

Ecosystem Management Emulating Natural Disturbance Project

2014 Annual Report



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1) Executive Summary

2014 was the beginning of what is planned to be three years data collection (funding permitted) for the Year 15 Post-Harvest Assessment of the EMEND experiment. We started the 2014 field season with an ambitious and small but diligent core crew which began work on the year 15 data set. The Project received support from Alberta Environment & Sustainable Resource Development (AESRD) of \$133,000 (less U Alberta overhead) to support core programming. In addition, we were told that AESRD was able to add EMEND as a budgetary line item that could provide more certainty about continued support in the future and assure the completion of the 15 Year re-assessment in a timely manner. An unexpected jolt of funding of c \$250,000 also came to EMEND from Natural Resources Canada (NRCan), mainly for equipment purchases (which replaced some funding budgeted for this from AESRD), wages and contracts for the 10 Year Synthesis, and to provide graduate stipends during Jan-Mar 2015.

The 2014 Core Crew program was delivered by 2 Lead Core Crew members, and 2 Core Crew Field Assistants. This crew, made up of Zoltan Domahidi, Meghan Jacklin, Fatima Shire, and Julien Appleby-Millet were led by Amy Hayden in the role of Field Activities Manager while also serving as Project Coordinator. The 2014 Core Crew tackled the forest mensuration and forest health data collection, completing work on c. 327, of the 600, Permanent Sample Plots (PSP), dispersed throughout the 100 EMEND compartments. When necessary, baselines and PSP were re-marked to ensure site integrity. Linhao Wu a PhD student, funded through the China Scholarship program and supervised by John Spence, and his field assistant Jeffery Anderson assisted the Core Crew this year in collecting the experiment-wide arthropod data that is significant for the EMEND core biodiversity data set. New funding provided through the DMI/FRIAA-FRIP program provided support for four field assistants who worked with graduate students helping to deliver core objectives. Using funding from AESRD, the Core Program also hired Fatima Shire to enter the core data collected this field season, and a student assistant (Jeffrey Andersen) to help with sorting the arthropods collected this field season.



Core and Beetle groups avoiding the bugs

The EMEND Health and Safety Program was finalized and implemented this field season. The 2014 staff, students, and visitors embraced the plan and provided feedback on ways to enhance it. We intend to make the plan a 'living document' with scheduled checks to review it on an annual basis, both with University of Alberta's Environmental, Health and Safety (EH&S) personnel but also with the EMEND Partners. Significant additions to the Health and Safety Program during 2014 include Standard Operating Procedures, and Reference Procedures focused on winter work at EMEND that was initiated this year. The EMC had opportunity to review the 2014 year end statistics as well as season-end recommendations of the EMEND field coordinator. They have provided comment on actions recommended for 2015, and Health and Safety Plan enhancements. It is perhaps noteworthy that some funding agencies now demand evidence of safety

plan implementation in their grant funding contracts. EMEND is well-positioned and ahead of the game in this respect.

A number of graduate students and postdoctoral fellows in different stages of their projects worked at the EMEND site during 2014. These are funded mainly under the NSERC CRD and Strategic (WAM) Programs, and in 2014 included Matthew Robinson, Hosen Alam, Linhao Wu, Caroline Franklin, Kristen Whitbeck, Silvia Ronzani, Laureen Echiverri, and Zoltan Domahidi, who all spent their first field seasons at EMEND; Sarah Kahn and Dingliang Xing were recruited and started their data modeling projects this year; Sonya Odsen, Jared Amos, and Seung-Il Lee were all busy with analysis and writing during 2014-15, and thesis defenses are expected from all during 2015. Dr. Colin Bergeron, a Post-doctoral Fellow who is supported under the FRIAA-FRIP funding, finished a second field season in a project intended to quantify decomposition on the EMEND site.

Extensive fund-raising by the EMT during years leading up to 2014, have collectively garnered c. \$3.5 million in funding (and c. \$300,000 of in-kind donation) to support a diversity of specific projects during 2012-2016. This success underscores the continued relevance of EMEND's original aspirations and design today. Our partnership has also addressed current issues-of-the-day, management policy challenges, and the interests in broader society in science-based guidance to sustainability questions. Our academic, industry and government partners have risen to the challenge of preparing and presenting a strong business case for EMEND, and we remain hopeful that such efforts will bear the fruit required to carry the project forward toward its long-term goals. With these successful projects underway and some nearing completion, it is necessary and prudent to begin looking for future funding opportunities to support both core and graduate student work at EMEND



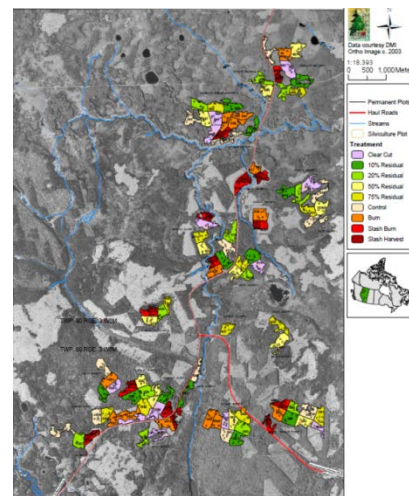
Graduate Work on Amphibians



Graduate Work on Fur Bearers

2) EMEND Project Introduction

The EMEND (Ecosystem-Based Management Emulating Natural Disturbance) Project, is a valuable and highly unusual resource, remotely located NW of Peace River, Alberta, Canada. The heart of EMEND is a large-scale (1000 ha) variable retention harvest experiment set within a 7000 hectare forested landscape which is protected for long-term ecological research highly relevant to sustainable forestry in the western boreal region. EMEND was originally designed to answer questions about how retention of green-tree residuals affects harvest cost, forest regeneration, patterns of succession, biodiversity, nutrient cycling, ground water characteristics and public perception of forestry activities, and to be a resource for developing science-based provincial policies about forest management. We believe that the project is the largest single site-manipulative forestry experiment in the world. It has been used by the Canadian government to illustrate the modern Canadian approach to forest management around the world, and since its inception it has inspired other research efforts around the globe. However, EMEND was the first of its kind, and the most advanced of these undertakings.



The experimental site has been developed through significant industrial and public investment. Project design and planning occurred during 1996-97 through many meetings of a scientific committee involving both federal and provincial government, universities and industry. The experiment was laid out in previously un-harvested forest in 1998-99, and harvest treatments were executed during the winter of 1999. Collection of the experiment-wide or “core” data required to monitor EMEND has been initiated at 5 year intervals, and given limited resources, 2-3 years are required to collect these data. The initial goal was to support world-class research activity for at least one stand rotation, or approximately 80-100 years. The experiment allows scientists to study a real working industrial forest, within the western boreal plain, from initial harvest through a first rotation harvest. This will provide unique insights into processes over an entire woodland life cycle. The project’s assets comprise an ‘experimental site’, a ‘remote field research facility’ (camp field lab), developed through contributions from the industry and the University of Alberta together with a large grant from the Canadian Foundation for Innovation, as well as some limited equipment (trucks, ATVs, chain saws, etc.). Keeping equipment up-to-date for safe use is a challenge for EMEND. It was addressed this year with an unexpected infusion of funds from Natural Resources Canada, and the promise of continuing funding from AESRD that could be partially directed at equipment needs.

Research funded through EMEND consists of two main components: 1) a core research program that is designed to elucidate long-term (i.e., >10 years) patterns of response to disturbance on the research site while answering questions defined by industry and government partners; and 2) a graduate student program that seeks to answer a broad range of focused scientific questions about the responses of biodiversity, productivity, and social values to variable retention harvesting through original scholarly research conducted at EMEND. Work under component #2 connects EMEND to a vibrant international research culture and provides exceptional educational opportunities to secure the interests of university-based scientists, while that under component #1 assists industry and governments directly with development toward objectives that can be defended today, and that are set in the context of the evolution of effective operating rules and policy for forestry in Alberta. Taken together these efforts comprise the double edges of the research and development sword, which we aim to keep as sharp as possible, given the resources available.

EMEND continues to inform management applications and policy in a way that balances social, environmental and economic values, so that the project remains relevant across northern boreal landscapes. While the program’s roots are founded in forest management questions, the fundamental knowledge of the structure and function of boreal ecosystems holds distinct value beyond the forest sector, and should be of significant value to any group attempting to manage boreal forest land, including the energy sector. The research site is readily accessible by an all-weather forest road that facilitates both research and demonstration of the benefits of EMEND to a wide variety of audiences. The project consequently enjoys regular visitors as well as growing national and international reputation for its design, credibility, long-range view and its longevity as a model partnership of industry, government and academic collaborators.

3) Structure of the EMEND Management Team

EMEND continues to see direction occur through an EMEND Management Committee (EMC) comprises representatives from core central partner organizations. Management of the research and extension program occurs through the University of Alberta (UA), with scientific leadership shared between the University of Alberta and Natural Resources Canada (through the Northern Forestry Centre (NoFC)). There was a small change in organization representation in 2014, including replacement of Shawn Barraclough, who changed job locations with the Government of Alberta (GOA), by Mark Crowley; and the retirement in late 2014 of Jim Stephenson with Canfor who has been replaced by Kari Stuart-Smith in the project management role. EMC members in 2014 included:

