AGRICULTURAL NUISANCES AND RIGHT-TO-FARM LAWS: IMPLICATIONS OF CHANGING LIABILITY RULES

John C. Bergstrom and Terence J. Centner*

Introduction

In many areas of the country, conflicts between agricultural and nonagricultural land uses are increasing because of urban sprawl and the extension of residential land uses into rural areas. Most conflicts between agricultural producers and residential homeowners focus on such waste by-products of agricultural production as noise, odor, and dust that are emitted into the environment. These waste by-products may be viewed by residential homeowners as nuisances that reduce the value and enjoyment of their property.

In this paper, the implications of changing liability rules with respect to agricultural nuisances are examined. The discussion begins by examining agricultural nuisances within economic externality theory. The effects of holding producers liable for damages caused by waste by-products are then considered. Economic theory suggests that this assignment of liability will result in increased abatement of agricultural waste by-products and reduced production of agricultural commodities.

The discussion then turns to public concern over the loss of agricultural capacity due to nuisance actions authorized by legislation known as "right-to-farm" laws. Right-to-farm laws attempt to reduce the liability of agricultural producers for damages caused by waste by-products through the provision of an affirmative defense to some nuisance actions. Economic theory suggests that this change in liability should result in increased abatement of agricultural waste by-products and reduced production of agricultural commodities.

The externality relationship between producers and residents can be modeled as follows. First, consider the atmosphere as a capital good that provides a flow of services to both producers and residents. The production function of a producer is given by:

\[ Q_k = Q_k(Z_k, X_k, W_k), \]

(1)

where \( Q_k \) is the vector of agricultural commodities produced by producer \( k \); \( Z_k \) is the vector of agricultural nuisances produced by producer \( k \); \( X_k \) is the vector of variable inputs; and \( W_k \) is the vector of fixed inputs. Emission of \( Z_k \) is assumed to be positively related to production of \( Q_k \), that is, \( \frac{\partial Q_k}{\partial Z_k} > 0 \).

In equation (1), \( Q_k \) represents the agricultural output of a producer; e.g., corn, wheat, hogs, or poultry. The variable \( Z_k \) represents wastes that are produced jointly with \( Q_k \), e.g., noise, odors, and dust. The production of \( Q_k \)
where $Q_\kappa$ are the agricultural commodities consumed by household $i$, and $Y_\kappa$ are all other commodities consumed by household $i$. The utility function in equation (4) is monotonically increasing with respect to $Q_\kappa$ and $Y_\kappa$, but monotonically decreasing with respect to $Z$ (Baumol and Oates 1975). That is, $Q_\kappa$ and $Y_\kappa$ are associated with positive marginal utilities, $\partial U / \partial Q_\kappa > 0$, $\partial U / \partial Y_\kappa > 0$, and $Z$ is associated with a negative marginal utility, $\partial U / \partial Z < 0$.

These functions provide a clear framework for describing the bilateral externality relationship caused by competition for the use of the atmosphere. As an individual producer combines inputs to produce commodities, wastes such as noise, odor, and dust are emitted into the atmosphere. The total amount of wastes emitted by all producers, denoted by $Z$, enters into the utility function of a resident as a "bad". As $Z$ increases, utility or satisfaction decreases. Moreover, $Z$ enters the utility function as an unpriced, rationed commodity. Rationing occurs for $Z$ in the sense that the quantity of $Z$ which enters a utility function is exogenously determined by producers. Hence, residents may claim that they are being unjustly harmed by changes in $Z$ that are caused by the actions of producers.

On the other hand, suppose residents are successful in preventing the emission of $Z$ into the atmosphere through some legal or political means. The abatement of $Z$ would force producers to substitute man-made waste-disposal services for atmospheric disposal, to recombine variable inputs to reduce emission of $Z_\kappa$ to zero, or shut down completely. These actions become necessary because of a change in the amount of $Z_\kappa$ entering production functions that is determined exogenously by residents. Hence, producers can claim that they are being harmed unjustly by changes in $Z_\kappa$ that result from the actions of residents.

