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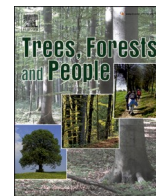


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Challenges and opportunities for agroforestry practitioners to participate in state preferential property tax programs for agriculture and forestry

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ABSTRACT

All 50 states offer preferential property tax programs that lower the taxes paid on enrolled agricultural and/or forest lands. While agroforestry is a land-use that combines elements of both agriculture and forestry, eligibility criteria and other rules and regulations may prevent landowners from enrolling agroforestry practices in one or more of the agricultural and forestry tax programs. This pilot-scale study developed conceptual and methodological frameworks to identify the current barriers to and opportunities in preferential tax policies applicable to agroforestry practices. We conducted an extensive review of state preferential property tax programs relevant to agroforestry practices, following focus group discussions with regional experts in five selected states across the United States: North Carolina, Nebraska, Wisconsin, New York, and Oregon. Based on a systematic review of statutes and their supporting documents, we developed a database of programs, which support or create barriers to enrollment of agroforestry practitioners into the programs. We found that agricultural tax assessments were more likely to favor multi-use agriculture and forestry systems than the preferential tax assessments of forestlands in the five states. Forest farming and silvopasture, followed by alley cropping, windbreaks, and riparian forest buffers, were found to be the most common agroforestry practices allowed under preferential tax classifications in the study states. This study provides a framework for cataloging and analyzing preferential property tax-programs to document barriers and facilitators to agroforestry practices in the United States.

Introduction

Market conditions and regulatory policies related to taxation, investment, trade, and financial assistance are the major determinants collectively influencing sustainable private land management investments (Ellefson et al., 2005; Cabbage et al., 2020). Preferential property tax treatment of private rural lands in the United States dates back over a century but gained momentum in the mid-20th century (England 2012). Each of the 50 states offer preferential property tax programs (PPTP) which defer, reduce, or eliminate the taxes paid on enrolled agricultural and/or forest lands (Kilgore et al., 2017; Frey et al., 2019).

PPTP have helped to influence forest stewardship, encourage the production of timber and non-timber products and services, and delay

conversion of rural lands by restoring the balance between a property's taxable value and its income-producing potential (Granskog et al., 2002; Meier et al., 2019). Anderson and England (2015) estimated that agricultural lands enrolled in use-value assessment programs experience significant tax savings compared to lands not under preferential assessment. For example, Ohio's Agricultural Use-Value Program reduced land values to 15–25% of the average market value in selected counties (Anderson and England 2015). In addition, forestry programs can reduce taxes by \$8 per acre per year on average across the United States (U.S.), and much more in many states (Kilgore et al., 2017).

Agroforestry is the intentional integration of trees or shrubs with crop and animal production to create environmental, economic, and social benefits (U.S. Department of Agriculture [USDA] 2021; Schoeneberger et al. 2017). Agroforestry practices are commonly believed to

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provide greater environmental services than agricultural monocultures, reduce risks related to monoculture crop yield and price, and favor enhanced long-term site productivity and soil protection (Zomer et al., 2016; Bentrup et al., 2018; Chizmar et al., 2020). The U.S. Department of Agriculture (USDA 2021) National Agroforestry Center (NAC) identifies five primary agroforestry practices: alley cropping, forest farming, riparian forest buffers, silvopasture, and windbreaks.

In addition, agroforestry has been found to benefit forestry systems by reducing income risks, increasing forest management, and reducing impacts on native plant populations (Food and Agriculture Organization 2020). The integration of trees into agricultural systems has also been found to benefit livestock systems. For example, livestock windbreaks have been found to increase yields, provide protection during inclement weather, extend forage opportunities, provide visual screening, reduce odors, and provide shade (Smith et al., 2021). Agroforestry strategically placed may reduce odor transfer from livestock operations, resulting in reduction of social conflict (Tyndall and Colletti 2007), which itself may reduce the incidence of nuisance litigation against such operations (Tyndall 2009).

State PPTP for forest and agricultural lands may preclude agroforestry adopters from potentially crucial tax savings, which by and large are substantial for landowners (Hibbard et al., 2003; Kilgore et al., 2017). The multifaceted structure and inherent characteristics of agroforestry practices – intentional, intensive, interactive, and integrated – may prevent or facilitate these land uses from qualifying for enrollment. For instance, minimum trees per acre requirements for forestry tax programs might prohibit certain agroforestry uses, especially windbreaks and riparian forest buffers, where the trees are typically grown in narrow strips. Likewise, maximum tree cover requirements or minimum annual income requirements for agriculture tax programs could limit participation by other agroforestry practitioners. Consequently, state mandated PPTP without clear statutory or regulatory guidance may result in various interpretations, and thus, uneven application by county tax administrators.

Cutter et al. (1999) cataloged nine direct and 11 indirect state policies, which promoted at least one of five forms of agroforestry: forest farming, windbreaks, riparian buffers, silvopasture, and alley cropping. Of the 20 policies in the United States, only six states (Delaware, Indiana, Michigan, New Jersey, North Dakota, and Wisconsin) utilized property tax reductions or exemptions to either directly or indirectly encourage the adoption of agroforestry (Cutter et al., 1999). Reviewing existing programs that either support or prohibit agroforestry practices is essential to understanding agroforestry adoption patterns and opportunities.