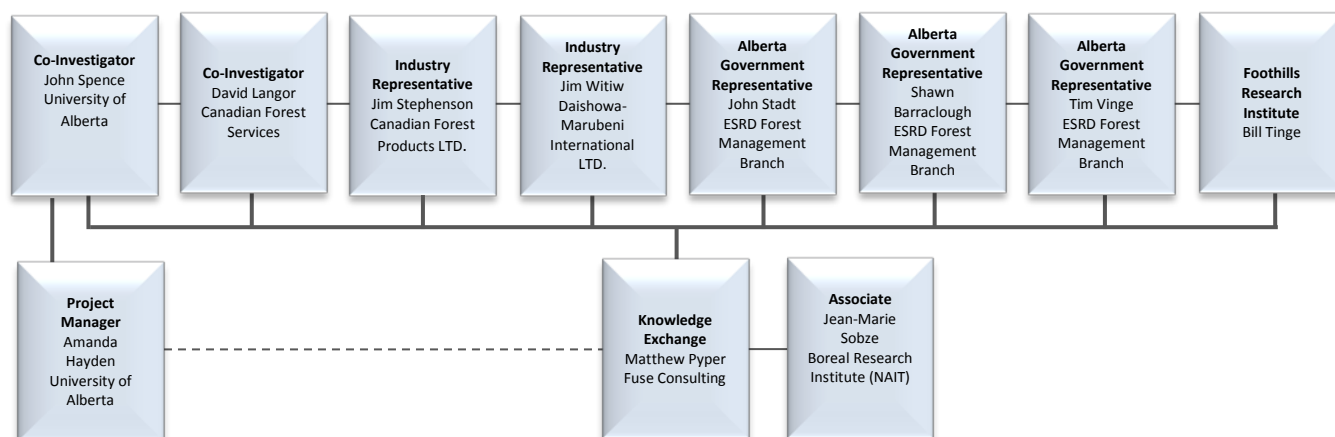
- John Spence (UofA, Science Co-Lead)
- Dave Langor (NRC, NoFC, CFS, Science Co-Lead)
- Jim Witiw (DMI)
- Jim Stephenson/Kari Stuart-Smith (Canfor)
- John Stadt (Alberta ESRD –Forest Management Branch)
- Mark Crowley (Acting) (Alberta ESRD –Forest Management Branch, Peace River)
- Tim Vinge (Alberta ESRD—Forest Management Branch)
- Bill Tinge (Foothills Research Institute)
- Jean-Marie Sobze (novaNAIT Boreal Research Institute, AFEX) (Associate Member)

NovaNAIT Boreal Research Institute, AFEX (BRI) is interested in joining the EMC as a full partner organization. They have brought a number of proposals for specific projects to the table, along with indicating that they wish to be involved both in the Core Project as well as current graduate programs in any way they can. The EMC endorses their potential role as a full partner.

Amanda (Amy) Hayden continues in the position of EMEND Program Coordinator. She coordinates the EMEND Program Activities, working closely with Drs. Spence and Macdonald (UA) and Langor (NoFC), to support development of the science and educational programs at EMEND. A Field Project Manager position is needed to assist Amy in the day to day running of camp and in organizing work of the Core Crew, to help alleviate an impossible work load during the field season.

Fuse Consulting, continues to be contracted by the EMC to facilitate the knowledge exchange program with external contract support, as determined by the EMEND partner organizations. Matthew Pyper, Fuse Consulting President and manager, is also contracted to assist in facilitating EMC meetings.

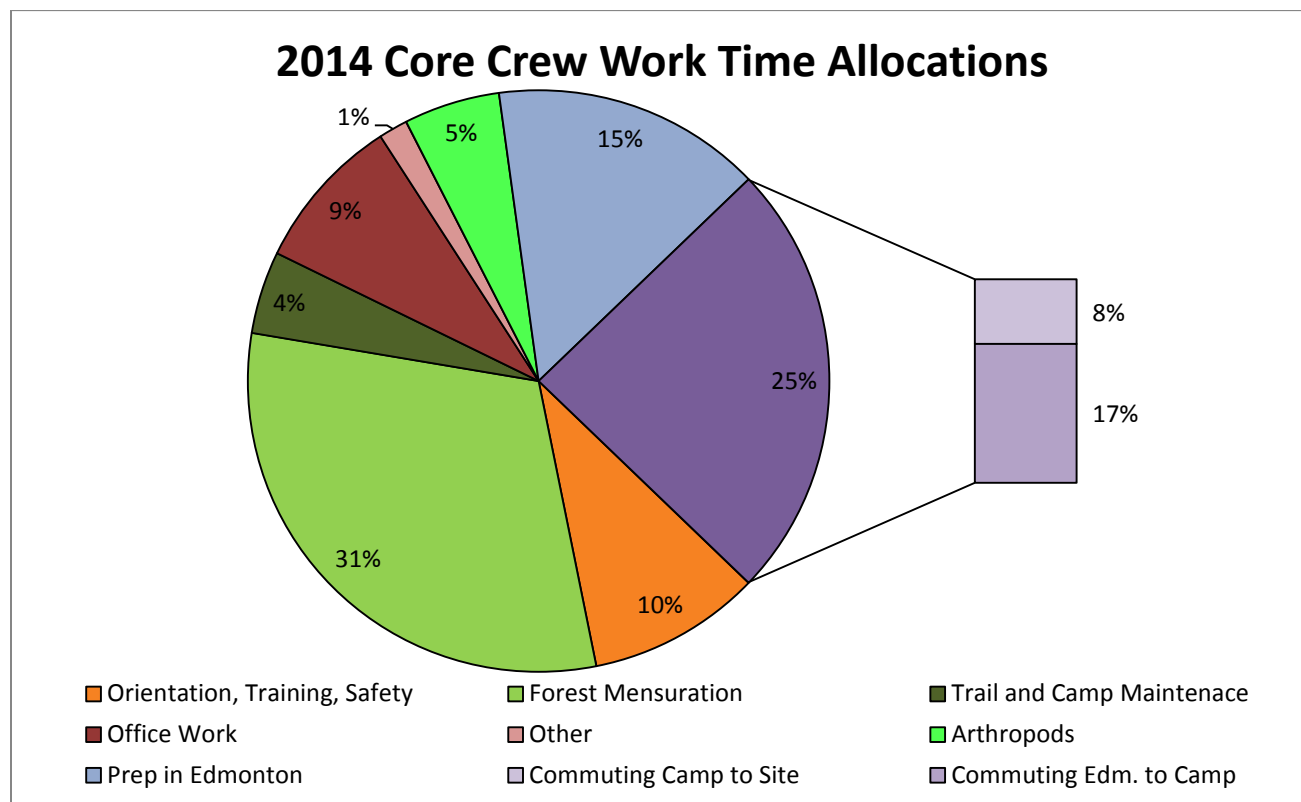
EMEND Management Committee Organizational Chart 2014



4) Core Activities

Core Activities Summary

2014 marked the start of the Year 15 Post-Harvest Core Data Collection. Please see the below diagram for a summary of Core Crew time allocations in 2014, 5 May to 12 September. It is important to understand that much of the field coordinator/project management time is not reflected in this chart, including: preparation of an employee handbook, training procedure, safety orientations, and the field season. It is interesting to see the large amount of time allocated to the commuting category, a trend that was noted in 2013. It is still notable in 2014, even with changes in timing of staff time-off.



Collection of forest mensuration and forest health data were top priority this season for the Core Crew, and absorbed 31% of their effort. Because of funding uncertainties we were unable to begin work programs for two of the four field assistants until mid-June. Meghan assisted in much of the paperwork preparation this spring, Meghan and Zoltan also assisted Linhao Wu and Silvia Ronzani with setting up the arthropod collection (5% of core-crew effort). We note that although this is a well-defined part of long-term core effort in achieving biodiversity objectives, Dr. Spence has linked this to the graduate program of Mr. Wu who is funded by off-shore scholarship funds, and thus makes fewer demands on core resources, while at the same time, ensuring that the core objectives are met. Although such efficiencies are possible and have been employed for meeting other core objectives (e.g., songbirds), resources to meet core objectives remain inadequate. While doing the forest health and forest mensuration the Crew was also able to complete some of the basic and required plot and baseline maintenance; however, this time is embedded within the forest mensuration percentage. More work on site maintenance is urgently required and without core resources to achieve this, shortcomings will become a safety and efficiency concern.

Orientation, training and safety activities included ATV training; bear awareness training, first aid training, driver assessments, camp and site safety orientations, road surveys, and safety meetings. These tasks comprised a combined total of



9% of the Core Crew's time. It should also be noted that Amy performed seven Safety Orientations prior to the EMEND field season and three orientations at the EMEND camp for research personnel arriving later in the season; students, field assistants, supervisors and lab technicians participated in these 3-4 hour safety orientations. Amy standardized these orientations by creating a power point presentation that can be tailored to the needs of the group of people attending the orientation.



Trail and Camp maintenance took up 4% of the Core Crew time. This includes the site up-keep (e.g., mowing of the grass at camp) and the assistance provided for the Peace River Junior Forest Rangers (JFRs), in July. The JFR assisted the Core Crew in a trail maintenance project which included cleaning up vegetation on the main trail in B. Without the help of the JFRs this important and much needed trail work would not be possible. We were also able to get the JFRs into the stands to see what our data collection looks like. They assisted both the Core Crew with forest mensuration and Silvia and Linhao with arthropod collection, providing educational opportunity in exchange for the excellent work that they did.

The chart attributes 9% percent of Core Crew time to office work. This included entering locations of PSPs into a new GPS, doing end of day paper work (including substitute for personnel with limited work schedule due to an injury), and assisting Amy with other tasks. It also includes the time of Zoltan Domahidi who took on many of Amy's tasks while she was away on holidays. Such work includes printing out data forms, providing weather updates, doing Field Safety meeting, work planning, and inventory all core equipment and supplies. The category "other" (1%) includes getting gas and other needs (supplies and equipment) from Peace River.

Another aspect of the Core Program in 2014 was the continued development of the EMEND Synthesis Report. Six chapters are actively under way, with 4 waiting for comment and further development, once the pressures of the academic term relent. Drs. Anna Dabros and Jaime Pinzon have been working on cleaning and analysis of the vascular plant data. A Post-doctoral student (Kristen Whitbeck) with an interest in bryophytes, organized identification problematic outstanding of core vegetation data with the help of Ellen Macdonald, Derek Johnson, Terri Hill, Richard Caners, and Rene Bellard. This is another example of efficiencies provided by the cross-over of category 2 research (as defined above) into category 1 effort.

Planned Core Activities - 2015

Many activities await the 2015 summer Core Crew, with the extent to which they can be engaged depending on funding (especially from AESRD) that eventually will materialize. We are hoping to have a 4-10 person crew for this season as there is much work to be done on the ground at EMEND. On 30 April, we await news of funding for the 2015 field season.

We were lucky enough to have received a FRIAA-FRIP Grant from a proposal written by Dr. Spence to help manage costs for the productivity studies within EMENDs core data: mensuration/forest health, silviculture, and snag assessment. This latter work should be more than enough to fully occupy the 4 people that can be funded under this funding during the 2015 field season. Without additional funds, the Year 15 Assessment will likely stretch into 4 or possibly 5 years.

