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# Minnesota AGRICULTURE ECONOMIST



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## Economics Of Land Use Regulation In Flood Hazard Areas

by Alan R. Hopeman

FLOODS CREATE economic problems by damaging homes and businesses. Flood damages within the Minnesota River Basin totalled nearly \$39 million in the 1965 spring floods and nearly \$33 million in spring 1969. Future floods of the same intensity will be even more costly. This is because of:

- increased development in flood plain areas
- increased value of existing property
- increased flood depths due to manmade changes in natural drainage patterns.

Flood damages can be prevented. Here are two approaches:

1. Alter the flow of floodwaters to keep floods away from people;
2. Alter land-use patterns so damageable property is kept out of floodwater's reach.

Either approach would slow the rise in flood damage potential.

This article reports a study to determine how flood costs can be minimized in the Minnesota River Basin. Components of flood costs were analyzed. The economic incidence of these costs was studied to determine who pays them. If the persons paying

flood costs are not the same persons enjoying the benefits of flood plain occupancy, perhaps some policy modifications may be in order.

### 1965 and 1969 Floods

Table I gives a breakdown of damages incurred in the 1965 and 1969 floods.

Urban damages included:

- damage to homes, businesses, streets, bridges, and utilities;
- flood fight costs;
- evacuation and relief costs;
- wages and profits foregone;
- costs of traffic detours;
- cleanup costs.

Urban damages accounted for more than a third of total damages. In 1969, over 50 percent of urban costs were detour costs.

Transportation costs included damage to bridges, roads, and railroads, except for those incurred in urban areas. Detour costs in non-urban areas are also included. Both years transportation damages accounted for about 15 percent of total flood costs.

