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Business Environmental Risk Management: An Introduction

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Managing business environmental risk in agriculture consists of making the production process more efficient in such a way as to limit its environmental consequences while increasing profitability.

No productive activity is 100 percent efficient. Among the inputs used, some are transformed into the desired product while others are discarded as waste or by-products or escape into the environment. Unused inputs in a productive process constitute a pollutant if they have a negative impact on the environment. This publication focuses on the potential impact of various agricultural production and land-based decisions on the environment.

This publication defines risk, progressively focusing on farming-related risk as it pertains to business viability and the environment. Risk categories are introduced to help readers understand (1) whether a decision affects the environment, their business or both; (2) whether the effect is immediate or in the future; and (3) whether the best course of action is to reduce the likelihood of a problem or to minimize the adverse consequences of a problem. The publication describes various management alternatives intended to promote profitable production while minimizing environmental impact.

What is risk?

Risks arise from uncertainty, but risk is not the same as uncertainty. Given a course of action — for example, choosing a production practice or planting a particular crop — uncertainty is the exposure to possible (uncertain) outcomes that would significantly affect production, prices or profits (positively or negatively). Risk centers on the possibility and degrees of *adverse* consequences or outcomes (e.g., loss, damage, delay or peril).

Risk can be described as the combined answer to three questions:

- What can go wrong?
- How likely is it to go wrong?
- What are the adverse consequences?

Business environmental risk management on the Web

The University of Missouri has developed an interactive Web site, **cares.missouri.edu/berm**, where Missouri landowners can easily generate an individualized report of the known environmental sensitivities associated with their land. (Note that at this time, the Web site is accessible and functional only on computers using the Windows operating system.) By means of aerial photographs, the Web site enables a user to locate a parcel of land by selecting a county and then zooming in on a specific place by following natural landmarks such as highways and streams.

A user can generate a report on environmental sensitivities such as location in an impaired watershed, presence of landscape features such as sinkholes and floodplains, and slope of the land. Reports are designed to provide farmers with insight into environmental risks associated with their land.

The report includes links to information about regulations, educational programs and financial assistance to help farmers in managing environmentally sensitive land.

See page 6 for information about how to use the BERM Web site.

Pollutants

A **pollutant** is anything released into the environment that can have negative effects on the environment and health. Some common pollutants arising from agriculture are

- Sediment
- Fertilizers — nitrogen and phosphorus
- Chemicals — herbicides, insecticides and fungicides
- Particulate matter — dust and smoke
- Microorganisms — fecal coliform
- Gases — ammonia, hydrogen sulfide

What can go wrong?

In agriculture, as in all complex enterprises, any number of things can go wrong. Agriculture-related problems that can have environmental consequences include the following:

- Soil loss from crop fields
- Manure storage discharge or leaks
- Odor from the production site
- Chemical runoff from applied sites
- Land-applied manure entering streams

How likely is it to go wrong?

Farmers have little ability to control some events, such as the timing and amount of rainfall or the price of inputs. But the probability that certain activities will "go wrong" depends in part on management decisions made by the farmer. The probability of soil loss from a field can be affected by tillage practices, crop choices and characteristics of the field. The probability of a manure storage leak can be affected by the materials used to construct the manure storage, the capacity of the storage, or the type of manure stored.

What are the adverse consequences?

Adverse consequences of an agricultural event can affect both the business of a farm and the environment. For an action or event to have an adverse effect on the environment, a pollutant lost into the environment must be in a location and in a sufficient quantity that negative effects on the environment can occur. For it to have an adverse effect on the business, it must create a cost to the business. The cost can be in the form of expenses of cleaning up the problem, paying fines, decreased ability to obtain financing, loss of good neighbor relations, etc.

Whether or not a potential pollutant has an adverse environmental consequence depends on whether it enters the environment in sufficient quantity to damage the environment or impair health. Even if no clear environmental damage occurs from an event (such as a manure spill), it can affect business through cleanup costs or fines for violating laws.

Odors are a fact of life for livestock production. They create an adverse consequence when they irritate neighbors. If the odors result from hazardous levels of pollutants in the air, they can have an adverse effect on the business when they lead to increased medical expenses or downtime for farm workers, decreased productivity or increased animal health expenses.

What is environmental risk?

In every production process, whether agricultural or nonagricultural, inputs are used to create a finished product or commodity. Inevitably, some inputs are not fully used and are released into the environment in forms that may be considered pollutants. Whenever the level of pollution exceeds the environment's ability to absorb and process these discharges, environmental risks develop.

