

October 2005

FREC RR05-04

Gauging Support for Innovative Farmland Preservation Techniques

Joshua M. Duke

Lori Lynch

FOOD
& RESOURCE
ECONOMICS

FREC Research Reports

Department of Food and Resource Economics • College of Agriculture and Natural Resources • University of Delaware

Joshua M. Duke
Food and Resource Economics and Legal Studies
University of Delaware
Newark DE 19716-2130
P: 302-831-1309
F: 302-831-6243
duke@udel.edu

Lori Lynch
Agricultural and Resource Economics
University of Maryland
College Park MD 20742
P: 301-405-1264
F: 301-314-9091
llynch@arec.umd.edu

Gauging Support for Innovative Farmland Preservation Techniques. By Joshua M. Duke, Department of Food and Resource Economics, University of Delaware, and Lori Lynch, Department of Agricultural and Resource Economics, University of Maryland. FREC Research Report No. 05-04.

Abstract

This report describes the results of interviews and focus groups, gauging support for innovative farmland preservation techniques. Four techniques were selected for assessment from approximately 30 novel techniques identified in previous research: (1) Term conservation easements; (2) Land preservation tontines; (3) Rights of first refusal; and (4) Agricultural conservation pension with purchase of agricultural conservation easements. Data were collected from three types of stakeholder groups, including land preservation program administrators in Delaware and Maryland, Delaware legislators, and Delaware landowners.

The results show that these stakeholders believed rights of first refusal was the most promising concept, and the groups identified some specific challenges to effective implementation. Targeting areas to implement the technique and having a dedicated, regular funding source were perceived to be essential. Agricultural conservation pensions were also viewed favorably, although some were skeptical that it could be implemented in practice. Tontines were perceived to be an interesting concept, but confusing, difficult to implement, and needing more work to flesh out details. Term easements were, for the most part, not viewed favorably. Most saw term easements having the fatal shortcoming of impermanent preservation.

A fiscal analysis was preformed to demonstrate how additional funding for innovative techniques might complement continued purchase of agricultural conservation easements (PACE) activities. The results show that the conservation pension might preserve more acres than PACE, while rights of first refusal will preserve less, but more threatened, acres. Term easements should preserve many more acres than PACE, albeit temporarily. The land preservation tontine will likely act to increase the value of land maintained in agricultural land use, but will not preserve land in the same manner as the other three techniques. Hence, land preservation tontines might best be viewed as a complement to the other preservation techniques.

Keywords: Rights of first refusal, Agricultural Conservation Pension, Term easement, Land Preservation Tontine

Funding: The Delaware Agricultural Lands Preservation Program sponsored this research with a grant awarded in 2003.

Acknowledgement: We owe a special debt to Michael McGrath for first identifying three of these techniques in 2001 and supporting this research. We are grateful for the assistance of the program administrators, lawmakers, and landowners who were interviewed for this report. We also thank Kristen Trevisan for research assistance.

223 Townsend Hall
University of Delaware
Newark, DE 19717

October 2005

Table of Contents

Abstract.....	iii-iv
List of Tables	viii
List of Figures.....	ix
Introduction/Summary of Results	1
Summary of Previous Findings.....	1
Summary of Interview/Focus Group Results	3
Summary of Likely Fiscal Impacts Assessment	3
The Organization of this Report.....	3
Data	4
General Perceptions about Preservation	6
What Should the Goals of Farmland Preservation Be?	6
What Should the Landscape Look Like?.....	6
How Much Agricultural Land is Needed?.....	6
Term Conservation Easements.....	8
Concept	8
Summary of Stakeholder Perceptions.....	8
Program Administrator Acceptance	9
Delaware Lawmaker Acceptance	10
Delaware Landowner Acceptance	11
Land Preservation Tontines.....	12
Concept	12
Economic Efficiency.....	12
Land Preservation Tontine Incentives	12
Variants of the Prototypical Tontine.....	13
Summary of Stakeholder Perceptions.....	15
Program Administrator Acceptance	15
Delaware Lawmaker Acceptance	17

Delaware Landowner Acceptance	17
Rights of First Refusal	18
Concept	18
Summary of Stakeholder Perceptions.....	19
Program Administrator Acceptance	19
Lawmaker Acceptance	21
Landowner Acceptance	21
Agricultural Conservation Pension	22
Concept	22
Summary of Stakeholder Perceptions.....	23
Program Administrator Acceptance	23
Lawmaker Acceptance	24
Landowner Acceptance	24
Respondents' Final Comparisons.....	26
Program Administrators	26
Lawmakers	26
Landowners	26
Fiscal Analysis	28
Statewide Financial Impact Analysis	
Assumptions	28
PACE Performance	28
Term Easements Performance.....	29
Rights of First Refusal Performance.....	29
Land Preservation Tontine Performance	30
Agricultural Conservation Pension	
Performance	31
Appendix 1—Term Easements: Further Fiscal Considerations	32
Appendix 2—Defining Terms for the Land Preservation	
Tontine Concept.....	36
Prototypical Tontine—Indefinite Term w/	
Dividends	38
Appendix 3—Valuing Rights of First Refusal.....	41

Works Cited.....42

List of Tables

1	Evaluation of Farmland Preservation Techniques.....	2
2	Summary of Focus Groups/Interviews.....	4
3	Fiscal Example for Term Easements.....	29
4	Fiscal Example for Agricultural Conservation Pension....	31
A1	Price Based on Agricultural Use-Values for a Range of Net Returns.....	33
A2	Net Returns Needed to Retain Land in Agriculture for 30+ Years when Value is Appreciating.....	33
A3	Net Returns Needed to Retain Land in Agriculture for 30+ Years if Value Appreciates Slowly.....	34
A4	Easement and Land Values of Actual Participants in Maryland Agricultural Land Preservation Foundation.....	35
A5	Hypothetical Values for Land Preservation Tontine Application.....	36
A6	Hypothetical Change from Neighbor's Conversion— Adams Farm.....	37
A7	Hypothetical Change from Neighbor's Conversion—Jones Farm.....	37
A8	Hypothetical Change from Neighbor's Conversion— Johnson Farm.....	37
A9	Definitions for Agricultural Land Preservation Tontines.....	39-40

List of Figures

1 Agricultural Land Preservation Tontine Design
(Prototypical Version).....14

Gauging Support for Innovative Farmland Preservation Techniques

Joshua M. Duke and Lori Lynch

Introduction/Summary of Results

This report describes four innovative techniques for farmland preservation and gauges the likely acceptance of these techniques by key stakeholders.

A previous report classified approximately 30 techniques using a four-part classification system—regulatory, incentive-based, participatory, and hybrid (Duke and Lynch 2003). This classification system depended on the way in which a technique affected the agricultural land market.

Regulatory techniques define the agricultural land market. Regulatory techniques also specify the maximum intensities of both agricultural and nonagricultural land uses. Changes in regulations altered land markets so as to benefit agricultural uses.

Incentive-based techniques increase the costs to landowners that make land-use decisions that do not perpetuate agricultural land uses. Alternately, these techniques may lower the costs of land uses that satisfy social preservation goals. Incentive-based techniques differ from regulatory techniques in that they do not alter the institutional structure of markets; they simply alter relative prices within markets.

Governmental participatory preservation techniques involve the state acting as a demander or supplier in a land market. These activities should lower the costs of private agricultural land demand or increase the costs of private agricultural land use supply.

Hybrid techniques combine the characteristics of two of the preceding types of techniques.

This report assesses one incentive-based technique, the **land preservation tontine**. Two types of participatory techniques are evaluated: **rights of first refusal** and **term easements**. One hybrid technique is also evaluated, **agricultural conservation pension**.

Summary of Previous Findings

Familiar preservation techniques will persist, but these four innovative techniques may offer a way to lower the costs of additional preservation activities, increase participation, and/or increase the acceptability of preservation techniques among key stakeholders.

In the previous report, “Farmland Preservation Techniques: Identifying New Options,” many new techniques for preserving land were assessed. The evaluative framework employed considered property rights issues, stakeholder acceptance, and the ability of these techniques to achieve the stated goals of farmland preservation.

Table 1 offers a (revised) summary of the evaluation for the four techniques addressed in the previous report (Duke and Lynch 2003).

Table 1
Evaluation of Farmland Preservation Techniques (Relative to the Average Technique)

Evaluation Criteria	Explanation	Term Easements	Land Preservation Tontine	Rights of First Refusal/PACE	Agricultural Conservation Pension
Property Rights Issues					
Right Holder	Implied holder of rights to develop	Landowner	Landowner	Landowner	Landowner
Duration	How long is the retention supposed to last?	Temporary	Temporary	Permanent	Permanent
Credibility of Persistence	How easy is it to redefine rights, say through variances?	Persistent	Persistent	Persistent	Persistent
Satisfaction of the Goals of Farmland Preservation					
Acres Enrolled		Average	More effectively	Less effectively	Much more effectively
Conversion Prevented	How does the technique promote one goal relative to the other techniques?	More effectively	Average	Much more effectively	More effectively
Productive Farms		Average	More effectively	More effectively	Average
Critical Mass		More effectively	More effectively	More effectively	Average
Financing					
Financing Source	From what source will preservation be funded?	General tax revenues & bonds	Self funding or general tax revenue & bonds	General tax revenues & bonds	General tax revenues & bonds
Stakeholder Acceptance					
Agricultural Landowner		Very high	Somewhat high	Average	High
General Public	How likely is the technique to be accepted relative to the other techniques?	Somewhat high	Somewhat high	Somewhat high	Somewhat high
Environmentalists		Very low	Somewhat high	Low	Average
Developers		Somewhat low	Average	Very Low	Somewhat low
Program Administrator /Simplicity of Implementation	How challenging is it to implement the technique relative to the other techniques?	Easier	Low	Easier	Average
Attract Nonparticipants					
Attract	Does the program have an ability to attract (or force) participation from those not participating in existing farmland preservation efforts?	Some ability	Some ability	Unusual ability	Unusual ability

Source: Adapted from Duke, Joshua M. and Lori Lynch. 2003. Farmland preservation techniques: Identifying new options. *Dept. of Food and Res. Econ. Research Report RR03-02*, Univ. of Del.

Table 1 offers initial work on the relative qualities of the various techniques. This report extends this effort with data collection and an in-depth evaluation of these issues.

Most hypotheses for landowners, administrators, and the general public (through lawmaker opinions) were supported by the interviews. Several hypotheses, however, should be adjusted in light of the interview.

Landowners did not support term easements as was hypothesized. Further, program administrators suggested that implementing the agricultural conservation pension would be more difficult than hypothesized. Finally, so many options in the design of land conservation tontines were identified that it is impossible to draw conclusions about the concept without being more specific about the design.

