Generic Environmental Impact Statement on Animal Agriculture:

A Summary of the Literature Related to Land Use (B)

Prepared for the Minnesota Environmental Quality Board

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ENVIRONMENTAL QUALITY BOARD

September, 1999

To Interested Minnesotans:

The GEIS on Animal Agriculture is a statewide study authorized and funded by the 1998 Minnesota Legislature and ordered by the EQB. The Legislature directs the EQB to "...examine the long-term effects of the livestock industry as it exists and as it is changing on the economy, environment and way of life of Minnesota and its citizens."

The intent of the GEIS is twofold: 1) to provide balanced, objective information on the effects of animal agriculture to future policymakers; and 2) to provide recommendations on future options for animal agriculture in the state. The success of the GEIS on Animal Agriculture will be measured by how well it educates and informs government officials, project proposers, and the public on animal agriculture, and the extent to which the information is reflected in future decisions and policy initiatives, made or enacted by Minnesota state and local governments.

The GEIS consists of three phases during the period summer 1998 through summer 2001: scoping the study; studying and analyzing the 12 scoped topics; and drafting and finalizing the GEIS. The EQB has established a 24-member Advisory Committee to provide advise to EQB during all phases of the GEIS. The scoping phase of the GEIS was completed in December of 1998.

This literature summary is the first step in the second phase aimed at study and analysis of the 12 key topics. This summary is intended to inform the Environmental Quality Board (EQB) members, EQB staff, and the Advisory Committee on the "Feedlot GEIS" scoping questions and research needed for adequate completion of the GEIS. The EQB would like to acknowledge the time and effort of the Advisory Committee members who provided invaluable input in the development of this "tool" for use throughout the GEIS process.

The literature summary is formatted to address the 12 topics of concern and 56 study questions outlined in the Feedlot GEIS Scoping Document (www.mnplan.state.mn.us). Any conclusions or inferences contained in this report are those of the authors and do not necessarily reflect the positions of the EQB or the Feedlot GEIS Advisory Committee.

The EQB would like to make this literature summary available to others interested in the effects of animal agriculture. Copies of this literature summary will be available for use in the Minnesota Planning/EQB Library: 300 Centennial Building, 658 Cedar Street, St. Paul. The Library will also house copies of the key literature review articles and the searchable database compiled as part of this literature review. A limited number of copies of this literature summary will be printed for distribution at cost.

For further information on the GEIS or this literature summary please contact the EQB at 651-296-9535.

Sincerely,

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EXECUTIVE SUMMARY

GENERAL COMMENTS ON RESULTS

The Literature Review for the GEIS on Animal Agriculture reviewed literature addressing:

- the sources of land use conflicts around animal agriculture,
- the land use strategies in use to address the conflicts, and
- the effectiveness of the land use strategies.

Because of the social science nature of the topic, literature reviewed included scholarly and professional journals, but also included industry and trade journals, and law review articles. The literature review report is written to describe the debate around land use issues and report on the differing views within the debate that are found in the literature.

The scholarly and professional literature identifying the sources of conflict and the strategies addressing the conflicts was adequate. Animal agriculture and land use is a very timely issue. Most of the important pieces of literature were published within the past five years, and several sources were published during the research period for the report.

Relatively few articles were found that consider the questions of how effective the various land use strategies are in addressing the conflicts around animal agriculture, or the costs and benefits of land use strategies. The report recommends future research focus on assessing the effectiveness of land use strategies on reducing identified conflicts. For example, a study of the impact of local zoning regulations on the locational decisions of feedlot owners/operators would help in assessing the effectiveness of local regulations.

Sources of Land Use Conflict

Land use conflicts surrounding animal agriculture are framed in terms of the differing value systems of people. People value land as a commodity, a natural resource, habitat, a cultural setting, and an aesthetic amenity.

Local land use decision-making is the forum used by the community to resolve conflicts such as those surrounding animal agriculture. A typical land use decision-making process includes the following steps: the issue/conflict is perceived; the issue/conflict is defined; factual/scientific information is obtained and reviewed; stakeholders provide anecdotal and perceptual data to elected officials and staff; a solution is crafted and reviewed by stakeholders; and a solution is adopted.

This report addresses how the conflict is perceived and defined, and the solutions that are crafted and adopted. Other literature reviews presented some of the factual/scientific data that is used in the process.

The sources of land use conflict identified in the literature include:

- environmental concerns (odor, air pollution, water contamination, manure handling and storage),
- human health concerns,
- nuisances (both agricultural use vs. non-farm rural uses, and small vs. large agricultural uses),
- differing rural aesthetics,
- threat to traditional rural culture,
- the use of land for agriculture vs. the use for tourism/recreation,
- fear of property value reduction, and
- fear of rural "brownfields" (contaminated sites that can not be reused for other uses without significant clean-up).

Land Use Strategies

The literature review identified four broad categories of land use strategies used to address conflicts over animal agriculture: comprehensive planning; zoning; ordinances/strategies with environmental requirements; and other ordinances/strategies.

Comprehensive planning generally defines where different land uses should be located within a community. The comprehensive plan expresses locally desired solutions for land use conflicts and sets a strong legal base for ordinance-based strategies. Townships and counties in Minnesota can use the comprehensive planning process to express how they want to address animal agriculture.

The literature reviewed paid particular attention to zoning strategies that could be used by townships and counties to address feedlots. The strategies discussed include:

- Multi-tier agricultural districts
- Separation standards
- Setbacks from roads
- Minimum site area requirements
- Limiting number of animals by area
- Definitions for non-conforming or non-complying structures that brings pre-existing operations under current land use regulations
- Requiring a Conditional Use Permit
- Special Exception review
- Performance standards or BMP's
- Clear definitions of what is regulated
- Site suitability standards/ performance standards
- Exclusive agricultural zones
- Large minimum lot sizes w/small building lot sizes
- Urban expansion zones/ urban growth boundaries
- Establishing an Ag Preserves area under the MN Ag. Land Preservation Act
- Purchase of Development Rights
- Transfer of Development Rights

Ordinances or strategies that address environmental requirements may be adopted by local governments. The literature suggests that local governments may adopt the following ordinances to address animal agriculture:

- Counties may adopt feedlot permitting standards that are more stringent than the standards required by the Minnesota Pollution Control Agency.
- Townships and counties can require that manure management plans be filed with the local government and be made available to the public.
- Manure application restrictions, including setbacks from waterways and wells can be adopted.
- Requirements for the closure of manure storage lagoons may be adopted.

Finally, the literature mentions several other types of ordinances or strategies that are used to address conflicts over feedlots. These include:

- Locally adopted right-to-farm ordinances that restate or make stronger the state statute.
- Requiring financial assurances for clean-up of manure spills.
- Equitably and consistently enforcing regulations that do exist.
- Putting moratoriums in place in order to have time to fully address conflicts.
- Landscape strategies including trees as buffers and odor filters, and creating treatment wetlands.
- Addressing general non-farm, rural development pressures to reduce conflicts.

The Effectiveness of Various Land Use Strategies

There is virtually no literature assessing the effectiveness, or cost and benefits, of various land use strategies that are used to address conflicts over animal agriculture. The few studies of the effect on property values of nearby feedlots show conflicting results. The general field of fiscal impact studies (not specific to feedlots) consistently show that new residential development is more fiscally advantageous if it is located in or adjacent to existing urban areas. The proximity of non-farm, rural residential development to feedlots gives rise to many of the conflicts described in the literature. Combining these two factors may argue for, in general, locating new residential development away from rural areas where feedlots are allowed. The question of effectiveness, however, is the most ripe for future research in the land use topic area.

CRITIQUE OF THE SCOPING DOCUMENT STUDY QUESTIONS

The three questions presented in the Scoping Document on the Generic Environmental Impact Statement on Animal Agriculture in Minnesota under the Land Use topic are clearly stated and logically build upon each other. The questions ask us to first identify the land use conflicts associated with animal agriculture, then to identify what land use strategies are used to address the conflicts, and finally to examine the effectiveness and costs and benefits of the strategies.

After examining the literature pertaining to land use and animal agriculture, the land use team offers the following three general comments about the nature of the questions posed in the Scoping Document.

1. ***Type of literature reviewed.*** The literature on land use is complex. This complexity arises in part from the varying definitions of externalities associated with animal agriculture. There is a body of technical and scientific literature concerned with technological definitions of externalities. Economic literature focuses on the pecuniary definition of externalities. Legal literature and the environmental perception literature deal with the perceptual dimensions of externalities. In addition to technical and scientific literature, there is "gray" literature that communicates findings and information in the technical and scientific literature to a variety of clientele. In the land use arena, this literature is often as important as the technical and scientific literature, as it conveys the perceptions and values of particular interest groups related to animal agriculture issues.

The largest category of work reviewed for this project was scholarly and professional journals in the fields of planning, agricultural economics, soil and water conservation, landscape ecology and perception, and conservation biology. Scientific journals were generally peer-reviewed (e.g. *Conservation Biology*). Planning journals, especially those published by the American Planning Association (e.g. *Journal of the American Planning Association* and *Planning*), tended to combine aspects of either peer- or editorial board review of empirical research with theoretical discussion, commentary and practical advice from professional planners and academics. APA's *PAS Reports*, including Jim Schwab's *Planning and Zoning for Concentrated Animal Feeding Operations*, are intended to provide planners and communities with case studies, analysis of current practice, and offer advice, ordinance language or other practical tools for dealing with common planning issues.

A handful of industry journals and trade publications (e.g. *Farm Journal, Urban Land, Feedstuffs*, etc.) were included, primarily to help frame the debate for the reader. This was also the purpose for including more clearly partisan and polemical publications. A small number of law review articles and topical case law newsletters were included (e.g. *Land Use Law and Zoning Digest, New York University Law Review*). These are standard sources used by the scholarly and legal practitioner communities.

2. ***Externalities.*** Land use regulation has historically concerned itself with issues associated with the externalities of land use. Externalities refer to the effects of land use decisions made by one landowner on the ability of abutting or approximate landowners to fully exercise their property rights. Externalities can be either positive (as when a golf course opens on property across the street from an owner thereby affording scenic views and perhaps increased property values) or they can be negative (as when an adjacent parcel becomes developed as an oil refinery). Parties to an externality can be private landowners, public landowners, as well as quasi-public institutions. The nature of the impact generated may involve land subsidence (as when an adjacent owner extracts minerals beneath the surface of an adjacent parcel causing land subsidence), degraded water quality or air quality, increased vehicular traffic and a concomitant decrease in safety, or degradation of neighborhood appearance that results in property value depreciation. The point of an externality is that one land owner knowingly or otherwise generates either a cost or a benefit that accrues and must be assumed by another land owner. In other words, the recipient's decision-making process with respect to the normal exercise of property rights is affected by the cost or benefit that is generated externally to his/her decisions.

Externalities can be defined in terms of their technological, pecuniary and perceived value. These distinctions between the various definitions of an externality are important in terms of how the land use team defined its task. Other members of the GEIS team possessing far better training and knowledge have already considered the technological definitions of externalities associated with such matters as air and water quality as they relate to animal agriculture. Similarly, economists have examined the pecuniary values of these externalities. Thus, in assessing the current conflicts of animal agriculture with other rural land owners, the land use team focused of an assessment of the perceived values of the externalities associated with animal agriculture.

3. ***Barriers to implementation.*** The idea of barriers to implementation of current and potential strategies is perhaps more germane to the issue of land use than it is to other issues. Some of these barriers are defined by institutional phenomena while others are based on cultural values.

