Rock of Ages Bethel Quarry

Forest Management Plan Amendment

2019-08-26

This amendment modifies the existing 2014 forest management plan for the Bethel quarry property; in order to incoporate information and prescriptions for stand areas 3 and 4, which were not previoulsy enrolled in the Use Value Appraisal program. The main body of the 2014 plan and its area 1 and 2 sections remain valid, and should stay in effect.

By signing below, I certify that I approve of—and agree to manage my forestland according to—the amended management plan. I further certify that any of my forestland that is enrolled in Vermont's Use Value Appraisal program is under active long-term forest management in accordance with the state's minimum acceptable standards for forest management. These standards include following Acceptable Management Practices to maintain water quality on logging operations.

Prepared by
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Owner
Rock of Ages Corporation
PO Box 482
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Property
328.4 acres woodland
Bethel, VT
SPAN 063-019-10832
Map delineation based on VMP
Photo(s) 4307212nw and 4307204sw

Effective date of plan
April 1, 2014

_____ _____
Landowner Date

_____ _____
Landowner Date

_____ _____
Landowner Date

_____ _____
Landowner Date

This forest management plan meets the standards promulgated by the Vermont Department of Forests, Parks and Recreation as required for eligibility in the Use Value Appraisal Program.

_____ _____
County Forester Date

Area 3

Mixedwood
16.64 legal acres | 14.51 measured acres

Site-specific information

- **Soils:**
  Buckland silt loam (very deep, moderately well drained, dense glacial till on footslopes)
  Glover-Vershire complex (shallow to moderately deep, excessively drained to well drained, loose, very rocky glacial tills on summits, shoulders, and backslopes)
- **Site Class:**
  II (determined from soil mapping and field assessment)
- **Access:**
  Less than 1 mile
- **Stand history:**
  Probably continuously forested, but used as wooded pasture. Older pines and hemlocks date to late 1800s. Younger cohort dates to 1930s maybe.

Current forest information

- **Age Class Structure:**
  Two-aged
- **Species (% stocking):**
  hemlock (28%), spruce (25%), yellow birch (13%), hard maple (10%), ash (8%), soft maple (5%), white pine (5%), hophornbeam (2%), aspen (1%), basswood (1%), paper birch (1%)
- **Regeneration:**
  Minimal spruce and hardwoods.
- **Forest health:**
  No exotic invasive plants noted. Ferns could impede regeneration in a few places.
- **Volume/ac:**
  0.5 MBF veneer, 12.8 MBF sawtimber, 1.8 MBF tie logs, 10 cds pulp
- **Size class structure (%BA):**
  6-10": 15% | 11-16": 38% | 17-22": 36% | 23+": 11%

Inventory information

- 6 points, 10 BAF, August, 2019

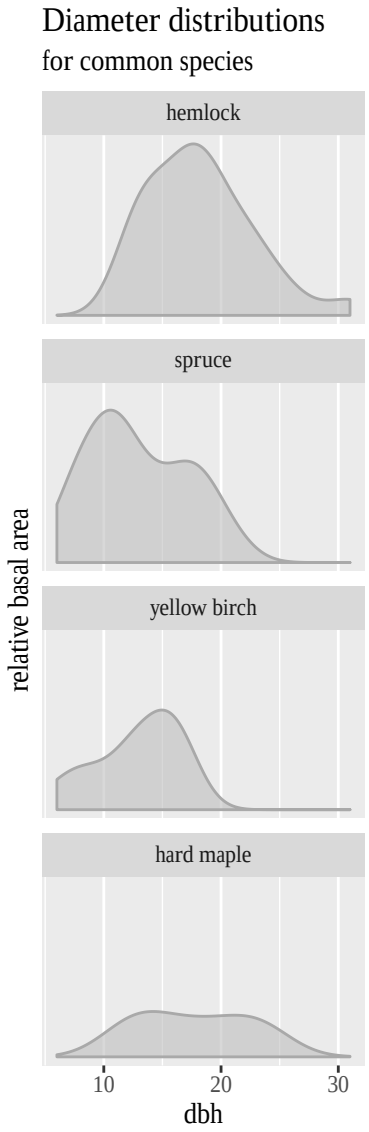

Figure 1: Distributions are approximated with kernel density estimation. Common species are those that account for at least 8 percent of the total stocking and areas under each curve represent species basal areas.

