

Supplementary 5 – Wildland Reserves Pathway

Through protection, a Wildland Reserve designation removes the possibility that an acre of timberland could be converted to a non-forest land use or, if it remains as forest, that it could be harvested. For the purposes of evaluating the carbon implications of strictly curtailed human management or disturbance, this study assumes that Wildland Reserves are neither converted to other land uses or harvested. The Wildland Reserves pathway estimates the carbon benefit of protecting a certain percentage of New England’s forests as wildlands as the avoided loss of carbon from avoided forest conversion to other land uses or forest harvest. The study estimates the potential carbon benefits of wildlands designation at 5%, 10%, and 30% tiers, reflecting the total percentage of forestland in each New England state that receives the Wildland Reserve designation and providing a sense of what increasing wildland designations may mean for carbon storage across New England.

A certain percentage of forestland in each New England state is already protected from development and/or harvest, referred to in the FIA database as “reserved” forests, or forestland that is “...withdrawn by law(s) prohibiting the management of the land to produce wood products.” The study uses the acres of reserved forest in New England from FIA data as a proxy for existing Wildland Reserves and calculates the percentage of forestland in each state that is currently reserved/wildlands.

While the “reserved” forest category from FIA is not a perfect proxy for existing Wildland Reserves, FIA provides carbon stock and sequestration data associated with the reserved category, allowing the study to have a carbon estimate specific to the type of forest contained in the reserved category, which are more likely to be akin to established Wildland Reserves. The difference between the 5%, 10%, and 30% tier goals and the existing proportion of reserved forestland is multiplied by the current total acres of forestland in each state to derive the additional Wildland Reserve acres required in each state to meet the tier goals. The BAU level of estimated Wildland Reserves designation is subtracted from the total gap to arrive at the additional wildland acres required to meet the tier goal by 2050.

As shown in Table 1, a goal of 10% Wildland Reserves across forests in New England would represent an additional 1.76 million acres of protected land that would not be available for development or harvest. Acres designated as Wildland Reserves are removed from the timberlands category to acknowledge that they would not be available for harvest once designated as Wildland Reserves. This analytical decision potentially introduces leakage (harvesting in areas outside of New England to compensate) if remaining harvestable acres within New England are not able to meet demand for timber and other wood products, and/or to more unsustainable harvest practices on the remaining acres in order to meet demand. However, the IFM pathway, if also applied in the region, could potentially mitigate the impact to harvest of the Wildland Reserves pathway by increasing tree stocking on remaining timberlands.

Table 1: Acres Required for Wildland Reserve Tier Goals

Wildland Reserves Acres Analysis	CT	ME	MA	NH	RI	VT	New England Total or Average
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Forestland (acres)	1,763,459	17,372,795	2,966,472	4,686,704	358,617	4,508,984	31,657,031
Timberland (acres) - "not reserved"	1,737,978	16,873,315	2,848,785	4,420,004	343,736	4,273,598	30,497,416
Reserved forestland (acres)	25,481	499,480	117,687	266,700	14,881	235,386	1,159,615
% forestland reserved (current Wildland Reserves)	1.4%	2.9%	4.0%	5.7%	4.1%	5.2%	3.7%
% gap to achieve 5%	3.6%	2.1%	1.0%	0.0%	0.9%	0.0%	1.3%
Additional Wildland Reserve acres @ 5%	59,085	278,280	13,378	-	810	-	233,192
% gap to achieve 10%	8.6%	7.1%	6.0%	4.3%	5.9%	4.8%	6.3%
Additional Wildland Reserve acres @ 10%	145,984	1,121,946	155,818	150,643	17,997	171,327	1,758,063
% gap to achieve 30%	28.6%	27.1%	26.0%	24.3%	25.9%	24.8%	26.3%
Additional Wildland Reserve acres @ 30%	493,580	4,496,609	725,575	1,034,644	86,744	1,026,047	7,857,546
Source: Acres of forestland, timberland and reserved forestland extracted from FIA Evaluator database.							

To evaluate the potential impact on carbon stock and sequestration of conserving 5%, 10% or 30% of the New England landscape as Wildland Reserves, the carbon benefits that result from moving an acre of forestland from conversion or harvest to a protected status is quantified. Critical here to additionality is considering the probability that an acre of timberland (i.e., not already reserved) *would have been converted* to another land use or harvested in the counterfactual. Wildland Reserves are forestlands that are conserved as forestland with no probability of being converted - here avoided conversions to cropland, "other land" and settlements - and no probability of being harvested. Therefore, the study estimates the probability that forestland would have been converted to a non-forest land use or would have been harvested on an annual basis in each state of New England, and then estimates the carbon benefits of those avoided disturbances as follows:

Wildland Reserves **carbon benefit (30 years)** = 5%/10%/30% Wildland Reserves goal x (carbon benefit from avoided probability of conversion to cropland/other land/settlements over 30 years) + (carbon benefit from avoided probability of harvest over 30 years) + (lost future sequestration from acres that were converted over 30 years)

Probability of Conversion or Harvest

The study assumes that acres that would have been converted or harvested are independent acres (no overlap) and estimates the probability of conversion or harvest over a 30-year period.

