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UNITED
STATES
DEPARTMENT
OF AGRICULTURE

**AN EVALUATION OF
THE FARMSTEAD ASSESSMENT PROGRAM
IN CRITICAL MICHIGAN WATERSHEDS
FINAL REPORT**

Submitted to: Michigan Department of Agriculture
Submitted by: Christina Coulon, Natural Resources
Conservation Service



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BACKGROUND

In 1994, the USDA's Natural Resources Conservation Service took a leading role in groundwater protection by launching their USDA/AmeriCorps Farm*A*Syst program. AmeriCorps, a national service program similar to the Peace Corps, provides volunteers to communities that have identified unmet needs. The Natural Resources Conservation Service saw an opportunity to advance groundwater protection efforts by using AmeriCorps members in the communities it serves. The USDA/AmeriCorps members delivered the Farmstead Assessment System, more commonly known as Farm*A*Syst, a risk assessment of farmstead structures and practices for their potential to contaminate groundwater. The USDA/AmeriCorps program began in October, 1994 and concluded in September, 1995.

Six watersheds were identified by the Natural Resources Conservation Service as having characteristics most favorable for groundwater contamination. These characteristics include soil type, geology, pesticide and fertilizer sales, incidence of contamination and population. The six watersheds selected are direct drainage to Lake Michigan, the Lower Grand River, the Kalamazoo River, the Upper Grand River, the Raisin River and the Black, Belle and Pine Rivers (see Appendix A).

The USDA/AmeriCorps members were placed in NRCS or Michigan State University Extension offices within these watersheds. The members began delivering Farm*A*Syst after completing their training in November, 1994. They used a variety of methods to solicit participants in the Farm*A*Syst programs, including but not limited to newspaper and newsletter articles, phone calls, group presentations, radio and TV spots and farm visits with a District Conservationist or Extension Agent.

When conducting an assessment, the USDA/AmeriCorps member would look at the farming operation at the farmstead with the farmer. After discussing the different farming activities, the USDA/AmeriCorps member and the farmer would complete the worksheets that are part of the Farm*A*Syst packet (see Appendix B for a sample worksheet). The farmer would only complete the worksheets pertaining to their operation, although pesticide recertification credits were given if certain worksheets were completed. A maximum of six recertification credits could be obtained in this manner.

OBJECTIVES OF THE EVALUATION

The specific objectives of the evaluation are as follows:

- 1) To gauge farmers perception of personal risk from groundwater contamination after completing a farmstead assessment.
- 2) To determine what factors are associated with making changes to lower risk from groundwater contamination.
- 3) To solicit feedback from farmers on how to improve the USDA/AmeriCorps Farm*A*Syst program.

THE EVALUATION STUDY

Although Farm*A*Syst has been used in Michigan since the early 1990's, no comprehensive evaluation of its effectiveness has been completed. There have been summary reports by Michigan State University Extension agents who have had Farm*A*Syst programs in their county, however no scientific study has been attempted.

The intent of Farm*A*Syst is to provide information to rural landowners so they can reduce the risk from practices around the farmstead that have been identified as high risk for groundwater contamination. To do this, it is necessary for the landowner with a high risk situation to make a change to lower their risk. This evaluation seeks to identify factors that can be associated with making the changes necessary to reduce high risk farmstead practices. Knowing what these factors or variables may be can also help focus education efforts.

RATIONALE

The ultimate reason for protecting groundwater from contamination is to protect the health of those dependant on this water for consumption. Therefore, theories of health behavior, and more specifically, preventative health behaviors are applicable in this case. Many explanatory theories exist, including the theory of reasoned action, the health belief model, and the subjective utility theory (Ajzen & Fishbein, 1980; Becker, 1974; Sutton, 1982). While these theories are useful and supported by empirical data, they are limited in scope. They look at the decision to adopt a health precaution as a cost-benefit decision, and assume the precaution will be adopted if the benefits outweigh the costs. They only consider one threat to health and one

preventive response. They also look at the factors that influence the decision to act as functions in an algebraic equation, allowing only the factors to change value. The factors themselves must remain constant and no other factors may be considered.

For this evaluation, a different type of model was used to assess preventive health behavior. The Precaution Adoption Process proposed by Neil Weinstein of Rutgers University views precaution adoption as a process involving distinct stages. The factors influencing change in one stage of the precaution adoption process may differ from those factors in other stages. Change is not seen along a continuum as in the other models. However, the factors influencing the decision to adopt a precaution may be the same as those used in the other models. These factors include the individuals perceived susceptibility to the threat, the perceived severity of the threat, the perceived effectiveness of the precaution and the perceived costs of adopting the precaution. The precaution adoption process assesses the stage of precaution adoption the individual is in and attempts to determine if the factors in question affect their standing in that stage. This evaluation was designed to assess precaution adoption according to Weinstein's model using the influencing factors that have been empirically tested in previous studies on preventive health behavior.

DESIGN

This study was designed to establish which stage of precaution adoption the individual is in after identifying a high risk situation through the farmstead assessment. The stages include: doing nothing about the situation, deciding what to do, planning to act but not acting yet, having already acted. The influencing variables used in the survey include general knowledge of groundwater pollution processes, the level of personal risk, level of concern about groundwater contamination, the perceived difficulty of remediation, the effectiveness of precautions adopted, property values if contamination were to occur, increased awareness of groundwater contamination and the likelihood of contamination on the individuals property. Other aspects of risk perception were addressed but not analyzed using the stages of precaution adoption.

DATA COLLECTION

The data were collected by surveying all participants in USDA/AmeriCorps Farm*A*Syst. The data collection began in May, 1995. Due to confidentiality concerns, the USDA/AmeriCorps members were not keeping official lists of those conducting assessments. Unfortunately, imperfect recall of those participating in the first few months of the program resulted in 100 participants excluded from the sample. In addition, a total of 145 assessments were conducted in classrooms or in workshops and were not included in the evaluation.

The initial mailing resulted in an approximately 30% response rate. A follow-up mailing was conducted one month after the first mailing. This increased the response rate considerably. A total of 795 Farmstead Assessments were conducted and a total of 550 surveys were sent out. The survey response rate was 56%, with a total of 308 surveys returned (see Appendix C for a sample questionnaire).

Another form of data collection used included tally sheets. The USDA/AmeriCorps member recorded the high risk areas on a sheet listing the different structures and practices covered in the Farm*A*Syst worksheets. If a high risk practice was encountered, a mark was made on the sheet next to the practice. Using this method of data collection was helpful in quantifying the number of high risk situation found given the restraints of confidentiality. It was not without problems however. Some of the USDA/AmeriCorps members were extremely reluctant to use the tally sheets and as a result did not keep an accurate count of high risk areas. Even with these problems, the survey results used in conjunction with the tally sheets does provide a good basis for both qualitative and quantitative analysis.

DATA ANALYSIS

The data were analyzed using the Statistical Package for Social Sciences, more commonly known as SPSS for Windows. Descriptive statistics were run on all responses. Cross tabulation for the determination of comparative frequencies were conducted. Analysis of Variance, or ANOVA, was conducted on the variables thought to influence precaution adoption, as described in the RATIONALE portion of this report. A multiple regression was attempted on the independent variables as they pertained to the stage of precaution adoption. Finally, percentages of high risk areas obtained from the tally sheets were tabulated. The results of these analyses

follows.

FINDINGS-SURVEYS

The Farm*A*Syst evaluation had a two-fold purpose. First, the evaluation sought to obtain general information that would be helpful for program improvement. The second purpose was to determine what factors influenced the farmers decision to make changes in high risk situations, based on a theoretical perspective. The findings regarding general information about the USDA/AmeriCorps Farm*A*Syst program will be presented first.

Marketing the Farm*A*Syst program was the first major task of the USDA/AmeriCorps member. Various marketing techniques were used to promote Farm*A*Syst, including publishing articles in newsletters and newspapers, direct mailings, radio or television advertisements, addressing farmers directly in meetings, posting flyers and through word-of-mouth. The survey asked farmers through which of these venues they heard of Farm*A*Syst. A majority of participants heard of the program through meetings, word-of-mouth or newsletters (see table 1 for the frequency of responses chosen). The survey included a question addressing the value of participating in Farm*A*Syst with a USDA/AmeriCorps member. The responses were on a scale ranging from 1 (no value) to 5 (very valuable). An overwhelming majority of participants rated their participation as being of some value to very valuable (94.8%). When asked if they would be interested in participating in a Farm*A*Syst type program for other aspects of their farming operation, most respondents indicated they would be interested (49.4%), with 38% indicating they would not. Although an undecided category was not included, 12.7% of respondents did not answer this question or answered it by pencilling in an undecided category.

As the USDA/AmeriCorps member worked one-on-one with the farmer, a question was included in the survey asking the farmer to rate the AmeriCorps member. A five point scale ranging from 1 (poor) to 5 (excellent) was used. A total of 96% of respondents rated the assistance provided by the USDA/AmeriCorps member as good, very good or excellent.

There was interest in learning which agencies or individuals the farmer wanting to make changes referred to for assistance. A list of options was given with the respondent instructed to choose all options that applied. The results indicated that Michigan State University

Extension was consulted the most frequently, followed by the Soil and Water Conservation Districts (see table 2 for a list of responses and frequencies).

To provide the most effective program possible it is necessary to know what those involved in the program would most like as services. A question was asked about what other assistance the respondent would like to have provided by the USDA/AmeriCorps member. The results of this question are listed in table 3, with water testing and financial assistance being the most popular responses.

The intent of Farm*A*Syst is to identify farmstead structures or management practices that could result in groundwater contamination. It is hoped that the farmer will make some change in those areas posing high risks as a result of the knowledge gained during the Farm*A*Syst process. The evaluation focused on the high risk areas identified and the changes made as a result.

When asked to recall the high risk area on their farmstead, about half of the respondents acknowledged a high risk situation existed (56%), while 44% said no high risk situation was present. Those having a high risk situation were asked to identify which of the Farm*A*Syst worksheet categories the high risk situation was in. For the breakdown of these responses, see table 4. The three most common high risk areas were petroleum product storage and handling, pesticide storage and handling and well condition.

The question preceding the high risk area identification attempted to determine where the respondent was in the precaution adoption process. The question asked the respondent to think about the high risk identified that was of most concern to him or her. It was encouraging to find that not a single respondent thought the high risk situation was unimportant. Many of the respondents had already made changes (22.4%). Of those not making changes, most people cited financial reasons for this decision. A cross-tabulation of the reasons for not making changes with the high risk area was generated in an attempt to determine the frequency of reasons given for not making changes with the practice in question (see table 5). Further analysis was carried out to determine if the high risk area cited was correlated with where the respondent is at in the precaution adoption process (see table 6).

The stage the respondent was at in the precaution adoption process was compared with the variables thought to influence the decision to adopt precautions. The ANOVA test was used

to ascertain if the dependent variables (those thought to influence precaution adoption) could be a factor in the variance of the responses. The stages of precaution adoption were divided into two categories, Stage 1 and Stage 2. Stage 1 includes the decision that action is not needed, being undecided about what to do and planning to act. Stage 2 includes the phases of planning to act and having already acted. From responses received it seems only the variables 'level of concern about groundwater contamination' and 'difficulty of remediation' can account for variance in the stage of precaution adoption with any level of certainty (see table 7).

A question was included asking the respondent what type of assistance would be helpful in making changes in areas where they have not already. A list of different types of assistance was given. Cost-share was selected most frequently, followed by technical design/engineering (see table 8).

Other findings of interest in the evaluation include the respondents awareness of the negative health effects possible from groundwater contamination and the perceived severity these effects. Not surprisingly, cancer was most frequently associated with contaminated groundwater (see table 9). What was surprising, however, was that 20% of the respondents did not select any of the negative health effects, instead leaving this question blank. There were two questions addressing the perceived severity of health problems resulting from groundwater contamination. When asked if they agreed that the health problems from polluted groundwater could be severe, 86.5% either agreed or strongly agreed. However, when asked how severe the health problems from contaminated groundwater could be, 38.6% said they would be minor, while only 33.4% said they would be serious.

Risk perception is directly related to whether or not someone will adopt precautions to protect their health. A number of questions on the evaluation addressed this area. The perception of risk was broken down into perceived risk to the respondent and his or her family, and the perception of risk to others or the community. A question asked if groundwater pollution is a problem in general, a problem for other or a problem for themselves (they were allowed to chose as many options as desired). A majority of respondents did believe that it is a problem (51.9%), and more respondents thought it a problem for themselves (43.5%) than for others (32.1%). However, when asked this question a slightly different way further on in the survey, a majority of respondents indicated that their families risk from groundwater

contamination is low (81.2%) versus believing others may be at risk from groundwater pollution (86.1% either agreed or strongly agreed with this statement). Similarly, most respondents did not believe their drinking water was likely to be contaminated from farmstead practices (81.3%) although they did acknowledge risks of groundwater pollution from practices around the farmstead are a problem (65.3% either agreed or strongly agreed with this statement).

Knowing someone negatively affected by the issue in question can influence ones perception of risk. Two questions attempted to measure this in the survey. Most people did not know someone that had problems caused by groundwater pollution (79.5%), and most had not themselves had problems because of contaminated groundwater (95.5%). Having some knowledge of groundwater dynamics also can influence risk perception. Three general questions designed to measure knowledge were asked. Most of the respondents did know that what they do may effect another's drinking water. They also know that the physical characteristics of the land play a part in how fast contaminants reach groundwater. In addition, they know that when groundwater does become polluted it is very difficult to clean up.

Another factor believed to affect an individuals likelihood to adopt a health precaution is their perceived ability to effectively change the situation. Two questions attempted to determine this quality and the results indicate that most participants in Farm*A*Syst believe the precautions they can take to protect their drinking water will be effective in reducing their risk (96% either agreed or strongly agreed with this statement).

Finally, the general level of concern about groundwater contamination was questioned. A majority of people were either concerned or very concerned about groundwater pollution (60%) but felt that the level of concern in their communities was somewhat less.

FINDINGS-TALLY SHEETS

As mentioned previously, the USDA/AmeriCorps members kept tally sheets of the high risk situations found during assessments. Some members kept more complete records than others, resulting in inaccurate numbers of high risk areas. However, the general trend in high risk areas can be determined. Results from the tally sheet counts found the lack of secondary containment for petroleum product storage to be the most frequent high risk situation. Inadequate petroleum storage tank enclosure was the second most frequent high risk finding,

followed by the lack of a pesticide mixing and loading pad. The three most frequent high risk areas are petroleum storage, pesticide storage and handling and hazardous waste management. These findings will be compared with the survey findings in the discussion section of this report.

DISCUSSION

One of the major objectives of this evaluation is to determine the farmer's perception of risk from contaminated groundwater. Many questions were asked in an attempt to measure this perception, ranging from questions about risk in general to questions about personal risk. The responses to these questions yielded some very interesting results.