The atmosphere usually is treated as an open-access resource. An open-access resource is an unowned resource (res nullius) as defined by Ciriacy-Wantrap and Bishop 1975. Without property rights to regulate their use, there is a tendency for competing parties to overuse open-access resources. For example, producers will use the atmosphere for an excessive amount of waste disposal and residents will use it for excessive aesthetic enjoyment (Hardin 1968; Runge 1981; Sutinen and Anderson 1985). Competition for the use of open-access resources creates pressures for the development of property rights to the resources (Cheung 1970; Diamond 1965). The structure of property rights established will determine final uses of open-access resources and allocation of the resources to alternative economic activities (Calabresi 1968; Furubotn and Pejovich 1972; Randall 1972, 1974). Two property rights structures are particularly relevant to the externality relationship associated with agricultural waste by-prod-
Agricultural Nuisances and Right-To-Farm Laws: Implications of Changing Liability Rules

The Full Liability Rule

Residents, as competitors for the use of the atmosphere, have turned to the courts for resolution of conflicts over such agricultural waste by-products as noise, odors and dust. The most common legal challenge has been based upon a claim in nuisance. A claim in nuisance attempts to establish that agricultural waste by-products result in an unreasonable reduction in the ability of residents to use and enjoy their property, and that producers are liable for damages. Hence, legal action establishing that agricultural waste by-products are nuisances implies a full liability rule.

The expected effect of a full liability rule on resource allocation is demonstrated by specifying the supply function of a producer for agricultural commodities as:

$$Q_k = c_k(Z_k, P_1, R, W_k),$$  \hspace{1cm} (5)

where $P_1$ is a vector of output prices and $R$ is a vector of variable input prices. The aggregate supply of agricultural commodities is determined by the supply function:

$$Q = \sum_{k=1}^{K} [c_k(Z_k, P_1, R, W_k)],$$  \hspace{1cm} (6)

where $Q$ is the aggregate supply of agricultural commodities.

Next, the household supply function of a resident for aesthetic enjoyment is given by:

$$A_i = g_i(Z, T_i, N_i, H_i),$$  \hspace{1cm} (7)

where $N_i$ represents the total variable costs to a household of "producing" aesthetic enjoyment (Bockstael and McConnell, 1981). The aggregate household output of aesthetic enjoyment is denoted by:

$$A_s = \sum_{i=1}^{I} [g_i(Z, T_i, N_i, H_i)],$$  \hspace{1cm} (8)

where $A_s$ equals the aggregate household supply and $I$ is the total number of residents.

The demand function of a resident for aesthetic enjoyment is given by:

$$A_i = h_i(P_1, P_2, N_i, M_i, T_i, H_i),$$  \hspace{1cm} (9)

where $P_2$ is a vector of prices of all other goods, and $M_i$ is income. Aggregate demand for aesthetic enjoyment is given by:

$$A_d = \sum_{i=1}^{I} [h_i(P_1, P_2, N_i, M_i, T_i, H_i)],$$  \hspace{1cm} (10)

where $A_d$ is the total amount of aesthetic enjoyment demanded.

The full liability rule affects allocation of resources to agricultural commodity production and to production and consumption of aesthetic enjoyment through equations (6), (8), and (10). The full liability rule may result in restrictions on the amount of $Z_k$ a producer can emit into the atmosphere. Consequently, costs of producing agricultural commodities may rise. In addition, the rule may result in court action that forces a producer to shut down. Let the number of producers under full liability be denoted by $K'$. Given the cost of production and the number of producers, the aggregate supply function is given by:

$$Q = \sum_{k=1}^{K'} [c_k(Z_k, P_1, R, W_k)],$$  \hspace{1cm} (11)

where $Z_k'$ is the quantity of waste by-products emitted by each producer under the full liability rule. This aggregate supply function is illustrated by the curve labeled $s'$ in panel (A) of Figure 1.

In equation (8), as agricultural waste by-products denoted by $Z$ decrease, more aesthetic enjoyment can be produced by individual residents. Under the full liability rule, the amount of $Z$ may be relatively small. Each resident thus is able to produce more aesthetic enjoyment (e.g., enjoyable backyard barbecue). In addition, because relatively little $Z$ is emitted, more residents may be encouraged to move near producers. Let the number of residents under the full liability rule be denoted by $I'$. Given the costs of producing aesthetic enjoyment and the number of residents under the full liability rule, the aggregate supply curve for aesthetic enjoyment is given by:

$$A_s' = \sum_{i=1}^{I'} [g_i(Z_i', T_i, N_i, H_i)],$$  \hspace{1cm} (12)

where $Z_i'$ is the total amount of agricultural nuisance under the full liability rule. This supply curve is illustrated by the curve labeled $s'$ in panel (B) of Figure 1.