Summary of Interview/Focus Group Results

Respondents did not find term easements appealing. In particular, the temporary nature of the program was seen as a fatal flaw to many respondents.

Most respondents believed that the land preservation tontine concept was interesting, but most believed the concept was too “bizarre” and noted significant challenges for implementation. The land preservation tontine concept was described in general terms, and, not surprisingly, many respondents had trouble understanding the details of the concept. We believe that this concept should be redesigned to enhance its clarity and detail specifics. A follow-up investigation may be warranted.

Rights of first refusal were appealing. Although significant implementation hurdles were noted, there seemed to be momentum and ideas for overcoming these challenges.

Almost all respondents found the agricultural conservation pension to be an attractive concept. Like land preservation tontines, however, most

seemed to want more details. The main concerns involved the formula for turning land value into pension payments and with the way successors in interest (to the land) or survivors (of the owner) would be compensated. A redesign of the concept and further research may be useful.

Summary of Likely Fiscal Impacts Assessment

The analysis assumed that the state had \$10,000,000 to implement new techniques. As a baseline, PACE would be expected to preserve between 1,000 and 2,500 acres with these funds. The results suggest that term easements might temporarily preserve many more acres than PACE would preserve permanently. ROFR would likely preserve fewer acres than PACE, but would preserve only those parcels with a credible conversion threat. An example of the pension program shows that it may be able to preserve more acres than PACE, with the same funds, assuming that owners in their late 40's participate and they are willing to accept payments of approximately \$60,000 per year when they retire. The tontine technique is difficult to compare to the others; however, a sketch of the analysis shows that with \$10,000,000 in funding, the agricultural land use value for 10,000 acres should increase by at least \$900. This would lessen the incentive to convert (and the costs of PACE).

The Organization of this Report

The data are described in the next section. Then, six sections present the results of the focus groups/interviews. First, a summary of general views on farmland preservation is offered. Then, four sections address each of the four techniques in turn. Each section describes the technique, including variants. Likely acceptance is evaluated by offering results from focus groups and interviews with key stakeholders. A sixth results section summarizes the comparative remarks from the respondents. A fiscal analysis concludes.

Data

Data for this study were collected using focus groups and interviews of various stakeholders and decision makers. Four landowners were interviewed in a focus group format. One lawmaker was interviewed individually, and another three were interviewed in a focus group format. All six program administrators were

interviewed individually. Sample statistics are presented in Table 2.

The same instrument (script of questions) was used in each interview and focus group, although the emphasis on specific items in the instrument varied in response to the dynamics of the administration process.

Table 2
Summary of Focus Groups/Interviews

Focus Group/Interview	Participants	Gender
1. Landowners	4	2M, 2F
2. Delaware Public Program Administrator/Official	1	M
3. Delaware Public Program Administrator/Official	1	M
4. Delaware Nonprofit Program Administrator/Official	1	F
5. Maryland Administrator or Official	1	M
6. Maryland Administrator or Official	1	M
7. Maryland Administrator or Official	1	M
8. Delaware Lawmaker	1	F
9. Delaware Lawmakers	3	2M, 1F
Total	14	

Program administrator interviews and the landowner focus group began with several general, warm-up questions about agricultural preservation preferences:

- What should the agricultural landscape look like?
- How much agricultural land is needed?
- What should the goals of farmland preservation be?

Then, each of the four techniques were investigated. First, the enumerator would describe a technique in disinterested terms.

Then, a series of questions would guide discussion of that technique:

- Do any aspects of program X appeal to you?
- Do you find any aspects of program X to be not appealing (or objectionable)?

Landowners were asked an addition set of questions:

- Would you consider participating in program X?
- Do you think your neighbors would consider participating in program X?

- What would participation hinge upon?

Program administrators were asked an additional set of questions:

- What aspect of X is easy (or hard) to administer?
- What aspect of X is easy (or hard) to fund?
- What is your perspective on constituents' support or opposition to this program?

Lawmakers were asked an additional question:

- What is your perspective on constituents' support or opposition to this program?

Interviews concluded with a question asking for a specific comparison of the techniques:

- What program is the most attractive?

Interviews and focus groups lasted between 45 minutes and two hours. Each session was tape recorded and then transcribed.

The participants remain anonymous, and no results are presented that can be linked to any individual respondent. The UD office responsible for the protection of human subjects approved this research protocol.

General Perceptions about Preservation¹

Collectively, program administrators express a broad, yet nuanced, vision for the agricultural landscape. Landowners, in contrast, were more interested in the state land preservation process than on a specific vision for the landscape.

Program administrators offer many interesting goals for farmland preservation, but economists may question several of these since they reflect services already priced by markets (soil quality, farm practices, etc.). The administrators also lack agreement on the importance of aesthetic and open space services.

Landowners and program administrators expressed support for using preservation to perpetuate a historically agrarian landscape.

The skepticism expressed by landowners focused on the use of eminent domain for roads. Landowners were especially concerned about changes currently occurring in agricultural areas and especially the recent escalation in land prices for development.

What Should the Goals of Farmland Preservation Be?

Program Administrators

- Future agricultural productivity and protection of best soils
- Protecting sensitive ecological areas
- Scenic values of farmland
- Open space values
- Not an open space focus
- Cultural and historic values
- To prevent impermanence—preserve one major property in each political district each year

- Stop development from gaining momentum
- Need large areas of agricultural land—not spreading cluster development in the countryside
- Preserve as much land as possible
- An adequate agricultural land base
- Improve farm practices and water quality
- Viable agricultural economy

Landowners

- Distrust state and local governments to solve land problems

What Should the Landscape Look Like?

Program Administrators

- An historic agricultural landscape that is also a working landscape
- In agricultural use, but with the understanding that this changes over time
- Aesthetics should be an “outcome, not an objective”
- In some cases, agriculture can be fragmented—i.e., mixed with other uses

Landowners

- Appreciate open space
- Appreciate the historical quality of the agrarian landscape
- Appreciate natural wooded settings that exist on farms and in rural areas
- Believe development should be concentrated and not able to sprawl throughout the countryside

How Much Agricultural Land is Needed?

Program Administrators

- Triple preserved land in agriculture
- Depends on what other goals are important
- Uncertain—this is a moving target

¹ The questions were not asked of any lawmakers, but were asked of landowners and most program administrators.

- Need enough to support infrastructure of input sector
- Enough so the area does not begin to look nonagricultural

Landowners

- Concerned that sprawl encourages the state to condemn too much farmland for roads—even preserved land is not safe
- Appreciate ability to pass on land to family
- Concerned about rapidly escalating value of land in Sussex County and Kent County, Delaware
- View that agriculture cannot compete with development in the price of land

Term Conservation Easements

Term conservation easements (also known as term easements and programs for the lease of conservation easements) preserve land by allowing a government or nonprofit agency to pay landowners a rental fee in exchange for a negative easement, prohibiting a set of activities associated with development. This technique is similar to PACE, except it applies only during a set period of time.

Duke and Lynch (2003) classify this as a governmental-participatory land preservation technique because the government acts as a participant in an existing market for lesser rights in land.

Concept

Agricultural landowners are familiar with using existing markets to buy and sell leases to farmland. In part, leasing land allows owners to optimize the size of their operation and to be flexible about how much land to farm in that the length of the lease is often quite short. By extension, some of the landowners who chose not to participate in PACE might be attracted to a “lease” of conservation easements because they are familiar with the lease concept and because it operates over a shorter timeframe.

Landowners also are familiar with similar conservation programs, such as the Conservation Reserve Program (CRP), which uses annual rental rates to encourage farmers to implement conservation practices on their land. Strictly speaking, a nonpermanent conservation easement is still a conservation easement, just with a nonperpetual term. So, this technique helps focus attention on varying the timeframe for conservation easements. The “lease” terminology, however, may be especially useful in marketing such a program because it requires less commitment from landowners.

If landowners—both interested and not interested in PACE—had similar preferences,

Gauging Support for Innovative Farmland Preservation Techniques in Delaware
Food and Resource Economics, University of Delaware

then one would expect leases to be less expensive (per year) than permanent easements. Simply, landowners would receive a discount if they were unwilling to make the permanent commitment. As such, one might suspect that term easements could be used to preserve, at a lower cost and temporarily, critical areas during times when there are insufficient funds for higher levels of preservation. Moreover, because participation ought to be greater under the shorter timeframes, leases could also be used in a similar fashion to moratoria to stabilize a particularly threatened region until a more permanent solution could be adopted.

If landowners differ significantly, however, then this assumption about the effectiveness of PACE may not hold. For instance, if some owners are predisposed against conservation easements—distrust of government, say—then those who have not yet participated in PACE would demand very high payments to participate in term easements.

Evidence on the extent of term easement supply could be collected using a random survey of landowners not participating in PACE.

Summary of Stakeholder Perceptions

The sample of program administrators, lawmakers, and landowners did not look favorably on the term-easement technique. Perceptions of term easements were framed relative to PACE.

As one may suspect, most respondents viewed negatively the temporary attribute of term easements relative to the permanence of PACE. Although some respondents identified important benefits of the technique—such as attenuating acute preservation challenges and attracting new participants—most respondents viewed the temporary nature of term easements to be a fatal flaw. Perceptions were dim about new funding for a term easement plan.

Program administrators did not favor this technique. Most appealing was that term easements could be an effective technique for enrolling lots of acreage at a low cost, thus buying time to employ alternate preservation techniques. It should also attract new participants, who are wary of long-term commitments—and many landowners would therefore be supportive.

On the downside, the administrators clearly perceive this technique to provide temporary benefits with the same or higher administrative costs than PACE because they anticipate increased levels of monitoring and enforcement. Overall, the technique would have questionable cost effectiveness and, for this reason, would be tough to sell to lawmakers and the general public. The administrators lack agreement about whether the technique would actually be less expensive than permanent easements in the long term.

Delaware's lawmakers appreciated the need for new techniques, but were unsure whether term easements were the best option. One opinion was that this technique should be investigated further by surveying landowners to determine their likely participation. In contrast, another lawmaker rejected the technique because of its temporary duration.

Landowners were intensely skeptical about term easements and the government's ability to administer the program fairly. They believed that term easements would not provide the benefits of permanency they want as landowners. This result ran counter to hypothesis since one expects the primary supporter of term easements to be landowners desiring greatly flexibility.