Most people thought that there is some kind of general risk from contaminated groundwater. This perception of risk seems to be amorphous, a feeling without any concrete justification. When the risk was communicated in a more tangible form, such as the negative health effects, the responses varied in an incongruous manner. For example, most people didn't know that all of the negative health effects listed were possible from contaminated groundwater. Some people felt so uncomfortable with this question that they didn't even respond. A few respondents even went so far as to comment that one would need to be a doctor to answer the health related questions! The questions of the perceived severity of the negative health consequences of groundwater contamination had even more interesting twists. When asked if the health consequences from contaminated groundwater could be serious to them, most people said no. A few questions later in the survey, the respondents said the health consequences would be serious. It is clear from these results that there is much ambiguity about the health problems contaminated groundwater may cause and how severe these consequences may be. This ambiguity may be a factor in the perception of personal risk.

Perceived severity of the negative health outcomes of certain behaviors (ie. not protecting oneself from risk in a high risk situation) is a common variable in the various health protection models. If the perceived severity is low then the perceived personal risk will be low. The perception of personal risk in this evaluation was consistently low. This could mean that people really did not think the health consequences would be severe. However, Weinstein's precaution adoption process hypothesizes that for an individual to reach the stage of planning to act or the stage of having acted they must perceive a higher degree of personal risk. This statement is

logical, a person would not be likely to invest the time, money or effort in changing a situation that they do not see as risky. In the data analysis, a test was run to try and determine if the perception of risk is related to the stage of precaution adoption. It was not possible to determine a relationship with any degree of certainty. The low perception of personal risk related in this evaluation does not support Weinstein's hypothesis. In fact, although most people saw their personal risk as low, almost 75% of those having high risk situation were at the planning to act or action stages.

It is interesting to learn that almost all of the respondents saw their risk as low when indeed at least 50% of them admitted to having a high risk situation. There are many possible explanations for this. It may be that some respondents may actually have a low risk. They may have had a high risk situation that was easily corrected and when responding to the survey referred to the risk present after they had taken precautionary measures. It may also be that the questions were interpreted differently than intended. Denial of the high risk situation may be a factor in the low risk perception. They may not agree that the risk actually is a "high" risk. Or, it may be that they do understand they have one or more high risk situations, which therefore should increase their perception of risk but does not because they have rationalized the existence of this situation to fulfill a psychological need of feeling comfortable with a risky situation. In psychology this is referred to cognitive dissonance and is a common phenomena for maintaining a sort of mental equilibrium.

Another explanation for the low risk perception may have to do with what is referred to by Weinstein as "optimistic bias". This is an "it won't happen to me" attitude, or unrealistic optimism in risk perceptions. Although this was not an expected outcome of the evaluation, the results support this bias. While respondents consistently saw their own risk as low, they overwhelmingly perceived others risk from groundwater pollution to be high. According to Weinstein in an article entitled "Reducing Unrealistic Optimism" there are "three processes that may contribute to exaggerated optimism in comparative risk judgments: 1) Selective recall of factors that reduce one's risk rather than factors that increase one's risk; 2) lack of information about the self-protective activities of others; and 3) a failure to think very carefully about others' risk status because of egocentrism." It is important to try and reduce this optimistic bias because it may interfere with one's decision to take precautions in risky situations.

The second main objective of this evaluation is to determine which factors are associated with making changes to lower risk from groundwater contamination. As stated earlier, Weinstein's precaution adoption process was used to try and establish which factors may influence where and individual is at in deciding to adopt precautions. A statistical analysis of the variables (as listed in table 8) with the stage of precaution adoption was inconclusive. The level of concern about groundwater contamination did seem to be associated with the stages of planning to act and action. The difficulty of remediation also could be associated with the stages of action not needed, undecided and planning to act. These results mean that a persons feelings about those variables had some influence on their decision to adopt precautions. For example, if there was a high level of concern about groundwater pollution the person would be more likely to act than if the concern was low. Likewise, the perceived difficulty of remediation is associated with being undecided or planning to act. Although the other findings were not statistically significant, there did seem to be some association between some of the other variables and the stage of precaution adoption (see table 10).

The significance of determining which factors may play a role in precaution adoption lies in targeting education efforts. Those factors that seem to be associated with peoples decisions should receive more attention than others in program planning. It would, however, not be advisable to exclude the factors not shown to be significant in this study. Further research is needed to confirm these findings.

There are other factors not explored in the theoretical framework that have an impact on whether a farmer makes a change in a high risk situation. Most respondents said they plan to act or have already acted to reduce the risk from the high risk practice. For the 25% that do not plan to act, financial reasons were cited most frequently as the reason for this decision. Referring to the tally sheet results, this reason makes sense because the most frequent high risk findings were costly to remedy (installing a pesticide mixing and loading pad for example).

Perhaps the most interesting finding in this evaluation relates to the acknowledgement of a high risk situation on the respondents farmstead. The survey results related that 50% of participants acknowledged a high risk situation on their farmstead. The results from the tally sheets, however, indicated that 70.5% of respondents had at least one high risk situation. Furthermore, the USDA/AmeriCorps members verbally reported that nearly 100% of the

Farm*A*Syst participants had at least one high risk situation. It is likely that the last figure is the most accurate of the three given the breadth and depth of the risk assessment.

This discrepancy is similar to that found with the precaution adoption questions in relation to the risk perception questions. The possible explanations for the discrepancy is the same. It may be the respondent did not understand what was meant by "high risk". It may be that they understood the question but do not acknowledge to themselves that the high risk situation exists. They may also be in a state of cognitive dissonance. Another possibility is that they do know the high risk situation exists and admit this to themselves. However, they are not reporting this on a survey for fear of regulatory action.

There are also many explanations for the difference between the tally sheet results and the actual situation. As mentioned earlier, the USDA/AmeriCorps members did not keep a complete record of the high risk findings. Also, the tally sheets were not used in the beginning of the program. Another, more provocative explanation for the differences also exists. Upon examination of the tally sheets, it becomes apparent that structural or physical high risk areas are recorded more frequently than high risks that are due to management. It may be that this is indeed the case, however it is likely that there is less difference between the two types of high risk areas. The landowner's intent to correct managerial high risks may result in him or her reporting that the situation does not exist. However, physical high risk situations are usually visible and are probably reported accurately. It may be that the USDA/AmeriCorps member did not feel comfortable discussing management practices with the landowner, especially if they were doing things that pose a high risk to groundwater. It is clear that this situation warrants further research.

The last objective of this evaluation is to solicit suggestions from landowners about the USDA/AmeriCorps Farm*A*Syst program. Surprisingly, many respondents made comments. Most comments were positive or constructive. For example, one farmer said, "Real good program, all landowners should be required to fill out the material." The negative comments referred primarily to the perception of the program as more government (see Appendix D for a summary of the comments).

The results from both the qualitative and quantitative data do indicate that the participants of the program think that the USDA/AmeriCorps members did provide a valuable service. They

found Farm*A*Syst to be informative and their time with the USDA/AmeriCorps member well spent.

CONCLUSIONS AND RECOMMENDATIONS

The findings from this evaluation provides much insight into how the USDA/AmeriCorps was received by the program participants. It seems the landowner found the USDA/AmeriCorps member to be knowledgeable and helpful. The training the USDA/AmeriCorps members seems to have prepared them well to promote and deliver Farm*A*Syst. Subsequent groups of USDA/AmeriCorps members would benefit from similar training. It would be wise to focus marketing efforts on the areas that were most successful in this program, specifically group presentations, newsletters and word-of-mouth.

An effort should be made to provide the additional assistance the landowner requested, such as water testing, cost-share and pesticide recertification credits. Offering these items will not only attract more interest in conducting Farmstead Assessments, but will encourage action for the protection of groundwater. Although confidentiality did not seem to be an overriding concern of the landowner participating in Farm*A*Syst, the discrepancy with the results pertaining to risk perception and "high risk areas" indicates that there may be a latent concern. A continuing emphasis should be made about confidentiality and the voluntary, preventive nature of Farm*A*Syst. Trust will improve over time given no breeches or perceived breeches in confidentiality. It would be interesting to see if there is any difference in the level of trust of the USDA/AmeriCorps member versus the groundwater technicians in the Michigan Department of Agriculture groundwater program.

More attention needs to be given to the health issues related to contaminated groundwater and the risks resulting from these issues. There was clearly a lack of understanding of the different problems contaminated groundwater may cause. There was also a lack of awareness about how others may be affected by groundwater contamination. A consistent "it won't happen to me" attitude offers a false sense of security to the individual with that attitude and may result in the individual failing to take preventive measures. The consequences of contaminated groundwater at the community, state and national levels need to be communicated more effectively. An accurate perception of risk will increase the likelihood of precaution adoption,

even though the findings in this evaluation do not seem to support that premise.

Future groundwater educational efforts should be targeted at those areas in the study found to have an impact on the likelihood of adopting precautions, such as maintaining a high level of concern about groundwater issues and communicating the difficulty of cleaning up a contaminated area. Perception of risk and the severity of the possible health consequences may also increase precaution adoption and should be emphasized as well.

Finally, further study needs to be conducted to try and understand the discrepancies in this data and to hopefully gain a more accurate picture of why precautions are adopted after a risk assessment such as Farm*A*Syst is completed.

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TABLES

TABLE 1

How Farm*A*Syst participant heard of the program.

Method	Frequency
Newsletters	24.7%
Newspapers	4.5%
Radio	2.9%
Television	0.0%
Direct Mail	12.3%
Meetings	52.6%
Word-of-Mouth	30.8%
Flyer	6.2%

TABLE 2

Who was referred to for assistance in making changes.

Person or Organization	Frequency
Michigan DNR	5.8%
Michigan Dept of Agriculture	5.8%
MSU Extension	25.6%
Nat'l. Res. Conserv. Service	13.3%
Contractor	8.4%
Soil and Water Cons. District	21.1%
Farm Services Agency	9.1%
Ag Dealer	6.8%
Vocational Ag Instructor	0.0%
Farmer	9.4%
Consultant	2.9%
Health Department	5.8%
None	6.5%

TABLE 3

Other assistance desired of the USDA/AmeriCorps program.

Type of Assistance	Frequency
Water Tests	57.1%
Informational Brochures	25.6%
Soil Tests	31.8%
Soil Maps and Descriptions	16.9%
Pesticide Recertification Credits	37.7%
Cost Share	39.3%
Tax Breaks	34.1%
Pesticide Information	21.8%

TABLE 4

Farm*A*Syst worksheet area found to have a high risk.

Area	Frequency
Well Condition	8.4%
Pesticide Storage & Handling	16.6%
Fertilizer Storage & Handling	4.2%
Petroleum Product Storage	21.8%
Hazardous Waste Management	1.0%
Household Wastewater Mgmt.	1.3%
Manure Storage	3.2%
Livestock Yards Management	2.6%
Silage Storage	.3%
Milking Center Wastewater	1.5%
Site Evaluation	2.3%

TABLE 5

Cross tabulation of reason for not making a change with the high risk area.

REASON

	Finan- cial	Lack of Info	Con- flict- ing Regs	Lack of Techni- cal Assist.	Lack of Time
Well Condition	58.3%	16.7%	25.0%	8.3%	25.0%
Pesticide Storage & Handling	75.0%	0.0%	18.8%	0.0%	12.5%
Fertilizer Storage	88.9%	22.2%	55.6%	22.2%	11.1%
Petroleum Storage	48.0%	16.0%	44.0%	8.0%	28.0%
Hazardous Waste	50.0%	0.0%	0.0%	0.0%	50.0%
Household Waste- water Mgmt.	66.7%	33.3%	33.3%	0.0%	0.0%
Manure Storage	100.0%	0.0%	14.3%	0.0%	28.6%
Livestock Yard	0.0%	33.3%	33.3%	0.0%	33.3%
Silage Storage	100.0%	100.0%	100.0%	0.0%	0.0%
Milking Center Wastewater	100.0%	100.0%	100.0%	0.0%	0.0%
Site Evaluation	25.0%	0.0%	25.0%	0.0%	0.0%

TABLE 6

Cross tabulation of stage in precaution adoption with area of high risk.

	Not going to act at this time	Deciding what to do	Plan to act but not yet	Have already acted
Well Condition	0.0%	8.0%	32.0%	64.0%
Pesticide Storage & Handling	2.0%	27.5%	21.6%	51.0%
Fertilizer Storage & Handling	7.7%	53.8%	15.4%	38.5%
Petroleum Storage	4.5%	24.2%	39.4%	36.4%
Hazardous Waste	0.0%	33.3%	33.3%	33.3%
Household Wastewater Mgmt.	0.0%	0.0%	0.0%	75.0%
Manure Storage	10.0%	50.0%	20.0%	40.0%
Livestock Yard	0.0%	12.5%	25.0%	62.5%
Silage Storage	0.0%	0.0%	0.0%	100.0%
Milking Center Wastewater	0.0%	20.0%	60.0%	20.0%
Site Evaluation	0.0%	28.6%	0.0%	57.1%

TABLE 7

Variance in response (r squared) by stage of precaution adoption.

Factors potentially affecting stage of precaution adoption	Stage 1 Action not needed vs. undecided vs. plan to test	Stage 2 Plan to act vs. have already done something
General knowledge	0.0	0.1
Families risk	0.3	0.9
Level of concern	7.1	4.0**
Difficulty of remediation	9.6*	2.3
Personal risk	0.7	0.7
Precautions effective	4.0	0.6
Property values	4.1	0.1
Likelihood of contamination	0.0	0.5
Increased awareness of precautions to lower risk	7.4	1.3

*p=.05 **p=.03

TABLE 8

Type of assistance that would be helpful in making changes in high risk areas.

Type of Assistance	Frequency
Technical Design/Engineering	14.6%
Equipment Recommendations	6.8%
Education on Mgmt. Options	11.7%
Cost Sharing	31.2%
Testing Services (soil, water)	14.9%

TABLE 9

Percentage of respondents that associate groundwater contamination with the listed negative health effect.

Negative Health Effect	Frequency
Diarrhea	47.7%
Cancer	53.6%
Neurological Problems	35.1%
Birth Defects	42.9%
Blue Baby Syndrome	22.4%

TABLE 10

Factors affecting variance in stage.

Stage 1	Stage 2
Difficulty of Remediation	Difficulty of Remediation
**Risk 2	**Risk 2
Property values affected by contaminated groundwater	Seriousness of negative health effects from contaminated groundwater
Precautions would be effective in reducing risk	*Risk 1
Concern about groundwater contamination.	

* Risk 1 is the combination of the following factors that appeared to be related to each other statistically: the seriousness of health problems, risks from groundwater contamination are a problem and the risk to others from polluted groundwater.

** Risk 2 is a combination of the following factors that appeared to be related to each other statistically: The affect of contaminated groundwater on property values, the effectiveness of precautions taken to lower risk of contaminating groundwater and an increased awareness of precautions available to the risk of groundwater contamination.

APPENDIX A

Americorp Michigan Priority Watersheds



District – Congressman

1 – Bart Stupak	7 – Nick Smith
2 – Peter Hoekstra	8 – Bob Carr
3 – Vernon Ehlers	9 – Dale Kildee
4 – Dave Camp	10 – David Bonior
5 – James Barcia	16 – John Dingell
6 – Fred Upton	

APPENDIX B

Worksheet #8

Assessing the Risk of Surface and Groundwater Contamination from *Livestock Yards Management*

Why should I be concerned?