More help is needed to complete the coarse woody debris, understory vegetation, and shrub plot data collection. We also acknowledge a presently un-funded requirement for continuing Core Crew effort for baseline and PSP maintenance. We are predicting that 4 people will be needed to do the understory vegetation assessment with an additional 2 people who are trained technically in bryophyte identification. Trail maintenance including bridge building and trail clearing has been removed from the core work plan on

the advice of the EMC. Instead, we will attempt an open FRIAA grant and hire a contractor for this work (including the fencing of an area at Old Camp).

The 10 Year Synthesis report is still on our radar and sections are planned to be ready for internal-team editorial review in mid-2015 with a targeted submission to publisher for technical editing-stage late 2015. The project is being led by a post-doctoral writing team in collaboration with the EMEND science leads.

5) Graduate Studies Activities

Graduate Student Activities – 2014-15

EMEND provides an invaluable educational opportunity for domestic and international post-secondary graduate students. We offer them simultaneous exposure to policy and management challenges, associated with the Canadian boreal forest across-sectors, through interaction with EMEND partners during the course of their research. 2014 saw the completion and final approval of the EMEND Graduate Student Framework (See Appendix: 2). A graduate student handbook was also created to ensure graduate students have adequate information about the project, field site, facilities, and more prior to going into the field.

We also ran our first (and by all accounts successful) partner/graduate student engagement session (a second is scheduled for Spring 2015). Six students visited the DMI Woodland Office Building in Peace River as well as the Canfor Woodlands Office and Mill. Graduate students presented a) proposed work, b) work that has been completed, or, c) work that has been completed and their proposed work moving forward. A number of employees from a variety of departments within our partner organizations participated to become more informed about EMEND, and especially, to help provide grad students with different perspectives of how/where their work could be used when complete. Partners were able to showcase on the ground use of EMEND research to graduate students in the field tour component of our partner/student engagement. In the upcoming summer a field tour was scheduled with partners to show students how EMEND research is being implemented on the ground. There was also a field tour hosted at the EMEND Site by Barry White of AESRD providing on the ground uses for WAM mapping.

Progress from graduate students funded under the NSERC CRD at EMEND:

Seung-Il Lee – PhD candidate with Dr. John Spence – Early colonization of white spruce dead wood by saproxylic beetles in mixed stands

During 2014 Seung-Il focused his time on writing his thesis. Three of his chapters have also been turned into papers, one of which has been published. He participated in a number of verbal and poster presentations as well. Seung-Il also lent some of his time to Colin Bergeron to assist in his field work. Seung-Il is expected to be ready to defend his thesis in September 2015. Seung-Il's published paper citation is:

Lee, S.-I., J.R. Spence and D.W. Langor. 2014. Succession of saproxylic beetles associated with decomposition of boreal white spruce logs. *Agricultural and Forest Entomology*. 16: 391–405.

Sonya Odsen—M.Sc. Candidate with Dr. John Spence—Boreal bird response to variable retention harvest

2014 was a productive year for Sonya. She has completed the first chapter of her thesis which is under review for publication. Sonya learned and mastered the Bayesian Hierarchical models which she is using to analysis counts of individual species given imperfect detection in the field. This is the topic of her second chapter which is currently being revised in association with her supervisors. Sonya also attended and presented at a few conferences, both provincially and internationally. She is expected to be ready to defend her thesis by September 2015.

Jared Amos – M.Sc. Candidate with Dr. John Spence—The effect of retention harvesting on pollinator population assemblages in the boreal forest of Alberta

Jared used a majority of 2014 to identify his collection of bees and hoverflies to species, with a small group identified to genus. Jared has been in contact with Cory Sheffield from the Royal Museum of Saskatchewan who is helping him to clear up uncertainties in the remainder of his identification. To date Jared has recorded individuals in 7 families, 44 genera, and 102 species from his approximate 1700 individuals. He is now in the analysis and writing stage. Jared has participated in a few conferences in which he verbally presented as well as created poster presentations. Jared is expected to defend his thesis in 2015.

Hosen Alam—Ph.D. with Dr. Soung Ryu—Can we create fire resilience landscapes under variable retention scenarios?

Hosen participated in an initial field season in 2014. Building on work of previous students and technicians in the Ryu lab, Hosen randomly laid out 3 replicated 40 meter transects and trenches in 5 retention blocks (20%, 50%, 75%, clear cut, and uncut) in compartment G. Within these transects duff samples were collected along with vegetation data (height, DBH, lowest live branch, crown, diameter, and length), and rain fall amounts. Hosen also installed thermal dissipation probes within each of his transects to continuously measure duff moisture throughout the summer season. During the fall season Hosen was able to start analyzing his data and writing a manuscript of some of his findings, he is hoping to have it published. Because Dr. Ryu is leaving the University of Alberta, effective 30 June, Hosen is dropping his effort back to an MSc program and is now preparing a thesis under the direction of Dr. Phil Comeau.

Matthew Robinson—M. Sc. Candidate with Dr. Scott Nielsen—Variable retention forestry's effect on amphibian populations

Matt was brought onto the project in May of 2014. During his first field season 12 amphibian breeding sites were identified by ground reconnaissance. In early May, egg mass counts were performed at each site to determine breeding effort (number of egg-laying females per site). Tadpole surveys were then conducted at each site every 14 days until tadpoles completed metamorphosis or until sites dried. These were done to assess growth and development of tadpoles under different forest canopy conditions. In June 2014, live-capture pitfall trapping arrays were installed in two harvest areas (Blocks A and G) to compare patterns of amphibian abundance and terrestrial habitat use among timber retention treatments. Trapping arrays were installed in 5 treatment compartments within each harvest area (uncut control, clearcut, 10, 20, and 50% timber retention). Live trapping occurred between July 18 and August 25, during which time traps were checked daily and captured amphibians were measured, weighed, ID-marked to trap site, and released.



Caroline Franklin—Ph.D. Candidate— Dr. Ellen Macdonald-- Thresholds of resilience and recovery for understory plants.—Dr. Scott Nielsen—How do fur bearers use landscapes harvested by variable retention?

Caroline was brought onto the project in the early spring of 2014. Her background made her interested in both fur bearer activity as well as understory vegetation. For this reason Caroline collected data for both sub-projects.



She collected data on understory vegetation composition (vascular plant species richness, individual species cover) and regeneration (sapling density) in two different types of variable retention harvesting (patch and dispersed) in conifer dominated stands at EMEND (0%, 10%, 20%, 50%, and 75% green-tree retention levels). In each compartment vegetation was sampled in eight 1 x 1 m quadrats placed in each the small patch retention, the large patch retention, and the dispersed retention areas. In addition to the harvested compartments (three replicates per treatment), eight 1 x 1 m quadrats were randomly placed in each of three control compartments.

Caroline's busy field season also included setting up a total of 25 motion-triggered cameras to collect fur barer use. These cameras were left for six weeks in June-July 2014 to detect the presence of lynx, wolves, coyotes, fisher, marten, hares, and squirrels in harvested and un-harvested forest stands. The cameras were distributed in deciduous dominated stands with conifer understory and a scent lure was applied at each station to attract target species. Six cameras were placed in forests with 10% green tree harvesting treatment 15 years ago, 13 cameras were deployed in forested stands that will be harvested within a year (located outside of EMEND), and the remaining six cameras were placed in control plots that were not and will not be subjected to harvesting in the near future. The cameras will be deployed this fall for at least one full year to determine the effects of partial harvesting on fur bearer distribution immediately after (1 year) harvest and 15 years post-harvest.

Zoltan Domahidi—M.Sc. Candidate— Drs. Scott Nielsen & John Spence—How do fur bearers use landscapes harvested by variable retention?

Zoltan was brought on to the project in September 2014 to assist Caroline in her field work and paper writing as a side project to his thesis, Boreal Owl use of Variable Retention Harvest sites, which will be funded under other funding, in the future. Zoltan will be doing the winter tracking component of the fur bearer data along transect within the EMEND landscape.

Kristen Whitbeck—Post Doctoral Fellow with Dr. Ellen Macdonald—Thresholds of resilience and recovery for understory plants

Kristen was brought on to the project in early 2014. She has spent approximately 70% of her time dedicated to this project including but not limited to identification of past bryophyte collections and herbaceous plants, database management, data assessment, managing field assistants and field technicians, as well as preparing for an oral conference presentation.

Linhao Wu—Ph.D. Candidate with Drs. John Spence and Fangliang He—Incorporating Succession into Temporal Variation.

Linhao started his project in early 2014. During his first and only field season he was focused on collecting carabid beetles specimen from pitfall traps within the EMEND PSPs. He collected three transects of six pitfall traps spaced 30 meters apart in 114 compartments, totaling 684 pitfall traps. Linhao will be using the 1999, 2000, 2004, 2009, and 2014 data to complete his dataset. Linhao is attempting to understand the variation of ground beetle assemblages in time, in relation to influences of habitat heterogeneity and disturbance and their interaction. In particular, he will focus on two main objectives: 1) Examining the variation of ground beetle assemblages across forest recovery stages after disturbance and habitat change; and 2) Modeling relationships among ground beetles and habitat features, disturbance and other environmental factors in each post-harvest stage.



Sarah Kahn—Ph.D. Candidate with Dr. Glen Armstrong—The trade-off between flow of wood products and conservation of biodiversity.

Sarah started on her project in June 2014 after difficulty on visa/immigration procedures. Kahn has spent most of her time familiarizing herself with the database, ArcGIS, current scientific literature, and modeling tools. She has met with a number of individuals to assist her in her project and has set her goals and an action plan in place.

Jaime Pinzon—Post Doctoral Fellow with Dr. John Spence

Jaime's position under the CRD is currently no longer funded. However he still spends approximately 20% of his time assisting students under the CRD and other projects with understanding the EMEND database, working with modeling and or data assessment tools. His support is critical to these programs.