Program Administrator Acceptance

A selection of program administrator perceptions about term easements:

Appealing

- Lower Cost*²
- Preserve more acres in short term*
- Effective in heading off problems in hot spots of development
- Could stabilize hot spots and prevent impermanence syndrome
- Might buy time until more effective regulations or land-use planning can be implemented*
- Might be more acceptable to some owners than permanent preservation
- Quicker agreements with landowners
- Comparison with Agricultural Preservation Districts: works in similar fashion but may attract more landowners
- An on-going payment/relationship may produce more contact and thus better land management

Objectionable/Not Appealing

- Temporary*
- Questionable durability*
- Landowners may use this as a temporary source of cash while they wait to develop—join once, but many owners will not re-enroll
- “A glorified transfer payment of public funds to farmers”
- Much of the land would not be developed, so the use of cash does not really secure a benefit
- Not clear what is being purchased if it is temporary
- Permanent easements are more “tangible”
- Questionable cost effectiveness
- May undercut the perceived attractiveness of existing permanent programs
- May attract the wrong type of participants, like developers wanting to hold land
- Does not adapt to unanticipated, future circumstances

² “*” indicates at least two people made this comment.

- “Going in the wrong direction” because the durability of permanent easements are increasingly being challenged

Difficulties in Administration and Funding

- Could result in a lot of monitoring and enforcement costs if successful—even more than permanent easements*
- Difficult unless the agency has an existing permanent program with the accompanying infrastructure
- Perhaps requires more staff time than the permanent program
- Some participants will want to break the agreement; should the contract be “iron clad” or should there be a penalty for leaving?
- A rollback penalty would counter some undesired incentives from landowners—i.e., enroll, then leave and convert
- Difficult to negotiate a yearly payment 10 or 20 years into the future—how do you account for land market changes and inflation?
- Ideally, will have a dedicated source of funding
- Participants will want assurances that money will be there each year in the future
- Examine costs in detail—may simply be cheaper to purchase permanent easements*
- IRS passed regulations requiring that easements be perpetual to be tax deductible

Perspective on Constituent Support

- Tough to get funding (i.e., to sell to politicians)—a cost for a nonpermanent benefit*
- Talbot County, MD, tried this and failed because state-level politicians did not like the temporary nature—accustomed to permanent easements
- Attempted and abandoned in the past in Maryland and, perhaps, Lancaster County

- Viewed as a poor-quality technique: “Do not like investing the time and effort into anything that is less than perpetual”
- Could be seen as throwing money away
- Easier to sell if it were linked to a target group, like new farmers
- Easier to sell as a solution inside a growth zone with permanent easements outside the zone
- Public has to learn about the technique and be convinced that this is good policy
- Public already buys into the existing easement program—a new term easement program may cause confusion or skepticism
- Landowners will be attracted to the temporary attribute—more flexible
- Landowners should like the program because they get cash—more tangible benefits than the Agricultural Preservation District

Delaware Lawmaker Acceptance

A selection of Delaware lawmaker perceptions about term easements:

Appealing

- May slow the progression of sprawl development
- May help in lower New Castle County, where the state’s permanent program has been less successful

Objectionable/Not Appealing

- This program is not appealing*
- Temporary—“What good does that do?”
- Not sure this would be the best use of money
- Delaware needs new ideas, but it is not clear that this is the best option

Difficulties in Funding

- How can the state compete with developers as land values rise so rapidly?

Perspective on Constituent Support

- Likely that landowners would want to participate
- Want to see evidence that landowners would want to participate
- May help address declining interest in permanent program

Delaware Landowner Acceptance

A selection of Delaware landowner perceptions about term easements:

Appealing

- No positive comments

Objectionable/Not Appealing

- We need even more participation in permanent easements—people will simply sell their land when the lease is up
- Temporary—if I decide to preserve my land, then I want it to be permanent
- Skeptical that there will be too many loopholes that allow people to opt-out*
- Skeptical that the state can come up with enough money to make appealing—compete with development value
- A rollback penalty would not be fair
- Distrust government with implementing this technique—related to concerns about use of eminent domain

Land Preservation Tontines

An agricultural land preservation tontine is a contract that internalizes the negative pecuniary and technological externalities³ that one agricultural landowner who converts imposes on neighboring owners remaining in agriculture.

Concept

Specifically, the tontine provides incentives for owners to maintain agricultural land use through:

- (1) multilateral claims to a fund that owners forfeit when they convert; or
- (2) multilateral claims to a penalty that converting owners pay to remaining owners.

The first type will be termed the “prototypical” version, while the second type is the “alternate” version.

Michael McGrath, a planner with the State of Delaware, first sketched the alternate version of this technique to one of us (Duke).⁴ Subsequently, Duke and Lynch

(2003) offered an original development of the prototypical version. Although the technique seems intuitive, Duke and Lynch (2003) were unable to locate a written source that describes the use of tontines for agricultural land preservation. Hence, the technique offered here is original research.

This report addresses the prototypical version of the land preservation tontine.

Economic Efficiency

More work is needed to understand the resource allocation efficiency of the land preservation tontine concept. However, it is clear that the efficiency of this concept differs from many other agricultural land preservation policies. Most land preservation (say, PACE) is warranted as a way to internalize the positive externalities associated with agricultural land, i.e., the public goods value accruing off the farm. Tontines, however, address the external effects that neighboring agricultural landowners have on one another. It seems that these “local” externalities can be internalized with tontines and not necessarily allow “double-dipping” from other programs, which are rationalized as providing broader externalities.

Land Preservation Tontine Incentives

The land preservation tontine provides an increasingly powerful incentive because as more of their neighbors convert, the pool of remaining owners shrinks and their payouts

³ Several sorts of impacts on remaining farmers arise from conversion. First, conversion brings residents into agricultural areas so that remaining farmers likely operate below their most intensive, profitable level in order to prevent agricultural nuisance lawsuits. Second, these changes are capitalized as a lower value for remaining lands in agriculture land use, which in turn raises the incentive to convert. The impact of conversion also may lower or raise the value of land in developed use, depending on several factors in the land market. The authors contend it is likely that the value of agricultural land in developed use rises as neighbors convert. Hence, the incentive to convert increases further.

⁴ McGrath suggests the following scenario. Assume 10 farmers agree to the land preservation tontine

contract and assume that there is no initial capital. If one owner sells to a nonfarmer or gets a subdivision plan approved, then the remaining nine share 10 percent of the proceeds. In this version, there is no need for any member or the government to establish a cash fund.

rise. Mainly, we report perceptions about the prototypical version and its variants. In the prototypical version, the last owner of agricultural land “wins” the entire fund.

Tontines provide direct incentives against converting. Unlike many farmland preservation techniques, which involve interactions between owners and governments, tontines are essentially contracts among owners.

The conversion decision of any one agricultural landowner in productive areas affects the viability of his or her neighbors’ operation—even though that landowner has no responsibility to the neighbors to stay in farming. In this sense, tontines are designed to achieve the key preservation goal of maintaining a critical mass of agriculture.

Variants of the Prototypical Tontine

For purposes of farmland preservation, this report offer many variations on the prototypical tontine concept. Figure 1 demonstrates key questions in designing the policy. Answers to these questions describe possible options in the design of many different land preservation tontine policies.

In the appendix, consistent terminology and many variants are offered for the tontine concept.

The source of funding is a key element in distinguishing the variations on the prototypical land preservation tontine. One might reason that the state could establish this fund in an initial year in anticipation of the benefits of reduced conversion. Alternately, the individual owners could establish their own fund. The state’s role may simply be to aid with the contracting process among private individuals and/or by

passing enabling statutes to support such contracts.

The manner in which these funds are disbursed also might vary greatly. The historical tontine concept would have the last remaining owner “win” the entire fund.

David Edgell, a planner with the State of Delaware, proposed as alternate version of the land preservation tontine in which the fund is disbursed earlier, say, after 20 years. In addition, this version allows alternate uses for the funds. Beginning, say, with 10 participants and with a significant fund, perhaps \$1 million, which is put it in an interest bearing account. Possibly, the participants could manage the investment of the fund. Over 25 years, one can anticipate how the fund will grow. If owner X wants to sell for conversion in year 11, then the other nine owners will pool together and buy the farm because they want to secure his claim to the fund. If the State were willing to buy the development rights in these instances, then the nine remaining participants would only need to come up with the agricultural land value for owner X’s land. This version relies on the social pressure of not breaking up the group and allows them to use the fund in a way that is a positive rather than divisive.

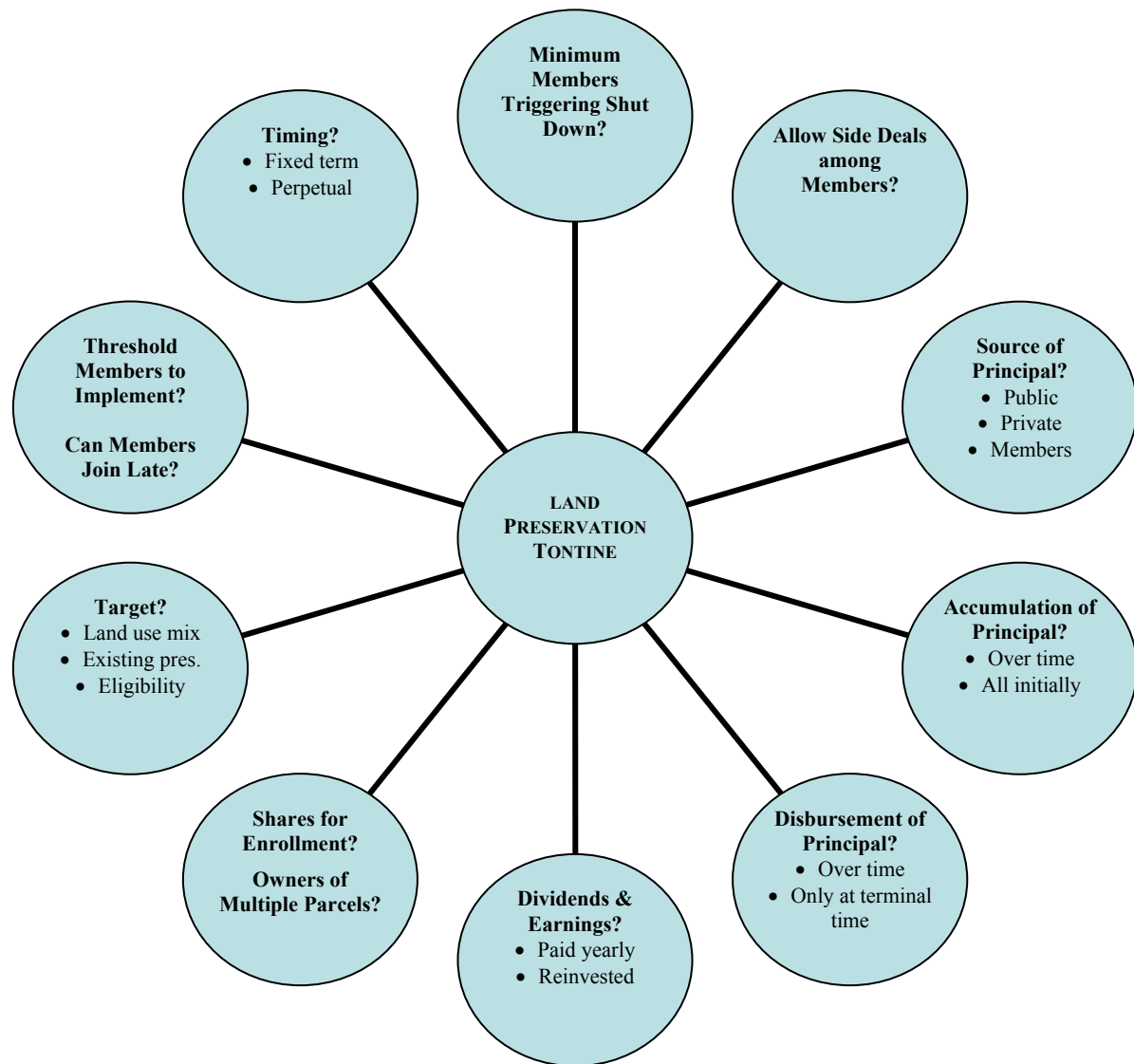


Figure 1
Agricultural Land Preservation Tontine Design (Prototypical Version)