Livestock yards, such as barnyards, holding areas and feedlots, are areas of concentrated livestock manure. They can be a source of nitrate and bacteria contamination of groundwater. This is especially true if there is no system to 1) divert clean water flow from the livestock yard or 2) collect polluted runoff from the yard for diversion to an area where its effect on surface water or groundwater is minimal. The potential for livestock yards to affect groundwater is greatest if the yard is located over coarse-textured permeable soils, if the water table is at or near the surface, if bedrock is within a few feet of the surface, or when polluted runoff is discharged to permeable soils and bedrock.

Nitrate levels in drinking water above federal and state drinking water standards of 10 milligrams per liter (mg/l; equivalent to parts per million for water measure) nitrate-nitrogen can pose health problems for infants under 6 months of age, including the condition known as methemoglobinemia (blue baby syndrome). Nitrate can also affect adults, but the evidence is much less certain.

Young livestock are also susceptible to health problems from high nitrate-nitrogen levels. Levels of 20-40 mg/l in the water supply may prove harmful, especially in combination with high levels (1,000 ppm) of nitrate-nitrogen from feed sources.

Bacteria in livestock waste can contaminate groundwater if waste seeps into nearby wells, causing such infectious diseases as dysentery, typhoid and hepatitis. Organic materials, which may lend an undesirable taste and odor to drinking water, are not known to be dangerous to health, but their presence does suggest that other contaminants are flowing directly into groundwater.

A livestock yard without a runoff control system typically has an earthen surface compacted by animal traffic. This surface is not shaped for water drainage, so it is usually dry in some places and muddy in others. Manure typically accumulates on the surface, and decaying manure is mixed into the soil by animal traffic.

The goal of Farm•A•Syst is to help you assess your current practices and determine how well you are protecting the groundwater that supplies your drinking water and surrounding surface water.

How will this worksheet help me protect surface and groundwater?

- It will take you step by step through your livestock yards management practices.
- It will rank your activities according to how they might affect the groundwater that provides your drinking water and surrounding surface water.

Livestock Yards Management: Assessing Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your farmstead, read across to the right and circle the statement that best describes conditions on your farmstead. (Skip and leave blank any categories that don't apply to your farmstead.)
3. Look above the description you circled to find your "rank number" (4, 3, 2 or 1) and enter that number in the blank under "your rank."
4. Directions on overall scoring appear at the end of the worksheet.
5. Allow about 15-30 minutes to complete the worksheet and figure out your risk ranking for livestock yards management.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
SITE CHARACTERISTICS					
Lot location in relation to wells	Active livestock yards on fine-textured soil or paved lot. 100 feet or more downslope from well or more than 300 upslope from well.	Active livestock yard on fine-textured soil or paved lot. More than 50 feet downslope from well.	Active livestock yard on coarse-textured soil. 100 to 300 feet upslope from well.	Inactive livestock yard on medium to coarse-textured soil, or inactive livestock yard on fractured limestone. Within 100 feet upslope of well.	_____
Lot location in relation to surface water	Livestock yard is more than 300 feet from surface water. Slope is less than 3%. Dense vegetation that is harvested exists between yard and surface water.	Livestock yard within 300 feet of surface water. Slope 3 to 6%. At least 150 feet of dense vegetation between yard and surface water.	Livestock yard is more than 75 feet from surface water. Slope less than 6%. Dense vegetation grows in a strip at least 75 feet wide adjacent to the surface water.	Livestock yard is located less than 75 feet from surface water. Slope exceeds 6% and minimal vegetation exists, or a stream runs through livestock yard.	_____
Runoff control system	All roofwater and upslope water drainage is diverted around livestock yard. All yard runoff directed to a settling basing and sealed runoff storage for at least 180 days.	Roofwater and upslope watershed drainage is diverted around livestock yard. All runoff directed to a settling basing and vegetated infiltration strip where vegetation is routinely harvested.	Roofwater and upslope watershed drainage is diverted around livestock yard. Runoff directed to cropland. Does not discharge into streams or lakes. Soils are fine to medium texture.	Roofwater and upslope watershed drainage runs through yard and no runoff control system in place. Yards rarely scraped.	_____

Use this total to calculate risk ranking on back page of worksheet.

TOTAL

APPENDIX C

FARM*A*SYST EVALUATION

Directions:

Answer each question as accurately as you can. Many questions can be answered by circling the item that best describes your opinion or situation. Other questions require you to check the response or responses that apply. All answers will be kept completely confidential.

1. How did you hear about Farm*A*Syst and the service available through USDA/AmeriCorps members? *(check all that apply)*

☐ Newsletters
☐ Newspapers
☐ Radio
☐ Television
☐ Direct Mail
☐ Meetings
☐ Word-of-Mouth
☐ Flyer
☐ Other _____

2. On a scale of 1 to 5, with 1 being of no value and 5 being extremely valuable, circle the number that most closely describes your feeling about your participation in Farm*A*Syst with a USDA/AmeriCorps member.

1	2	3	4	5
No value		of some value		very valuable

3. How would you rate the assistance from the USDA/AmeriCorps member?
(circle one option)

a. poor
b. fair
c. good
d. very good
e. excellent

9. If someone in your home did have negative health effects from groundwater contamination, how serious do you think they would be?

- a. Very minor
- b. Minor
- c. Somewhat serious
- d. Serious
- e. Very serious

10. When you think about groundwater pollution, how do you feel?

- a. Not at all concerned
- b. Somewhat concerned
- c. Concerned
- d. Very concerned

11. In general, how would you rate the level of concern about groundwater pollution in your community?

- a. Not at all concerned
- b. Somewhat concerned
- c. Concerned
- d. Very concerned
- e. Don't know

13. The following opinions about groundwater have been expressed. We want to know if you agree or disagree with them. *(Please circle your opinion)*

a. If my neighbor dumps oil in a drainage ditch the oil may end up in my drinking water. Agree Disagree Don't Know

b. What people do on their own property won't help prevent well water contamination unless their neighbors also work to prevent it. Agree Disagree Don't Know

c. Physical characteristics like soil and bedrock type and depth to groundwater affect the potential for groundwater and well water contamination at a specific site. Agree Disagree Don't Know

14. When groundwater is polluted it:
(circle one)

- a. Can be cleaned very easily
- b. Is very difficult to clean
- c. Cannot be cleaned
- d. Don't know

18. Did the USDA/AmeriCorps member suggest a precaution that would lower your risk ranking from the high risk practice? *(check one)*

☐ Yes
☐ No *(skip to 20)*

19. If yes, how do you feel about the precaution suggested?
(check all that apply)

☐ I remember that a precaution was suggested.
☐ The precaution suggested was clear to me.
☐ I believe the precaution suggested would reduce risk from the practice in general.
☐ I believe the precaution suggested would reduce risk from the practice for myself.

20. For the high risk areas you have identified on your farmstead that you would like to change, what type of assistance, if any, would be helpful in making those changes?
(check all that apply)

☐ Technical design/engineering
☐ Equipment recommendations
☐ Education on management options
☐ Cost sharing
☐ Testing services (soil, water etc...)
☐ Other (please specify) _____

Please use this space to write your comments about this survey.

Thank you for your cooperation with this evaluation. Please return the completed survey to:

Christina Coulon, USDA/AmeriCorps
Michigan State University Extension
11 Agriculture Hall
East Lansing, MI

48824-1039

APPENDIX D

COMMENTS FROM SURVEY

1. You would have to be a doctor to answer question #5 on the second page.
2. She (the USDA/AmeriCorps member) did a nice job.
3. It (Farm*A*Syst) made me more aware of problems.
4. Very important that the person doing the survey comes across as helping and not as a 'regulator'.
5. The survey is good but I'm one of the lucky farmers who have never had a water problem.
6. Need to get more people to participate in on site assessments.
7. Anytime you participate in a 1 on 1 program you've got to benefit from the program. Your more apt to ask more questions at home than in a meeting place.
8. Because of the emphasis on the soil rank in the scoring it averages down any management attempts. Possibly separate the controllable factors vs. the uncontrollable and score them separately.
9. Thank you for doing such a good and important job.
10. Survey (Farm*A*Syst worksheets) is not completed yet but am working on it.
11. The size of the farm should affect the scoring on some answers. For example, a farmer that mixes two tanks of spray without having a "mixing pad" I don't think is as high of a risk as one who mixes twenty tanks full. Same goes for fuel, a guy who stores 500 gallons vs. 10,000 gallons.
12. Probably good for the cause.
13. Some questions could have been yes or no or agree or disagree instead of 'may disagree'. Most every farmer has concern about our water.
14. The farmer needs to do all of the sheets with the AmeriCorps representative and not the AmeriCorps representative do some without the farmer. The farmer needs to have all the factsheets so that they can read over before any sheets are filled out.
15. Well done!
16. Do it other than at spring planting time!

17. I believe that the Farm*A*Syst program while beneficial-underestimates the technical and general knowledge (ie. most people I know have at least some college level education).
18. We covered some things that I didn't consider a risk until we did the survey. I think every farmer could benefit from this survey.
19. I basically already knew the problems I had. This survey prompted me to act on them. It also brought to light the seemingly harmless substances like paint, parking a truck or tractor that leaks can be potential problems.
20. It made me more aware of the problem. I'm trying to clean some as I see them but can not afford to spend much money to do this.
21. The survey was O.K. but the survey members need more training.
22. I work off the farm to like most farmers my age, and it helped me with a kind of hands on class as well as giving me credits so I wouldn't have to take time off work. Thank you.
23. Good program.
24. Appreciate voluntary participation.
25. I like it. Every farmer should be concerned.
26. I am very much interested in our water condition. Here is a question for you: Why is the city of Grand Rapids allowed to dump millions of gallons of raw sewage into the Grand River each year? Each individual farmer should be responsible for his or her actions: Where is the almighty DNR when GR decides to empty their cess pool? Please comment CHRISTINA COULON. How concerned are you with our water quality?
27. Very poor survey. The questions were worded like they were looking for answers they already had in mind. Many questions did not have my answer in the choice of answers typed.
28. Interesting. Informative. Comforting.
29. This program allowed me to know what regulations are in effect and what agency to contact to make beneficial changes- It also clarified conflicting regulations.
30. This is an excellent survey and I hope other farmers try to improve their practices where need be.
31. The Farm*A*Syst program is very good in bringing to our attention the possibility of problems that could be severe if left un-attended or not dealt-with.
32. Good program- not politically/regulatory threatening. Enthusiastic young presenters- used referral techniques well when they lacked background or experience.

33. I feel I did my share in keeping groundwater clean when will the USDA survey non-farmers about pollution.
34. Several moderate and low risks were identified, and suggestions made for correcting them.
35. We are long overdue in testing to see the effect of chemicals and fertilizers used. I think it has caused cancer in people and animals in the last 20 to 40 years.
36. Need to know approved methods for implementing and designing new safety improvements, impoundments, enclosures etc...
37. The AmeriCorps assessment by Ms. Faith Traylor was thorough and clearly understood. Follow-up information was done well by Faith. We did not have anything High risk (our two fuel tanks are currently tested and have not leaked). We have removed our underground gas by specialized contractor and will remove fuel oil as it is too close to well. Am pleased with assessment, will prevent program here, far better than 'curing' later.
38. Very good program.
39. Very complete, covered most all aspects.
40. I thought the survey was very helpful, in that it addresses a wide range of questions relating to my farming operation. It brought to my attention a couple of areas that needed to be taken care of; of which I have.
41. The AmeriCorps member was very helpful.
42. Ms. Traylor was of great help to inform me to use safe practices so as to reduce groundwater contamination.
43. Need to tailor questions to particular areas of ag- N.W. Lower Michigan is quite tuned in and maybe needs to be addressed on a higher level.
44. The Farmstead Assessment Program made me aware more of what to do for prevention.
45. Jennifer Blaker did a excellent job. She is a good person to do this type of work.
46. Survey is fine but, what about private citizens that bury iron, junk, dump oil, antifreeze and other items in ground. Report them and nothing happens. I even reported them to the DNR.
47. Very informative and helpful. Thank you for the information provided.
48. Jennifer did ours and was quite knowledgeable and willing to answer our questions.

49. We all get busy in our work and need to be reminded about things we might of let go.
50. USDA/AmeriCorps rep. was knowledgeable and completing survey helped address potential problem areas and solutions to problems.
51. At another address located in a city where we had city water I had 4 pets plus my mother die of cancer. This was always a concern for me.
52. Most unsafe wells in this area are residential non approved wells kept secret from local health department.
53. It's important to protect our groundwater and environment, but sometimes people are sacrificed for the sake of laws and lots of red tape. Somehow people need to be responsible to their fellow man and government agencies and work for the common good of all mankind.
54. Difficult questionnaire. It is probably very dear to you- but so many questions are difficult to answer without explanation. Not clear on what you want to know or why. Evaluator was excellent. We are continually aware of groundwater contamination and evaluate what we can do and what we should not do.
55. The survey opened by eyes to a few possible sources of contamination which will be corrected.
56. Just a make work program.
57. I think this is a good way to build another very large bureaucracy for MSU and USDA. The good it may do will be last.
58. Just yet one more survey which contributes to mounds of paperwork and takes my time away from productive work.
59. Would like to solve all problems (chemicals) before they arrive.
60. Everybody should go through the course. Very informative, brings out awareness of subject.
61. It is helpful to know there is a department on call if I have questions.
62. Kristin was very pleasant to work with also very informative.
63. I think USDA should check the cities, anyone can spray lawns and by laundries. It can run off right into storm sewers and right into rivers.
65. Conversation after the assessment was thought provoking in calling attention to possibility of problems. the Extension Service is appreciated.

66. It is a great program that keeps you aware of being cautious and doing correct farm practices.
67. I would like cost-sharing for liquid fertilizer storage.
68. A worthwhile and informative program: A 'high quality' presentation was conducted by Kristin Korutz.
69. Well informed, easy to complete.
70. I feel it was a good survey, it keeps us on our toes and makes us think about what we can do to make our liver healthy.
71. I enjoyed the assistance from the AmeriCorps member- nice experience and well worth our time.
72. The farm is not the only source for contamination. I have a hard time believing Amoco "leaked" 60,000 gallons of gas from a pipe in the ground where the aquifer is only 4 feet deep and we have NO contamination. Yet a gas station has contamination from the small amount of gas spilled by customers. As far as I can tell the DNR feels there is no contamination. What do you think the credibility of the DNR is in our area. DNR=Government. Have a nice day!
73. Christina,
I'm not sure I should have filled this out since I work on campus. However, I think that the issues and awareness that the evaluation brings out among producers may be more valuable than they would be willing to admit. If the producers you are working with don't feel that they are on the defensive, they might gain a lot of valuable insight from this process. I think it is hard to write a survey that gets to issues and attitudes of producers. This one is somewhat subjective in places, but asks the right questions for the most part and should be a good feed back tool. Anonymous.
74. This is a bad situation on all fronts, just keep your eyes open.
75. Teresa Rudnicki did a good job.
76. Could be useful if more people fill it out.
77. The young lady conducting the survey of our farm was very congenial, qualified and helpful. Many things we as farmers do are harmful to ourselves and others because we have been unaware of the consequences. Many things we are encouraged to do by MSU like burying our fuel tanks to preserve octane.
78. Good helpful program- keep it in effect with more credits.
79. I think it is very important to have a survey like this hopefully it will help all of us in the future and now.

