

OVERVIEW OF

Incorporating Wild Forests into Vermont's UVA Program



Incorporating Wild Forests into Vermont's UVA Program, a report prepared for Wild Forests Vermont (WFV) by consultants John & Lydia Roe, investigates the consequences of adding a new category of enrollment to Vermont's Use Value Appraisal (UVA) program: wild forest enrollment. Called reserve forestland by proposed legislation and Forest, Parks & Recreation materials,

WFV prefers the term wild forest, which emphasizes the ability of these forests to exist as natural communities that are largely passively managed. Their trees are left to grow, not as a "reserve" from which later wood products may be drawn, but as sylvan ambassadors left to mature into complex old forests of the kind that have essentially disappeared from Vermont's landscape.

Prepared for Wild Forests Vermont
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Currently, private landowners are unable to enroll their land in forestry UVA unless they are managing their land to produce timber (with the caveat that, on a parcel-by-parcel basis, the presence of Ecologically Significant Treatment Areas (ESTAs) can exempt some portion of enrolled land from timber-focused management). While wood products are invaluable to society and Vermont's economy, harvesting those products was never the sole goal of UVA, which became law in 1977 and originally required only 50% of enrolled land to demonstrate adherence to accepted management practices for "growing and harvesting repeated forest crops." Given that when the program was initially conceived only half of enrolled land had to actively be managed for timber harvest, incorporating wild forests into UVA could be interpreted as a return to the roots of the program—a wild idea only in the ecological sense of the word.

Such a change would better align UVA with its stated goals: of preserving productive forestland, yes, but also of "encourag[ing] and assist[ing] in the preservation and enhancement of Vermont's scenic natural resources" and "enabl[ing] the citizens of Vermont to plan its orderly growth in the face of increasing development pressures in the interests of the public health, safety, and welfare." Not only do Vermont's forests continue to face development pressure—beginning, in the last two decades or so, to lose acreage for the first time in about a century,^{1,2}—they are subject to increasing climate change-induced stress. UVA has, on the whole, been very successful at achieving its stated goals, but it is time for an update. As currently implemented, the program limits rather than encourages forests to reach their maximum health and provide maximum public benefit. It also limits the ways in which Vermont landowners can fulfill their civic responsibility, referenced in the law, to act in the interest of the public at large.

The creation of more wild forests than currently exist in Vermont is in everyone's best interest because these forests play essential ecological roles that complement managed forests on a landscape



Many Vermont landowners love their forests and wish to let their trees grow into maturity like this tremendous sugar maple. Right: Decaying wood demonstrating its ability to support an abundance of plant and fungi life.

scale, especially once they reach old forest stage. Old forests provide maximum habitat for a wide range of species, and very high percentages of Vermont's beloved wildlife are in some way linked to an abundance of large decaying woody material on the forest floor, which creates healthy soil conditions that support the mycorrhizal fungi we now know trees depend upon for their health. Old forests also create unique habitats to support species that would be rare in a highly managed forest, creating source populations of these species that disperse into managed forest and fulfill their ecological functions across the landscape. Most importantly during a time of rapid climate change, old forests store large amounts of moisture and enhance resistance to stand destroying fire, greatly enhance moderation of storm run-off and erosion, moderate some of the temperature extremes climate change will create, and absorb massive quantities of carbon. After years of scientific debate, it has now been established that old forests sequester not only more total carbon than young ones, but do so at a faster rate.^{3,4}

Scope of Study

Incorporating Wild Forests into Vermont's UVA Program modeled the ecological and financial outcomes if three possible thresholds of eligibility were to be implemented for wild forest enrollment in UVA. These three thresholds were:

The ALL Scenario

This universe of parcels includes essentially all parcels that are eligible for productive forestland enrollment in UVA (whether currently enrolled or not). Eligibility would not be determined ecologically under this scenario; it would be solely based on the landowner's interest in wild forest. ALL is the most expansive scenario in terms of eligible acreage, making wild forest possible in every part of Vermont's landscape.

The VCD Scenario

This universe of parcels uses Vermont Conservation Design (VCD), a planning document released by Vermont Fish & Wildlife in 2018, to determine which parcels of those eligible for productive forestry UVA

should also be eligible for a wild forest category. Parcels that were at least 75% overlaid by VCD's highest priority core forest blocks—Interior Forest, Connectivity, and Physical Landscape blocks—or had at least 50 acres within these blocks were considered eligible for wild forest UVA in this scenario. The VCD scenario is less expansive than ALL, but more expansive than the ESTA scenario, below.