Environmental risk, as the term is used in this guide, refers to the likelihood that a business action or process will have an adverse effect on the environment. Specifically referring to agriculture, environmental risk refers to the likelihood of adverse environmental effects of activities associated with farming or land ownership. Environmental risk can never be eliminated from food and fiber production.

Environmental risk can be categorized by where the effects of adverse outcomes occur. Most environmental risks are associated with effects on water (both surface and groundwater), air and habitat. Similarly, environmental regulations that govern decisions on the farm center on water, air and habitat concerns. One difficulty with environmental risk is identifying the possible adverse environmental consequences associated with modern farming activities and the likelihood of their occurrence.

Environmental risks are complicated by the time lag between a management action or event and its effect on the environment. Some adverse effects materialize quickly, as in a fish kill or a spike in drinking water concentrations of agricultural chemicals. Other events occur only after a significant period of time. The amount of time required for fertilizers to percolate through the soil into groundwater can be several years. Remediation of an adverse environmental consequence that took years to develop can take equally long to see improvements from corrective actions.

Another complicating factor in environmental risk is that the pollutants released by a single farm or farming operation may not trigger an adverse effect when considered in isolation. However, when many farms produce similar discharges, the cumulative effect can be adverse. In other words, any given farm can affect the environmental consequence of actions on other farms. For example, a farmer who applies excessive nitrogen fertilizer that subsequently enters a stream may have little or no negative environmental effect on water quality if no other farmer in the watershed has nitrogen runoff into the stream. However, if several farmers in the watershed have nitrogen fertilizer leave their fields and enter a stream, the level of nitrogen could exceed a standard that indicates that the stream has been impaired by nitrogen.

What is business environmental risk?

Business environmental risk arises from the probability that adverse environmental effects of business decisions will affect business performance and viability. An adverse effect on the environment for which the business is not held responsible does not necessarily have an adverse effect on the business. Examples of environmental risk without business environmental risk are loss of fertilizers or chemicals from fields into water sources or odors that neighbors accept as normal.

Many environmental risks have an inherent effect on business. Soil loss into a stream means that the productive topsoil of the fields is diminishing. Chemical and fertilizer loss might mean that insufficient amounts are available to the crops for which they are intended. Because environmental effects frequently are linked to business performance, the opportunity exists to increase profitability while enhancing the environment.

Business environmental risk management

Farmers manage, or minimize, environmental risk for several reasons. First, farmers consider themselves stewards of the land, interested in preserving the productive capacity of their farms and minimizing waste and its effects on the environment. Second, farmers manage environmental risk because government regulations, farm program guidelines or informal community pressures compel them to minimize their effect on the environment. Third, farmers manage environmental risk to help manage business risk — by lowering one they lower the other.

Risk implies a chance of an adverse outcome. Managing environmental risks involves taking steps to (1) reduce the probability of the adverse event and (2) reduce the magnitude of the event should it occur.

Rarely, if ever, can the probability of an adverse outcome be reduced to zero. It can, however, usually be reduced by management that more closely controls the production process. For example, the probability of a lagoon overflow can be reduced by building a lagoon that contains sufficient volume to store 13 months of manure rather than 6 months of manure. Chronic, or long-duration, rainfall events are less likely to affect the level of a properly managed 13-month lagoon than they are a properly managed 6-month lagoon. While the probability of an overflow is lower, it is not zero.

Rather than, or in addition to, reducing the probability of an adverse event, the purpose of risk management may be to reduce the magnitude of an adverse event. A breach of a full 13-month lagoon would clearly be a much more adverse event than a breach of a smaller lagoon. As a risk management measure, a secondary containment system between the lagoon and a stream would catch a spill from a lagoon so that the magnitude of the environmental problem is reduced.

Both the choice of lagoon size and the presence or absence of secondary containment are management decisions. Routine inspection of the lagoon liquid levels is another management activity that reduces environmental risk at little cost. The financial position of the farm influences which management decisions are appropriate for the business.

Production management

The most basic way to manage environmental risk is to practice sustainable production practices. Sedimentation in a stream is not only an environmental problem but a production problem. Soil is productive in the field where crops are being grown — not in the stream. Spray drift of pesticides indicates that the pesticide did not reach its intended target at its intended rate. The potential environmental and legal liability associated with pesticide spray drifting off the farm is accompanied by a production cost of reduced pesticide efficacy or additional pesticide applications.