The overall objective of this study is to develop conceptual and methodological frameworks to identify the current barriers and opportunities in preferential tax policies for agroforestry practices through an extensive review of state PPTP for agriculture and forestry, and where available, agroforestry. We adapted the methodology of Cutter et al. (1999) and Kilgore et al. (2017) to review the tax programs systematically following focus group discussions with regional experts working in agroforestry and related fields. The methods and results of this case study provided a framework for cataloging and analyzing tax-program related barriers and facilitators to agroforestry in the rest of the United States. For landowners and natural resource professionals engaged with agroforestry, this will likely provide a starting point for how to navigate the complex issue of PPTPs, including those in states not covered in this study.

Methodology

Focus group discussion

In November 2020, the research team facilitated a virtual focus group discussion and online forum according to the Institutional Review Board (IRB) guidelines at North Carolina State University (NCSU). The

USDA NAC study collaborators provided a list of 18 individuals within their network prior to the focus group discussion and forum. Individuals were regional experts in agroforestry, which is often recognized as a highly specialized topic. Experts were selected from across the nation to ensure representation of various land-use systems. Only a subset of the pool of potential participants were also familiar with PPTPs. Seven professionals knowledgeable about agroforestry practices and PPTPs ultimately volunteered to participate in the study. As a result, we selected Oregon, Nebraska, Wisconsin, New York, and North Carolina based on the regional experts available and to represent a range of state circumstances including variation in region, property tax policy, and agroforestry practices. The research team then invited the seven experts to garner general information, provide direction in the initial review of property tax assessment of forests and agriculture, and identify potential implications for agroforestry practices.

The research team separated the discussion topics into the following categories: forestry-related characteristics, agriculture-related characteristics, and general management characteristics. Each focus group participant was given the option to contribute or pass to another participant for each of the topics. Potential focus group participants also had the opportunity to participate in the discussion via a virtual forum. The virtual forum included the topics and prompts featured in the live focus group discussion. The focus group transcript, once verified by participants, was used to provide context to understanding the agroforestry practices common in each state. These insights provided us with an empirical perspective when designing and implementing the review of tax manuals, property assessment statutes, and supplemental publications.

Review criteria

We adapted the methodology used by Kilgore et al. (2017) to identify statutory, regulatory, and other relevant publications (guides, manuals, etc.). We assessed the sources included in Kilgore et al. (2017), and then performed an online search of each state government agency's websites and supplemental websites to ensure that our database featured current data. We extracted the following data for each of the selected states:

- Name of program and administrative and/or regulatory organization
- Ownership requirements
- Eligible lands and land-uses
- Productivity requirements
- Management of lands
- Preferential assessment of property
- Penalties for non-compliance and disqualification

In addition, we modified the framework utilized by Cutter et al. (1999) to review the publications and categorize PPTP by the compatibility of each policy with the following agroforestry practices: alley cropping, forest farming, riparian forest buffers, silvopasture, and windbreaks. Alley cropping systems feature agricultural and tree crops planted in alternating rows and grown simultaneously (USDA 2021). Meanwhile, forest farming leverages managed forests to foster cultivation of high-value crops under tree canopies. Riparian forest buffers are defined as forested areas within non-forested or mosaic landscapes, alongside streams, rivers, and other bodies of water. Silvopasture strategically integrates the production of trees and woody crops with livestock operations on the same pastureland. Lastly, windbreaks protect and enhance the production of crops, livestock, and ecosystem services through linear plantings of trees and other vegetation which improve environmental conditions such as wind and shade (USDA 2021).

Subsequently, we condensed the forestry-related, agriculture-related, and general management characteristics utilized in the focus group discussion to pinpoint "acceptable" and "unacceptable" practices under each preferential assessment in the study. Characteristics used to analyze the eligibility of agroforestry practices included use of trees,

grazing livestock in treed environments, production of agricultural and horticultural crops, and an integrated agriculture-forest interface. We also adapted the coding used by Kilgore et al. (2017) to include “emphasized” in order to reflect practices and characteristics of land-uses that were considered particularly noteworthy. We discerned characteristics categorized as “emphasized” from “acceptable” to classify practices related to the main objectives of the programs and those that are directly mentioned and promoted in the publications, whereas “acceptable” practices typically were eligible for preferential assessment within bounds and limits.

Furthermore, we performed a literature review of both gray and peer-reviewed publications in Google Scholar, Commonwealth Agricultural Bureau (CAB) Abstracts, and the NC State University Summon Database. We utilized combinations of keywords such as “agroforestry,” “barriers,” “opportunity,” and “property tax” to pinpoint publications relevant to the study subject area. Lastly, we searched the publications and past press releases to identify leveraging points for policy change. This allowed us to note how the programs have evolved over time and which factors encouraged past policy changes. We compiled state profiles with the results from the literature review, state statutes, and supplemental guides. We contacted tax professionals in each of the states to verify our findings and complete any missing information.

Results

We focused our review on the compatibility of agroforestry practice characteristics, instead of specific agroforestry practices following the focus group. The findings from the focus group discussion reinforced our expectations: agricultural and forest land-uses and the preferential tax assessment of rural working lands vary greatly from state to state. Transitioning the focus from specific agriculture or forestry practices to characteristics allowed us to accommodate for the diversity of programs and land-uses across the sample. There was also overwhelming support from the focus group to identify leveraging points for policy change, which we incorporated in our review methodology.

