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Richmond, Virginia; April 21<sup>st</sup> 2015

NATURE, VIRGINIA'S ECONOMY, AND THE CLIMATE THREAT

## Abstract

Biodiversity loss is a particularly concerning effect of climate change because as greenhouse gas emissions increase global temperatures, decreases in the abundance and diversity of species has reduced ecosystem resiliency to these changes (Verchot et al. 2007). Weakened ecosystems and threatened species decrease the environment's capacity to provide humans with services like safe drinking water, fuel, and protection from natural disasters, just to name a few (US EPA 2013). The agricultural industry plays a unique role in this environmental conversation, as farmland both contributes to climate change and is jeopardized by the negative effects created by the issue in a complex reciprocal cycle. This close relationship, along with the presence of 8.3 million acres of farmland in Virginia, suggests that agriculture should be incorporated into the state's climate change adaptation and mitigation strategies (VDACS 2015b). Agroforestry, the strategic integration of trees in agriculture to create a sustainable land-use system, has been utilized for environmental benefits in the past (Bentrup 2014, USDA NAC 2012). This paper proposes the creation of a program that requires the use of agroforestry on large farms in order to preserve biodiversity in the wake of climate change. An alternative solution is a certification program for farmers who use agroforestry practices to enhance wildlife habitat. Economic incentives and implementation assistance will encourage participation, while funding for the establishment of this program, creation of publications, and organization of events will be sourced from governmental and private organization grants.

## Farms and the Environment

Agriculture serves a unique role in the environmental discussion because of its contributions to climate change and biodiversity loss, but also the negative effects the industry is facing because of the issue. On the one hand, tension exists between the need for profitable operations that provide global food security and efforts to reduce environmental impacts of intensive food production (Robertson and Swinton 2005).

- Agriculture sector accounts for 13.7% of global GHG emissions (Schieffer and Dillon 2015)
- Farm runoff (fertilizers, livestock waste, sediment) decreases aquatic habitat suitability (Matson et al. 1997, Rodriguez et al. 2004)
- Monocultures decrease diversity of plants and associated species (Matson et al. 1997, USDA NAC 2012)
- Agriculture fragments landscapes, disconnecting habitat patches for wildlife (Bentrup 2014, Figure 1)

On the other hand, agriculture depends entirely on environmental factors like water availability, growing season conditions, and interactions among species, so climate change and biodiversity loss threaten perpetuation of the industry.

- Warming temperatures cause geographic range shifts of beneficial pollinators, soil microbes, and invertebrates (Matson et al. 1997, Verchot et al. 2007)
- Range shifts also introduce novel pests and invasive species to farms (Verchot et al. 2007)
- Increased need for pesticides, herbicides, fungicides, etc. (Nair and Garrity 2012)
- Socioeconomic effects: crop damage, decrease in food output, loss of profits for farmers (Matson et al. 1997)