Under the full liability rule, residents may be compensated by the courts for nuisance damages caused by agricultural waste by-products. In addition, specifying full legal liability may reduce the transactions costs incurred in reducing agricultural waste by-products through nuisance litigation. As a result of reduced transactions costs and increased compensation, the income and thus the demand...
Figure 1. Economic Effects of Liability Rules for Damages Caused by Agricultural Waste By-Products
for aesthetic enjoyment by each resident may increase (Calabresi 1968; Randall 1972). Also, because of the potential for compensation and/or enjoinment of waste by-products emission under nuisance litigation, more residents may be encouraged to "come to the nuisance". The aggregate demand curve for aesthetic enjoyment under the full liability rule thus would be given by:

$$A^f_d = \sum_{i=1}^{n} \left[ h_i \left( P_1, P_2, N_i, M^f_i, H_i \right) \right],$$

where $M^f_i$ is the amount of income under the full liability rule. This aggregate demand curve is illustrated by the curve labeled $d^f$ in panel (B) of Figure 1.

The curves labeled $S^f$, $s^f$, and $d^f$ in Figure 1 indicate agricultural commodity production and aesthetic enjoyment consumption under the full liability rule. In panel (A) of Figure 1, assume that demand for regionally produced agricultural commodities is perfectly elastic and equal to a national (or world) market-determined price $P^*$. Given $P^*$ and $S^f$ in panel (A), $Q^f$ quantity of agricultural commodities will be produced in the region under the full liability rule. Given $s^f$ and $d^f$ in panel (B) of Figure 1, quantity $A^f$ of aesthetic enjoyment will be consumed under the full liability rule (Calabresi 1968; McKean 1970; Randall 1972).

The Zero Liability Rule

Public concern over the loss of agricultural land and facilities because of nuisance action has resulted in the enactment of right-to-farm laws in 48 states (Centner 1986; Thompson 1982). The relevant statutory codes are summarized in Appendix I. Right to farm laws modify common law nuisance by codifying the "coming to the nuisance doctrine" (Grossman and Fischer 1983; Hand 1984; Hanna 1982). Persons who move close to an established agricultural facility are limited in their ability to use nuisance law to obtain relief from objectionable agricultural practices. Property uses in existence prior to the adoption of the right-to-farm law, or prior to the establishment of a new agricultural operation, are not affected, and the property owners may use nuisance law to shut down an objectionable agricultural facility. Right to farm laws attempt to establish zero liability for damages caused by waste by-products currently being emitted by producers. These laws are targeted toward problems arising from urban sprawl and the location of residential housing near existing agricultural operations.

The expected economic effects of the zero liability rule established by right-to-farm laws can be examined by using equations (6), (8), and (10). Under the zero liability rule, producers are able to emit increased amounts of $Z_i$ into the atmosphere at a zero price. Hence, each producer will be able to increase production of $Q_k$, since in Equation 1, $\delta Q_k / \delta Z_i > 0$. In addition, since producers are protected from court ordered shutdowns, the number of producers will be greater with right-to-farm laws than without. Let the number of producers under right-to-farm laws be denoted by $K^*$. The aggregate supply curve for agricultural commodities under right-to-farm laws then is given by:

$$Q^z = \sum_{i=1}^{K^*} \left[ c_k \left( Z^z_k, P_1, R, W_k \right) \right],$$

where $Z^z_k$ is the quantity of waste by-products emitted by each producer under the zero liability rule. This aggregate supply function is shown by curve $S^z$ in panel (A) of Figure 1.

