ASSESSMENT OF TIMBER HARVESTING AND FOREST RESOURCE MANAGEMENT IN VERMONT: 2012

EXECUTIVE SUMMARY

VERMONT AGENCY OF NATURAL RESOURCES

DEPARTMENT OF FORESTS, PARKS AND RECREATION

December, 2014

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This publication is available upon request in large print, braille and audio CD.
VT TDD 1-800-253-0191

The *Assessment of Timber Harvesting and Forest Management in Vermont: 2012* was funded in part through a competitive grant from the USDA Forest Service, Northeastern Area State and Private Forestry (NA S&PF), Competitive Allocation Request for Proposals (CARP) process.

ACKNOWLEDGEMENTS

This report would not have been possible without the dedication of a long list of volunteers who gave their time and expertise to all aspects of the project from planning, to data collection, to data analysis, and the preparation and review of the final report. This report represents the collective effort of many individuals with diverse points of view. As such, not everyone will be in agreement with all of the interpretations, conclusions and/or recommendations presented in this report.

The project advisory committee, made up of representatives from the forest products industry, environmental groups, academia, and state and Federal government worked cooperatively to guide the project. The technical committee was made up of experts in various forest resource areas and spent countless hours designing the assessment methodology, analyzing the results and writing the report. The field crew made up of VT FPR foresters, made numerous calls requesting sale information, obtaining landowner permission, and spent the summer of 2012 collecting data from over eighty timber harvesting operations in every corner of the state, regardless of the weather. The field staff also assisted with data analysis and assisted in preparation of the final report. The data analysis team at RJ Turner Company was invaluable in developing the data collection tools, database, and in analyzing the data. The patient cooperation of all of the individuals involved made the project possible.

Our thanks also goes out to the foresters and loggers that helped in compiling the list of timber harvesting operations, and in many cases providing timber harvest information and maps. Finally, we are especially grateful to the cooperating landowners who graciously allowed us to conduct assessments on their property.

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In 1988 the VT State Legislature charged the Commissioner of the Department of Forests, Parks and Recreation with recommending "specific initiatives deemed necessary to mitigate undue adverse effects of timber harvesting in the state." That legislation led to a study of timber harvesting in Vermont conducted by researchers at the University of Vermont. *The Impact Assessment of Timber Harvesting Activity in Vermont*, which was published in March of 1990, provided a detailed look at the characteristics of timber harvesting operations and the associated impacts on a number of forest resources.

The 2012 Timber Harvesting Assessment did not have the same purpose as the 1990 Assessment. Many changes in timber harvesting practices, as well as the introduction of new concerns, such as climate change and invasive plants and pests, have occurred in the years since the last field assessment was completed in 1990. Recognizing these changes, the VT Department of Forests, Parks and Recreation (VT FPR) applied for and received a grant through the USDA Forest Service, Northeastern Area State and Private Forestry (NA S&PF), Competitive Allocation Request for Proposals (CARP) process, to conduct an updated Assessment of Timber Harvesting Activity in Vermont. It was the goal of this project to evaluate a sample of timber harvests for potential impacts (positive and negative) to a number of forest attributes and to compare this snapshot with results from the previous assessment where possible.

The assessment project was overseen by an advisory committee that included representatives from the forest industry, landowner associations, conservation groups, and other partner organizations. This committee was charged with guiding the assessment process and recommending resources to be evaluated. A technical committee was formed to design the ecological assessments, analyze the data, present findings and recommendations to the advisory committee, and to draft the final report. The technical committee included resource professionals with expertise in water quality, timber productivity, forest health, forest soils, aesthetics, archeology, and wildlife. Field assessments were conducted by VT FPR staff.

As in the 1990 report, this document provides basic descriptive information about the number, size, and characteristics of timber harvesting operations around the state. It further provides a snapshot of harvesting practices as they relate to specific forest attributes including: aesthetic values; archeological and historic resources; rare, threatened, and endangered species; timber quality and forest health; forest soils; water quality and wildlife habitat. Where possible and appropriate, the report also provides comparisons between the 1990 results and those of the 2012 assessment.

Understanding and Interpreting These Results

The following report presents a brief summary of the results of the field assessment completed in 2012. Readers are encouraged to refer to the full report of the assessment for supporting data and more detailed explanations and analyses of the results.