80. Poorly written survey- many questions make assumptions that aren't necessarily true.
81. I thought the meeting was very informational and it made me more aware of areas to address and made me have a better understanding of what you agencies are trying to help with.
82. This additional lay of government seems unnecessary- the same thing could have been accomplished through a mailing to the ag community, without hiring additional staff.
83. Educational. AmeriCorps member very knowledgeable of survey process and willing to provide assistance/information in a non-intrusive manner.
84. Less than one sucker long. Very pleased with the information provided.
85. Where will the results go- will anything become of the survey and what benefit will I get out of it!
86. Survey information was helpful. AmeriCorps person should become more familiar with both soil types and subsurface geology relative to potential for groundwater contamination.
87. O.K. but many farms need to have this done also city dwellers need to be aware of this on their lawns! They over fertilize and use pesticides way too much! Farmers are the ones afraid to use it or don't care. It should be promoted as a no risk no cost program.
88. It was worth doing.
89. Try and keep program simple, direct, and with results. The rules and regulations are somewhat out of hand- common sense not too much red tape.
90. Questionnaire well planned.
91. Does this really do any good but create bigger government and waste my tax dollars on surveys and self adhered envelopes and stamps.
92. I think information on general water and soil cleanness or contamination should be publicly shared, along with ways to solve problems and get rid of contamination. Let individuals know if their well water is very healthful or not healthful and what ways to improve it if necessary.
93. Our farm is leased by reliable farmers and our main concern is the lagoon system across the road from our property.
94. I think it was worth the time to do it.
95. A bad time of the year to send out the survey.

96. The concept that the results are for the property owner only is good. The biggest problem is that corrections needed in many cases are so costly. The young people administering these evaluations may have some of the answers, but don't realize what it is to have to pay for the actual risk reductions practices.

97. I am very skeptical about any information today because of our society of today, misusing and gaining false information and using it to their advantage and that does include our government agencies.

98. No problems only I wish I could have taken it sooner since the evaluation.

99. AmeriCorps and Farm*A*Syst did tests for groundwater pollution on my farm and did not find any contamination problems. Every test came out good.

April 29, 1996

Katherine:

This is the first "quasi-scientific" study of one of our projects. It shows that 75% of the farmers helped with farm-a-systs in Michigan plan to take concrete actions to implement the AmeriCorps recommendations to improve water quality.

Please work with Dave White to have NRCS prepare a press release and work to development placments in AG and other speciality publications.

Thanks.



**EVALUATING PROTECTIVE HEALTH BEHAVIOR ADOPTION OF
FARM*A*SYST PARTICIPANTS USING THE
PRECAUTION ADOPTION PROCESS MODEL**

By

Christina Coulon

A PLAN B PAPER

Submitted to the Department of Resource Development,
Michigan State University, in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE

1996

ABSTRACT

EVALUATING PROTECTIVE HEALTH BEHAVIOR ADOPTION OF FARM*A*SYST PARTICIPANTS USING THE PRECAUTION ADOPTION PROCESS MODEL

By

Christina Coulon

In 1995, the United States Department of Agriculture began promoting the Farm*A*Syst groundwater risk assessment program through the Michigan Natural Resources Conservation Service. Fifteen USDA/AmeriCorps members were used to conduct one-on-one Farm*A*Systs with rural landowners, primarily farmers in Michigan watersheds that were considered critical based on the potential for groundwater contamination.

The Farm*A*Systs were conducted for a ten month period and the participants in the Farm*A*Syst program were surveyed after the completion of their assessment. The survey was used to try and determine if participation in Farm*A*Syst prompted them to make changes to protect their groundwater (the primary source of drinking water) where high risk situations were found.

A theoretical model called the Precaution Adoption Process (PAP) Model was used to analyze where the participant was at in the process of making changes to protect their drinking water and ultimately their health. The PAP model looks at the adoption of precautions as a process occurring in distinct stages, with certain variables affecting which stage the adopter is in. Analysis of the findings from this evaluation demonstrated that certain variables considered in the model did seem to influence whether the landowner decided to make a change in a high risk situation. The two variable that did seem to make the most difference in the stage of precaution adoption were the participants perception of the

difficulty of remediation of groundwater pollution and the level of concern among the participants about groundwater contamination problems.

The results of this study made it clear that risk perception of groundwater contamination and the actions resulting from this perception of risk are quite complex. Almost half of the respondents reported having a high risk situation on their farmstead, however more than 80% of the respondents stated they were at a low risk from groundwater contamination problems. Nearly 75% of those reporting a high risk situation either plan to act or have already acted to lower their risk from groundwater contamination problems. It seems that something other than perception of risk is motivating these individuals to act in the protection of their drinking water resources.

The findings reported in this study are useful for any change agent involved in promoting health protective behaviors. A follow-up evaluation is being conducted by the Michigan Natural Resources Conservation Service and will be available by October, 1996.

Dedicated to the:

Pioneer Michigan USDA/AmeriCorps members
and
Alan Herceg, Program Director,
Michigan USDA/AmeriCorps

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I am also deeply appreciative to my family and friends, including my children Alex and Jesse, my parents, Tom and Mary, my sisters Cathy and Connie, my best friend Ana Boiba, my fellow students Kenrick Pierre and Clyde Young, and my partner, George Gonzalez. Their moral, emotional, academic and financial support has buoyed me through these years as a graduate student and has made it possible for me to complete what I started.

The superlative faculty and staff in the Department of Resource Development and in the other departments at Michigan State University, including Dr. Cynthia Fridgen, my committee members, Dr. Eckhart Dersch and Dr. Ted Loudon, and Dr. Frank Fear, Dr. Paul Nickel, and Dr. Murari Suvedi have challenged my mind and have given me the incentive needed to follow through with this study. I am extremely grateful for everything they have done and very proud to say I studied in the Department of Resource Development.

Finally, I would like to thank those in the agencies that have funded and assisted in this study. Alan Herceg, the program director for the USDA/AmeriCorps program in Michigan gave me the opportunity to fund my research and combine it with my work as a USDA/AmeriCorps member. I am grateful for his support, faith in my abilities and vision of what could be done. I thank the Michigan Department of Agriculture for generously

funding this study. Finally, I want to acknowledge the MSU Extension service and thank those in that were in Rm. 11, Agriculture Hall during my stay there for their assistance and support. Their smiles and friendship made all the difference.

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I. INTRODUCTION

The study and practical applications of risk perception and communication are increasingly significant in our society. As humans continue to alter and exploit their physical environments, the need for better information and transfer of that information becomes paramount. The unknown affects of the manipulation of our environment requires a maximum effort in prevention of the potentially far reaching consequences of environmental contamination. This study attempts to take one critical, life-sustaining element in our environment and analyze how one segment of the population has responded to the threat of their activities on its sustainability.

Statement of the Problem

The realization that our groundwater resources may be at serious risk from contamination by agricultural activities has resulted in a call for action by federal and state regulatory agencies. To continue to use pesticides that leach readily into the groundwater, the U.S. Environmental Protection Agency mandated the development of groundwater protection programs by states wanting to use those pesticides. In response to this mandate, the State of Michigan passed the Groundwater and Freshwater Protection Act (P.A. 247 of 1993). This act is designed to provide agrichemical users an opportunity to take a proactive, non-regulated approach to pesticide and fertilizer management. Because clean-up of contaminated aquifers is so costly, prevention provides the best means of managing this situation.

Although we know prevention is the best method of avoiding groundwater contamination from agricultural practices, we do not know how effective the attempts at promoting this pro-active approach to groundwater prevention has been.

One of the tools used in by those implementing the state groundwater management plan is called Farm*A*Syst. Farm*A*Syst is a groundwater risk assessment checklist designed for use by farmers to assess their farmstead practices in respect to risk to groundwater. Their perception of risk from groundwater pollution after completing a Farm*A*Syst is not known. This study will evaluate how the farmers that participated in Farm*A*Syst perceive risk from groundwater contamination and what precautions, if any, they will adopt or have adopted to protect themselves from the potential harm exposure to agrichemicals and other contaminants may inflict.

Research Objectives

The relationships between risk perception and precaution adoption was examined in this evaluation. Specifically, this study sought to determine the following:

- 1) What is the farmer's perception of personal risk from groundwater contamination after completing a Farm*A*Syst?
- 2) Do those individuals reporting a high risk situation perceive themselves to be at greater risk from groundwater contamination than those individuals that don't report a high risk situation?
- 3) What factors are associated with making changes to lower risk from groundwater contamination?
- 4) Does the Precaution Adoption Process Model serve as a useful predictive tool in determining who will make changes in this evaluation ?

Background to the Problem

Groundwater serves as the primary source of drinking water for over fifty percent of the entire United States population and for nearly ninety-five percent of the rural U.S. populace (USGS National Water Summary). There is no question that this resource is the life-blood that sustains rural inhabitants. For this reason alone we must take extreme care of the groundwater supplies available. Increasingly, however unintentionally, the activities of those dependant on this resource jeopardize the quality of it. Agriculture and many of the activities surrounding the production of food and fiber require inputs that find their way into drinking water supplies. According to 1987 figures, nearly 330 million acres of farmland used technology-intensive production systems, requiring large inputs of pesticides and fertilizers. (U.S. Bureau of Census, 1989) These pesticides and fertilizers, even when applied correctly, can migrate down into aquifers. Although the microorganisms in the soil do naturally degrade some chemicals , rendering them harmless, other chemicals leach quickly through the soil, circumventing this natural degradation process. Indeed, research has shown that pesticides and fertilizers have contaminated groundwater, at times exceeding the U.S. EPA's maximum contaminant level (MCL) allowable for drinking water (Lee and Nielsen, 1987).

Contaminants of Concern

Nitrogen in the form of nitrate is the component of fertilizer that causes health problems in humans. Other sources of nitrate-nitrogen from agricultural activities include septic systems, animal feedlots, and leaking manure storage facilities. Infants comprise the

segment of the population most at risk from health problems resulting from the ingestion of nitrate. Bacteria present in the gastrointestinal tract of infants converts the nitrate to nitrite, inhibiting the absorption of oxygen. This causes methemoglobinemia, or blue baby syndrome. This same effect can be found in the adult population, although in milder forms. Excess quantities of nitrates may lead to impairment of the nervous system, a subclinical form of methemoglobinemia. Studies have also shown that nitrate can react with amines in humans to form nitrogen-nitrosoamine. These chemicals are known to cause cancer in lab animals and are suspected human carcinogens (USGS, 1984). An Australian study has even linked excessive nitrate exposure to congenital malformations (American Journal of Epidemiology, 1984). The negative health effects of nitrates seem to occur when the levels in water exceed 10ppm nitrogen as nitrate, the U.S. EPA's MCL for drinking water.

The myriad chemical constituents in agricultural pesticides comprise another category of contaminants of concern in groundwater supplies. Until the mid 1970's it was believed that pesticides would not find their way into groundwater except where coarse, cracked and otherwise vulnerable soils overlay the aquifer (Bouwer, 1990). However, as more sensitive testing methods developed and pesticide use increased, detection of pesticides increased. U.S. EPA data indicate that of a sample of 45,000 wells in sensitive geographical areas, 5,500 had levels exceeding the MCL for at least one pesticide. The data also revealed the presence of 46 pesticides in groundwater samples from 26 states where the pesticides were applied according to normal agricultural practices. The pesticides found include alachlor, atrazine, aldicarb, carbofuran, chlordane, ethylene dibromide (EDB), dibromochloropropane (DBCP) and 1,2-Dichloropropane (Williams, 1988). The negative health effects associated

with these chemicals range from respiratory problems, paralysis, heart, liver, kidney, spleen, lung and testicular injuries, to cancer, birth defects and genetic mutations (State of California, Assembly Office of Research, 1985). The conclusive evidence pointing to the dangers of a few of these pesticides, such as EDB, has prompted the EPA to ban their use, although residuals of the chemicals may still be present in the groundwater only to show up years later.

Pesticides and fertilizers, although most frequently cited as the most prevalent agricultural contaminants are only two of the potentially harmful categories of substances resulting from agricultural activity. Petroleum fuel, necessary for the functioning of farm equipment, is made up of a variety of carcinogenic substances such as benzene. Frequently, fuel is stored in manner that increases the probability of it entering the ground. The results from one survey done in Wisconsin indicated that one third of the farms had underground fuel storage tanks of more than 20 years in age, about 50% of tanks were within 100 feet of the well and 90% of farms had no spill or overflow protection (Taylor, 1990). The risk from petroleum fuels may not seem as great due to the familiarity and frequent use of gasoline. Nearly every farmstead has some sort of fuel storage. The sheer number of fuel tanks increases the potential risk for groundwater contamination and the certainty that benzene causes cancer makes that risk all the more significant.

Unfortunately, a great amount of uncertainty surrounds many chemicals, including pesticides, due to the difficulties of performing long-term epidemiological studies. Most scientific studies of these chemicals involves the use of lab animals given large doses of the chemical in question. The results of the exposure to the chemical is then extrapolated to

humans. Based on their findings, scientists make calculated guesses about the risk the chemicals pose to the population in question based on the dose and the exposure. This so called "scientific" risk calculation is then communicated to those thought to be at risk from exposure to the chemical in question. But how does the public perceive this risk? Often the risk felt by the public differs from the scientific assessment of the risk.

Risk Perception

Many factors, other than scientific knowledge of the risk, contribute to an individual's perception of risk. Paul Slovic has researched the area of risk perception extensively, and has concluded that one major determinant of risk perception is the voluntariness of the risk (Slovic, 1987). Does the individual willingly engage in the risky behavior with full knowledge of the risk inherent in that behavior, such as smoking, or is the risk imposed involuntarily, such as from having to live near a radioactive waste site? Another factor contributing to the perception of risk is the level of dread associated with the risk. Taking aspirin is seen as less risky than parachuting from an airplane due to the level of fear (dread) most people experience from heights. The differing views of risk may play a part in how farmers view the potential contamination from pesticides, fertilizers, fuels and other chemicals in their drinking water.

*Farm*A*Syst*

Studies show that pollution resulting from agricultural activities is more likely to occur at the farmstead where the chemicals are stored than from leaching in the field where the chemicals are applied (Taylor, 1992). Improper storage, leaky containers, spills from filling tanks and sprayers, improperly maintained septic systems, animal feedlots and many other activities all can cause contamination of the groundwater at the most undesirable location, near the drinking water well. The well, especially an older well without casing, can provide a direct conduit to the groundwater aquifer. Even more hazardous are abandoned wells that may be located near the farmstead. In Michigan it is estimated that there are nearly one million abandoned wells (Michigan Department of Agriculture, 1995).

