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The impact of urbanization on pest situations in Korea, 1972

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Abstract

Urbanization is viewed as one aspect of development or modernization. and, so far as the exacerbation of pest problems is concerned, the major impacts are probably in the rural areas. The major pest is the rice stem borer and current attempts to control this insect with chemicals intersect with a major problem in public health. The mosquito vector for Japanese encephalitis breeds in paddy fields. Continued emphasis on chemical control for stem borers may produce genetic resistance to pesticides by the mosquitos, quite aside from the deleterious effects of pesticides on fish, birds, and people (large numbers of spray operators have been killed in Korea in recent years.) A more intensive search for alternative methods to control stem borers is strongly recommended. Rodent pests are important but not serious in the sense that plagues are present in either agricultural land or in humans. Control efforts and research are in a primitive state, here as elsewhere, and the national massive campaigns have little permanent impact on either the environment or on the rat populations. The sale of beta methyl fluoroacetate should either be suspended or its concentration reduced to 0.5% instead of the current 2% that provides a lethal dose for humans. Alternative methods of control are available.

INTRODUCTION

While the mission originally conceived was focused on the city of Seoul as a potential problem area for studying the environmental impacts of urbanization, no city can be an independent island--it must exchange goods, services, and waste products with the outside world and these interactions must be considered at least as an indirect part of any impact. Insofar as urbanization is related to "development" and "modernization", it can be determined readily that the major deleterious impacts on pest situations are likely to be in the rural areas of Korea.

While the human population of the ROK has increased rapidly in recent years, emigration from rural to urban areas is now such that there is an absolute decline in the number of rural residents. Although the ROK is striving to reduce the rate of movement by improving rural income and living conditions, some experts like Jo Nelson view the present trend as inexorable. With the current intent to develop agribusiness, there is also the possibility of adding positive feedback unless the process is well regulated. That is, any technological improvement in agriculture causes the rich to get richer and the poor to move to the city.

This report briefly reviews the current status of some insect and rodent pest situations in public health and agriculture and some of the ways in which the processes of urbanization and development alter pre=existing relationships.

The status of vector borne diseases

The general situation was summarized by Dr. Sungwoo Lee, Chief, Public Health Section, MHSA. From a very pragmatic position, the major concern is with diseases that commonly kill people. Presumably, vectors causing lesser morbidity will receive greater attention when the important problems are solved.

Mosquitos

The current major problem is Japanese encephalitis (JE). General epidemics occured in 1949 and 1966 with a mortality rate of about 30% among the several thousand cases, mainly in the south and western rice belt areas. Vaccine costs are high and of uncertain value. A planned field evaluation of the vaccine (70-80,000 inoculations) failed because the incidence of the disease among the untreated control population was virtually nil. Recent spotty cases have been in suburban areas. The reasons for the epidemics and near disappearance of the disease are unknown. The vector, Culex tritaeniorynchus breeds in paddy fields and it has been suggested that the increased use of agricultural pesticides reduced vector density. The relationship, however, is not likly to be so simple. The ecology of the vector is poorly known. The disease may be carried by swine and horses and possibly by poultry, other birds, frogs and reptiles. Public health workers currently (1971) use 6000 gal. of 25% DDVP for fly and mosquito control. In previous years they used Lindane and, still earlier, DDT. Reasons for switching are uncertain but were not due to problems of resistanee.

Malaria (Plasmodium vivax) parasites have largely disappeared from the country except for Kyongsang pukdo. Present control is with drugs and there is no mortality. DDT was used for vector control (An. sinensis) through 1969 but the attempt at total eradication was discontinued in 1969 for budgetary reasons (presumably coupled to the fact that it didn't work.)

Malayan-type filariasis is present on Cheju Island and is controlled with drugs.

Flies

House flies are a nuisance and may transmit shigellosis and typhoid. Cholera and polio may also be transmitted by flies but the major carrier for all of these diseases is probably water. Fogging with DDVP is considered to be ineffective for fly control. Screening is increasingly common in urban areas and the switch from privies to WC's may help reduce the problem since Dr. Lee thinks that Musca domestica breeds in human feces in Korea.

Rodent ectoparasites

Korean hemorrhagic fever was a major problem during the war but is now confined essentially to the DMZ where it affects ROK troops. About 1000 cases occured from 1960-63 with 2 to 300 deaths. Cases also occured in 1971. The ecology of the disease id poorly known; presumably it is transmitted by a mite from small rodents such as Apodemus agrarius which thrive in the abandoned lands of the DMZ. Seasonal peaks in late May to early June and late October to November account for 80% of the cases. No vector control is planned.