Since pre-harvest conditions were not assessed as part of this project, it was not possible to evaluate some attributes that might have been affected by the harvest (e.g., growth rate, tree health, or wildlife habitat quality and use).

Readers should recognize the following limitations of this assessment:

- The results reported are based solely on the harvests assessed, represent a single point in time, and cannot be representative of every timber harvesting operation in Vermont.
- Assessments were conducted after harvest operations had been completed and were intended to evaluate potentially ongoing effects of timber harvesting. Impacts (positive or negative) that might have occurred during the active period of the harvest may not have been captured.
- For the purpose of comparing results with the 1990 assessment, every effort was made to replicate the methods and measurements during 2012. However, this was not always possible, and in some cases improved methods were used making comparisons impossible.

A master list of over 450 commercial timber[1] sales "closed out" between May 1, 2010 and April 30, 2011 was compiled from all over the state, and after removal of duplicates, the final list included 420 distinct sales from 13 counties. A stratified random sample of timber harvesting operations (THOs) was drawn from the master list, with a goal of completing 80 field assessments. Each county was sampled[2] and the number of sites selected per county was proportional to the number of operations listed by county in the master list.

Operations on state, federal, municipal, private, and corporate ownerships were included in the population of sales from which the sample was drawn. Participation in the assessment was completely voluntary and some individuals chose not to provide sale information or to allow field visits. While every attempt was made to ensure that the master list of sales was as comprehensive as possible, some eligible sales were not reported. Eighty-one THO assessments were completed during the summer of 2012.

This summary is intended to present only some highlights and key recommendations of the assessment report. The key recommendations are a compilation from the technical committees, as well as observations provided by the advisory committee.

Changes in Timber Harvesting Characteristics

Based on the THOs sampled during the two assessments, the mean operation size in 2012 was 2/3 the acreage of the mean operation size in 1990. When the average harvested acreage from the sampled THOs was expanded to a statewide-basis, commercial harvesting activity was estimated to have occurred on 70,122 acres

[1] Commercial operations were defined as those that resulted in the sale of forest products.

[2] All counties were sampled with the exception of Grand Isle. As was the case in 1990, no information on sales was received from Grand Isle County, so Grand Isle and Franklin counties were combined.

annually in 1990 and on at least 26,040 acres annually during 2012. While both of these figures represent estimates, Vermont's Annual Forest Resource Harvest Summaries indicate a reduction in volumes harvested over the same period, helping to support the finding of reduced harvesting activity. However, less accurate and potentially inflationary mapping techniques used during the 1990 assessment and under-reporting of operations in 2012 are also likely to have contributed to the magnitude of the difference.

Parcels enrolled in the Use Value Appraisal (UVA) or Current Use program accounted for 40% of the sampled operations in 1990, compared to 73% of operations in 2012. This substantial increase in the proportion of the sample enrolled in UVA is explained, in part, by the fact that in 2012 considerably more forestland parcels and acres were enrolled in UVA than in 1990. In 1987, an estimated 669,353 acres of forestland, 18% of the potentially eligible forestland in Vermont, was enrolled in UVA; in 2011 a reported 1,734,012 acres was enrolled, an increase of roughly 225%.

Forester involvement in harvesting operations increased from the 1990 assessment, from 77% in 1990 to 86% in 2012, with more responsibility and participation in several aspects of timber harvests than was reported in the 1990 assessment.

The use of mechanical harvesters in timber harvesting is an area of significant change in the forest products industry since 1990. Hand felling with chainsaws was the dominant tree harvesting method in 1990 and mechanical felling was not even mentioned in the 1990 report. Hand felling was still the dominant felling method in the 2012 assessment, but mechanical harvesters were used on 49% of operations.

Use of whole-tree skidding (transporting the entire tree with branches attached from stump to landing) has also become much more common and is linked to the use of mechanical harvesters. The earlier assessment found that only 10% of operations used whole-tree skidding, entirely or in part. However, by 2012, 41% of the operations sampled were using at least some whole-tree skidding. Log- and tree-length "skidding" techniques (without branches attached) were used on the majority of operations, but the trend toward increased mechanization is clear.