Progress under FRIAA-FRIP/Industry funded Projects:

Colin Bergeron—Post Doctoral Fellow with Dr. John Spence—Local carbon dynamics associated with coarse woody debris (DMI)

Colin took the lead on a study of carbon dynamics in the boreal forest with emphasis on decomposition of coarse woody material on the EMEND landscape. First he reviewed the literature regarding proper methods of assessing biomass, carbon and other nutrient content from forest ecosystems. In the summer he along with Dr. John Spence, Seung-II Lee, and Linhao Wu, completed his sample collection. He collected two samples per tree, these logs were cut in 2002 and left decomposing in situ, for 12-15 trees of each aspen, balsam poplar, white spruce, pine, black spruce, and larch. He and his lab assistants completed laboratory measurements of biomass (wood density) and developed simple model of decomposition rate including tree species, eco-site, bole size and canopy opening for aspen, balsam poplar and white spruce. These results



were presented in a well-received oral presentation.

Furthermore, he prepared a subset of samples for nutrient analysis in collaboration with Dr. Sylvie Quideau that are now being process and results should be back in early 2015. Colin also supervised an undergrad student in the preparation of a manuscript that relates to carbon dynamics in the sense that we studied growth release of conifer in mixedwood forests at EMEND and SAFE during FTC outbreak, and concluded that reduced carbon sequestration related to aspen growth reduction by FTC may be offset, at least partly, by carbon sequestration due to growth release of conifer

species.

Valerie Kerbs—M. Sc. Candidate with Dr. Philip Comeau—Stand dynamics following canopy removal and release of advance regeneration in aspen and lodgepole pine dominated stands: Refining models of spruce release following understory protection harvesting. (Weyerhaeuser Canada)

Although Valerie's project was not funded under the EMEND strategic funding her work focuses on important process based questions which the Project's Lead Scientists felt would correlate directly to EMEND research directives. Valerie and her field assistant were able to take samples within the EMEND landscape which will be accumulating samples from across northern Alberta to assess white spruce (*Picea glauca*) reaction to strip cut harvesting (EMEND's 20% residual). Valerie sampled 45 white spruce at least 10m away from existing permanent sample plots. She collected data on sample trees, trees within 3.99m radius of selected tree, as well other variables. She also took hemispherical pictures from each stump. The data collected will help to improve the model behaviour of the Mixed Wood Growth Model (MGM) concerning yield of white spruce at strip cut understory protection sites.

Progress under the NSERC Strategic Grant: Wet Areas Mapping (WAM)

Kristen Whitbeck—Post Doctoral Fellow (initially M.Sc.) with Dr. Ellen Macdonald—Bryophytes as a predictor variable using WAM.

Kristen spent approximately 30% of her time working on this project. Two field assistants were hired to perform the field work required for this project so that Kristen could focus her time on bryophyte identification of past core collections.

Wiebe Nijland—Post Doctoral Fellow with Dr. Nicholas Coops (UBC)—Forest Structure using LiDAR and LANDSAT data

Wiebe used 2014 to prepare data, and maps related to forest structures using LiDAR, LANDSAT, and EMEND data. In the summer Wiebe was able to visit the site to take photos to document forest structure and get a better feeling for the EMEND landscape on the ground.

Silvia Ronzani—Ph.D. Candidate with Dr. John Spence—Epigaeic beetles as a predictor variable using WAM



Silvia began her project in January 2014. During her first field season Silvia set 70 pitfall traps in all the control stands. The sites were selected using LiDAR-DEM generated depth to water map to identify different levels of humidity. The traps were serviced every three weeks for a total of three collections and each trap was active for an average of 63 days. The specimens were sorted during the summer and all the ground beetles are going to be identified at the species level. All the traps are still active to describe the overwinter activity and the seasonal succession of carabid beetles. Silvia spent the fall taking classes, identifying specimen, as well as working on literature reviews.

Laureen Echiverri—M.Sc. Candidate with Dr. Ellen Macdonald—assessing the relationship between remotely sensed predictor variables and vascular plants.

Laureen started on her project in June 2014. This field season, she collected understory vegetation data along moisture gradients, identified by the Wet Areas Mapping (WAM) tool. The goal of this research is to determine if WAM can predict biodiversity patterns for understory vegetation. We also want to explore WAM's ability to predict recovery patterns of understory vegetation in partially harvested sites. Laureen and her assistant completed sampling in all the harvested blocks and were also able to collect data on forest structure for these plots.

Dingliang Xing—Ph.D. Candidate with Dr. Fangliang He—LiDAR predictive terrain modeling for forest productivity.

Dingliang was hired in December 2014. He spent this month becoming familiar with the project and data.

Planned Graduate Student Studies Activities- 2015

2015 will see an assortment of students in the EMEND graduate student mix thanks to the DMI/Canfor/NSERC collaborative research development grant; the WAM Strategic Grant; the DMI FRIAA-FRIP funding; as well as individual study projects taking place at EMEND. We look forward to bringing on new students to work on the biodiversity, wildlife, soils, fire, and social dimensions of the EMEND project as well as remote sensing and landscape scale management planning. These funding grants anchors the relevance of these diverse themes to the CCFM criteria defining sustainable forest management in Canada's boreal forest, with the intent of inspiring refinement or development of science-based management tools, practices and policy. 2015 looks to be a very busy year for graduate students with a potential of 10-15 graduate students working at EMEND this summer. A short summary on these projects can be found below. 2015 will see the partner/graduate student engagement tour and also include our government organizations.

NSERC-CRD Grant

1. **Seung-Il Lee—PhD Candidate (Spence)—*Early Colonization of white spruce dead wood by saproxylic beetles in mixed stands*.** Seung-Il will complete the writing of his thesis, with a proposed thesis defense for April 2015. Seung-Il's funding through the NSERC-CRD expired mid-2014, however due to funding for other students we were able to continue to fund Seung-Il until April 2015. Given the lack of other funds, he is being supported toward finalization and defense of his thesis under Dr. Spence's NSERC Discovery Grant. This is not sustainable or an option available for additional students and it compromises ability to meet the objectives of the NSERC proposal that secured the funds.
2. **Sonya Odsen—MSc Candidate (Spence)—*Boreal bird response to variable retention harvest over time*.** Sonya will be completing the writing of her thesis. Her thesis defense is proposed for April 2015. Sonya's NSERC-CRD funding expires mid-2014, however due to funding for other students, and her past ability to find additional funding for her work through competitive scholarships, we are able to continue to fund Sonya toward the expected defense of her thesis in 2015.
3. **Jared Amos—MSc Candidate (Spence)—*The effect of retention harvesting on pollinator population assemblages in the boreal forest of Alberta*.** Jared will be continuing to identify his specimens, analyze data and write his thesis. We plan that Jared will defend his before the end of 2015. Jared's NSERC-CRD funding expired mid-2014 but with the contribution from NRCAN we were able to provide a partial stipend for the period until 31 March 2015. Unless, additional funds are found Jared must be self-supporting during the balance of 2015.
4. **Hosen Alam—MSc Candidate (Ryu)—*Duff Moisture Dynamics*.** As mentioned above, Hosen is now focused on writing an MSc thesis under the supervision of Drs. S. Ryu and P. G. Comeau.
5. **Caroline Franklin--PhD Candidate (Macdonald)—*Thresholds of resilience and recovery for understory plants*.** Caroline will be starting her second field season in 2015. She plans to sample in deciduous dominated stands to ultimately compare the effects of dispersal types on understory vegetation between forest types. She will also collect data on vascular plant species presence in fixed areas within the different retention types and levels to gain a better understanding of the effectiveness of patch and dispersed retention on life-boating sensitive species. Caroline's funding is through the NSERC-CRD Grant, her original funding has been saved from previous years and will be put to use in future years due to a late start. She will have one field assistant. Caroline will also be assisting with the fur bearers project under the NSERC CRD with Scott Nielsen.
6. **Cassandra MacKenzie--M.Sc. Candidate (Quideau)—*Forest floor processes response to variable retention harvesting*.** Cassandra will not technically start her MSc until September 2015 (as she is an undergraduate student). However, she will have her first field season starting in May 2015. Cassandra will be studying soil characteristics on the EMEND site under the NSERC CRD Grant, her funding will be pushed back two years due to her late start.
7. **Matthew Robinson--M. Sc. Candidate (Nielsen)—*Variable retention forestry's effect on amphibian populations*.** Matthew will be starting his second field season in 2015, having completed his first field season prior to his graduate studies enrolment start date (September 2014). During the 2015 field season Matt and his field assistant will be installing trapping grids at a 3rd study site at EMEND and live-trapping will occur for the full duration of the field season (May – August) to allow collection of capture data during springtime movements (migration to breeding ponds and post-breeding dispersal to upland forest). Breeding pond sampling will be conducted as in 2014, but additional sites will be included that were identified late in the 2014 season. In addition, detailed habitat data will be collected at breeding

ponds and live-trapping sites to assess amphibian aquatic and terrestrial habitat suitability under different forest canopy conditions and among different timber retention treatments. The expected completion date for this study is September 1, 2015. Matt is studying amphibian populations on the EMEND landscape under the NSERC-CRD. He will have one field assistant.

8. **Zoltan Domahidi—M. Sc. Candidate/Caroline Franklin—PhD Candidate (Nielsen)—*How do fur bearers use landscapes harvested by variable retention?*** Caroline will continue her video collection during the summer field season (second). Zoltan Domahidi will be completing his first full season of winter field work collecting the tracking data. They are jointly completing this project under the NSERC-CRD.
9. **Kristen Whitbeck—PhD Candidate (Macdonald)—*Thresholds of resilience and recovery for understory plants*.** Kris has left EMEND to take a permanent job with an environmental consulting company in New Mexico, USA. Dr. Macdonald has recruited a new postdoctoral fellow who will take up the work in May 2015.
10. **Linhao Wu—Ph.D. Candidate (Spence)—*Incorporating Succession into Temporal Variation*.** Linhao will be identifying his specimen, and start the preliminary modeling of his work in 2015. He will be attempting partition year-to-year variation in biodiversity data (from 1999, 2000, 2009, and 2014) between effects of succession and annual variation in climate through on the ground research with carabid beetles. To do this Linhao will be sorting and identifying his specimen and running analysis. He will also attempt to start the writing of his thesis.
11. **Sarah Kahn—Ph.D. Candidate (Armstrong)—*The trade-off between flow of wood products and conservation of biodiversity*.** Sarah will be focused on modeling and data assessment along with preliminary writing for her thesis in 2015.

