Table S1. Summary of jack pine release treatment details applied on two sites in Ontario, Canada.

Treatment	Site	Details	Date and time	Plot size (ha)
Single aerial application	Bending Lake	4 L ha^{-1} of Vision® (1.5 hg acid equivalent [a.e.] ha^{-1}) applied in a total spray volume of 35 L ha^{-1} with a G47T helicopter equipped with conventional boom and nozzle gear (D8-46 nozzles). Morning and evening application (divided into two parts due to weather conditions); temperatures were 9–13 °C, relative humidity (RH) 68–100%, and windspeed 0–6 km h^{-1} in the morning, and t15–17 °C, 52–56%, and 0 km h^{-1}, respectively, in the evening.	August 26, 1992 (1.18 hr)	2.0–2.5 ha
	E.B. Eddy	*4 L ha^{-1} of Vision® (356 g L^{-1} a.e. glyphosate as a water soluble liquid) applied in a total spray volume of 34 L ha^{-1} with a Bell 206 helicopter equipped with conventional boom and nozzle gear (36 D8-45 nozzles mounted on an 8 m boom, orientation 45°, boom pressure 234 kpa, air speed 120 km h^{-1}, track spacing 20 m). Morning application; temperatures were 10–12 °C, RH 82-97%, and windspeed 1 km h^{-1}.	*August 21, 1993 (0.02 hr)	100 x 200 m (2 ha)
Motor-manual brushsaw	Bending Lake	All non-crop vegetation was cut at ground level with a motor-manual brushsaw by the local forest company (then Boise-Cascade).	June 1993	2.0–2.5 ha
	E.B. Eddy	*All non-crop vegetation was cut at 25 cm above groundline with a Husqvarna 165 clearing saw.	*October 4–5, 1993 (4–8 hr)	50 × 100 m (0.5 ha)
Complete competition removal	Bending Lake	Annual backpack mistblower applications of a 2% solution (400 mL glyphosate in 20 L water) of Vision®. Plots were randomly located in aerial spray plots (aerial spray was the first removal). Note: the amount of Vision® sprayed via backpack application varied among plots depending on the amount of vegetation that survived previous applications; however, comparing the efficacy of different Vision® rates was not an objective of this study.	September 1993; August 1994	2.0–2.5 ha
	E.B. Eddy	*Annual direct foliar applications of a 2% solution of Vision® using a backpack sprayer and a flat fan nozzle. Plots were randomly located in aerial spray plots (aerial spray was the first removal). Note: Plots did not require application in 1994.	August 1993; June 1995; June 1996	40 × 40 m (0.16 ha)
Control	Bending Lake	Plots left undisturbed.	NA	2.0–2.5 ha
	E.B. Eddy	Plots left undisturbed.	NA	50 x 100 m (0.5 ha)

*[22]

Table S2. Data collected on crop trees, noncrop vegetation growth and yield, and biodiversity during the 25th growing season after aerial herbicide application, manual brushsaw cutting, and complete competition removal at two sites (Bending Lake and E.B. Eddy) in Ontario, Canada.

Indicator	Variable	Comments and calculations	Scaling for radar diagrams (calculations based on a scale of 0—100%, with 100% representing maximum/ideal conditions)
Biodiversity	Softwood richness (S)	Number of softwood tree species (dominate and subdominant tree layer) observed in a plot	Maximum softwood species richness per plot (6): 100%
	Hardwood richness (S)	Number of hardwood tree species (dominate and subdominant tree layer) observed in a plot	Maximum hardwood species richness per plot (5): 100%
	Shrub richness (S)	Number of shrub species (<0.5 m to 10 m shrub layer) observed in a plot	Maximum shrub species richness per plot (22): 100%
	Herb richness (S)	Number of herb species (herbs, grasses, sedges and ferns layer) observed in a plot	Maximum herb species richness per plot (24): 100%
	Tree abundance (abun)	Average ocular estimate of tree cover (dominate and subdominant tree layer) in a plot	Maximum percent tree cover per plot (61.66): 100%
	Shrub abundance (abun)	Average ocular estimate of shrub cover (<0.5 m to 10 m shrub layer) in a plot	Maximum percent shrub cover per plot (76.63): 100%
	Herb abundance (abun)	Average ocular estimate of herb cover (herbs, grasses, sedges and ferns layer) in a plot	Maximum percent herb cover per plot (105.80): 100%
	Shannon's diversity (H')	$H' = \sum_{s=1}^{S} p_s ln(p_s)$ where S equals the number of species in the understory and p_s is the proportional abundance of the s^{th} species [105]. $Ps = \frac{C_s}{\sum C_s} \cdot C_s$, the mean percentage cover of understory species s, was estimated in the field, and ΣC_s is the sum of all cover values included in the plot [28].	Maximum plot understory diversity (3.01): 100%