The production of wood chips is often associated with mechanical harvesting and whole-tree skidding, but this was found to not always be the case on sampled operations. While 34 operations assessed in 2012 used at least some whole-tree skidding, only 30 operations actually produced chips. On those operations not producing chips, tops were removed at the landing and returned to and deposited within the harvest area.

Key Recommendations:

- Continue to conduct periodic assessments of timber harvesting activity on a ten-year cycle.
- Monitoring the positive and negative effects of timber harvests should be incorporated into the forest health monitoring efforts carried out by the Department of Forests, Parks and Recreation and the University of Vermont.

Future monitoring efforts related to timber harvesting should consider not only assessments such as those conducted in 1990 and 2012, but should also incorporate studies to compare pre- and post-harvest site conditions.

- A timber sale contract fact sheet should be prepared and distributed to foresters for use with landowners, suggesting possible contract conditions and language designed to help better manage potential negative impacts to a variety of forest attributes such as aesthetics, archaeologic and historic sites, water quality, and wildlife habitat.

Aesthetic Values

While poorly executed timber harvest operations can loom large in the public eye, this assessment does not indicate any serious aesthetic impacts to public viewing areas resulting from timber harvests in this assessment. The number of occurrences of factors contributing to negative visual impacts was lower than the results reported for the 1990 assessment. The vast majority of THOs sampled (80%) were not visible from visually sensitive vantage points (paved roads, recreation areas, and trails) and therefore had no readily visible aesthetic impacts. There were a number of THOs for which significant visual impacts could have resulted if they had been located along hillsides facing public viewing areas rather than away from them. Whether this was by design or coincidence is not known.

A number of characteristics of harvested stands can be viewed as aesthetically undesirable by the public. For instance, slash and dead or down wood is nearly always viewed negatively from an aesthetic perspective, as are scattered trees silhouetted along a ridgeline. Bare soil and debris left on landing areas are also viewed as negative.

One significant improvement noted during the 2012 assessment was the lack of heavily cut areas along visible hillsides and ridgelines. Another was the lack of highly visible landing areas in which remaining wood chips or other debris were highly evident. Slash described as "left where it falls, large trunks and limbs dominate the scene” was notable on only one THO. Vegetative screens along roadsides, used to reduce any negative aesthetic impact, appeared to be a common practice.

Some of these improvements may be attributable, in part, to laws such as the 1997 Heavy Cutting Law, as well as an increased sensitivity to public concerns and desires by the forest products industry as a whole. Sustainable forest management practices and treatments are sometimes at odds with the public’s perception of what is aesthetically acceptable. For example, the retention of snags, tops, and logging residues to meet wildlife and other biodiversity goals, such as ensuring long-term site productivity, maintaining hydrologic functions, and sequestering carbon, are often viewed as negative by casual observers. The public needs to be educated to the ecological benefits of these practices to better understand and accept them.

Key Recommendations:

- Ensure that recommended practices, guidelines, statutes and other directives related to timber harvesting adequately address visual impacts. Provide foresters and timber harvesting professionals with tools and training on public perceptions of the visual results of forest management practices to allow aesthetic concerns to be better addressed.
- Provide demonstration areas designed to educate foresters, loggers, landowners, and the general public about a variety of timber harvest practices, their benefits, and how they can be managed to reduce aesthetic impacts.
- Provide incentives and educational programs for loggers and landowners that help foster appropriate forest management practices including considerations for reducing aesthetic impacts.

Archaeological Resources

Archaeological resources are particularly vulnerable to negative impacts from timber harvesting because impacts to archeological sites are irreparable and permanent. The values of archeological resources are codified in protections mandated by federal and state law, as well as numerous state program policies and procedures.

The 2012 assessment evaluated potential impacts to archaeological resources in two general categories: historic period sites (ca. A.D. 1609-1950's) and “pre-contact” sites of Native American settlement and/or resource exploitation that date to before the arrival of Europeans, between approximately 9,000 B.C. and A.D. 1600. Sampling methods to assess actual impacts to subsurface artifacts would require substantial excavation at numerous sites, an effort beyond the scope of this assessment. As in 1990, in lieu of confirming presence or absence of actual archeological sites, methods were applied to identify areas with relatively high potential for sites and document observed impacts to these “high risk” areas. It was assumed that artifacts would have been compromised if the high-risk site was impacted by timber harvesting.