Because producers are free to emit waste by-products into the atmosphere under the zero liability rule, increased $Z$ will enter the supply function for aesthetic enjoyment of each resident. Hence, production of $A^z$, by each resident will decrease since $\delta A^z / \delta Z < 0$ in Equation 3. Intuitively, the implication is that as more agricultural waste by-products are emitted into the atmosphere, the ability of nearby residents to use and enjoy their property will decrease. For example, increased odor and flies from a hog raising operation would decrease the recreational use of residents' backyards. In addition to decreasing production of $A^z$ from each resident, the zero liability rule will discourage additional residents from locating near producers. Thus the aggregate supply curve for aesthetic enjoyment under the zero liability rule is given by:

$$A^x_z = \sum_{i=1}^{1^*} \left[ g_i \left( Z^z_i, T_i, N_i, H_i \right) \right],$$

where $1^*$ is the number of residents, and $Z^z_i$ is the total amount of agricultural waste by-products under the zero liability rule. This aggregate supply curve is denoted by curve $s^z$ in panel (B) of Figure 1.

Under the zero liability rule, residents cannot receive compensation for damages caused by agricultural waste by-products. Transactions costs incurred in an attempt to obtain relief from agricultural waste by-products also are likely to be high. For example, residents may have to accept additional annual taxes to develop, implement, and enforce local land use planning ordinances. Hence, the income of residents will be lower under the zero liability rule than the full liability rule (Calabresi 1968; Randall 1972). As a result, demand for aesthetic enjoyment from each resident will decrease. The aggregate...
demand curve for aesthetic enjoyment under the zero liability rule is given by:

\[ A_{a}^{z} = \sum_{i=1}^{n} \left[ h_{i}(P_{1}, P_{2}, N_{p}, M_{i}^{z}, T_{p}, H_{j}) \right]. \]  

(16)

where \( M_{i}^{z} \) is the amount of income under the zero liability rule. This aggregate demand curve is illustrated by curve \( d^{a} \) in panel (B) of Figure 1.

The curves labeled \( S^{a} \), \( s^{a} \), and \( d^{a} \) indicate agricultural commodity production and consumption of aesthetic enjoyment under the zero liability rule. In panel (A), the quantity of agricultural production under the zero liability rule is given by \( Q^{a} \), assuming a perfectly elastic demand and price \( P^{a} \) for agricultural commodities. The implementation of the zero liability rule through right-to-farm laws therefore would be expected to increase agricultural commodity production from \( Q^{a} \) to \( Q^{e} \) (Calabresi 1968; Randall 1972; McKean 1970). The net gains to producers are expressed in increased producers' surplus by the area of \( OCE \).

Consumption of aesthetic enjoyment under the zero liability rule is given by \( A^{a} \) in panel (B) of Figure 1. The implementation of a right-to-farm law would be expected to decrease the consumption of aesthetic enjoyment by residents from \( A^{a} \) to \( A^{e} \) (Calabresi 1968; Randall 1972; McKean 1970). The net loss to residents is measured in reduced consumers' surplus by the area \( ABEC \). The net loss to residents in reduced producers' surplus is given by area \( OCE \).

**Right to Farm Laws and the Courts**

The conceptual economic analysis summarized in Figure 1 indicates that right-to-farm laws are expected to increase agricultural commodity production and decrease aesthetic enjoyment. These effects are caused by changing agricultural waste by-product liability from the full liability rule to zero liability. The effectiveness of right-to-farm laws has been tested in several court cases involving conflicts between agricultural producers and rural or suburban residents.

In *Herrin v. Opatut*, residents around an egg farm in Georgia filed suit to eliminate the "flies and offensive odors" generated by the farm. The residents asked the court to declare the farm a nuisance and shut down its operation. The defendants attempted to establish zero liability under the Georgia Right-to-Farm Law. The court found that the right-to-farm law did not apply because the egg farm was constructed after the residents had already moved in. The Georgia right-to-farm law thus did not provide the egg farm zero liability. Rather, under nuisance law, the court enjoined the egg farm from further business activity.

The ruling in this case meant that the egg farm was fully liable for damages caused by its agricultural waste by-products. Pursuant to the economic model summarized in Figure 1, production of eggs was decreased at the expense of the welfare of producers. Because of the subsequent decreases in flies and offensive odors, consumption of aesthetic enjoyment increased, leading to an increase in the welfare of residents.