FRIAA-FRIP Grants

12. **Colin Bergeron—Post Doctoral Fellow (Spence)—*Local carbon dynamics associated with coarse woody debris. (DMI)*** Colin will be having his samples analyzed for nutrients; enter, check, clean, and analyze his data. Colin will also continue to produce papers for peer review. Colin's funding is through the FRIAA FRIP Fund and is scheduled to expire in January 2016.

NSERC-Strategic Grant--WAM

13. **Wiebe Nijland—Post Doctoral Fellow (Coops), University of British Columbia—*Assessment of forest structure metrics modeling using LiDAR and LANDSAT datasets*.** Wiebe will work with other students who are using his work for their projects. Wiebe's funding under the NSERC Strategic grant expired in early 2015. However he was able to find other funding to support his continued work on this project.
14. **PhD Candidate (Quideau)—*The relation and underlying processes of soil ecosystems to terrain gradients and vegetation cover*.** The individual for this position is still being recruited. This individual will potentially have their first field season at EMEND during 2015 where they will be studying questions related to the soil ecosystem, namely they will measure carbon fluxes, soil moisture in relation to the terrain gradients and vegetation and will investigate the underlying processes (e.g. differences in microbial activity) controlling differences. This project is funded under the WAM Strategic Grant. They will most likely have one field assistant.

15. **Silvia Ronzani—Ph. D Candidate (Spence)—*Using epigaeic beetles as a function of the predictor variables of landscape management***. This will be Silvia's second field season at EMEND she will be collecting epigaeic beetle samples throughout the EMEND Site across a variety of soil moistures. Silvia's funding is through the WAM Strategic Grant.
16. **Laureen Echiverri--M.Sc. Candidate (Macdonald)—*Assessing the predictability of remote sensed predictor variable and vascular plants***. Laureen will be conducting her second field season at EMEND. She is studying vascular plants under the WAM Strategic Grant.
17. **Kristen Whitbeck—PhD Candidate (was an M.Sc. Project) (Macdonald)—*Assessing the predictability of remote sensed predictor variables and patterns of bryophyte diversity***. Kristen will be conducting her second field season at EMEND during 2015 where they will be collecting bryophyte samples under the WAM Strategic Grant. They will most likely have one field assistant. Kris Whitbeck will be assisting with the identification of specimens.
18. **Dingliang Xing—Postdoctoral Fellow (Nielsen, Spence, Macdonald)—*LiDAR predictive terrain modeling for forest productivity***. Dingliang will be working closely with other students on this project to model terrain as a predictor of forest productivity. He will input new field data into his model to assist in finding new sample sites.

Other Students, Other Funding

19. **Additional Students:** There are no additional students at this time. However, other projects not associated completely to EMEND strategic funding could be studying varying topics across the EMEND landscape in the coming years.

The EMC hopes this renewal of EMEND research opportunity will also prepare enthusiastic students as the next generation workforce to meet the challenges of one of Canada's flagship sectors through a highly interactive university-industry-government collaboration. It is with this in mind that partner-graduate engagement opportunities are being developed for 2015.

6) Knowledge Exchange Program

The main objective of this knowledge exchange work is to ensure communication of research results to project partners, and ensure mutual learning between students and industry partners.

KE Activities Summary – 2014

The following activities were delivered as part of the EMEND CRD knowledge exchange program through Fuse Consulting. Fuse Consulting was contracted in 2014 to provide EMT approved Knowledge Exchange. Matthew Pyper, Fuse Consulting's president, has deep ties to the project which gives him and his employees an important perspective on our desired knowledge exchange program.

2014 saw the coordination and delivery of five EMEND student/partner engagement tours. These tours were designed to foster interaction and knowledge sharing between industry partners and students participating on the EMEND CRD, however all graduate students were offered the chance to participate. Overall feedback was extremely positive and students and partners have continued to dialogue following these tours. We believe our intended result to foster increased innovation and relevance in the students research, was successful through this new initiative.



EMEND Insights, plain language research summaries, are an important way for the project to deliver graduate student research to EMT members and other interested parties. A total of five research summaries are currently in the final stages of development.

EMT members felt it was important to develop an EMEND Current Activities Poster. This plain language poster summarizes the diversity of current research being conducted at EMEND was developed and is currently being used to showcase EMEND research in the offices of the industrial partners.

All knowledge exchange work is currently being funded through the EMEND CRD Knowledge Exchange component. Matthew Pyper, the knowledge broker also donated six hours as in-kind support.

Planned KE Activities – 2015

Fuse Consulting has been contracted to provide the following services and products:

- 1) Finalization of three EMEND Insights from 2014
- 2) Writing and layout of up to 3 new EMEND Insights research notes. Priority student profiles include: Colin Bergeron Ph.D. thesis, Suzanne Abele M.Sc. thesis, and Chris Pengelly M.Sc. thesis
- 3) Coordination and editing of 2 EMEND Insight research notes drafted by students. Priority student profiles include: Jared Amos M.Sc. thesis, and Seung-II Lee Ph.D. thesis.
- 4) Facilitation and coordination of the EMEND Partner Engagement Tours including: (a) spring session with GoA, DMI, and Cafor; and (b) a summer field session with GoA, DMI, and Canfor
- 5) EMEND Workshop Planning and Delivery
- 6) Project Management/Meetings

7) EMEND Infrastructure and Capital Investments

EMEND partners and researchers benefit from a range of infrastructure representing capital investments that support field activities and promotion. These include a University funded base camp and field lab (equipment, buildings), a temporary camp site, the research forest site compartments, all-weather road access, All Terrain Vehicles, and a visitor staging area. The project also relies on a website and database for storing and sharing data and project information. It is important that the EMT maintain an eye on the condition of these fundamental elements supporting the research effort. For a list of proposed projects and/or costs please see Appendix 4.

Camp Facilities

The EMEND Camp Facilities were heavily used during the 2014 summer field season, with just under 1200 person days. User fees, which are based on person days, were again implemented for users of the camp facilities including costs associated with catering, utilities, and maintenance needs; moving the camp into a self-sustaining model unsupported directly by any funding. Camp costs will continue in this manner unless funding/subsidies present themselves. Camp fees were approximately \$123/night per person.



As with previous years, EMEND contracted a catering company, Whitemud Wilderness Catering, to supply camp with a cook, food, cleaning services, water, waste disposal, and assistance in opening/closing the camp facilities. In 2015, we will be bringing the management of these services under the EMEND Project Coordinator and Field Project Manager positions. A cook and cooks assistant will be hired through the University and costs associated with these positions will be incorporated into the cost of using the camp facilities.

Students have continued to use the camp facilities without the usual amenities throughout the fall and winter season. A field toilet along with disposable bags with biodegradable gel was purchased for overnight use. There have been no user fees associated with this off-season use to date. However, we may want to consider some sort of fee to cover utilities.

Very little work was conducted around the camp facilities by the core crew. However, they did help cut the grass and clean up a number of junk piles around the yard (anything that was not needed was disposed of). Thanks to surplus funding from Natural Resources Canada, the Camp Facilities has been outfitted with (1) a new 4600L fuel tank (including removing old tank); (2) a better structure to protect the water tank; (3) three additional tents and frames; and (4) a hazardous materials storage cabinet.

A few areas were identified as potential topics to be addressed in the future: (1) more lab space/ATV storage is needed on site; (2) control of the noxious invasive weeds at camp; (3) camp night lighting enhancement or motion sensor to capture site incursions from the roadway beyond the gravel pad; (4) more accommodations including but not limited additional dining room space, washroom space, and bedrooms; (5) leaky lab roof repairs; (6) fire alarm system maintenance; and, (7) painting tent structure exteriors (all necessary supplies are already purchased).

Field Infrastructure

This year with the assistance of the Peace River Junior Forest Rangers trail maintenance was conducted in B with some minor fixes to the bridge. The Visitor Staging Area improvements continued with an expected

competition date within the winter of 2015. This was made possible through the Canfor FRIP funding. Thanks to surplus Natural Resource Canada funding a repeater tower was purchased and we hope to have it in place for the field season in 2015.

Trail and bridge maintenance should be considered areas of concern to be addressed in 2015 and future years. Many of the ATV trail in EMEND are becoming quite degraded (especially in wet areas). Solutions (ex. Hardening or moving) to this need to be considered in the near future or some sites may become inaccessible by ATV. There are a number of areas where bridges are needed to reduce the degradation of small wet hollow areas along the trails as well as the safety concerns of our users. Trail sign upgrades would also be helpful for new staff and graduate cohorts. It is hoped that another open FRIP funding proposal will assist in this work as well as to implement a small fenced area at Old Camp for ATV storage and overnight protection.



Two areas of concern for trail degradation

A second area to consider the partners should be aware of is the spread of prohibited noxious and noxious weeds at the EMEND site. Canada Thistle, Scentless Chamomile, and Knapweed (all designated noxious or prohibited noxious species under the Alberta Weed Control Act) have all been sighted at EMEND and all have the ability to take over a disturbed site rapidly.



Canada Thistle



Scentless Chamomile



Knapweed

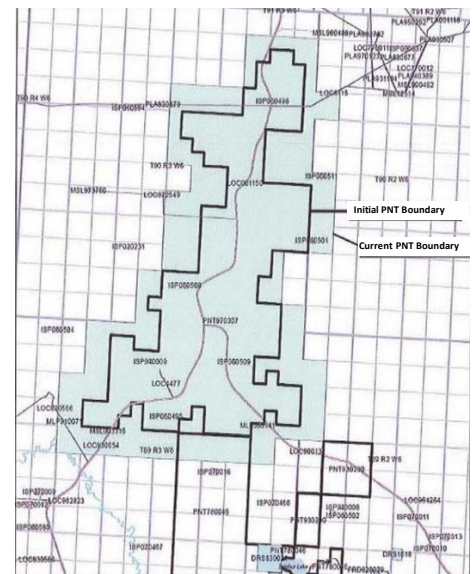
Field Equipment

2014 saw a very intensive year for the EMEND field equipment with all ATVs being used regularly during the field season both by Core Crews as well as graduate students in the Spence Lab. Thanks to the surplus NRCan funds 4 new ATVs, a 4 quad trailer, 2 Snowmobiles, 7 hand held radios, 2 Hypsometers, 3 hand held GPS devices, 4 snowmobile/ATV helmets, and a snowmobile ramp were purchased for EMEND core use. Chainsaws were used by trained staff for clearing large trees off trails and to aid in brush clearing. Chainsaw PPE was also purchased this year to ensure appropriate safety equipment was available (saw pants, helmet with visor and ear muffs). An additional GPS was purchased for use by the Core Crew to increase productivity (two teams). To see a list of the EMEND Core Fleet and Field Equipment please go to Appendix: 3. All ATVs, trucks, and trailers were maintained in Edmonton. Our inability to store the ATV fleet at Ellerslie Farm highlighted the need for ATV storage. Luckily the UofA Field Research Office (FRO) allowed us to use their 2 sea cans (which still didn't hold all the ATVs) this winter.