The ESTA Scenario

This universe of parcels was defined by the Forest, Parks & Recreation's work in their own report entitled *Considerations for a Reserve Forestland Subcategory in Vermont's Use Value Appraisal Program*, from October 2021. In this scenario, parcels that have greater than 30% of their total area covered by ESTAs or by steep slopes of greater than 35% grade would be eligible to enroll all of the parcel's forested area as wild forest. In this scenario, eligibility is driven by small-scale biodiversity filters, and was designed by Forest, Parks & Recreation to minimize the amount of productive timberland that would be lost to wild forest management. This is the most restrictive of the scenarios. Basic attributes of each scenario are explored in Table 1, Figure 1, and Figure 2.

Table 1 Summary statistics of the three scenario universes.

Scenario	ALL					VCD (>75% or 50 acres)					ESTA				
	Parcels	Parcel Acres (millions)	Parcel Size (acres)	Forested Acres (millions)	Forested Acres in VCD (millions)	Parcels	Parcel Acres (millions)	Parcel Size (acres)	Forested Acres (millions)	Forested Acres in VCD (millions)	Parcels	Parcel Acres (millions)	Parcel Size (acres)	Forested Acres (millions)	Forested Acres in VCD (millions)
Total land acres enrolled or eligible to be enrolled in UVA	26,761	3.149	Avg: 118 Med: 70	2.358	1.728	15,497	2.188	Avg: 141 Med: 80	1.728	1.728	7,184	.928	Avg: 129 Med: 70	.731	.595
UVA Enrolled	15,645	2.248	Avg: 144 Med: 84	1.680	1.277	9,155	1.615	Avg: 176 Med: 99	1.277	1.277	4,212	.675	Avg: 160 Med: 84	.535	.450
Not UVA Enrolled	11,116	.901	Avg: 81 Med: 55	.678	.451	6,342	.573	Avg: 90 Med: 59	.451	.451	2,972	.252	Avg: 85 Med: 56	.196	.145