The activities taking place around the farmstead and around the drinking water well are the focus of one risk assessment tool. The Farmstead Assessment System, or Farm*A*Syst for short, was developed in a collaborative effort between the University of Wisconsin, the University of Minnesota and Region 5 of the EPA (Jones and Jackson, 1990). Farm*A*Syst is an attempt to provide a systematic method of evaluating the activities around the farmstead in relationship to their risk to groundwater. The Farm*A*Syst package consists of 12 worksheets and 10 fact sheets that evaluate the risk to groundwater from the following practices; pesticide and fertilizer storage and handling, petroleum product storage, hazardous waste management, household wastewater management, manure storage, livestock yards management, silage storage and milking center wastewater. Well condition, a site evaluation and an overall assessment are also covered. The worksheets list various practices and conditions that are ranked from low risk to high risk on a 4 point scale. When the

worksheets are completed a risk ranking is calculated for the practice the worksheet evaluates.

Research has shown that farmers do not have access to enough information and technical assistance to identify potential causes of groundwater contamination or management practices to reduce contamination risks. Farmers also lack a means to evaluate their farms' potential pollution sources in a systematic manner (Jones and Jackson, 1990). Farm*A*Syst gives the farmer a general idea of how they are managing the farmstead with regards to groundwater protection. The fact sheets that accompany the worksheets offer information about the practice evaluated in the worksheet and gives information about further assistance available.

In Farm*A*Syst pilot studies conducted in Michigan by Michigan State University Extension a variety of methods of delivering Farm*A*Syst were attempted. The delivery methods included allowing the farmer to complete the worksheets alone, in group settings, such as in meetings, or with personal assistance. Farmers indicated that when the assessment was completed with a trained individual they were more easily understood (source). In response to this finding, Michigan State University Extension and the USDA Natural Resources Conservation Service (NRCS) proposed a Farm*A*Syst program using volunteers from the new community service program, AmeriCorps, to assist farmers with the assessments. In 1994 the USDA/AmeriCorps Farm*A*Syst program was launched. The program began in October of '94 and ran through August '95. Placement of the USDA/AmeriCorps members was based on an analysis of the different watersheds in Michigan. Investigations indicated that six large Michigan watersheds had the most potential

for groundwater contamination from agricultural activities (Michigan Natural Resources Conservation Service, 1994). Fifteen USDA/AmeriCorps members were assigned to the six watersheds, with twelve members in NRCS or MSU Extension field offices and three members in the state NRCS and MSU Extension headquarters. The twelve field members advertized Farm*A*Syst to farmers with the goal of assisting with 1000 assessments by the years end.

Rationale for this Evaluative Study

Although Farm*A*Syst has been used in Michigan since the early 1900's no comprehensive evaluation of its effectiveness in influencing precaution adoption has been completed. There have been summary reports by MSU Extension agents who have had Farm*A*Syst programs in their counties, however no scientific study has been attempted.

The intent of Farm*A*Syst is to provide information to rural landowners so they can reduce the risk from practices around the farmstead that have been identified as high risk for groundwater contamination. To do this, it is necessary for the landowner with a high risk situation to make a change to lower their risk. This study is an evaluation of precaution adoption by the participants in Farm*A*Syst, focusing on identifying factors that can be associated adopting precautions necessary to reduce high risk farmstead practices. Knowing what these factors or variables are may help focus education efforts.

II. LITERATURE REVIEW

Theories of Health or Preventative Behavior

Researchers have developed a variety of theories and models to explain why individuals take measures to protect themselves from harm in situations that threaten their health. There is no clear cut universal explanation for the adoption of precautions, as the action taken to protect one's health will be called here. Four such models or theories have served as the basis for most of the research in health prevention studies. They include the Health Belief Model (HBM), proposed by a group of social psychologists at the U.S. Public Health Service (Rosenstock, 1974), The Subjective Expected Utility Theory and the Theory of Reasoned Action (Edwards, 1954 and Fishbein & Ajzen, 1975), which were not developed solely as health behavior models but lend themselves to the topic, and Protection Motivation Theory developed by Rogers in 1975 and revised in 1983 (Rogers 1975, 1983). Each one of these models has held up in empirical testing and holds the common assumption that the anticipation of and desire to avoid a negative health outcome creates a motivation for self-protection. In addition, they assert that it is necessary to believe that his resultant action will reduce the likelihood of harm to the individual (Weinstein, 1983). The four theories assess the effect of several principle variables, including the probability of a negative health consequence, the severity of that consequence, the costs of taking an action to prevent the consequence and the effectiveness of the precautions taken. The essential difference between the theories is how they measure and combine variables. Some of the theories may attempt to measure a certain variable directly while others may infer the value of the variable

indirectly. Whether the variables are handled as additive or as multiplicative also differs between theories. Nevertheless, all of the theories attempt to boil the decision to adopt a precaution down to a single prediction rule. It is increasingly hypothesized that precaution adoption is too complex an issue to be summarized in that manner. In response to this realization, Neil Weinstein has developed the Precaution Adoption Process Model.

The Precaution Adoption Process Model (PAP)

Weinstein's Precaution Adoption Process model views the decision to take measures to protect one's health as occurring in five core stages (Weinstein & Sandman, 1992). Simple awareness of a threat to health is the first, necessary stage in the process of deciding to change. Although this may seem elementary, it is important not to assume that the target group of a prevention campaign even knows what you're talking about. An amazing example illustrating the importance of this stage recently occurred. Even with the widespread media and educational efforts in AIDS education, the commissioner of the northeast boxing association did not know what AIDS was until boxer Tommy Morrison tested positive for the HIV virus which causes AIDS!

The second stage it is necessary to reach for making the decision to adopt precautions goes beyond awareness of the issue to the judgement of the threat as significant enough to warrant attention. Weinstein labels this stage "engagement". If the individual does decide that the issue poses enough of a threat, or risk, to themselves then they are poised to go on to the next stage, "engaged and deciding what to do". If they do not think the threat is important enough to themselves to take precautionary measures, it may be very

difficult to change this opinion. The extensive research done by Leon Festinger (1957) on cognitive dissonance has shown that once a person has committed to a particular viewpoint, they will selectively seek out information to reinforce their opinions and disregard information that contradicts what they believe. They do this remain in a type of psychological comfort zone.

The fourth stage of precaution adoption in this model, "planning to act" is thought to occur only if the preceding three stages, awareness, engagement and deciding what to do have been reached. In this model the important distinction between planning to act and acting, the final stage, "acting" is made. In earlier research (Kuhl, 1985; Fishbein, 1975) intentions were considered equivalent to action because of a self-regulatory process thought to keep the individual committed to their decision. Later findings brought this assumption into question (Ajzen, 1985). The PAP accounts for barriers to action that may interfere with following through with the precaution. By analyzing the adoption of precautions in a stage-wise manner, differentiating between the intention and the action, impediments to action can be identified.

Assumptions of the PAP Model

The precaution adoption process model has one important assumption that is shared by many of the preventive health theories. It assumes that the reason people take action is to avoid harm and reduce risk (Weinstein, 1988). This may be a fatal assumption for evaluative purposes as the motivation for adopting risk averting behaviors may have nothing to do with the risk. The PAP does not take into consideration social, cultural or economic

factors that may affect the decision to make change. However, social influence in the form of peer pressure or economic reasons, such as resale values on property may be the determinants of action.

Another assumption of the model is that the behavior in question is relatively complex and non-habitual. There needs to be a cognitive component of the decision to change the behavior that requires planning. Other models may be more appropriate if they do not meet those criteria.

Why the PAP in this Study?

Evaluating a program using the PAP is especially useful because it allows the researcher to analyze the adoption of precautions by specific stages. Determining where the individual is at in this process will then allow for the development of interventions focused specifically on where the individual is at in the process to move them on to the next stage, thereby hopefully making changes based on the evaluation for program improvement. (It must be noted that the model does not assume unidirectionality for all stages. One may have decided to act but for some reason is unable to carry through with their intention. They may then decide that they will not act.)

The other models presented previously use a linear equation, plugging the different factors thought to influence precaution adoption into the equation as variables. As the value of the equation varies, the probability of precaution adoption either increases or decreases. Precaution adoption is seen along a continuum, rather than as a process with distinct stages. It is difficult to determine exactly which variable most affects the decision to adopt the

precaution.

Risk Perception and Precaution Adoption

There is one factor that usually is present in some form when people decide to make changes, the perception of risk. In the case of precaution adoption for the protection of health it is assumed the risk perceived relates to the individuals perception of risk to their health, but the risk could also be seen as affecting their economic standing or social status (Weinstein, 1993). Whatever the case, this risk perception is necessary for the individual to progress through the stages of precaution adoption, from awareness of the health threat through acting. If the precaution is seen as being effective by the individual, then a reduced level of risk perception will result (Weinstein, 1988).

How a person determines his or her personal level of risk is rarely a straightforward or even logical process. Many studies have been conducted on how people perceive risk, including Paul Slovic's classic study, Characterizing Perceived Risk (Slovic, Fischhoff & Lichtenstein). Slovic asked subjects (students, members of the League of Women Voters and Active Club members) to rate thirty hazards with regard to how they perceived the risks from these hazards. He then asked experts (scientists) to rate these same risks. There were glaring differences between what the experts saw as the most risky activities and those of the lay community. This discrepancy between how people view risks is not news. Many researchers have tried to uncover the complexities behind the individuals determination of risk.

Risk Perception and Optimistic Bias

Neil Weinstein has published a series of articles on what he calls "Optimistic Bias", the tendency of individuals to perceive risk to themselves as less than the risk to others even though both themselves and others may have the same circumstances (Weinstein, 1983, 1984, 1989). In his first study, Weinstein described three factors that contribute to how people make comparative risk judgements; remembering factors that reduce ones risk as opposed to factors that increase the risk, not knowing what others are doing to protect themselves from harm, and thinking only of the risk to oneself and not much about the risk to others (egocentrism) (Weinstein, 1983). In a subsequent study, Weinstein found control over the risk to be associated with unrealistic optimism (Weinstein, 1984). Probability of the risk and personal experience with the risk also seem to contribute to optimistic bias (Weinstein, 1989). It is important to consider the phenomena of optimistic bias because the existence of this in the individual can seriously interfere with efforts to promote risk-reducing behaviors. If the individual does not perceive risk, they probably will not be motivated to adopt precautionary measures.

Risk Perception and Culture

Although not accounted for in the Precaution Adoption Process Model, cultural factors are important to consider when researching a rather homogeneous population with a strong cultural foundation. The American farmer fits this category and is perhaps the epitome of the American way. When referring to farmers at the cultural level, one will often hear the adjectives "independent", "self-reliant", "protective", and "private". The

characteristic of "individualism" seems to be the unique distinction between the American culture and other world cultures (Fitchen, 1987). In Fitchen's article on Individualism and Chemical Contamination of Groundwater she concludes that, "individualism may be a force working against the protection of groundwater for the future".

Fitchen also found that Americans place a heavy emphasis on their own senses as a source of accurate information about risk. If something cannot be perceived as threatening by it's smell, taste, color or texture than it is likely to be considered "safe". She states, "When told that 'routine' sampling has shown their water to be contaminated, people express doubt about the existence or significance of the chemical contaminants. They exhibit rather little concern about health issues because their individual sensors for judging reality give them no reason to worry."

Another cultural factor with the potential to hinder attempts at risk communication is the tendency of the American to judge risk at the micro level as opposed to the macro. Risk messages concerning groundwater contamination are generally expressed in terms of probabilities and aggregates, while the American is more likely to judge risk on how likely they personally may be affected. Because experts cannot say with certainty how the individual will be affected, the individual is left to make their own risk judgements. If a definite cause and effect relationship is apparent, the individual may exaggerate the risk. If this causal relationship is less certain and the negative effects of the exposure may only appear after much time has passed, people have a tendency to underestimate the risk (Fitchen, 1987). Unfortunately, most risk from the chemical contamination of groundwater fall in the latter category, making the risk communicator's job more difficult.

Risk Perception and Uncertainty

A discussion of risk perception would be incomplete without a mention of uncertainty as they are closely related (Wilson & Crouch, 1987). Risk implies a level of uncertainty, but how uncertain a risk is will dictate how the risk is perceived. According to Tversky, the more certain outcome will be seen as more risky than the less certain outcome, even if the less certain outcome is more probable (Tversky and Kahneman, 1974). In a different take on this same relationship Zechhauser and Viscusi state that with risk, "We know the states of the world that may prevail and the precise probability of each state", while with uncertainty, "the precise probabilities are not known" (Zechhauser and Viscusi, 1990).

Uncertainty also plays a role in the adoption of precautions. Most precautions entail a cost of some sort, whether it be financial, psychological etc... Tversky postulates that while the costs of adopting the precaution are certain, the resultant benefit may not be. This situation may play a definite role in deciding to adopt the precaution or not.

III. DESIGN, DATA COLLECTION AND ANALYSIS

Design

In this study the Precaution Adoption Process Model was used to try and determine where the individual is at in the precaution adoption process and what factors might be associated with the stage of the process the individual is in. In addition to determining the stage of precaution adoption, a list of variables that are thought to influence the adoption of precautions was compared with the stage of precaution adoption (Weinstein, 1992). These influencing variables include general knowledge of groundwater pollution processes, the perception of personal risk, the level of concern about groundwater contamination, the perceived difficulty of remediation, the perceived effectiveness of precautions if adopted, variation in property values if contamination were to occur, awareness of groundwater contamination and the perceived likelihood of contamination on the individuals property. Other issues related to risk perception were addressed as well.

Questions aimed at gleaning demographic data were purposely omitted from the survey. The Farm*A*Syst program is a highly confidential and there was great concern that the results of the survey may somehow be used against the participant. This was the first year Farm*A*Syst had wide spread use in Michigan. In subsequent years, as trust between the participants and the agencies providing assistance to the participants increases, it may be possible to ask questions regarding demographics.

Data Collection

The data were collected through a mail survey. The USDA/AmeriCorps members sent the surveys from their offices and the survey was returned to the campus office of Michigan State University Extension. The survey population included all rural landowners that completed a Farm*A*Syst with a USDA/AmeriCorps member. The data collection ran from May through August, 1995. The surveys were sent approximately two weeks after the Farm*A*Syst was completed.

The initial mailings were yielding an approximate 30% response rate. In an attempt to improve this, follow-up mailings were sent out. This increased the response rate considerably. A total of 550 surveys were sent out. The survey response rate was 56%, with a total of 308 surveys returned.

Another form of data collection used included tally sheets. The USDA/AmeriCorps member recorded the high risk areas on a sheet listing the different structures and practices covered in the Farm*A*Syst worksheets. If a high risk practice was encountered, a mark was made on the sheet next to the practice. This was not a completely accurate method of record keeping. Some of the USDA/AmeriCorps members were extremely reluctant to use the tally sheets and as a result did not count all high risk areas. Even with this problem, the survey results used in conjunction with the tally sheets does provide a good basis for both qualitative and quantitative analysis.

Data Analysis

The data were analyzed using the Statistical Package for Social Sciences, more commonly known as SPSS for Windows. Descriptive statistics were run on all responses. Cross tabulation for the determination of comparative frequencies were conducted. Analysis of Variance, or ANOVA, was conducted on the variables thought to influence precaution adoption versus the stage of precaution adoption. A multiple regression was attempted on the independent variables as they pertained to the stage of precaution adoption. Finally, percentages of high risk areas obtained from the tally sheets were tabulated. The results of these analyses follows.

