasters, both the economic, quantitative ones as well as what we might call the hidden costs. At Fire Island we're talking in the tens of millions range certainly over the years.

When you consider there's only a couple thousand homes for the entire island and a few hundred that are seriously exposed to damage, the cost per damaged home is pretty high. To look at Fire Island alone it is not a vast expenditure, like the big dig in Boston where they're spending 12 billion dollars, mostly federal money, for two miles of highway, but it adds up.

Fire Island is strictly summer communities, but when you go down the coast, year-round communities really can benefit from federal infusion of disaster funds as well as other kinds of money. It's a big help. I'm not saying they don't deserve federal aid, but there should be a quid pro quo if they do receive it: serious measures should be taken to restrict rebuilding in hazardous areas on both the bay and the ocean side.

ER: What about the floods of 1993 in the Mississippi Valley?

RP: Mississippi Valley is a less black and white kind of issue. In that case this was a big flood; there

was no question that the federal involvement was needed. Many of the victims were low income, the property values were relatively small, and these people needed help. Many of them didn't have flood insurance.

The St. Charles County planning department during the recovery period was seriously trying to limit future losses, and with federal help they bought up several thousand mobile homes and small parcels of land.

St. Charles is a suburb of St. Louis, and so you have this situation where you've got all the upper-income professionals living in three or four

I think the Clinton administration in particular has wanted to be very agreeable to state and local governments and not exercise much leverage or impose strings on various federal benefits, including disaster assistance and flood insurance.

hundred thousand dollar homes up on the high ground, and then you've got the bottom lands where most of the flooding occurred and where the poor people are. It's one thing to buy out poor people and give them a little money to relocate themselves. But what happened to them? Nobody knows. They couldn't possibly afford to take the tiny sums of money they got and move into the rich part of St. Charles County. So the question arises, did they go to another part of the floodplain? Did they go over to Illinois? What happened to them? Nobody knows. Another issue we deal with in the book was the changes in the rules of the game while the administration of flood recovery was going on.

Federal agencies, particularly FEMA, constantly were changing the way in which houses should be surveyed and assessed for purposes of whether they could be rebuilt or not.

ER: What did you find with regard to the Berkeley Hills fires?

RP: With the hills around Oakland and Berkeley we're back into high-value real estate. This doesn't involve Flood Insurance Program at all. We selected these case studies deliberately to get a regional balance and represent different kinds of hazards, different politics. The Berkeley Hills fire was absolutely horrific. It consumed about 3,300 homes in six hours. It was a firestorm; and it was not the first fire that affected that area. They've had several, and there've always been these blue-ribbon reports on how to reduce future damage, which are never followed. A disaster of course was

declared by President Bush and federal assistance came in in a major way. They were trying to make up for bad publicity they'd had with hurricane Andrew a few months earlier, and so they really tried hard to help these people, and that's fine. Many of them also had huge insurance coverage on their homes. The victims of the fire of course lost all their personal property and sometimes their pets and their computers, everything. Nobody's questioning that they were grievously injured economically, and twenty-five people died.

The question arises, what to do with this area that was burned to the ground, to the concrete foundations?

So there's this tendency for various forms of federal assistance to become more readily available, with constraints on rebuilding to become weaker particularly on the coast...

There was this huge influx of insurance money and a good deal of federal money to facilitate the rebuilding process, including setting up a one-stop shopping center in an old supermarket. It was good government trying to help out, providing a place where homeowners could come and get access to the federal, state, and local agencies and the utilities, everybody under one roof.

But what limitations were to be placed on the rebuilding of the areas that were isolated and where roads were narrow and which are subject to recurrent fires? Plus the whole area was right above the Hayward fault, which is expected with high probability to have an earthquake within the

next thirty years, resulting in more fires and landslides.

I wrote this case study with the perspective of asking did they consider buying out the burned area, which was on the order of 3,000 acres or so and adding it to the regional parks system, which already existed along other areas of the hills? No, they did not consider that. The whole impetus for federal, state, and local authorities was to promote rebuilding as fast and as expensively as possible. This was important tax revenue for Oakland; it was important to their builders and merchandisers and retailers. The whole political process was devoted to rebuilding these sites, all of them, and

often more densely than they were before. These, I might add, were 5,000 square foot lots. They were incredibly obsolete-sized lots dating back to the twenties with these narrow winding roads.

ER: That's part of its charm.

