

Collation of on-going Canadian research on biomass harvesting and biodiversity

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In preparation for a workshop on *The Scientific Foundation for Sustainable Forest Biomass Harvesting Guidelines and Policies*, held in Toronto, Ontario, from 18-21 Feb. 2008, a collation of relevant, ongoing biodiversity studies was made, based on replies to a request for information that was circulated across Canada. Specifically, information was sought on current and unpublished Canadian studies that contribute to our understanding of the potential effects of forest biomass removals on biodiversity, habitat, or individual species. This collation complements a literature review undertaken by experts from across Canada that was presented at the workshop, and information presented by a panel of regional experts at the workshop. (These presentations are available as pdf files, along with other outputs from the workshop.)

Projects are listed from east to west, and sub-projects are listed in a smaller font and with the sub-project name indented.

For corrections or addition of studies not listed, please contact Elaine Mallory at elaine.mallory@ontario.ca.

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Explanation of column headings in the table:

Prov. = province where study is being carried out

Forest type: GLSL = Great Lakes-St. Lawrence, CWH = Coastal Western Hemlock, ESSF = Engelmann spruce-subalpine fir

Study type: Biomass = study on some aspect of forest biomass (no other organisms, no forest biomass removals); Habitat = habitat study, no forest biomass removals; Harvest = study on effects of usual harvesting practices (i.e. merchantable live stem removal); Extra = study on effects of extra forest biomass removals (e.g. removal of slash (full-tree harvesting), downed wood, dead trees)

Removal treatments = types of forest biomass removals being studied

Biomass type = types of forest biomass being studied

Project name	Prov.	Forest type	Contact	Study type	Removal treatments	Biomass type	Organisms studied
Taking Stock of Canada's Forests for Canadians: Mapping Carbon Stocks with Satellite Remote Sensing Data http://www.pfc.forestry.ca/eosd/biomass/index_e.html	NL, QC, NT	Boreal. ecozones: boreal shield, taiga shield, taiga plain	J. Luther jluther@nrcan.gc.ca	Biomass		live trees	
Effects of harvesting on dead wood	NL, NS		M.T. Moroni mmoroni@nrcan.gc.ca	Harvest			
Comparing measured and modelled forest carbon dynamics in Newfoundland boreal forests of harvest and natural disturbance origin	NL	Boreal	M.T. Moroni	Harvest	clearcut, fire, insects; chronosequence	live trees, snags, stumps, downed wood, buried wood, litter	
Comparing measured and modelled forest carbon dynamics in Labrador high-boreal black spruce forests of harvest and natural disturbance origin	NL	Boreal. black spruce	M.T. Moroni	Harvest	clearcut, fire	live trees, snags, stumps, downed wood, buried wood, litter	
Comparing measured and modelled forest carbon dynamics in old growth and recently harvested Nova Scotia tolerant hardwood forests	NS	Tolerant hardwood	M.T. Moroni	Harvest	harvest (not specified); chronosequence	live trees, snags, stumps, downed wood, buried wood, litter	
Dead wood abundance in Labrador high-boreal black spruce forests	NL	Boreal. black spruce	U. Hagemann	Harvest	clearcut, fire	dead wood (not specified)	
Dead wood abundance in recently harvested and old Nova Scotia hardwood forests	NS	hardwood	M.T. Moroni	Harvest	harvest (not specified); chronosequence	slash, downed wood	
Longevity and density of snags in post-harvest landscapes of western Newfoundland	NL	Boreal. balsam fir	C.Y. Smith	Harvest	harvest (not specified); chronosequence	snags	
Snag availability for cavity nesters across a chronosequence of post-harvest landscapes in western Newfoundland	NL	Boreal. balsam fir	C.Y. Smith	Harvest	harvest (not specified); chronosequence	snags	birds, mammals
Saproxyllic beetle species	NS, NB, PEI		C.G. Majka c.majka@ns.sympatico.ca				insects
Saproxyllic beetles of the Maritime Provinces of Canada	NS, NB, PEI	Atlantic maritime ecozone	C.G. Majka	Habitat			insects

