Interim Progress Report on the EMEND Project

1 April 2000 - 30 September 2000

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Executive Summary. The past 6 months of CORE research conducted by the EMEND Research Corps have focused on the following activities: i) pulling root systems and estimating their volumes and biomass in association with the whole-tree productivity initiative begun in 1999; ii) collecting the second year of post-harvest treatment data from our experiment-wide plot system, including assistance with whole-experiment monitoring of arthropod biodiversity; iii) establishing an experiment wide-system of larger snag plots required to for life-history analysis of dead and dying trees; iv) assisting with research projects being conducted by graduate students and CFS personnel; and v) work with CFS and ALFS personnel to attempt to get more experimental burns underway during 2000. Significant CORE data have been collected and processed by other researchers involved in additional experiment-wide studies of fire ecology, understory vegetation, avian biodiversity, and climate. A booklet including an overview of EMEND and descriptions of all studies being conducted on site has been prepared and printed in association with the Sustainable Forest Management Network.

1. Overview of EMEND research. Field research at the EMEND site, and presently comprising the main thrust of the project, has two major components: 1) collection of experiment-wide or "CORE" data done mainly by the centralized Research Corps ("Core Crew"), as required to ensure that comparisons of all treatments can be made over all 4 forest types to answer the main questions that motivated the experiment (this year's work summarized in Table 1); and 2) research about more limited functional questions planned and executed by researchers interested in using a portion of the EMEND experiment as a template for their work. Work done under category 2 includes most projects by graduate students and those by research scientists interested in questions other than the "big-picture" questions addressed in the core experiment. Support provided by FRIAA is aimed mainly at the CORE work although more limited support is provided for category 2 projects by i) Core Crew assistance to individual projects (Table 2), ii) provision of the majority of camp costs, a feature that encourages a broad range of work at our site, which is far removed from the location of most research institutions and iii) a small number of small top-up grants for researchers working at EMEND.

Overall, 17 principal researchers and 68 associated research personnel (including 12 graduate students, 66 technicians, assistants or volunteers) used the EMEND facilities during the past summer (see Table 3) in addition to the 10 people directly associated with the "Core Crew". This was down *c.* 20% from the number of people using the camp last year. Overall 2581 camp nights were used, down *c.* 30% from 1999.

Research falling into category 2 continues to span a wide range of projects, including plant and animal biodiversity, forest health, forest genetics, fire studies, soil studies, hydrology, silviculture and meteorology. For the most part, work done this year represented the second year of post-harvest data collection for projects that will be able to make comparisons among the various harvesting schemes. Now that the second year of data have been collected, most researchers will be entering an analysis and reporting phase.

A total of 13 graduate student projects are being conducted at EMEND. One new MSc student, Joshua Jacobs (MSc student, U Alberta), initiated research this year on saproxylic insects and the response of beetles to experimental burns. Another MSc student, Rene Martin (MSc student, U British Columbia) was not at camp during the summer but is preparing her thesis in Vancouver. Most of the student projects have finished the data collection phase during 2000 and a number of theses are expected during the upcoming academic year. Refereed research publications will follow.

Details of projects underway in both categories are summarized individually in the attached booklet, *Ecosystem Management Emulating Natural Disturbance -- Research Study and Field Guide* compiled by D. Sidders and J. Spence and updated in August 2000. Thus, they are not repeated in this report. However,

the three main avenues of experiment-wide work that occupied the Core Crew during the past summer are laid out in the next section.

2. ACTIVITIES OF THE CORE CREW. As outlined in Tables 2 and 3 about 12% of Core Crew time was devoted to providing assistance to category 2 projects. Most Core Crew effort during 2000 focused on three experiment-wide projects as summarized below.

a. *Forest Productivity Estimates.*

In August 1999, 76 trees representing the dominant species (white spruce, trembling aspen or balsam poplar) in each of the original stand polygons were felled and disked at one-metre intervals. Branches, foliage and discs were sampled and dried to provide estimates of above ground biomass. During fall and winter 1999-2000, measurements of the aboveground data were collected from the samples and a database was established for this work.