IV. FINDINGS AND DISCUSSION

One of the major objectives of this evaluation is to determine the farmer's perception of risk from contaminated groundwater. Many questions were asked in an attempt to measure this perception, ranging from questions about risk in general to questions about personal risk. The responses to these questions yielded some very interesting results.

As mentioned previously, the USDA/AmeriCorps members kept tally sheets of the high risk situations found during assessments. The tally sheets demonstrate the general trend in high risk areas. Results from the tally sheet counts found the lack of secondary containment for petroleum product storage to be the most frequent high risk situation. Inadequate petroleum storage tank enclosure was the second most frequent high risk finding, followed by the lack of a pesticide mixing and loading pad.

It was interesting to find that the acknowledgement of a high risk situation on the respondents' farmstead differed depending on the data collection method used. The survey results related that 50% of participants acknowledged a high risk situation on their farmstead. The results from the tally sheets, however, indicated that 70.5% of respondents had at least one high risk situation. Furthermore, the USDA/AmeriCorps members verbally reported that nearly 100% of the Farm*A*Syst participants had at least one high risk situation. It is likely that the last figure is the most accurate, if using the categorical ranking of risk in the Farm*A*Syst worksheets. It is possible that the respondent defined risk in a way different than the categorical ranking. The Farm*A*Syst worksheets each cover a separate topic relating to the farmstead operation. For example, one worksheet analyzes the risk to the

drinking water well, another addresses pesticide storage and handling. The eleventh worksheet looks at the soils and geology at the farmstead, and the last worksheet incorporates the findings from each of the first ten worksheets with the soils and geology information on the eleventh worksheet to come up with an overall risk ranking from each structure or practice on the farmstead. This overall risk ranking may lower the risk from an individual practice if the soil is heavy (a clay for example) and the bedrock is deep under the surface. It is quite possible that when answering the risk questions, the respondent was considering the overall risk ranking as opposed to the individual risk ranking calculated for each structure or practice separately.

Upon examination of the tally sheets, it becomes apparent that structural or physical high risk areas are recorded more frequently than high risks that are due to management. (see Table 1 for an example of this difference using the Pesticide Storage and Handling Worksheet). It may be that this is indeed the case, however it is likely that the ratio between structural and management high risks is less. Managerial high risks are easier to hide, the USDA/AmeriCorps member must rely on what the landowner tells them. Physical high risk situations are usually visible. It may be that the USDA/AmeriCorps member did not feel comfortable discussing management practices with the landowner, especially if they were doing things that pose a high risk to groundwater.

Worksheet #2: Pesticide Storage and Handling	
<i>Structure</i>	<i># of Farmsteads with a high risk</i>
Mix/load pad spill containment	256
Backflow prevention	91
Spill or leak control in storage	67
Formulation of pesticide (liquid vs. dry)	35
Distance to well from mix/load area	23
Leachability of pesticide	9
Distance to surface water from mix/load area	8
Pesticide handling system	4
Total	493
<i>Management Practices</i>	<i># of Farmsteads With a High Risk</i>
Security	101
Amount of pesticide stored and duration	47
Water source (nurse tank vs. well)	22
Container disposal (location)	17
Spray cleaning and rinsate disposal	9
Containers properly labeled	6
Supervision while filling sprayer	0
Total	202

Table 1- Differences between the number of structural and managerial high risks regarding pesticide storage and handling recorded on tally sheets.

A majority of respondents thought that there is some kind of general risk from contaminated groundwater. Chart 1 illustrates the perception of a problem from the risks of groundwater pollution.

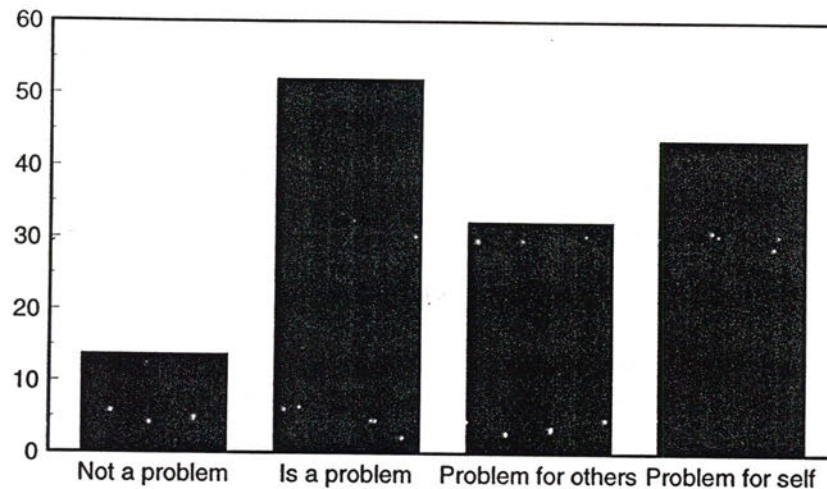


Chart 1 - Respondents perception of a problem from groundwater pollution (reported as the percentage of total respondents)

Most respondents felt the risks of problems resulting from groundwater pollution were a problem in general as well as specifically for themselves. It is interesting to find that further along in the survey this question was asked in a slightly different way with strikingly different responses. When asked if risks from groundwater pollution around the farmstead (most respondents lived on farmsteads) are a problem, 93.2% of respondents said the risks are not a problem! Eighty-six percent of respondents also stated that although they were not at risk from problems resulting from groundwater pollution, others were at risk. It would appear that in the first case, the perception of risk seems to be amorphous, a feeling without any concrete justification. When the risk was communicated in a more direct form,

relating specifically to their residences, the perception dropped dramatically. This low perception of risk to the residence, and thus to the inhabitants of the residence, was consistent with another question which was aimed at determining perception of personal risk. When asked directly the risk of groundwater contamination to the family, 81.2% stated the risk as low (see Chart 2). This was the perception even though at least 50% of the respondents admitted to having a high risk situation. Although these findings may seem illogical, they are supported by theory and similar findings in other studies.

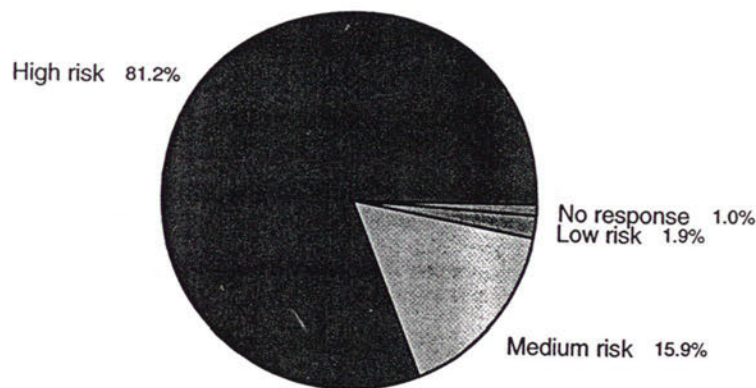


Chart 2 - The perceived level of risk from groundwater contamination (reported as percentage of total respondents).

It is part of the American culture to feel shielded from harm in our dwellings (Fitchen, 1987). Home is seen as a place of comfort and safety. We are protected from the elements and physically removed from dangerous influences, including contaminated drinking water entering our homes through the pipes. A similar psychological phenomena allows individuals to feel this shield of safety in their bodies. The attitude "It can't happen to me," protects one from the discomfort of having to deal with the possibility that harm may occur.

Neil Weinstein calls this phenomena "optimistic bias". It is important to try and reduce this optimistic bias because it may interfere with one's decision to take precautions in risky situations. Denial of a high risk situation may be a factor in the low risk perception. Even though the respondent may have been told by an "expert" that the risk situation on his or her farmstead is a high risk, they may continue to block this out of their consciousness in an attempt to maintain a level of psychological comfort. This psychological trick has been coined "cognitive dissonance" (Festinger, 1957).

There are other possible explanations for the inconsistencies in the findings. It may be that some respondents may actually have a low risk. They may have had a high risk situation that was easily corrected and when responding to the survey referred to the risk present after they had taken precautionary measures. Or, it may be that they do know the high risk situation exists and admit this to themselves. However, they are not reporting this on a survey for fear of regulatory action.

Another issue of interest in this study related to risk is whether or not those that actually reported a high risk situation saw themselves as having a greater risk from groundwater contamination than those that did not report a high risk situation. To answer this question we need to know information about those reporting a high risk situation. Table 2 breaks down the responses to the survey with regard to high risk situations and stage of precaution adoption.

Of the 308 responses to the survey, 152 individuals stated they did not have a high risk situation on their farmstead. The remaining 156 respondents did report a high risk situation and varied in their stage of precaution adoption.

Percentage of respondents vs. stage of precaution adoption	
<i>Stage</i>	<i>Percentage of respondents</i>
Aware of groundwater contamination problem	100%
Engaged but not going to act	2.3%
Deciding what to do	11%
Planning to act	15.3%
Acting or have acted	22.4%
No high risk reported	49.3%

Table 2 - High risk situation vs. stage of precaution adoption

The PAP states that for an individual to reach the stage of planning to act or the stage of having acted they must perceive a higher degree of personal risk. This statement is logical, a person would not be likely to invest the time, money or effort in changing a situation that they do not see as risky. In the data analysis, a test was run to try and determine if the perception of risk is related to the stage of precaution adoption. It was not possible to determine a relationship with any degree of certainty. In fact, although most people saw their personal risk as low, almost 75% of those having high risk situation were at the planning to act or action stages.

There is a possible explanation for the respondents making changes in the absence of a perception of risk. As stated earlier, one of the underlying assumptions of the Precaution Adoption Process Model is that people take action for the purpose of avoiding harm and reducing risk. If this is not the reason for taking action, the PAP model will not apply. The respondents in this evaluation may have had altogether different reasons for taking action.

They may have made a change for economic reasons, to increase the value of their property or to prevent possible future liability in the event of a lawsuit. They may have made a change because the change required was simple and low cost, not requiring much effort. Perhaps they made a change because someone seen as an expert said they should do so. Risk may have had little to do with their decision. Indeed, when analyzing the variables thought to influence precaution adoption, it seems likely that risk to the respondents health was not a determining factor in the adoption of precautions.

The third objective of this evaluation was to determine which factors may be associated with making changes to lower risk from groundwater contamination. As stated earlier, the PAP model was used to try and establish where the respondent is in the process of making changes and which factors may influence where and individual is at in this process. The analysis of variance (ANOVA) test was used to try and establish a relationship between the factors chosen for comparison and the PAP model. The results of this analysis appear in Table 3.

Factor or variable potentially affecting stage of precaution adoption	Stages of precaution adoption used for comparison	
	<i>Action not needed vs. Undecided vs. Plan to act</i>	<i>Plan to act vs. Already acted</i>
General knowledge	0.0%	0.1%
Families risk	0.3%	0.9%
Level of concern	7.1%	4.0%**
Difficulty of remediation	9.6%*	2.3%
Personal risk	0.7%	0.7%
Precautions effective	4.0%	0.6%
Property values affected	4.1%	0.1%
Likelihood of contamination	0.0%	0.5%
Increased awareness of precautions to lower risk	7.4%	1.3%

* p=.05

** p=.03

Table 3 - Percentage of variance in response (r squared) by stage of precaution adoption. (r squared is called the coefficient of determination and helps illustrate the strength of the relation between the variables being compared)

The level of concern about groundwater contamination did seem to be associated with the variability between the stages of planning to act and action with a reasonable degree of certainty. The difficulty of remediation also could be associated with the variability between the decisions of action not being needed, undecided and planning to act with some degree of certainty. These results mean that an individual's response to those factors had some influence on their decision to adopt precautions. For example, if there was a high level of concern about groundwater pollution the person would be more likely to act than if the concern was low. Although statistical significance could not be conclusively determined,

there did seem to be some association between some of the other factors and the stage of precaution adoption.

Another variable that is theoretically related to the adoption of precaution is the perception of the severity of the potential negative health effects. The responses regarding this factor varied in an incongruous manner. For example, most people didn't know that all of the negative health effects listed were possible from contaminated groundwater. Some people felt so uncomfortable with this question that they didn't even respond. A few respondents even went so far as to comment that one would need to be a doctor to answer the health related questions! When the question of severity was communicated as the "seriousness" of the negative health consequences resulting from polluted groundwater even more puzzling responses were given. When asked if the health consequences from contaminated groundwater could be serious to them, most people said no. A few questions later in the survey, the respondents said the health consequences would be serious. It is clear from this inconsistency that there is much ambiguity about the health problems contaminated groundwater may cause and how severe these consequences may be. This ambiguity may be a factor in the low perception of personal risk. However, this may not necessarily mean that the probability of adopting a precaution against these health threats will be lowered. Some research has shown that the seriousness or severity of the illness resulting from exposure to contaminated groundwater may not influence peoples decision to adopt precautions. It has been found that when respondents didn't know the severity of the threat they may base their decision to act on some other variable (Kunreuther et al, 1978).

Never the less, perceived severity of the negative health outcomes of certain behaviors

(ie. not protecting oneself from risk in a high risk situation) is a common variable in the various health protection models. It is hypothesized that if the perceived severity is low than the perceived personal risk will be low. The perception of personal risk in this evaluation was consistently low. This could mean that people really did not think the health consequences would be severe, thereby confirming the hypothesized relationship. And as stated earlier, it could also mean that the respondents are framing risk not in the realm of health, but perhaps from an economic or social perspective.

It is important to try and determine which factors may play a role in precaution adoption for education efforts. Focusing on those factors that seem to be associated with peoples decisions to adopt precautions would perhaps yield better results than focusing on those that do not seem to be association with precaution adoption. It would, however, not be advisable to completely ignore the factors not shown to be significant in this study. Further research is needed to confirm these findings.

There are other factors not explored in the theoretical framework that have an impact on whether a farmer makes a change in a high risk situation. Most respondents said they plan to act or have already acted to reduce the risk from the high risk practice. For the 25% that are still deciding what to do or do not plan to act, financial reasons were cited most frequently as the reason for this decision. Referring to the tally sheet results, this reason makes sense because the most frequent high risk findings were costly to remedy (installing a pesticide mixing and loading pad for example).

The final objective of this evaluation was to test the Precaution Adoption Process model as a tool for predicting who will make changes after conducting a Farm*A*Syst. To

do this, the model is used in conjunction with the variables thought to influence precaution adoption. The model can demonstrate a relationship between those variables and the stage of precaution adoption. In this study, the model did not show a relationship between most of the variables and the stages of precaution adoption. There may really be no relationship between the variables and the stage of precaution adoption in this case. It also may be that the conditions needed to be present for the model to fit the evaluation (the underlying assumptions) were not fulfilled. Further study would be necessary to determine why the PAP model did not fit this evaluation.