We identified a total of 10 programs in the five states in the study area (Fig. 1). Both North Carolina and Nebraska include all preferential assessments for rural working lands under one program (Appendix A). Oregon has four PPTPs for agriculture and forests, the most among the states chosen for the study. Six programs in the study require a minimum acreage in order to qualify for preferential assessment, two of which are

also bounded by a maximum acreage. The most common method for preferential assessments is an income-based use value, which was included in four programs. Wisconsin and New York both assess agricultural land utilizing a different approach than forestlands: use-valuation as opposed to reduced tax rate and reduced fair market value, respectively. Wisconsin is the only state in the sample that lowers the tax liability of rural lands, specifically forestlands, using a reduced tax rate. No assessment program includes both a reduction in the tax rate and the land value for a unified approach to preferential treatment of a single land-use classification. Multiple organizations at the local and state level work collectively to administer and manage each of the programs described in the study. State-specific land assessment characteristics of rural working lands are explained in more detail below.

Nebraska

Nebraska assesses agricultural and horticultural, which includes forestland and shelterbelt areas, owned by private landowners under the General Property Tax Program (Property Assessment Division 2021; Nebraska Dept. of Revenue 2021). Interestingly, the program also features a separate sub-class for intensive land-uses such as nurseries and orchards. The program is run in concert by the Nebraska Department of Revenue, county tax assessors, the Nebraska Forest Service, and the Nebraska Tax Equalization and Review Commission. The General Property Tax program does not require a minimum or maximum acreage, a minimum income, or a management plan for preferential assessment of any of the land-use classifications (Nebraska Dept. of Revenue 2021). The program, however, requires that forests maintain at least 35% canopy cover (National Timber Tax 2020a). Lands with less than 35% forest cover are instead classified as grasslands (agriculture). Enrolled lands are taxed at a reduced land-value, currently 75% of the fair market value. There are no penalties, fees, or deferred taxes due upon disqualification or when non-compliant (Nebraska Dept. of Revenue 2021).

Tree canopy along water bodies such as rivers and streams may be classified for agricultural or timber production (Table 1), which may indirectly permit riparian forest buffers under either classification (Table 2) (Nebraska Dept. of Revenue 2021). The agriculture and horticulture classification emphasizes land uses that relate to their respective classification but also includes trees when the underbrush is managed and removed. For example, the program requirements for the

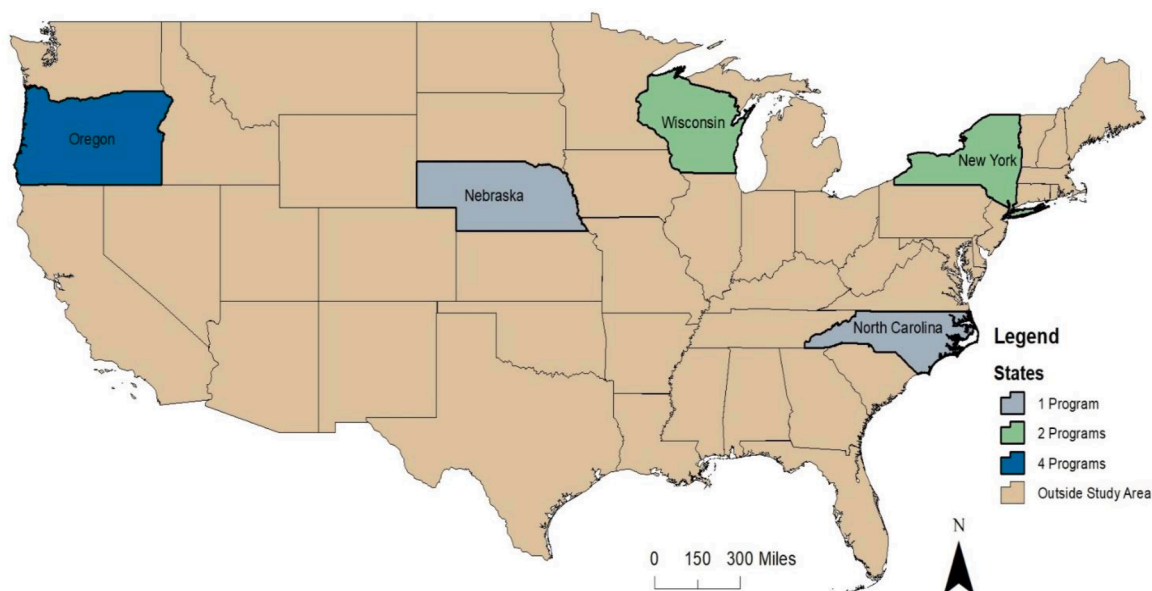


Fig. 1. Map of state programs investigated in study, symbolized by number of PPTP per state.

Table 1
Compatibility of agroforestry-related characteristics with the PPTP in the selected states.