Summary of Stakeholder Perceptions

The land preservation tontine concept did not resonate as a viable technique with most in the sample of program administrators, lawmakers, and landowners. Many expressed a general level of interest, especially program administrators. Some program administrators were quite interested in the incentives. Overall, however, the concept seemed too “bizarre” and many implementation problems were noted.

Since the respondents had trouble understanding the concept, a redesign for clarity and a follow-up investigation may be in order.

Program administrators were interested in the technique, especially the incentives created and the private, collective quality of the technique. However, their qualms were strongly held. Most perceived this technique to be too “strange” to implement. Many noted practical problems such as explaining the concept, attracting participants, and preventing abuse. Several noted that a refinement could be more workable, ranging from a simple name change to more significant modifications like eliminating the government role and explicitly modeling the concept as a cooperative.

Program administrators also noted very significant implementation challenges—perhaps, the most of any of the four techniques—which is somewhat surprising since the land preservation tontine is seen to be a “private” solution. Understanding the concept seems to be the main hurdle to funding and implementing the technique.

Lawmakers and landowners did not find land preservation tontines to be an attractive concept. Several expressed a general level

of interest in the technique and the incentives created, but most were too unsure of the concept to offer definitive opinions. One lawmaker found the technique to be “bizarre.” Landowners argued that regular cash payments to be essential.

Program Administrator Acceptance

A selection of program administrator perceptions about the land preservation tontine concept:

Appealing

- Interesting idea* and very “different”
- Like the idea
- No-capital version is most appealing
- Can be an entirely a private solution—no governmental role
- Another tool to generate participation: As a private solution, would appeal to owners who distrust government
- A grassroots solution in that some farmers want to ensure that their area remains farming
- It is a way to formalize trust among a group of neighbors (reduce monitoring costs since the trust would be a formal contract)
- May help bind farmers to a course of action when the farm is owned by many owners (say siblings or cousins)
- Creates a formal incentive to persist in agriculture—everyone wants to be the owner that “survives”
- Progressively increasing incentive to remain in farming
- Could cause chain reactions: real estate agents beg off; farmers invest
- Like a cooperative, you hope the participants “hang together”
- A collective way to manage risk

- If the state provides the money, what is the downside for participants?
- Appealing notion of farmers working together to protect their agricultural interests

Objectionable/Not Appealing

- “Strange” and “weird”* and so unusual
- Difficult to understand what government’s role will be
- “I just don’t see how it could work”
- If funded publicly, is it possible that farmers could collaborate to undercut the system by developing at the same time?
- Potential for bad incentives, including corruption
- Don’t call it tontine—more like the “Survivor” game
- Because landowners will have trouble understanding this, they may not want to assume the risk of participating—even if publicly funded
- Will the incentive really stop the farmer who has a life event?
- May create animosity among neighbors
- Won’t be taken seriously; just a game
- How could the pot provide a big enough incentive to override the incentive to convert?
- Why not just create a farmer’s cooperative?
- Does not see a role for the government

Difficulties in Administration and Funding

- Lawyers need to figure out how to write the contracts
- Legislatures need to create enabling statutes

- Must figure out the state’s role in enforcement to avoid litigation every time a farm is sold
- Need a significant amount of state funding to get landowners interested with the thought of dividends
- Where will the money come from?
- Challenges in the state’s role: how to make the process timely?
- How to articulate, clearly, how this tool works?*
- Difficult to generate participation, motivate the formation of tontines, and educate
- Unsure if people would participate; perhaps, try a pilot project to understand the challenges
- A lot of administration effort in getting groups to agree
- Managing the money may be easy, but not managing the participants if behavior degenerates
- Need to write down exactly what activities are not permitted
- Unsure how difficult to administer, but probably more than PACE
- Uncertainty—“How big does the pot have to be to affect the decision making of farmers?”
- Figure out how a pot of money will adjust over time to reflect inflation and land-market conditions
- Need more work on the incentives—think hard about the possibility for side deals, and how to deal with these
- May be a “bias” in the legislatures against innovation—what we do is working, so why try something new
- Might be able to combine with other tools

Perspective on Constituent Support

- Taxpayers won't fund it because it is too "weird"
- "Free market crowd" may find this appealing

Delaware Lawmaker Acceptance

A selection of Delaware lawmaker perceptions about the land preservation tontine concept:

Appealing

- An incentive to preserve for the last party

Objectionable/Not Appealing

- "It's kind of bizarre"
- Need to consider further before giving an opinion

Difficulties in Administration and Funding

- Complicated equity—participants having different acreages with different values and different-aged owners

Perspective on Constituent Support

- Not sure how this technique "would go over"
- Nonfarmers will not feel strongly

- No incentive without a payment—simply cannot look at the pot of money without any payments

Objectionable/Not Appealing

- "Not confusing to me, but it's just not attractive"
- Difficult to reconcile ownership with interest in this pot of money
- You could not use this interest as collateral at a bank
- Might only appeal to the youngest farmers

Delaware Landowner Acceptance

A selection of Delaware landowner perceptions about the land preservation tontine concept:

Appealing

- Not very appealing, unless a cash payment

Rights of First Refusal

Rights of first refusal (ROFR) enable a state agency to match an offer, which an agricultural landowner receives from a developer to convert.

ROFR has been used in the real estate markets to protect renters from having their homes sold out from under them. It also has been used by third parties to ensure that they are “at the bargaining table” whenever an owner decides to sell and receives an offer from a buyer.

ROFR differ from options. Options are exercised by the option holder, while ROFR are “activated” by the property owner. Even if there is no term recorded with the ROFR, it may never be activated.

This mechanism could protect farmland by making the government the “interested” third party in the sale of farmland for development. If a government entity had secured from a farmer the right of refusal, then at the time when a farmer has received an offer and has decided to sell his or her land this, the governmental body could decide whether or not to match the negotiated price.

By paying the price equal to that of the existing offer, the government prevents the conversion of the land. Moreover, the government will still hold title to a valuable asset.

ROFR should be a cost-effective land preservation tool because only those parcels actually threatened with conversion are targeted.

Concept

The version of ROFR envisioned here couples this right with PACE so that the government can resell the land to a farmer and thus only bear the costs of the development increment in preserving with this technique.

ROFR are classified as a government-participatory technique because a state agency participates in an existing market for lesser rights in land (Duke and Lynch 2003).

Duke and Lynch (2003) note that ROFR could be coupled with other programs. For instance, assigning ROFR could be a condition for participating in a use value assessment program. Or, ROFR could be condemned with just compensation through eminent domain in key areas. Hence, this concept could be voluntary or compulsory in a targeted area.

ROFR can be a win-win situation for both the government and the farmer. Unlike other preservation programs, the government does not pay any money—or, only nominal sums for the right—until an offer has been made and the farmer has decided to sell. In this sense, the strategy is cost effective. If the government determines that this particular farm does not fit its needs/goals/budget at this time, it could decide not to match the price.

The farmer should also receive the developed use value of the farmland because developers have an incentive to make legitimate offers—the offer may be accepted after all—even if they are aware that the parcel of land is already subject to a right of first refusal.

The drawbacks of this approach is the government has to purchase the land, which

is more expensive than purchasing development rights and then it either needs to sell the land to another farmer (potentially taking a large loss) or maintain it (which is expensive).

Developers may be opposed to this technique since they invest resources in developing offers. It also could decrease the supply of land available, which will increase the price of developable land.

Agricultural landowners and developers also could potentially collude to increase the price of the land.

In theory, this may be a difficult technique to implement. Program administrators would need to justify the purchase of individual parcels. In addition, they would now have the selling of the land to administer.

Summary of Stakeholder Perceptions

ROFR held appeal for the respondents. Although significant implementation hurdles were noted, there seemed to be momentum and ideas for overcoming these challenges.

Program administrators were enthusiastic about the cost effectiveness of ROFR and the possibility of targeting and prioritizing important agricultural areas in the state. Yet, this group was also concerned about funding this program—a need for regular, dedicated funds—and the opportunities for abuse by owners and developers.

Program administrators had many strong opinions about the implementation of ROFR. Most agreed that a successful ROFR program would need to prioritize parcels at the outset. Many saw challenges in implementing ROFR, especially in monitoring sales, in enforcing contracts, and

in managing land bought fee simple. Nevertheless, the program administrators offered suggestions as to how best to address these challenges.

Lawmakers also found the ROFR technique to be appealing. They suggested that prioritization was important—perhaps though existing plans such as Livable Delaware—and the need for dedicated funding to avoid a “cash crunch.”

Landowners valued the voluntary nature of the program.