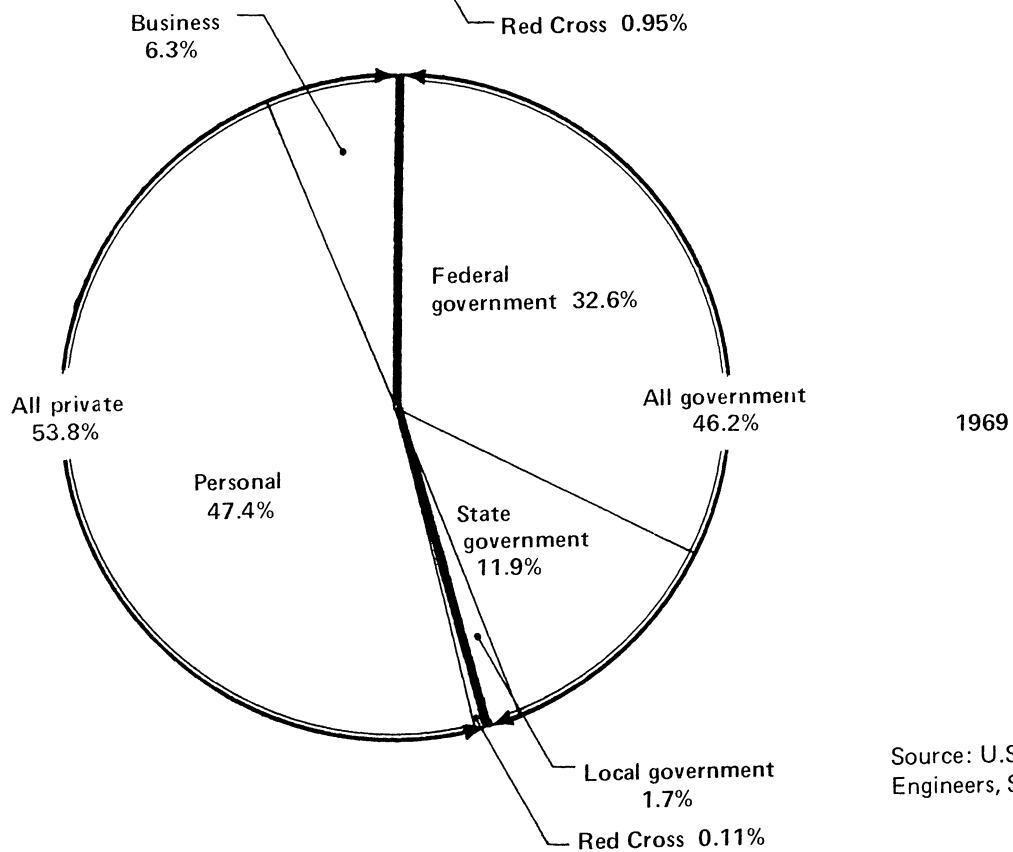
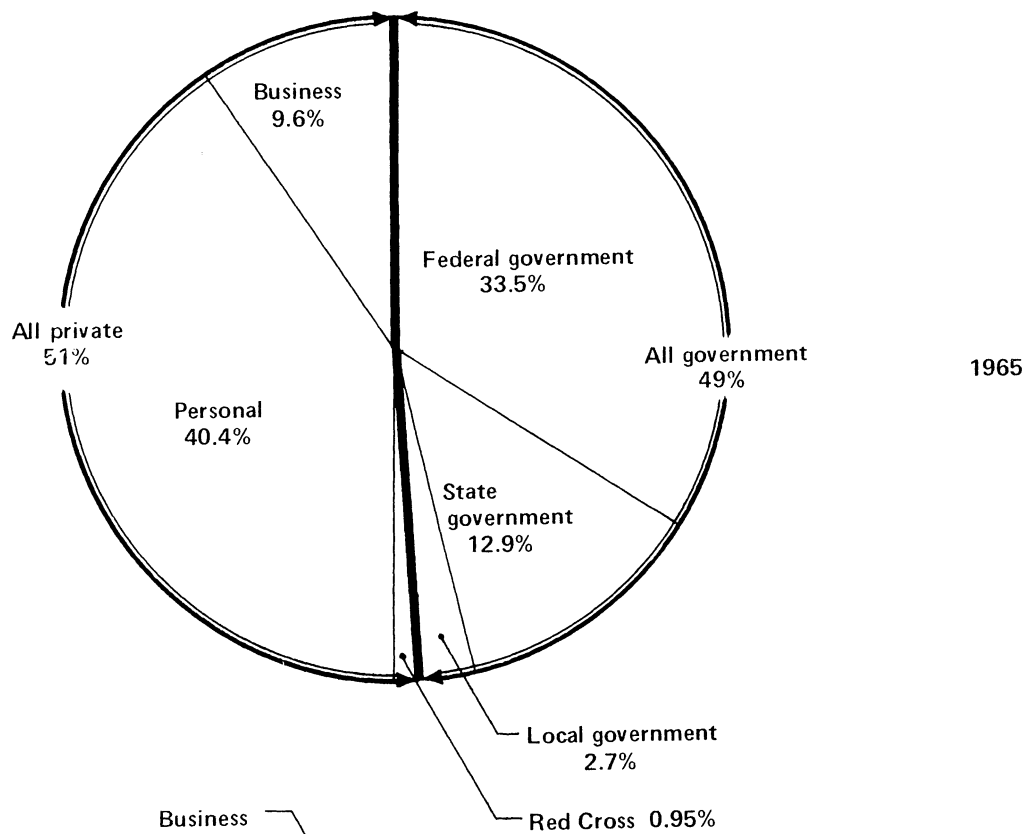
Of these costs, approximately 90 percent were road and bridge repairs; 8 percent were detour costs; and 2 percent were railroad repairs.

Table I. Flood Damages in the Minnesota River Basin, 1965 and 1969.