- ***For probability of conversion***, Domke's 2021 data on forest conversion to cropland, other land, and settlements for the period 1990-2019 are used. These data are detailed in Supplementary 3 and 4. Conversion to water is not included in the analysis under the assumption that activities that lead to the conversion of forestland to water would be the same in both the Wildland Reserves and non-Wildland Reserves areas. The probability that forest was converted to non-forest overall and to each of the land conversion categories (cropland, other land, and settlements) is estimated as total acres lost to the specific land category over the 30-year period 1990-2019 divided by the total acres of timberland for each state.

- **For probability of harvest**, FIA data on the annual acres of forest harvested in each state is used to estimate the probability that forestland is harvested. These data are detailed in Supplementary 3 and 6; discounted harvest acres as estimated in Supplementary 3 and 6 are used in the Wildland Reserves analysis. Discounted harvested acres are divided by the total timberland area by state to arrive at the annual probability that timberland is harvested for each of the states.

Table 2 summarizes the probability of conversion and harvest of timberland across New England states and the estimated acres of Wildland Reserves that would have been converted or harvested over a 30-year period under the 10% tier based on these probabilities. Note that the study uses the medium forest estimate, which accounts only for losses to settlements.

Table 2: Probability of Conversion or Harvest of Timberland in New England States (2020-2050)

State	CT	ME	MA	NH	RI	VT	New England Total or Average
Probability of conversion to cropland							
Forest conversion to cropland (acres lost over 30 years)	-	71,117	63,555	82,953	18,904	194,225	430,753
% acres forest lost to cropland over 30 years	0.00%	0.42%	2.23%	1.88%	5.50%	4.54%	1.41%
Acres that would have been cropland -> wildlands	-	4,729	3,476	2,827	990	7,786	19,808
Probability of conversion to other land							
Forest conversion to other land (acres lost over 30 years)	1,334	56,019	13,294	3,954	-	6,870	81,471
% acres forest lost to other land over 30 years	0.08%	0.33%	0.47%	0.09%	0.00%	0.16%	0.27%
Acres that would have been other land -> wildlands	112	3,725	727	135	-	275	4,974
Probability of conversion to settlements							
Forest conversion to settlements (acres lost over 30 years)	49,569	371,769	86,215	137,563	27,775	172,825	845,717
% acres forest lost to settlements over 30 years	2.85%	2.20%	3.03%	3.11%	8.08%	4.04%	2.77%
Acres that would have been settlements -> wildlands	4,164	24,720	4,716	4,688	1,454	6,929	46,670
Probability of harvest							
Discounted harvested acres (30 years)	197,295	9,948,829	215,086	1,434,428	68,218	804,638	12,668,494
Percent of acres harvested over 30 years	11.35%	58.96%	7.55%	32.45%	19.85%	18.83%	41.54%

Acres that would have been harvested -> wildlands (30 years)	16,572	661,521	11,764	48,888	3,572	32,258	774,575
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Carbon Impact of Wildland Designation

The carbon impact of a Wildland Reserves designation on any particular acre of timberland in New England is the change in carbon stock and sequestration over 30 years resulting from the Wildland Reserves designation. To isolate the additionality of Wildland Reserves designation, the existing stock and sequestration of acres that could have been converted or harvested is subtracted from the additional stock and sequestration gained from the Wildland Reserves designation.

- **Carbon stock benefit from Wildland Reserves acres that avoided conversion** = avoided carbon stock changes for loss of forestland to cropland, other land, and settlements by state in New England as calculated in Supplement 4.
- **Carbon stock benefit from Wildland Reserves acres that avoided harvest** = avoided carbon removals from harvest by state in New England as calculated in Supplement 3.
- **Carbon sequestration benefit** = additional sequestration benefit resulting from moving from a forested acre that would have been converted to a protected forested acre. For new wildland acres that would have been converted, the carbon sequestration benefit is represented as the net growth rate for reserved forests from FIA data.¹ Net growth is used for reserved forests and assumes no harvest occurs on reserved land in the FIA database. In practice, certain forested areas designated as reserved in the FIA database may still be subject to some management/human disturbance. For new wildland acres that would have been harvested, a carbon sequestration benefit is not estimated as harvested acres would grow back and continue to sequester carbon. The study recognizes that the sequestration rate of forests post-harvest may differ from the sequestration rate of forests that are designated as wildlands, but estimating this potential difference is beyond the scope of this study.

Based on sample error associated with the small number of reserved plots in Connecticut and Rhode Island, estimates for net growth on reserved forestland from Massachusetts are applied for these states. To calculate the total carbon benefit, the carbon stock change is estimated once over the 30-year period and 15 years of sequestration is added to account for the fact when over the 30-year period of analysis the acre of forestland would have been designated as a wildland is unknown.

¹ In the FIA database, net growth = gross growth – mortality.

This document is a supplement to the paper *New England’s Climate Imperative: Our Forests as a Natural Climate Solution*. [Read more here.](#)