Institutional barriers to implementation of land use strategies emerge from several dimensions of the United States Constitution: the Separation of Powers Doctrine of the Tenth Amendment, and the Takings Clause of the Fifth Amendment. In addition, constitutions of the various states enable them to create and empower entities as deemed appropriate. In Minnesota, this has resulted in creation of counties and various orders of municipalities as well as special purpose districts such as soil and water conservation districts and watershed districts. Within this institutional framework, there is potential for conflict between those powers reserved for exercise at a higher level of government (e.g. water resource appropriation and air and water effluent discharge regulation) and those passed to lower levels of government. In the instance of land use, this potential is acute because land use regulation has traditionally been reserved for exercise by the lowest possible unit of government. On the one hand, a state agency establishes performance standards for on-site operation of a particular land use which may be at odds with the wishes of the local unit of government. In addition, there is potential for

variability in implementation to exist across township, municipal or county boundaries. This has potential for creating entirely different policy strategies for dealing with exactly the same problem in identical physical settings that have varying political definitions.

Cultural traditions may also pose barriers to the ability to implement land use policies. First, the United States was founded partly on the basis of rejecting monarchical control of the landscape and preserving the free exercise of property rights by those owning such rights. England and other northern European countries have had long traditions of the sovereignty owning the entirety of a country and granting rights of property use to specific individuals. Immigrants to this nation, on the other hand, recognized early the necessity of individual property ownership to developing the country's vast resource base. Whereas a new technology might be introduced to European farmers and its adoption expected within a reasonable timeframe, such action in the United States would be antithetical to the conscientiousness of American society which is designed to protect the rights of individual property owners from the tyranny of the majority.

The United States and almost all of the states have historically delegated exercise of land use regulations to the most local unit of government. This reflects the Jeffersonian ideal that those closest to the land and its operators are most knowledgeable about local conditions and needs. But it also poses a barrier to systematic implementation of policies on a regional or state-wide basis.

REVIEW OF LITERATURE

QUESTION 1: WHAT ARE THE CURRENT LAND USE CONFLICTS ASSOCIATED WITH ANIMAL AGRICULTURE IN MINNESOTA INCLUDING CONFLICTS WITH THE USE OF RESOURCES FOR RECREATION AND TOURISM AND LAND FOR HOUSING AND URBAN DEVELOPMENT?

LAND USE CONFLICTS AND ANIMAL AGRICULTURE

Land use conflicts related to animal agriculture are a microcosm of the broader social, economic, environmental and legal values influencing all decisions about the use of land. Virtually every land use conflict can be framed in terms of differing value systems, and/or the weight given to a particular value. The fact that land can be simultaneously valued as a commodity, natural resource, habitat, cultural setting and aesthetic amenity complicates the land use decision-making picture. Any land use change can affect any one of these values and result in community conflict over that use.

The real, potential and perceived "detrimental offsite impacts" of a particular land use form the basis of most conflicts related to concentrated animal feeding operations, commonly referred to as CAFOs in land use literature (Schwab 1998). Throughout this report CAFO will be used in reference to animal feedlots. CAFO was originally, and still is, used by the Environmental Protection Agency Land to refer to feedlots that fell under EPA regulation. The term is coming into use in the land use literature to refer more generally to all animal feedlots. In this report, CAFO will be used interchangeably with animal feedlot, particularly in discussing literature in which the term CAFO was used.

The land use conflicts related to detrimental offsite impacts are addressed in the planning, environmental, social science and agriculture journals, as well as in the agricultural trade journals and popular press. The land use literature on these impacts tends to fall into one or more of the categories outlined in the EQB scoping document (e.g., economic, social/cultural, environmental) and many of these issues are addressed more comprehensively in other literature review reports. While it can be argued that virtually every economic development decision or environmental quality issue has a land use connection, the literature reviewed for this section had a more narrowly focused land use/planning perspective.

LAND USE CONFLICTS - GENERAL

Conflicts over land use are colored by competing visions of economic futures, fear of perceived loss or harm (e.g., economic, environmental, health or safety), concerns about outside interference in local and/or private decisions over the use of land, and even the personal squabbles, jealousies and political rivalries of the constituent stakeholders. Teasing out the "real" conflicts from these embedded layers of values, priorities and perceptions is probably impossible. Yet planning for the best use of a particular piece of the earth's surface requires some attempt to understand the conflict origins. Without this understanding even the most objectively developed and applied land use controls will

fail. Because it is human nature to "fight with the sharpest sword", land use controls can become the weapon of choice in community conflicts only marginally related to land use.

The tools of land use planning can be crafted to effectively mitigate many of the direct impacts of feedlots on the land and on the residents of surrounding communities. Land use planning can enable a community to move toward desired economic development goals while guiding that development toward the most environmentally appropriate locations. It cannot address ethical issues related to animal rights or the economic dislocations resulting from restructuring of the livestock industry.

John Ikerd's highly polemical, *Top Ten Reasons for Rural Communities to be Concerned About Large-Scale, Corporate Hog Operations* (Ikerd 1999), underscores the dilemma. Ikerd has long observed and participated in the debate over large-scale animal agriculture. His comments reflect one point on the spectrum of opinions about animal agriculture. Only two of the reasons on his list are really amenable to land use/planning solutions - odor and manure problems - and both are subject to environmental regulation when they affect air and water quality. Ikerd acknowledges that these problems can be ameliorated by the use of mitigation technologies and appropriate siting criteria. His remaining reasons - the work is not good for people, consumers will not benefit, the future of the community will be turned over to outside interests, the conflicts generated by such facilities polarize rural communities - require policy decisions that address business organization and competitiveness, quality of work life, occupational safety and health, and the economic future of rural communities. Abdalla and Kelsey have described a process for untangling these imbedded issues using a "collaborative conflict resolution" technique. (Abdalla and Kelsey 1996) Spain has discussed the importance of recognizing divergent visions of community identity in negotiating conflicts over land use. (Spain 1993)

RURAL LAND USE CONFLICTS

Rural land use conflicts existed long before the introduction of modern animal feeding operations. Land use conflicts in rural areas have often occurred between agriculture and competing economic uses of the land. Traditional, rural natural resource-based land uses - e.g., farming, ranching, forestry, mining, fisheries - now compete with other economic activities, especially those devoted to tourism and outdoor recreational land uses. (Marcouiller 1997) Heightened concern over environmental quality issues has engendered conflicts related to agricultural impacts on surface and groundwater resources and wildlife habitat. The human health effects of many agricultural practices/land uses have also become a growing concern for many farm and non-farm rural residents. The effects of various land use changes on groundwater quality - especially in rural and agricultural areas - were reported in the MPCA's recent *Nitrate in Minnesota Ground Water* report. (Minnesota Pollution Control Agency and Ground Water Monitoring and Assessment Program 1998)

The NIMBY/LULU conflicts (not-in-my-backyard or locally unwanted land uses) of urban America also have their rural counterparts. Proposals to locate highways, hazardous waste sites, landfills, power lines, big-box retail outlets, prisons and various

types of industrial enterprises have encountered local opposition even in the most economically depressed rural areas. (Horah 1993) Conflicts over feedlots have resulted in manuals that guide communities on how to avoid the unwanted effects of feedlots. The Land Stewardship Project's *When a Factory Farm Comes to Town: Protecting Your Township From Unwanted Development* is one of many such guides. (Land Stewardship Project 1997)

Some of the planning and zoning literature takes a polemical approach to the issue. Michael Barrette's *Hog-Tied by Feedlots* casts rural citizens as powerless players in the war against corporate CAFOs. Barrette quotes Kendall Thu, "One of the beneficial things that happens when people fight this is that they discover that it is not about odor, it's not about pigs, or even about farming. It is about a whole constellation of issues that determine how we live our lives." (Barrette 1996)

Other researchers have taken a highly theoretical approach to analyzing land use conflicts. Thurow and Thompson used a game theory model to explain obstacles to negotiating community conflicts related to siting livestock facilities. The lack of common ethical norms amongst the various stakeholders removes the basis of communication and undermines the cooperative behavior necessary to reach compromises over siting. (Thurow and Thompson 1998)

Martin and Zering describe how the industrial concentration of livestock production has altered the public's perception of environmental risk. The larger scale of production heightens the potential for greater environmental damage, while smaller-scale operations posing smaller risks over a wider area are often not perceived to be as detrimental. The fact that large facilities are simply more visible to the public and to regulators may actually reduce environmental risks. Larger operations may be more motivated to reduce their own liability risks, and may be better able to make the capital investments in mitigation technologies. (Martin and Zering 1997)

Abdalla and Shaffer use interest group theory to argue that the battles over animal agriculture can best be understood in terms of political interest groups allying themselves with the agency or level of government most likely to pursue their agendas. Unorganized interest groups - primarily nearby residents - tend to prefer local regulatory authority because it is perceived to be more knowledgeable about local situations and more sympathetic to their interests. Organized interest groups - including producers, other agricultural and agribusiness groups, and statewide environmental organizations - tend to prefer state-level regulatory authority. Producers may feel they have greater influence over state legislators than local planners. Agribusiness groups may desire the uniformity and predictability of regulatory impacts/costs afforded by statewide approaches. Environmental groups may have less faith in the technical and political capacity of local officials to implement their goals. (Abdalla and Shaffer 1997)

A more pragmatic approach to analyzing and resolving land use conflicts associated with animal agriculture has been adopted by other writers. Neil Hamilton, Professor of Law and Director of Drake University's Agricultural Law Center, has produced a series of articles, handbooks and white papers designed to aid livestock and other agricultural

producers in navigating the sea of land use and environmental regulations and in minimizing land use conflicts. In his 1992 *Livestock Producer's Guide to: Nuisance, Land Use Control, and Environmental Law* he advises producers to make conscientious efforts to work with neighbors (including educating them about the livestock production business), to employ the latest mitigation technologies and design strategies to minimize odors and potential water quality problems, and to implement the full range of "sound agricultural practices" to avoid future problems. He also presents a thoroughgoing analysis, with representative cases, of the application of nuisance, right-to-farm, zoning and environmental protection law to agricultural land use conflicts. (Hamilton 1992) (Hamilton 1993)

Two newer sources designed for practical implementation by local governments and citizen/planners comprehensively address the range of issues and conflicts surrounding land use and feedlot siting - Duncan and Associates' *Planning and Zoning for Animal Agriculture in Minnesota* and James Schwab's *Planing and Zoning for Concentrated Animal Feeding Operations.* (Duncan 1996) (Schwab 1998)

Schwab discusses land use conflicts arising from improper manure handling, surface and groundwater contamination, odors and air quality. He addresses the potential impact of environmental degradation on recreational land uses and tourism; the economic burden on county and/or township residents of cleaning up rural brownfields resulting from improperly managed/closed manure lagoons, increased road maintenance costs. Schwab also addresses: rural economic development resource allocation conflicts, e.g., does encouraging one type of land use discourage more "attractive" economic activities/land uses; non-farm rural residences encroaching on agricultural land and the associated increase in nuisance complaints; the lack of adequate local controls and planning or enforcement staff to draft and monitor effective plans and controls; and conflicts over the state and federal role in land use issues - e.g., environmental and health regulations. (Schwab 1998)

URBAN PLANNING-RURAL LAND: CONTROL OVER LAND USE DECISION-MAKING

The imposition of urban land use controls and values on rural landowners has been the focus of several researchers. Wadley and Falk (Wadley and Falk 1993) have argued that rural notions of self-sufficiency, independence and utilitarian views of the land are at odds with the environmental and nostalgia-based attitudes of rural newcomers and urban planning elites who increasingly impose their values on the countryside (by virtue of their growing numbers and political clout). "Farm landowners believe they are losing control over land use decisions. Rural landowners reject the rationale that land regulation rescues rural land from the consequences of harmful rural-oriented uses. Rather, [they] believe the regulations are an attempt to keep rural areas pure and unspoiled for urban purposes." These suspicions are especially aggravated when regulations appear to stray from the public health and environmental quality impacts of certain agricultural land use practices, into the realm of aesthetics or toward an "urban-oriented agenda designed to shape rural land use activity to fit an urban vision of the countryside."