	Simpson's dominance (D)	$D = \sum_{s=1}^{S} {p_s}^2$ where ps equals the importance probability element s (element s relativized by row total) [28]. When D = 0, assume no dominant species and when D = 1, assume a single dominant species [106].	Maximum plot understory dominance (1.00): 100%
	Heip's evenness (E_{Heip})	$E_{Heip} = \frac{e^{H'} - 1}{S - 1}$ where S equals the number of species in the understory and H' is Shannon's diversity. E_{Heip} is the relative abundance of species [107]	Maximum plot understory evenness (0.94): 100%
Stand-scale growth and yield	Gross total (stems ha^{-1})	$Gross\ total = Conifer\ density + Hardwood\ density$	Maximum tree density per plot (5525): 100%
	Conifer density (stems ha^{-1})	For detail on calculations, see [29]	Maximum conifer density per plot (3600): 100%
	Hardwood density (stems ha^{-1})	For detail on calculations, see [30]	Maximum hardwood density per plot (4750): 100%
	Conifer basal area (m^2 ha^{-1})	For detail on calculations, see [29]	Maximum conifer basal area per plot (32.32): 100%
	Conifer inside bark volumes (m^3 ha^{-1})	For detail on calculations, see [31] [32]	Maximum conifer inside bark volume per plot (199.75): 100%
	Hardwood basal area (m^2 ha^{-1})	For detail on calculations, see [29]	Maximum hardwood basal area per plot (26.22): 100%
	Hardwood inside bark volumes (m^3 ha^{-1})	For detail on calculations, see [33]	Maximum hardwood inside bark volume per plot (202.30): 100%
Crop tree growth	Survival (%)	Dead – tree: remains of dead tree beside pin are present	Dead – tree present: 0% Dead – tree absent: 0% Healthy tree: 100%

	Dead – no tree: no tree or remains of a tree beside the pin Healthy: tree may have some deformities but is otherwise healthy Missing: no evidence of the tree or pin Unhealthy: visible evidence of tree being unhealthy	Missing tree: 0% Unhealthy tree: 50%
Total height (m)	Height of tree from ground to the highest live point (00.0 m for dead trees with DBH ≥10 cm)	Maximum individual tree height (16.9 m): 100%
Quadratic mean diameter (cm)	$QMD = \sqrt{\frac{BA}{k * n}}$ where BA is plot basal area (ha^{-1}), n is the total number of trees in the plot and k is a constant (0.0000785)	Maximum quadratic mean diameter (by plot) (15.85 cm): 100%
Stem quality (0 to 4)	0: dead/missing tree 1: normal straight tree, no crooks or defects 2: moderate crook or stem defects 3: slight crook or minor stem defects 4: major crooks or stem defects	0: not included 1: 100% 2: 75% 3: 50% 4: 25%
Stems with maximum form (%)	Stems with a stem quality rating of 1: normal straight tree, no crooks or defects	Percentage of individual tree stems with a stem quality rating of 1 (by plot)
Height to live crown (m)	Height of crown at the lowest live foliage (does not include epicormic branching or discontinuous branching)	Maximum individual tree height to live crown (10.5 mm): 100%
Branching (0 to 4)	0: dead/missing tree 1: very fine, lightly branching, diameters <30% of size of bole 2: fairly fine, moderate branching, diameters 31 to 40% size of bole	0: not included 1: 100% 2: 75% 3: 50% 4: 25%

	3: moderate to coarse branching, diameters 41 to 50% size of bole 4: heavily branched with very coarse branching, diameter >50% size of the bole	
Branch diameter (mm)	Average diameter of five largest branches within 50 cm above or 50 cm below DBH; measured as close to tree bole as possible perpendicular to branch	Maximum individual tree branch diameter (46.26 mm): 100%
Rings (per centimeter)	$\mathrm{RPI} = \left(\frac{a}{\left(\frac{d}{2}\right)}\right) - 1$ where a is the age of the tree in years and d is the diameter at breast height of an individual tree	Maximum individual tree rings per cm (5.24 per cm): 100%
Merchantable volume (m^3)	For detail on calculations, see [28]	Maximum individual tree merchantable volume (0.434 m^3 $tree^{-1}$): 100%

Table S3. *P* values from three-way analysis of variances (ANOVAs) for biodiversity indicators (ŋ=85) after vegetation management treatments applied on two sites (Bending Lake and E.B. Eddy) in Ontario, Canada. Statistical significance was accepted at Bonferoni adjusted alpha levels of $p<0.0125$ and $p<0.0167$ for simple two-way interactions at Bending Lake and E.B. Eddy, respectively.