VI. CONCLUSIONS AND RECOMMENDATIONS

One of the primary concerns of the agency representatives promoting the USDA/AmeriCorps Farm*A*Syst program was the impact the AmeriCorps members would have on the relationship developed between the agency and the landowner. The cornerstone of these relationships is trust, which can only be developed over time and is very easy to destroy. Farm*A*Syst is a confidential groundwater risk assessment program, but the belief on behalf of the landowner that confidentiality would be maintained was uncertain. Although outwardly confidentiality did not seem to be an overriding concern of the landowner participating in Farm*A*Syst, the discrepancy with the results pertaining to risk perception and "high risk areas" indicates that there may have been a latent concern. A continuing emphasis should be made about confidentiality and the voluntary, preventive nature of Farm*A*Syst. Trust will improve over time given no breeches or perceived breeches in confidentiality. This may aid in lessening the discrepancy between risk perception and the "high risk areas" reported.

Although a conclusive relationship between perception of health risks and precaution adoption was not demonstrated in this evaluation, more attention needs to be given to the health issues related to contaminated groundwater and the risks resulting from these issues. There was clearly a lack of understanding of the different problems contaminated groundwater may cause. In this case, many of the respondents had not even reached the first step necessary for precaution adoption according to Weinstein's model, awareness.

There was also a lack of awareness about how others may be affected by groundwater

contamination. A consistent "it won't happen to me" attitude offers a false sense of security to the individual with that attitude and may result in the individual failing to take preventive measures. Communicating the message of groundwater contamination at the micro level, how pollution affects the individual and what the problem is like in the individual's local community, will serve to personalize the message.

Future groundwater educational efforts should be targeted at those areas in the study found to have an impact on the likelihood of adopting precautions. Maintaining a high level of concern where there is a high likelihood of having a groundwater contamination problem, and communicating the difficulty of cleaning up a contaminated area seem to be the two factors associated with precaution adoption. The other factors considered may also increase precaution adoption and should be emphasized as well.

The issues explored in this evaluation indicate that there is much more to be learned about why people will protect themselves from the problems caused by polluted groundwater. It is vital to attempt to apply a theoretical approach to evaluation of on-going programs. By doing so, predictive models can be developed and utilized to elicit change for the protection of health. These models can be used for a variety of different programs that are aimed at getting people to make changes.

A follow-up evaluation will be conducted for the USDA/AmeriCorps Farm*A*Syst program. Similar questions will be asked and new ones added based on the results of this evaluation. Demographic data will be requested and other variables thought to affect risk perception will be tested. The results of this study will be available from the Michigan Department of Agriculture, Groundwater Protection Programs section in October, 1996.

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APPENDIX A

Americorp Michigan Priority Watersheds



A – Direct Drainage to Lake Michigan
Congressional District 1

1 Americorp Employee
3 SCS Field Offices

B – Lower Grand River
Congressional Districts 2, 3, 4

3 Americorp Employees
5 SCS Field Offices

C – Kalamazoo River
Congressional Districts 2, 3, 6, 7

3 Americorp Employees
7 SCS Field Offices

D – Upper Grand River
Congressional Districts 3, 4, 7, 8

2 Americorp Employees
7 SCS Field Offices

E – Raisin River
Congressional Districts 7, 16

2 Americorp Employees
4 SCS Field Offices

F – Black, Belle, and Pine Rivers
Congressional Districts 5, 9, 10

1 Americorp Employee
3 SCS Field Offices

District – Congressman

1 – Bart Stupak	7 – Nick Smith
2 – Peter Hoekstra	8 – Bob Carr
3 – Vernon Ehlers	9 – Dale Kildee
4 – Dave Camp	10 – David Bonior
5 – James Barcia	16 – John Dingell
6 – Fred Upton	



APPENDIX B

Worksheet #8

Assessing the Risk of Surface and Groundwater Contamination from *Livestock Yards Management*

Why should I be concerned?

Livestock yards, such as barnyards, holding areas and feedlots, are areas of concentrated livestock manure. They can be a source of nitrate and bacteria contamination of groundwater. This is especially true if there is no system to 1) divert clean water flow from the livestock yard or 2) collect polluted runoff from the yard for diversion to an area where its effect on surface water or groundwater is minimal. The potential for livestock yards to affect groundwater is greatest if the yard is located over coarse-textured permeable soils, if the water table is at or near the surface, if bedrock is within a few feet of the surface, or when polluted runoff is discharged to permeable soils and bedrock.

Nitrate levels in drinking water above federal and state drinking water standards of 10 milligrams per liter (mg/l; equivalent to parts per million for water measure) nitrate-nitrogen can pose health problems for infants under 6 months of age, including the condition known as methemoglobinemia (blue baby syndrome). Nitrate can also affect adults, but the evidence is much less certain.

Young livestock are also susceptible to health problems from high nitrate-nitrogen levels. Levels of 20-40 mg/l in the water supply may prove harmful, especially in combination with high levels (1,000 ppm) of nitrate-nitrogen from feed sources.

Bacteria in livestock waste can contaminate groundwater if waste seeps into nearby wells, causing such infectious diseases as dysentery, typhoid and hepatitis. Organic materials, which may lend an undesirable taste and odor to drinking water, are not known to be dangerous to health, but their presence does suggest that other contaminants are flowing directly into groundwater.

A livestock yard without a runoff control system typically has an earthen surface compacted by animal traffic. This surface is not shaped for water drainage, so it is usually dry in some places and muddy in others. Manure typically accumulates on the surface, and decaying manure is mixed into the soil by animal traffic.

The goal of Farm•A•Syst is to help you assess your current practices and determine how well you are protecting the groundwater that supplies your drinking water and surrounding surface water.

How will this worksheet help me protect surface and groundwater?

- It will take you step by step through your livestock yards management practices.
- It will rank your activities according to how they might affect the groundwater that provides your drinking water and surrounding surface water.

Livestock Yards Management: Assessing Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your farmstead, read across to the right and circle the statement that best describes conditions on your farmstead. (Skip and leave blank any categories that don't apply to your farmstead.)
3. Look above the description you circled to find your "rank number" (4, 3, 2 or 1) and enter that number in the blank under "your rank."
4. Directions on overall scoring appear at the end of the worksheet.
5. Allow about 15-30 minutes to complete the worksheet and figure out your risk ranking for livestock yards management.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
SITE CHARACTERISTICS					
Lot location in relation to wells	Active livestock yards on fine-textured soil or paved lot. 100 feet or more downslope from well or more than 300 upslope from well.	Active livestock yard on fine-textured soil or paved lot. More than 50 feet downslope from well.	Active livestock yard on coarse-textured soil. 100 to 300 feet upslope from well.	Inactive livestock yard on medium to coarse-textured soil, or inactive livestock yard on fractured limestone. Within 100 feet upslope of well.	_____
Lot location in relation to surface water	Livestock yard is more than 300 feet from surface water. Slope is less than 3%. Dense vegetation that is harvested exists between yard and surface water.	Livestock yard within 300 feet of surface water. Slope 3 to 6%. At least 150 feet of dense vegetation between yard and surface water.	Livestock yard is more than 75 feet from surface water. Slope less than 6%. Dense vegetation grows in a strip at least 75 feet wide adjacent to the surface water.	Livestock yard is located less than 75 feet from surface water. Slope exceeds 6% and minimal vegetation exists, or a stream runs through livestock yard.	_____
Runoff control system	All roofwater and upslope water drainage is diverted around livestock yard. All yard runoff directed to a settling basing and sealed runoff storage for at least 180 days.	Roofwater and upslope watershed drainage is diverted around livestock yard. All runoff directed to a settling basing and vegetated infiltration strip where vegetation is routinely harvested.	Roofwater and upslope watershed drainage is diverted around livestock yard. Runoff directed to cropland. Does not discharge into streams or lakes. Soils are fine to medium texture.	Roofwater and upslope watershed drainage runs through yard and no runoff control system in place. Yards rarely scraped.	_____

Use this total to calculate risk ranking on back page of worksheet.

TOTAL

APPENDIX C

FARM*A*SYST EVALUATION

Directions:

Answer each question as accurately as you can. Many questions can be answered by circling the item that best describes your opinion or situation. Other questions require you to check the response or responses that apply. All answers will be kept completely confidential.

1. How did you hear about Farm*A*Syst and the service available through USDA/AmeriCorps members? *(check all that apply)*

☐ Newsletters
☐ Newspapers
☐ Radio
☐ Television
☐ Direct Mail
☐ Meetings
☐ Word-of-Mouth
☐ Flyer
☐ Other _____

2. On a scale of 1 to 5, with 1 being of no value and 5 being extremely valuable, circle the number that most closely describes your feeling about your participation in Farm*A*Syst with a USDA/AmeriCorps member.

1	2	3	4	5
No value		of some value		very valuable

3. How would you rate the assistance from the USDA/AmeriCorps member?
(circle one option)

a. poor
b. fair
c. good
d. very good
e. excellent

9. If someone in your home did have negative health effects from groundwater contamination, how serious do you think they would be?

- a. Very minor
- b. Minor
- c. Somewhat serious
- d. Serious
- e. Very serious

10. When you think about groundwater pollution, how do you feel?

- a. Not at all concerned
- b. Somewhat concerned
- c. Concerned
- d. Very concerned

11. In general, how would you rate the level of concern about groundwater pollution in your community?

- a. Not at all concerned
- b. Somewhat concerned
- c. Concerned
- d. Very concerned
- e. Don't know

13. The following opinions about groundwater have been expressed. We want to know if you agree or disagree with them. *(Please circle your opinion)*

a. If my neighbor dumps oil in a drainage ditch the oil may end up in my drinking water. Agree Disagree Don't Know

b. What people do on their own property won't help prevent well water contamination unless their neighbors also work to prevent it. Agree Disagree Don't Know

c. Physical characteristics like soil and bedrock type and depth to groundwater affect the potential for groundwater and well water contamination at a specific site. Agree Disagree Don't Know

14. When groundwater is polluted it:
(circle one)

- a. Can be cleaned very easily
- b. Is very difficult to clean
- c. Cannot be cleaned
- d. Don't know

18. Did the USDA/AmeriCorps member suggest a precaution that would lower your risk ranking from the high risk practice? *(check one)*

☐ Yes
☐ No *(skip to 20)*

19. If yes, how do you feel about the precaution suggested?
(check all that apply)

☐ I remember that a precaution was suggested.

☐ The precaution suggested was clear to me.

☐ I believe the precaution suggested would reduce risk from the practice in general.

☐ I believe the precaution suggested would reduce risk from the practice for myself.

20. For the high risk areas you have identified on your farmstead that you would like to change, what type of assistance, if any, would be helpful in making those changes?
(check all that apply)

☐ Technical design/engineering
☐ Equipment recommendations
☐ Education on management options
☐ Cost sharing
☐ Testing services (soil, water etc...)
☐ Other (please specify) _____

Please use this space to write your comments about this survey.

Thank you for your cooperation with this evaluation. Please return the completed survey to:

Christina Coulon, USDA/AmeriCorps
Michigan State University Extension
11 Agriculture Hall
East Lansing, MI 48824-1039

APPENDIX D

COMMENTS FROM SURVEY

1. You would have to be a doctor to answer question #5 on the second page.
2. She (the USDA/AmeriCorps member) did a nice job.
3. It (Farm*A*Syst) made me more aware of problems.
4. Very important that the person doing the survey comes across as helping and not as a 'regulator'.
5. The survey is good but I'm one of the lucky farmers who have never had a water problem.
6. Need to get more people to participate in on site assessments.
7. Anytime you participate in a 1 on 1 program you've got to benefit from the program. Your more apt to ask more questions at home than in a meeting place.
8. Because of the emphasis on the soil rank in the scoring it averages down any management attempts. Possibly separate the controllable factors vs. the uncontrollable and score them separately.
9. Thank you for doing such a good and important job.
10. Survey (Farm*A*Syst worksheets) is not completed yet but am working on it.
11. The size of the farm should affect the scoring on some answers. For example, a farmer that mixes two tanks of spray without having a "mixing pad" I don't think is as high of a risk as one who mixes twenty tanks full. Same goes for fuel, a guy who stores 500 gallons vs. 10,000 gallons.
12. Probably good for the cause.
13. Some questions could have been yes or no or agree or disagree instead of 'may disagree'. Most every farmer has concern about our water.
14. The farmer needs to do all of the sheets with the AmeriCorps representative and not the AmeriCorps representative do some without the farmer. The farmer needs to have all the factsheets so that they can read over before any sheets are filled out.
15. Well done!
16. Do it other than at spring planting time!

17. I believe that the Farm*A*Syst program while beneficial-underestimates the technical and general knowledge (ie. most people I know have at least some college level education).
18. We covered some things that I didn't consider a risk until we did the survey. I think every farmer could benefit from this survey.
19. I basically already knew the problems I had. This survey prompted me to act on them. It also brought to light the seemingly harmless substances like paint, parking a truck or tractor that leaks can be potential problems.
20. It made me more aware of the problem. I'm trying to clean some as I see them but can not afford to spend much money to do this.
21. The survey was O.K. but the survey members need more training.
22. I work off the farm to like most farmers my age, and it helped me with a kind of hands on class as well as giving me credits so I wouldn't have to take time off work. Thank you.
23. Good program.
24. Appreciate voluntary participation.
25. I like it. Every farmer should be concerned.
26. I am very much interested in our water condition. Here is a question for you: Why is the city of Grand Rapids allowed to dump millions of gallons of raw sewage into the Grand River each year? Each individual farmer should be responsible for his or her actions: Where is the almighty DNR when GR decides to empty their cess pool? Please comment CHRISTINA COULON. How concerned are you with our water quality?
27. Very poor survey. The questions were worded like they were looking for answers they already had in mind. Many questions did not have my answer in the choice of answers typed.
28. Interesting. Informative. Comforting.
29. This program allowed me to know what regulations are in effect and what agency to contact to make beneficial changes- It also clarified conflicting regulations.
30. This is an excellent survey and I hope other farmers try to improve their practices where need be.
31. The Farm*A*Syst program is very good in bringing to our attention the possibility of problems that could be severe if left un-attended or not dealt-with.
32. Good program- not politically/regulatory threatening. Enthusiastic young presenters- used referral techniques well when they lacked background or experience.

33. I feel I did my share in keeping groundwater clean when will the USDA survey non-farmers about pollution.
34. Several moderate and low risks were identified, and suggestions made for correcting them.
35. We are long overdue in testing to see the effect of chemicals and fertilizers used. I think it has caused cancer in people and animals in the last 20 to 40 years.
36. Need to know approved methods for implementing and designing new safety improvements, impoundments, enclosures etc...
37. The AmeriCorps assessment by Ms. Faith Traylor was thorough and clearly understood. Follow-up information was done well by Faith. We did not have anything High risk (our two fuel tanks are currently tested and have not leaked). We have removed our underground gas by specialized contractor and will remove fuel oil as it is too close to well. Am pleased with assessment, will prevent program here, far better than 'curing' later.
38. Very good program.
39. Very complete, covered most all aspects.
40. I thought the survey was very helpful, in that it addresses a wide range of questions relating to my farming operation. It brought to my attention a couple of areas that needed to be taken care of; of which I have.
41. The AmeriCorps member was very helpful.
42. Ms. Traylor was of great help to inform me to use safe practices so as to reduce groundwater contamination.
43. Need to tailor questions to particular areas of ag- N.W. Lower Michigan is quite tuned in and maybe needs to be addressed on a higher level.
44. The Farmstead Assessment Program made me aware more of what to do for prevention.
45. Jennifer Blaker did a excellent job. She is a good person to do this type of work.
46. Survey is fine but, what about private citizens that bury iron, junk, dump oil, antifreeze and other items in ground. Report them and nothing happens. I even reported them to the DNR.
47. Very informative and helpful. Thank you for the information provided.
48. Jennifer did ours and was quite knowledgeable and willing to answer our questions.