Current biodiversity studies in Canada

Project name	Prov.	Forest type	Contact	Study type	Removal treatments	Biomass type	Organisms studied
Deadwood and saproxylic beetle diversity in naturally disturbed and managed spruce forests in Nova Scotia	NS	spruce	D.J. Bishop	Harvest	harvest (not specified)	dead wood (not specified)	insects
Saproxylic beetle (Coleoptera) communities and forest management practices in coniferous stands in southwest Nova Scotia	NS	coniferous	P.E. Dollin	Harvest	harvest (not specified)	dead wood (not specified)	insects
Dynamics of coarse and fine root biomass in eastern species of contrasting silvical characteristics	NB	coniferous, hardwood, mixedwood	M.J. Krasowski marek@unb.ca	Harvest	harvest (not specified); chrono-sequence	live trees, stumps, roots	
Impacts of forest management on the herbaceous layer	NB		M.R. Roberts roberts@unb.ca				plants
Effectiveness of leave patches in providing refugia for herbaceous-layer species	NB	not specified	M.R. Roberts	Harvest	harvest (not specified)		plants
Assessing the impacts of pre-commercial thinning on herbaceous species composition	NB	not specified	M.R. Roberts	Extra	pre-commercial thinning		plants
Diversity and abundance of ground and rove beetles in red spruce stands under different silvicultural regimes	NB	red spruce	J. Sweeney jsweeney@nrcan.gc.ca	Harvest	selective cut, strip cut, clearcut, plantation		insects
The effects of patch harvesting and site preparation on ground and rove beetles in yellow birch dominated forests of south-eastern Quebec - SSAM	QC	mixedwood, yellow birch	J. Klimaszewski jklimaszewski@cfl.forestry.ca	Harvest	gap cut (variable sizes), clearcut		insects
Diversity of saproxylic and epigeic beetles in balsam fir stands following spruce budworm outbreaks or harvesting – <i>L'île d'Anticosti</i>	QC	Boreal, balsam fir	C. Hébert hebert@cfl.forestry.ca	Harvest	harvest (not specified), insects	not specified	insects
Effects on biological diversity of partial cutting in the boreal forest of the clay belt - RECPA http://web2.uqat.ca/cpabitibi	QC	Boreal, black spruce	T. Work work.timothy@uqam.ca	Harvest	partial cut (variable retention), clearcut; chrono-sequence	deadwood (not specified)	plants, invertebrates, insects, birds, mammals
Deadwood pulse model – ECT	QC	Boreal, jack pine	S. Brais Suzanne.Brais@uqat.ca	Harvest	late commercial thinning, snag retention, cutting snags	snags, downed wood	plants, invertebrates, insects

Current biodiversity studies in Canada

Project name	Prov.	Forest type	Contact	Study type	Removal treatments	Biomass type	Organisms studied
Functional ecology of deadwood in the boreal forest – <i>SAFE & another area</i>	QC	Boreal. mixedwood, black spruce	P. Drapeau drapeau.pierre@uqam.ca	Extra	fire, salvage logging, partial cut (variable retention)	live trees, snags, stumps, downed wood, buried wood	plants, invertebrates, insects, birds,
Partial salvage logging trials – <i>Quévillion Fire</i>	QC	Boreal. black spruce, jack pine	P. Drapeau drapeau.pierre@uqam.ca	Extra	fire, salvage logging	not specified	insects
Saproxyllic colonisation and decomposition of woody debris after fire in the boreal forest – <i>Bas-Saint-Laurent</i>	QC	Boreal. coniferous	L. Sirois luc_sirois@uqar.qc.ca	Extra	fire, salvage logging	not specified	invertebrates
Effects on biological diversity of silvicultural systems inspired by natural dynamics in boreal mixedwood forests – <i>SAFE</i> http://web2.uqat.ca/safe/	QC	Boreal. mixedwood	S. Brais Suzanne.Brais@uqat.ca	Extra	partial cut (dispersed & aggregated retention), clearcut, full-tree, fire; removal & addition of downed wood	downed wood	micro-organisms, fungi, plants, invertebrates, insects, birds
Amount of down woody debris and its prediction using two stand characteristics in boreal and mixedwood forests of Ontario, Canada	ON	GLSL & Boreal	M.T. Ter-Mikaelian Michael.TerMikaelian@ontario.ca	Biomass		downed wood	
Development of Empirical versus Process-Based Habitat Element Curves for Habitat Projection Modeling	ON	Boreal	R. Rempel rob.rempel@ontario.ca	Biomass		live trees, snags, downed wood	birds
Nest tree selection by flying squirrels	ON	GLSL tolerant hardwood	J. Bowman jeff.bowman@ontario.ca	Habitat		live trees, snags	mammals
Impacts of harvest regimes on sustainable forest management in deciduous hardwood forests	ON	Carolinian & GLSL. hardwood	D.M. Burke dawn.burke@ontario.ca	Harvest			
The effects of partial harvest on the understorey vegetation of southern Ontario woodlands	ON	Carolinian. hardwood	D.M. Burke	Harvest	diameter limit, single-tree selection		plants