Some economically justifiable management decisions reduce production risk but increase environmental risk. Fall application of inexpensive nitrogen fertilizer fits with some production situations. Fall application is more convenient than preplant spring application. Considering the potential cost of delaying spring planting due to difficulty in timely nitrogen fertilizer application, fall application can make economic sense. However, fall application does increase the probability that the nitrogen will leave the field and harm the environment. These situations require trade-offs and experimentation to maximize production efficiency while minimizing negative externalities.

One management decision that has benefited the environment and agricultural profitability for many farmers is no-till production. No-till production reduces the costs of many inputs while simultaneously reducing soil loss by erosion.

Retiring marginal land from production and using it as a buffer or wildlife habitat may actually increase farm profit if these areas are unprofitable or if the

Externalities

In discussions of environmental issues, a hidden cost is often described as an externality. A "negative externality" is a hidden cost created by one party but borne by another. Correcting negative externalities is one of the major purposes of environmental policy and regulation.

The major difficulty in such situations is estimating the costs and benefits of correcting the negative externality. What is the benefit to society of not having another inch of silt in the reservoir? What are the costs of policies to reduce erosion?

As government regulation emerges to address such long-term problems, the adverse consequences also affect the farm indirectly through costs of compliance with new farm program rules or regulations.

When the party that creates an externality is required to pay for the costs associated with those decisions, it is called "internalizing the cost."

farmer's time is better spent on another activity. New technologies such as precision agriculture facilitate the evaluation and separate management of portions of fields. Public policy that pays farmers to keep land in production or remove land from production can have environmental consequences.

Production investment

Several improvements can be made in fields to reduce the probability of significant environmental impact. Building terraces on steeply sloping fields and installing grassed waterways can reduce soil erosion and filter sediment out of runoff water so that it does not enter a stream. Buffer strips and riparian zones can also preserve water quality and wildlife habitat.

These improvements are often expensive. State and federal technical assistance and cost-share dollars can help reduce the cost to farmers. Contact local offices of the U.S. Department of Agriculture or the Fish and Wildlife Service, and the Missouri Department of Conservation or Soil and Water Conservation Districts to find out what programs are available to landowners to improving their landscapes.

Reducing the environmental risk from animal production can be managed by investments such as larger manure storage facilities or more efficient land application equipment. If insufficient land exists for applying manure according to a nutrient management plan, producers can enter into spreading agreements with neighbors or acquire easements to permit application of manure on nearby land.

Community involvement

Because pollution can affect large areas, individuals frequently must organize to accomplish particular environmental goals. Community involvement can range from organizing and helping other farmers manage their land in ways that reduce environmental risk to educating citizens about how agriculture affects the local environment and economy.

Farmers may want to consider evaluating their watershed for potential problems. In recent years the Environmental Protection Agency (EPA) has required that states identify "impaired waterways," where water quality is below a specified standard. Impairments can result from excessive levels of nutrients (fertilizer or manure), bacteria, pesticides, sediment, metals and other pollutants. In these watersheds, a total maximum daily load (TMDL) of specific pollutants will be established.

Farmers who identify and address issues in their watershed before it is designated as "impaired" will find that approach more flexible and economical in the long run. Any farm within an affected watershed needs to be involved in identifying the environmental risks present and methods of reducing the probability and size of potential adverse events.

Watershed management programs in the EPA and the U.S. Department of Agriculture have been set up to reduce nonpoint source pollution within an area that drains into a particular body of water.

Stakeholders in the watershed must work together to set targets and work to implement practices to reduce the levels of the pollutant in question. Involvement in setting standards for individual bodies of water and in developing watershed management plans is one way landowners can manage their business environmental risks associated with environmental policies such as the TMDL program.

When the cumulative effect of many farming operations is creating an environmental risk, it may be economical for individual farms to implement a relatively inexpensive management practice to reduce nitrogen runoff, each by a modest amount. Unless all or most farmers cooperate, the voluntary, economical approach may break down.

Political involvement

Environmental regulations commingle science and public policy. While science can determine how much of a pollutant is in the water or air at any point in time, it is public value judgments that determine whether that amount is considered to impair the quality of the environment. Involvement in both the scientific and public policy realms of environmental regulations can be a way of managing business environmental risk.

When a regulation is promulgated, it must be open to public comment. During this period, all interested parties can express their views of the proposed regulations. These comments are considered by the regulatory agency before the rule is finalized. By submitting thoughtful comments regarding the incentives farmers

Point vs. nonpoint source pollution

Point source pollution originates from an identifiable source — typically a pipe emptying a liquid or gas into the environment. By altering the makeup of the material coming out of the pipe, it is possible to alter its effects on the environment.