State/Program Characteristics	NE For	Ag/ Hort	NY For	Ag	NC For	Ag	Hort	OR HF	DF	STF	EFZ	NFZ	WI For	Ag
<i>Forestry-related</i>														
Commercial (timber) tree species	A	A	E	A	E	A	A	E	E	E	A	A	E	A
Nontimber Use of Trees: ecosystem services, aesthetics, etc.	A	A	A	A	A	A	A	A	A	A	A	E	A	A
<i>Agriculture-related</i>														
Commercial agricultural/horticultural products (including mushrooms, ginseng, etc.)	A	E	U	E	U	E	E	U	U	U	E	E	U	E
Grazing of livestock	U	E	U	E	U	E	U	A	A	A	A	A	U	E
Eligibility of Buffers: riparian, vegetative, or tree	A	A	A	A	U	A	A	A	A	A	A	A	E	A
Fallow Land and/or wasteland included	U	A	U	A	A	A	A	U	U	U	A	A	A	A
<i>General Management</i>														
Include residential area in assessment	U	U	U	A	A	A	A	A	A	A	A	A	U	U
Agriculture and forestry interface	A	A	U	E	U	A	A	A	A	A	A	A	U	A

KEY: U="Unacceptable;" A="Acceptable;" E="Emphasized".

Unacceptable: not permitted or rarely permitted on a case-by-case basis.

Acceptable: allowed within limits, permitted but not primary objective.

Emphasized: related to main objective, particularly noteworthy practice.

Acronyms: For = Forest; Ag = Agriculture; Hort = Horticulture; HF = Highest Best Use Forest; DF = Designated Forest;

STF = Small Tract Forestland; EFZ = Exclusive Farm-Use Zone; NFZ= Nonexclusive Farm-Use Zone.

Table 2
Agroforestry practices permitted under each state program in the study area, by land classification.

State	Program	Use	Agroforestry types allowed (Y = Yes)				
			Silvopasture	Windbreak	Alley Crop	Riparian Forest Buffer	Forest Farm
NE	General Property Tax Program	Forestland and Shelterbelt		Y		Y	Y
		Agriculture/Horticulture	Y		Y	Y	Y
NY	Forestland Program Agricultural Assessment Program	Forest				Y	
		Agriculture	Y	Y	Y		Y
NC	Present Use Value Program	Forest					
		Agriculture	Y	Y	Y	²	Y
		Horticulture		Y	Y		Y
OR	Forestland Program Small Tract Forestland Exclusive and Nonexcl. Farm-Use Zone	HBU ¹ or designated forest	Y			³	
		HBU ¹ or designated forest	Y			³	
		Agriculture	Y	Y	Y	³	Y
WI	Managed Forest Law Program Use Value Assessment	Forest				Y	Y ⁴
		Agriculture and Agricultural Forest	Y	Y	Y		Y

¹ HBU = Highest Best Use.

² Wildlife Conservation Program appraises riparian and stream zones that protect wildlife habitat using agricultural use values.

³ Riparian lands under their own respective special assessment are exempt from property taxes in Oregon.

⁴ Maple syrup production conditionally permitted.

agricultural and horticultural classification specifically includes “timbered grassland” where grazing is the primary use. Meanwhile, the forest classification explicitly includes both natural and planted areas for windbreaks but negates to specify eligible non-wood forest products. Therefore, the agricultural and horticultural classification permits silvopasture, alley cropping, and riparian forest buffers, while the forest sub-class allows windbreaks configurations, riparian forest buffers, and potentially forest farming (Table 2) (Nebraska Dept. of Revenue 2021).

New York

Privately-owned forests in New York enrolled in the Forestland Program are taxed at a reduced land-value (80% of fair market value) (New York State Dept. of Environmental Conservation 2020). The New York Dept. of Environmental Conservation, county clerks and tax assessors, and the New York Dept. of Taxation and Finance jointly manage the Forestland Program. Meanwhile, the Agricultural Assessment Program reduces the tax liability of enrolled privately-owned agricultural and horticultural lands by basing land-values on productivity potential (use-value) (New York State Dept. of Taxation and Finance 2019). Soil and Water Conservation District Offices and the New York Dept. of Taxation and Finance administer the Agricultural Assessment Program.

Forests must be at least 50 acres to participate in the Forestland Program, whereas the agricultural assessment only requires a minimum of seven acres to qualify (New York State Dept. of Environmental Conservation 2020; New York State Dept. of Taxation and Finance 2021). However, agricultural lands less than seven acres may qualify if they gross a minimum of \$50,000 on average in product sales annually.

Forests enrolled in the Forestland Program must adhere to a written management plan for 10 years and contain at least 800 trees per acre (TPA) or, if underplanted, approximately 300 TPA (Bureau of Forest Resource Management 2019). Recently planted and naturally regenerated tracts must be projected to produce a merchantable forest crop in 30 years (New York State Senate 2021). The Agricultural Assessment Program stipulates that lands return at least \$10,000 per year on average (gross) in the two years before receiving preferential treatment, unless the land was leased, experienced damage from a natural disaster, or was under certain conservation programs (New York State Dept. of Taxation and Finance 2019, 2021). Agricultural properties with woodlands of less than 50 acres may also include up to \$2000 in gross sales of wood products to the \$10,000 income requirement (New York State Dept. of Taxation and Finance 2019).

The Agricultural Assessment Program mandates a conversion fee up to \$1000 for changing from agriculture to a non-agriculture use;

however, the language is unclear regarding if converting agricultural lands to forestlands would trigger a fee (New York State Dept. of Taxation and Finance 2019). Both the forestland and agriculture assessments require declassified landowners to pay the deferred taxes plus interest for up to 10 years for forests and no more than five years for agriculture (Bureau of Forest Resource Management 2019; New York State Dept. of Taxation and Finance 2019). In the case of deferred taxation statutes when land is converted to ineligible uses, the land is reassessed, and a penalty that is based on the tax savings accrued during the preferential classification period is imposed (Polyakov and Zhang 2008).