Source of variation (fixed effects)	**Softwood richness**	**Hardwood richness**	**Shrub layer richness**	**Herb layer richness**	**Tree abundance**	**Shrub layer abundance**	**Herb layer abundance**	**Understory diversity (*H'*)**	**Understory dominance (*D*)**	**Understory evenness (E_{Heip})**
Site	<0.001	0.780	0.229	0.635	<0.001	0.050	0.049	0.660	0.528	0.039
Treatment	0.711	0.233	0.459	0.091	0.288	0.437	0.111	0.835	0.976	0.534
Site*Treatment	0.098	0.658	0.973	0.437	0.071	0.700	0.056	0.943	0.778	0.161

*Denominator degrees of freedom ranged from 2 to 6

Table S4. Species list for Bending Lake and E.B. Eddy sites 25 growing seasons after jack pine release treatments. Bolded names refer to species found only at the Bending Lake site and those with asterisk (*) were found only at the E.B. Eddy site.

Species	Common name
Abies balsamea (L.) Miller	balsam fir
***Achillea millefolium* L.**	yarrow
Acer rubrum L.	red maple
Acer spicatum Lam.	mountain maple
*Alnus viridis spp. Crispa (*Chaix) DC.	green alder
***Alnus incana* (L.) Moench**	speckled alder
Amelanchier spp.	serviceberry species
***Anaphalis margaritacea* (L.) Benth & Hook. f**	pearly everlasting
***Anemone quinquefolia* (L.)**	wood anemone
***Antennaria neglecta* Greene**	field pussytoes
Apocynum androsaemifolium L.	spreading dogbane
Aralia nudicaulis L.	wild sarsaparilla
Aster macrophyllus L.	large-leaved aster
Aster spp.	aster species
**Actaea spp.*	baneberry species
Betula papyrifera Marshall	paper birch
Carex spp.	all sedges
Chimaphila umbellata (L.) Barton	prince's pine
Circaea spp.	nightshade species
Clintonia borealis (Aiton) Raf.	blue bead lily
Cornus canadensis L.	bunchberry
Corylus cornuta Marshall	beaked hazel
Comptonia peregrina (L.) J.M. Coult.	sweet fern
Coptis trifolia (L.) Salisb.	goldthread
**Cypripedium acaule* Aiton	pink lady's slipper
***Diphasiastrum complanatum* (L.) Holub**	north ground cedar
Diervilla lonicera Miller	bush honeysuckle
Epilobium angustifolium L.	fireweed
Epigaea repens L.	trailing arbutus
***Fallopia cilinodis* (Michx.) J.Holub**	fringed black bindweed
All ferns[†]	fern
***Fragaria vesca* L.**	woodland strawberry
***Gaultheria hispidula* (L.) Muhlenb. ex Bigelow**	creeping snowberry
Gaultheria procumbens L.	wintergreen
***Galium triflorum* Michx.**	fragrant bedstraw
***Geum fragarioides* (Michx.) Smedmark**	barren strawberry
Goodyera spp.	rattlesnake plantain
All grasses	grass
Hieracium spp.	hawkweed species
* *Hypopitys monotropa* Crantz	pinesap
**Ilex mucronata* (L.) M.Powell, V.Savolainen & S.Andrews	mountain winterberry
**Kalmia angustifolia* L.	sheep laurel
**Larix laricina* (Du Roi) K. Koch	tamarack
**Ledum groenlandicum* Oeder	Labrador tea