Several authors have called for planners and local communities to develop new models of rural planning and zoning, based not on the old urban planning framework, but designed specifically to meet the needs of rural areas. Over twenty years ago, Lefaver published an article in *Urban Land* which called for a more flexible approach to rural planning - moving away from the "unresponsive tools" of traditional zoning and density restrictions. (Lefaver 1978)

Most of the literature, however, calls for more rather than less planning - or at least taking a look at more creative strategies. (Russell 1996a; Russell 1996b) (Daniels and Lapping 1996) Rural planning guidebooks routinely encourage community residents to undertake a comprehensive community planning process to establish common goals and work out potential conflicts proactively. (Daniels and others 1995) (Duncan 1996)

NON-FARM NEIGHBORS AND RURAL NEWCOMERS

Over the last twenty years, rural areas within commuting distance of urban centers have experienced significant population growth. The conflicts generated by urban encroachment into agricultural land bear a close resemblance to those encountered by feedlots. The farmland protection literature has documented the tensions that exist over land use between farmers and non-farm newcomers to the urban-rural fringe. (Nelson 1992) (Coughlin 1991) (Thompson 1997) (Daniels1996, 1997, 1999) (National Association of Counties Research Foundation 1980)

Non-farmers are attracted to the countryside by a perception of a cleaner, aesthetically more pleasing environment than in a city or suburb. They may also be drawn by cheaper land and the potential to build a large house. Often, non-farm newcomers are able to commute to jobs in suburbs and even cities. In this sense, they are trying to have the best of both worlds: a house in the country and a high-paying job elsewhere.

It is common for newcomers to move to the countryside before they understand what life in the country and nearby agriculture are all about. For example, Larimer County, Colorado and Spokane County, Washington have both published versions of The Code of the West that warn non-farmers who are thinking about moving to the countryside about what they can expect. (A slightly edited version of Larimer County's Code of the West is re-printed in Daniels (1999)).

Newcomers often arrive to find that there are a host of “spillovers” from nearby farm and ranch operations. These spillovers may include: noise, dust, odors, and slow moving farm machinery on the roads. Farmers and ranchers may experience trash in their fields, vandalism, and harassment of livestock by children and dogs. Moreover, non-farm neighbors may file nuisance suits or pressure local governments to enact nuisance ordinances to limit certain farming practices.

Researchers have shown that most ex-urbanites have no conception of the realities of modern farming. Expectations of pastoral tranquility, pristine environments and scenic rural landscapes can be shattered by the industrial scale and production methods of many agricultural operations. Heavy machinery, extended hours, bright lights, dust and flies,

aerial and ground spraying of herbicides and pesticides, truck and equipment noise, and unpleasant odors are facts of life on most conventional farms. (Daniels, 1997, 1999) (Thompson 1997)

Efforts of newcomers to preserve their vision of "rural quality of life", and their propensity to value the scenic qualities of the land more than its income producing potential, come into conflict with the land use preferences and practices of long-time rural residents. (Spain 1993)

NUISANCE AND THE RIGHT-TO-FARM

An outgrowth of the concern over farmland loss to urbanization and the rising number of complaints by non-farm neighbors against farm operators was a wave of state- enacted "right-to-farm" laws in the 1980s. These laws were designed to protect farmers engaged in normal agricultural activities. Several manuals and reports have been published to assist producers in dealing with potential conflicts with non-farm neighbors (e.g., *A Livestock Producer's Legal Guide to: Nuisance, Land Use Control, and Environmental Law).* (Hamilton 1992) Some have questioned the legal basis of these laws, asserting that they have radically restructured common law property rights.(Reinert 1998)

The Minnesota law on nuisance (Minnesota Statutes, Section 561.19) finds that an agricultural operation is not considered a private or public nuisance if the operation has been operating for two or more years and was not a nuisance at its start of operation, when the operation expanded the number of livestock by at least twenty-five percent, or when there was a distinct change in the operation, such as from dairy to hog production. However, the farm operation may be considered a nuisance if conditions or injury result from practices that are not normal farming practices or are in violation of state, federal, or local laws, rules, permits, and ordinances.

Lisansky has shown that the rationale for most of these laws - urban expansion into agricultural lands - may have been based on faulty assumptions. Size and type of farm and the community characteristics of the neighboring areas are more predictive of nuisance complaints and concerns than the actual population density or rate of population growth. Larger operations, livestock producers and farms located near areas that can be characterized as "suburban" are more vulnerable to nuisance complaints. (Lisansky and others 1988)

In September of 1998, the Iowa Supreme Court ruled the Iowa Right-to-Farm Law unconstitutional. In February of 1999, the United States Supreme Court refused to hear the Iowa case on appeal. As a result, it is likely that there will be challenges to the constitutionality of right-to-farm laws in other states.

PROPERTY VALUES

One of the concerns expressed by feedlot neighbors is the fear of reduced property values. The research on feedlot impacts on nearby landowners' property values is limited and contradictory. Taff's 1996 study, funded by the Minnesota Department of Agriculture, is based on 1993-4 home sales price data for Renville and Redwood

Counties. Taff unexpectedly found a "positive proximity effect" - primarily for newer, higher priced homes located away from small towns and nearer feedlots.(Taff and others 1996) The one-mile increment proximity categories used in the study make these results difficult to evaluate in light of the much smaller required separation distances between feedlots and neighboring residences commonly used in many Minnesota zoning ordinances (e.g., 500-2640 ft., depending on the size/type of operation).

The three other studies of feedlot impacts on residential property sales prices do not support Taff's conclusions. Palmquist's research of rural residential property sales in nine North Carolina counties and Abeles-Allison and Connor's Michigan study found a negative impact on home values. Abeles-Allison, however, only measured the impacts on properties in the vicinity of "problem" feedlots. Palmquist reported a 4.75% reduction in value for homes located within 1/2 mile of a hog operation. (Palmquist and others 1997) (Prof. Pat Norris of the University of Michigan is working on revised version of the 1990 Abeles study)(Abeles-Allison and Conner 1990). Rikoon et al. (1999) studied four northern Missouri counties and found that properties within two miles of a CAFO experienced a loss in value.

See also the discussion these studies in the External Benefits and Costs Literature Review, pages F-23 to F-25. The conclusion of the External Benefits and Costs report is that too few studies have been completed to draw conclusions about the impact of feedlots on property values.

PROPERTY RIGHTS

Balancing the constitutionally protected property rights of individual landowners with the legitimate public interest in protecting the health, safety and welfare of the community has always been the challenge of land use regulation. The growth of federal and state involvement in the land use arena - primarily through environmental regulation - has led to increasing conflicts over the appropriate level and extent of government involvement in land use decision-making.

The feeling that federal and state regulations have usurped local and/or individual decision-making powers over land use has led to the growth of strong property rights and "wise use" movements in many parts of the country. More than half of the states have some type of property-rights legislation. (Jacobs 1998) Some commentators believe property rights issues have been oversold to agriculture - potentially resulting in a backlash movement, e.g., the recent fate of Iowa's "right-to-farm" statute being ruled unconstitutional. (Hamilton 1995) Others acknowledge that the movements have succeeded in shifting the debate - making governments and regulators at all levels more sensitive to property rights issues, and "bringing these issues into public consideration in a more explicit way." (Jacobs 1998)

ENVIRONMENTAL QUALITY

Schwab (1998) describes three main environmental issues associated with CAFOs: odors, air pollution, and water pollution. Odors vary according to the type of livestock, the

number of livestock, and the degree of concentration. Generally, hog odors create the most complaints, followed by the smell of chickens, cattle, and turkeys. The distance that odors travel will depend on the location of CAFOs, prevailing wind direction, and temperature and humidity (the greater the temperature and humidity the more powerful the smell). Air pollution from CAFOs is a separate issue from odors. Air pollution can negatively affect human health and even livestock on neighboring farms. Water pollution can degrade drinking water supplies. Water pollution from CAFOs can occur in a number of ways. CAFOs also consume large amounts of water.

Another environmental land use issue concerns the eventual closure of CAFOs and in particular manure lagoons. There is a concern that some operators may simply abandon the farms, creating "rural brownfields" with concentrated pollution and an expensive clean-up challenge. Although concern about brownfields was raised in recent planning literature about CAFOs (Schwab 1998), no literature documenting feedlots as a cause of rural brownfields was found.

Concerns over the real and potential air and water quality impacts of intensive livestock facilities are in many ways a subset of the more general concern for the environmental consequences of all types of agricultural land use practices. (Caldwell 1998) Land use conflicts over environmental quality can also occur because different groups of rural residents (newcomers v. long-time residents or farmers v. non-farmers) do not assign similar values to environmental protection (or may dispute the causes of degradation). Hurley's study of rural residents' level of concern over water quality from the potential siting of a large livestock facility near their homes showed that occupation, age and source of drinking water influenced the level of concern over about potential nitrate contamination of drinking water. While all respondents expressed concerns about drinking water contamination, farmers, retirees, those over age 60 and municipal water users expressed a higher level of concern. Half of the survey group believed environmental issues were a high local policy concern, but farmers and male respondents generally gave these issues a lower priority. Hurley comments, "This is an interesting paradox since farmers indicated a greater concern over the potential for water contamination from large-scale confinement operations." He postulates that many of these farmers were small hog producers "masking concerns for economic survival in terms of water quality." (Hurley and others 1999)

Outsiders - tourists, hunters, anglers, and other outdoor recreationists - may hold entirely different views. The growing use of regions formerly devoted exclusively to agricultural production as places for pursuing leisure activities - recreational trails, wildlife watching, sport fishing, driving through the country - brings the environmental and "landscape consumption" values of visitors into conflict with local residents. (Marcouiller 1997) (Spain 1993; Clawson 1974)

LAND USE AND THE RURAL LANDSCAPE

Landscapes are a complex amalgam of landforms, topography, vegetation, water and climate, man-made structures, human culture and perception. The power of landscapes to impart meaning and values to human beings has spawned a literature devoted to

empirically assessing the role of landscape perception and visual preference, visual resource management and the relationship between landscape aesthetics and landscape ecology. (Zube 1976; Kaplan) (Schauman 1979) Although the mandate of the National Environmental Policy Act of 1969 to give "appropriate consideration … to presently unquantified environmental amenities and values" has gained substantial legitimacy over the past thirty years, it has not come about without serious conflict. (Pitt and Zube 1987)