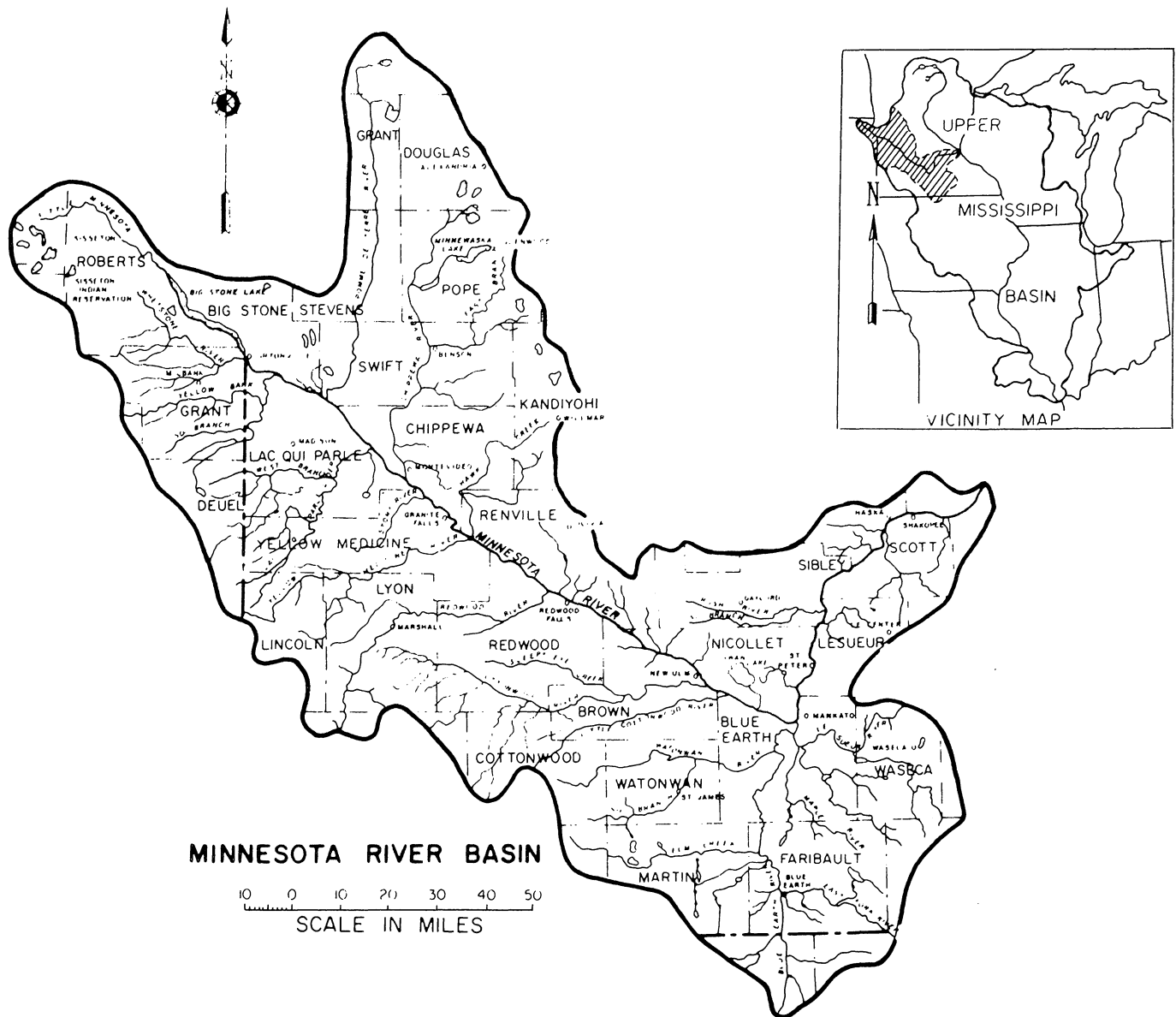
	Urban	Transportation	Agricultural
1965	\$13,800,000 (35.6%)	\$5,300,000 (13.7%)	\$19,700,000 (50.8%)
1969	\$12,400,000 (37.8%)	\$5,100,000 (16.5%)	\$15,300,000 (55.55%)

Source: U.S. Army Corps of Engineers, St. Paul District

FIGURE 1. Incidence of flood costs, Minnesota River Basin, 1965 and 1969



Source: U.S. Army Corps of Engineers, St. Paul District.