While smokestacks and sewer pipes typically are considered point sources, agriculture also can be a point source polluter. Concentrated animal feeding operations are considered point source polluters because the source of the pollutant is known and can be readily monitored.

Nonpoint source pollution originates from a source or sources not readily identifiable. Because the source is not readily identifiable, reducing the pollutant load can be difficult. It usually requires that studies be done to identify the sources. Even after the pollutant sources are identified, cleaning up the pollution can be difficult and time consuming.

Agriculture is typically considered a nonpoint source of pollution. Sediment, nutrients and chemicals running off the edge of fields into streams are classic nonpoint source pollutants. But agricultural runoff is not the only nonpoint source pollutant. Runoff from urban lawns, parking lots and construction sites are also nonpoint source pollutants.

face and how the proposed regulations are likely to be implemented in light of those incentives, farmers can help regulatory agencies design and put in place programs that are likely to have the desired outcomes.

State and federal governments have various programs designed to provide technical and financial assistance to landowners. While the broad objectives of these programs are established by the government, many of the programs require local citizen boards to determine local priorities. By serving on these boards, farmers can help to ensure that the priorities that are of greatest consequence to agriculture in their area can be targeted for these funds.

The importance of business environmental risk management

A major problem with regulations to reduce environmental risk is that policy makers often work under administrative directives that reduce their flexibility in accounting for differences in local conditions. Specific national-scope management practices are enacted without consideration for local circumstances or conditions. It might happen that a generic practice is prescribed when local conditions warrant another approach.

Business environmental risk will almost certainly be of increasing concern to farmers in light of current trends in society, environmental policy and federal farm policy. U.S. citizens, increasingly removed from the farm and accustomed to abundant, inexpensive food supplies, are focusing on environmental benefits. Federal environmental policy is intensively focusing on nonpoint sources of pollution, including agriculture. Likewise, the trend in federal agricultural policy toward incentives tied to conservation and environmental quality will continue as both environmental groups and international free trade negotiations call for reduced farm subsidies tied to production.

In demanding higher levels of environmental risk management by farmers, society could be faced with increased food prices and the prospect of some number of farm business failures. It is often said that as we become a wealthier country, we can afford to be more concerned with issues of environmental quality and food safety. American consumers are spending a decreasing proportion of their income on food. Thus, a trade-off between higher food prices and improved environmental quality is one that many citizens may be willing to make.

As consumer income increases, consumption patterns change. Given the current levels of income in the United States, increasing consumer income has little effect on the demand for food. But the same increase in income will result in a significant increase in demand for other products and services. Increasingly, consumers are demanding "environmental services" such as outdoor recreational opportunities, clean streams, safe drinking water and clean air where they live and travel.

Business environmental risk management becomes more important with the increasing cost of complying with regulations. It becomes more important also with the increasing cost of ignoring environmental risk. Crop farmers must follow conservation guidelines or risk losing program payments. Large livestock producers must follow nutrient management plans or risk incurring fines or losing operating permits. For some livestock producers, local ordinances and community pressure, to a greater extent than federal and state policies, have forced increased attention to environmental risk.

Societal trends pointing to the need for greater environmental awareness in agriculture:

- Decline in the number of people employed in agriculture
- Decline in the proportion of the population on farms
- Increasing size of farms
- Urbanization — more affluent nonfarm citizens living in proximity to agricultural production
- Public perception of agriculture as big business
- Perception of hazardous accidental pollution from modern, large-scale agriculture
- Importance of regulating nonpoint sources, such as agriculture, to achieve further improvement in water quality

Governmental assistance programs

USDA Environmental Quality Incentives Program
http://www.nrcs.usda.gov/programs/eqip/

a voluntary conservation program for farmers and ranchers to promote agricultural production and environmental quality as compatible national goals.

Missouri Department of Natural Resources Soil & Water Conservation Programs
http://www.dnr.mo.gov/wpscd/swcp/service1.htm

• Special Area Land Treatment (SALT) program — a watershed-based program in which soil and water conservation districts (SWCDs) direct technical and financial assistance to landowners to reduce agricultural nonpoint source pollution.

• Cost-Share — funds are available to landowners to pay up to 75 percent of the cost of instituting soil conservation practices.

Missouri Department of Agriculture Animal Waste Treatment Loan Program
http://www.mda.mo.gov/Financial/a2c.htm

finances animal waste treatment systems for independent livestock and poultry producers at below conventional interest rates.

Missouri Department of Conservation Private Land Assistance
http://www.mdc.mo.gov/landown/

helps Missouri landowners achieve their land use objectives in ways that enhance conservation of Missouri's natural resources.