The loss of rural cultural landscapes, traditional rural scenery (e.g., old farmsteads, hedgerows, pastured animals) and other visual impacts on the rural landscape have been addressed in David Copps' *Views From the Road: A Community Guide for Assessing Rural Historic Landscapes*. (Copps 1995) The aesthetic of rural preservationists may not always coincide with that of people who make their living from the land. The conflict of aesthetic definitions between those who value "working rural landscapes" and those who cherish the "beautiful countryside" is also a function of familiarity with changing technology and production methods, e.g., bright lighting in and around linear rows of corrugated sheet metal buildings might look oddly industrial and out of place to an outsider, but it is simply a functional expression of the production needs and 24-hour operating schedule of the facility. (Riley 1985) Added to the conflicts between those who perceive landscapes for their use value and those who value landscapes primarily as amenities is another dimension - ecological health - which is often unrecognized and unseen. (Nassauer 1989; Nassauer 1992)

The relationship of the visual quality of the landscape to recreation and tourism development, and the potential conflict between traditional land uses - including agriculture - and outdoor recreation and tourism has been studied most extensively in the context of rural forested landscapes. Clawson's study of land use incompatibility problems between recreational and natural resource based uses focused on conflict management and dispute resolution strategies. (Clawson 1974) Marcouieller's recommendations for integrating tourism planning more broadly into rural development strategies also addressed the issue of land use conflicts:

> Increased use of rural areas for tourism coupled with an increased awareness of visual aesthetics and concerns about biodiversity have led to visitor skepticism toward traditional economic uses of natural resources in rural areas and to compatibility issues of traditional land uses with … tourism. Tourism-based development of rural regions has limited compatibility with the manner in which these lands are managed for commodity production. (Marcouiller 1997)

The rural landscape has been transformed over the past 50 years by changing agricultural technologies and land uses that have dramatically altered the function and appearance of the land. (Riley 1985) (Hart 1998) The shift away from mixed-use/small grain and pastured animal production toward intensive, specialized row crop, livestock or poultry production has resulted in a "cleaner" more stripped-down agricultural landscape. The loss of hedgerows, woodlots, shelterbelts, pasture and hayland, and wetlands of the pre-1950 farming era have corresponded with significant declines in pheasant and other grassland bird populations. (Friesen and others 1999) (Warner 1994) The decline of these features in the modern rural landscape has also reduced its visual diversity. These losses

may also impact the perceived desirability of a region as a destination for visitors, especially birders, pheasant hunters and those looking to take in the countryside scenery.

But it not just for outsiders that rural landscape quality matters. "Farmers are more likely to participate in [conservation] programs that enhance the look of their farms." Rural residents have their own community- based standards of beauty. "People have widely shared values about what makes landscapes beautiful. People who have similar experiences - farmers or others who live in a particular region - have similar ideas of landscape beauty. We can say a lot about what makes rural landscapes beautiful if we include people who are familiar with an area in the discussion. Rural Midwesterners' perceptions of landscape aesthetic quality may be … bound to larger concepts of stewardship." (Nassauer 1989)

QUESTION 2: WHAT ZONING AND LAND USE PLANNING STRATEGIES EXIST, TO WHAT EXTENT ARE THEY IN PLACE IN MINNESOTA AND HOW EFFECTIVE ARE THE LAND USE PLANNING STRATEGIES?

a. addressing the identified land use conflicts;
b. promoting citizen participation;
c. identifying and promoting the best uses of the land;
d. addressing development pressures in agricultural areas;
e. reducing negative environmental, economic, health and social impacts of animal agriculture; and
f. balancing property rights?

GENERAL ISSUES OF AUTHORITY FOR LAND USE REGULATION OF ANIMAL AGRICULTURE IN MINNESOTA

The issues involved in the land use regulation of siting and operation of concentrated animal feeding operations are many, complex, and interrelated. In general, there are two main issues: 1) regulating the operation of new and existing CAFOs; and 2) regulating the location and design of new CAFOs. Health and environmental regulations generally emerge from the state or federal government. Local land use planning and zoning are generally directed at regulating the location and design of new CAFOs. The Role of Government report addresses the question of the implications of regulating animal agriculture at different levels of government. This report briefly addresses the authority of local land use control, what current land use strategies are in use and their effectiveness.

Legal issues first and foremost concern the legal authority that local governments, including townships and counties, have to regulate CAFOs. The legal basis of local authority for planning and zoning are discussed at length in the Role of Government report, however, a brief discussion is warranted here. The Tenth Amendment to the United States Constitution allows state governments the power to exercise their police power to protect public health, safety, and welfare. Local governments are the creation of the state government. The state government, through state zoning and planning enabling legislation, decides what powers of land use control to delegate to the local

governments. Unlike other states, such as Iowa, **Minnesota does allow local governments to use zoning to regulate agriculture in general, and specifically CAFOs** (Minnesota Statutes, Section 394.25 (counties) and Section 462 (townships)). Also, local governments may enact environmental and health regulations that prevent private property owners from creating public nuisances.

Another issue is the effect of zoning and other regulations on private property rights. The Fifth Amendment to the Constitution states that a government cannot take private property without paying "just compensation." A regulation is not a physical taking of property in the manner of a condemnation by use of eminent domain powers. Zoning and other regulations, however, can become a taking if they are unreasonable and result in taking all of the economic use of a property.

Obviously, a tension occurs between the Fifth Amendment and the Tenth Amendments. State and federal courts continue to vary in their interpretations of these two amendments in land use cases. Nonetheless, the regulation of CAFOs appears to have strong support as being in the interest of the public health and safety.

Finally, the Fourteenth Amendment to the Constitution requires due process and equal protection under the law. This means that governments must respond in a timely and procedurally correct manner for land use permits and decisions, and that all citizens must be treated the same. Governments cannot make arbitrary and capricious decisions. For example, this means that a government could not delay indefinitely a decision on whether to issue a building permit for a CAFO. In Minnesota, however, a local government (in this case a Township) may impose a moratorium on the permitting of new CAFOs while drafting new zoning and environmental regulations (Duncanson v. Board of Supervisors (Minn. App. 1996)).

As discussed in *Planning and Zoning for Animal Agriculture in Minnesota: A Handbook for Local Government,* Duncan and Associates (1996a) highlight the potential interaction between state and local regulations. They raise the question of what authority local governments can exercise. They ask, for example, can state regulations "pre-empt" local regulations? This is the case in Iowa where CAFOs are regulated by the state; local governments cannot use zoning powers to regulate CAFOs. In *Goodell v. Humboldt County* (IA Sup. Ct., March 1998) the Iowa Supreme Court ruled that the 1996 ordinances adopted by Humboldt County to control large operations were not valid. These ordinances did not apply zoning regulations to operations, rather the ordinances required large operations to obtain county construction permits. The construction permit process included a process for public hearing, manure management plans, financial assurances for clean-up, and restrictions on application of manure around drainage wells. The Iowa Supreme Court held that the ordinances violated the state's scheme of uniform regulations. In a strong dissent, however, two justices said the Court's ruling called into question the applicability of county "home rule" as guaranteed in Iowa's constitution.

Duncan and Associates strike a note of caution about whether local zoning in Minnesota could be pre-empted by state regulations. Duncan and Associates cite the Minnesota right-to-farm law and the Agricultural Land Preservation Act as examples of where the

state has made incursions into local regulation. The Minnesota right-to-farm law grants immunity from most public and private nuisance actions for operations that have been in operation for two or more years and follow "generally accepted agricultural practices." The Agricultural Land Preservation Act allows land enrolled in Agricultural Preserves some special, though not absolute, protections against annexation, condemnation, and public uses.

In his review of local government authority across the country, Schwab (Schwab 1999) states that local governments in Minnesota have the authority to use planning and zoning to regulate CAFOs.

The Minnesota Court of Appeals recently supported the position that local governments have the authority to adopt land use restrictions on feedlots. In the Minnesota case of *Canadian Connection v. New Prairie Township* (581 N.W. 2d 391), the Court of Appeals held that the New Prairie Township ordinance imposing setback requirements on feedlots was valid. The Court specifically held that the ordinance did not conflict with MPCA permitting authority and was not pre-empted by the act of the MPCA issuing a permit to the feedlot. Even though MPCA issued a permit, the Township ordinance prevented the feedlot from being built because it did not meet setback standards.

Duncan and Associates (1998) note that the Minnesota Pollution Control Agency has the authority to regulate the environmental impacts (air and water pollution and smells) of feedlots. It is an open question whether local governments can address the environmental impacts of CAFOs in their zoning ordinances.

LAND USE STRATEGIES FOR ADDRESSING CONFLICTS OVER ANIMAL AGRICULTURE

With the notable exceptions of Schwab and Duncan (Schwab 1998; Duncan 1996a,b), most of the land use literature does not directly address the issue of regulating feedlots. The literature explains the planning and zoning process as applied to rural areas in general and agricultural land protection specifically. Agricultural land protection is pursued for many reasons, including the reduction in conflicts between neighbors over odor, noise, and dust. These conflicts also arise with concentrated animal feeding operations. Therefore, some of the strategies suggested to address agricultural land protection can also be applied to the regulation of CAFOs.

Addressing Land Use Conflicts

Duncan and Associates argue that "in most Minnesota counties, existing controls to protect agricultural land are inadequate." In 1996, "only 20 counties in the state [had] comprehensive plans that [were] ten years old or less. Although a vast majority of Minnesota counties (61 out of 80) [had] adopted county-wide zoning controls, few use measures such as exclusive agricultural zoning districts or residential density standards [were used] to protect agricultural land" (Duncan and Associates, 1996b, p. II-2). A survey of county use of agricultural zoning conducted in 1997-98 for the Minnesota

Department of Agriculture found 45 counties with density requirements of at least twenty acres per residential unit. (Resource Management Consultants, Inc., et al., 1999)

Comprehensive Planning

Local comprehensive plans form the legal and policy basis for local land use ordinances in Minnesota. Through statute, the State of Minnesota has given authority for comprehensive planning to counties (Minn. Stat. Section 394.21 *et seq.*) and cities and townships (Minn. Stat. Section 462.351 *et seq.*). The development of comprehensive plans should involve citizens in defining community needs, issues, goals and solutions. Comprehensive planning can specifically direct the creation of ordinances to implement the goals of the plan.

Agricultural land uses, and animal agriculture specifically, can be addressed in a comprehensive plan. Comprehensive plans should reflect community values, culture and history as well as the community's vision for the future. As noted by Schwab (1998) a well-developed comprehensive plan that outlines what land uses the community wants and where they should be located prepares communities to respond to CAFO siting requests.

Zoning Strategies

In his handbook for local government officials dealing with animal agriculture in Minnesota, Duncan and Associates suggests that counties and townships create multi-tier agricultural districts: a limited agricultural district in which crop farming is the dominant enterprise, and a general agricultural district in which CAFOs would be allowed and indeed encouraged to locate. The general agricultural districts would be further removed from non-farm residential, or urban areas. This concept is similar to what is currently done in zoning industrial uses: a light manufacturing zone for firms that generate few spillovers onto nearby properties, and a heavy manufacturing zone for firms that produce noise, dust, and odors that could travel some distance. The creation of two agricultural zones was done in 1998 in Elkhart County, Indiana. The county's A-5 zone allows farm operations with 3,000 or more head of livestock, and the A-1 zone allows farm operations with fewer than 3,000 head of livestock.

A sample ordinance incorporating the multi-tier agricultural zones, conditional use requirements, and land use standards for CAFO's is included in the handbook. The land use standards include:

- setback requirements from roadways,
- separation standards from other land uses,
- minimum site area requirements, and
- definitions for nonconforming uses and noncomplying structures that when met would bring pre-existing operations under current land use regulations.