During summer 2000, stumps of these 76 trees were pulled to provide estimates of below ground biomass. Table 4 gives the locations of and distribution of these stumps across the experiment. The stump pulling was done using Kamatsu Hoe (PC250LC) with bucket. The stump along with roots projecting 1m from the centre of each stump was removed. The hoe scraped a small landing beside the road to place the stumps. Each stump required 5-10 minutes. Moving the hoe between sites was a major time constraint.

It took 39 hours over 4 days to pull 64 stumps. 12 stumps were left on-site as the hoe could not travel along the trail routes. These 12 stumps were later removed using shovels and winches. After pulling stumps free from the ground, the clay soil was removed from the stump and roots using garden trowels and a water pump. Removal of the clay soil from the roots was the most time and labour intensive part of this study. In general, it required nearly a full day of work from 4-5 Core Crew members to prepare a single stump for measurements.

Below ground biomass was estimated by immersing the stump in a large tank of water and recording the volume of water displaced. Roots had to be severed from the main stump to permit immersion in the water tank for volume determination. Each stump was divided into three measuring categories: main stump, large roots, and small roots. For all roots projecting up to 1m from the main stump, they were classified as large roots if they had a diameter = 5 cm and small roots had a diameter < 5 cm. A sample root was selected from each stump to be returned to Edmonton for further measurements such as specific gravity determination.

Although time and resource intensive, this work will provide an unusual and incredibly useful baseline of site-specific pre-disturbance productivity at the site. In addition we propose to develop the best possible regression measures of for foliage, branch, stem and root biomass using easily measured tree

characteristics as the independent variables. The value of such data and analytical tools will become apparent in the future as investigators attempt to understand the long-term effects of the various harvest treatments in comparison to wildfire. The regression estimators, developed specifically for the EMEND site, will streamline and simplify the measurements required to accurately measure productivity in the future.

b. Responses of Arthropod Biodiversity to the Harvesting Treatments

Experiment-wide pitfall trapping for litter-dwelling invertebrates has been conducted at the EMEND site since 1998 to ascertain how assemblages of these invertebrates respond to cover type and disturbance treatment, and whether there is any interaction between these driving variables. During summer 2000 the trapping design was modified to ask whether there were any local responses to the different microhabitats provided by machine corridors, on the one hand, and the harvest strips or ellipses in which residual green trees have been left behind, on the other hand. In addition, we have further inflated the number of traps in the aspen-dominated compartments (252 traps vs. 150-156 in other cover-types) to discover how many traps, on average, must be used to catch 95% of the species occurring in these sites. The answer to this question is of high practical significance for designing future biodiversity studies in this ecosystem that are both effective and maximally cost-efficient.

David Shorthouse (a PhD candidate at U Alberta) has organized and managed the data collection aspect of this work during both 1999 and 2000, although his doctoral research will deal mainly with the spider component of the catch. The core interest in terrestrial beetles from this effort is being developed through cooperation between researchers at the U Alberta and Northern Forestry Centre. Up to now, these workers have handled the sorting and identification of the EMEND samples without core funding support. However, for the data to have maximum comparative value all 708 traps spread over all compartments of the study in association with the permanent EMEND plots (6/compartment) must be collected as simultaneously as possible. For this aspect of the study, assistance of the Core Crew has been essential and it accounted for a significant portion of Core Crew time during 2000 (effort summarized in Table 1).

Because some sort of surface layer habitat remains after any disturbance, epigaeic invertebrates may be developed as biological indicators of system recovery that are useful throughout succession. Together with changes in understory vegetation, which is expected to respond somewhat more slowly to disturbance, data about litter-dwelling invertebrate species or species groups should provide excellent indication of overall stand condition. Such indicators are important in view of EMEND's focus on the impact of residual structures. Careful study of litter invertebrates and understory plants will point the way to retaining sufficient heterogeneity both within and between stands to retain the biological basis of stand productivity as well as the lion's share of biodiversity.

c. Fate and of Snags and Dynamics of Coarse Woody Debris

After several discussions, Spence, Langor, Volney and Morneau decided that the present set of permanent EMEND plots would be insufficient to estimate 'life-cycles' (snag to incorporation in the humus) of coarse woody debris (CWD) across all treatments because relatively few snags were represented, especially in the low residual harvest treatments. Therefore, a new set of permanent 'snag plots' was established; these are spatially linked with the permanent EMEND plots and the larger 'growth & yield' plots established last year. The protocols are given below.