Program Administrator Acceptance

A selection of program administrator perceptions about the ROFR concept:

Appealing

- Timing of the intervention—targets parcels truly threatened
- Could be designed to target certain areas in the state requiring intervention
- Should be some interest among certain types of farmers
- Should be inexpensive if owners are comfortable with government and are in farming areas
- Gives policy makers a lot of control
- Offers flexibility
- Can target key parcels
- Appealing if integrated into the use-value assessment program (like NJ)—also may stop developers from taking advantage of UVA

Objectionable/Not Appealing

- Difficult to get the rights voluntarily
- May require a lot of money up front, with little immediate returns on what that money was spent for
- Opportunities for fraud. State is

going to be taken advantage—
developers and owners will
abuse/manipulate the system if
targeted parcels are known*

- Could mistakenly be used to preserve parcels in targeted development areas
- Farmers and developers will figure out which parcels are enrolled on their own, through word of mouth
- Such abuse may already be taking place in PACE—owners tell the state of “large” offers from developers; or, perhaps the “large” offer is contingent on a subdivision, which really has little chance of being approved
- Uncertain how this will affect speculative behavior
- Unlike PACE, which preserves now at low cost, ROFR waits and could be very high cost
- Probably not worth the work for private groups, but it is for public groups

Difficulties in Administration and Funding

- Tough to write the law and contracts
- Tough to write the statute, and then defend it in litigation
- Requires additional staff
- More effort than PACE
- May get really complicated in rules for resale
- Not all agencies have the ability to own land fee simple
- Fee simple ownership may be a big burden on the state
- State preservation is well-positioned to do this, depending on the volume
- Easier than PACE
- Large funding required at uncertain times*; need to have an “Emergency Land Protection Fund”

- Need a well-written law to try to prevent fraud: here is a targeted area, and if our board does not act on its ROFR, then there will be severe penalties if the transaction doesn’t go through
- Need to prioritize
- If you prioritize, publish the list of targeted farms so developers believe the state has made a credible threat to match any offers
- Need to create a database to monitor whether encumbered farms were changing hands—need an administrative mechanism to monitor*
- Need communication with owners in program, just like PACE
- Need a plan for dealing with people who didn’t hold to their agreement (litigation)
- Transactions of encumbered land take place with PACE, so monitoring is important
- Needs a little funding up front to get owners to sign up
- May be difficult to write enforceable contracts, especially if the sale already took place
- It would be easier to administrate in an existing structure like DelDot-real estate section (good at acquisition transactions) or DDA-land preservation
- State could hold purchased properties over time, but with more management expenses
- Sometimes the state takes a lot of effort to figure out what land is really worth
- Use an initial seed money fund to get it started, then account rises with sales and falls with purchases
- Unlikely to have a large initial endowment that the state promises not to touch

- In designing targeted areas, the state is going to need to be especially thoughtful in deciding where they want growth to go
- Increase familiarity—perhaps start by having the farm community ask for ROFR with their leases
- Easier to get funding if a well-developed targeting plan exists
- Any targeting plan will make some folks upset if they are not in the targeted area

Perspective on Constituent Support

- Farming community won't accept it if it is perceived to be a new regulation (i.e., is coercive)*
- If the state exercised ROFR on every property in a targeted area, then developers would stop bringing offers to these farmers—this could alienate developers and drive up the costs of the contracts
- May feel “creepy” to landowners if coerced or as a requirement for participation in another program
- Passionate agricultural landowners may participate, but others may not without a strong incentive

Lawmaker Acceptance

A selection of Delaware lawmaker perceptions about the ROFR concept:

Appealing

- A “wonderful” concept
- An “appealing” concept
- Doesn't “penalize” the farmer
- Less expensive because State could pay the first development offer rather than after the property has been “flipped” several times
- Tool is used privately—some familiarity

Objectionable/Not Appealing

- Risk of “cash crunch”
- State sometimes cannot act fast enough; when a farmer needs to sell due to a life event, they can't wait
- State may not be able to come up with enough money quickly

Difficulties in Administration and Funding

- Must be prioritized, possibly with Livable Delaware*
- May be difficult to prioritize
- Need to have funding on hand to deal with cash crunch—to do this, need a dedicated revenue stream to support it
- Some interest in locating a revenue stream

Perspective on Constituent Support

- Concept implies changing titles, which would intimidate farmers
- Nonfarming community may object to the expenditures
- Constituents may favor some parcels selected, but oppose others

Landowner Acceptance

A selection of Delaware landowner perceptions about the ROFR concept:

Appealing

- Voluntary nature of participating
- Compensation

Objectionable/Not Appealing

- Confusion with eminent domain for roads
- Confusion with TDR
- Wondered if it would bind heirs

Agricultural Conservation Pension

Often agricultural landowners will say that the equity in their land is their retirement fund. If another source of these funds could be supplied, then the owners would not need to sell for development when they retire.

The pension plan concept guarantees pension benefits for farmers who will dedicate their development rights to the state.

Concept

The agricultural conservation pension concept benefits participating owners by attenuating the risks owners face if their accumulated savings is too low to retire merely on the proceeds of selling their land to another farmer rather than for development. The savings of farmers may be low due to unexpected cyclical patterns that occur near the time of retirement or because returns to farming are persistently low.

States are better positioned to insure against cyclical savings risks than individual farmers because they can pool risks over the population of farmers.

The state benefits from this technique because it does not have to bear the entire financial burdens of PACE in the present. Moreover, the gains from risk pooling reduce the aggregate expenditures.

Duke and Lynch (2003) classified this technique as a hybrid of an incentive-based technique (pension incentive) and a participatory technique (government participation in the market for less-than-fee-simple rights in land). When used with

PACE, this technique also includes a governmental participatory element.

A general sketch of this technique was first described to the authors by Michael McGrath, planner for the State of Delaware, and was reported in Duke and Lynch (2003).

One can imagine many specific formulations of this technique. Two general versions are the pension tied to the land as an annuity and the pension tied to the owner.

In the annuity version, described by McGrath, a pension runs with the land rather than a specific owner. If one farms for X years in the program, then the pension runs for X years. The PACE restriction is permanent.

In the owner version developed here and in Duke and Lynch (2003), the payments would be tied to an individual and act as a pension from a retirement age (say, 65 years) until the person's death. Options would include lump sum payouts to survivors. This version takes advantage of the risk-pooling benefits of the state. The PACE restriction is also permanent.

Alternatively, the program could be designed to be exactly like a reverse mortgage, which converts the value of the conservation easement increment into cash to live on during retirement. In this case the owner could extract a percentage of the land value each year to finance living expenses. The government could ensure these payments will continue for life of the owner and/or spouse in exchange for an easement or outright sale of the land. When the owners die, the estate would be settled so that the land is sold for farming purposes and the following owner would not be eligible to participate in the pension plan.

Respondents were initially presented with the “owner” version, but many variations arose in the discussions. As such, the comments presented below were more exploratory than a definitive reaction to a single version of the technique. Over time, it is hoped that a single version of this concept can be specified and future research conducted to get additional respondent reactions.

Summary of Stakeholder Perceptions

Almost all respondents found the agricultural conservation pension to be an attractive concept. Yet, all seemed to want more details on how the concept would be implemented. Many respondents offered suggestions on the design. The main concerns were with the formula for turning land value into pension payments and with the way successors in interest (to the land) or survivors (of the owner) would be compensated. Most suggested that this concept would appeal more to younger owners. It is evident that further specification and research is needed.

Program administrators found this concept to be very appealing and interesting. In particular, they felt it addressed directly a common reason owner give for conversion—the need to retire. Because the concept was described in general terms, most of the program administrators’ concerns involved how the technique would be specifically designed. They offered many suggestions on how it could be designed and challenges overcome.

Lawmakers also were attracted to the concept, but felt like it needed to be described as a single-version in detail. It was suggested that legislative staff could further flesh out the details of such a plan.

Landowners thought the concept offered an attractive option, but wanted more details.

Program Administrator Acceptance

A selection of administrator perceptions about the pension concept:

Appealing

- Very appealing* and interesting*
- A good plan
- Generate new participants—many avoid PACE because “my land is my pension”
- Deals directly with an important, frequently cited incentive to convert—retirement*
- More research on whether this plan would correctly counteract the conversion incentive and satisfy owners
- Provides security*
- Pooling of risks provides advantages*
- Leverages state dollars—in effect, it spreads PACE payments out over a long period of time
- Expedite the transfer of land to young farmers
- Paying people to be farmers with a pension
- Buying annuities rather than easements

Objectionable/Not Appealing

- Health insurance is more important
- Might not leave enough money in the land for heirs in large families
- Annuity has to be large enough to “get people’s attention”

Difficulties in Administration and Funding

- Sell to the legislature as another way to get development rights
- Consider whether this is a way to avoid the estate tax?
- Implement for people who are younger
- Difficult to determine a value—normal pensions are based on salary, but this one is different and more complicated
- Create a formula (instead of salary and years of service into pension) where farm value is analogous to salary
- Complicated for PACE staff, but may rely on other groups in government that handle pensions
- Because the payment is made over time, PACE staff may be familiar with this sort of financial arrangement

Perspective on Constituent Support

- Very attractive to farmers
- May not generate interest among farmers
- Determine whether farmers who sell were just making “excuses” when they claimed retirement is the reason they sell
- Farmers would like the security*
- Most farmers are already comfortable participating in government programs, so they probably will not object to the arrangement with the state
- Amish or Mennonite farmers may not want to be seen as employees of the state
- Nonfarmers may object, saying how come we don’t get a pension?
- Version with a low monthly payout and a bigger death payout would probably sell better

- Better for farmers who don’t need cash for their agricultural operations

Lawmaker Acceptance

A selection of Delaware lawmaker perceptions about the pension concept:

Appealing

- “Great concept on paper”
- Interesting*
- Security in the farming community
- Want to see more details on paper
- Helps address problems when an owner’s children do not enter farming

Objectionable/Not Appealing

- Tough sell—seems like just another expensive program for the farmer

Difficulties in Administration and Funding

- Already a bill to allow small business owners option to hook into state health insurance
- Could have lawyers and legislative research staff flesh out details
- Difficult to fund

Perspective on Constituent Support

- Probably not opposition from any group to this plan
- Farmers might need to be educated about the program, initially
- Would be a lot of interest

Landowner Acceptance

A selection of Delaware landowner perceptions about the pension concept:

Appealing

- More appealing to younger farmers

- Might be an attractive option
- Want to know more about the tax implication—is it better to take pension payments over time than a one-time payment from PACE?
- My younger, farming relative would find this attractive
- Would overcome the incentive to sell land for retirement

Objectionable/Not Appealing

- If someone were to have an accident, it is unclear how benefits go to survivors
- Need a guaranteed level of payment in case of an accident
- Figure out how to increase pension over time to keep up with appreciation in the land market
- Unclear who will do the appraisal—desire for it to be unbiased
- Cash upfront is better than a pension because it offers more flexibility

Respondents' Final Comparisons

At the end of most interviews and focus group sessions, the participants were asked to make final comparisons and/or rank the proposed techniques. This section reports the results of these comparative questions, but does not summarize the comments made from the previously reported questions about the individual techniques.

Program Administrators

Most program administrators were willing to make comparative comments about the innovative techniques. One was skeptical of the need for new techniques, arguing that dedicated funding—that is actually funded—for existing techniques is more important than introducing new techniques.