In the companion handbook explaining the Minnesota Agricultural Land Preservation Act, Duncan discusses the establishment of agricultural preserves, exclusive agricultural

zones, and urban expansion zones as possible solutions for land use conflicts over animal agriculture.

In *Planning and Zoning for Concentrated Animal Feeding Operations* (Schwab 1998), Schwab presents a thorough explanation of the legal and environmental issues involved in the regulation of CAFOs. The land use conflicts center on the potential creation of public and private nuisances by CAFOs and the fear on the part of CAFO operators that public hearings will turn into free-for-all attempts to ban CAFOs.

The report also discusses the local government zoning ordinances that have been used to regulate CAFOs. Schwab distinguishes between zoning for future land uses and local environmental and public health regulations that can be applied to existing land uses. Zoning affects future land uses, once land uses are properly permitted they retain a right to exist and are subject to zoning only when there is a change or expansion of the existing use that is not permitted. Schwab pointedly notes that zoning cannot be used to shut down legally permitted existing uses, including CAFOs.

Zoning strategies listed by Schwab that can be used for addressing CAFOs include:

■ agricultural districts that allow CAFOs to be separated from non-farm land uses;
■ separation standards that establish minimum distances between incompatible uses such as CAFOs and residences;
■ conditional use standards requiring a higher than normal level of review for compliance with the standards;
■ performance standards or best management practices for the siting and operation of CAFOs that address potential impacts on natural resource and surrounding land uses; and
■ moratoriums on the siting of CAFOs to allow local governments time to develop plans and regulations.

Resource Management Consultants (1999) examined several Minnesota counties which use some form of agricultural districts. This report evaluates the effectiveness of state agricultural land preservation programs and does not directly consider animal operations. Nicollet County implemented an agricultural zoning ordinance in 1985 and allows one dwelling unit per 40 acres. The County reports that there have been no major rezonings of agricultural land to residential or other non-agricultural uses in the 85% of the county land area zoned for agriculture.

In Stearns County, twenty of the thirty-seven townships in the county have agricultural zoning ordinances with varying density requirements. There is currently a moratorium in the county to slow down the increase of rural non-farm development and consider more comprehensive agricultural zoning. The report also noted that Grant County is not considering any planning and zoning.

The Resource Management Consultants report also describes the results of a survey of counties regarding the status of zoning for general agricultural land protection in Minnesota. Almost 13.5 million acres of agricultural land in 45 counties is currently under some type of agricultural zoning. Four counties the allowable density in

agricultural zones is one residential unit per 20 and 40 acres. Forty-one counties allow one unit per 40 acres or more. More than 56% of the agricultural land in Minnesota (as identified by the 1992 USDA Census of Agriculture) is zoned under the limits stated above. Seventeen counties have implemented agricultural zoning ordinances since 1990. The report describes Minnesota as "at the forefront of states in the nation adopting agricultural zoning."

Patricia Norris (July 1999) discusses an integrated planning and zoning approach that may be used by township governments in Michigan. She states that "planning and zoning for animal agriculture cannot be simplified as an issue of planning and zoning for agriculture in general", rather specific regulations should be directed at CAFOs. Townships in Michigan, similar to townships and other local governments in Minnesota, do have the authority to zone and regulate agricultural land uses. Norris suggests regulations that: clearly define what animal agricultural uses are regulated; set limits on specific concerns such as size and proximity limits for odor; and consider site suitability standards. Norris suggests using a special permitting process for animal operations.

Mo and Abdalla (1998) incorporated the presence of local zoning ordinances in their study of the effect of regulation on the expansion of the swine industry. Their study included examining the variable of whether or not states allowed local governments to zone for agricultural land uses or whether the state exempted agriculture from local zoning. This was one of seventeen variables incorporated in a linear model to estimate the relationship between the variables and swine industry expansion. They did not examine the effects of specific zoning strategies. The results indicated that states with laws that provide an exemption had a greater growth or slower decline in the swine industry than states without an exemption.

While not addressing CAFOs directly, Daniels (Daniels, 1999) and the American Farmland Trust (1999) are the most recent general discussions of the land use conflicts associated with urban growth in rural areas. Growth in America today is occurring in the "rural-urban fringe" on land outside of established cities and towns. This pattern of residential development on one-, two-, five-, and ten-acre lots is bringing many newcomers into conflict with farming operations, especially those farms that have livestock.

Even with incentives and regulations to keep agricultural land open for agricultural use some development will continue to occur in the countryside. The important issues are where the development happens and at what scale and density. Rural residential zones, such as in Oregon, can be used to accommodate residential development away from commercial farm operations and thus reduce potential conflicts.

Daniels notes that an effective technique to separate urban uses and rural areas is the urban growth boundary or village growth boundary. This technique, pioneered in Oregon, has been adopted in communities in California, Colorado, Florida, Kentucky, North Carolina, Pennsylvania, Virginia, Washington, and in the Twin Cities metropolitan region in Minnesota. A growth boundary comes about through an agreement between local governments (a city and a county, or between a city and neighboring townships), or

in the case of the Twin Cities region, between local governments and the regional planning agency (the Metropolitan Council). A growth boundary contains enough buildable land to support development over the next 20 years. Urban-type services, such as public sewer, water, and schools are placed within the growth boundary to encourage a more compact form of development and minimize sprawl into areas with farm uses.

Purchase of development right (PDR) and transfer of development rights programs (TDR) and cluster subdivisions are also used throughout the country for the protection of agricultural land in general. (Allman 1997; American Farmland Trust 1997; Daniels 1997; Schnidman 1990) The application of these techniques should be considered in the development of programs to separate animal agriculture from incompatible uses.

In a PDR program, a local government purchases the right to develop land from the landowner for the purpose of limiting the future use of the property to agricultural and open space uses. A permanent conservation easement is placed on the land to prevent future development. TDR programs allow development rights to be transferred from farmland to urban areas. Local governments adopt an ordinance that defines a sending area where agricultural resources are to be protected, and a receiving area where development is encouraged. Landowners in the sending area can chose to sell development rights to developers. Developers use the development rights to develop a parcel in the receiving area at higher densities than typically allowed. A permanent conservation easement is placed on the land that sold development rights to prevent future development.

The Minnesota Legislature, in 1997, amended the land use authority of counties and municipalities to specifically include the authority to establish PDR and TDR programs. (1997 Minn. Laws Chapter 216, sections 135 and 138) Washington County has explored the possibility of establishing a PDR program, and Chisago County is in the preliminary stages of considering the development of a TDR program. (Resource Management Consultants, Inc. 1999)

The Minnesota Legislature, in 1997, also amended the land use authority of counties to require notice of a permit to construct four or more residential units on land zoned for agriculture (or agricultural land in counties without zoning) to owners of all agricultural land within 5000 feet of the proposed development. (Resource Management Consultants, Inc. 1999)

The recent evaluation of Minnesota Agricultural Land Preservation Programs (Resource Management Consultants, Inc. 1999) recommends that the Minnesota Department of Agriculture analyze and summarize the effectiveness of TDR and PDR programs as agricultural land protection tools. Depending on the findings, the Department may choose to assist counties in the development of programs.

Cluster development (Arendt 1994: Yaro 1989: Washington County 1997) is also promoted as an tool for the protection of farmland from non-farm uses. Cluster development ordinances for agricultural protection typically require new developments in agricultural areas to cluster housing on small lots away from agricultural operations,

permanently preserve at least half of the open space in the development. Cluster developments are encouraged in Washington County under their density-based land use requirements. Clusters are, however, essentially suburban housing developments placed in the countryside. The location of these non-farm developments near CAFO's could merely increase conflicts.

Other Local Regulatory Strategies

Duncan and Associates (1996a) also suggests the adoption of a local right-to-farm ordinance as an additional tool to decrease conflicts between CAFOs and other land uses. Local right-to-farm ordinances can complement the state right-to-farm law. Duncan suggests incorporating an "early notice" provision that may prevent people from "coming to the nuisance." A sample local right-to-farm ordinance is included in the handbook.

Enforcement of Local Regulations

Local land use regulations may be enforced at several points in time: when a permit (building, certificate of occupancy, zoning change, variance, conditional use permit, etc.) is applied for; when parcels of land are sold or subdivided; and when violations occur. If a land use regulation for a feedlot is violated, the local enforcement officer (often the zoning officer or feedlots officer) can enforce the regulation within the process and penalties outlined in the ordinance. Local enforcement officers become aware of violations through citizen complaints and visual inspections. A consistent criticism, however, of all types of local land use regulations is that regulations are not consistently enforced. The general farmland protection literature urges local governments to apply ordinances consistently to prevent challenges to the ordinance and to achieve the goals of the ordinance. Enforcement of an ordinance is often more important than the adoption of the ordinance. (American Farmland Trust 1997) (Daniels 1995) (Lefavor 1978)

Minnesota Agricultural Land Preservation Program

Duncan and Associates (1996b) discusses Minnesota Statutes, Chapter 40A of 1984, better known as The Minnesota Agricultural Land Preservation Program. This statute establishes a program to offer property tax incentives to farmers who put their land into an "agricultural preserve." In return, farmers place a restrictive covenant on the land, limiting the use to agriculture. Farmers may petition to remove the covenant in a process that takes at least eight years, or the county may remove land from an agricultural preserve. Enrolled farmland also receives:

- exemptions from local ordinances that restrict normal farming practices, "unless the ordinance has a direct relationship to public health and safety" (Chapter 40A.12);
- limits on annexation;
- greater protection from eminent domain actions;
- ban on public facility siting in preserve areas; and
- exemptions from special assessments.

Chapter 40A defines "Agricultural Use" as the production of livestock, dairy animals, poultry or poultry products, fur-bearing animals as well as crops. Duncan and Associates

states that the question of whether a CAFO could locate in an agricultural preserve and receive exemptions from local ordinances that restrict normal farming practices remains unanswered. If a CAFO were challenged in court, the court would have to rule whether a CAFO and its mode of operation constituted a "normal agricultural practice."

As of 1996, only 3 non-metro counties were using the Agricultural Preserves Program with about 152,000 acres enrolled (Duncan and Associates, 1996b, p. III-2). An Agricultural Preserves Program must be integrated "with comprehensive county and municipal plans" (Chapter 9 40A). Agricultural land must be identified, along with growth trends and housing needs, and sewer and water facilities. Land classified for long-term agriculture becomes eligible for the Agricultural Preserves Program.

Once the agricultural land preservation plan has been developed (with public input), local land use controls must contain the following provisions to implement the plan:

■ the creation of exclusive agricultural zones that allow for conditional, compatible uses that do not conflict with long-term agricultural use;
■ designation of urban expansion zones where limited growth and development may occur;
■ residential density and minimum lot sizes in exclusive agricultural use zones and urban expansion zones; and
■ standards and procedures for county decisions on rezoning, subdivision, and parcel division.

Duncan and Associates discusses the treatment of a CAFO as a conditional use, a special exception, or an outright permitted use in an agricultural preserve. Conditional uses and special exceptions must meet specific articulated standards involving siting and design considerations in order to be permitted. Conditional use permits are generally imposed on land uses that have the potential to cause impacts over a large area. A special exception is a decision of the zoning board and involves a land use that impacts only immediate neighbors to the use. In general, the purpose of a special exception is not to keep out a certain use, but to make sure that it will operate responsibly and with a minimum of spillover effects onto neighboring properties. An outright permitted use requires no more than a building permit, as long as zoning setback, height, and bulk coverage requirements are met.