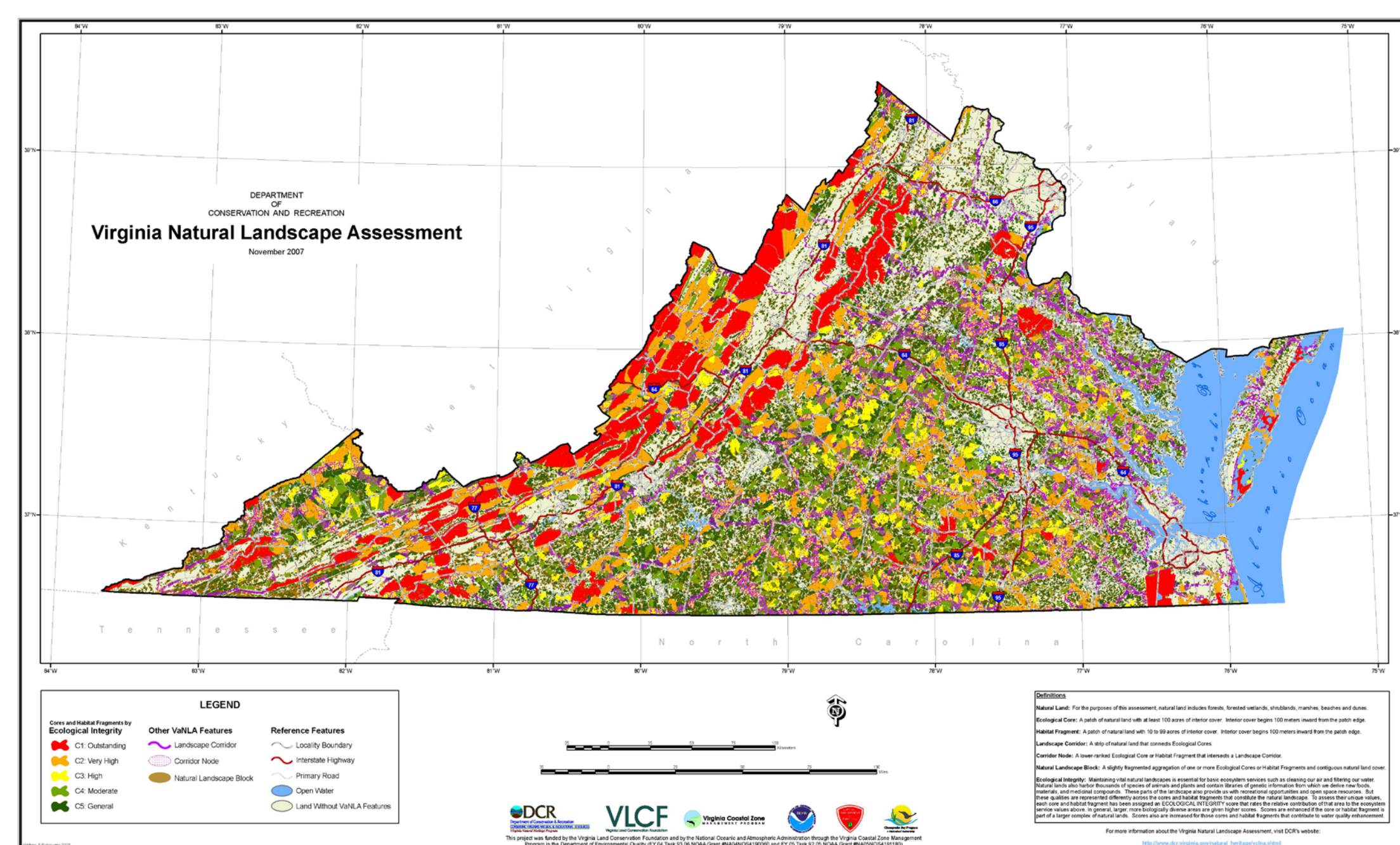


Figure 1. Virginia's ecological landscapes (Virginia DCR 2007).



1. Alley cropping



2. Forest farming



3. Riparian buffers



4. Silvopasture



5. Windbreaks

Figure 2. The five types of agroforestry practices, as outlined in the USDA's Agroforestry Strategic Framework (2011).

## Virginia's Agroforestry Program

In order to mitigate for climate change and biodiversity loss, Virginia should implement a program that requires farms larger than fifty acres to implement at least one of the five agroforestry practices (Figure 2):

1. Alley cropping that integrates annual crops with high-value trees and shrubs
2. Forest farming where food, herbal, and decorative products are grown under the protection of a managed forest canopy.
3. Riparian forest buffers along waterways
4. Silvopasture systems with trees, livestock, and forages growing together
5. Field, farmstead, and livestock windbreaks

### Implementation Assistance

A type of User's Guide (the Guide), modeled after the Training Manual put together by The Center for Agroforestry at the University of Missouri, will be published and distributed to all owners of farmland in Virginia (University of Missouri Center for Agroforestry 2013). This document will include a template that allows farmers to determine which of the five practices are best to implement on a farm based on its characteristics, and descriptions of what qualifies as each agroforestry practice, as derived from NRCS National Conservation Practice Standards (NRCS 2011). Workshops will be offered to farmers that will provide demonstrations of how to feasibly execute agroforestry projects. These workshops will be open to all farmers, but owners and operators of farms larger than fifty acres will be required to attend at least one workshop every other year. Topics will include the use of a specific crop or tree species in a landscape, and exercises regarding general implementation of agroforestry.

### Incentives

Landowners who employ agroforestry tools will secure benefits of diversified income and profits. Both short-term value in specialty crops and long-term value in lumber production exist, while the strategic use of trees reduces the need to purchase fertilizers and pesticides (Missouri Center for Agroforestry 2013). Farmers who implement these practices will be eligible for federal tax incentives already in place through the Internal Revenue Code (IRC) in areas of cost-share payment exclusions, conservation deductions, qualifying business property deductions, and reforestation deductions (Godsey 2007). In addition to these existing tax advantages, landowners who exceed the minimum of one agroforestry practice, farms smaller than fifty acres that voluntarily participate in the regulatory recommendation, and farms that use agroforestry to connect their land to existing conservation easements or preserved land in the area will receive an additional state property tax break.

### Funding

- Agriculture and Forestry Industries Development Fund (AFID)
- USDA Agriculture and Food Research Initiative: Agriculture and Natural Resources Science for Climate Variability and Change Challenge Area
- National Fish and Wildlife Federation (NFWF) Conservation partners Program

### Support

- Riparian buffers do not require pesticides, allowing for avian predators to inhabit land while maintaining profitable crop production (Puckett et al. 2009)
- As adjacent forest area increases, so does native herb species richness, abundance, and diversity (Roy and de Blois 2008)
- Trees decrease the distance between hospitable habitat patches, allowing species to move freely throughout an area (Bentrup 2014)
- Alley cropping reduces the survival of pests that reduce crop yield (Stamps et al. 2008)
- University of Missouri Center for Agroforestry has a well structured and effective agroforestry program in place
- USDA Agroforestry Demonstration Sites in Virginia provide prime examples of what this farming system would look like

## A Voluntary Alternative

Firm regulations tend to face opposition and obstacles in the policymaking process. As an alternative to this agroforestry requirement, a certification program could be established in Virginia that awards farms a type of biodiversity conservation designation based on the extent to which they use agroforestry on their land. In order to cater to the smaller statewide scale and unique needs of each individual farmer, this program would be modeled after initiatives such as the grassroots Certified Naturally Grown program or South Carolina's Certified SC Grown program (CNG 2015, South Carolina Department of Agriculture 2015). This program would be more incentive-based in the sense that farmers would not only gain direct environmental and economic benefits from agroforestry practices, but they could use green marketing to increase profitability and public relations with consumers and citizens. Federal and state tax incentives would still be available as in the regulatory option, and farmers participating in the certification program would be required to attend at least one workshop every other year.



Figure 3. Certified SC Grown (South Carolina Department of Agriculture 2015).

## Acknowledgements

Thank you to the following individuals, whose advice and guidance helped shape this recommendation.  
Gary Bentrup, Research Landscape Planner at the USDA National Agroforestry Center  
Katie Frazier, President of the Virginia Agribusiness Council  
Chris Burkett, Wildlife Action Plan Coordinator of the Virginia Department of Game and Inland Fisheries

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