The most striking contrast between the 1990 assessment and this assessment is that for nearly every metric, the 2012 assessment produced fewer negative impacts or results of a more moderate scale. This is likely due to smaller mean acreage of THOs in the 2012 sample, refinement in estimates of the percentage of pre-contact sites that actually contain resources, and perhaps a much greater proportion of 2012 THOs being conducted in more remote areas with a lower density of archeological sites, rather than a change in timber harvesting practices. Although more information exists for identifying “high potential” areas for pre-contact sites than was available in 1990, the information could be better communicated to landowners, foresters, and logging contractors.

Data for historic sites, based on actual impacts, indicate that the rate of impacts (percentage of observed historic foundations impacted) has increased substantially, suggesting less protection for historic resources in 2012 than in 1990. Two decades ago impacts to foundations due to various causes (rutting, erosion, skid trails, etc.) ranged

from 0-36% of foundations, while in 2012, 50% of foundations were impacted, even though the number of THOs with timber sale contracts reported to have included protections for resources is comparable.

In 1990, two types of landscape features – glacial terraces and quarry sites for stone tool material – were considered to have high potential for containing pre-contact Native American sites. In 2012, a Geographic Information System (GIS) model was used to expand the criteria for potential pre-contact Native American sites to areas beyond glacial terraces and quarry sites. Although the GIS model applied more liberal criteria for identifying areas with high potential to contain pre-contact sites, high probability areas were mapped on only 12% of the THOs, compared to 22% of THOs identified by the more exclusive criteria in 1990. Previous testing of the model, using actual excavation data, indicates that only a portion of the potential sites identified will actually contain artifacts. When these assumptions are applied to the results from the assessment, the data indicate pre-contact Native American sites were likely impacted on 1 to 2% of the 2012 timber harvests statewide.

Key Recommendations:

- Produce an updated guide to the stewardship of historical and archaeological resources including recommended best management practices applicable to private land owners, land managers, and loggers.
- Develop and implement educational materials, programs and workshops for presentation to a wide range of audiences, particularly landowners, loggers, and foresters on recognizing potential archaeological sites and avoiding or mitigating impacts to them. Educational materials should include a listing of timber harvest regulations affecting private lands relative to cultural resources.
- Conduct focused training for ANR staff and other resource professionals on recognition of less obvious sites and how to avoid them during harvesting operations on state and private lands.
- Integrate data from the Vermont Archeological Inventory (VAI) and the predictive model GIS layer developed for the VT Map Tool (currently not publicly accessible) into the new ANR Natural Resource Locator.
- Encourage consulting foresters to prepare Forest Stewardship Program eligible management plans, which include consideration of cultural resources, when preparing plans for enrollment in the Use Value Appraisal (UVA) Program.

Rare, Threatened, and Endangered Species

Rare native plants and animals, those species that have few populations in the state or that face threats to their continued existence, are an important part of Vermont's natural landscape. Timber harvesting operations have the potential to benefit or harm populations of rare species. If the operation is guided by special considerations aimed at improving the habitat or conditions for a particular rare species, the overall effect may be positive. In contrast, an operation that alters suitable habitat for a rare species, or

that causes physical damage to individual rare plants or animals, is likely to have a negative effect on the long-term persistence of that population.

The 2012 assessment followed the methodology used in 1990 of comparing the location of sampled THOs with the mapped locations of rare, threatened, or endangered (RTE) species as recorded in the VT Fish and Wildlife Department's Natural Heritage Database. Of the 81 THOs evaluated in this assessment, three overlapped with these mapped locations. This overlap does not in itself demonstrate impact (positive or negative), but was used during the 1990 assessment as a broad indicator of the degree to which timber harvesting operations are potentially impacting RTE species.

All three sites of overlap were on land managed by the State of Vermont, and a wildlife biologist and ecologist were involved in each of the operations. No additional assessment was possible to determine whether the THOs resulted in positive or negative impacts to RTE species.