Resources Management Consultants (1999) in their evaluation of Minnesota Agricultural Preservation Programs, report that participation in the statewide program is limited to only three counties (Waseca, Winona, and Wright) that participated in a pilot program early in the program's history. Approximately 156,000 acres have been enrolled in the three counties out of a total potential acreage of 979,000 acres. This report recommends the following changes in the Program to increase its effectiveness:

■ increase the property tax credit;
■ increase the enrollment period from eight to 10 years;
■ strengthen the prohibition on annexations of any land enrolled;
■ provide for differential assessments as well as property tax credits;
■ instill confidence in long-term funding of the Program;
■ increase education and outreach efforts;

■ require density-based zoning with maximum lot size provisions and clustering of non-farm residential units;
■ require zoning densities of one unit per 40 acres; and
■ produce model agricultural zoning ordinances.

Minnesota Feedlot Permit Program

In 1998, Minnesota SF 3353 established a program for the authorization and transfer of feedlot permits, although MPCA has permitted feedlots since 1971. Under the new program, counties may adopt standards for animal feedlots that are more stringent than those of the Minnesota Pollution Control Agency. After January 1, 2001, a county that has not accepted delegation of the feedlot permit program must hold a public meeting before the MPCA can issue a feedlot permit for a facility with 300 or more animal units. Any state or local government agency that conducts an inventory or survey of feedlots must publicize notice of the inventory in a newspaper of general circulation in the relevant area. Local governments conducting an inventory must hold at least one public meeting. Until June 30, 2000 neither the MPCA nor a county board may issue a permit for the construction of an open-air clay, earthen, or flexible membrane liner swine lagoon.

Another provision of the law required counties and towns that adopt ordinances related to animal feedlots to supply copies to the Commissioner of Agriculture by August 1, 1998. This collection of Minnesota ordinances is the most comprehensive found and is discussed below.

Promoting Citizen Participation

While literature addressing citizen participation in the context of developing land use policy and regulation for CAFOs is unavailable, the general planning literature does give some guidance. *The Small Town Planning Handbook* (Daniels, 1995) details how to involve the public in the creation or updating of a local comprehensive plan. Elements of effective public participation include:

■ comprehensively identifying stakeholders;
■ reducing barriers to participation (travel time, child care, time of day, time of year, fear of speaking in public);
■ providing a variety of access points to the process (written materials, small meetings, large meetings, media coverage of the process, individual access to elected officials, staff and consultants); and
■ incorporating iterative meetings where the results of prior meetings are explicitly used in subsequent meetings.

The book also explains how to create or update a local zoning ordinance, subdivision regulations, and capital improvements plan. The book places a great deal of emphasis on public involvement because the authors' belief that if the public helps create the plan, the public will support the plan and the ordinances that put the plan into action. The book also tells how to hold a fair public hearing.

James Duncan and Associates' (1996a) Minnesota handbook emphasizes a comprehensive planning approach which includes extensive citizen involvement in

"visioning" and participating in the drafting of a comprehensive plan.

Community-based comprehensive planning is promoted in Minnesota under the Community-based Planning Act adopted in 1997. This legislation established eleven statewide goals for local comprehensive planning, and provided technical support for communities completing local comprehensive plans that emphasized local citizen involvement. According to Minnesota Planning (1999) sixteen of Minnesota's 87 counties are participating in community-based planning, along with numerous cities, townships and other local governmental units. State funding grants for community-based planning projects by local governments will end in June 2000. During the last session, the Minnesota Legislature passed legislation that will cause the Act to end, or sunset, in June 2001.

Addressing Development Pressures in Agricultural Areas

Daniels and Bowers (1997) in *Holding Our Ground: Protecting America's Farms and Farmland*,

discusses the development pressures that farmers face in terms of the economics of farming, the conflicts created by non-farm neighbors, property taxes, and the "Impermanence Syndrome" in which farmers reduce investment in their operations as they perceive the inevitability of development. The book presents a thorough explanation of the techniques used to protect and preserve farmland, including: comprehensive planning, zoning, property tax programs, right-

to-farm laws, urban growth boundaries, purchase and transfer of development rights. The book also talks about how to put together a strategic package of protection and preservation techniques.

Reducing Negative Environmental, Economic, Health, and Social Impacts of Animal Agriculture

Health and environmental standards are not the traditional methods used in land use planning, however, some environmental regulations are adopted as land use controls. (Schwab 1998) Schwab observes that environmental regulations differ from zoning controls in that they apply to both existing and future land uses.

Schwab lists several environmental regulations that have, or could, be used to reduce the negative impacts of animal agriculture. Lagoon closure requirements are one strategy that could be used in dealing with CAFOs. Closure requirements were one subject of the Humboldt County, Iowa, ordinances discussed above that were overturned. Financial performance guarantees are another strategy for protecting against the abandonment of CAFOs. Manure application setback requirements also fall into the environmental regulation category. A final strategy suggested by Schwab is requiring public access to Comprehensive Nutrient Management Plans as suggested by the US EPA. This would allow interested individuals to view and assess the proposed location and timing of manure applications.

In a July 6, 1999, *Farm Journal Today* article, Bernick, describes the two-year moratorium on new hog facilities that was imposed in North Carolina from mid-1997-mid 1999. The North Carolina legislature is considering a two-year extension of the moratorium. North Carolina Governor Jim Hunt has ordered state inspectors to assess the environmental risks of each manure lagoon in the state by September 1, 2000. Hunt is willing to spend state dollars to close abandoned lagoons, but also wants the livestock industry to help pick up the cost, which could be as high as $400 million. Hunt is also proposing a 10-year phase out of all lagoons.

Balancing Property Rights

The concept of property rights can change over time, as can the responsibilities that attach to owning land, such as the responsibility not to pollute the air and water. Jacobs, in *Who Owns America? Social Conflict Over Property Rights* (1998) has collected papers about property rights and responsibilities. The idea that landowners can do what they want with their property is contrary to the laws against creating public and private nuisances. But the use of private property has been central to America's economic system. The tension between private property rights and society's interests is a continuing struggle.

Schwab (1999) makes the argument that regulations aimed at controlling the environmental effects of CAFOs are on strong legal footing. Schwab contends that these regulations are clearly intended to protect public health from air and water pollution. Moreover, the regulations do not take away all possible economic uses of a property, and hence are not a "taking" under the 5th Amendment.

Balancing property rights is not directly addressed in local zoning ordinances. In *The Livestock Management Act & Other Zoning Issues - Impact on Non-Farm Residential Use in an Agricultural District,* Carmichael (1997), discusses the balancing act that counties must perform in attempting to regulate CAFOs through zoning one the one hand and upholding private property rights on the other. Carmichael points out that inconsistency in zoning regulations and zoning enforcement is a major problem among counties in Illinois. Daniels and Bowers (1997) explain what a local government can and cannot in zoning agricultural land. The chapter includes several citations of court cases about the legality of agricultural zoning, and how the extent of regulations in agricultural zones varies from state to state.

USE OF LAND USE STRATEGIES FOR REGULATING ANIMAL AGRICULTURE IN MINNESOTA

See also the Role of Government Report section on County Feedlot Ordinances.

As stated, local governments in Minnesota have the authority to enact zoning ordinances for the regulation of animal feedlots (Duncan 1996b). Local government interest in feedlot ordinances was prompted at the beginning of this decade by the emergence of new facilities considered “large” by traditional standards. Fears of odors and to a lesser degree fear of water quality risks, and concerns about ownership and community change caused the calls for controls.

Many Minnesota counties and townships have adopted feedlot ordinances in the past few years. Some counties and townships do not have feedlot ordinances per se, but use the regular zoning requirements such as setback from right of way, as requirements for issuing permits for livestock facilities. Feedlot ordinances usually address a much broader array of concerns.

Some of the provisions commonly found in Minnesota feedlot ordinances are:

■ **Setback distances** from rural residences, towns, parks, etc. (some are set such as shoreland)
■ **Conditional use procedures and requirements** (including conditions dictating when a conditional use is required such as feedlot size)
■ **Hearing process (**notification procedures, timelines, etc.beyond state requirements).
■ **Fee Schedules**
■ **Lagoons and Earthen Basins** (requirements beyond MPCA standards)
■ **Required manure storage capacity**
■ **Acres required for responsible manure utilization**
■ **Land ownership requirements**
■ **Feedlot licensing and inspection**
■ Allowable number of animal units per site or section

Issues sometimes addressed in conditional use permits requirements are:

■ Road damage occurring from feedlots or feedlot construction
■ Manure incorporation requirements
■ Accessibility for inspection
■ Responsibility for cleanup if abandoned

Elected officials and appointed planning commissioners who develop and set policy for zoning/feedlot ordinances are often plagued by the confusion of environmental and land use issues with agricultural policy and social issues. In general, zoning deals with land use, feedlot permits address environmental concerns (but the distinction is somewhat blurred), and neither are particularly designed to deal with agricultural policy and social issues. However, agricultural policy and social issues are often the motivation for calls for stricter environmental and land use controls.

Land use ordinances are ever- changing: it is difficult to summarize current provisions – there are very often calls to address new concerns as new situations arise, usually prompted by an individual application. Some individual county ordinances have been opened for revisions 3 or 4 times since their original enactment

Summary of Animal Related Ordinances in Minnesota

The 1998 Legislature passed Minnesota Laws Chapter 401 Sec. 57 requiring all counties and townships to submit copies of their animal-related ordinances to the Minnesota Department of Agriculture (MDA). MDA received a variety of animal related regulations taken from adopted and draft feedlot ordinances as well as zoning ordinances, land use plans, development codes, shoreland ordinances, and interim ordinances. A total of 79 of Minnesota's 87 counties responded to the reporting requirement. Of the 79

counties, 64 submitted animal-related ordinances, 15 reported no ordinances and 1 reported an animal-related ordinance but did not submit it. Eight counties did not respond. The ordinances submitted included 29 zoning ordinances, 20 feedlot ordinances, 3 development codes, 3 interim ordinances, 3 shoreland ordinances, and 5 draft feedlot/zoning ordinances.

Twenty-seven townships also submitted animal-related ordinances. The township ordinances have not been summarized. MDA does not have current plans to summarize the township ordinances. This is a choice based only on lack of funding for staff to undertake the summary.

MDA has prepared a draft report summarizing the county ordinances. MDA states that the challenges posed by logistics, incomplete submissions, and the complexity of regulations limit this report from 100% accuracy and inclusivity. However, MDA staff have made a strong effort to make this study an enlightening summary of county animal-related ordinances as of March 22, 1999. The data presented gives a good representation of the situation as it existed in early 1999.

From the submitted animal-related ordinances MDA staff developed three tables profiling county animal-related ordinances that are presented in their report, “Summary of Animal-Related Ordinances”. The first table profiles feedlot regulations on requirements for separations distances (also called setbacks in many cases), conditional use permits, maximum animal units, and minimum acreage. The second table profiles setback requirements for land application of manure, and the final table profiles manure incorporation and certificate of compliance requirements.

The MDA did not make an assessment as to the effectiveness or appropriateness of the provisions in the ordinances. Also, there is no assertion that the most commonly occurring provisions and specific values are in some way more “right” than others.

Following is a summary of some of the findings in the report.

Setbacks and Separation Distances

All of the animal-related ordinances include setback requirements and separation distances standards. Separations distances are often referred to as “setbacks”, which is the preferred terminology in the majority of submitted ordinances. Separation distances and setbacks are however different in purpose. "Setbacks" are primarily useful as a means of protecting adjacent rights-of way and lots from encroachment by buildings and structures. “Separation distances and standards” are land use control strategies that are based on the notion that spatial segregation is the best method of ensuring that different land uses do not have an adverse effect on one another.

