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Agriculture and Environmental Policy: Recent United States and Australian Developments

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Agricultural development in both the United States and Australia has led to suboptimal levels of environmental degradation. While both countries face similar forms of agricultural environmental degradation, the different resource endowment and population distributions have resulted in a different incidence of the costs of these problems. Increasing demand for environmental services and better information on off-site damages have led to increasing demand for reform of agricultural, rural development, and environmental programs to eliminate biases against practices viewed as more environmentally compatible.

Although Australia and the United States have many political and cultural features in common, their response to similar forms of environmental degradation often differs. These differences can be used to examine the factors shaping environmental policy. Differences between U.S. and Australian agricultural and rural-development policies, resource endowments, attitudes toward environmental quality, and demographic characteristics explain different approaches to environmental policy.

Two factors that have driven environmental policy over the last two decades are the increased demand for environmental services and better information on the external costs of agricultural production. Increased demand for environmental quality has been exhibited through increased public funding of environment-monitoring programs, enactment of tighter clean air and water regulations, and expanding memberships of "green movements" that are actively involved in political lobbying.

Legislative initiatives responding to the increased demand have tended to be observed in the U.S. before Australia. The U.S. has a larger population than Australia and a greater dependence on inland waterways as sources of domestic and industrial water supplies, transportation, and recreation. As a result, the effects of water quality

problems and other environmental problems on the community are noticed at an earlier stage and have been found to be quite substantial. The greater exposure to these problems led to a greater need for action. Consequently, information on the off-site impacts of agricultural production has been gathered in the U.S. for a much longer time period than in Australia.

A comparison of the different responses of the two countries to environmental problems associated with agriculture can provide each with future direction for more effective policies.

Government Intervention

Agriculture in both the United States and Australia has been the focus of numerous government programs because both countries have agrarian roots, have historically placed importance on food security, and have used agriculture to bolster rural communities. These agricultural programs have changed economic incentives. Altering the incentives has changed the economic environment in which farmers plan their production, thereby changing the rotations selected, the type and amount of the inputs used, and the viability of the agricultural sector. These production decisions in turn affect environmental quality. Thus, government policies influence environmental quality indirectly by altering agricultural practices (Figure 1).

Agricultural policies that change economic incentives frequently combine with market imperfections to exacerbate environmental degradation (Reichelderfer). Environmental degradation can