ROFR was ranked the highest, overall. One administrator noted that it is a potentially high-benefit technique, but will only work with dedicated funding. Another administrator ranked it first, but with the caveats that it depends on the quality of the contract instrument and careful planning (targeting). A third administrator, who liked all of the techniques, noted that ROFR was especially promising, but also that it might be politically “sensitive” to introduce because it creates explicit winners and losers.

Pension plans were the second most promising technique. One administrator suggested that this technique is high-benefit, but low-feasibility.

Term easements and tontines were ranked lowest by administrators. Several noted that term easements would be unpopular because of the impermanent nature, but one

suggested that it would be the best from the farmers' points of view.

Tontines were perceived by most administrators to be an interesting concept, but with low feasibility in practice. One administrator suggested that tontines might be workable if they were set up explicitly as cooperatives, i.e., not the versions with government funding.

Lawmakers

The lawmakers from both focus groups/interviews had positive feelings about ROFR, and one group ranked it as the clear top choice. It was noted that ROFR should be given a new, less-intimidating name.

Both focus groups/interviews also ranked term easements highly, though there were strong positive and negative feelings. One lawmaker felt that this technique would “go over well,” but many other lawmakers believed that the impermanent nature of the technique would raise many objections.

The pension plan technique was viewed favorably. One group ranked this technique as tied for second. The other group felt more information was needed, but said that the technique was worth exploring.

Both lawmaker groups ranked tontines poorly. In one group, it was felt that there was not enough clarity about the concept to make an opinion and the other group ranked it the lowest.

Landowners

Landowners preferred pension plans and rights of first refusal. Nothing specific was

noted in the concluding questions about term easements or tontines.

Landowners had several clarifying remarks about ROFR. The voluntary nature of participation in ROFR appealed to them, as did the way competition in the development land market would lead farmers to get the highest possible return for their land. The group felt that ROFR would be less appealing if it were mandated.

Overall, the landowners felt that education is important with any new program, noting that they felt as though they learned about PACE too late. Most information about land preservation came via word of mouth from neighbors.

Fiscal Analysis

This section offers a comparison of the fiscal performance of the four techniques under reasonable assumptions about expected land market conditions in Delaware. Although many versions of each technique are proposed, this analysis is limited to a single version of each technique. Several comments on the techniques identified during the interviews and focus groups are incorporated into this analysis.

The analysis assumes that the state had \$10,000,000 to implement new techniques. As a baseline, PACE would be expected to preserve between 1,000 and 2,500 acres with these funds. The results suggest that term easements might temporarily preserve many more acres than PACE would preserve permanently. ROFR would preserve fewer acres than PACE, but would preserve only those parcels with a credible conversion threat. An example of the pension program shows that it may be able to preserve more acres than PACE, with the same funds, assuming that owners in their late 40's participate and they are willing to accept payments of approximately \$60,000 per year when they retire. The tontine technique is difficult to compare to the others; however, a sketch of the analysis shows that with \$10,000,000 in funding, the agricultural land use value for 10,000 acres should increase by at least \$900. This would lessen the incentive to convert.

Statewide Financial Impact Analysis Assumptions

A useful way to summarize the findings of this report is to speculate on how Delaware might implement the four techniques. Consider this statewide financial comparison, updating and extending the

assessment in Duke and Lynch (2003). Assume:

- Delaware has \$10 million in new funding to spend on farmland preservation
- Existing programs continue
- There are 550,000 acres of farmland in the state
- There are 200,000-300,000 acres of productive farmland that it would like to preserve
- Current minimum rural zoning is 2 acres per house
- Low-valued parcels sell for \$6,000 per acre (\$2,000 agricultural value and \$4,000 development increment)
- High-valued parcels sell for \$12,000 per acre (\$2,000 agricultural value and \$10,000 development increment)

PACE Performance

Consider PACE to be the baseline preservation technique. With PACE the state should be able to secure additional participation, but at costs higher than in the past. Costs rise because developed land values have greatly increased recently and because average owner willingness to accept compensation increases over time as those with low willingness to accept enroll in the program.

If the average cost per acre for PACE were low (\$4,000), then the state could preserve 2,500 acres. If the average cost per acre were high (\$10,000), then the state could preserve 1,000 acres. Prioritization criteria could be used to secure the most desired farms, but it is not certain that the willing owners will be all located in the same part of the state.

Term Easements Performance

Term easements would offer a yearly payment to owners who participate in the program for the term, say, 10 years. The payment ought to be less than the annualized PACE payment; otherwise, running a term easement program probably is not in the state's interest since it could simply extend the program funding a little and get permanent easements.⁵

If a 5 percent discount rate is assumed, then the annualize value of the development increment is \$200 for low-valued increments (\$4,000) and \$500 for high-valued increments (\$10,000).

Some owners may require 25 percent of this annualized value (Forthcoming-type) to participate in a term easement program, while others may require 75 percent (Reticent-type).

Under these assumptions, \$10 million could be used to preserve the following acreages for 10 years.

Table 3
Fiscal Example for Term Easements

	Yearly Payment per acre	Ten Year Payment per acre	Acres Preserved for \$10 million
Forthcoming, Low value	\$50	\$500	20,000
Forthcoming, High value	\$125	\$1,250	8,000
Reticent, Low value	\$150	\$1,500	6,667
Reticent, High value	\$375	\$3,750	2,667

⁵ A caveat to this claim: if the state desires participation—even temporary—from a set of landowners who are unwilling to participate in PACE at any reasonable payment, then term easements may be warranted.

This assessment demonstrates that the number of acres preserved under the 10-year term easement plan would vary widely depending on the assumptions. However, it is possible that the fund could preserve thousands of acres for 10 years.

This financial analysis should be qualified, however. Agricultural economists use the term *slippage* to describe owners who respond to a policy incentive in a way that undercuts the intent of the policy. We believe that slippage would also undercut the effectiveness of a term easement plan. Specifically, there are currently thousands of acres enrolled in Delaware's Agricultural Preservation District program—a program that preserves land temporarily. Rational landowners would likely simply switch from the Agricultural Preservation program to the term easement program, if the latter were offered. Hence, it is likely that a term easement program of modest funding, say, \$10 million would have minimal or no impact on preservation over a 10 year time frame.

Rights of First Refusal Performance

If the state invested a small amount of the fund to obtain rights of first refusal from owners in a targeted area, then the \$10 million fund may prevent more conversions of farmland. Assume that the state could buy these rights from 100 owners for \$1000 on average. Assume these owners own farms averaging 200 acres. Hence, 20,000 acres would be targeted with the rights of first refusal program. The remaining \$9.9 in the fund could be put in an interest bearing account to save for matching development offers.

From the interviews, it seems clear that the state must: (1) establish this fund in advance to make a credible threat to participate in the land development market; and (2) target a specific area for protection. Perhaps the interest from the account could be used to cover the costs of monitoring the land market for offers and enforcing the contracted rights.

For example, if offers were made in the near term on low-valued parcels (\$6,000), then the state could match offers for 1,650 acres. Assume the state could sever the development rights on these parcels and resell them for a 20 percent transaction cost. When the state resold the 1,650 acres, they would net \$2,640,000. This amount could be returned to the fund and be used to match more development offers.

In the limit, the rights of first refusal technique approaches the acreage preserved by PACE, but falls short because of the assumed 20 percent transaction costs. To counter balance these costs, however, the rights of first refusal program preserves only those farms with an immediate threat of conversion.

Timing is another important distinction between PACE and rights of first refusal. If all preservation takes place in the near term, then the result above holds. However, if PACE preservation occurs in the present and preservation by rights of first refusal takes place in the distant future, then the relative effectiveness of rights of first refusal declines. This is because interest from the fund is used to monitor the land market, and over time the principal in the fund decreases in real value as developed land values would rise at or above the rate of inflation.

Land Preservation Tontine Performance

In theory, the land preservation tontine concept is incommensurate to the three other innovative techniques. This is because tontines address a distinct externality from the other types of preservation techniques. Furthermore, the tontine concept can be self-funding. Participation depends on the individual, interdependent decisions of farmers in a proposed district. The other techniques have no interdependence.

A sketch of implementation, however, may shed light on the concept. Assume the state were to use, say, 90 percent of its \$10 million to stake a land preservation tontine fund. The remaining 10 percent would be used to encourage contracting and for monitoring. With \$9 million in the fund, the interest could be used as a dividend for remaining in the group and the principal would be retained as the incentive to maintain agricultural land use. A 5 percent return on investment would yield \$450,000 per year for dividend. If 50 owners participated, then each year these owners would receive a \$9,000 dividend in addition to retaining a claim to the tontine principal. With no term limiting the tontine and the expectation of a \$9,000 dividend per year, one expects this value to be capitalized into the value of land. From the dividend alone, each farm would increase in value by \$180,000 in an agricultural land use is maintained. If we continue to assume that these farmers own an average of 200 acres, then each acre increases in value by \$900. This increase would narrow the gap between land in agricultural and developed use and should work to keep more land in agriculture.

Agricultural Conservation Pension Performance

There are two main versions of the agricultural conservation pension plan. In the owner version, the state takes advantage of its position in risk pooling to more efficiently deliver retirement pension payments. An in-depth investigation of actuarial tables for agricultural landowners and state pension administrative costs would be needed to identify these efficiency gains.

One can reason, nevertheless, that the agricultural conservation pension would be efficient relative to PACE. Simply, if the state had \$10 million to spend on PACE or the agricultural conservation pension, then the state's superiority in risk-pooling (say, a 50 percent efficiency advantage) would allow it to leverage \$5 million extra dollars toward the purchase of conservation easements through the pension plan.

Without knowing the risk-pooling efficiency advantage of the state, one can still simulate

this technique with an assumed \$60,000 payment per year per participant.

The analysis in Table 4 assumes that the State starts with \$10,000,000 in 2005. Farmers sign up for the program in exchange for their development rights. It is assumed that the fund will grow at 5 percent each year and that the farmers participating are 49 years old. The fund therefore grows until 2019 when all farmers retire and begin receiving \$60,000 a year. There is no cost of living adjustment (COLA).

Under these conditions, the fund would last for 20 years, and could fund 26 farmers. If these farmers had an average of 200 acres, then 5,200 acres of development rights could be exchanged for the \$10,000,000 stake.

The analysis becomes more complicated as the individual payouts vary to reflect land values, acreage, and COLAs.