Furthermore, land designated for crop production, for grazing of livestock, as fallow, or as wasteland are not eligible for preferential assessment through the Forestland Program, whereas the Agricultural Assessment Program emphasizes land-uses that combine agriculture and forestry (Table 1) (New York State Dept. of Taxation and Finance 2021). For example, silvopasture and forest farming, specifically maple production and wild mushroom cultivation, have been added to the program for agriculture over time (Bond Schoeneck and King PLLC 2015). Noteworthy, neither program directly discusses the inclusion of riparian forest buffers as eligible land-uses. However, the income requirements for New York's PPTP for agricultural lands may prevent riparian buffers from qualifying for enrollment. As a result, four of the five agroforestry practices are eligible under the agricultural assessment (silvopasture, windbreaks, alley cropping, and forest farming) and only riparian forest buffers may be permitted under the forest assessment (Table 2).

North Carolina

Certain lands in North Carolina classified as either agricultural, horticultural, or forest land are appraised at their use values under the Present-Use Value (PUV) program, (North Carolina Dept. of Revenue 2019). The North Carolina Dept. of Revenue, county tax assessors, the North Carolina Forest Service, the North Carolina Property tax commission, and the North Carolina Use-Value Advisory Board jointly administer the PUV program. Individuals and certain trusts and business entities who own at least 5, 10, or 20 acres depending on whether they are horticultural, agricultural, or forestry businesses, may qualify for the use-value assessment.

In addition, the PUV program requires that agricultural and horticultural lands must generate at least \$1000 in gross income on average annually over the three years preceding classification. A forest landowner or consultant must follow a written forest management plan that supports the "commercial production and sale of forest products" to be eligible for the PUV program. Meanwhile, agricultural and horticultural lands must meet one of six characteristics, such as compliance with a farm management plan, to be considered under sound management (North Carolina Dept. of Revenue 2019).

North Carolina's PUV program mandates a declassification penalty for the three fiscal years preceding disqualification as well as the year of disqualification with interest due immediately (Granskog et al., 2002; North Carolina Dept. of Revenue 2019). The PUV program managers may levy a fee equating to 10% of the total deferred taxes plus interest for failing to report the cause for disqualification (Hamilton et al., 2020). However, the statutes which regulate the PUV program do not directly address land-use conversion between the covered classifications (agriculture, horticulture, and forest) (North Carolina Dept. of Revenue 2019). While that means there is not a fee to convert to a different, eligible land-use, landowners are expected to satisfy each of the new land-use requirements in order to qualify.

Moreover, neither the horticulture nor the forest classifications permit grazing of livestock on lands enrolled in the NC PUV Program (Table 1) (North Carolina Dept. of Revenue 2019). The forest class also prohibits land-uses associated with agricultural crop production. Meanwhile, the PUV program defines the highest and best use of small woodlands adjacent to enrolled agricultural or horticultural lands

through their ability to reduce wind erosion, protect water quality, or buffer livestock and poultry operations. In addition, a separate classification under the PUV program, the Wildlife Conservation Program, which is appraised utilizing the use values of agricultural land, explicitly permits conservation of stream and riparian zones through open or wooded lands (North Carolina Dept. of Revenue 2019). As a result, only the agricultural and horticultural classifications allow certain agroforestry practices (Table 2).

Oregon

The Forestland Program and Small Tract Forestland (STF) Programs are available to landowners of forests classified as either highest and best use (HBU) or designated forests in Oregon (Oregon Dept. of Revenue 2014b; c, 2017). Both preferential assessment programs for forestlands are managed by the Oregon Dept. of Revenue, county assessment offices, the Oregon Dept. of Forestry, the State Board of Forestry, and the Oregon Dept. of Fish and Wildlife. Farmland within and not within an Exclusive Farm-Use (EFU) Zone may qualify for preferential assessment. Preferential assessment for qualifying farmland is managed by the Oregon Farm Credit Services, the Oregon Dept. of Revenue, and county assessors (Kilgore et al., 2017; Oregon Dept. of Revenue 2014b, c). Private landowners are eligible to participate in the agricultural assessments and the Forestland Program, whereas the STF program specifies eligible participants in more detail: private landowners including individuals, partnerships, certain corporations, estates and trusts, and contract purchasers (Oregon Dept. of Revenue 2017).

The Forestland Program is available to forest landowners with at least two contiguous acres, while only landowners holding between 10 and 5000 acres of forestland are eligible for the STF Program (Oregon Dept. of Revenue 2017). There is not a minimum or maximum size requirement if farmland is located in an EFU zone (Oregon Dept. of Revenue 2014b). However, landowners not in an EFU zone are expected to fall within the following acreage categories: less than 6.5 acres, between 6.5 and 30 acres, and greater than 30 acres. Farmland less than 6.5 acres must gross \$650 per year for any three years during the consecutive five-year period before assessment (Oregon Dept. of Revenue 2014c; Oregon Secretary of State 2021). Landowners in the middle size class, between 6.5 and 30 acres, are required to earn \$100 gross income per acre annually for any three years during the five consecutive years before assessment. Finally, the farmland in the largest size class must gross at least \$3000 per year for three of the five years preceding preferential assessment (Oregon Dept. of Revenue 2014c; OregonLaws.org 2020).