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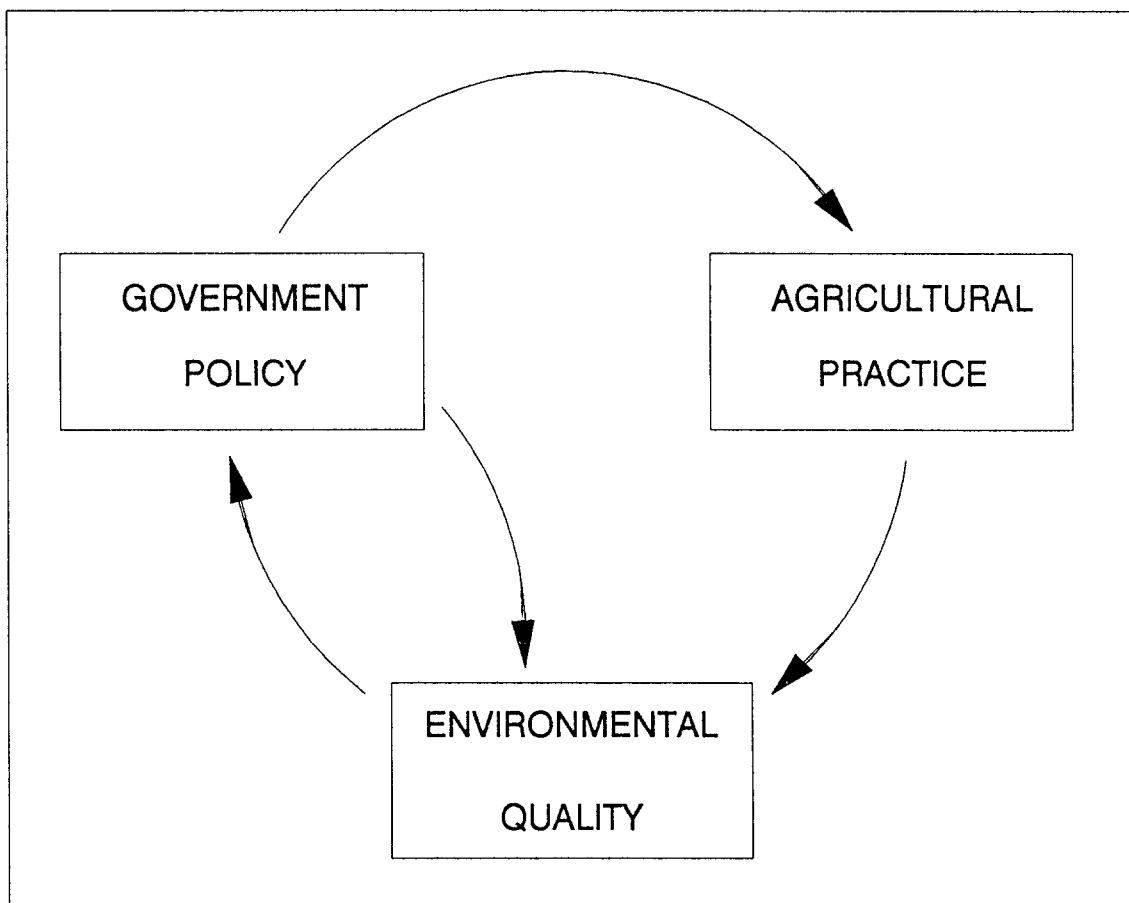


Figure 1. The Relationships between Agricultural Policy, Agricultural Practices, and Environmental Quality

often be traced to ambiguous property rights, high transactions costs, imperfect information, or some other form of market failure. Thus, a government can increase social welfare if it can remedy market failures.

The fact that a market failure exists is not a sufficient justification for government intervention (Blyth and McCallum). Government should intervene only if it can be demonstrated that the intervention can result in a net social gain (Kirby and Blyth, Chisholm). More specifically, intervention can only be justified if the cost of administering, measuring, and correcting the market failure is less than the social gains that result from the intervention.

Agricultural Policies

Agricultural policy provides a good illustration of the evolution in attitudes and policies towards the

environment. Agricultural production encompasses both the productive and consumptive aspects of environmental quality. The quantity and quality of water available for irrigation affects agricultural production, runoff from agricultural production affects local and downstream water quality by introducing sediment, fertilizer, and pesticide residues to the surface and groundwaters, and soil erosion affects current and future agricultural productive capacity.

Earlier agricultural policies in both countries gave little consideration to the environment as a good. These earlier policies have led to many of the environmental problems associated with agriculture today. Because agricultural production is so closely linked with environmental quality, more recent agricultural programs often contain environmental incentives or provisions. An examination of past government initiatives towards agricultural production offers examples of how policies can affect environmental quality.

Australian Agricultural Policies

Australian policies affecting agricultural commodity markets tend to be less direct than those of the United States. For instance, rather than using support prices, export subsidies, and import barriers to stabilize farm incomes, Australia uses state and national marketing boards for grains, wool, and livestock. Aside from marketing boards, Australian intervention in agriculture has focused on land use, land-tenure systems, and input subsidies. Although these latter policies do not directly affect agricultural commodity markets, they do change economic incentives and have a substantial impact on agriculture and the environment.