For the 2015 season at least 2 new handheld GPS devices, compasses, and calipers will need to be purchased, if a full eight person crew is on. All other field gear appears to be in good shape and ready to be used in the 2015 field season. To make data collection more accurate and to remove some human error it has been suggested that barcode scanners would be a great addition to the core field equipment. Since new handheld computers (PDAs) are also going to be required in the coming years (as our current equipment is running Microsoft XP—an expired operating system) these two devices could be combined into one device, as many “PDA” machines have barcode scanning capabilities. A member of the core crew also suggested having small digital cameras with the core crews; these could be used to document samples, and have an image of PSP through time, group photos, etc. It is also important to keep the renewal of the Core Crew vehicle fleet on your radars as it is aging and over the coming years will need to be replaced. We require graduate student researchers and other users to arrange their own vehicles. That being said this is becoming increasingly difficult for many supervisors who do not have the extra funding or lab fleets to provide this much needed equipment to their students. For a prioritized list of Equipment/Infrastructural needs please see Appendix 5.

EMEND PNT (Research Site Integrity Project)

The enhanced protection of the research forest lands (7000ha) and collective EMEND research investments in this site continues to be protected under a fairly strict PNT. This protection does not assure a solution for pre-existing sub-surface rights holders, however all surface land applications received by Alberta on the EMEND landscape will now see initial screening by Edmonton ESRD staff. It is relevant to discuss whether we will pursue stricter protection rights.



EMEND Website and Database

Canadian Forestry Service (CFS) continues to host the EMEND Website and database and provide the time and services of: Brad Tomm who maintains the database and Jon Elofson who maintains the EMEND website. Some minor changes to the EMEND website will be coming in 2015 to update the website and provide better information to students and supervisors.

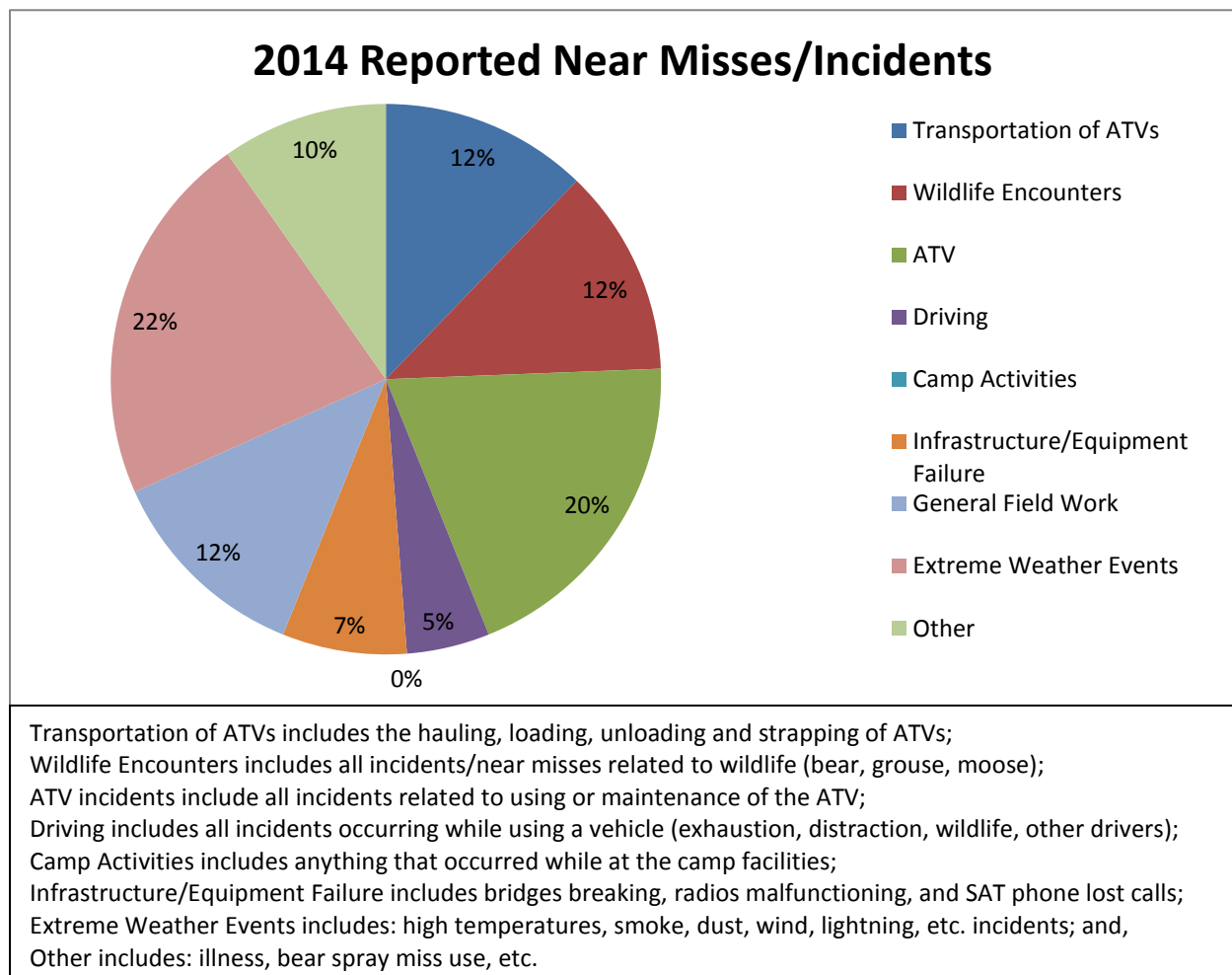
8) Health and Safety Program

2014 saw the finalization and complete implementation of the new Health and Safety Program with University of Alberta department approval and distribution to all Partners. This new document was due to the collaboration and hard work of Mr. Gord Winkle, Matthew Pyper, Dr. John Spence, and Amanda Hayden. The plan addresses Cardinal Rules, Required Work Practices, Critical Procedures, Certification and Training, Standard Operating Procedures, Referenced Procedures as well as numerous appendices related to safety at EMEND. This plan standardizes all Safety Protocols and ensures that all staff, students and users of the EMEND Site and Camp Facilities have the knowledge required to work safely and be prepared for most situations. It is anticipated that this living document will grow and change as needed by the project, partners, administration, and funding bodies. A standardized Safety Orientation has also been prepared and presented to all EMEND users, attendance and participation is mandatory. An initial 3-4 hour presentation has been designed and in use. It is anticipated that in the coming year a supplementary orientation will be added to provide a refresher course for returning users. This shorter orientation will highlight updates to the Health & Safety Program and to remind returnees of the most important aspects of the Plan.

The new document and orientation were well received by staff and students of the EMEND site, however the increased documentation was initially criticized, but after clarification and explanation was embraced by all who needed to use it.

2014 Near Misses/Incidents

In 2014, forty-one near misses/incidents were reported through documented reports or verbal communications. To see a complete list of these please see Appendix 6.



Of the forty-one documented near misses and/or incidents which occurred at the EMEND Site, Camp Facilities or while on EMEND business (traveling), most were minor in nature and all appeared to be dealt with appropriately (following emergency response plan, SOPs, etc.) at the time of the incident by those involved. One incident resulted in equipment damage (truck), and one in a visit to hospital facilities for assessment (sprained ankle and heat exhaustion).

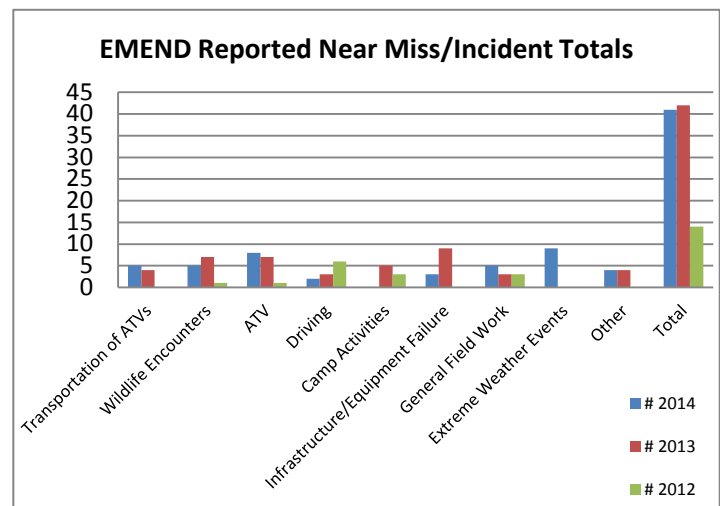
The largest number of incidents occurred under the category extreme weather events at nine reports. These included induced asthma due to excessive smoke (from NWT fires) and dust (dry roads), high wind events, and temperatures above 30°C. Those involved reported that once comfort tolerance levels had been reached users used proper safety decision making and either did one or a combination of the following: consumed more water, slowed their pace, took extra breaks, or halted work and returned to camp. Where temperature was concerned the Project Coordinator provided extra water and ice packs (for storage of extra water in vehicles), and electrolytes for extreme cases of dehydration. Extreme temperatures and heat injuries were discussed twice during the field season during safety meetings. Users were also informed about poor air quality days and told to limit their work during these days.

ATV incidents were the second highest recorded, at 8 reports. None of these resulted in injury or equipment damage and many were a result of trail maintenance and speed (not driving to the conditions). A couple included the need to use a winch. Early in the field season a demonstration and hands on workshop on proper winch use was a part of our safety meetings, and most found this beneficial as they had never used a winch before. Due to an incident caused by mechanic error a checklist was created for maintenance of ATVs and must be used unless suitable alternative is provided.