RP: I guess so, although a lot of people say the new houses are incredibly ugly. But aesthetics aside, it was definitely a rebuilding process where yes, they did incorporate some recommendations of the state of post-disaster reports. They did improve the water system; they prohibited wood shingle roofs, and they made some very modest changes I think to the road system, but basically they rebuilt in the same pattern, very much the way San Francisco did after the 1906 earthquake.

But this is an isolated area; it's hard to get to it; it was impossible to fight the fire there, partly because the water failed and the roads were clogged with vehicles that were trying

to escape, and people were trapped and had to run for their lives. This would have been a good opportunity to consider simply making at least portions of the area an addition to the trail and regional open space system. Not done. So it's sitting there waiting for the Hayward fault or the next fire.

ER: Did you estimate what it would have cost to buy out all the suppliers of building materials and the tax base and all of that?

RP: Well, not so much the indirect players, but I did a rough calculation based on the asking price for lots that had been burned and were on the market. If they were all bought out at the asking price, it would have cost on the order of 400 million dollars to buy them out. Considering that some of that might have been federal money, some of that might have been bonded through the Park District, it would have been feasible if somebody had pushed it, but that wasn't the agenda.

ER: What do you recommend in the way of change?

RP: There are a number of recommendations in the final chapter, some of which are not original with me, but I pulled together a lot of ideas from various reports. There have been quite a number of official critiques of federal policy from the Senate; the House of Representatives had reports back in 1994 as to the waste of resources.

One of the recommendations that I and many others have made is reduce the political discretion of disaster declarations. If it has to be through that mechanism, limit the declarations

to really serious events. Let's get federal assistance back to being what it was intended to be, which is to deal with the major catastrophes, and at the same time promote or require states and local governments to provide more for their own financial well being, rainy day funds and so on.

The idea that local governments thought to have access to flood insurance for their own infrastructure wasn't original with me, but it's echoed in the book. Right now the Flood Insurance Program only insures private property, and local damage to schools, to roads, to parking lots, and so forth is covered out of the disaster assistance money if a disaster is declared. It would remove some of the

Fire Island property owners want federal money to include a beach nourishment project and disaster assistance and flood insurance, but they won't accept any limits on building or rebuilding at the water's edge.

need for that if local governments would be expected to recover some of their costs from a flood insurance fund that they have been paying into, like communities in the Northeast sometimes insure themselves against heavy snow removal costs. Fiscal responsibility at the state and local level needs to be promoted rather than the opposite, which has been the direction we've been going; that is, the feds will provide and we don't need to do anything locally.

That's a bit of a strong statement, and some of my friends in the disaster hazard world would say, Oh, Platt, he's out of date, there's a lot of things going on. But how much of it is rhetoric? How much is feel good lip service and going to meetings and partnerships and all that? How much

of it is real financial commitment? I'm not sure.

There's a fairly succinct chapter on the lessons of the case studies and then broader recommendations. One of them I should mention is that there is always a political appeal to helping low-income people after disasters, everybody shares that, and there should be. But there are other ways to deal with lower-income victims than a presidential declaration. In fact most federal disaster assistance doesn't go to poorer people, it goes to local governments and it goes to organizations of various kinds. The poorer victims need assistance as quickly as possible. The Red Cross steps in and helps as far as it can, but there is a program within FEMA which is called

Individual Assistance to Individuals and Families, and you have to have a declaration of the president to trigger that.

I suggest in the book that low-income victims should be protected. They

should receive these modest benefits regardless of whether the disaster is declared or not. It shouldn't be a political decision, it should be a financial decision, and it should be administered through the Red Cross, which is out there anyway, and just split that off completely from the rest of the federal response. That would reduce the inclination to say Oh, we've got to help those people, therefore we'll put 100 million dollars into rebuilding infrastructure. That's one modest suggestion.

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Wildlife Conservation in Africa

Introduction:

How humans co-exist with wild animals is a growing problem in the parts of the world where wildlife still exists. In the case of sub Saharan Africa it is often the poorest villagers and subsistence farmers who have to live with roaming elephants, and less charismatic animals such as wild dogs. We spoke with Wayne Getz about the respective roles of science and politics in community-based wildlife management.

ER: Professor Getz, what is your training?