The policies governing land settlement in Australia were designed to encourage agricultural development. There were numerous variations on the theme, but most land settlement policies required the clearing of a prescribed portion of land. This clearing needed to be completed within a stated period of time to demonstrate the farmer's stewardship and improvement of the land (Bradsen and Fowler; Campbell; Moncrieff and Mauldon). Among the consequences of the land-clearing requirements was the substitution of shallow-rooted vegetation for the native deep-rooted species, and the replacement of permanent ground cover with agricultural systems that periodically expose the soil to erosive forces. In some instances, the introduced plant species could not survive the periodic drought conditions that are characteristic of the climate in Western Victoria, New South Wales, and Queensland. These requirements often resulted in landowners clearing land more rapidly than they could establish crops or improved pasture, leading to suboptimal land management practices (Moncrieff and Mauldon).

A further aspect of government land tenure regulations is the past promotion of closer settlement. The closer settlement program established farms of "an area sufficient to sustain a family in average seasons and conditions" (Davidson). Such programs have been employed over various periods in Australia's history. Unfortunately, in many cases the farms were not of sufficient size to be operated efficiently, and many of these farms failed. Young indicates the environmental degradation on these farms tends to be greater than levels observed on larger farms in the same area. He hypothesizes that the higher level of degradation is a result of the need to overstock the land in order for the farm to remain solvent.

Over the years Australia has used input subsidies to stimulate agricultural production. Irrigation water, nitrogen, and phosphorus have each received input

subsidies. The subsidies lower the cost of these inputs relative to land rental, labor, and other inputs, increasing their use. Shifting relative costs can change the optimal rotation and production practices, which in turn can change physical and biological processes affecting hydrologic conditions, chemical reactions, and soil movement.

Australia subsidized nitrogen and phosphate fertilizers between 1966 and 1984. During this period, nitrogen fertilizers received subsidies ranging from 3.4 percent (1980–82) to 46.8 percent (1968–69), and phosphate fertilizers received subsidies ranging from 0 percent (1974–75) to 80.5 percent (1969–70) (Rose et al.). These subsidies increased fertilizer applications above the level that would have been observed if the farmers had to pay the full market cost (Wonder). An estimate of the effect of the subsidy during the 1969–73 period suggests the subsidy may have increased phosphate use as much as 35 percent (Hyberg 1990b). Given the increase in soil acidity associated with the use of nitrogen and phosphate fertilizers and the increased use of fertilizers due to the subsidies, the subsidization of fertilizers may have contributed to the soil acidification observed in the 1980s.

While the subsidies for fertilizers have ended, those for irrigation continue. Irrigation projects constructed with federal funds provide water to irrigators at rates which frequently do not cover the variable costs of delivering the water (Watson and Rose, Davidson). In Victoria and New South Wales, a farmer has an entitlement to a certain amount of water, for which the farmer is charged a flat annual fee whether the water is used or not. Because the farmer must pay a lump sum for the initial water allotments, the marginal cost of water approaches zero for farmers who use only their basic water allotment (Centre of Policy Studies). This results in inefficient water use when the allocation provides more water than would be used under a unit-pricing schedule. In periods of surplus flow, above-allocation water may be available to irrigators. This water has a positive price but is usually offered at a subsidized rate.

The rules governing irrigation often act to promote economic inefficiency. Irrigation permits are granted by the state on an annual basis, and technically renewals are not automatic. Water entitlements can be revoked for a number of reasons, the most significant being failure to establish a beneficial use for the water (Randall). This, coupled with the water rate structure, serves to encourage the full use of a farm's irrigation allotment.

Until recently the irrigation rights have been fixed and nontransferable, which has led to economically inefficient use of the irrigation water. Producers

with irrigation entitlements who faced low marginal returns from irrigation were encouraged to irrigate because they were prevented from transferring water to producers who are able to make higher marginal use of the water. The regulations that have prevented the transfer of irrigation water are slowly changing but curtail the movement of water beyond catchment boundaries. This prevents the purchase of irrigation water by municipalities, the users with the greatest water demand.

The combined effect of these incentives to use water has been to increase the water table in some of the irrigation districts and areas, resulting in waterlogging of some soils. It has also resulted in increased salinity in the irrigation tail water. This has reduced the water quality for users downstream.