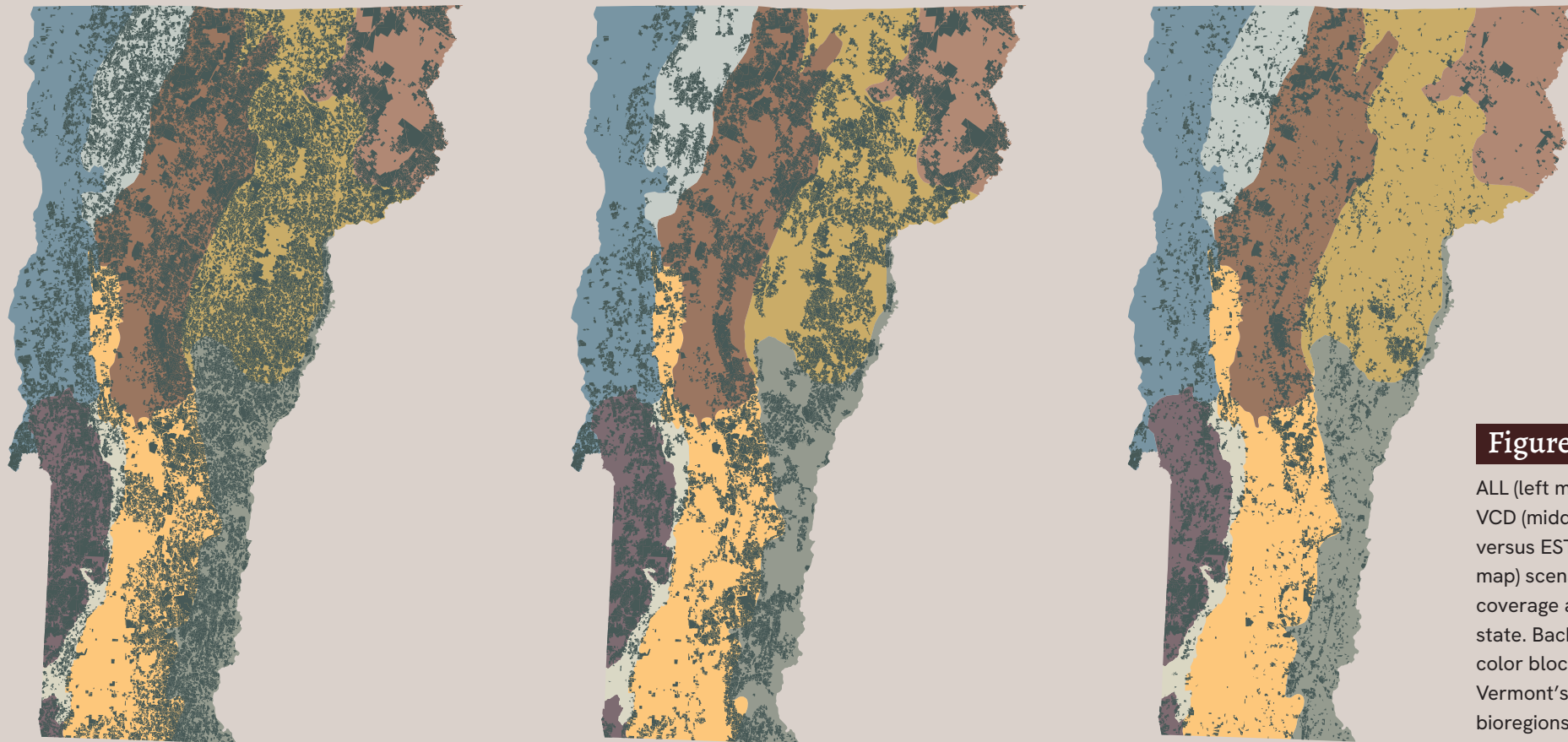
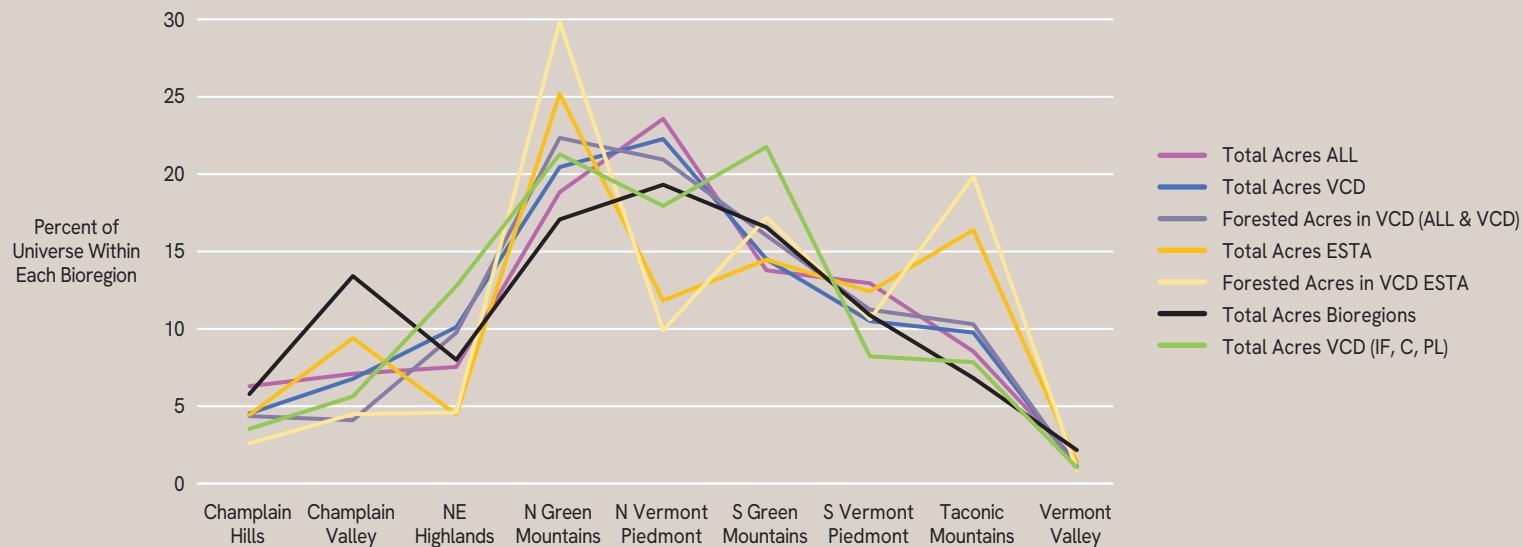


Figure 1

ALL (left map) versus VCD (middle map) versus ESTA (right map) scenario parcel coverage across the state. Background color blocks indicate Vermont's nine bioregions.