In contrast to the 2012 assessment results, the timber harvest impact assessment conducted in 1990 identified no overlaps between the THOs and the locations of threatened or endangered species. (The previous assessment only considered species listed in Vermont's Endangered Species Act.) However, in 1990 there was substantially less information available on the locations of RTE species. If anything, this suggests that timber harvests in 1990 had a much greater chance of having unintended negative impacts on an RTE species simply because many sites with RTE species had yet to be identified.

Key Recommendations:

- Continue statewide efforts to find, record, and monitor the locations of rare, threatened and endangered species, and continue to use the Vermont Fish and Wildlife Department's Natural Heritage Database as the primary archive of this information.
- Continue to widely distribute information on the locations of RTE species using tools such as the Vermont Agency of Natural Resources Natural Resources Atlas.
- Encourage greater involvement from ecologists or biologists in pre-harvest inventories or forest management planning to identify whether RTE species are present, particularly where observations or pre-screening tools suggest a possibility of their presence.
- Educate landowners and managers to the full suite of options and programs available to them to identify and address RTE species when managing forests. A few examples of these include:
    - The Natural Heritage Inventory of the Vermont Department of Fish and Wildlife can provide information on known occurrences of rare, threatened, and endangered plant and animal species.

- The Wildlife Habitat Improvement Program (WHIP) may be able to provide financial incentives and cost-sharing for management and conservation of rare species.
- Sites with rare species can also be enrolled as Ecologically Significant Treatment Areas under the Use Value Appraisal (UVA) program.

Timber Quality, Regeneration, and Forest Health

Harvesting effects on timber quality and forest health were assessed using measures of damage to residual trees, changes in species composition, adequacy of residual stocking, abundance and species composition of regeneration, the health of residual trees (crown dieback), deer and moose browsing impacts, invasive plant competition, and the presence or absence of residual down woody material sufficient to replenish site productivity. Each of these factors influences future forest diversity, structure, and functions.

Residual tree damage[3] was limited, with 88% of trees sampled having no damage and 92% of operations having less than 20% of the residual basal area damaged. A direct comparison to 1990 assessment data was not possible due to changes in data collection methods. Sites in northern Vermont tended to have a higher incidence of residual tree damage, but the cause of this difference was not assessed.

Crown health is a good indicator of tree survival. Eighty-six percent of trees sampled were rated as having limited crown dieback (<15%), and only 2% had significant[4] dieback. Without knowledge of the health characteristics of the trees on the sampled THOs prior to treatment, it is not possible to speculate on the reasons behind the dieback observed.

The most common forest type, northern hardwoods (sugar maple, beech, yellow birch), was dominant both before and after harvests. The notable change in composition was from softwood to hardwood types. Close to a third of softwood cover types were converted to hardwood or mixed wood types, similar to results reported in the 1990 assessment. Furthermore, understory composition trends suggest a further shift from softwood or mixed types to hardwood. Changes in composition may be attributable to a number of factors including silvicultural practices, land management history, beech bark disease, accumulated browsing impacts and natural succession.

Forester involvement and enrollment in UVA both had a positive effect on anticipated silvicultural outcomes. In general, operations with forester involvement led to results that more closely followed established guidelines for post-harvest conditions. Forester involvement and UVA participation resulted in better stocked stands of sawtimber

[3] Residual tree damage included open wounds (sapwood exposed), broken tops (crown), damaged and/or exposed roots, and bent over trees.

[4] "Significant" was defined as having a dieback rating of greater than 50%.

quality[5] trees in partial cuts, and clearcuts that were silviculturally correct and effective with respect to ensuring regeneration success.

Less than half of all plots were projected to have an understory dominated by tree seedlings and/or saplings (3 to 5 years following harvest). On nearly one third of plots, ferns and herbaceous plants were the expected dominant understory vegetation. In regenerating plots, 48% of plots were expected to have a dominant understory of seedling/sapling/coppice (in 3 to 5 years), compared to 89% in 1990.

When looking at a subset of harvests specifically intended to regenerate stands (plots on which the overstory had been removed), in 1990 the forest floor was occupied primarily by seedlings or coppice 68% of the time, and ferns/herbs/Rubus 8% of the time. In 2012 seedling/sapling/coppice stems were the dominant understory vegetation in 49% of this harvest type, and 45% were occupied by ferns/herbs and Rubus spp. Combined with the presence of competing vegetation and/or deer and moose browse pressure, there are concerns for the successful establishment of regeneration of adequate density and desirable species composition in some areas. Results of this assessment suggest that regenerating native tree species will be a challenge on a number of the THOs assessed that will require attention to silvicultural practice, control of competing vegetation, and continued population management of whitetail deer and moose.