The MDA survey found that counties have primarily used two different methods for separation standards and setbacks. The two methods are “simple” and “sliding scale”. The most common approach reported was the use of simple standards (28 counties). The definition of “simple standards” is that the number of animal units is not considered when determining separations distances and setbacks. Table 1 shows the number of counties

with “simple standard” separation distances for feedlot facilities from specific land uses and the distances reported.

Table 1: Range of “Simple Standard” Separation distances

Separation Distances From:	Lowest Distance Reported	Highest Distance Reported	Median	Mode
Neighboring Residence	500’	2,640’	1,160’	1,000’
Park	1,000’	5,280’	2640’	2640’
Church	1,000’	2,640’	2640’	2640’
10 or More Residential Dwellings	2,000’	5,280’	2640’	5,280’
Residential District or Development	500’	10,560’	2640’	2640’
Municipal Boundaries	2,640’	10,560’	5,280’	2640’

2640’= ½ mile
5280’= 1 mile

The highest distance reported compared to the lowest distance reported for the separation of feedlots from various land uses ranges from approximately 2-1/2 times greater (church and 10 or More Residential Dwellings) to 21 times greater (Residential District or Development). Since simple standards do not consider animal units or technologies employed, the distances reported suggest considerably different perceptions about the necessary distance to protect other land uses from feedlot impacts and create widely different conditions for operators of similar feedlots based only on county of location.

Nineteen counties reported a sliding scale system for setting separation distances and setbacks. The standards varied widely between counties and are difficult to summarize. For distance from “neighbors” the median was 1000’ for 1-300 animal units, 1320’ for 301-1000 animal units, 1320’ for 1001-2000 animal units, and 2640’ for 2001-5000 animal units.

The report provides information on the specific factors used by individual counties using a sliding scale system. Four counties reported using type of manure storage as a factor in determining separation standards and setbacks. Two counties allowed a reduction in setback distances if an odor reduction technology is employed and approved by the county planning commission. One county reported using prevailing wind direction as a factor in conjunction with number of animal units.

Since odor concerns are often cited as the major reason for setting separation distances, and since factors including local conditions, species, animal housing type, manure storage technology, and number of animal units can affect odor risk, it appears that the Odor Rating System under study by the University of Minnesota with funding and support from MDA, or other techniques to quantify odor risk and intensity, could assist counties to improve effectiveness and consistency in setting appropriate separation distances.

Currently widely varying standards are being used in Minnesota counties to deal with the issues connected to separation distance.

Size Limitations

Thirteen counties limited the maximum size of feedlots. Those limits varied from 1000 hogs (equivalent to 400 animal units) in one case, and 1,500 animal units (equivalent to 3,750 finishing hogs) in 3 others, and up to 5,000 animal units (equivalent to 12,500 finishing hogs). The other counties had no size limit per se but it could be surmised that that applications for very large feedlots would be severely scrutinized through means such as conditional use in many or all of those counties.

Thresholds For Conditional Use Permits

Conditional Use Permits are required in some ordinances under certain specified conditions.

They imply that the use somehow requires additional deliberation beyond that applied by the standards of the ordinance. A planning commission may require conditions above those in the ordinance standards if the conditional use is granted. A public hearing process is involved in a conditional use procedure.

An argument for the liberal use of conditional use permits (requiring them at a low threshold-in the case of feedlots usually a size based on number of animal units) is that each application can be studied on its individual merits and that the public can have input in those permitting situations. Negatives seen for low conditional use thresholds are that bias is more likely to enter the process (as opposed to enforcing impassionately arrived at standards) and that politics can become a factor in granting permits. Conditional use procedures also can be costly, both to the applicant in preparation and time, and to the county in staff time and planning commission and hearing costs. Counties may attempt to offset some of the cost with conditional use fees paid by the applicant.

MDA staff summarizing conditional use standards for the *Summary of Animal-Related Ordinances* found it very difficult to profile the thresholds for conditional use permits. The thresholds are primarily based on animal units and often include additional considerations such as distance to adjacent land use and zoning districts, type of manure storage facility and land application of manure, requirement of an environmental assessment worksheet or a NPDES permit. The thresholds vary widely from county to county. For example, in reviewing individual county reports one can find an instance of three adjoining counties in southwest Minnesota, one with no conditional use procedures required, one with a 300 animal unit threshold, and the third with a 1000 animal unit threshold. This is representative of the differing philosophies on employing conditional use procedures versus establishing and enforcing standards.

Minimum Acreage Requirements

Some counties have adopted minimum acreage requirements to site animal feedlot operations. The advantages of requiring a minimum number of acres for an operation include: the opportunity for the owner to place the livestock facility further from the property line, and; additional value for the site if it should ever be defaulted to the county. The additional value could be used to cover potential clean-up costs if the property went tax forfeit. Opponents of this concept see it as discriminatory compared to requirements for other uses, and an artificial barrier to feedlot siting.

Eleven counties in the survey required some level of minimum number of acres required to site a feedlot. Among the highest requirements were one county requiring 40 acres, one requiring 40 acres for over 2000 animal units, and one requiring 20 acres up to 300 animal units, 75 acres for 301 to 2000 animal units, and 115 acres for 2001 to 5000 animal units.

Manure Application Setbcks

Table 2 below shows the range of manure application setbacks, in addition to the most commonly found setback requirements.

Table 2: Range of Manure Applications Setbacks

Manure Application Method	Streams/ Rivers	Lakes	Wetlands	Tile Inlets	Wells Public/ Private	Residential Dwellings/ (10+neighbors)	Drainage Ditch	Roads (right of way)
Surface Applied	50-750' typically 300'	50-750' typically 300'	50-500' typically 300'	10-300' typically 100'	50-1000/50-1000' typically 1000/200'	50'-1 mile/100-500' typically 200/200'	16.5-500' typically 300'	25-100' typically 25'
Injected	50-300' typically 100'	50-300' typically 100'	25-300' typically 100'	10-300' typically 10'	100-1000/50-300' typically 1000/200'	50'-1 mile/100-1000' typically 500/300'	16.5-100' typically 100'	10-200' typically 10'
Incorporated	10-300' typically 100'	50-300' typically 100'	50-300' typically 100'	10-300' typically 10'	100-1000/50-300' typically 1000/200'	50'-1 mile/100-500' typically 100/100'	16.5-300' typically 100'	10'
Irrigated	50-500' typically 300'	50-500' typically 300'	50-500' typically 300'	10-300' typically 10'	100-1000/200-500' typically 1000/200'	50'-1 mile/50-500' typically 100/100'	50-300' typically 300'	25-300' typically 300'

Manure Application Setbacks Within Shoreland Areas

The State of Minnesota requires local governments to adopt and implement shoreland protection ordinances that meet or exceed state thresholds for land use in shoreland areas. The threshold requirements include limitations on the application of manure within the

floodplain areas of lakes and rivers. These thresholds apply in all local jurisdictions unless exceeded by local ordinance area. Several of the county feedlot ordinances submitted to MDA specifically restate these limitations, while others exceed the limits.

Reflections on the Survey Findings

It is easy to conclude from the survey findings that there is a wide variety in both the provisions included in local ordinances, and the specifics of those provisions. There have been attempts to encourage more consistency in the ordinances between counties in Minnesota. This activity has included the development of "Model Ordinances" that were adopted in 1996 by the Association of Minnesota Counties. In some instances these model ordinances have served as the foundation or beginning document in a development process for a county adopting an ordinance for the first time. However, no regions of the state have adopted multi-county ordinances, and it is unlikely that any two county ordinances are exactly alike.

The value of consistency has been debated. Some producer groups feel that wide variations between counties create an uneven playing field for producers. Policy makers defending variety contend that differing county situations (feedlot density, topography, population density, local culture and history, presence of lakes and streams) dictate differing ordinance provisions. Others feel that feedlot ordinances, like traffic laws could be determined statewide, with the standards and provisions for a feedlot being determined by site specific conditions as spelled out in a state or regional ordinance.

The situation around state and local feedlot regulation is dynamic and controversial. County ordinances are variable and subject to frequent changes. Meanwhile more townships are considering adoption of ordinances. The same turmoil exists at the national level as states struggle to find effective and fair ways to deal with a changing livestock industry.

Separation Standards - How Far Away is Far Enough

The traditional basis of planning and zoning is the separation of conflicting land uses. However, very few places in the United States employ "exclusive farm zones" in which only agriculture and agriculturally-related activities are allowed. Far more common are "non-exclusive agricultural zones." The non-exclusive zones allow non-farm residences, usually by right or in a few cases, by special exception. The question becomes: how many houses can a farmer farm around and avoid complaints or threats of nuisance suits? The number of non-farm houses is usually based on a minimum lot size. For example, a 40-acre minimum lot size would mean that a landowner would have to own or purchase 40 acres in order to erect a house. Large minimum lot sizes tend to discourage non-farm buyers because of the price and the fact that most non-farm buyers don't want 40 acres for a building lot. Small minimum lot sizes, such at 2-acres or 5-acres, typically lead to an influx of non-farm residents. This is when the trouble usually begins between non-farmers and feedlot operators. (Coughlin 1981; Daniels 1997; Schindman 1990; Steiner 1984).

The location of an animal feeding facility in relation to non-farm neighbors is important for potential complaints and nuisance suits. The farther an operation is from non-farm

neighbors, the the lower the likelihood of complaints and nuisance suits. The National Pork Producers Council has recommended a modified version of an Austrian federal guideline designed to be incorporated into local land use development plans. The state of Iowa requires distances of 750-2500 ft. between residences and various CAFO structures. (Lorimor 1995)

The Model Feedlot Ordinance adopted in 1996 by the Association of Minnesota Counties' District VIII Feedlot Task Force recommends a 1/4 mile setback from a single neighboring residence and a 1/2 mile setback from 10 or more residences or a municipality. (Association of Minnesota Counties 1996) As discussed above, local governments in Minnesota have required setbacks and separation distances ranging from 500 to 2640 ft. The application of empirical research regarding the most effective separation, set-back and buffer distances for mitigating odors from animal feeding operations would aid in the development of more uniform standards.

A design-based approach to separating many types of agricultural land uses from non-farm uses has been to cluster non-farm rural residential lots on a smaller area of land away from neighboring farms. The protected open space buffers the residential cluster from farm impacts (and visa versa) and can serve as an aesthetic amenity or wildlife area. (Arendt 1994; Yaro, et.al 1989).

Landscape Based Strategies

Implementing land use policies and/or practices which simultaneously address aesthetic and ecological values and still meet the mitigation needs/concerns of intensive livestock production presents real challenges. Nassauer's explorations of the link between the appearance of agricultural landscapes and their ecological health in the corn and soybean country of Minnesota and Iowa may be relevant ((Nassauer 1979; Nassauer 1986; Nassauer 1989; Nassauer 1992) Using the Conservation Reserve Program (CRP) as a possible vehicle for incorporating aesthetic objectives into agricultural conservation policy, she has attempted to develop a set of visuals cues - based on culturally recognized aesthetic norms and indicators of good stewardship - that would serve to portray the landscape care intended by the farmer. Many of these cues/signs are directly translatable form row crop to animal agriculture - others would have to modified.