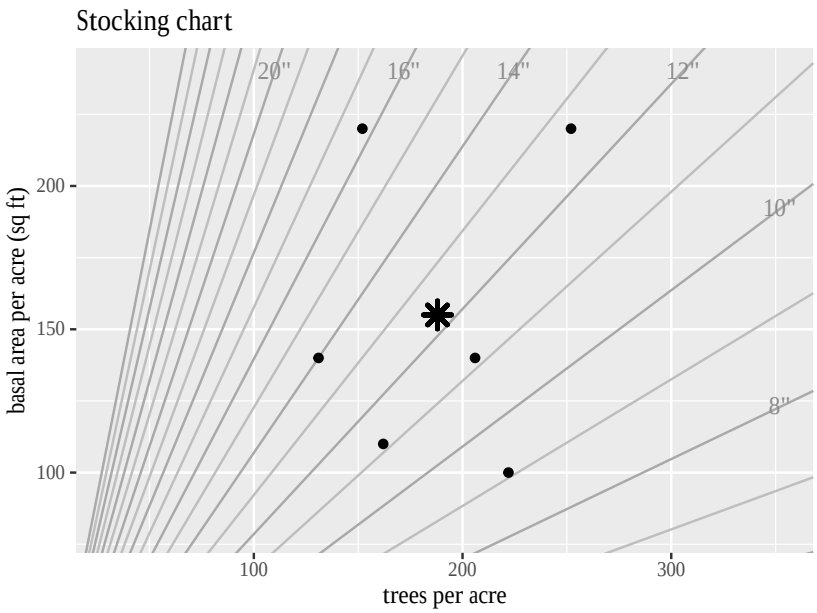

Figure 2: Points represent individual plots. Asterisk represnts stand average. Radial lines are quadratic stand diameters.

Table 1: Measures of stocking for all live trees (total) and acceptable growing stock.

	Total	Acceptable
Basal area (sqft/ac)	155	125
QSD (in)	12	13
Stems/ac	188	131

Long-term management system

Even-aged management[1]

The older cohort is overmature (with hard maples averaging 23" dbh and white pines averaging 30“) and should be removed. Stocking in the younger cohort averages 125 ft^2/ac, but unacceptable growing stock and very low vigor trees (with crown ratios of 20% or less) account for 45% of that. The stocking of acceptable growing stock with reasonable vigor averages only 77 ft^2/ac, and is as low as 50 ft^2/ac in some places. Over approximately two thirds of the stand, it is below c-line on the mixedwood stocking chart. As such, the stand should be regenerated to make better use of the growing space. Because the higher quality trees that are present are not yet mature, a deferred shelterwood should be used. This will allow the imature, acceptable trees to reach their full potential without underutilizing the remaining space.

Overall, the goal is to grow a diverse mixedwood forest dominated by high value species like sugar maple, yellow birch, black cherry, red spruce, and some white pine; with a focus on stem quality and vigor. A rotation of approximately 110 years is expected, but that is subject to change based on observed growth rates and markets. Tending operations should be conducted every ten years or so once crop trees in the new cohort have developed clear lower boles.

[1] Leak, W.B., M.Yamasaki, and R. Holleran. 2014. Silvicultural Guide for Northern Hardwoods in the Northeast. USDA For. Serv. Gen. Tech. Rep. NRS-132.

