Identifying barriers and gateways for agroforestry adoption in the U.S. Corn Belt

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Introduction
The Multifunctional Perennial Cropping systems (MPCs) research project surveyed cropland landowners to explore how their socio-demographics and attitudes influence their willingness to adopt perennial cropping systems. For the Corn Belt of conventional agriculture, MPCs would be implemented on marginal land, low yielding and high environmental degradation for annual crops. There are 24.68 million hectares of cropland with marginal productivity in the U.S. [1], signifying an opportunity for agroforestry, specifically MPCs.

Method
A farmer survey was developed following the guidelines for mixed-mode mail and online surveys [6]. Survey materials were mailed out to landowners in the study region within Central Illinois. Landowners were given the option to complete the survey online: https:// cropland.wufoo.com/forms/farm-survey/

The survey was comprised of four parts:

Part I. Demographic questions about the respondent’s age, education, etc. and their agricultural land.

Part II. Adoption potential - Direct questions to gauge if the respondent had high adoption potential (marginal land acres, conservation program acres, interested in agroforestry).

Part III. Likert Scale questions (rank 1-5) on perennial crop system interest and evaluation of 10 ecosystem services.

Part IV. Motivators - Questions to explore motivators for or against adoption of new cropping systems (information needs, incentives, agronomy related needs)

Results
Exploration of the survey data and statistics were calculated using the SAS Statistics program. Multivariate statistical procedures were employed to determine landowner typologies for agroforestry adoption interest: Discriminant Analysis (DA) and Hierarchical Cluster Analysis (HCA).

For survey respondent dataset, the discriminant function correctly classified potential adopters 78% of the time and correctly classified non-potential adopters 89% of the time. The variables, or survey questions, most important for predicting adoption potential were:

- How involved will you be in the farm management decisions in the future?
- Would you be willing to sublease a portion of your land, marginal, to a MPCs farmer?
- Do you prefer long or short lease lengths as a landowner?
- How do you value the conservation of plant diversity on a farm?

Conclusions
The agricultural landowner typologies can be used to prioritize implementation efforts for agroforestry and MPCs through education and outreach. Efforts can be focused first on the landowners that match the “high adopter profile.”

High potential adopter profile:
- Have marginal land acres and interest in perennial cropping systems.
- High valuation of ecosystem services such as soil, insect control, water quality, and provisioning services, indicating interest in multifunctional systems that provide more than just a crop yield.
- Highly value the conservation of plant diversity on their farmland, thus outreach could target those involved with conservation organizations.
- Majority have small farms, however larger farm landowners looking to sublease their property may be open to alternative cropping systems, and those that are more involved in the management decisions are more likely to be open to a MPCs system.

References
[8] Small Conventional Medium C 22 Smaller average farm size Moderate interest in MPC systems Moderate valuation of all ES Prefers crop share leasing agreements.
[9] Large Conventional Medium D 17 Larger average farm size Olderst average age. Not very interested in perennial cropping systems. Low valuation for ES except for soil and pest insect control.

Figure 1: MPCs are designed to be an agroforestry-esque system that would provide benefits in three areas [2,3].

Figure 2: The study area for the MPCs project was a watershed located in Central Illinois (orange star), part of the U.S. Corn belt (green) [5].

Figure 3: Likelihood that a landowner would participate in a Multifunctional Perennial Cropping System (n=87).

Table 1: Typologies of landowners.

<table>
<thead>
<tr>
<th>Name</th>
<th>Potential Cluster</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young</td>
<td>High</td>
<td>A</td>
</tr>
<tr>
<td>Medium</td>
<td>B</td>
<td>12 Youngest age. Most interested in perennial cropping systems. Prefers shorter leases. Indicated higher importance in farm management decisions, especially for the future.</td>
</tr>
<tr>
<td>Small</td>
<td>Conventional</td>
<td>C 22 Smaller average farm size Moderate interest in MPC systems Moderate valuation of all ES Prefers crop share leasing agreements.</td>
</tr>
<tr>
<td>Large</td>
<td>Conventional</td>
<td>D 17 Larger average farm size Olderst average age. Not very interested in perennial cropping systems. Low valuation for ES except for soil and pest insect control.</td>
</tr>
<tr>
<td>Money-Motivated</td>
<td>Low</td>
<td>E 9 Prefers cash rent and long lease arrangements. Highest average ES valuation for provisioning ES (food, fuel, and fiber) Low value for recreation ES.</td>
</tr>
<tr>
<td>Absentee</td>
<td>Low</td>
<td>F 7 More likely to own farmland and lease out. Lowest score for market importance. Not interested in perennial cropping systems and lowest valuation of all ES.</td>
</tr>
</tbody>
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Ecosystem service (ES) valuation, demographic characteristics, and interest in various perennial cropping systems (Figure 2) were key differences found between clusters. Potential was measured by whether or not the respondent explicitly responded yes to interest in perennial crop adoption and reported marginal land acres that they could covert.

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