CWD was surveyed on the permanent 40 m^2 plots within each compartment as well along two temporary plot lines established at the southwest (SW) corner of each compartment to represent conditions on the edge. A total of 3949 snags within 784 plot lines were surveyed during summer 2000. Snags in this survey were defined as all standing dead woody material meeting the following three criteria: = 1.3 m tall; = 7.5 cm diameter at breast height (DBH); < 45º lean.

Snags meeting the above criteria were then recorded in regards to species, diameter, height, % bark, and decay class. During summer 2000, existing tree plots were temporarily extended to 40 m long x 10 m wide instead of 40 m^2. Two new temporary snag plots were set up along the SW corner of each compartment. They are located by measuring 25 m north or 25 m east of the SW corner of the compartment. These temporary plots are also 40 m long x 10 m wide. New snags will be recorded in periodic re-measurements as they enter the snag population.

Since the central focus of EMEND is on the fate and function of residual material left in the wake of harvests or natural disturbance, it is essential to have a reliable and accurate means of following the fate of snags from origin to incorporation into the soil. The work carried out during 2000 sets the stage for collecting the relevant data for the projected duration of the experiment.

Core Personnel. There were no changes to the core personnel between April and September 2000. It is anticipated that both Mr. Sousa and Mr. Morneau will leave the project during the spring of 2001 to pursue other opportunities. Both have done an excellent job in leading the Core Crew to a very productive and well organized summer of field work.

Changes to project design and methodology. There have been no significant changes to project design or overall methodology, except for the improved procedures to keep track of snag dynamics experiment-wise. These are summarized above (Section 2.c).

Status of the burns. To date, it has been possible to get off only two burns: 1) Cdom compartment 926 on 19 July 1999 and Adom compartment 943 on 26 April 2000. MSc student J. Jacobs has already begun work on the biodiversity changes in these two compartments. The EMEND site was monitored continuously during 1999 and 2000 and the important indicator parameters for conducting burns were compared with threshold values daily. So far, we have simply not had conditions that would allow controlled burns to be conducted safely. We remain hopeful for the 2001 season.

Status of the EMEND web site. The web site is revised periodically to release new information that characterize EMEND research. It received a major face-lift in mid-April 2000. Over 4000 viewers from around the world have visited our website. The website may be viewed in its new location at:

http://www.biology.ualberta.ca/emend/index.html

Technology Transfer Activities and Presentations. A group of Junior Forest Rangers was given a tour of the site on 11 August 2000. During September two permanent display gazebos were erected at the junction of the Canfor and DMI forest roads in preparation for the Grand Opening of the site held on 21 September 2000. This event, which included an overview and description of the project and field tours, was attended by more than 70 people including upper-level managers at DMI and Canfor, a high school biology class from Peace River, and representatives of other forest companies, the media, the provincial government, the SFMN and the University of Alberta. The event was repeated a week later for the Ottawa-based managers and regional Director Generals of the Canadian Forestry Service.

Presentations* (April - September 2000).

Shorthouse, D. Boreal spiders as indicators of forest disturbance and management, contributed presentation, Annual Meeting of the American Arachnological Society, Lexington, KY, USA, July 15-19, 2000 .

Spence, J., J. Volney, D. Shorthouse and L. Morneau. The EMEND experiment: forest biodiversity conservation in context, Annual Meeting, Society for Conservation Biology, Missoula, MT, USA, 9-12 June 2000.

Spence, J. Forest management and insect biodiversity, invited symposium presentation, International Congress of Entomology, 20-26 Aug 2000, Iguassu Falls, Brazil (J. Spence).

Volney, J. and J. Spence. Management of forest stand structure and insect assemblages: implications for the good, the bad and the ugly, invited

symposium presentation, International Congress of Entomology, 20-26 Aug 2000, Iguassu Falls, Brazil.

Volney, J. and J. Spence. Biodiversity and forest management in *Populus*-dominated forests of North America, invited symposium presentation, 21st Meeting of the International Poplar Commission, Portland, Oregon, USA, September 24-30, 2000.