In *Cline v. Franklin Pork, Inc.*, residents brought suit to enjoin operation of a hog facility in Nebraska as a nuisance. The suit was initiated by a family suffering damages from waste by-products generated by a hog facility constructed on a neighboring farm. The plaintiffs argued that flies and offensive odors made it impossible to enjoy outdoor activities and entertain friends and relatives at their home. That is, the agricultural waste by-products severely limited their ability to produce and consume aesthetic enjoyment.

The defendants in this case attempted to establish zero liability under the Nebraska right-to-farm law. However, because the hog facility was constructed after the residents were established in their location, the court found that: "As to odor and flies, the operations of defendant's hog-raising facility . . . constituted a private nuisance interfering with the plaintiffs' use and enjoyment of their property" (p. 569)." This judgment established the full liability rule with the predicted result of decreased agricultural commodity production and increased consumption of aesthetic enjoyment. These two impacts were observed as the court ordered the hog facility to cease operation and move off the premises within 60 days.

In another Nebraska case, *Flannsbrugh v. Coffey*, residents asked the court to shut down a hog-raising facility on a neighboring farm. Reduction in aesthetic enjoyment was explicitly recognized in the argument that because of flies and offensive odors from the hog facility, residents "... can no longer have backyard cookouts, and their grandchildren cannot play outside (p. 130)." The defendants in this case also claimed protection from nuisance action under the Nebraska right-to-farm law. However, because the residents were established in their location before the hog facility was built, the court ruled in favor of the residents stating that "... the right to have the air flowing over one's premises free from noxious and unnatural impurities is a right as absolute as the right to the soil itself (p. 131)." This implicit assignment of property rights to the atmosphere implies that producers are fully liable for degradations of the clean air of residents.

The court permanently enjoined the hog facility from further operation. It awarded the residents $2,000 in
compensation for damages. Thus the full liability rule resulted in the decreased agricultural commodity production and increased aesthetic enjoyment consumption, as expected.

These court cases provide corroborating evidence of the ineffectiveness of right-to-farm laws. The cases indicate that if residents are enjoying air free of agricultural waste by-products, United States property law tends to assign them initial rights to the atmosphere for aesthetic enjoyment. Producers establishing new farms or new activities on existing farms therefore may be held fully liable for reductions in aesthetic enjoyment caused by degradation of the clean air of residents.

Thus, right-to-farm laws apply only when residents move into the proximity of an established agricultural operation. The intent of right-to-farm laws in such instances is to provide producers initial rights to the atmosphere for waste-disposal. This assignment of property rights provides producers zero liability for reductions in aesthetic enjoyment caused by agricultural waste by-products.

Conclusions

Right to farm laws are a result of public concern over losses of agricultural land and facilities from legal nuisance action. Nuisance law attempts to establish the full liability rule with respect to damages caused by agricultural waste by-products. The expected economic effects of the full liability rule are reduced agricultural commodity production and increased consumption of aesthetic enjoyment. Right-to-farm laws attempt to establish the zero liability rule in qualifying situations for reductions in aesthetic enjoyment caused by agricultural waste by-products. The expected economic effects of the zero liability rule are increased agricultural commodity production and decreased consumption of aesthetic enjoyment.

The economic effects of right-to-farm laws are dependent on the implicit assignment of initial property rights to the atmosphere. Assignment of these rights under current United States property law appears to follow a doctrine similar to the prior appropriation doctrine for water rights commonly used in the western states. That is, rights to the atmosphere tend to be assigned to the party with the first claim on the air for a particular use (e.g., waste-disposal or aesthetic enjoyment). Right-to-farm laws therefore generally offer protection only to agricultural producers whose use of the atmosphere for waste-disposal pre-dates the use of the atmosphere by residents for aesthetic enjoyment.

Conflicts between producers and residents over the use of the atmosphere cannot be resolved completely by current right-to-farm laws. Laws that explicitly assign prior property rights to the atmosphere potentially could be alternatives or supplements to current right-to-farm laws. Such laws would reduce the open-access nature of the atmosphere and the conflicts arising from its overuse for one purpose or another. More research is needed on the effectiveness of right-to-farm laws, the economic benefits and costs of these laws, and on potential alternatives, improvements, or supplements to these laws.

Notes


References


Appendix 1

State Right-to-Farm Legislation