### Who Pays Flood Costs?

Figure 1 illustrates the incidence of flood costs. These graphs do not show ongoing expenditures for flood damage reduction such as the Corps of Engineers' expenditures for flood control works and the Minnesota Department of Conservation's (now Department of Natural Resources) expenditures for flood plain management programs. The graphs do show who ultimately paid costs directly resulting from these two floods.

The Federal government paid 33.5 percent of the flood costs in 1965 and 32.6 percent in 1969. Much of this resulted from casualty loss deductions on individual and corporate income taxes. Another major component was Federal contributions to local governments to repair public facilities. These contributions were made under the

Disaster Relief Act of 1950 and the 1958 Highway Act (Public Law 86-767).

In the future, the Federal share will be much higher because of new programs:

- the highly subsidized Federal flood insurance;
- the Disaster Relief Act of 1970, which liberalized disaster aid provisions to private firms and individuals;
- the 1972 amendments to this Act, which further liberalized these provisions.

Minnesota paid 12.9 percent of the damages in 1965 and 11.9 percent in 1969. Repairs to state-owned roads and state income tax casualty loss deductions account for most of these costs.

Local governmental costs accounted for 2.7 percent of the 1965 floods and 1.7 percent of the 1969 floods. These were primarily flood fight costs and costs to repair public facilities. Both the 1950 Disaster Relief Act (in effect during both floods) and the 1970 Disaster Relief Act (now in effect) provide for payments to local governments to defray such costs. However, not all costs are eligible.

Businesses (excluding farms) bore 9.6 percent of 1965 flood costs and 6.3 percent of 1969 costs. Most of this was damage to structures, although some were detour costs and profits foregone. Business losses would have been higher if Federal and Minnesota income tax structures did not permit casualty loss deductions.

Individuals paid 40.4 percent of 1965 flood costs and 47.4 percent of

1969 flood costs. This category includes farm losses not compensated by tax subsidies or relief payments.

Finally, the American Red Cross paid about 1 percent of losses in both floods. This was primarily for emergency relief and rehabilitation.

#### **Effect of Cost Incidence on Flood Plain Development**

Federal, state, and local governments paid 49 percent of 1965 flood costs and 46.2 percent of 1969 flood costs. These shares will increase in future floods. The Federal government's role in disaster relief has been expanded. A subsidized flood insurance program has also been instituted.

Presently, a flood plain landowner has little incentive to consider flood costs. Yet most public costs are in flood plain development. Some public costs are unavoidable. However, most would be eliminated if people did not locate homes and businesses in the path of floodwaters.

If flood plain land is to be put to its best use, landowners must consider the economic costs of occupancy. Flooding would be a less serious economic problem if these people would weigh the benefits of living in such areas against possible consequences.

Certain external costs are seldom paid by the land user. Therefore, unwise land use is encouraged.

In varying degrees, Federal, state, and local governments all participate in flood programs. They build permanent and temporary flood control structures; provide disaster relief and

rehabilitation; remove debris and clean up, etc. Yet these programs are not directly paid for by occupants. As a result, dwellers do not take these costs into account. Uneconomic developments within flood plains are common.

Other external costs are repair costs to service facilities, including roads and utility lines. These would not be required in flood plains if people chose sites outside such areas. Also, flooded property can alter the flow of floodwaters and contribute debris and contaminants to floodwaters. In this way upstream or downstream flood damages are increased.

Also, occupancy entails public costs by creating a demand for flood control structures. Structures such as dikes, dams, and channel improvements are normally paid for by all taxpayers rather than by specific beneficiaries of such projects. Thus, all taxpayers may have to subsidize flood plain occupants' economically unwise choices of location.

The construction of dikes, dams, flood protection structures, etc. is a classic example of the use of political pressure to invest tax revenues in protection measures benefiting a very few landowners.