WG: My Ph.D. training is in applied mathematics from the University of the Witwatersrand in Johannesburg, South Africa. After I did a post-doc for six months at Colorado State University and six months at Berkeley, I applied for a position in the Entomology Department at Berkeley. The position was for someone with a mathematical background to work on the management of insect pests in agricultural systems. I didn't study biology at university but during my graduate studies and subsequently at Berkeley I was exposed to the world of biology and became interested in applying mathematics to ecological and evolutionary problems.

In the early nineties, when the College of Natural Resources at Berkeley was reorganized, I become a member of the Department of Environmental Sciences, Policy, and

Management. This gave me access to students who were interested in working in wildlife management and conservation problems. It's at this time that I turned back to Africa because of my attachment to the continent. I started taking on students who would use mathematics to address wildlife conservation and management problems in Africa.

My training and inclinations are to use mathematics to model population processes and then to use these models to make management decisions. There are different modes of decision analysis in wildlife biology. One mode is where we regard wildlife as an exploitable resource. A case in point is ranching wild animals for the production of meat. In this case, we can use optimal stocking policies if we

There are different modes of decision analysis in wildlife biology. One mode is where we regard wildlife as an exploitable resource.

understand the relationship between population growth and vegetation and how this relationship is affected by other variables.

A second mode of analysis is to look at the problem of conserving species or maintaining biodiversity in contained areas. When animals are confined to a small reserve so that they can't migrate out of the reserve under poor environmental conditions, the ability for that area to support large populations declines. Instead of supporting these animals on a seasonal basis, the reserve is now supporting them year round. One approach to this problem is managing the population through culling policies to prevent the degradation of the habitat. When it comes to culling elephant populations though, the action is controversial because elephants are enormously

intelligent and charismatic animals, and it's horrific to see what happens when managers go in to cull a herd. They have to kill all the individuals because if they don't wipe out family groups, all kinds of problems arise. The spared elephants become wary of and aggressive towards humans. Also, elephants have a strong social structure, so usually they take out a whole family groups or the fabric of elephant society breaks down. For example, if they spare young males and transport them to other areas, as they have done in the past, these males become delinquent teenagers in the absence of older animals and may kill rhinos as happened in parks in Natal, South Africa.

It was through thinking about the problem of wildlife conservation that I began to realize the key to preserving wildlife is to find ways for humans to coexist with wild animals. The

people who have to do the coexisting are those who live in the wildland areas, rural African people in rural communities. As scientists, we're not going to be able to manage wildlife populations without working with these rural communities and finding some incentives for them to preserve their wildlife. This is the concept behind the paper we wrote in *Science*¹.

The paper was a comment about the role that science has to play in community-based natural resource management. Community-based natural resource management, or CBNRM, is one of these buzz phrases of the nineties. I prefer to call it community-based wildlife management because the focus is on wildlife.

So how can mathematics or modeling and theoretical ecology be used to assist communities in utilizing

these natural resources? The key to this problem is not just biology or ecology but of course is also sociology and politics. So we wrote this article discussing the need for more science in community-based wildlife management. We were subsequently criticized in a letter to *Science* for possibly overplaying the importance of the scientific aspect and not commenting enough on the political and sociological problems. And also, the authors of the letter thought that perhaps we were being biased in the way we presented the CAMPFIRE program in Zimbabwe as a success story. (Editors Note: CAMPFIRE is an acronym for Communal Areas' Management Program for Indigenous Resources. Its Website URL is <http://campfire-zimbabwe.org/>)

The CAMPFIRE program is not confined to just a single area. It's a conservation program that has been implemented in a number of different rural districts in Zimbabwe, and in each of these districts there's a different story to tell. In some districts the program has been more successful than in others.

We did say in our original article that the CAMPFIRE program was not without its problems but, in fact, in some areas it has generated significant revenues for the local people. The criticism we received was that the sociological and political aspects are so important that it's not really worth pursuing, or pushing very hard, the scientific aspects. That's where we disagree with the critics of our paper: we agree fully with them that the sociology is important, that we need the right infrastructure and that has to come before we can do good science. But even if we're given the right infrastructure and everything is in

place, without good science it unlikely the resources will be managed effectively. For instance, where the political and social infrastructures are in place for the management of fisheries in North America or Europe, we still fail to manage fisheries properly. If the science isn't there to back up the management, even though we may have all the institutions in place that we need, we still might not be assured of reaching our goals of sustainable management or species conservation, or maintenance of biodiversity. We felt that somebody needed to speak up for the importance of the biological sciences in this process.

ER: What is the CAMPFIRE program?