U.S. Agricultural Policies

U.S. policies have at their root a desire to stabilize agricultural markets and assure "equitable" farm incomes. These policies evolved in response to the fluctuating prices that characterize agricultural markets. Advocates of these programs argue that the government can stabilize commodity prices by storing excess production in good years and selling these stocks in years when there is a crop failure. What has occurred is the programs have increased production by offering a minimum crop price, eliminating price risk, and thereby increasing farm output. This, combined with increased efficiency in the agricultural sector and expansion of the programs, has led to the need for supply controls.

U.S. agricultural policies are characterized by a voluntary set of programs that are defined by loan rates, target prices, deficiency payments, acreage reduction requirements, commodity base acreages, program yields, conservation provisions, and a ten-year conservation reserve. Farmers compare the expected profits available with and without the program, examine their risk preferences, and then determine whether they wish to participate.

Although the programs are quite complicated in practice, their economic implications are fairly straightforward. In essence, farmers with a proven history of crop production have a fixed set of base acreages and crop yields for the program crops they have grown. Provided they accept program requirements, these farmers may choose to enter commodity programs that guarantee a relatively high price for their crops. The programs require that participating farmers restrict the acreage planted in each program crop to the base acreage for that crop. In most years the programs require that a

portion of the base acreage be placed in conserving uses rather than planted.

Because not all crops are covered by agricultural programs and the programs effectively fix relative crop prices, the programs both discriminate against non-program crops and alter the relative profitability of program crops. Thus, they induce farmers to change crop rotations. Further, because the acreage bases for a farm are based on the crop history for that farm, any reduction in the area planted to a program crop reduces that crop's acreage base. These factors serve to diminish producer response to market signals, create incentives for the production of program commodities on marginal land, and induce more intensive production practices. As production of many of these crops, such as corn and wheat, often involves potentially erosive cultivation methods and elevated chemical applications, the commodity program may be causing greater levels of environmental damage than would otherwise occur.

The U.S. also has subsidized irrigation in the western states. Irrigators in many areas are charged for water on an ability-to-pay basis. In some areas, the water charge was as low as 25 percent of the water delivery cost in 1986 (Moore and McGuckin). In most instances, farmers can exchange irrigation water between themselves, but there are restrictions on the transfer of water to nonagricultural users. The effect of these regulations are increased salinity levels in the tail water. This has in one case resulted in the need to install a desalination plant on the U.S.-Mexican border in order to reduce salinity levels of river water flowing into Mexico.

Environmental Policies

Although the United States and Australia have many similarities, their environmental and agricultural policies have developed under different sets of circumstances. To evaluate these policies, one needs to identify their objectives and recognize several basic differences between Australia and the United States.

While both countries have approximately the same land mass, the population of the U.S. is approximately fourteen times greater than in Australia. This has two implications. The larger population provides the U.S. with a larger financial base to support research and extension activities. Also, the larger population, combined with an extensive system of rivers used for navigation and a dependence upon large aquifers and reservoirs for water supplies, means the off-site effects of agricultural pro-

duction are much more likely to be felt by nonfarmers in the U.S. than in Australia.

The U.S., in general, has deeper, more fertile soils, higher and better distributed rainfall, and more temperate climates than Australia. This permits more versatile and intensive agricultural production in the U.S. In addition, the generally deeper soils suggest that the marginal production losses due to soil erosion are generally less in the U.S. than in Australia.

In Australia, the state governments have responsibility for agricultural and environmental policies, while the federal government has control of fiscal, tax, and trade policies. In the U.S., the federal government has the primary responsibility for all of these areas, although many states are assuming more authority over environmental quality and other environmental issues.

These differences combine with the physical factors causing environmental degradation to define the conditions that environmental policy needs to address, and combine with the agricultural policies to determine the tools available to address the degradation. Thus, even when the environmental conditions in the U.S. and Australia are identical, the resource, demographic, and political differences can result in two distinctly different sets of circumstances. These circumstances might require two distinctly different policies, and the tools available to implement these policies might be completely different.