Figure 2

Bioregional distribution comparisons, where the acres of interest in each bioregion are displayed as a percentage of the total acres of interest across the state. Note that the ESTA scenario uniquely overrepresents the Taconic Mountains and the Northern Green Mountains, and underrepresents the Northern Vermont Piedmont. All scenarios underrepresent the Southern Green Mountains and the Northeastern Highlands, ESTA more severely than the others in the latter.



These parcels were assembled using publicly available data sets plus Forest, Parks & Recreation’s data on forest and ESTA coverage, which Keith Thompson graciously shared with us. Each scenario was analyzed, as a whole and sampled universe, for financial burden and ecological benefit. Sampling was done using QGIS’s random sample research tool, at 5, 10, 15, and 20% intensities, with five runs for each intensity. These percentages represent an estimated reasonable range of eligible landowners that would choose to enroll their land as wild forest, unweighted by any variable.

Results of Study

Three key questions were answered by this study.

1. How much progress could each scenario make towards meeting Vermont Conservation Design’s old forest goals?
2. How much carbon could each scenario sequester?
3. How much could each scenario reasonably be expected to cost the state?

Question One: how much progress could each scenario make towards meeting Vermont Conservation Design’s old forest goals?

Vermont Conservation Design outlines old forest acreage goals for each biophysical region in the state. One interesting way to measure how ecologically beneficial a wild forest category in UVA would be was to quantify how much each scenario could contribute to meeting those goals. To do this, we subtracted land already designated as GAP 1 (or wild land, managed for biodiversity, as defined by the U.S. Geologic Survey standards) and within VCD from each biophysical region’s VCD goal acreage, leaving us with the number of acres still needing to be set aside as future old forest in each biophysical region. We then

compared those needed acres to each scenario’s eligible forested acres within VCD, to see what percentage of the latter would need to enroll as wild forest in order to reach old forest goals of Vermont Conservation Design. Table 2 shows the results.

Because the ALL and VCD scenarios have the same total amount of land in VCD, they could fulfill old forest targets equally well, and ALL would also add forests outside of VCD as well. Based on these theoretical calculations, an average of 17.2% of all landowners would need to enroll as wild forest in the ALL and VCD scenarios to add enough forest to meet VCD’s old forest goals. The ESTA scenario can’t add enough forest to achieve those goals in the Northeastern Highlands and the Northern Vermont Piedmont, and outside of those regions would have to enroll an average of 46.1% of its eligible acreage to do so. Another way of looking at this data using random sampling results is presented in Figure 3.

Table 2

Percent of all forested acres in VCD in each scenario universe that need to enroll in order to meet VCD old forest goals.

Bioregion	ALL & VCD Scenarios, % of Forested VCD Acres Needing to Enroll to Meet VCD Old Forest Targets	ESTA Scenario, % of Forested VCD Acres Needing to Enroll to Meet VCD Old Forest Targets
Champlain Hills	17.3%	85.8%
Champlain Valley	12.7%	34.3%
Northeastern Highlands	26.3%	166.8%
Northern Green Mountains	12.6%	28.0%
Northern Vermont Piedmont	21.4%	133.7%
Southern Green Mountains	12.2%	33.6%
Southern Vermont Piedmont	15.1%	47.1%
Taconic Mountains	13.9%	21.3%
Vermont Valley	23.0%	72.9%
Average	17.2%	69.3% (or 46.1% if >100% removed from average)

Question Two: how much carbon could each scenario sequester?