The preferential assessment programs do not require a written management plan, but forests enrolled in either the Forestland Program or the STF Program must be adequately stocked (60–200 TPA depending on stand age and site factors) (Oregon Dept. of Revenue 2017). Meanwhile, farm woodlots up to 20 acres in size, which are a special farm use designation, are not required to meet minimum stocking standards. Interestingly, after 10 consecutive years of special farm use assessment, landowners in Western Oregon with no more than 2000 acres may request to change land designated as a farm use to forestland if its trees are less than 40 years of age (Oregon Dept. of Revenue 2017). There is no fee to switch from the different special assessments in the state for agricultural and forestlands reviewed in this study; however, the deferred taxes accrued while enrolled in the original special assessment will rollover to the new special assessment classification (Oregon Dept. of Revenue 2014a).

Each of the assessment programs reduce the tax liability of properties through use-valuation. The Forestland Program taxes land at 100% assessed forestland value, while the STF Program taxes enrolled lands at 20% of their assessed forestland values (Oregon Dept. of Revenue 2017). Deferred taxes accrued during each of the preferential assessments are due from the past five to 10 years depending on the classification, location of the property, and cause for disqualification (Oregon Dept. of

Revenue 2014b; c, 2017).

Qualifying lands not located in an EFU zone may include short-rotation hardwoods grown for bioenergy and Christmas tree production (Oregon Dept. of Revenue 2014c). Riparian lands are unique in that they fall under a separate special assessment which exempt them from property taxes (Oregon Dept. of Revenue 2014a). While the researchers did not find evidence of explicit agroforestry language, the special assessments for forestland in the state directly permit grazing (Table 1), so long as it does not deter forest production (Oregon Dept. of Revenue 2017). Lands under either agricultural assessment may practice four of the five agroforestry practices (silvopasture, windbreaks, alley cropping, and forest farming) due to the inclusion of woodlots less than 20 acres, while only silvopasture is permitted under the special assessment for forestland (Table 2).

Wisconsin

The Managed Forest Law (MFL) in Wisconsin is a PPTP that levies a flat tax on participating forestlands, the rate of which depends on if the land is open or closed to the public (Kilgore et al., 2017; Wisconsin Dept. of Natural Resources 2021b). The MFL program is collectively managed by county tax offices, the Wisconsin Division of Forestry, and the Wisconsin Dept. of Revenue. On the other hand, agricultural, horticultural, agricultural forest lands may qualify for preferential treatment through the Use-Value Assessment led by the Wisconsin Dept. of Revenue and the Wisconsin Farmland Advisory Council (Wisconsin Dept. of Revenue 2021).

Agricultural forests are assessed on 50% of the land's fair market value and defined as land capable of producing commercial forest products and, generally, are contiguous to parcels classified as agriculture (Wisconsin Dept. of Revenue 2021). The MFL program is available to all private forestland owners with a minimum of 20 contiguous acres, each capable of growing at least 20 cubic feet of wood per year and consisting of a least 400 planted TPA (800 TPA in natural stands) (Wisconsin Dept. of Natural Resources, 2018a, Wisconsin Dept. of Natural Resources, 2021b). The program allows up to 20% of each forest parcel to be deemed unsuitable to grow timber or to be in an unmanaged vegetation, while the remaining 80% must be in productive forest (Wisconsin Dept. of Natural Resources 2017; National Timber Tax 2020b).

Eligible forest landowners in Wisconsin agree to a 25 or 50-year sustainable forest management plan in exchange for preferential assessment (Wisconsin Dept. of Natural Resources, 2017, Wisconsin Dept. of Natural Resources, 2021a). However, if a landowner fails to follow the mandatory requirements of the MFL program, a non-compliance fee of \$250 is charged by the local municipality. Inability to follow the approved management plan may lead to withdrawal of MFL designation and an assessment of withdrawal taxes and fees (Wisconsin Dept. of Natural Resources 2017). Generally, fees are the higher of two options: (1) the previous year's assessed land value multiplied by the net tax rate and years of classification, with a maximum of 10 years; or (2) penalizing withdrawn properties by 5% of their stumpage values (Kilgore et al., 2017). Meanwhile, the use-value assessment for agricultural land, including agricultural forests, mandate a conversion fee when enrolled lands are converted to a non-agricultural use plus deferred taxes with interest; nonetheless, the charge is not levied against agricultural landowners who convert their lands to agricultural or productive forestland (Wisconsin Dept. of Revenue 2021).

Lands associated with agricultural crop or livestock production do not qualify under the MFL program (Table 1). However, the program requires landowners follow best management practices such as protection of riparian management zones to mitigate impacts of timber harvest as a part of the program's management requirement (Cutter et al., 1999; Wisconsin Dept. of Natural Resources 2018b). Therefore, we inferred that riparian forest buffers are an emphasized land use of MFL properties

(Table 1). In addition, the MFL program conditionally permits forest farming such as the production of maple syrup, while agricultural assessment explicitly highlights production of non-timber forest products such as ginseng (Wisconsin Dept. of Revenue 2021). The agricultural use-assessment, on the other hand, allows silvopastures, windbreaks, alley cropping, and forest farming (Table 2).