Current biodiversity studies in Canada

Project name	Prov.	Forest type	Contact	Study type	Removal treatments	Biomass type	Organisms studied
Response of salamander communities to partial harvest silviculture systems in the fragmented deciduous forests of southern Ontario	ON	Carolinian. hardwood	C.C. Vance	Harvest	diameter limit, single-tree selection	downed wood	amphibians
Effects of partial harvesting on cavity-nesting birds and mammals in the Carolinian forests of southwestern Ontario	ON	Carolinian. hardwood	K. Bavrlic	Harvest	diameter limit, single-tree selection	live trees, snags	birds, mammals
The effects of partial harvesting on cavity-nesting bird communities in southwestern Ontario	ON	Carolinian. hardwood	M. Straus	Harvest	diameter limit, single-tree selection, gap cut (variable size)	live trees, snags	insects, birds
Effects of single-tree and group selection harvesting on species richness and abundance of spring forest herbs in deciduous forests in southwestern Ontario	ON	Carolinian. hardwood	K.J. Falk	Harvest	single-tree selection, gap cut (variable size)		plants
Effects of single-tree selection silviculture on Ovenbird (<i>Seiurus aurocapillus</i>) demographics in the continuous deciduous forests of Algonquin Provincial Park	ON	GLSL. hardwood	J.P. Leblanc	Harvest	single-tree selection; chronosequence	live trees	plants, birds
The short-term effects of two experimental group-selection harvesting treatments on hoverflies (Syrphidae, Diptera) in the hardwood forests of Algonquin Provincial Park	ON	GLSL. hardwood	E. Proctor	Harvest	gap cut, gap cut with single-tree selection between gaps		insects
Forest management effects on coarse woody debris	ON	GLSL. hardwood	S.C. Thomas sc.thomas@utoronto.ca	Harvest	selective cut		
Decay dynamics of coarse woody debris in a northern hardwood forest depends on management history	ON	GLSL hardwood	M. Vanderwel	Harvest	selective cut	downed wood	
Impacts of selection forest management on coarse woody debris assemblages and bracket fungi community structure in tolerant hardwood stands	ON	GLSL tolerant hardwood	J. Shuter	Harvest	selective cut	live trees, snags, downed wood	fungi
A model of long-term dynamics of snags and downed woody debris under periodic surface fire, fire suppression, and shelterwood management	ON	GLSL pine	J.R. Malcolm jay.malcolm@utoronto.ca	Harvest	shelterwood, fire	snags, downed wood	
Some ecological effects of shelterwood harvesting and site preparation in white pine forests	ON	GLSL white pine	A.E. Morneau andree.morneault@ontario.ca	Harvest	shelterwood		
Effects on dead wood	ON	GLSL white pine	A.E. Morneau	Harvest	shelterwood	snags, downed wood	
Effects on salamanders	ON	GLSL white pine	A.E. Morneau	Harvest	shelterwood	downed wood	amphibians

Current biodiversity studies in Canada

Project name	Prov.	Forest type	Contact	Study type	Removal treatments	Biomass type	Organisms studied
Effects on plant diversity	ON	GLSL white pine	F.W. Bell	Harvest	shelterwood		plants
Forest Birds as Ecological Indicators for Alternative Retention Approaches – part of <i>Implementation of Enhanced Forest Productivity: A Pilot Project on the Romeo Malette Forest</i>	ON	Boreal. upland mixedwood	L.A. Venier lvnier@nrcan.gc.ca	Harvest	clearcut, dispersed & aggregated retention	live trees	plants, birds
Impacts of alternative mixedwood silvicultural on invertebrate assemblages – part of <i>SLAM</i> project http://www.mixedwood.ca/default.asp	ON	Boreal. aspen- dominated mixedwood	L.A. Venier lvnier@nrcan.gc.ca	Extra	full-tree, strip cut, clearcut, herbicide, planted & natural regeneration		invertebrates, insects
Effects of woody debris removal on nutrient cycling and biodiversity	ON	Boreal. mixedwood	J.R. Malcolm jay.malcolm@utoronto.ca	Extra	Horse logged, mechanically logged; removal & addition of downed wood	downed wood	fungi, invertebrates, insects, amphibians, mammals
The impact of biomass removal on understorey community assemblage, and exploration of site productivity implications in boreal conifer – part of Ontario <i>LTSP</i> project	ON	Boreal. black spruce, jack pine	H.M. Kershaw hmkersha@lakeheadu.ca	Extra	stem only, full-tree, full- tree plus forest floor removal	slash, litter	plants
NEBIE Plot Network - comparing the effects of natural disturbance and silvicultural practices of various intensities www.forestresearch.ca/product_catalogue/NEBIE%20fact%20sheet%202006.pdf	ON	Boreal & GLSL	F.W. Bell wayne.bell@ontario.ca	Extra		live trees, snags, stumps, slash, downed wood	plants
Sioux Lookout	ON	Boreal. jack pine, black spruce	F.W. Bell	Extra	full-tree, clearcut	live trees, snags, stumps, slash, downed wood	plants
Dryden	ON	Boreal. mixedwood	F.W. Bell	Extra	full-tree, clearcut, dispersed retention	live trees, snags, stumps, slash, downed wood	plants