* This is a short list of presentations that dealt explicitly with the experiment-wide objectives of the EMEND project. It is a small subset of the overall list of EMEND presentations. This latter list will be compiled for the next report.

Publications

Sidders, D. and J. Spence. 2000. Ecosystem management emulating natural disturbance: Research Study and Field Guide. Sustainable Forest Management Network.

Morneau, L. 2000. EMEND camp rules and field guide. (Internal).

Table 1. Summary of Core Crew Activities & Research from April 27 – October 31, 2000.

Project	Work Description	Total Number of Person-days of Core Crew Activity
Epigaeic Arthropods (John Spence/ David Shorthouse)	• Setting up and removing pitfall traps • Collecting spider samples	111.5
Fire Ecology (Bill DeGroot/ Pete Bothwell)	• Burn clean-up • Fuel inventory • Aspen removal by weather station	15.0
Forest Productivity (John Spence/ Jan Volney)	• Digging out and cleaning roots • Measuring biomass of roots	294.5
Snags (Dave Langor/ Darryl Williams)	• Surveying snags within permanent plots • Setting up temporary plots along edge of compartments • Classifying species, diameter, height, % bark, and decay class	171.5
Training, Orientation, and Infrastructure Activity[a]	• Bear awareness course • Chainsaw safety course • EMEND Trail maintenance • Emergency Response Plan Mock Incident Protocol Test • Quad safety course	111.5
	Total:	**704.0**

[a] Quad maintenance, vehicle maintenance, equipment and supplies purchases

Table 2. Summary of Core Crew assistance to other researchers from April 27 – October 31, 2000.

Project	Work Description	Total Number of Person-days of Core Crew Help Provided
Bark Beetles (Mary Reid/Jane Park)	• Setting up and removing Lindgren traps • Collecting beetle samples	10.0
Fungal Polypores (John Spence/Sheena Adamson)	• Collecting polypores	6.0
Genetics (Om Rajora/ Mohammed Rahman)	• Surveying new spruce seedlings	1.0
Hydrology (Ceceilia Feng/Greg Taylor)	• Collecting well and piezometer readings • Clearing trails for well drilling	39.0
Mixed-species Regeneration (Dan Gilmore/Carrie Becker)	• Counting germinants • Collecting seed traps	8.0
Moths (Louis Morneau/Michelle Dias)	• Setting up and taking down light traps • Collecting moth samples • Sorting moths	29.0
Saproxylic Beetles (John Spence/Joshua Jacobs)	• Setting up and removing window traps • Collecting beetle samples	6.0
Spruce Beetle Parasitoids (John Spence/Julia Dunlop)	• Setting up enclosures • Collecting parasitoids	2.0
White Spruce Regeneration (Jim Stewart)	• Snow transects • Counting white spruce seedlings	3.0
	Total:	**104.0**

Table 3a. CORE Activities and Research conducted by the EMEND Research Corps from April 27 – October 30, 2000.

EMEND Personnel		Association	Title	Number of days spent at the EMEND camp facilities							**Total**
				April	May	June	July	Aug.	Sept.	Oct.	**(April-Oct.)**
CORE ACTIVITIES & RESEARCH											
EMEND core crew											
Spence,	John	UofA	Researcher		1		1				**2**
Morneau,	Louis	UofA	Co-ordinator	4	30	17	23	20			**94**
Raza,	João	UofA	Associate co-ordinator		23	23	24	22			**92**
Adamson,	Sheena	UofA	Core crew		29	18	24	21			**92**
Knaga,	Paul	UofA	Core crew		23	23	24	22			**92**
McCormack,	Mark	UofA	Core crew			18	24	21			**63**
Pierce,	Julie	UofA	Core crew		23	23	24	22			**92**
Pollard,	Martin	UofA	Core crew	5	25	23	24	22			**99**
Taerum,	Stephen	UofA	Core crew		21	28	24	21			**94**
Vesey,	Meghan	UofA	Core crew		29	18	24	16			**87**
Work,	Tim	UofA	Volunteer				1				**1**
											808
Technology Transfer & Tours											
Gilmore,	Dan	UofMinn	Researcher						1		**1**
Kishchuk,	Barb	CFS	Researcher						1		**1**
Sidders,	Derek	CFS	Researcher						1		**1**
Spence,	John	UofA	Researcher						1		**1**
Volney,	Jan	CFS	Researcher						1		**1**
Taylor,	Carol								6		**6**
Taylor,	Rob								6		**6**
Morneau,	Louis	UofA	Co-ordinator						5		**5**
Raza,	João	UofA	Associate co-ordinator						5		**5**
Carlson,	Diane	CFS	Technician						3		**3**
Lambe,	Kim	CFS	Technician						1		**1**
Jones,	Travis	CFS	Technician						3		**3**
Thorsen,	Lori	CFS	Technician						3		**3**
Roberts,	Jessica	CFS	Technician						1		**1**
											38