WG: I am not an expert on the CAMPFIRE program so my comments reflect only a cursory knowledge of the program. The CAMPFIRE program goes back to the late eighties and has a dual purpose. One purpose is to enable rural communities to better use wildland resources, especially wildlife; the other is to promote conservation and biodiversity.

A second mode of analysis is to look at the problem of conserving species or maintaining biodiversity in contained areas.

The CAMPFIRE program was developed by several groups in Zimbabwe in the 1980s and heavily funded by USAID throughout the 1990s. Some of the more sociological oriented ideas come from the Centre for Applied Social Studies at the University of Zimbabwe. CAMPFIRE arose out of a realization that the way to promote conservation was to empower local people to manage their biological resources themselves. If

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they could develop suitable markets for their resources, they would have an incentive to conserve them and manage them in a way that would yield income or rents on a sustainable basis.

There are several ways that rural communities can exploit wildlife as a resource. The first is they can have a certain takeoff of biomass for meat, but this will not generate any cash income. Then, of course, they could sell some of the animals they are able to hunt, but that's going to be a fairly small source of revenue. Then there's the possibility for ecotourism. If one's going to have tourists who want to come on camera safaris, some of them may want hotels, some may be satisfied with tented camps. So there's a certain investment that has to take place in building some infrastructure, but any community will be competing with the premier game areas of Africa that have denser concentrations of charismatic game,

such as lion, leopard, buffalo, elephant, and rhino. Not everybody has the "big five" in high densities. So the number of places that can be successful in terms of attracting tourists who come to take photographs is quite limited.

Another way to go is to allow controlled hunting because in most national parks hunting is not allowed. Trophy hunting is a potential source of money, and certain animals are prized as trophies: male buffalo with large horns, some of the big predators, lion and leopard; people will pay a lot of money to shoot these animals. Hunting can be a major source of revenue. Hunters don't buy a license for just a single animal, they usually buy a package that includes several different kinds of animals. So the license may be for a big trophy animal, but there will be other game that they are expected to buy licenses for as well. And then there are going to be taxidermy expenses, there are going to be tour operator expenses. So hunters going on safari will end up spending several tens of thousands of dollars on their adventure.

The disposable cash income of families in some of these rural areas may be on the order of a few dollars or tens of dollars a month, if that. So all of a sudden for cash poor villagers to have thousands of dollars flowing into their communities can make a big difference. The main issue then is who gets to keep the money. This is where the CAMPFIRE program is criticized in not having devolved power to a low enough level. The villagers are not benefitting as much as they should. Most of the power is at the rural-district council level or higher, and many social scientists argue that the amount of money going down to the village level is much less than it should be. In order to make the CAMPFIRE or any CBNRM program

successful, the bulk of the money needs to flow to the village level.

CBNRM programs exist in other countries. For example, in Zambia there's a community based wildlife management program called ADMADE [Editor: an acronym for administrative management design. Its Web Site URL is <http://www.admade.org.zm/>]. This program uses computer software to help make management decisions. This program also has USAID funding.

In NAMIBIA there is a program called LIFE, which is an acronym for Living In a Finite Environment. A central concept of the LIFE program is to bring more sophisticated monitoring methods to the local peoples. In this program, indigenous game scouts are trained to use icons on palmtop computers to enter game, animal tracks, and fresh dung sightings, as part of an effort to monitor the density of animals in their traditional homelands and neighboring game parks. The form each CBNRM program takes in different countries is going to depend firstly on the local political and sociological systems, second the kind of habitat whether forest, grassland or desert, and third on the kind of technologies available for monitoring the environment.

It's difficult to say how successful these programs are because each program is equivalent to a non-repeatable experiment. Once we get involved in a program, we have no way of really knowing how successful it's been because we can't compare it to what it would have been if the program had not been implemented.

All large-scale management problems are one-time experiments because there's no way of replicating them. Management of parks are all non-repeatable experiments, because they all differ. There-

fore traditional ways of doing science through repeatable experimentation doesn't apply. Because some of the things we do could be irreversible, we need to take a conservative approach to managing parks. There's a lot of sociological and political pressures as well as economic pressures, to make bad decisions: the Tragedy of the Commons being one of these pressures.

ER: Do the people living next to wildlife preserves support conservation or do they resent it?