Current biodiversity studies in Canada

Project name	Prov.	Forest type	Contact	Study type	Removal treatments	Biomass type	Organisms studied
Thunder Bay	ON	Boreal. mixedwood	F.W. Bell	Extra	full-tree, clearcut, dispersed & aggregated retention	live trees, snags, stumps, slash, downed wood	plants
Wawa	ON	Boreal. mixedwood	F.W. Bell	Harvest	stem only, clearcut, dispersed retention	live trees, snags, stumps, slash, downed wood	plants
Kapuskasing	ON	Boreal. mixedwood	F.W. Bell	Extra	full-tree, clearcut, dispersed retention	live trees, snags, stumps, slash, downed wood	plants
Timmins	ON	Boreal. mixedwood	F.W. Bell	Extra	stem only & full-tree, clearcut, dispersed retention	live trees, snags, stumps, slash, downed wood	plants
North Bay	ON	GLSL. tolerant hardwood	F.W. Bell	Extra	stem only, shelterwood, downed wood cut and piled	live trees, snags, stumps, slash, downed wood	plants
Petawawa	ON	GLSL. pine	F.W. Bell	Extra	stem only, shelterwood, salvage logging from wind storm	live trees, snags, stumps, slash, downed wood	plants
Use of arthropods and plants as biological indicators of forest ecosystem health and function in naturally burned and harvested boreal forest	MB	Boreal. black spruce, jack pine, mixedwood	R. Westwood r.westwood@uwinnipeg.ca	Harvest	harvest (not specified), fire; chronosequence	live trees, snags, slash, downed wood	plants, invertebrates
Short-term effects of cut-to-length versus full-tree harvesting on understory plant communities and understory-regeneration associations in Manitoba boreal forests	MB	Boreal. black spruce, jack pine, mixedwood	S.W. Kembel skembel@berkeley.edu	Extra	stem only, full-tree	slash, downed wood, litter	plants
Ecosystem Management Emulating Natural Disturbance Project (EMEND) http://www.emend.rr.ualberta.ca/	AB	Boreal. deciduous, mixedwood, spruce, deciduous with spruce understory	J.R. Spence John.Spence@ualberta.ca	Harvest	clearcut, partial cut (variable retention, dispersed & aggregated), fire, slash burns	live trees, roots, slash, downed wood	Micro-organisms, fungi, plants, invertebrates, insects, birds, mammals

Current biodiversity studies in Canada

Project name	Prov.	Forest type	Contact	Study type	Removal treatments	Biomass type	Organisms studied
Arboreal biodiversity across spatial scales (ABASS) http://web.uvic.ca/~canopy/ABASS.html	BC	CWH. Sitka spruce	N.N. Winchester winchest@uvic.ca	Habitat		live trees, epiphytic moss mats	invertebrates
Nitrogen fixation in tuberculate mycorrhizae found in coarse woody debris	BC	not specified	W. Chapman Bill.Chapman@gov.bc.ca	Habitat		downed wood	fungi
Characterization of the spider species assemblages in an ancient forest and a regenerating clear-cut	BC	CWH	C. Copely ccopley@royalbcmuseum.bc.ca	Harvest	clearcut		invertebrates
Pieces and Piles: evaluating the spatial distribution of ecologically representative coarse woody debris to provide guidance to forest habitat, fuel and timber management	BC	Sub-boreal Spruce; ESSF; CWH	M.A. Todd Melissa.Todd@gov.bc.ca	Harvest	harvest (not specified); chrono- sequence	live trees, snags, downed wood	
Evaluating the effectiveness of stand-level structure using arthropod functional groups (CREAP) http://www.for.gov.bc.ca/rco/research/silv/roberts_creek.htm	BC	CWH	M.A. Todd Melissa.Todd@gov.bc.ca	Harvest	harvest (not specified)	live trees, snags, stumps, downed wood	invertebrates
Structural Recruitment: factors affecting survival and growth of residual immature trees after clearcut overstorey harvesting	BC	Sub-boreal spruce; ESSF	M.A. Todd Melissa.Todd@gov.bc.ca	Harvest	clearcut	live trees	
Developing a strategy for the management of dead wood in forested ecosystems of west-central British Columbia	BC	Sub-boreal spruce; ESSF	M.A. Todd Melissa.Todd@gov.bc.ca	Harvest	harvest (not specified)	live trees, snags, downed wood	
Development of a model to predict the impact of forest management alternatives on dead wood supply	BC	Sub boreal and high elevation	S.C. DeLong Craig.Delong@gov.bc.ca	Harvest	harvest (not specified)	snags, stumps, downed wood	
The response of macrolichens and bryophytes (mosses and liverworts) on coarse woody debris (CWD) to environmental gradients	BC	Sub-boreal spruce	S.C. DeLong Craig.Delong@gov.bc.ca	Harvest	clearcut, retention patches (aggregated), insects	downed wood	plants