Transportation of ATVs, wildlife encounters, and general field work had 5 reported incidents each. This ranged from forgetting to attach the trailer to the vehicle before loading ATVs, to encountering wildlife in the forest, to trips and slips in the forest. All who encountered wildlife while on ATVs or foot all had bear spray available and ready, along with air horns and in some cases bear bangers; all proceeded to make more noise while backing off and giving the animal space. If the animal didn't look to be moving on most groups moved onto their next targeted area and came back at a later date. A big thank you goes out to Jim Witiw with DMI for providing the staff and students with a well-rounded Wildlife Encounters Safety Training.

Near Miss/Incident Trends – 2012-2014

Reported Near Misses/Incidents			
Type	# 2014	# 2013	# 2012
Transportation of ATVs	5	4	0
Wildlife Encounters	5	7	1
ATV	8	7	1
Driving	2	3	6
Camp Activities	0	5	3
Infrastructure/Equipment Failure	3	9	0
General Field Work	5	3	3
Extreme Weather Events	9	0	0
Other	4	4	0
Total	41	42	14



The above table and graph, provide us with a comparison tool which we can use to determine trending near miss/incidents to help us make additional changes to our Health and Safety Plan/Program. There is a definite

and potentially worrisome trend of near misses/incidents involving transportation of ATVs, Wildlife Encounter, and ATV use. These could be related to the increased number of EMEND users and/or better communication of incident near miss reporting; however, further measures will need to be taken to ensure adequate protection of our staff and students. Internally the University of Alberta is instituting an ATV policy which is expected to be out before the 2015 field season and an onsite ATV and vehicle training is in the works with university trainers.

A positive (decreasing) trend that can be seen is under the driving category. Our new driving policies (which restrict student and employee driving and communicate the safety implications of driving while exhausted, distracted, and in a hurry) seem to have reduced these instances.

Recommendations and Anticipated Changes in 2015

With winter field work creating a winter field season at the EMEND field site new policies and procedures are being put in place to ensure the health and safety of EMEND winter users.

We will also have to keep in mind the limited financial allocations to safety equipment and upgrades that could be encountered in coming years due to financial constraints. For example, the number of near misses resulting from ratchet straps loosening while ATVs are in transport may require yearly purchasing of new straps to maintain their integrity. ATV helmets should be replaced any time a helmet sustains a fall, or large hit, or is older than 5 years. Mandatory training costs are not covered by the university. Trail maintenance in busy data collection years is almost impossible and new bridge building unfeasible. Bear spray now expires annually or biannually and needs to be replaced regularly even if not used (bear bangers are similar). It is important for the continued integrity of the EMEND health and safety program it is important that a third party audit is performed. It is essential that safety trainings, equipment, and PPE be considered and included/added to future funding applications.

In 2013 the EMEND Management Team committed to a number of changes to the Health & Safety Program. Please see the list below to see the progress on each of these commitments.

- not only requiring ATV safe rider training and defensive driving for drivers but to also incorporate EMEND based training opportunities during orientation to provide employees and researchers an opportunity to learn different techniques required for the differences in their original training grounds and the conditions at EMEND. (eye lead time, mapping routes, maneuvering in mud, etc.) (in development with University trainers and EH&S)
- clarification of extreme weather incidents, (Completed through Safety Orientation)
- implementation of a “communications” board (will be used to inform on issues on the site, changes to the safety plan, and other pertinent information) for crews that are different schedules (completed),
- tailored safety meetings to noted trends in near misses and incidents (completed and very successful with staff and students)
- investigation of repeater antenna installation (repeater has been purchased through NRCan funding),
- desire to turn the Safety Plan material into other mediums besides a conversation (movie, power point, etc.), as well as have up-dated copies on the website (Safety Orientation has been standardized in a power point presentation, however we wish to create a web page for EMEND safety documentation, the new document will be added to the EMEND webpage by April 2015),
- proposed changes to the EMEND maps (not complete),
- up-dating of ATV PPE (helmets) (4 helmets were updated in 2014 and an additional 4 will be changed in 2015),
- proposal for ATV storage at Camp Facilities (not competed),
- implementation of stricter Safety checks on vehicles and ATVs (Completed),
- suggestions for purchasing hazardous material storage (competed),

- suggestion for motion censored lights or better lighting in parking lot at EMEND camp facilities (not compete)
- Train EMEND Coordinator and Field Program Manager in Incident Investigation (Complete)
- Including of root causes in near miss/incident reporting chart (complete)
- The university should consider engaging some form of annual 3rd-party audit of the Health and Safety Program to enable continual improvement cycle and arms-length assessment of its implementation and the documentation and field-evidence level. Such audits are a standard-of-practice assisting credibility and due diligence (Incomplete)
- In the coming years start compiling the near miss/incident information into a table that tracks incidents (including per capita) so as to be able to better identify changing trends. (complete)
- Re-initiate the Emergency Response plan testing with assessment and feedback. (incomplete, scheduled for 2015 field season)

EMEND Management has assessed the current years incidents and has/is taking steps to incorporate measures to reduce the probability of these occurring in the future. This includes but is not limited to:

- Implementation of ATV Safety Check lists (completed)
- Implementation of Vehicle Safety Check Lists (completed) (UofA protocol cleared up by admin)
- Implementation of Maintenance Checklist (complete) to ensure all work is completed by mechanics.
- Contracted trail maintenance and bridge building plan and proposal (August 2015)
- Clarification from University of Alberta on Religious traditions and field work (April 2015)
- Updated Wildlife Safety Protocol to include mandatory bear banger presence with users without close vehicle/ATV presence (April 2015)
- Enhanced Safety Orientations for foreign staff and students who are not used to Canadian Safety Standards/English as a 2nd language, etc. (April 2015)
- Add extra water (cold) and electrolyte to safety gear required by users (completed)
- Implementation of a Camp Seasonal Safety Checklist (April 2015)
- Inclusion of Bear Bangers to SOP Transportation and Use of Bear Spray (April 2015)
- Having complete sign off on the EMEND Health and Safety Plan by the University of Alberta Environmental Health & Safety Department (EH&S). (April 2015)
- Inclusion of winter field work policy and protocols (completed)
- Addition of a trailer loading and unloading cheat-sheet added to the vehicle safety documents (April 2015)

9) Funding & Financials

The EMEND Project relies solely on the support of partner agencies and funding bodies for the running and management of all work (Core and Graduate) surrounding the EMEND Project. Currently financial funding is coming from the Government of Alberta (GoA), the Government of Canada (GoC) (NRCan), Natural Sciences & Engineering Research Council (NSERC)—Strategic & CRD grants, DMI, and the University of Alberta (UofA). We also rely on a large amount of in-kind contributions which come from UofA, GoA, GoC, DMI, Canfor, UofA, NAIT Boreal Research Institute (BRI), Foothills Research Institute (FRI), and numerous other agencies. Please see Appendices: 7 and 8 for more information on past, present and expected future funding and Appendix 9 for important funding dates. All amounts in tables have been rounded to the nearest dollar.

Core Activity Financial Summary – 2014

Funding support for the 2014 Core activities at EMEND was provided by the AESRD (Biodiversity), and the DMI/FRIAA-FRIP Funding (Productivity) and the SRD (FRI) Legacy funds.

Foothills Research Institute Legacy Funds

This funding was used to support core activities and camp upkeep expired on March 31, 2014. All funds were used completely. It covered a small amount of utilities costs and wages and benefits of Jaime Pinzon a Post-Doctoral Fellow who is assisting with writing the 10 year synthesis report as well as data management and support. The funds that were left over in 2014 were nominal and did not warrant a 2014 FRI work plan submission.

FRIAA-FRIP (DMI): Core Productivity and Coarse Woody Debris

DMI FRIAA-FRIP Funding was awarded to the program for Core Productivity data collection and Coarse Woody Debris analysis. This funding is for \$150,000 a year for two years, 2014 and 2015.

Although slightly under budget, this project is moving along smoothly. Over expenditures in lab and field supplies are a result of needing to purchase most of the field needs for the two years in the first year (calipers, GPS, safety gear, etc.) these will not need to be purchased in 2015 therefore the costs associated will be lower.

Alberta Environment and Sustainable Resource Development Funding

AESRD was able to add EMEND funding as a budgetary line item enabling them to ensure a minimum funding allocation on a yearly basis. In 2014, \$133,000 was provided to the EMEND Project for Core work (biodiversity) and other project needs. The University however takes 20% of the award in overhead leaving a functioning budget of just over \$110,000.

In 2014 Jaime Pinzon's wage, a Lab assistant, and a data entry clerk were paid from this account. Approximately \$5000.00 of the Project Coordinator's wages was also paid from this account. The computers at EMEND as well as in the office of John Spence badly needed updating, the costs associated with this were also incurred on this account. All other expenses were expected, albeit a bit higher than expected for lab supplies, however, equipment that was updated in 2014 will not be in 2015. Camp fees were much lower due to costs off-set from the FRIAA-FRIP funding.

Two budgets for 2015 have been provided, the first is a best case scenario the second is a budget that would be similar to the 2014 budget. In the best case scenario we would hire 6 field assistants for 4 months, 4 regular core crew and 2 who would be focused on bryophyte identification; 1 data entry clerk for part-time

work for 6 months, and 2 lab technicians at part-time work for 6 months. These estimates include wages and benefits. In a similar budget to this year we would hire 2 field assistants, 1 data entry clerk, and 1 lab technician. Both scenarios have camp fees for the number of staff needed at 112 days.

Other Core Funding

In 2013 the EMEND Project received a grant from the University of Alberta that covered \$30,000 of our EMEND Project Coordinator/Field Project Manager positions for the years 2013, 2014, and 2015.

The EMEND Core Program also received an influx of funding from Natural Resources Canada that provided approximately \$251,000 for equipment upgrades and needs as well as to fund some work to help complete the 10 Year Synthesis Project, identification for the 15th year Data collection, and grad student work. Equipment that was purchased includes: 4 ATVs, trailer, 2 snowmobiles, 1--4600L fuel tank (and related expenses), water tank protective structure, 3 handheld GPS devices, fencing for old camp, PPE, hazmat security cabinet, 3 canvas tents and frames, 15 bed frames and mattresses, 3 hypsometers, 7 hand held radios, and a repeater.