Even if structural flood control works were paid for by their beneficiaries, the structural approach may not be advisable. Adverse environmental effects may result from altering a river's ecology. Secondly, structural protection can seldom be complete and may provide a false sense of security. This encourages further development of "protected" flood plain. If a flood occurs which is too large for the structural protection, damages could be much higher than if the structure had never been built.

If flood plain land users considered the full costs — both private and social — of their occupancy, more economically efficient settlement patterns could result. The need for structural protection would be reduced. External costs (costs borne by persons other than land users) distort this pattern of flood plain land use.

The government should alter settlement patterns to end uneconomic uses of flood plain land. This can be done by regulation; by altering the economic system so that land users take the costs of their occupancy into account; or by a combination of these two alterations.

In terms of capital expenditure, regulation is inexpensive compared to structural protection. If suitable alternative sites are outside the flood plain — as is usually the case — the opportunity cost (opportunity cost is defined as income foregone as a result of a decision) of regulating flood plain land use would be small. Some land speculators may lose capital gains due to regulations restricting building, but these losses would be offset by gains in land values outside the flood plain.

**"Certain external costs are seldom paid by the land user. Therefore, unwise land use is encouraged."**



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Flood hazard areas could be reserved for land use with low damage potential, such as farming, outdoor recreation, or parking areas. The major cost would be technical studies to define and delineate flood hazard areas. This, however, would be a one-time expense. Several Federal agencies and the Minnesota Department of Natural Resources are prepared to finance such studies. Administrative and enforcement costs would be small. Since most localities have zoning ordinances, existing means of enforcement could be used.

Alternatively, some institutional changes could be introduced to eliminate subsidies to the flood plain occupants and to require them to bear full costs of damage. Changes could include:

- restructuring financing arrangements for structural flood control works so that beneficiaries pay more of the costs.
- restructuring flood disaster relief programs so persons suffering preventable damages are not eligible for aid or must repay such aid at realistic interest rates.
- requiring occupants to pay repair costs of flood-damaged public facilities built specially to serve them.

These changes may be politically difficult to achieve. An attempt to reduce or eliminate disaster aid would cause tempers to flare. Persons in flood plain areas may interpret these as harsh and punitive changes. Such changes may be deemed discriminatory, favoring victims of other disasters over flood victims.

However, economic factors would then discourage uneconomic use of flood plain land. These changes could be accompanied by an information program to point out the costs of flood plain settlement and to inform flood plain dwellers that they will have to bear most flood costs on their own.

However, some flood plain users would still impose costs on others by contributing contaminants or debris to floodwaters and by altering floodwater flow so that flooding increases upstream or downstream. Here regulation of use is probably needed, even if the above modifications are made. Flooded feedlots, chemical companies, and sewage plants could cause widespread contamination. Lumber yards or trailer parks could contribute sizeable debris, causing damage and clean-up problems downstream. Landfills may cause floodwaters to back up, thus compounding upstream flood problems. The simplest way to prevent these occurrences is to establish land-use regulations in flood plain areas.

## Conclusion

To put flood plain lands to their wisest use, a balanced governmental approach is required. Controls are needed so flood plain land is not used in ways that impose external costs on upstream or downstream users. Institutional modifications are needed to induce flood plain occupants to consider the social costs of their locations.

Where institutional modifications are unfeasible or inadequate, further regulation is in order. Aggressive information dissemination should inform flood plain purchasers about flood hazards. Regulation may be necessary so prospective purchasers are not at the mercy of unscrupulous or uninformed developers.

Structural measures may be warranted in some areas. However, proposals should be evaluated cautiously. Such proposals should be subject to new constraints. Beneficiaries of structural protection works should pay more of the cost. Structural protection works should be combined with land regulation schemes so that the works do not encourage unwise land use. Structural protection works should only be used to protect properties having a sound economic reason for being located in flood plain areas. Other land use should be redirected to nonhazardous locations.



## Natural Resources In Minnesota

John J. Waelti is associate professor in the Department of Agricultural and Applied Economics at the University of Minnesota. There he has teaching, research, and extension responsibilities in economics of water and natural resources.

by John J. Waelti

No one agrees what

Minnesota's population will be.