EMEND Personnel		Association	Title	Number of days spent at the EMEND camp facilities							**Total**
				April	May	June	July	Aug.	Sept.	Oct.	**(April-Oct.)**
CORE ACTIVITIES & RESEARCH											
Biodiversity: birds											
Harrison,	Bruce	UofA	M.Sc. candidate		16	24	23				**63**
Dow,	Corry	UofA	Summer student		16	24	31	4			**75**
Quinn,	Shannon	UofA	Summer student		16	24	11				**51**
											189
Climate											
Hurdle,	Rick	CFS	Researcher	2	7	2		1	4		**16**
Epigaeic Arthropods											
Shorthouse,	Dave	UofA	Ph.D. candidate		6			8			**14**
Edwards,	Jason	UofA	Summer student		24	20	24	10			**78**
											92
Fire Ecology											
DeGroot,	Bill	CFS	Researcher	1							**1**
Bothwell,	Pete	CFS	Researcher	1							**1**
											2
Forest Productivity											
Volney,	Jan	CFS	Researcher					1			**1**
Myrholm,	Colin	CFS	Technician		3					2	**5**
Elofson,	Jon	CFS	Technician							2	**2**
Colgan,	Stephen	CFS	Summer student		3						**3**
Hamelink,	Amanda	CFS	Summer student		3						**3**
Read,	Jocelyn	CFS	Summer student		3						**3**
Volney,	Pete	UofA	Volunteer					1			**1**
											18

EMEND Personnel		Association	Title	Number of days spent at the EMEND camp facilities April	May	June	July	Aug.	Sept.	Oct.	**Total (April-Oct.)**
CORE ACTIVITIES & RESEARCH											
Soil Nutrients											
Kishchuk,	Barb	CFS	Researcher		2	2			1		**5**
Christensen,	Paul	CFS	Technician		16	6	6	2	10		**40**
Flynn,	Erin	CFS	Technician		8	6	6	2	10		**32**
Cassidy,	Susan	CFS	Technician		2						**2**
Fyles,	Jim	McGill	Researcher			2					**2**
											81
Understory vegetation											
Johnson,	Derek	CFS	Researcher				8				**8**
Bugden,	Lisa	CFS	Technician				8				**8**
Paton,	Marie	CFS	Technician				8				**8**
											24
Windthrow & seedbeds											
Carlson,	Diane	CFS	Technician		9						**9**
Lambe,	Kim	CFS	Technician		9						**9**
											18

CORE ACTIVITIES & RESEARCH							
Sub-total April	**Sub-total May**	**Sub-total June**	**Sub-total July**	**Sub-total Aug.**	**Sub-total Sept.**	**Sub-total Oct.**	**Subtotal Beds (April-Oct.)**
13	**347**	**301**	**342**	**216**	**63**	**4**	**1286**

Table 3b. Other Research Activities conducted by individual researchers from April 27 – October 30, 2000.