Linnaea borealis L.	twinflower
All lichens	lichen
Lonicera canadensis Bartram ex Marshall	Canada honeysuckle
Lonicera hirsuta Eaton	hairy honeysuckle
Lycopodium clavatum L.	running club moss
Lycopodium lucidulum Michx.	shining club moss
Lycopodium obscurum L.	ground pine
Maianthemum canadense Desf.	Canada mayflower
Melampyrum lineare Desr.	cow wheat
All moss	moss
**Monotropa uniflora* L.	Indian pipe
**Oryzopsis asperifolia* Michx.	mountain rice grass
Orchid unknown	unknown orchid
Orthilia secunda (L.) House	one-sided pyrola
***Oxalis dillenii* Jacq.**	wood sorrel
Pilosella aurantiaca (L.) F.W. Schultz & Sch. Bip.	orange hawkweed
Pinus banksiana Lamb.	jack pine
Picea glauca (Moench) Voss	white spruce
Picea mariana (Miller) B.S.P.	black spruce
Pinus resinosa Sol. ex Aiton	red pine
Pinus strobus L.	eastern white pine
Polygaloides paucifolia (Willd.) J.R. Abbott	gay-wing milkwort
***Polygonatum biflorum* (Walter) Ell.**	solomon seal
Populus grandidentata Michx.	largetooth aspen
Populus tremuloides Michx.	trembling aspen
Prunus pensylvanica L.f.	pin cherry
Prunus virginiana L.	choke cherry
Pteridium aquilinum L. Kuhn	bracken fern
Pyrola spp.	pyrola species
**Ribes glandulosum* Grauer	skunk currant
**Ribes hirtellum* Michx.	smooth gooseberry
Rosa acicularis Lindl.	prickly rose
Rubus idaeus L. *ssp. strigosus* (Michx.) Focke	wild red raspberry
**Rubus spp. blackberry*	black berry species
Salix spp.	willow species
**Sorbus americana* (Marshall) Nieuwl	American mountain ash
Sorbus decora (Sarg.) C.K. Schneid.	showy mountain ash
***Spinulum canadense* (Nessel) A. Haines**	interrupted club moss
Streptopus lanceolatus (Aiton) Reveal	rose twisted stalk
Trientalis borealis Raf.	starflower
Vaccinium angustifolium Aiton	lowbush blueberry
Vaccinium myrtilloides Michx.	velvetleaf blueberry
Viola spp.	viola species
Viola renifolia A. Gray	kidney leaved violet

[†]Except bracken fern

Table S5. *P* values from three-way analysis of variances (ANOVAs) for stand growth and yield indicators (*n*=82) after vegetation management treatments applied on two sites (Bending Lake and E.B. Eddy) in Ontario, Canada. Statistical significance was accepted at Bonferoni adjusted alpha levels of $p < 0.0125$ and $p < 0.0167$ for simple two-way interactions at Bending Lake and E.B. Eddy, respectively.

Source of variation (fixed effects)	Gross total	Conifer density	Hardwood density	Conifer basal area	Conifer inside bark volume	Hardwood basal area	Hardwood inside bark volume
Site	0.149	<0.001	<0.001	0.002	0.039	0.003	0.001
Treatment	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Site*Treatment	<0.001	<0.001	0.729	0.056	0.008	0.020	0.024

*Denominator degrees of freedom ranged from 2 to 6

Table S6. Adjusted means for individual jack pine survival (n=560), stem quality (n=360), and branching (n=360), grouped by site x treatment variables after tending treatments applied on two sites (Bending Lake and E.B. Eddy) in Ontario, Canada. Statistical significance at $p < 0.05$, calculated only for variables with a significant main effect of site. Stem and branching were rated on a scale of 1 to 4, with 1 having best stem form and least branching.

Site	Treatment	Bending Lake	E.B. Eddy	*p* value
Survival (%)	Control	47.5 (5.6)	36.7 (6.3)	0.267
	Brushsaw	58.8 (5.5)	84.7 (4.7)	<0.001
	Aerial spray	72.5 (5.0)	81.7 (5.0)	0.233
	Complete removal	61.3 (5.5)	78.3 (5.4)	0.035
Stem quality	Control	3.0 (0.2)	2.0 (0.2)	<0.001
	Brushsaw	3.2 (0.1)	2.2 (0.2)	<0.001
	Aerial spray	2.8 (0.1)	2.2 (0.1)	0.007
	Complete removal	3.0 (0.1)	2.4 (0.1)	0.011
Branching	Control	2.4 (0.2)	1.7 (0.2)	0.011
	Brushsaw	2.3 (0.1)	2.2 (0.1)	0.930
	Aerial spray	2.3 (0.1)	2.3 (0.1)	0.411
	Complete removal	2.6 (0.1)	2.4 (0.1)	0.612

Table S7. *P* values from three-way analysis of variances (ANOVAs) for individual jack pine growth indicators (n=360) after vegetation management treatments applied on two sites (Bending Lake and E.B. Eddy) located in Ontario, Canada. Statistical significance was accepted at Bonferoni adjusted alpha levels of $p < 0.0125$ and $p < 0.0167$ for simple two-way interactions at Bending Lake and E.B. Eddy, respectively.

Source of variation (fixed effects)	Total height	Quadratic mean diameter	Height to live crown	Branch diameter	Rings per cm	Merchantable volume
Site	<0.001	0.791	0.062	<0.001	<0.001	<0.001
Treatment	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Site*Treatment	0.007	0.032	0.023	0.385	0.026	<0.001

*Denominator degrees of freedom ranged from 2 to 6