Carbon sequestered was measured by running parcels in each sampling run through The Nature Conservancy's Resilient Land Mapping Tool, which can estimate the carbon stock of any land in the U.S., and its increase by 2050 (from 2010) if that land were to be left alone to grow. Figure 4 outlines the results of this analysis, which showed that the ALL scenario will sequester an average of 1.36 times more additional carbon by 2050 than the VCD scenario, while the VCD scenario will sequester an average of 2.51 times more than the ESTA scenario. This is in large part a result of the total sizes of each universe, but not solely—the VCD scenario was shown to consistently sequester carbon at the fastest rate per acre. On average across all runs, it sequesters .217 metric tons of carbon annually, 6.9% more than ESTA and 4.8% more than ALL.

At the smallest scope of UVA wild forest eligibility and enrollment

(ESTA scenario at 5% enrollment), about 361,000 additional metric tons of carbon would be sequestered in 40 years. At the largest scope (ALL scenario at 20% enrollment), that number would be 5,223,000 additional metric tons, an almost 15-fold increase.

Question Three: how much could each scenario reasonably be expected to cost the state? Deb Brighton (former director of the UVA program and recent chair of the Vermont Tax Structure Commission) found the potential cost for each parcel that is currently unenrolled in UVA if it were to enroll as wild forest. Figure 5 shows average costs associated with each scenario's enrollment range, while Table 3 shows three other ways of considering these costs across scenarios. The total cost of all potential parcels in each scenario is shown in column one, and the total cost of meeting Vermont Conservation Design's old forest

Figure 3

Percent of currently unmet old forest goal completed by different levels of wild forest enrollment. Note that specific variations between VCD and ALL scenarios likely reflects variability due to limited numbers of runs rather than significant differences, since the two scenarios wouldn't be expected to behave differently, and do appear to be converging on the same VCD acre totals.

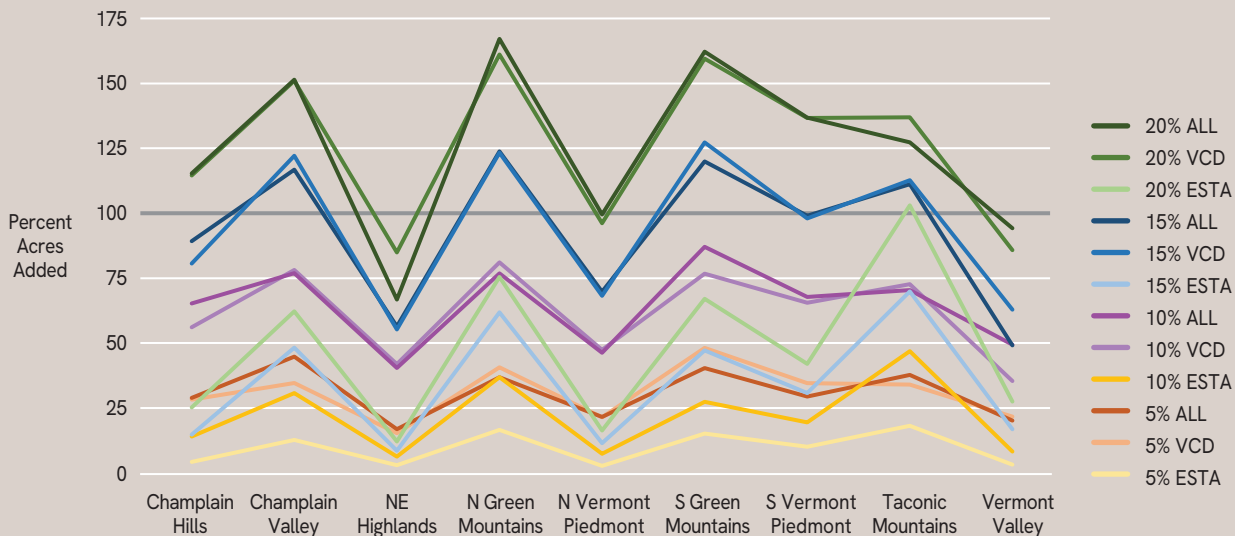
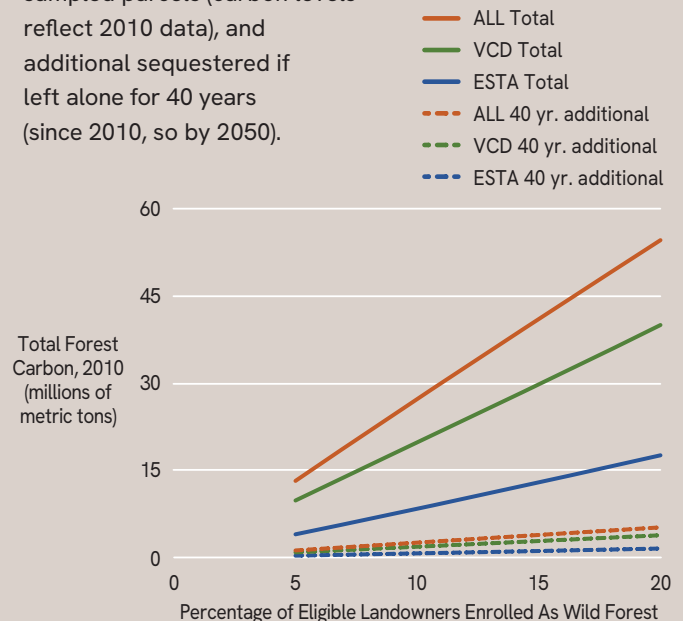