Discussion

Forest farming and silvopasture, followed by windbreak and alley cropping configurations, are the most common agroforestry practices allowed under preferential classifications for the five states investigated in this study. Riparian forest buffers are the least common agroforestry practice under preferential classifications for agriculture and forestry. Preferential assessment for forests and agriculture in Nebraska permit riparian forest buffers to be included, while Wisconsin allows inclusion of riparian buffers in their MFL program. Nevertheless, North Carolina and Oregon each have separate programs for special treatment of riparian lands. Furthermore, New York is the only state that does not address riparian forest buffers. However, we inferred that the land-use may be conditionally accepted under the forestland PPTP due to the inclusion of streams and wildlife habitat, so long as the land can produce the minimum merchantable wood supply. We identified at most four agroforestry practices available for preferential treatment under the agricultural classification alone in the study states, with the exception of Nebraska. We explore opportunities for agroforestry land-uses in the next sub-section.

Opportunities for preferential assessment of agroforestry

Based on the five states investigated in this study, the greatest potential for preferential treatment of agroforestry exists with agricultural property tax programs. This is due to the frequent inclusion of adjacent woodlots and forests less than a maximum acreage and whose best use is not timber production as eligible land-uses under the agricultural classifications. Further, none of the PPTP for agricultural lands assessed in the study prohibit landowners with larger acreage forest tracts from enrolling in PPTP for forestland, if the land meets the other program's requirements. While not a criterion reviewed in this study, it is worth noting that the programs did vary in their compatibility with federal incentive programs such as those administered through the Farm Bills, which would be an interesting attribute to explore in future research.

In addition, agricultural programs in each of the five states allow an integrated agriculture-forest interface. Nevertheless, each program varies in the specific land-uses allowed, particularly for agricultural crop and livestock production. New York's agricultural assessment emphasizes an integrated agriculture-forest interface to specifically target landowners interested in silvopasture and forest farming. The Forestland Program and STF Program in Oregon, similar to New York, directly allow grazing of livestock on enrolled forestlands but not production of agricultural crops.

Additionally, programs without acreage size requirements may welcome small-scale agroforestry practices for those landowners considering adoption but who do not want to convert all their land. Nebraska is the only state in the sample that does not require a minimum, or maximum acreage for preferential assessment for agricultural, horticultural, or forest lands. Conversely, Oregon allows farmland of any acreage to potentially participate in use-value treatment but restricts access to preferential assessment to forestlands greater than two contiguous acres. Therefore, Nebraska and Oregon, along with North Carolina, New York, and Wisconsin, present opportunities for agroforestry practices such as windbreaks and alley cropping on smaller landholdings to qualify for preferential assessment.

Likewise, programs without strict, annual income constraints may support adoption of agroforestry practices in the study area that do not produce merchantable material for annual income. Nebraska and

Wisconsin do not require a minimum income from agricultural or forest product sales. The assessments for agricultural lands in New York and North Carolina allow landowners to qualify using annual average income over multiple years, while Oregon mandates potential lands not in an EFU zone meet minimum income requirements for three of the five years preceding assessment. None of the preferential assessments for forestlands in the sample institute a minimum income requirement.

Riparian forest buffers may be particularly well-suited for lands under forest classifications, as they help mitigate timber harvest practices. Interestingly, certain riparian lands up to 100 feet from a waterway are exempt from property taxes in Oregon (Oregon Dept. of Revenue 2017; Oregon Dept. of Fish and Wildlife 2021). Meanwhile, riparian zones may qualify under the wildlife conservation classification of North Carolina's Present Use Value Program (North Carolina Dept. of Revenue 2019). In the case of Wisconsin, Cutter et al. (1999) characterized the state's MFL Program as an indirect legislation, which promotes riparian buffers on a maximum of 20% of qualified lands, since these lands may be in swamp, standing water, and/or bog.

Challenges to preferential assessment of agroforestry

Preferential tax assessments for forestlands in the states investigated are less compatible with agroforestry practices than agricultural assessments. Crop production, grazing of livestock, and land classified as fallow or wasteland primarily limit agroforestry from enrolling in preferential assessments for forests, as these were the characteristics with the highest frequency of unacceptable practices. None of the preferential assessments for forestlands in the five states allow the production of agricultural products on enrolled lands. As a result, alley cropping configurations, and potentially forest farming depending on the treatment of non-timber forest products, are ineligible for preferential treatment in these regions. Furthermore, four of the five states prohibit grazing of livestock on forestland enrolled in preferential assessment programs, restricting access to preferential tax assessment to producers using silvopasture.

Nevertheless, not all agroforestry practices were so clearly prohibited on lands enrolled in PPTP for agricultural or forest lands. For instance, programs in each study state, except for Oregon, only explicitly address at most two agroforestry practices as eligible land-uses. Consequently, the authors of this study had to infer if agroforestry practices were eligible for preferential tax treatment based on the acceptable and unacceptable land-use characteristics described in the tax guides and manuals and other supplementary publications. This could prove to be extremely difficult for landowners as well as professionals not familiar with both agroforestry practices and PPTP, which may deter adoption of agroforestry practices and/or participation in vital tax saving programs.