There is no certain evidence for the past presence of plague in Korea. Plague occured in Manchuria about 1900 during the pandemic. At present, ports of entry for returning Vietnam-based troops are carefully monitored to prevent the possible introduction of plague. A flea (X. cheopis) index is maintained and is always less than 1.0.

Murine typhus, scrub typhus, relapsing fever, and trichinosis are either rare or absent.

Rabies presumably is maintained in the wild fox (Vulpes vulpes) population which has been very low since the war. Fifteen to 20 cases of dog rabies are diagnosed each year by the Agricultural Veterinary Dept. The dog population of Korea is estimated at about 800,000, of which 200,000 are

vaccinated for rabies. Dogs run free in rural villages but seem to be relatively rare on the streets of Seoul.

In so far as the available information provides an adequate picture, urbanization and development have probably served to reduce most problems of vector borne diseases in Korea, as they have elsewhere. Some of the processes involved are an increased standard of living (especially housing) and dissociation of the human population from the vector populations.

The status of agricultural pests

The major crop in Korea is rice and the major pest is the stem borer. Rust is also an important problem and leaf hoppers can cause trouble. This review must necessarily be both limited and superficial and, since I did not have the oportunity to discuss the situation with Dr. Lamey of the UNDP, it may not reflect all current knowledge and thinking.

According to Dr. Hyun, about 70% of the recent increases in the yield of rice can be attributed to the use of insecticides and fungicides. Cultural practices, including the use of compost fertilizer, inorganic fertilizer, and new strains of rice have also contributed. Plans are now underway to make extensive use of IR667,,which is said to increase yields by 30%. This estimate has not stood the challenge of the real world and several qualified people are skeptical and rightfully concerned with the unpredictable consequences of reducing genetic diversity over wide areas. The recent US corn blight has provided a meaningful lesson within academic circles and the current rice crisis in the Philippines (birthplace of the miracle rices) is even closer to home. IR667 is now resistant to rust in Korea but is highly susceptable at IRRI.

The rice stem borer (Chilo supressalis) overwinters in the larval stage in rice straw and stubble. Two generations are produced during the summer, the second of which causes the most damage. Control in many areas is compulsary and is based on heavy applications of organo-phosphorous (OP) compounds such as Sumithion. The use of Parathion has been outlawed in Korea but other OP's are hazardous to use under conditions of constant exposure by operators. Literally hundreds of spray operators have been killed in recent years, presumably because they failed to exercise proper precautions. According to JF researchers at the NIH, rice fields have become shrouded in death--a scene that is not rare in parts of the USA. What good are the rice birds, field mice, minnows, frogs and snakes anyhow? A rather wide variety of

agricultural pesticides have been used in Korea in recent years. Recommendations seem to shift frequently but I am not familiar with the reasons except that they reflect a certain amount of understandable floundering.

Rice straw is used extensively for thatched roofs in rural villages and the thatch must be replaced every two years. Rice straw has several other uses such as for baskets, bags, mats and hats. The annual surplus is burned when it is clearly unneeded, usually long after the borers have departed. The relative number of borers that remain in the field stubble is unknown. Some poorly drained fields remain partially flooded but the larvae can survive submersion for 20 days.

Clearly the success of the destructive second generation of borers is related to that of the first and what is known of the ecology of this species in Korea suggests alternatives to the total dependence on pesticides for control. Burning most of the straw with the stubble soon after the harvest would be of obvious benefit if the straw were not useful to the farmer. Other possibilities exist and researchers are aware of the problems. Judging by the review on the control of paddy stem borers by cultural practices conducted in 1964 (Kâhn 1967), however, the miracle of modern pesticides seems to have stifled research on alternative methods for many years.