EMEND Personnel		Association	Title	Number of days spent at the EMEND camp facilities							**Total**
				April	May	June	July	Aug.	Sept.	Oct.	**(April-Oct.)**
OTHER RESEARCH											
Biodiversity: arthropods											
Bark beetles											
Reid,	Mary	UofC	Researcher			3					**3**
Park,	Jane	UofC	M.Sc. candidate	7	14	23	10	16	2		**72**
Dance,	Kerri	UofC	Summer student	7	14	18					**39**
											114
Lepidoptera											
Morneau,	Louis	UofA	M.Sc. candidate	1	1	1	1	1			**5**
Dias,	Michelle	UofA	Summer student		5	30	24	16			**75**
											80
Saproxylic beetles											
Jacobs,	Joshua	UofA	M.Sc. candidate	5	28	18	17	18			**86**
Decker,	Christine	UofA	Summer student	5							**5**
											91
Spruce beetles											
Langor,	Dave	CFS	Researcher		1						**1**
Williams,	Darryl	CFS	Technician		1					2	**3**
Hindmarch,	Trevor	CFS	Summer student							2	**2**
											6
Spruce beetle parasitoids											
Dunlop,	Julie	UofA	M.Sc. candidate		5	9	5	7			**26**
Caltagirone,	Gayle	UofA	Summer student		3	9	5	7			**24**
											50
Biodiversity: bats											
Barclay,	Robert	UofC	Researcher				4				**4**
Patriquin-Meldrum,	Krista	UofC	M.Sc. candidate		17	30	24	7			**78**
Chruszcz,	Bryan	UofC	Summer student		17	30	31	7			**85**
Hogberg,	Laureen	UofC	Summer student		17	30	24	7			**78**
											245

EMEND Personnel		Association	Title	Number of days spent at the EMEND camp facilities April	May	June	July	Aug.	Sept.	Oct.	**Total (April-Oct.)**
OTHER RESEARCH											
Biodiversity: bryophytes											
Mills,	Suzanne	UofA	M.Sc. candidate						2		**2**
Heinlen,	Jeff	UofA	Summer student						2		**2**
											4
Biodiversity: fungi											
Lazaruk,	Lance	UofA	M.Sc. candidate		6	6			3		**15**
Decker,	Christine	UofA	Summer student						3		**3**
Hahn,	Charlene	UofA	Summer student		6	6					**12**
											30
Biodiversity: plants											
Boreal canopies											
Kembel,	Steve	UofA	M.Sc. candidate		2		1	4			**7**
Hahn,	Charlene	UofA	Summer student		4		1	4			**9**
											16
Understory regeneration											
Fenniak,	Treena	UofA	M.Sc. candidate		6	13	7	6			**32**
Gregerwich,	Kirsten	UofA	Summer student		6	13	7				**26**
Hahn,	Charlene	UofA	Summer student					6			**6**
											64
Vegetation structure											
Stafford,	Ed	UofA	Technician		11			7			**18**
Charest,	Carey	UofA	Summer student		11			7			**18**
Hahn,	Charlene	UofA	Summer student		11						**11**
Mac Innis,	Chrissy	UofA	Summer student		1						**1**
											48
Genetics											
Rajora,	Om	UofA	Researcher				1	1			**2**
Rahman,	Mohammed	UofA	Researcher				1	1			**2**
											4

EMEND Personnel		Association	Title	Number of days spent at the EMEND camp facilities							Total (April-Oct.)
				April	May	June	July	Aug.	Sept.	Oct.	
OTHER RESEARCH											
Hydrology & Microclimate											
Hydrology											
Feng,	Cecilia	CFS	Researcher		10	12	11	15	5		**53**
Taylor,	Greg	CFS	Technician		10	12	11	15			**48**
Hillman,	Graham	CFS	Researcher					3	3		**6**
Incine,	Robyn		volunteer					3			**3**
											110
Silviculture											
Mixed-species regeneration											
Gilmore,	Dan	UofMinn	Researcher			5					**5**
Becker,	Carrie	UofMinn	M.Sc. candidate			26	26	16			**68**
Charman,	Catherine	UofA	Summer student			25	26	15			**66**
Haiby,	Kathy	UofMinn	Technician			6					**6**
Cryer,	Karen	UofA	Technician							2	**2**
Jacobs,	Joshua	UofA	M.Sc. candidate							2	**2**
Morneau,	Louis	UofA	Co-ordinator							2	**2**
Raza,	João	UofA	Associate co-ordinator							2	**2**
											153
White spruce competition											
Frey,	Brent	UofA	M.Sc. candidate		2			2	4		**8**
Hahn,	Charlene	UofA	Summer student		4			2	4		**10**
											18
White spruce regeneration											
Stewart,	Jim	CFS	Researcher		3			7		5	**15**
Jones,	Travis	CFS	Technician		12	9	7	17	10	5	**60**
Lin,	Felix	CFS	Summer student		10	7		10	4		**31**
Roberts,	Jessica	CFS	Technician		10			7		5	**22**
Taylor,	Shereen	CFS	Summer student		13	16	7	14			**50**
Thorsen,	Lori	CFS	Technician					10	10		**20**
											198