Accelerated soil erosion offers an example of a situation where the same environmental forces are causing the degradation, but other factors cause the problems to be distinctly different. While soil erosion is a naturally occurring event, agriculture generally results in higher levels of soil erosion than would naturally occur. The vegetation protecting the soil is removed and the soil cultivated, exposing the soil to wind, precipitation, and flowing water. The energy from these agents displaces soil particles. The removal of the soil particles lowers the productive capacity of a field by reducing the soil available for plant growth, destroying the soil structure, and removing plant nutrients. The deposition of these eroded particles causes off-site damage by clogging drainage ditches and waterways, filling ponds, and polluting water bodies. In both countries, soil is eroded and deposited, cropland productivity diminished, and off-site damages incurred. However, in spite of these similarities, the situations are distinctly different. These differences include who bears the erosion costs, the existing agricultural and rural development policies, and the tools available to implement soil conservation policies.

The distribution of the on-site and off-site costs of soil erosion in the U.S. and Australia is quite different and has a direct bearing on conservation policy. The ratio of off-site to on-site costs from soil erosion is 5:1 in the U.S. and 1:6 in Australia. In the U.S., the higher population density, distribution of the population, extensive system of navigable rivers, and large reservoirs and hydroelectric power stations lead to off-site costs (\$3.2 billion per year) from soil erosion that are large relative to the on-site costs (\$0.6 billion) (Strohbehn; Ribaud; Alt, Osborn, and Colacicco). While Australian data on the cost of soil erosion are difficult to obtain, the evidence indicates the distribution of the costs is reversed.

In Australia the greatest portion of the cost from soil erosion is borne by the farmers as a result of lost productivity and increased fertilizer expenditures. Dumsday and Edwards estimate that soil erosion results in on-site costs of about \$260 million a year for all of Australia. Extrapolating from Hyberg (1990a), off-site costs of soil erosion in Australia are likely to fall between \$20 million and \$30 million a year.

The different cost distributions are reflected by the conservation policies adopted by the two countries. Soil conservation programs in both the U.S. and Australia arose in the 1930s as knowledge of the effects of erosion on agricultural production became available. In both countries, soil conservation practices were encouraged to preserve agricultural productivity. The extension and research efforts, cost-share programs, and tax subsidies included in the original programs were designed to address the on-site damages. While there are differences in the operational details, the intent of the research and extension activities in both countries is to increase the efficiency and competitiveness of agriculture, while minimizing the loss of future productivity and reducing damage to the environment.

In spite of the resource, demographic, and political differences, the policy of maintaining and supporting extensive research and extension organizations is well suited for both the U.S. and Australia. These research and extension activities are able to satisfy the policy objectives because both nations have modern, export-oriented agricultural sectors, well-developed research facilities, and communication systems capable of reaching a well-educated farm population.

Both countries have also utilized tax policies and cost-share benefits to provide incentives for practices that maintain agricultural productivity. In the U.S. and Australia, structural measures such as ponds, terraces, and banks have received up to 50

percent government cost-share subsidies. In addition, such soil conservation measures also have received preferential tax treatment.¹ These programs have led to increased levels of investment in soil conservation structures but have been criticized as inefficient. Critics argue that because the cost-share and tax subsidies are offered for structural measures but not changes in management practices, they make structural measures less costly relative to other conservation practices. Thus, the subsidies have led to the emphasis of structural and mechanical solutions for soil conservation problems when changes in farm management practices would be at least as effective and less expensive (Reichelderfer). Others have argued that the cost-share programs may have merely resulted in the substitution of government funds for private investment (de Steiguer).

In Australia, the general thrust of the soil conservation policy continues to be the maintenance of agricultural productivity. In the U.S., soil conservation policies have changed to address the off-site effects of soil erosion as information on the extent of the off-site costs became available. As the policies addressing soil erosion were expanded to encompass the off-site damages, the soil conservation policies began to address water quality issues. The Conservation Reserve Program, the Conservation Compliance and Sodbuster provisions introduced in the Food Security Act (1985) (and continued in the Food, Agriculture, Trade, and Conservation Act of 1990 (FATCA), with some changes), and the Water Quality Act of 1987 contain elements meant to address the off-site damages of soil erosion. Each of these initiatives also has an effect on water quality.