Rodent problems and control

The very idea of squatter settlements and slums as one aspect of the process of urbanization on Korea naturally conjurs up visions of hoards of rats associated with filthy conditions. My limited observations suggest that there is no substance to that illusion at this time. This is not to say that there are no rats in the squatter settlements but that they are probably no worse than in many of the older residential areas of Seoul at this time. In no small measure, the observed condition is probably due to the relatively cleanly nature of Koreans living in dense situations plus municiple garbage collection which prevents the accumulation of food for rats. There may also be a time lag associated with the availability of harborage in newly constructed areas. Suitable sites for burrows may be abundant but it takes time for rats to discover and develop such situations--after which they may be used by several generations of rats when and if food is available, or, temporarily. The Korean slums are a marked contrast to some of the urban ghettos of the USA where the poor are often transients with no stake in either the building they occupy or in the local community. Perhaps there are many reasons for the visible differences in living habits and attitudes, including racial homogeniety vs discrimination and rapid growth and hope vs relative stagnation and despair. On the other hand, the very favorable impression of the cleanliness of squatter settlement streets may simply reflect a difference in where individuals draw the line of responsibility for sanitation, since the steep upper bank below an older settlement bore a rather liberal coating of garbage and trash and looked like a good place to find rat burrows.

Public health problems have been treated above and are considered to be of minor importance despite the usual PR arguments for controlling rats. Rat bites were unheard of among the few people queried but if the incidence is no higher than that in the USA and is not newsworthy, a lack of awareness would be likly. House rats are undoubtedly common in Korea and detract from the

general quality of life.

Crop destruction

Losses of grain in the field are especially difficult to estimate because of the great variability in location and time. The recent estimate of a 4% loss in paddy fields (Bae, et al 1971) seems reasonable but the variation and factors associated therewith should be determined. The massive campaigns are not aimed at preventing this type of loss.

Stored grains

Protecting grain after the harvest is a major justification for the recent campaigns against rats. Granary rats clearly produce an absolute loss of foodstuffs in proportion to their numbers. That rats living in other circumstances are consuming food ultimately destined for human consumption is more questionable.

Structural damage

A problem in Korea is associated with the method of constructing and heating houses. Heat and combustion gases are circulated beneath the stone and cement floors of the house. Burrowing by rats may cause shifting of the foundation and inconspicuous cracking of the floor. Seepage of gases into the living space can cause CO poisoning.

The impact of control measures

The four campaigns so far conducted have doubtlessly been effective in making the public "rat conscious" and in providing some elementary training in control methodologies. Safety in handling poisons has been emphasized and the zinc phosphide used in the campaign is a good choice for avoiding accidents and side effects. The safety record seems to be excellent.

A potentially greater hazard is associated with the rat poison which is readily available at a nominal sum (50 won) at drug stores. The compound, beta methyl fluoroacetate is not discussed in the technical literature in

protected from snap traps. Live traps are perfectly safe. Very effective yet inexpensive live traps are made in Japan.

5. I am not familiar ~~with~~ with Korean building codes but rat proofing should be an important consideration in the design of new construction.

6. When sanitary sewers are constructed, they should be designed in ways to minimize rat harborage and to either prevent or reduce the movement of rats through the system. Such considerations will make future sewer rat problems less likely to develop and easier to control.

A GROSS GUIDELINE

It is extremely likely that Korea is headed for some disasters in agriculture and public health if present plans for increasing rice production are implemented. I refer specifically to the proposed drastic increase in the use of chemicals to control stem borers and leaf hoppers and to the proposed widespread use of IR-667. The highly touted success of IR-8 in the Philippines has been reduced to a blunder of major proportions, highlighted by the devastating effects of a virus transmitted by leaf hoppers. Resistance to chemical control by these pests seems inevitable with the currently conceived plan of operation in Korea. The present level of resistance to rust exhibited by IR-667 in Korea is likely to be short-lived. Even if the local varieties of rust don't mutate, no quarantine can prevent the possible transportation of a rust spore from Los Banos. In addition, the production of insecticide resistant strains of Culex tritaeniorynchus --the vector of JE--is virtually certain if paddy fields are routinely doused with chemicals.

The desire to increase food production is certainly understandable but the costs in terms of the probable instability of the agroecosystem make current proposals highly questionable. No instant solutions are visible and proposed panaceas are likely to be transient illusions. The situation in Korea seems quite amenable to alternatives for controlling stem borers. The critical overwintering population is vulnerable to control by sanitation; most of the spring moths and their larvae can be hit in the seed beds--with chemicals if necessary; attempts to develop sex lures for a different species of Chilo are just underway (J. Dale Newsom, LSU, pers, comm. , 22 May 1972) and may prove useful in trapping spring moths without using pesticides. (One can only note that it's about time!)