In addition to providing wildlife habitat and soil enrichment, down woody material serves many other ecological functions. Leaving tree tops, some large diameter downed trees, and foliage on site after a timber harvest helps to replenish organic matter content, moisture holding capacity, increase rooting depth, and enhance soil nutrition. The average volume of coarse woody material (CWM) on sampled THOs was considerably higher than the statewide average reported by USDA Forest Inventory and Analysis, but much less than volumes considered desirable when practicing silviculture. The majority of CWM was less than 8 inches in diameter and the new down woody material, some from current harvest operations, represented about half the total CWM.

Whole-tree harvests (WTH) left measurably less down woody material than tree-length harvests, though the average volumes were slightly higher than the statewide average.[6] These results indicate relatively lower volumes of residual material left to conserve soil productivity where this harvesting system is utilized.

Key Recommendations:

- The lack of regeneration and the presence of established competing vegetation and/or mid-level shade in many stands suggest a need to carefully apply

[5] High quality trees were defined as meeting the standards for AGS (Acceptable growing stock) – a commercial species less than rotation age with relatively good vigor, containing no pathogens that may result in the death or serious deterioration of the tree before rotation age, and which contains or has the potential of producing merchantable sawtimber of USFS grade 3 quality or better (see Appendix F of the full report for USFS grading standards).

[6] On average, tree-length skidding left 975 cubic feet/acre of CWM compared to 611 cubic feet/acre left from whole-tree skidding. FIA data put the statewide average for CWM at 550 cubic feet/acre.

silvicultural guidelines to ensure more effective regeneration treatments in the future. Current conditions in some stands may require aggressive pre-harvest treatments (mechanical, herbicides, or in combination) to control competing vegetation, and/or site preparation to ensure the establishment of desired regeneration. Silvicultural systems may need to be adjusted to adequately address the increased potential for interfering vegetation.

- Longer term monitoring should be conducted to determine the ultimate success or failure of obtaining desirable regeneration under a variety of conditions.
- More focused assessment of softwood and mixed wood stands, managed to perpetuate these forest types, should be conducted to determine the most successful techniques for insuring successful establishment of softwood regeneration on suitable sites.
- The browse sensitivity method of assessing deer and moose browse intensity should be further evaluated and, if needed, refined to better reflect observed and recorded forest and regeneration condition.
- Regional differences in regeneration success or potential were significant in some instances and should be used to inform deer and moose population management and silvicultural practice and climate change adaptation.
- Develop a single standard for an Acceptable Growing Stock tree, and provide training regarding what constitutes a high quality stem at the regeneration, pole, and sawtimber size class.
- Develop guidelines for down woody material retention to ensure adequate amounts and sizes of down material are left on site following harvests.
- Future assessments should consider measurement of both recent and pre-existing wounds as well as noting whether or not the wounded tree was retained to serve as a bumper tree along a skid trail.
- Investigate the possibility of aggregating existing data from a variety of sources (public and private) to help provide a statewide data set as a basis of comparison with pre-harvest conditions in future assessments. A subset of basic and consistently defined data on stand density, composition, and quality, as well as regeneration condition, could yield ongoing information to guide practice and policy.

Timber Quality and Productivity – Forest Soil Assessment

Soil is a fundamental ecosystem component and a foundation of maintaining healthy forests. Five physical soil disturbance parameters were selected for measurement for the 2012 assessment based on the Forest Soil Disturbance Monitoring Protocol developed by the USDA Forest Service. The parameters chosen were the extent of bare soil, erosion, compaction, rutting, and the Soil Disturbance Class.[7] Soil data points were located throughout harvested stands and were not targeted to disturbed areas

[7] Soil Disturbance Class is used to group the type, degree and extent of soil disturbance into an overall rating of soil disturbance.

such as roads in order to broadly characterize soil disturbance and impacts, in general, across the THO.