U.S. Department of Interior Private Stewardship Program
http://endangered.fws.gov/grants/private_stewardship/index.html

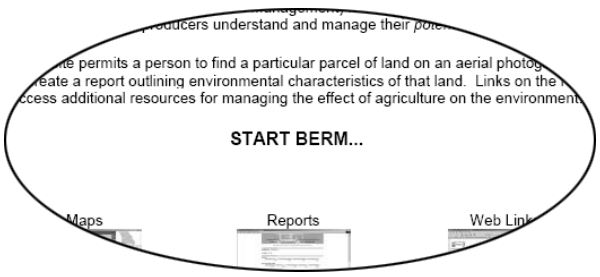
provides grants and other assistance on a competitive basis to individuals and groups engaged in local, private and voluntary conservation efforts that benefit federally listed, proposed, or candidate species, or other at-risk species.

Using the BERM Web site

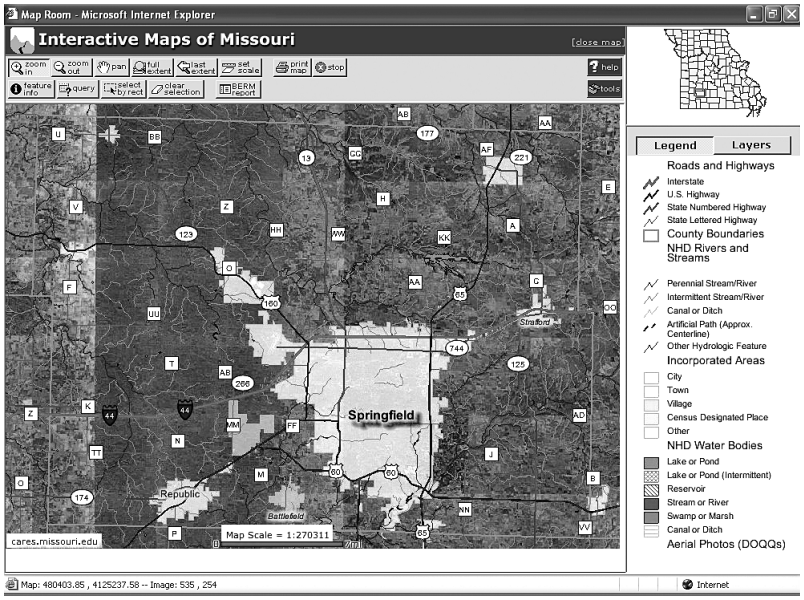
http://cares.missouri.edu/berm/

BERM
Business Environmental Risk Management
Information for Managing the Effect of Agriculture on the Environment

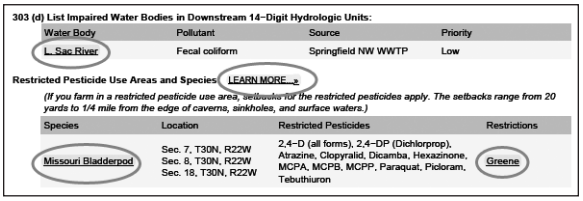
1. Select "Start BERM" from main menu.



2. Select the county of interest and click the "Make Map" button.
3. Use highways and other landmarks to locate the land of interest.



4. Click the "zoom in" button at the upper left corner of the screen. In the upper left corner of the approximate area you wish to enlarge, press and hold your left mouse button while moving the curser to the lower right corner of selected area. This creates a zoom box around the area. Release the mouse button. Continue the process until the land area you have selected is centered on the screen.
5. If you zoom in too far, use either the "zoom out" button or the "last extent" button to expand the view.
6. Press the "BERM report" button to generate a report for the selected location. Choose the format in which you would like to view the report. PDF is the recommended format.
7. The BERM report includes numerous links to other Web sites for further information. In this example, links are circled.



8. You may print the report or save it as a PDF file for easy access in the future.
9. The map legend shows map symbols of the current visible layers. Click the "Layers" button to list the data layers and display setting controls.

   a. Check the box in the show column to show or hide a map layer.
   b. Check the box in the label column to turn on or off feature names.
   c. Use the active column to determine the map layer for interaction (feature info, query, etc.).
10. A layer must be shown on the map (see step 9) to use the "Feature Info" button. Select the "Feature Info" button, and then click the area of interest on the map to view land features or attributes on the interactive map. Examples of data to choose from:

    a. Soil outlines
    b. Flood plains
    c. National Hydrology Dataset (NHD) rivers and streams
    d. National Wetlands Inventory
    e. NHD water bodies