WG: In many parts of Africa there is a strong feeling that current patterns for conservation are inherited from colonial times, and militant movements exist in some places against preserving national parks. In other words, some Africans would like to dismantle a few of their parks because they feel they were set up by colonial powers to meet colonial objectives. There are cases where local peoples were removed from traditional lands to enable a park to be established

ER: Well, people frequently resist conservation in this country, so it should be no different in Africa.

WG: Yes, but in Africa I think the pressures are different in the sense that in the U.S. special interest groups may have a lot of economic power, but in Africa it's just local people trying to survive. In some areas, for example, the only firewood available for people to cook with is in a neighboring park. And there are different kinds of poaching going on in parks. One is to poach meat for local consumption, another is to poach for trophies or trade for the world markets in ivory, rhino horn, cat skins, and so on. Now, you can't blame local people for poaching to get meat for their own

use; when it comes to the world market that's a whole different ballgame.

ER: Selling hunting licenses for trophies may not be too popular in the American conservation community.

WG: When trophy animals come up for auction and there are hunters there to pay for them, there could also be conservationists there to buy those animals to save their lives. And you don't see much of that going on. I would love to see conservationists going to auctions. But then if they buy the animals, we've still got to ask, where is the money going? If the money were going to the local communities, that would be fine, but if the money is going to the operators who are going to take it out of the community, then I'm not sure that would solve the problem. Also, once someone has saved the life of an elephant, say, by buying it at an auction, it is going to be almost impossible for them to protect that elephant from further hunting, unless appropriate infrastructures are in place.

ER: Is there enough social structure in place to build an effective program, say in Zimbabwe?

WG: Zimbabwe has done some remarkable things, but many people are saying that there needs to be a much stronger entitlement at the village level than currently exists. I think it's difficult because the politics of conservation are often overwhelmed by other political events. When wars

break out, wildlife conservation becomes a low priority. When the local people are worried for their lives they can't pay any attention to conservation. People outside may be concerned about conservation of species, but it's hard to make the case when local people are dying. We've got to solve these problems first.

Returning to the theme of our *Science* paper, I think it's important to start thinking about finding a mechanism to develop or to start collecting data on the state of the environment in Africa's last remaining wildlands where we are trying to maintain biodiversity. The idea is that with the



assistance of ecologists and social scientists we should train local people to monitor their environment, using fairly simple techniques and identifying things they could measure. The local people are the ones who know their environment the best and have a sense of what's happening to their wildlife. Is the wildlife increasing? Is it decreasing? How many animals are around? They can assess the state of the vegetation, or if it's possible, they measure environmental variables, temperature, rainfall, these sorts of things.

If we begin now to generate this database using a web infrastructure, in twenty to thirty years time we would begin to provide a valuable record of what's happening to the environment in parts of Africa where we have virtually no information. This could be useful not just for people who are interested in conservation, but in the impact of, for example, global warming, or development itself on African wildlands.

The computing industry in Silicon Valley should be interested in this kind of program because it could piggyback on bringing the Worldwide Web to remote areas of Africa, with possible links to the local schools and to education. Perhaps the teachers in rural areas could be trained to use computers to access information on the Web. If this network were developed, we could piggyback on it so that in the villages with schools where these facilities are available, local people could both upload information on the state of their

environment and download information that would enable them to improve the quality of their lives.

They could also get back the environmental information they originally uploaded in a form that has been processed using information from other villages in their regions. For example, this would give them access to maps of how the wildlife that visits their local area moves around on a regional scale. This would provide them with insight into what's happening in their local area, and would also

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give them access to scientists who can work with them to make better management decisions.

ER: Your idea sounds like more of a bottom-up form of assistance rather than the usual top-down approach.

WG: It's a bottom-up approach in the sense that local peoples know their environment better than anybody else, and we could get them to collect information in a coherent way and build a region wide database. But the top-down component is that a lot of expertise exists on how to take data, build maps, and do things with it, and so it would be that interface with the bottom-up and the top-down that would be the real synergism of scientists working with villagers. So people at the local level have to be involved from the beginning. We have to be aware of what can be done and who is able to do it. We are getting to the point where with satellite technologies the Web can be brought to rural areas. There can be a two-way flow of information into out of those areas. We need to train people to provide the kind of information that can lead to helping them to manage

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**GEOLOGY AND
NUCLEAR WASTE
DISPOSAL:
Rodney C. Ewing**

**OUR RENEWABLE
ENERGY FUTURE
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their environment. This is the critical role that scientists can play. We are ready to build the needed web if we can get the necessary funding.

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