Producing strains of rice which are more resistant to stem borers is yet another possibility and workers in the field can doubtless think of several other alternatives which should be tested. Unfortunately, I did not have the oportunity to discuss the problem with Dr. Art Lamey of the UNDP but suspect he would agree with the above statements.

What is called for is a major redirection in research aimed at promoting stability, even at the expense of a hoped-for immediate increase in productivity. Attempting to regulate the instabilities generated by certain new methods of production by using insecticides means getting hooked on a technology that runs counter to ecological and evolutionary principles. Stability is, at least in part, a function of diversity, but a scheme for diversifying crops in what is now paddy land does pose special problems. Nevertheless, this seemingly impractical suggestion should net be dismissed out-of-hand. It is both feasible and realistic to develop and maintain genetic diversity within a species (crop) instead of breeding purely for an increased production which must be proped-up by artificial means.

The success of urbanization--development--modernization rests squarely on a dependable food supply. Importing food is a real solution for some developed countries at this time. What the world food supply will look like in another generation of humans is a matter for grim speculation. Presumably, when and if the human population achieves a steady-state relationship with its limiting resources, some countries will be net importers and some net exporters of foodstuffs but a detailed design for world order is beyond our present understanding. An essential characteristic of such a stable system, however, is a landscape design which optimizes the mix of several human needs and values and minimizes the need for chemical control of rodents, insects, fungi, and other pests.

Detailed models with realistic constraints and assumptions should be developed immediately for various key countries and Korea, with its rapid change and vitality, is a prime testing area for the usefulness of such models.

A philosophy and program of managing the landscape in ecologically and economically (the terms should be synonymous) sound ways depends on the availability of a large cadre of highly trained extension workers. Since there is much groundwork to be done, in learning how to manage systems, an effective approach would be to enlist students as assistants in the essential research programs. Most research programs suffer from an inadequate data base, due largely to environmental heterogeniety. Training, action, and research should be integrated.

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April 8, 1972

Mr. William L. Eilers
Office of Environmental Sciences
Smithsonian Institution
Washington, D.C. 20560

Dear Mr. Eilers:

The following is a record of my services as a Program Assistant provided to Dr. Kyle R. Barbehenn, consultant of Environmental Study Group during March 27 - April 8, 1972:

Date		Brief Description of Program	Time Spent
March 27 (Mon)	AM	Meeting services, arrival by NW021 at 11:35	
	PM	Program arrangement at USAID while Dr. Barbehenn discussing with AID officials	Full day
March 28 (Tue)	AM	No escorted program	
	PM	Meeting with Mr. Shin Young-kul, Management Section, Agricultural Admin. Ministry of Agriculture & Forestry	
		Meeting with Mr. Chon Soon-pyo, Plant Protection Division, MOAF	Half day
March 29 (Wed)		Visit to College of Agriculture, Seoul National University, meeting with Dr. Hyun Jai-sun, Dept. of Agricultural Biology and other faculty members	
		Visit to Office of Rural Development	Full day
March 30 (Thu)	AM	Meeting with Dr. Lee Sung-woo, Chief of Public Health Section, Bureau of Public Health, MOH&SA	
	PM	Meeting Mr. Chu Hyun-bai, Agricultural Economics Research Institute and two officials	Full day
March 31 (Fri)	AM	Meeting with Dr. Kim Hon-kyu, Entomologist Ewha Women's University	
		Meeting with Dr. Won Pyong-kwi, Dong Kuk University	Half day

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Date		Brief Description of Program	Time Spent
April 1 (Sat)	AM	Meeting with Dr. Yon Ryong-oh, Ornithologist, Kyung Hee University	Half day
April 2 (Sun)		No program	
April 3 (Mon)		Program not escorted	
April 4 (Tue)	AM	Visit to National Institute of Health, meeting with staff of "Japanese Encephalitis Virus Research Unit" and WHO staff	Half day
April 5 (Wed)		Field observation to slum areas--Chonggyechon canal bank and Choongrang River banks, and to Kwangju Resettlement	Half day
April 6 (Thu)		Program not escorted	
April 7 (Fri)		Program not escroted	
April 8 (Sat)		Dr. Barbehenn departs from Korea by KE703 at 09:00 AM	
		Total service	5 1/2 days

I certify that the above record is true and correct to the best of my knowledge and that my services therefor have not been paid.

Pak Tae-jin
647-2 Hannam-dong, Yongsan
Seoul, Korea

CERTIFIED BY:

Kyle F. Barbehenn (Date)