49. We all get busy in our work and need to be reminded about things we might of let go.
50. USDA/AmeriCorps rep. was knowledgeable and completing survey helped address potential problem areas and solutions to problems.
51. At another address located in a city where we had city water I had 4 pets plus my mother die of cancer. This was always a concern for me.
52. Most unsafe wells in this area are residential non approved wells kept secret from local health department.
53. It's important to protect our groundwater and environment, but sometimes people are sacrificed for the sake of laws and lots of red tape. Somehow people need to be responsible to their fellow man and government agencies and work for the common good of all mankind.
54. Difficult questionnaire. It is probably very dear to you- but so many questions are difficult to answer without explanation. Not clear on what you want to know or why. Evaluator was excellent. We are continually aware of groundwater contamination and evaluate what we can do and what we should not do.
55. The survey opened by eyes to a few possible sources of contamination which will be corrected.
56. Just a make work program.
57. I think this is a good way to build another very large bureaucracy for MSU and USDA. The good it may do will be last.
58. Just yet one more survey which contributes to mounds of paperwork and takes my time away from productive work.
59. Would like to solve all problems (chemicals) before they arrive.
60. Everybody should go through the course. Very informative, brings out awareness of subject.
61. It is helpful to know there is a department on call if I have questions.
62. Kristin was very pleasant to work with also very informative.
63. I think USDA should check the cities, anyone can spray lawns and by laundries. It can run off right into storm sewers and right into rivers.
65. Conversation after the assessment was thought provoking in calling attention to possibility of problems. the Extension Service is appreciated.

66. It is a great program that keeps you aware of being cautious and doing correct farm practices.
67. I would like cost-sharing for liquid fertilizer storage.
68. A worthwhile and informative program: A 'high quality' presentation was conducted by Kristin Korutz.
69. Well informed, easy to complete.
70. I feel it was a good survey, it keeps us on our toes and makes us think about what we can do to make our liver healthy.
71. I enjoyed the assistance from the AmeriCorps member- nice experience and well worth our time.
72. The farm is not the only source for contamination. I have a hard time believing Amoco "leaked" 60,000 gallons of gas from a pipe in the ground where the aquifer is only 4 feet deep and we have NO contamination. Yet a gas station has contamination from the small amount of gas spilled by customers. As far as I can tell the DNR feels there is no contamination. What do you think the credibility of the DNR is in our area. DNR=Government. Have a nice day!
73. Christina,
I'm not sure I should have filled this out since I work on campus. However, I think that the issues and awareness that the evaluation brings out among producers may be more valuable than they would be willing to admit. If the producers you are working with don't feel that they are on the defensive, they might gain a lot of valuable insight from this process. I think it is hard to write a survey that gets to issues and attitudes of producers. This one is somewhat subjective in places, but asks the right questions for the most part and should be a good feed back tool. Anonymous.
74. This is a bad situation on all fronts, just keep your eyes open.
75. Teresa Rudnicki did a good job.
76. Could be useful if more people fill it out.
77. The young lady conducting the survey of our farm was very congenial, qualified and helpful. Many things we as farmers do are harmful to ourselves and others because we have been unaware of the consequences. Many things we are encouraged to do by MSU like burying our fuel tanks to preserve octane.
78. Good helpful program- keep it in effect with more credits.
79. I think it is very important to have a survey like this hopefully it will help all of us in the future and now.

80. Poorly written survey- many questions make assumptions that aren't necessarily true.
81. I thought the meeting was very informational and it made me more aware of areas to address and made me have a better understanding of what you agencies are trying to help with.
82. This additional lay of government seems unnecessary- the same thing could have been accomplished through a mailing to the ag community, without hiring additional staff.
83. Educational. AmeriCorps member very knowledgeable of survey process and willing to provide assistance/information in a non-intrusive manner.
84. Less than one sucker long. Very pleased with the information provided.
85. Where will the results go- will anything become of the survey and what benefit will I get out of it!
86. Survey information was helpful. AmeriCorps person should become more familiar with both soil types and subsurface geology relative to potential for groundwater contamination.
87. O.K. but many farms need to have this done also city dwellers need to be aware of this on their lawns! They over fertilize and use pesticides way too much! Farmers are the ones afraid to use it or don't care. It should be promoted as a no risk no cost program.
88. It was worth doing.
89. Try and keep program simple, direct, and with results. The rules and regulations are somewhat out of hand- common sense not too much red tape.
90. Questionnaire well planned.
91. Does this really do any good but create bigger government and waste my tax dollars on surveys and self adhered envelopes and stamps.
92. I think information on general water and soil cleanness or contamination should be publicly shared, along with ways to solve problems and get rid of contamination. Let individuals know if their well water is very healthful or not healthful and what ways to improve it if necessary.
93. Our farm is leased by reliable farmers and our main concern is the lagoon system across the road from our property.
94. I think it was worth the time to do it.
95. A bad time of the year to send out the survey.

96. The concept that the results are for the property owner only is good. The biggest problem is that corrections needed in many cases are so costly. The young people administering these evaluations may have some of the answers, but don't realize what it is to have to pay for the actual risk reductions practices.

97. I am very skeptical about any information today because of our society of today, misusing and gaining false information and using it to their advantage and that does include our government agencies.

98. No problems only I wish I could have taken it sooner since the evaluation.

99. AmeriCorps and Farm*A*Syst did tests for groundwater pollution on my farm and did not find any contamination problems. Every test came out good.

APPENDIX E

**MICHIGAN STATE
UNIVERSITY**

April 10, 1995

TO: Christina Coulon
11 Agriculture Hall

RE: IRB#: 95-160
TITLE: EVALUATING FARM*A*SYST USING THE PRECAUTION
ADOPTION PROCESS MODEL
REVISION REQUESTED: N/A
CATEGORY: 1-C
APPROVAL DATE: 04/10/95

The University Committee on Research Involving Human Subjects' (UCRIHS) review of this project is complete. I am pleased to advise that the rights and welfare of the human subjects appear to be adequately protected and methods to obtain informed consent are appropriate. Therefore, the UCRIHS approved this project including any revision listed above.

RENEWAL: UCRIHS approval is valid for one calendar year, beginning with the approval date shown above. Investigators planning to continue a project beyond one year must use the green renewal form (enclosed with the original approval letter or when a project is renewed) to seek updated certification. There is a maximum of four such expedited renewals possible. Investigators wishing to continue a project beyond that time need to submit it again for complete review.

REVISIONS: UCRIHS must review any changes in procedures involving human subjects, prior to initiation of the change. If this is done at the time of renewal, please use the green renewal form. To revise an approved protocol at any other time during the year, send your written request to the UCRIHS Chair, requesting revised approval and referencing the project's IRB # and title. Include in your request a description of the change and any revised instruments, consent forms or advertisements that are applicable.

**PROBLEMS/
CHANGES:**

Should either of the following arise during the course of the work, investigators must notify UCRIHS promptly: (1) problems (unexpected side effects, complaints, etc.) involving human subjects or (2) changes in the research environment or new information indicating greater risk to the human subjects than existed when the protocol was previously reviewed and approved.

If we can be of any future help, please do not hesitate to contact us at (517)355-2180 or FAX (517)336-1171.

Sincerely,

David E. Wright
David E. Wright, Ph.D.
UCRIHS Chair

DEW:pjm

cc: Cynthia Fridgen



**OFFICE OF
RESEARCH
AND
GRADUATE
STUDIES**

University Committee on
Research Involving
Human Subjects
(UCRIHS)

Michigan State University
232 Administration Building
East Lansing, Michigan
48824-1046

517/355-2180
FAX: 517/432-1171

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Farmstead Assessment Program
Pre-Assessment Survey of
Farmers in Louisiana
March 1994

FARMSTEAD ASSESSMENT PROGRAM

(Farm *A* Syst)

A PRE-ASSESSMENT SURVEY OF FARMERS IN LOUISIANA



Louisiana Agricultural
Extension Service

in association with
University of Wisconsin-Madison
Department of Agricultural Economics

March 1994

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Farmstead Assessment Program
Post-Assessment Survey of
Farmers in Louisiana
March 1994

FARMSTEAD ASSESSMENT PROGRAM

(Farm *A* Syst)

A POST-ASSESSMENT SURVEY OF FARMERS IN LOUISIANA



Louisiana Agricultural
Extension Service

in association with
University of Wisconsin-Madison
Department of Agricultural Economics

March 1994

Joseph L. Wysocki

**NPL—Family Housing & Environment
Home Economics and Human Nutrition**

Extension Service, USDA
Room 3444 South Building
Washington, DC 20250-0900

(202) 720-8344

FAX: (202) 690-2469

Internet: jwysocki@es.usda.gov



Date: *May 10, 1994*

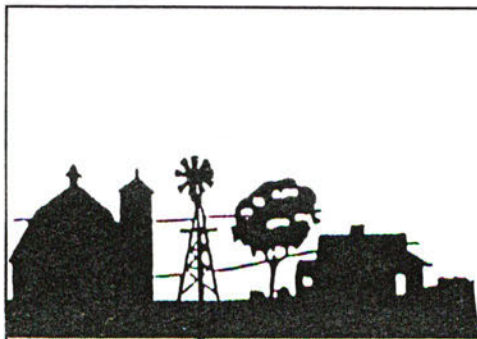
To: *Joel Berg*

- ☒ For information
- ☐ For action
- ☐ As requested
- ☐ Per phone call
- ☐ Please return by

Subject:

*Current information about the
Farm - A-Syst program*

STRENGTHENING FAMILIES THROUGH EDUCATION



FARMSTEAD POLLUTION PREVENTION U · P · D · A · T · E

NEWS ABOUT FARMSTEAD ASSESSMENTS FOR GROUNDWATER PROTECTION

March 1994

Student labor boosts Wisconsin Farm*A*Syst assessments

(adapted from a "Keeping Current" newsletter article)

Wisconsin Extension agents may have found a natural partnership for Farm*A*Syst when they teamed up with students from Fox Valley Technical College in Appleton. Future natural resource managers benefit from the hands-on training, while farmers may respond more openly with students who are still learning the ropes.

Last fall, Waupaca County Extension Agent Greg Blonde and Outagamie County Extension Agent John Biese helped soils instructor Bruce Cecka turn theory into practice for 44 students who were trained to conduct Farm*A*Syst assessments.

"Before they [students] got involved in this project, they would drive by a farm and just see buildings and machinery. Now they see it entirely differently," says Cecka, whose students teamed up to conduct assessments on 27 area farms.

From Blonde's standpoint, the experience was "time-consuming, but we all agree that it was time well spent. I see it as a way to expand the number of farmstead assessments in my county and I'm willing to give it two weeks of my time every year. Not only are we getting these assessments completed, but a large group of students is getting excellent training experience that they will take with them to their jobs throughout the state."

Biese added, "This is an excellent program. The farmstead assessment process ought to be much more widely available. Using these technical college students helps us achieve that."

The learning process started in September with a two-hour orientation session on the Farm*A*Syst assessment system and a lesson on the basics of groundwater and groundwater pollution, using a groundwater model. Then a week later, Biese arranged for the class to visit a nearby farm for a live run-through of the farmstead assessment process.

In early October, the students were provided with soil surveys and well logs to conduct the groundwater and subsurface assessments for their assigned farms. This activity tied the project to the soils curriculum of the class. Then the students had about 30 days to establish contact with the farmers and complete the ten worksheets.



"This interaction with the farmers was a real lesson in human relations for many of the students," Cecka observed. "I told the students to be very up-front with the farmers... I also advised the students to show an interest in what the farmer said and to not argue with the farmer's judgement about a particular situation. A farmer may not wish to admit that he has a problem in a certain area, but just by raising it, I can guarantee that they will be thinking about it. The students really caught on to this," he said.

Blonde noted that there are still some bugs to work out with the collaboration— "We need to refine the program to [better] meet farmers' needs," he said. The lengthy time needed by staff to develop individual action plans tends to deflate farmer interest in the program. "The longer we wait, the further from farmers' minds it becomes," he noted.

And, like every class graded on a curve, there are the "A" students and the "F" students. Using students does not ensure every assessment will be conducted properly, he added, although using teams lessens the effect.

All in all, Blonde feels the effort has a "lot of potential. Eventually, all of the farms in our county may be assessed... There's no way I could reach 27 farms by myself."

For more information about creating a partnership with vocational-technical students and your Farm*A*Syst program, contact Greg Blonde, Waupaca County Extension, 715/258-6230, or the Farm*A*Syst national office, 608/262-0024.

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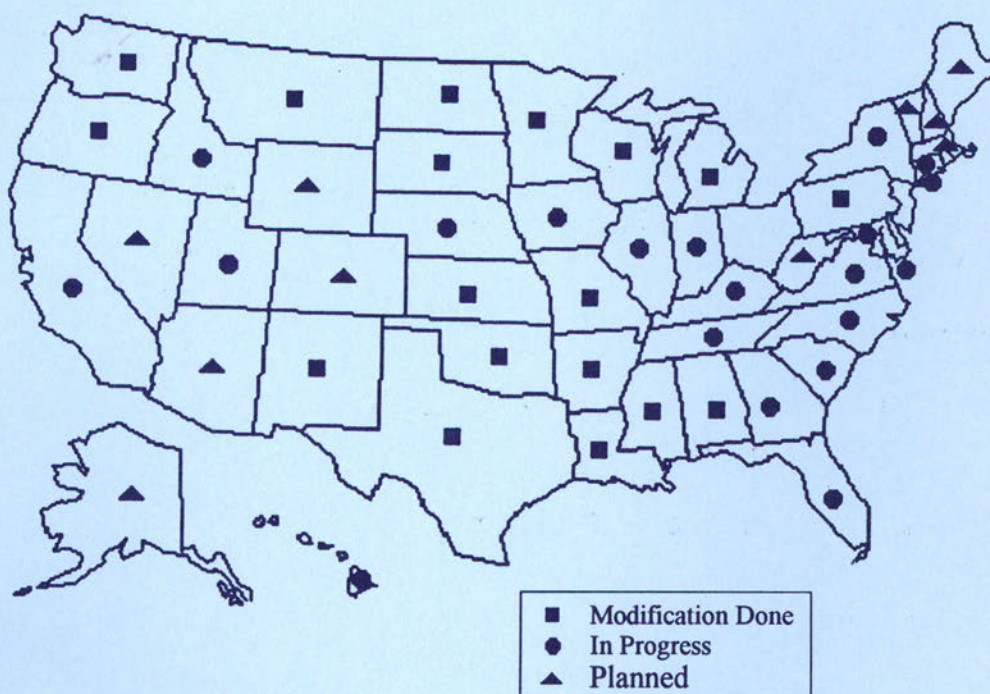
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*Farm*A*Syst*

Farmstead Assessment System

Farm*A*Syst Programs Across America



National Farm*A*Syst Directory

April 1994