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Project name	Prov.	Forest type	Contact	Study type	Removal treatments	Biomass type	Organisms studied
Stand-level Biodiversity Effectiveness Evaluation	BC	forest districts throughout BC	N. Densmore nancy.densmore@gov.bc.ca	Harvest	clearcut, variable retention (dispersed & aggregated)	live trees, snags, slash, downed wood	
Green tree retention: a tool to maintain ecosystem health and function - at <i>STEMS</i> site www.for.gov.bc.ca/hre/stems	BC	CWH	S.J. Grayston sue.grayston@ubc.ca	Harvest	clearcut, variable retention (dispersed & aggregated)		micro-organisms, fungi, invertebrates
Northern Caribou Silviculture System Replicated Research Trial (<i>Itcha - Ilgachuz Alternative Silviculture</i>) http://cfs.nrcan.gc.ca/subsite/ferns/itcha	BC	Montane spruce; Sub-boreal pine-spruce	M.J. Waterhouse Michaela.Waterhouse@gems4.gov.bc.ca	Extra	gap cut (shelterwood & group selection, variable size); stem only, full-tree	live trees, slash	fungi, plants, birds, mammals
The effect of ants on carabid communities relative to vegetation characteristics at different successional stages after clear cutting	BC	Sub-boreal spruce	B.S. Lindgren lindgren@unbc.ca	Extra	clearcut; addition of downed wood	downed wood	insects
Manipulating woody debris to encourage fungi antagonistic to <i>Armillaria ostoyae</i> (root disease fungus)	BC	not specified	W. Chapman Bill.Chapman@gov.bc.ca	Extra	manipulation of downed wood (not specified)	downed wood	fungi
BC Long Term Soil Productivity Study (LTSP) www.for.gov.bc.ca/hre/ltsp/index.htm	BC	interior forest regions	S.M. Berch Shannon.Berch@gov.bc.ca	Extra	stem only, full-tree, full-tree plus forest floor removal	live trees, slash, litter	various studies ongoing
Sicamous Creek Silvicultural Systems Research Project http://www.mountainforests.net/sicamous/siccreek.htm	BC	ESSF	A. Vyse vyse@telus.net	Extra	single-tree selection, gap cut (variable size), clearcut; removal & addition of downed wood	live trees, downed wood	various studies ongoing

Current biodiversity studies in Canada

Project name	Prov.	Forest type	Contact	Study type	Removal treatments	Biomass type	Organisms studied
Does retention of downed wood help maintain stand-level functional biodiversity of mycorrhizal fungi in ESSF clearcuts	BC	ESSF	M.D. Jones Melanie.Jones@ubc.ca	Extra	clearcut; removal of downed wood	downed wood	fungi
Opax Mountain Silviculture Systems Research Project http://www.for.gov.bc.ca/RSI/research/opax/index.htm	BC	interior Douglas-fir	A. Arsenault andre.arsenault@gov.bc.ca	Extra	single-tree selection, diameter limit, gap cut, retention patches; removal & addition of downed wood	Live trees, snags, slash, downed wood	plants, insects, birds, mammals
Investigating the distribution of non-vascular plant species distribution on coarse woody debris and cut stumps	BC	interior Douglas-fir	A. Arsenault	Extra	all or subset of above (not specified)	stumps, downed wood	plants
Understorey protection operational trial	YK	not specified	A. Ogden aynslie.ogden@gov.yk.ca	Harvest	not specified	live trees, snags	plants, mammals
Monitoring the effects of post-fire salvage harvesting	YK	not specified	A. Ogden aynslie.ogden@gov.yk.ca	Extra	fire, salvage logging	downed wood	plants