Based on the sampled harvest operations, the observed impacts to forest soils within harvested stands from timber harvesting operations were minimal. Measurable impacts were generally limited to skid trails and truck roads.

- Ninety-five percent of points exhibited no bare soil.
- No erosion was observed on 96% of soil observations.
- Ninety percent of points exhibited no identifiable compaction.
- Ninety-six percent of points had no rutting.
- Eighty-five percent of soil data points were rated as exhibiting natural, undisturbed soil conditions.

Overall, 15% of soil data points fell on skid trails. For the purposes of this assessment, a skid trail was defined as an identifiable trail made by two or more passes of a piece of heavy skidding or forwarding equipment and included both permanent infrastructure designed to be used in subsequent harvests and "single use" trails.

Key Recommendations:

- Limit the construction of new skid trails as much as possible and re-use existing skid trails, if they meet AMPs guidelines and are otherwise properly designed and located. Existing skid trails typically have soils that are already compacted. Re-use limits the creation of new areas of compaction.
- Insure proper installation of AMPs to keep erosion to a minimum. This also protects soil productivity.
- On sensitive or wet sites, conduct harvest operations in winter, when skid roads and landings are frozen, and/or covered with a thick layer of snow. This minimizes rutting, compaction, creation of bare soil, and erosion.

Water Quality

The major objectives of the water quality portion of the assessment were to perform an evaluation of direct and indirect water quality impacts associated with timber harvesting operations in Vermont, to evaluate compliance[8] with the Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont (AMPs), and to evaluate compliance of silvicultural activities allowed under the Vermont Wetland Rules.

Analyses were also performed on permanent stream crossing structures to assess flood resiliency and conditions favorable to fish passage. Post-logging impacts to water

[8] "Compliance" with a particular AMP was defined as implementation of the recommended practice as described in the Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont (VTFPR 1987). Failure to comply with the AMPs may not result in reduced water quality.

quality with observable lingering effects, including sedimentation, logging slash, and petroleum product residue, were also evaluated. Operations were evaluated for compliance with 17 of the 24 Acceptable Management Practices. Six of the AMPs apply only to the active phase of a timber harvesting operation and were not evaluated during this assessment. AMP compliance was determined by both frequency of observation and by frequency of operation for purposes of comparison.

Results of this assessment suggest a lower incidence of negative impacts to water quality, as compared to the 1990 report findings. Practices were observed to have been implemented on all timber harvesting operations for protection of water resources. AMP compliance was high for practices related to streamside protective strips, truck roads, and log landings.

Findings from this assessment indicate that 22% of stream crossings showed evidence of sedimentation and represented the principal source of sediment associated with the timber harvesting operations observed. Of the 147 stream crossings evaluated, 32 showed evidence of sedimentation as a result of logging. This is less than reported in the 1990 assessment (28% of crossings in 2012 vs. 42% of crossings in 1990).

The number of waterbars observed on skid trails was below levels recommended by the AMPs. The number of waterbars and other drainage structures installed on skid trails according to spacing requirements in Table 1 of the AMPs averaged 42% of the required number by observation (segment) and 39% of required number by operation. Seventy-four percent of observations were rated as having “none to sheet” erosion as the most severe surface erosion type encountered on skid trails. There was a high level of compliance with the Vermont Wetlands Rules on timber harvesting operations. Twenty-three wetlands and their associated buffers were evaluated for timber harvesting impacts on 21 operations. Timber harvesting impacts to wetlands occurred on 2 of the 21 operations evaluated.

Permanent stream crossing structures (bridges and culverts left in place following logging) were evaluated to determine if they were adequately sized to meet hydrologic capacity requirements for the 1 to 3-year, 10-year and 25-year flood events. Structure size openings indicated that 61% of those structures were adequately sized to accommodate a 1 to 3-year flood event; 16% were adequately sized to accommodate a 10-year flood event, and 8% were adequately sized to accommodate a 25-year flood event.

Key Recommendations:

- Direct and enhance efforts to reduce sedimentation associated with temporary stream crossings on logging operations by:
    - promoting and increasing the use of portable skidder bridges through education, outreach and program delivery.
    - providing guidance and training for choosing the appropriate type of temporary stream crossing structure, as allowed in the AMPs, based upon

stream characteristics.