Table 4
Fiscal Example for Agricultural Conservation Pension

Year	Fund Value	Year	Fund Value	Year	Fund Value	Year	Fund Value
Initial stake-							
2005	\$ 10,000,000	2014	\$ 15,513,282	2023	\$ 18,902,397	2032	\$ 11,262,310
2006	\$ 10,500,000	2015	\$ 16,288,946	2024	\$ 18,209,517	2033	\$ 10,187,425
2007	\$ 11,025,000	2016	\$ 17,103,394	2025	\$ 17,481,993	2034	\$ 9,058,797
2008	\$ 11,576,250	2017	\$ 17,958,563	2026	\$ 16,718,093	2035	\$ 7,873,737
2009	\$ 12,155,063	2018	\$ 18,856,491	2027	\$ 15,915,997	2036	\$ 6,629,423
2010	\$ 12,762,816	2019	\$ 19,799,316	2028	\$ 15,073,797	2037	\$ 5,322,895
2011	\$ 13,400,956	2020	\$ 20,789,282	2029	\$ 14,189,487	2038	\$ 3,951,039
2012	\$ 14,071,004	2021	\$ 20,190,746	2030	\$ 13,260,961	2039	\$ 2,510,591
2013	\$ 14,774,554	2022	\$ 19,562,283	2031	\$ 12,286,010	2040	\$ 998,121

Appendix 1—Term Easements: Further Fiscal Considerations

An important policy question associated with agricultural land preservation is: how to establish institutions so that agriculture is profitable?

Land (houses and other real estate as well) has both a “use-value” and an investment value. Most people purchase a home as a consumption good—they use the home as living space—and as an investment good which they hope will appreciate. Agricultural land purchases often have similar goals. People use the land as an input into the production process and also expect they will receive some return from their investment. In Table A1, the agricultural land value, based on the “agricultural use-value,” is presented for a range of net returns. Thus, if one purchased land solely for the productive value this value is the price one would pay.

However, given that land is purchased for both use as a productive input and as an appreciating asset, the net returns required to maintain an agricultural enterprise under various market values for land given both the use value and the investment value. We assume that land is appreciating at 3.5 percent per year and there is a discount rate of 4 percent. As shown in Table A2, if the land value is \$2,500 per acre, one would need to earn \$35 per acre to retain the land in an agricultural use.

The farmer earns more money by staying in agriculture and not selling the land for 30+ years than by selling today. If the local land value is \$9,000 per acre, the owner would have to earn \$125 per acre to stay in an agricultural use. This result is due to the landowner trading off the value he could receive today from selling the land with the agricultural rents and the capital gains he is accruing overtime. As a rule, when the land value is appreciating, the owner needs approximately \$7 per acre in net returns for each \$500 in value.

Because capital gains play a role in this analysis, one sees that unless some other approach is taken, at some point in the future the land will be sold for its “highest and best” use. Even with profits of \$125 per acre, the land value for its agricultural use value would only be \$3,125 per acre. Therefore, while increasing agricultural profits will delay conversion, if the land has value for purposes beyond agricultural use it will not prevent conversion forever to this alternative use.

To estimate the size of term easement payments, one can refer to Table A2 above. Landowners in areas where land values are increasing will wait to sell if they have net returns sufficient to ensure that the increase in the land value (their capital gain) and the agricultural profit is greater than the annual value they lose from not selling their land.

In Table A2, we found a landowner needed approximately \$7.00 more in net agriculture for every \$500 of land value. If the land value is appreciating more slowly, such as in Table A3, a landowner needs approximately \$20 more in net returns for each \$500 of value to not sell their land. Of course, a market sale requires that there is a buyer.

In Table A4, we look at the annualized value for a 30 year period a landowner receives from selling their land and the corresponding value if he or she had sold a preservation easement in year 1.

Table A1
Price Based on Agricultural Use-Values for a Range of Net Returns

Net returns from agricultural production (per acre)	Use-Value of land (per acre)
\$35	\$875
\$41	\$1,025
\$48	\$1,188
\$55	\$1,375
\$62	\$1,550
\$68	\$1,700
\$75	\$1,875
\$82	\$2,050
\$89	\$2,225
\$96	\$2,400
\$103	\$2,575
\$110	\$2,750
\$117	\$2,925
\$125	\$3,125

Table A2
Net Returns Needed to Retain Land in Agriculture for 30+ Years when Value is Appreciating

Land Price (per acre)	Optimal Sales Year	Value in Year 31	Profit needed (per acre)
\$2,500	31	\$280,369	\$35
\$3,000	31	\$334,613	\$41
\$3,500	31	\$389,773	\$48
\$4,000	31	\$446,761	\$55
\$4,500	31	\$502,835	\$62
\$5,000	31	\$557,079	\$68
\$5,500	31	\$613,153	\$75
\$6,000	31	\$669,227	\$82
\$6,500	31	\$725,301	\$89
\$7,000	31	\$781,374	\$96
\$7,500	31	\$837,448	\$103
\$8,000	31	\$893,522	\$110
\$8,500	31	\$949,596	\$117
\$9,000	31	\$1,007,499	\$125

Note: Land appreciating at 3.5% a year; discount rate of 4%; 100 acre farm

Table A3
Profit or Net Returns Needed to Retain Land in Agriculture for 30+ Years if Value Appreciates Slowly

Land Price	Optimal Sales Year	Value in Year 31	Profit needed per acre
\$500	31	\$57,363	\$20
\$1,000	31	\$115,182	\$40
\$1,500	31	\$173,002	\$61
\$2,000	31	\$230,364	\$81
\$2,500	31	\$288,641	\$101
\$3,000	31	\$346,004	\$121
\$3,500	31	\$404,281	\$142
\$4,000	31	\$460,729	\$161
\$4,500	31	\$518,091	\$181
\$5,000	31	\$575,453	\$201
\$5,500	31	\$632,816	\$221
\$6,000	31	\$690,178	\$241
\$6,500	31	\$747,541	\$261
\$7,000	31	\$804,903	\$281
\$7,500	31	\$862,265	\$301
\$8,000	31	\$919,628	\$321
\$8,500	31	\$976,990	\$341
\$9,000	31	\$1,034,353	\$361

Land appreciating at 1 percent a year; discount rate of 4 percent; 100 acre farm.

Table A4
Easement and Land Values of Actual Participants in Maryland Agricultural Land Preservation Foundation

Number of Years	Term				
	0	15	20	25	30
	Actual value	Annualize Value of Easement Payments over different terms			
Average Payment per acre	\$2,511	\$226	\$185	\$161	\$145
Minimum Payment per acre	\$761	\$68	\$56	\$49	\$44
Maximum Payment per acre	\$9,444	\$849	\$695	\$605	\$546
	Actual value	Annualize Value of Market Value			
Average Land Value per acre	\$3,201	\$288	\$236	\$205	\$186
Minimum Land Value per acre	\$1,403	\$126	\$103	\$90	\$81
Maximum Land Value per acre	\$10,062	\$904	\$740	\$644	\$582
	Difference in Actual values	Annualized Difference between selling now and selling an easement			
Average	\$690	\$62	\$51	\$44	\$40
Minimum	\$642	\$58	\$47	\$41	\$41
Maximum	\$618	\$56	\$45	\$40	\$40
	Agricultural Use value	Annualized Stream of Agricultural income*			
Average	\$55	\$42	\$38	\$35	\$32
Minimum	\$35	\$27	\$24	\$22	\$21
Maximum	\$120	\$92	\$84	\$77	\$71

* These are hypothetical net returns

Appendix 2—Defining Terms for the Land Preservation Tontine Concept

Table A8, at the end of this section, offers a consistent framework and language for selecting the specific attributes of any Agricultural Land Preservation Tontine.

Assume the State authorizes a TD program, which consists of funding, contract standardization, and agency support organizing participants. The responsible agency also establishes several tontine targeted areas (TTA). The TTA modeled here will be in an area under moderate growth pressure. This area nevertheless maintains a large, productive agricultural economy.

Three parcels are identified by the state agency as being eligible, $\bar{j} = 3$. The eligible parcel set is $Y = \{\text{Adams farm, Jones farm, Johnson farm}\}$. If one perceives three parcels to be too small, then consider the third parcel to represent many other parcels and treat the first and second parcels as examples demonstrating the dynamics of the tontine process. The ownership set is $J = \{\text{Mr. Adams, Mr. and Mrs. Jones, Ms. Johnson}\}$.

Assume that the agency and owners are well informed about their land values. In reality, owners vary in their personal love of farming their land, which is characterized as a nonpecuniary value for continuing to farm. This analysis abstracts from these differences. Values are detailed in Table A5.

Table A5
Hypothetical Values for Land Preservation Tontine Application

Farmer	Type	Acres	Ag Returns Per Acre Per Year	Parcel Value Per Acre in Ag*	Parcel Value Per Acre in H&B Use	Parcel Value in Ag	Parcel Value in H&B Use	Value of ACE
Adams	Small farm, low agric. value	100	\$100	\$2,000	\$7,000	\$200,000	\$700,000	\$500,000
Jones	Small farm, high agric. value	100	\$150	\$3,000	\$7,000	\$300,000	\$700,000	\$400,000
Johnson	Large farm, low agric. value	300	\$100	\$2,000	\$7,000	\$600,000	\$2,100,000	\$1,500,000

*Assumes discount rate of 5%

Also, assume that the owners have information on how these values will change over time.

To complete the analysis, one also needs to assume the value of the negative pecuniary and technological externalities, which affect each owner's operation if one of the farms exits. Qualitatively, these harms might

include scaling back operation intensity to avoid agricultural nuisance claims or from a desire to be a “good” neighbor. The conversion of a neighboring farm also likely raises the value of converting any remaining agricultural lands to developed uses.

1. Increases the cost of farming by \$5 per acre (decreases agricultural returns); and
2. Each additional conversion raises the value of converting by 5%.

Accordingly, this analysis assumes that each additional conversion:

For the Adams farm, the example creates the following changes.

Table A6
Hypothetical Change from Neighbor’s Conversion—Adams Farm

	Initial Value	First Conversion	Second Conversion	Cumulative Change
Parcel Value in Ag	\$200,000	\$190,000	\$180,000	- 10.0%
Parcel Value in H&B	\$700,000	\$735,000	\$771,750	+ 15.8%
Value of ACE	\$500,000	\$545,000	\$591,750	+ 8.6%

Table A7
Hypothetical Change from Neighbor’s Conversion—Jones Farm

	Initial Value	First Conversion	Second Conversion	Cumulative Change
Parcel Value in Ag	\$300,000	\$290,000	\$280,000	- 10.0%
Parcel Value in H&B	\$700,000	\$735,000	\$771,750	+ 15.8%
Value of ACE	\$400,000	\$445,000	\$491,750	+ 10.5%

Table A8
Hypothetical Change from Neighbor’s Conversion—Johnson Farm

	Initial Value	First Conversion	Second Conversion	Cumulative Change
Parcel Value in Ag	\$600,000	\$570,000	\$540,000	- 10.0%
Parcel Value in H&B	\$2,100,000	\$2,205,000	\$2,315,250	+ 15.8%
Value of ACE	\$1,500,000	\$1,635,000	\$1,775,250	+ 8.6%

The first result from this simple analysis is that the pecuniary and technological impacts of conversion will harm larger farms more than smaller farms. All else equal, entry to the TD will be more attractive to larger farms.