The Water Quality Act affects agriculture through its nonpoint source pollution provisions. These provisions were drafted to permit state authorities to meet national water quality standards, rather than as an attempt to offset the effects of other policies. The Water Quality Act permits state authorities to restrict land use and chemical applications on farms that are judged to be contributing to nonpoint source water-pollution problems.

The environmental provisions introduced in the Food Security Act of 1985 and expanded in FATCA address the adverse environmental effects of agricultural production. These programs depend upon the benefits offered by the commodity programs to

encourage producers to comply with the environmental provisions. Farmers who do not comply are denied eligibility for the commodity program benefits. Major provisions that use program benefits to induce participation are the Conservation Compliance Program, the Sodbuster, and the Swampbuster provisions.

These provisions each use program payments to acquire specific environmental benefits by denying program eligibility to those producers who drain wetlands, cultivate vulnerable, previously undisturbed soils, or use unapproved farm management plans on highly erodible soils. These programs are voluntary because producers only have to comply if they wish to receive benefits from the commodity programs. If the benefits from participating in the programs are expected to be smaller than the cost incurred through complying with the conservation provisions, then producers may prefer not to comply with the requirements.² Australia does not make direct payments to farmers; therefore, its soil conservation programs do not contain similar provisions.

The Conservation Reserve Program (CRP) was also introduced in the Food Security Act of 1985 with the aim of removing between 40 million and 45 million acres of highly erosive land from agricultural production. Land is rented from the farmer for a period of ten years. During this period, the land cannot be used for any agricultural purpose and must be planted to either grass or trees.

Although commodity programs are considered to have an adverse effect on the environment, some programs can have a beneficial effect. The primary objective of the ARP is to control agricultural production through reducing the area of land planted to commodity program crops. However, the cropland set-aside requirements also can have a conserving effect by reducing soil erosion and chemical applications on the unplanted acreage.

In addition to providing an inducement for farmers to participate in environmental programs, commodity program payments have in recent years offered a means to limit the expense of the environmental initiatives. Because the program payments are tied to base acres planted in program commodities, a reduction in the area planted under the program reduces the overall cost of agricultural and environmental programs. These programs use set-asides, conservation reserves, and other conservation provisions to reduce total government

¹ In Australia, the clearing of native vegetation has also received favorable tax treatment (Roberts; Haynes and Sutton). This tax policy is viewed as environmentally harmful because the tax deduction reduces the cost of farm management practices that expose soil to erosion and increase water-table levels.

² The reduction in area eligible to receive commodity program payments in the 1990 Farm Bill may encourage many farmers on highly erosive (but productive) soils to forgo the (reduced) payments in order to avoid the costs of complying with the conservation provisions.

expenditures. In particular, to the extent the Conservation Reserve Program has reduced acreage planted under the commodity programs, it has reduced overall government expenditures for long-term land retirement (Young and Osborn).

Soil conservation policies offer an example of how the distribution of costs and agricultural policies can affect environmental policies. However, a reasonable comparison of the differences in Australian and U.S. environmental policy requires an examination of off-site impacts in Australia.

Both the United States and Australia have difficulty in solving disputes between states and regions. However, Australia has greater difficulty in formulating national or interstate environmental policies because the responsibility for environmental matters falls on the state governments. However, on occasion, problems can grow to a point where the public supports interstate cooperation or national initiatives. In these situations, the states and Commonwealth delegate a great deal of responsibility to a national or regional commission. Two prominent examples of this approach are the Murray Darling Basin Commission and the Resource Assessment Commission.