The most vigorous, best-formed immature trees should be reserved to provide seed and shade and so they can continue to add value. Valuable hardwoods should be preferrentially retained over hemlock, but we do expect to keep a significant component of hemlock. All trees in the older cohort should be removed, as well as unacceptable growing stock and trees with small crowns that won't respond well to release.

Area 4

Mixedwood
11.87 legal acres | 10.35 measured acres

Site-specific information

- **Soils:**
  Buckland silt loam (very deep, moderately well drained, dense glacial till on footslopes)
  Cabot silt loam (very deep, poorly drained, very stony, dense glacial till on toeslopes and drainageways)
  Glover-Vershire complex (shallow to moderately deep, excessively drained to well drained, loose, very rocky glacial tills on summits, shoulders, and backslopes)

- **Site Class:**
  II (determined from soil mapping and field assessment)

- **Access:**
  Less than 1 mile

- **Stand history:**
  Probably continuously forested, but may have been used as wooded pasture. Periodic logging left a number of distinct irregularly arranged cohorts. Evidence of heavier logging in or around the 1960s. The most recent entry was probably in the 90s.

Current forest information

- **Age Class Structure:**
  Uneven-aged

- **Species (% stocking):**
  hemlock (59%), ash (10%), spruce (10%), hophornbeam (7%), paper birch (7%), black cherry (3%), hard maple (3%)

- **Regeneration:**
  Moderately well established maple, ash and birch.

- **Forest health:**
  A handful of exotic honeysuckle plants were seen on the old landing in the south and in one other wet area.

- **Volume/ac:**
  0 MBF veneer, 7.5 MBF sawtimber, 1.7 MBF tie logs,
  7 cds pulp

- **Size class structure (%BA):**
  6-10": 34% | 11-16": 52% | 17-22": 14% | 23+": 0%

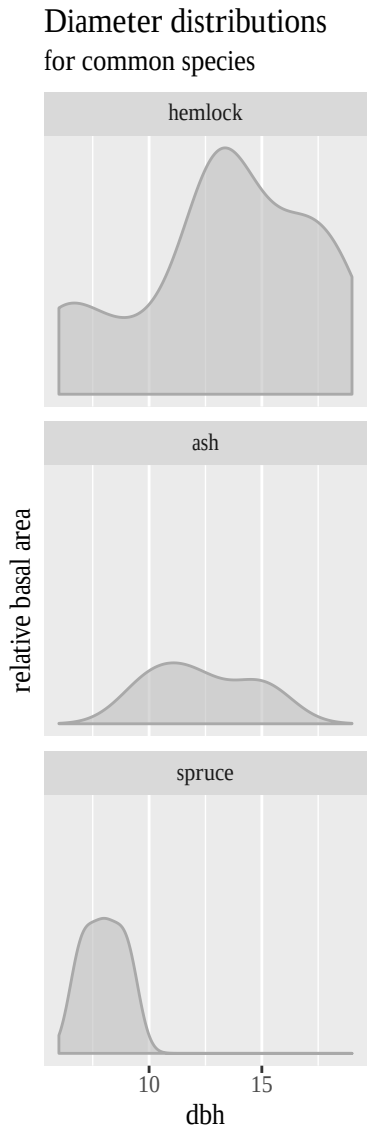

Figure 3: Distributions are approximated with kernel density estimation. Common species are those that account for at least 8 percent of the total stocking and areas under each curve represent species basal areas.