Nassauer discusses several rural landscape qualities - scenic quality, neatness and stewardship - that were ranked highly by her Minnesota research participants:

> Scenic quality will be most apparent to tourists and it relates most directly to economic development opportunites. Scenic quality often is apparent in landscapes that have a mix of land suitable for cultivation and land that farmers might describe as "not meant to be farmed," too steep, or too wet for farming. Where farming has respected limits imposed by natural features… the landscape is often scenic. (Nassauer 1989)

While this type of scenic beauty is also recognized by farmers, they have a different set of aesthetic standards for their own land:

> Neatness is the aesthetic theme traditionally associated with good farming. The fact that farmers have control over and responsibility for the neatness of their land helps to explain why neatness is attractive. By keeping farmsteads and fields neat, farmers also express a concern for their neighbors and the appearance of the neighborhood. Unlike scenic quality, neatness shows what the farmer has been doing; it reflects on the farmer.
>
> Farmsteads and rural residences described as neat are well-maintained (buildings recently painted, new or highly functional agricultural buildings); grass is mown; trees, shrubs, flowers, and often fences and lawn ornaments are included on the site. Equipment is not left outside; any buildings not being used have been taken down. Interview participants suggested that a neat farmstead indicated that the farmland itself was well cared for. (Nassauer 1989)

Stewardship is the third landscape theme. It is not necessarily visible and is often open to misinterpretation:

> Stewardship is not always noticeable. Many conservation practices demonstrate no visible control by the farmer. They may even be taken for signs of neglect. No-till farming, wetland restoration, and perennial cover on CRP land are examples. (Nassauer 1989)

Using socially recognized signs of stewardship to portray ecological health and human purpose in the rural landscape involves "labeling ecological function" with conventional signs of human intention, "setting expected characteristics of landscape beauty and care side by side with characteristics of ecological health." (Nassauer 1992)

Designing CRP land (or other rural landscapes) to better communicate their ecological benefits and make it clearer that such areas are not being neglected might involve selective mowing (neatness), introducing flowering plant species into roadside or fencerow vegetation (scenic beauty), or using fences and signage to provide information about the purpose of the landscape. (Nassauer 1989)

A demonstration project is currently underway in Hamilton County, IA to determine the "aesthetic, odor control and economic benefits of tree landscaping around hog barns." Iowa Select Farms has been working in partnership with Trees Forever, a nonprofit environmental organization, to study how plants affect odor control. "A major goal of the project is to determine which species of trees do the best job of filtering particulate matter, thereby reducing odors." Other goals of the project are to improve energy savings from the use of tree windbreaks, attract wildlife by providing food and cover in the form planted trees, shrubs, native grasses and wildflowers (which is also intended to reduce mowing) and created wetlands, and generally improve the appearance of the facility and grounds. (Bernick 1999)

The use of treatment wetlands to improve water quality, e.g., from urban stormwater and wastewater, is becoming increasing popular. (Kaldec and Knight 1996) They are often more cost effective then conventional treatment methods, and offer ancillary benefits such as wildlife habitat and recreational open space. Wetland vegetation and wildlife provide aesthetic enjoyment and can become magnets for birdwatchers. Constructed

wetlands are also finding their way into the agricultural environment to treat animal wastewater.

The Tennessee Valley Authority, in cooperation with the Soil Conservation Service (now NRCS) and Auburn University built one of the first such systems in 1988. The system at Auburn's Sand Mountain Agricultural Experiment Station was constructed to handle effluent from a secondary lagoon treating waste from approximately 500 hogs. (Hammer 1993) The number, size and type of animal facilities served by such systems has now expanded significantly. (Constructed Wetlands for Animal Waste Management 1996) (Schwab 1999; Henderson 1998)

QUESTION 3: WHAT ARE THE COSTS AND BENEFITS OF THESE DIFFERENT LAND USE STRATEGIES?

The literature quantifying the costs and benefits of different land use strategies as applied to animal agriculture is nearly nonexistent. As noted earlier in this report, and researched in the External Benefits and Costs report, the research on the cost and benefits of feedlot impacts on nearby landowners' property values is limited and contradictory. (Taff and others 1996) (Palmquist and others 1997) (Abeles-Allison and Conner 1990) (Rikoon 1999).

There is, however, substantial literature investigating “smart growth”, the cost of public services and the fiscal impact of various types of urban development. These studies, including the most recent study by the Minnesota Department of Agriculture on cost of services, show that “new residential development is more fiscally advantageous when it occurs within or adjacent to established urbanized areas.” (Duncan Associates 1999) Low-density residential development is more expensive than high-density development. The cost of services studies and fiscal impact studies are in virtual consensus. The conclusion that increasing density decreases societal, public, or private costs is held by nearly every type of organization that has studied the cost issue. (American Farmland Trust 1986, 1992, 1994; Burchell 1992: Center for Energy and Environment 1999: Dahlgren Shardlowe Uban 1996; Fodor 1997; Gray 1989; Minnesota Extension Service 1996; Minnesota Planning 1997a,b; Sherburne County 1995; Young 1995)

The agricultural land protection policy debate is informed by cost of service and fiscal impact studies. These studies are often used to support the development of growth boundaries and agricultural preservation programs. It can not necessarily be assumed, however, that these results transfer directly into the debate over siting and operating animal agricultural operations.

The 1999 Duncan report for the Minnesota Department of Agriculture reports on case studies in five Minnesota Counties where they applied a fiscal impact model developed for the project. Key findings of the study include:

■ Urbanization accounted for only a portion of Minnesota’s decline in agricultural acreage. Other factors included: lower market prices, soil degradation, and greater production efficiencies.

■ Where agriculture is a large part of the tax base, it usually produces more in taxes than it requires in services.
■ New residential development will likely generate a financial shortfall for all five county governments over the next two decades.
■ New residential development will generally come closer to supporting itself in cities than in townships when the combined impact on county and municipal budgets is considered.

These key findings reflect the findings of the other Minnesota specific cost of service studies; that agricultural land demands less in service costs than it contributes in taxes. (American Farmland Trust 1992, 1994; Gray 1989; Sherburne County 1995)

GAPS IN THE LITERATURE AND RECOMMENDATIONS FOR ADDITIONAL RESEARCH

As highlighted in the report, the two areas with virtually no literature responding to the scoping questions are:

- the effectiveness of suggested land use strategies over time, and
- the costs and benefits of land use strategies used to address animal agriculture conflicts.

The results of research on effectiveness and costs and benefits would be helpful to local policy-makers and community residents in making choices between strategies. These two research areas are related in that effectiveness could be researched in cost/benefit terms. Research on effectiveness could also measure indicators of effectiveness such as:

- nuisance complaints,
- non-farm residences within proximity of feedlots,
- conditional use requests and whether or not conditions are complied with,
- request to view comprehensive nutrient management plans,
- abandoned operations and clean-up procedures, and
- other responses of operators.

Additional effectiveness related research questions include:

- What is the cost to producers of complying with the regulations?
- Are land use regulations influencing the size and location of CAFOs?
- Are the regulations creating quantifiable benefits, such as improvement in air and water quality, and reduction in complaints from non-farm neighbors?
- Are regulations aimed at closure and clean-up of manure storage lagoons working satisfactorily or are "rural brownfields" being created? Who is paying to clean up abandoned manure lagoons?
- Do local governments have adequately trained staff and equipment to enforce zoning and environmental regulations concerning the siting and operation of CAFOs?
- What are reasonable setbacks, screenings with trees and vegetation, and best management practices?
- What are the risks to local governments in operators suing over land use regulations?
- What are some examples of citizen participation in the creation of local government comprehensive plans and zoning ordinances that involve the regulation of CAFOs?
- Are different zoning and environmental regulations more effective for different animal species?
- Does the use of moratoria result in better policy development?

These many questions for future research suggest that it will be many more years before the impacts of attempts to regulate CAFOs will be fully known.

LIST OF RESEARCHERS CONDUCTING FOR ADDITIONAL RESEARCH

Key Researchers	On-going Research	Expected Completion Date
Prof. Ronald Fleming Dept. of Agricultural Economics, University of Kentucky	Manure Application Setbacks	February, 2000 Land Economics
Prof. Jim Pease Dept. of Agricultural Economics, Virginia Tech University	Impact on dairy production of implementing best management practices to improve water quality	December 1999
Prof. Pat Norris Agricultural Extension Economics Service, Michigan State University	Appropriate setbacks for concentrated agricultural feeding operations	September 1999
Mr. Lee Christensen USDA - Economic Research Service, Washington, D.C.	Constructed wetlands as an alternative swine waste treatment option	September 1999
Prof. H.L. Goodwin Dept. of Agricultural Economics, University of Arkansas	A planning tool for local governments in planning and zoning for CAFO's. Model uses Geographic Information System spatial analysis with multiple criteria to identify suitable locations for CAFO's.	Spring 2000

Note: The Indiana Department of Environmental Management is currently working on regulations for large hog farms. IDEM 100 N. Senate, P.O. Box 6015, Indianapolis, IN 46206-6015. Phone # (317) 233-6645.

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General environmental impact 1.3. Overall waste production 1.4. The Key-indicator. 1.1. Introduction. The study describes and analyses the relationship between the production of waste in animal product processing industries on the one hand and the prevention and treatment of the waste on the other. The industries discussed are slaughterhouses, tanneries and the dairy industry.Â The conclusions and recommendations in chapter 6 summarize the technological and policy options that may help reduce waste production and the negative impact on the environment from the processing of animal products. 1.2. General environmental impact. 1.2.1. Wastewater 1.2.2. Solid waste 1.2.3. Air pollution. In fact, fertilizers and pesticides play a crucial role in agriculture, representing a powerful tool for growers to increase yield and guarantee continuous productivity throughout the seasons under both optimal and suboptimal conditions. In the last three decades, several technological innovations have been proposed to enhance the sustainability of agricultural production systems, through a significant reduction of synthetic agrochemicals like pesticides and fertilizers. A promising and environmental-friendly innovation would be the use of natural plant biostimulants (PBs) that enhance floweri The environmental impact of agriculture involves a variety of factors from the soil, to water, the air, animal and soil variety, people, plants, and the food itself. Some of the environmental issues that are related to agriculture are climate change, deforestation, genetic engineering, irrigation problems, pollutants, soil degradation, and waste.Â Environmental impact of modern agriculture. The Environmental Impact of Livestock - RUVIVAL Toolbox. Animal Agriculture and Climate Change | This video may change your life, for good! Modern Agriculture Effects Part 1. The Environmental Impacts of Agriculture (In Brief). Transcription. Contents. The following points highlight the five main impacts of agriculture on environment. The impacts are:- 1. Degradation of Land 2. Deforestation 3. Biodiversity 4. Pest Problem 5. Disposal of Industrial & Agricultural Wastes. Impact # 1. Degradation of Land: The degradation of land in one form or the other is matter of serious concern endangering sustainability of agriculture.Â Similarly, increased dependence on intensive agriculture and irrigation also resulted in salination, alkalination and water logging in the some irrigated area of the country. Therefore apart from problem soils forming a significant part of the total area, the following are the kinds of land degradations taking place Agriculture can have significant impacts on the environment. While negative impacts are serious, and can include pollution and degradation of soil, water, and air, agriculture can also positively impact the environment, for instance by trapping greenhouse gases within crops and soils, or mitigating flood risks through the adoption of certain farming practices. The OECD monitors the linkages between the environment and agriculture, identifies successful agricultural policies that mitigate the negative environmental impacts while enhancing the positive ones, and provides recommendations to impro