Figure 4

Carbon sequestered in current sampled parcels (carbon levels reflect 2010 data), and additional sequestered if left alone for 40 years



goals solely with new parcel enrollment is shown in column three (note that the ESTA scenario can't actually meet VCD's goals solely with new enrollments in any bioregion but the Taconic Mountains, so it essentially requires all its potential new parcels to enroll and thus the cost in column three is very close to that in column one). Column two assumes that parcels already enrolled in productive forestry UVA and potential parcels will be equally likely to enroll in a new wild forest category and shows the cost of meeting VCD goals if this is the case.

The main point is that column three shows the highest possible cost of meeting VCD's goals through wild forest enrollment, while column two shows a likely lowest possible cost of the same. While it is impossible to predict exactly what the ratio of wild forest enrollment will be among enrolled versus potential parcels, this table demonstrates that an investment of just five million dollars or so

would likely make great progress in meeting VCD's old forest goals. Five million is just a 7.6% increase in current UVA costs (66 million).

Table 3 also shows that it would cost significantly more under the ALL scenario as compared to the VCD and ESTA scenarios to meet VCD old forest goals. In general, the VCD and ESTA scenarios are essentially equally cost-efficient across a variety of ecological metrics, and are more cost-efficient than the ALL scenario. Ecological metrics quantified were: each scenario's forested acres, each scenario's VCD acres, each scenario's acres identified by The Nature Conservancy as conducive to resilience, diverse flow, and recognized biodiversity ("RFRB" acres), and each scenario's metric tons of additional carbon sequestered by 2050. The greatest discrepancy between ESTA and VCD versus ALL was in cost per RFRB acre, which was 1.7 times greater for the ALL scenario as compared to ESTA and VCD scenarios, based on sampling results.

Figure 5

Total costs of each eligibility scenario given a range of enrollment rates, with standard deviations. The standard deviation for cost is higher than any other attribute in the sampling results. These runs were random and unweighted, and thus represent enrolled and potential parcels proportionately to the whole universe.

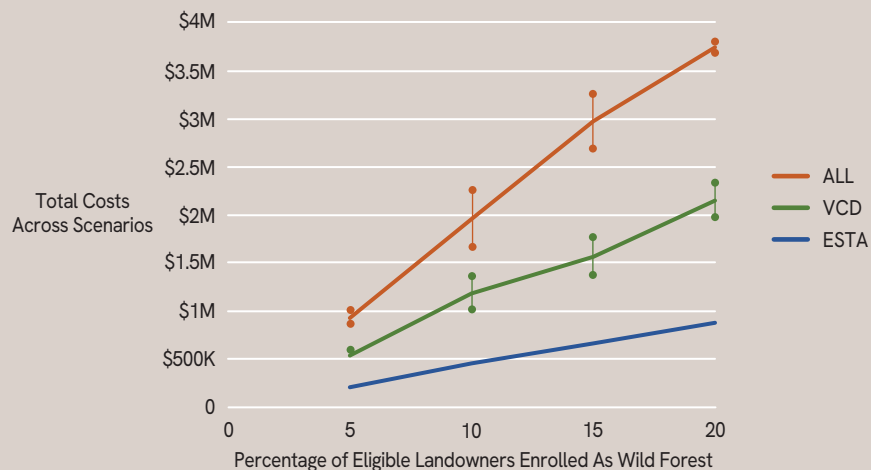


Table 3

Cost summary of scenarios rounded to the nearest hundred thousand dollars.