    - providing guidance and training on specific techniques for stabilizing approaches to temporary stream crossings within the stream buffer on skid trails.

- Provide technical guidance and training for installing and sizing permanent bridges and culverts on perennial streams to improve flood resiliency and reduce sedimentation.
- Continue efforts to develop the second edition of the AMP manual. The next edition will provide enhanced guidance to help attain a higher level of AMP compliance and protection of water resources.
- Explore potential funding opportunities for conducting AMP effectiveness and evaluation monitoring of logging operations using the USDA Forest Service State & Private Forestry Northeastern Area protocol – Best Management Practices (BMPs) Implementation and Effectiveness for Protection of Water Resources.
- Explore the feasibility of starting a program in Vermont that provides incentive financing to loggers to reduce non-point source pollution risk on timber harvests, using the Maine Forestry Direct Link Loan Program as a model.

Wildlife Habitat

Wildlife species vary in their habitat requirements and sensitivity to disturbances, and timber harvesting can have positive, negative, or neutral impacts on wildlife habitat. A harvest operation may improve habitat for some species while reducing habitat for others. This assessment focused on impacts to a variety of habitat features at multiple scales, with the understanding that they are broad indicators and not the only measures of habitat quality. Examples of these features include: snags, coarse woody material, deer wintering areas, vernal pools, rare natural communities, and forest habitat block size. Many other factors are commonly used to provide a more complete picture of the relative quality of wildlife habitat, but were beyond the scope of this assessment.

The indicators used in this assessment showed no conclusive evidence that the sampled THOs caused substantial negative or positive impacts to the wildlife habitat features that were studied. This does not mean that impacts did not occur, but rather that any impacts to these features could not be detected in a single, post-harvest assessment.

None of the locations of the timber harvesting operations overlapped with a known occurrence of a rare natural community.

Many types of forest harvesting practices were used on the THOs assessed, resulting in a wide variety of residual stand structures, providing habitat for a variety of species.

One area of concern identified in this report is the possible loss of deer wintering habitat. Several plots with softwood cover, which were within or adjacent to mapped deer wintering areas, transitioned to hardwood post-harvest. However, this assessment

was not at a fine enough scale to determine if these specific plots were in fact, functional deer wintering areas.

Some aspects of post-harvest wildlife habitat may be the result of pre-harvest forest condition, rather than harvest operations.

- For example, while snags are generally not present in adequate numbers for wildlife, this is not necessarily interpreted as a direct negative impact of the most recent harvesting activity. It may be a result of a combination of the average age of Vermont's forests and previous harvesting activities that has resulted in a low abundance of snags overall. In these cases, harvesting practices such as leaving trees for future snags, could improve the post-harvest conditions for wildlife over time.
- The abundance of large coarse woody material on the sampled plots is similar to statewide estimates from the FIA program across nearly all diameter classes greater than 12 inches, but lack of pre-harvest data makes definitive conclusions on harvest operation impacts impossible.

On the landscape scale, this assessment found that sampled timber harvests typically occurred in larger-than-average areas of unfragmented forest. The mean size of forest habitat blocks that included one or more timber harvest operation is significantly larger than the mean size of all habitat blocks that are greater than 25 acres in size. Timber harvesting is generally not considered to fragment a landscape if the harvested area is allowed to regenerate as forest and is not maintained as a permanent opening.

Key Recommendations:

- Conduct additional study on the relationship between timber harvesting and the following wildlife habitat features: mast trees, snag and den trees, coarse woody debris, vernal pools, invasive species, and forest habitat blocks. Increase outreach to encourage retention and creation of snag trees, cavity trees, coarse woody material and the retention of trees for recruitment as future snags or coarse woody debris.
- Encourage foresters, loggers, and other natural resource professionals to take advantage of all available information to assist in identifying important wildlife habitat features when planning timber harvesting operations.
- Continue outreach efforts to educate foresters, loggers, landowners, and the public about possibilities for incorporating wildlife habitat considerations into timber harvest operations.
- Encourage enrollment in programs such as the Use Value Appraisal "Ecologically Significant Treatment Areas" (ESTAs) or USDA Farm Bill programs, where appropriate, to provide financial incentives for private landowners to manage significant natural communities or wildlife habitats, respectively.