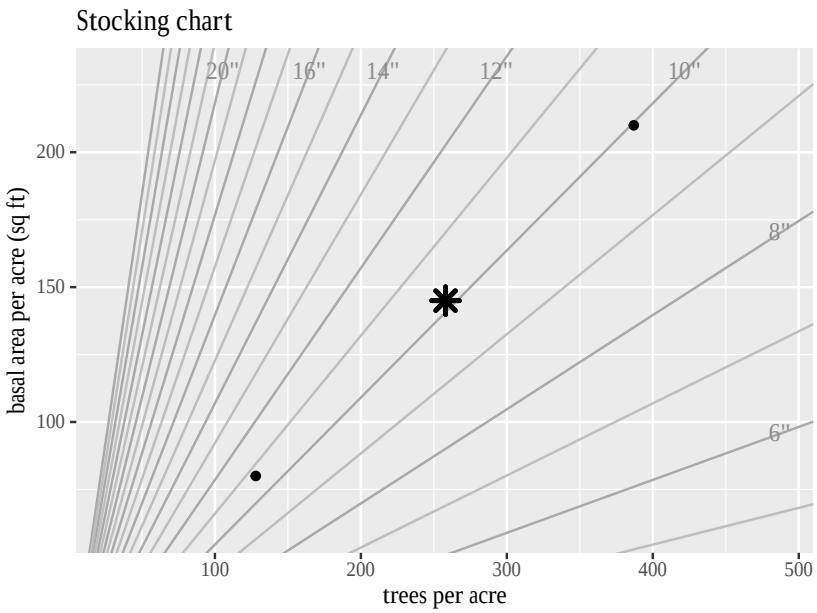

Figure 4: Points represent individual plots. Asterisk represnts stand average. Radial lines are quadratic stand diameters.

Inventory information

- 2 points, 10 BAF, August, 2019

Table 2: Measures of stocking for all live trees (total) and acceptable growing stock.

	Total	Acceptable
Basal area (sqft/ac)	145	125
QSD (in)	10	10
Stems/ac	258	218

Long-term management system

Even-aged management[3]

The older cohort is overmature (with hard maples averaging 23" dbh and white pines averaging 30“) and should be removed. Stocking in the younger cohort averages 125 ft^2/ac, but unacceptable growing stock and very low vigor trees (with crown ratios of 20% or less) account for 45% of that. The stocking of acceptable growing stock with reasonable vigor averages only 77 ft^2/ac, and is as low as 50 ft^2/ac in some places. Over approximately two thirds of the stand, it is below c-line on the mixedwood stocking chart. As such, the stand should be regenerated to make better use of the growing space. Because the higher quality trees that are present are not yet mature, a deferred shelterwood should be used. This will allow the imature, acceptable trees to reach their full potential without underutilizing the remaining space.

Overall, the goal is to grow a diverse mixedwood forest dominated by high value species like sugar maple, yellow birch, black cherry, red spruce, and some white pine; with a focus on stem quality and vigor. A rotation of approximately 110 years is expected, but that is subject to change based on observed growth rates and markets. Tending operations should be conducted every ten years or so once crop trees in the new cohort have developed clear lower boles.

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Table 3: Current and target basal area by size class. Poles are 6-10" dbh, small sawtimber is 11-16“, and large sawtimber is >16”. Investment grade growing stock is a subset of acceptable growing stock.

size class	total	acceptable	investment grade	post harvest target
poles	50	45	10	22
small sawtimber	75	60	40	38
large sawtimber	20	20	20	20

Silvicultural prescription

Shelterwood establishment[4]

Year: 2022

Honeysuckle fruits in Sep/Oct; maybe avoid logging then. A shelterwood establishment cut should reduce the overstory stocking to approximately 70 ft^2/acre, on average. We expect the residual stocking to be quite variable: to take best advantage of the existing high quality stems and to create varied light conditions to regenerate a diverse mixture of species. Projections show the residual stocking ranging from 40 to 100 ft^2/acre and being compositionally similar to the existing forest. Yellow birch, sugar maple, soft maple, black cherry, and spruce are targeted for regeneration.

The most vigorous, best-formed immature trees should be reserved to provide seed and shade and so they can continue to add value. Valuable hardwoods should be preferrentially retained over hemlock, but we do expect to keep a significant component of hemlock. All trees in the older cohort should be removed, as well as unacceptable growing stock and trees with small crowns that won't respond well to release.

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