However, there is general agree-

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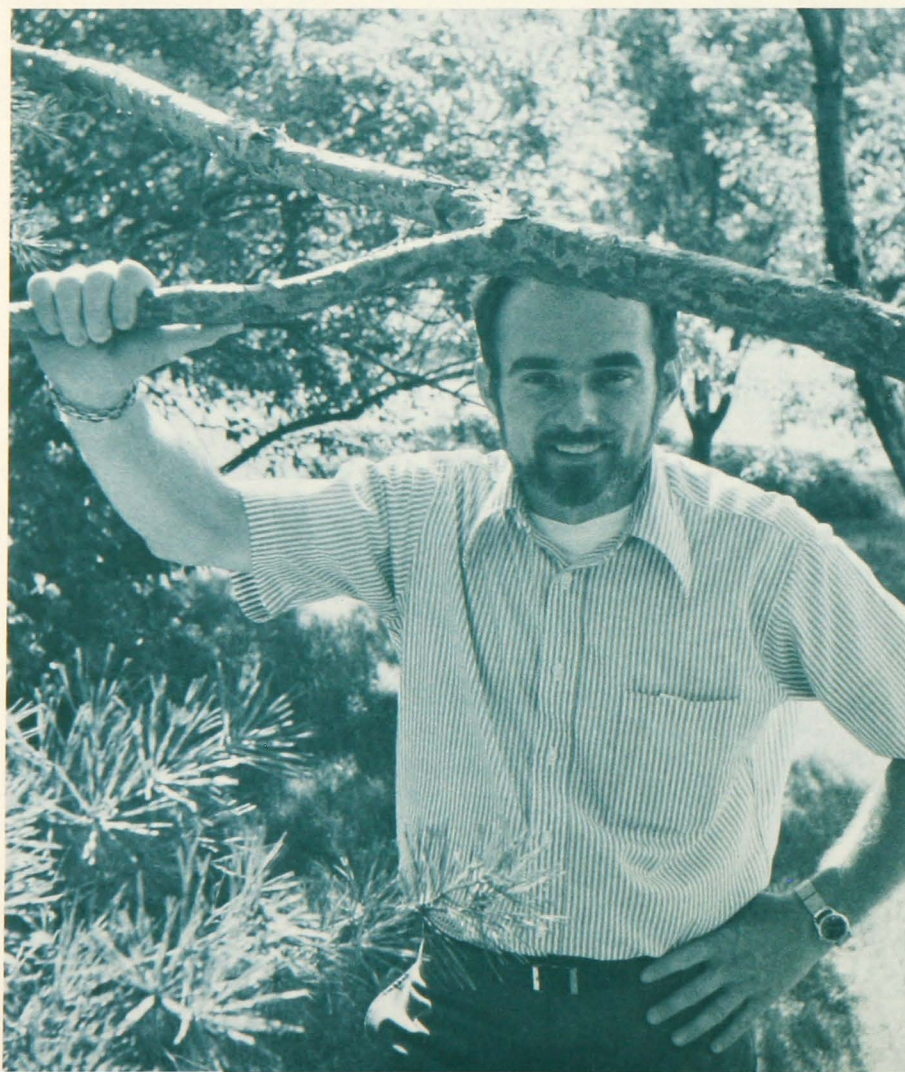
would put less strain on natural

resources.

### A Central Question

MORE FREQUENTLY than ever before, Minnesota citizens are questioning the relationship between economic growth, population growth, natural resources, and quality of life. These are not only philosophical questions. Major policies are now being considered in Minnesota. Resulting decisions will affect natural resources today, and they shall have considerable bearing on Minnesota's future.

Federal-state plans are completed or are being completed for water resource development in Minnesota's portion of the Missouri, Upper Mississippi, Red-Rainy, and Great Lakes



# Alternative Futures

Drainage Basins. These plans are based upon relatively high population growth.