The Resource Assessment Commission (RAC) was formed to analyze national resource issues which are politically sensitive, require the integration of physical and economic technical analyses, and have broad distributional ramifications. Currently the RAC is examining the management of Australia's southeast forests, coastal development, and gold and uranium mining in Kakadu, a national park in the Northern Territory. The RAC is directed to make recommendations to the Australian government, which tends to follow the RAC recommendations.

The Murray Darling Basin Commission (MDBC) was established to advise the state governments on the implementation of the Murray Darling Basin Natural Resources Management Strategy and to oversee programs having a basinwide impact or requiring actions by two or more states. The establishment of the MDBC and the adoption of the Murray Darling Basin Natural Resources Management Strategy is the most prominent example of interstate environmental cooperation in Australia.

In the Murray Darling Basin, the off-site impacts of irrigation and vegetative change in New South Wales and Victoria include increased salinity in the Murray River. Because the salinity lowers the usefulness of the river water for irrigation, requires cleaning for industrial use, lowers the desirability of the water for human consumption, and reduces the life span of appliances and other machinery, the agricultural practices in Victoria and New South Wales impose costs on South Australia's residents.

The elevated salinity in the Murray River has been a contentious issue since the turn of the century.

The Murray Darling Basin Natural Resources Management Strategy was adopted in 1988 to address the rising salinity levels and other environmental concerns in the basin. The strategy assigned each state a salt discharge level. These discharge levels are designed to reduce Murray River salinity below the 1988 level, while permitting states to initiate local land management programs to control waterlogging and dryland salinization. Each state was permitted to design its own strategy to meet the agreed upon discharge level, but the proposed salinity interception and mitigation projects are subject to environmental review by the MDBC prior to implementation.

Under the Murray Darling Basin Resources Management Strategy, the landholders, individual states, the Commonwealth, and local governments each contribute funds to develop and implement salt-mitigation projects. These projects can be viewed as programs to reverse the combined effects of agriculture and government-subsidized irrigation and vegetative change.

Environmental Constituencies

Environmental policies evolve not only due to environmental circumstances, but also because of the demand for environmental services. Both the United States and Australia have exhibited increasing demand for environmental services and quality. This increasing demand is reflected in the increased strength of environmental constituencies in both countries.

The environmental movement in the U.S. has preceded the green movement in Australia. Although organizations such as the Sierra Club, the Izaak Walton League, and the National Wildlife Society have existed for decades, public environmental involvement has grown rapidly over the last twenty years. During this period numerous new environmental organizations arose. These organizations started as small, grass-roots groups with simplistic proposals and small store-front facilities. However, over the years many groups have developed legal and economic staffs that support sophisticated lobbying networks. The established organizations also expanded both their lobbying capabilities and their constituencies. These organizations have repeatedly demonstrated their ability to form coalitions to advocate legislation or combat legislation proposed by other constituencies.

Another aspect of the maturation process has been the development of increased understanding

of the intricacies of environmental issues. This understanding, combined with more detailed in-house economic and physical analyses, has led many environmental organizations to change their strategies. This has led both to a more informed presentation of environmental proposals, a more careful selection of issues, and a less confrontational approach.

The United States environmental organizations have had a significant effect on agricultural and environmental legislation by providing analyses of proposals and developing alternatives. This effect is reflected in environmental provisions in the Food Security Act of 1985 and the FATCA of 1990, the Endangered Species Act, the Clean Air Acts of 1973 and 1990, and the Clean Water Acts of 1972, 1977, and 1987.

Public concern over environmental issues has been demonstrated in Australia by the effect of environmental issues on election results. The proposed damming of a pristine river has been credited with bringing down a federal and a state government. In spite of the demand exhibited, the Australian environmental organizations have not demonstrated the same sophistication as their U.S. counterparts in developing environmental policy.

Over the last five years, some environmental organizations in Australia have demonstrated greater maturity by slowly developing staffs that permit them to analyze the physical and economic merits of alternative proposals. This development is similar to the increasing political sophistication of environmental groups observed in the U.S. in the 1970s. One would expect that as some Australian environmental organizations successfully influence policy through the use of economic analyses, others will adopt similar strategies.