	Total Cost of All Potential Parcels in Each Bioregion (millions)	Cost of Meeting VCD Targets by Proportionally Equal Enrollment from UVA-Enrolled & Potential Parcels (millions)	Cost of Meeting VCD Targets by New Enrollments of Potential Parcels (millions)
ALL	\$18.9	\$3.1	\$11.1
VCD	\$10.7	\$1.7	\$6.2
ESTA	\$4.6	\$2.1	\$4.4

A fledgling hermit thrush, one of Vermont's interior forest bird species.



Summary of Results

ESTA Scenario: This scenario was designed by Forest, Parks & Recreation to limit the conversion of productive timberland while still expanding wild forest possibilities in UVA beyond what is currently accomplished by ESTAs. In that goal, it succeeds, but is then more restricted in the environmental benefit it can offer Vermont, and the tax benefits it can offer Vermont landowners. The ESTA scenario sequesters significantly less carbon than the other two, and will likely not be able to meet VCD's old forest goals in any biophysical region (with all regions requiring enrollment of greater than 20% to meet old forest goals). It also likely carries the highest administrative burden on the state and landowners of the three scenarios, as the details of proving eligibility are the most complex.

VCD Scenario: This scenario captures carbon at the highest annual rate per acre, meets old forest goals as well as the ALL scenario, and captures a similar number of ecologically most-important acres (RFRB acres) as the ALL scenario. It does this while costing about 55% of what ALL does. It does not sequester as much carbon as ALL, but sequesters roughly two and a half times as much as the ESTA scenario. Put simply, VCD is somewhat of a compromise between the two scenarios; it is preferable to ESTA in terms of numbers of acres, while it is preferable to ALL in terms of cost.

ALL Scenario: The ALL scenario places the development of wild and, eventually, old forest on equal footing with the harvesting of timber as a statewide goal. It gives landowners the most options in caring for their forest and sequesters the most carbon. On the other hand, ALL would cost the most of any scenario, and is less efficient at capturing RFRB acres than either VCD or ESTA. ALL also introduces the most potential for the random scatter of wild forests across the landscape,

which has ecological drawbacks. These parcels will be more subject to invasive species exposure, and might pull interior forest species closer to edge habitat and the predators that accompany it.

Wild Forests Vermont's Policy Preference

After reading the results of this study, Wild Forests Vermont (WV) has concluded that the ALL scenario best encompasses its preferred policy changes to UVA. The ALL scenario places the importance of wild forests as equal to the importance of harvested forests, a value which WV is strongly in favor of. It is also the fairest option to landowners; WV feels all landowners who are currently eligible for forest current use tax reductions should be allowed to choose to manage their forest under the wild forest land use category if that is their choice, regardless of geographic location or other criteria. This is a matter of equity and private property rights, in addition to being a positive choice for the land if willing landowners want to go that route.

WV supports having more private forestland voluntarily enrolled as wild forest under UVA than just those forests found within the VCD highest priority blocks. These wild forests will provide additional resiliency across Vermont's landscape in the face of stronger storms caused by a rapidly changing and increasingly violent climate. Enhanced carbon sequestration and storage, peak storm flow attenuation, water quality protection, and wildlife species richness and abundance are key ecological services of wild, self-willed forests no matter where they are located. Along with these benefits, wild forests can serve as a scientific reference point against which other managed lands can be compared. As Aldo Leopold wrote in his essay "Wilderness," "A science of land health needs, first of all, a base datum of normality, a picture of how healthy land maintains itself as an organism."⁵

Wild forests are also places of solitude and spiritual renewal for people, sorely needed in our stressful society and world. Intrinsically beautiful and valuable in their own right, their conservation and protection benefits all Vermonters.

In addition to supporting the ALL scenario above, WFV recommends all parcels that have forever-wild conservation easements on them to be automatically eligible for this new wild forests category (or the currently existing Conservation Category that allows public non-profits to passively manage their lands.) This would reward landowners who are willing to take on the expense of making sure their wild forest will grow old in perpetuity, thus providing its many benefits to Vermont for generations to come.

References

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Left: Wild forests offer serenity in a busy world.