In addition, size requirements for qualification in preferential assessment may restrict adoption of agroforestry practices, particularly if an integrated agriculture-forest interface is not allowed. As an example, agroforestry practices that qualify for North Carolina's PUV Program would be classified as a single land-use – agriculture, horticulture, or forestry – and would be held accountable for the classification's acreage criteria. Agricultural land enrolled in North Carolina's PUV program, as well as Wisconsin's Use-Value Assessment, may include up to 20 acres of woodlands. Nonetheless, woodlands and forests greater than 20 acres that are capable of timber production must be classified as a forest and meet all associated requirements (North Carolina Dept. of Revenue 2019; Wisconsin Dept. of Revenue 2021). Strict acreage requirements tied to single land-use classifications challenge preferential treatment of agroforestry practices, particularly to the landowners using agroforestry systems that are small in acreage (e.g., windbreaks and riparian forest buffers) but protect and/or treat large acreages of adjacent land.

Similarly, productivity criteria, including timber volume and annual income, may restrict preferential assessment of agroforestry practices in the study area. Forests in New York and Oregon must meet a minimum

number of trees per acre or be able to produce a merchantable forest crop within 30 years, as is the case with the New York Forestland Program. On the other hand, Nebraska classifies forestland as land with trees and a thick underbrush such that livestock are not able to graze. Fully stocked forests typically include a closed canopy, which restricts eligible agroforestry practices to forest farming and riparian buffers. For example, riparian management zones in New York that produce approximately 7 million-board-feet of sawtimber per acre would qualify for preferential assessment if at least 50 acres in size (Jayasuriya et al., 2018). However, agroforestry practices that benefit from a partially open canopy, such as silvopasture in North Carolina with 15–20% forest cover, may not be able to meet the stocking required to receive preferential assessment (Chizmar et al., 2019).

Finally, the findings from our analysis of programs in the five states suggest that converting from an agricultural use to a forest-based use may involve less conversion fees than switching from forestry to agriculture or horticulture, which would have implications for agroforestry practices depending on how PPTP characterize the land-uses; however, this varies by program. For example, agricultural assessments in Nebraska, North Carolina, Oregon, and Wisconsin do not charge a fee to convert lands to specially assessed forestland. The PPTP in Nebraska and North Carolina also do not levy a fee for switching from a forest-based land-use to either an agricultural or horticultural land-uses, but in the case of North Carolina, landowners must meet the required elements of the new classification including acreage and income to qualify. Meanwhile, Wisconsin's PPTP for forestland mandates a fee for failure to follow the program's mandatory requirements. Since the MFL program prohibits agricultural land-uses including livestock production, we inferred the fee would apply to landowners transitioning their forests to land-uses which incorporate agriculture and horticulture.

Conclusion

Agroforestry practices in the U.S. – silvopasture, alley cropping, windbreaks, riparian buffers, and forest farming – integrate elements of forestry and agriculture. We identified 10 programs from multiple states across the United States (Nebraska, New York, North Carolina, Oregon, and Wisconsin), which offer PPTPs related to agroforestry. Based on the sampled states, we found the integrated land-uses innate in agroforestry may preclude them from consideration in certain preferential tax assessments, and thus, crucial tax savings. Our findings suggest that agricultural assessments in the selected states are generally more accepting of small-scale agroforestry practices than the preferential tax assessments of forestlands, due to the inclusion of small woodlots and forests contiguous to agricultural lands. Forest farming and silvopasture, followed by alley cropping, windbreaks, and riparian forest buffers, are the most common agroforestry practices potentially eligible for PPTPs in the study area.

Minimum acreage, income, and productivity requirements, particularly for programs that prohibit an integrated agriculture-forest interface are the principal factors limiting agroforests from preferential tax treatment under the existing forestry programs. Stocking requirements for forestlands enrolled in PPTPs largely restrict access to agroforestry practices such as silvopasture, alley cropping, and windbreaks. Preferential tax assessments for forestlands in Nebraska, New York, Oregon, and Wisconsin allow at most one to three agroforestry practices. Nevertheless, updates to preferential assessment programs to include agroforestry may capitalize on established frameworks and networks to establish eligibility criteria and disseminate information to landowners.

Sharing the results of these case studies, both the opportunities for and challenges to agroforestry practitioners participating in PPTP, may be educational for landowners, natural resource professionals, and the tax assessment community. Findings from this study may aid landowners in designing agroforestry systems that qualify for their state's PPTP for agriculture and forestry. In addition, conclusions from the state programs investigated may provide case studies for tax assessors and

others to model qualifying agroforestry practices. For instance, tax assessors in the states investigated, as well as the remaining states, may utilize the scenarios analyzed in this study to illustrate which agroforestry practices qualify for PPTP in their state.

Further research should expand the scope of this study to assess the compatibility of agroforestry practices with preferential assessment of rural working lands such as agriculture and forests in the remaining 45 states. This study highlights some of the diversity of agroforestry practices and PPTPs across the U.S. However, state-specific analyses of these land-uses and programs in the remaining states is essential to better understand trends and patterns in agroforestry practices and PPTPs for agriculture and forestry. Policy makers can then pinpoint distinct characteristics of various communities and design policies tailored to the unique needs of landowners across the nation. Additionally, future research should explore the preference of landowners between forest and agricultural tax programs in terms of their perceived program effectiveness and efficiency for undertaking agroforestry practices.

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Declaration of Competing Interest

The authors declare no conflict of interest related to this paper.

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Supplementary materials

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