Using the U.S. experience, one would expect Australian green organizations to continue to mature. As these groups mature, they will become more selective in choosing issues, use more analytical support, and adopt a less confrontational approach towards environmental policy. In changing their strategy in this manner, Australian environmental groups would be expected to become more effective in influencing and developing environmental policy.

Discussion

The development of environmental policies is shaped by the resource, demographic, and political situation in which these policies evolve. The distribution of costs, the objectives and effects of other government policies, and the tools available all

affect the set of policies used to address environmental concerns.

In the U.S. a large nonfarm population results in the off-site costs of agricultural soil erosion greatly exceeding the on-site costs. Thus, environmental policies are designed to address the off-site effects of environmental degradation. The converse is true in Australia, where the soil erosion programs concentrate on preserving agricultural productivity. One would expect Australia to reorient its soil conservation as an increasing population results in greater off-site costs from agricultural soil erosion. Such a shift was observed in the U.S. as information on the off-site costs of agricultural soil erosion was obtained.

Examination of environmental policies in the United States and Australia reveals that to a significant degree these policies exist to offset the effect of past or current agricultural and rural policies. In a number of cases, the most effective environmental policy would be to terminate the agricultural or rural-development program contributing to environmental degradation. Because the programs that cause environmental degradation often have strong support from powerful constituencies, it is unlikely that such actions will be taken in the near future. It is more likely that these programs will be dismantled incrementally over time as the strength of environmental constituencies continues to grow.

The United States's agricultural commodity programs and Australia's irrigation programs are examples of popular programs that adversely affect environmental quality. Both sets of programs have recently been modified in ways that in the long run will lessen their adverse effects. The 1990 Farm Legislation uses the triple-base option to reduce the constraints on crop rotations, while recent changes in regulations covering irrigation in Australia serve to encourage more efficient irrigation practices and to restrict saline effluent. While these modifications have often been in response to other concerns, environmental considerations also played a role.

Existing government programs also affect the formulation of environmental policies by modifying the tools available to the policy makers. For instance, agricultural commodity programs in the U.S. provide authorities with both a carrot and a stick that can be used to persuade farmers to participate in environmental programs. The commodity programs offer benefits to farmers that can be denied to those who decline participation in environmental programs. Thus, environmental provisions are included in U.S. agricultural legislation. The effectiveness of these provisions will likely decline as the benefits from commodity programs

are reduced. Australia has no similar agricultural programs and therefore cannot use such environmental provisions.

Conclusions

Agricultural and environmental policies are shaped by demographic, resource, and political considerations. An examination of policies and their evolution in both the United States and Australia provides a number of enlightening contrasts.

While both countries have attempted to support the development of an efficient and competitive agricultural and rural sector, they selected different agricultural and rural-development policies to achieve this goal. These policies have had different effects on the environment and have resulted in different tools available to address the adverse affect of agriculture on the environment. In both countries the agricultural and rural-development policies and programs that adversely affect the environment are slowly being dismantled.

Two factors that have strongly affected government policies over the last twenty years have been better information on the significant off-site environmental effects of agricultural production and increased demand for environmental services. While the latter has most likely been more responsible for the introduction of environmental provisions in agricultural policy, the former has most likely had the greatest impact on the type of legislation introduced. Both of these factors gained prominence in the United States before Australia.

The larger off-site damages from agriculture in the United States have resulted in agricultural and environmental legislation that seeks to reduce these off-site damages. As information on the off-site costs of agriculture increases in Australia, similar legislation might be expected. However, because Australia has a much smaller population that is generally located away from agricultural regions, these programs are not expected to be as far-reaching as those in the United States.

The demand for environmental services is expected to continue to increase in both the U.S. and Australia. Using the U.S. experience, one would expect Australian environmental organizations to mature and play a more prominent role in the formulation of future government policies. The recent creation of the Resource Assessment Commission and the Murray Darling Basin Commission reflects both the growing influence of the environmental constituencies and the government's attempts to address their demands.

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