The second result is that the incentive to develop (captured by the value of the development increment) rises more for the productive farms, all else equal.

Hence, these multilateral pecuniary and technological externalities are important because they will tend to drive larger, more-productive farms to convert.

For this example, it is useful to note that these farmers remain in farming even though the pecuniary returns to owning land suggest that development is a viable option at present. This is common for most farms in Delaware. Owners should still be regarded as rational under these circumstances. For instance, owners might see a financial gain to investing in land relative to what they would earn if they sold their land or ACE. Owners might also enjoy special, nonpecuniary returns to their agricultural ownership or labor.

Prototypical Tontine—Indefinite Term w/ Dividends

To model the ability of the tontine to counteract these externalities, consider a prototypical version in which the TD is of infinite term: $\tilde{t} = \infty$. Also, assume that initial funding comes from the state: $z_0 = z_0^{\text{pub}}$. Finally, assume all earning from this fund are paid as yearly dividends to those members who do not convert: $d_t = e_t = .05z_0$.

Only the final remaining owner will receive the fund.

In this formulation, one asks: how large the tontine fund must be to counteract the externalities?

Assume one owner converts because of a life event. Then, at that time, the value of future tontine dividends must exceed the additional incentive to convert. Each owner would have the following additional incentives from a first conversion:

- Adams—\$45,000
- Jones—\$45,000
- Johnson—\$135,000

With the discount rate of 5 percent, the owners would need the yearly payments of at least this much in order to not convert:

- Adams—\$2,250
- Jones—\$2,250
- Johnson—\$6,750

To generate yearly dividends of \$11,250, with 5 percent average return, the fund would need to be at least \$225,000.

This analysis does not consider the impact of time and asymmetric changes in agricultural use values, developed use values, and nonpecuniary values.

Note that although this fund is much less than the value of the development rights on these parcels, the tontine incentives only counteract the multilateral incentives generated by the aforementioned pecuniary and technological externalities. The incentives to convert arising from the market still exist.

Table A9: Definitions for Agricultural Land Preservation Tontines

Term	Definition	Definition of Notation	Notation
Policy Variables			
Tontine Targeted Area	A spatial indicator of lands that are to be preserved and affected by preservation using this technique		TTA
Tontine District	The collection of lands from the Tontine Targeted Area, which are enrolled in the program		TD
Tontine	The contract owners sign creating, perhaps, a negative covenant that runs with the land		
Parcels and Owners			
Parcel	A unit of land	y is a single parcel with one ownership unit	y
Eligible parcel	An agricultural land-use parcel in the TTA that would be eligible for owners to enroll voluntarily in the TD	Y is the set of eligible parcels \bar{j} is the number of $y \in Y$	$Y = \{y \mid y \text{ is eligible}\}$ $= \{y_1, y_2, \dots, y_{\bar{j}}\}$
Owner	The legal owner of an eligible parcel	Owner j owns y	$J = \{j \mid j \text{ owns } y\}$ $= \{j_1, j_2, \dots, j_{\bar{j}}\}$
Enrolled parcels	Among eligible parcels, the subset that owners enroll in the program by signing the tontine contract	X_t is the set of enrolled parcels at time t i_t is the number of $x \in X_t$	$X_t = \{x \mid x = y, x \in Y \text{ is enrolled}, 0 \leq t \leq \min\{\bar{t}, \tilde{t}\}\}$ $= \{x_1, x_2, \dots, x_{i_t}\} \subseteq Y$
Member	An owner that enrolls his or her parcel in a year. Membership runs with the land, so successors in interest assume membership	Owner i enrolls x at time t	$I_t = \{i \mid i \text{ owns } x \in X_t, 0 \leq t \leq \min\{\bar{t}, \tilde{t}\}\}$
Timing			
Initial year	The year in which the tontine takes effect	t indicates year, normalized so that the beginning of the first year is 0	$t = 0$
Terminal year	The last year in which the tontine operates. If the tontine is perpetual, then the final year is $t = \infty$	\tilde{t} is the ex ante final year of the tontine If perpetual, then $\tilde{t} = \infty$	$t = \tilde{t}$
Term	The length of the tontine		\bar{t}
Rules			
Converted	The year in which a member converts	Owner i converts x at	$C_t = \{x \mid X_{t-1} - x = X_t\}$

parcel	(or sells for conversion) to a proscribed land use	time t	
Minimum number	The minimum number of owners that must enroll their parcels for the tontine to become activated	A tontine begins in year $t = 0$ when this critical number of parcels, \underline{i} , are enrolled	$i_0 = \underline{i} \Leftrightarrow t = 0$
Critical number	If an active tontine drops to this number of members, it ends, and the principal is divided among ultimate owners	A tontine ends in year \bar{t} when this critical number of parcels, \bar{i} , are enrolled	$i_t \leq \bar{i}, i_{t-1} > \bar{i} \Leftrightarrow 1 \leq t = \bar{t} \leq \tilde{t}$
Original member	The owner that enrolls a parcel at the initial time.	Owner i enrolls x at time 0	$I_0 = \{i \mid i \text{ owns } x \in X_0\}$
Final members	The set of members claiming the principal in terminal year	Member i who did not convert x	$I_t = \{i \mid i \text{ owns } x \in X_t, t = \min\{\bar{t}, \tilde{t}\}\}$
Final parcels	The set of parcels owned by final members	Parcels x owned by final members	$X_{\min\{\bar{t}, \tilde{t}\}} = \{X_0 \cup \dots \cup X_{\min\{\bar{t}, \tilde{t}\}}\} - \{C_1 \cup \dots \cup C_{\min\{\bar{t}, \tilde{t}\}}\}$
Financial Variables			
Principal	Main fund, which is traditionally associated with a tontine	There are z dollars available in time t for principal	$z_t, 0 \leq t \leq \min\{\bar{t}, \tilde{t}\}$
Source of principal	Funded by the public, private organizations, the members, or combinations.	z_t^{pub} = public funding z_t^{ngo} = private funding z_t^i = member i payment to principal	$z_t = z_{t-1} + e_t - d_t - p_t + \sum_t \left(z_t^{pub} + z_t^{ngo} + \sum_i z_t^i \right) \geq 0, t > 0$
Dividends & Earnings	Income from the principal can be paid to remaining owners or can be reinvested in the principal	d_t = dividend payment e_t = earnings on principal	d_t e_t
Principal Payments	Members can receive payments from principal similar to a reverse mortgage	p_t = principal payment	p_t

Appendix 3—Valuing Rights of First Refusal

Malcolm, Duke, and Mackenzie (2005) investigated the possibility of using rights of first refusal as a farmland preservation tool. Of concern in this paper was deriving a theoretical explanation for a value (in the present) for these rights.

Economic theory predicts that with perfect markets these rights ought to be without value since the state merely matches the best offer the seller obtains from the market. Of the few economic studies to consider ROFR in any context, none has modeled value in the present—what Malcolm, Duke, and Mackenzie (2005) term the “ex-ante” value.

Nevertheless, this is an important question for agricultural land preservation because it is this ex-ante value that owners should demand if they are to participate in an ROFR program.

Malcolm, Duke, and Mackenzie (2005) theorize that ex-ante value arises from the following market characteristic:

“If the ROFR holder does not know competitors’ values for raw land and has the highest value, then the ROFR holder pays the second highest value and gains the difference between his or her value and the next highest bidder.”

Malcolm, Duke, and Mackenzie (2005) also suggested that ex ante value may arise because:

“(1) ROFR guarantee “tickets” to final negotiation tables so that ROFR holders can save the costs of monitoring when farmers decide to sell; or (2) ROFR allow developers

to advance purchase market share in raw land, which may result in securing enough land to affect developed-land prices.”

The reader may find details of the valuation model in Malcolm, Duke, and Mackenzie (2005).

Works Cited

Duke, Joshua M. and Lori Lynch. 2003.
Farmland preservation techniques:
Identifying new options. *Dept. of
Food and Res. Econ. Research
Report* RR03-02, Univ. of Del

Malcolm, Scott A., Joshua M. Duke, and
John Mackenzie. 2005. Valuing
rights of first refusal for farmland
preservation policy. *Applied
Economics Letters* 12:285-288.

**The Department of Food and Resource Economics
College of Agriculture and Natural Resources
University of Delaware**

The Department of Food and Resource Economics carries on an extensive and coordinated program of teaching, organized research, and public service in a wide variety of the following professional subject matter areas:

Subject Matter Areas

Agricultural Finance	Natural Resource Management
Agricultural Policy and Public Programs	Operations Research and Decision Analysis
Environmental and Resource Economics	Price and Demand Analysis
Food and Agribusiness Management	Rural and Community Development
Food and Fiber Marketing	Statistical Analysis and Research Methods
International Agricultural Trade	

The department's research in these areas is part of the organized research program of the Delaware Agricultural Experiment Station, College of Agriculture and Natural Resources. Much of the research is in cooperation with industry partners, other state research stations, the USDA, and other State and Federal agencies. The combination of teaching, research, and service provides an efficient, effective, and productive use of resources invested in higher education and service to the public. Emphasis in research is on solving practical problems important to various segments of the economy.

The department's coordinated teaching, research, and service program provides professional training careers in a wide variety of occupations in the food and agribusiness industry, financial institutions, and government service. Departmental course work is supplemented by courses in other disciplines, particularly in the College of Agriculture and Natural Resources and the College of Business and Economics. Academic programs lead to degrees at two levels: Bachelor of Science and Masters of Science. Course work in all curricula provides knowledge of tools and techniques useful for decision making. Emphasis in the undergraduate program centers on developing the student's managerial ability through three different areas, Food and Agricultural Business Management, Natural Resource Management, and Agricultural Economics. The graduate program builds on the undergraduate background, strengthening basic knowledge and adding more sophisticated analytical skills and business capabilities. The department also cooperates in the offering of an MS and Ph.D. degrees in the inter disciplinary Operations Research Program. In addition, a Ph.D. degree is offered in cooperation with the Department of Economics.

For further information write to:	Dr. Thomas W. Ilvento, Chair
	Department of Food and Resource Economics
	University of Delaware
	Newark, DE 19717-1303

FREC Research Reports

are published as a
service to Delaware's

Food and Agribusiness

Community by the

Department of

Food and Resource

Economics, College

of Agriculture and

Natural Resources

of the University of

Delaware.