EMEND Personnel		Association	Title	Number of days spent at the EMEND camp facilities April	May	June	July	Aug.	Sept.	Oct.	Total (April-Oct.)
OTHER RESEARCH											
Silviculture											
White spruce survey											
Bleutchen,	Jeremy	ARC	Researcher		3						3
Nolan,	Luke	ARC	Researcher		3				5		8
Braon,	Adam	ARC	Technician						5		5
Lorenz,	Angela	ARC	Technician						5		5
Sames,	Christa	ARC	Technician						5		5
Varna,	Amar	ARC	Technician						5		5
Zeleny,	Kelly	ARC	Technician						5		5
											36
Soils & Nutrient Cycling											
Soil compaction											
Edwards,	Ivor	CFS	Researcher					4	7		11
Blank,	Martin	CFS	Technician			3	3	4	7		17
											28

OTHER RESEARCH

Sub-total April	Sub-total May	Sub-Total June	Sub-Total July	Sub-Total Aug.	Sub-Total Sept.	Sub-Total Oct.	Subtotal Beds (April-Oct.)
25	267	360	254	266	96	27	1295

	Total April	Total May	Total June	Total July	Total Aug.	Total Sept.	Total Oct.	Total Beds (April-Oct.)
CORE ACTIVITIES & RESEARCH	13	347	301	342	216	63	4	1286
OTHER RESEARCH	25	267	360	254	266	96	27	1295
	38	614	661	596	482	159	31	2581

A total of **92 people** used the EMEND camp facilities (April - October).
The subtotal number of days spent in camp for CORE Activities and Research (April - October) = **1286**.
The subtotal number of days spent in camp for Other Research (April - October) = **1295**.
The total number of days spent in camp for all EMENDers (April - October) = **2581**.

Table 4. Location of Stumps and Trees cut for Forest Productivity Research.

Map	STAND	Stump #	BP	TA	WS	TOTAL stumps/map	TOTAL stumps/Stand
A	77	87	1			4	4
		84 or 85	2				
		86		1			
		84 or 85		2			
B	66	81	1			4	4
		82	2				
		80		1			
		83		2			
C	42	25		1		14	4
		26		2			
		27			1		
		28			2		
	43	23			1		2
		24			2		
	44	33		1			4
		35		2			
		34			1		
		36			2		
	49	31		1			4
		32		2			
		29			1		
		30			2		
D	29	59		1		10	4
		60		2			
		61			1		
		62			2		
	31	51			1		2
		52			2		
	5	47		1			4
		50		2			
		48			1		
		49			2		
E	201/202	66		1		4	4
		68		2			
		65			1		
		67			2		

Map	STAND	Stump #	BP	TA	WS	TOTAL stumps/map	TOTAL stumps/Stand
F	121	37	1			10	4
		38	2				
		39		1			
		40		2			
	254/9104	41	1				6
		42	2				
		45		1			
		46		2			
		43			1		
		44			2		
G	303	13		1		6	4
		16		2			
		14			1		
		15			2		
	314	17			1		2
		18			2		
H	284	53		1		12	4
		56		2			
		54			1		
		55			2		
	306	63			1		2
		64			2		
	423	19		1			4
		22		2			
		21			1		
		20			2		
	445	57			1		2
		58			2		
I	9488/481/9493	7		1		6	4
		8		2			
		9			1		
		10			2		
	9481	11		1			2
		12		2			
J	582	1		1		6	2
		2		2			
	9601	3		1			4
		4		2			
		5			1		
		6			2		
	Total:		**8**	**34**	**34**	**76**	**76**