There are two general objections to such plans. First, plans based on high population growth emphasize development. Examples are structural alternatives to reduce flood damage. These include storage reservoirs; developments for intensive water and water-related land use; and minimum preservationist-oriented policies.

A more significant objection is whether society should only react to population growth. Instead, some ask, can the population growth be influenced through public policy? In particular, can population relocation or redistribution relieve pressures on natural resources? Can relocation and redistribution offset the negative effects of burgeoning population centers and declining rural towns? Central questions, then, are "how can public policy influence the magnitude and direction of population growth, and what is the relationship of population growth alternatives to the demand for natural resources and related amenities?"

## Alternative Futures

No one agrees what Minnesota's population *will* be in the future. Nor is there agreement on what *should* be the

level or distribution. However, there is general agreement that less population growth would put less strain on natural resources. Also, less population growth would provide planning flexibility.

For *planning purposes*, then, one should consider alternative growth rates and evaluate their implications for natural resource development. An upper limit may be relatively high, approximating that occurring with average 3 child families.<sup>1</sup> This high rate could be associated with alternative policies ranging from developmental to preservationist. However, a high growth rate would place limits or constraints on policy alternatives. This is because more people implies more needs and greater resource use.

A contrasting alternative would be lower population growth approximating average families of 2 children.

Again, developmental or preservationist policies could be adopted. However, a lower rate would provide more flexibility. Policies could be more environmentally oriented and still satisfy needs such as recreation, water supply, and flood control. Furthermore, a lower growth rate may be associated with higher *per capita income*, even though economic activity may be lower.<sup>2</sup>

Alternative natural resource policies should be analyzed for their implications in land use, flood control policy, waste treatment, energy use, drainage and wetland preservation, wilderness and recreation, and other natural resource uses.<sup>3</sup>

In addition to its direct effect on Minnesota's water and water-related land resources, state and national water policies have a direct bearing on Minnesota's agricultural economy. The Missouri Basin has large tracts of potentially irrigable land. Texas planners view water transfer from the Mississippi River as a means to supplement falling Texas water tables. The net result in either case would be increased feed grain production in competition with Minnesota producers. It's certain that most Minnesotans will not

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<sup>1</sup> The U.S. Census Bureau's "Series B" population projections approximates an average family size of 3 children. The "Series E" projections approximates an average family size of 2 children.

<sup>2</sup> One reason for this is that a lower rate of population growth suggests a lower dependency ratio, i.e., a greater *proportion* of people in the work force and thus a higher per capita income.

<sup>3</sup> The lead article in this publication is based on an analysis of flood control alternatives in the Minnesota River Valley.



favor Minnesota water storage for out-state regions competing with Minnesota producers.

#### Conclusion

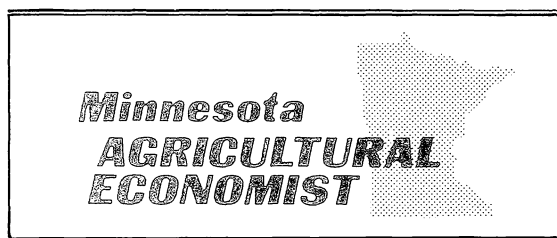
Increasingly, Minnesotans desire to actively shape Minnesota's future rather than to passively react to "inevitable" events. This is partly because of their concern for natural resources and the environment.

Furthermore, there are increasing signs that Minnesotans favor natural resources policies which are environmentally oriented. This is evidenced by:

- declared state policy which seeks to reduce flood damages through broad programs of flood plain management rather than through sole reliance on structural measures such as large-scale dams.
- increased citizen participation and interest in energy policy and power plant siting.
- increased interest in local planning and zoning commissions' policies.

- increasing interest in environmental legislation in the 1973 session of the Minnesota Legislature.

While a general consensus doesn't exist regarding the specific course the state should take for population growth and natural resource use, there is agreement that alternatives for population growth and its distribution have implications for natural resource use. These implications need to be examined in greater detail.



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