Grad Studies Activities Financial Summary – 2014

Funding support for the 2014 grad student activities at EMEND came in the form of a NSERC-CRD agreement; DMI-FRIAA-FRIP; and, the NSERC-Strategic grant for WAM research.

NSERC-CRD Funding

The NSERC CRD grant provides 5 years of funds with financial and in-kind support from DMI and in-kind support from Canfor. In its third year of funding all but one position need to be filled (this person is in ready to start May 2015). A number of sub-projects started later than anticipated due to poor recruitment/lack of appropriate candidates for positions. It is our intention to push the funds for these projects into come years. Both a complete project budget (all 5 years) as well as a current budget has been provided below.

This budget is still significantly under budget due to student start dates and changes in projects. There are three noted over expenditures two in Salary and Benefits and one in Lab/field supplies sections. The over expenditures within Salaries and Benefits are using leftover funds from previous years (2012 or 2013). The over expenditure in lab/field supplies is a result of additional field and safety equipment and training needs, these will be limited in 2015 however. Two 2015 budgets have been provided: the initial budget and an adapted budget that takes into account the carry over needs and changes around sub-project late starts.

NSERC-Strategic WAM Funding

The WAM NSERC Strategic Grant includes graduate student funding for three years along with funding for field assistants and lab technicians. Please see the below chart for further detail.

In-Kind Support

The EMEND Project would not be what it is without the support and contribution of the people and organizations surrounding it. These people and organizations donate in-kind support in a number of ways including but not limited to: wages and benefits of graduate student supervisors, technical assistants, consultants, the EMEND Management Team, and other employees; equipment rental/donation to the program; location/room bookings for meetings; training costs; data, maps, aerial photo use; tour needs (helicopter charter, etc.) and so much more.

Appendix 1: Graduate Student and Core Crew Scheduling

	Supervisor	Type	Name	2012	2013	2014	2015	2016
NSERC-CRD	Spence/Acorn	MSc	Sonya Odsen	VR Harvesting and Birds				
	Macdonald	PDF	Kris Whitbeck		Understory Plants			
	Macdonald	PhD	Caroline Franklin			Thresholds of understory plants		
	Quideau	MSc	Cassandra MacKenzie			Forest Floor Processes and VR Harvesting		
	Spence/Langor	MSc	Jared Amos	VR Harvesting and Pollinators				
	Spence/Langor	PhD	Seung-Il Lee	Deadwood and Beetle diversity				
	Ryu	PhD	Hosen Alam			Fire resilient Landscapes		
	Nielsen	MSc	Zoltan/Caroline			VH Harvesting and Fur bearer use		
	Nielsen/Eaton	MSc	Matthew Robinson			VH Harvesting and Amphibians		
	He/Spence	PhD	Linhao Wu		VH Harvesting and Landscape Biodiversity			
	Armstrong	PhD	Sarah Kahn		Trade-Offs—Biodiversity and Wood Products			
	Spence/Langor/He	PDF	Jaime Pinzon	10 Year Synthesis				
	Spence	PM	Matthew/ Amy	EMEND Project Coordination				
NSERC-Strategic-- WAM	Coops (UBC)	PDF	Wiebe Nijland			Forest Structure Matrix		
	Nielsen/Macdonald	PDF	Dingliang Xing			Terrain Modeling		
	Dyck/Quideau	PhD				Soils and Underlying Processes		
	Spence/Langor	PhD	Silvia Ronzani			Beetles and predictor variables		
	Macdonald, Spence	MSc	Laureen Echiverri			Vascular Plants & Remote Sensing		
	Macdonald, Caners	PhD	Kris Whitbeck			Bryophytes & Remote Sensing		
	Nielsen/He	PDF				Modeling/trade-offs		
FRIA-FFIP	Spence	PDF	Colin Bergeron			Coarse Woody Materials		
	Spence	LFA				Productivity and Silviculture		
	Spence	CCFA				Productivity and Silviculture		
	Spence	LFA				Productivity and Silviculture		
	Spence	CCFA				Productivity and Silviculture		
	Spence	CCFA				Productivity and Silviculture		
AESRD Funding	Spence	PDF	Jaime Pinzon			Lab Technician and 10 Year Synthesis		
	Spence	LFA				Biodiversity		
	Spence	CCFA				Biodiversity		
	Spence	LFA				Biodiversity		
	Spence	CCFA				Biodiversity		
	Spence	CCFA				Biodiversity		
	Spence	PM	Amy Hayden			EMEND Project Coordination		

Appendix 2: Graduate Student Framework (Short)

Mission Statement:

EMEND offers a model of interaction during the course of graduate studies that provides:

- i) Benefits that support graduate students and supervising research-leads in meeting high-end educational and scientific objectives,*
- ii) Outcomes with convincing value to business partners and government agencies co-funding this initiative and to other interested partners.*

In addition to supporting continual improvement of forestland management in northern Alberta, EMEND seeks to be relevant to on-the-ground applications across Canada and to the general discussion of Sustainable Forest Management (SFM) across the globe. The value of our program will be judged by the career paths of our students in addition to the uptake of our results in Canada and the contribution to international dialogue about SFM.

Research at EMEND is managed through the EMC and falls into 2 Principle Categories

1. **Core Data Collection**—experiment wide data collection occurring at 5 year intervals. Collected by the core crew to ensure comparisons of forest treatments can be made over all four forest types. EMEND Core Data Database is managed by the CFS and is accessible to researchers in Category 2a.
2. **Individual Research Projects**—executed by researchers and must be focused on forest ecology or management questions. Must be approved by EMC (graduate students, Post-doctoral fellows, and scientists)
 - a. Research projects with themes guided, approved and financially supported by the EMC
 - b. Research projects not contributing substantially to the general direction of EMEND but are nonetheless deemed relevant to northern boreal forest conservation, management, or for which the EMEND landscape provides an exemplary template for the work. (must be approved by EMC)

EMCs Vision for Graduate Studies Research

1. To be **EFFECTIVE**
 - Supportive atmosphere for student development and experience to prepare them for their futures.
 - The EMC communicates effectively about expectations, deliverables and funding support.
 - Emphasis on leading-edge, high quality data which compels and engages researchers continued support, international attention, and local understanding and support.
 - To meet academic aspirations, scientific mandates, and professional demands of partners.
 - Promotes 2-way communication between researchers and industry and government partners.
 - Strives for transparent and consensus-based administration of funding that values clarity and criteria-based prioritization of research work.
2. To be **DYNAMIC**
 - Flexibility (direction, administration, & planning) without compromising current research to take advantage of potential funding opportunities
 - Prospective student's interests are considered while building research proposals.
 - Inspires creative potential and independent thinking during the development of research questions and approaches and suggested management applications
 - GSR is responsive to partners (which are dynamic—evolving around challenges within boreal land management and policy) needs while maintaining the project's original objectives
 - The EMC embraces the philosophy of *adaptive management*—in testing off the EMEND land base as appropriate predictions and management prescriptions that flow from EMEND research.

Appropriate Graduate Student Research Themes

- Themes are generally anchored to understanding of natural disturbance, functional dynamics of natural systems, defining range of natural variation, topics relevant to management challenges, public values, and current policy issues. GSR supported by the EMC will connect to one or more of these themes.

Financial Support

1. **Funds Available:** the EMC GSR funding strategy includes a combination of funding opportunities:
 - *Industry contributions*, primarily targeting GSR for themes designated by the EMC
 - *Grant funds* at varying award-success rates pursued collaboratively by the EMEND partners and led by University participants (NSERC CRD, NSERC Strategic Grant, NSERC-IPS)

- *Other funds* available directly to students or supervisors at their initiative. (Not managed by the EMC but are considered in allocating other funds to the project.)
- 2. **Annual Budget Plan:** based on the following assumptions and will be reviewed as needed.
 - Additional funding will be required for most projects. Industry will assist where possible; final responsibility falls on the supervising researchers, academic institute and/or student
 - Scholarships obtained by students will significantly reduce the costs borne by EMEND Budgets
 - Approximate student stipend + benefit costs, and approximate investment period
 - Incidental Costs
 - Incidental Cost fall into four categories:
 - *Overall EMEND Costs:* Administrative costs—covered by EMC (availability of funds) essential to success of EMEND Research (Administrative Coordinator (EAC), knowledge exchange, etc.)
 - *Special Research Costs:* additional to normal research costs (long-distance travel, ATV maintenance, satellite phones, safety trainings, etc.) EMC attempts to assist with such costs.
 - *Normal Research Costs:* (travel costs, field assistant wages, laboratory costs, publication expenses, etc.) Researchers can expect to absorb these expenses through other funding, where possible the EMC will assist with these costs
 - *Costs Borne by the University and Participating Research Agencies:* include costs generally overlooked when research costs are discussed (salaries of research supervisors and technical support staff, library access, specialized equipment, etc.) The EMC acknowledges their importance however these costs remain outside the province of the EMC.

Non-Financial Support

1. **The EMEND Research Facility consists of three Complimentary Components:**
 - a. *A Permanent Camp and Field Laboratory facility*
 - It is located 10km west of Dixonville, AB on private lands owned by the U of A.
 - Can accommodate up to 30 researchers, optimally 15-20 people.
 - funded and developed through a partner supported grant from the Canadian Foundation for Innovation (CFI); managed under EMEND Project Budget
 - Occasionally other researchers wish to use the EMEND camp facilities their camp use fees are cost recovery rate plus 15% fee
 - b. *A 1000-hectar Boreal Forest Research Site*
 - Replicate treatments (designed & established in 1997-99) located in the P1 area under the DMI Forest Management Agreement within a 7400-hactar working forest landscape
 - It is approximately 40-50km northwest of the Camp Infrastructure and starts at approx. KM-30 along DMI's Sulphur Lake Main Haul Road (P2-200)
 - The site is protected by the Province under a Protective Notation (PNT) disposition as a long-range research installation that informs forest management policy and practices.
 - c. *Various Equipment Resources*
 - 2 4x4 trucks owned by Dpt. Renewable Resources, primarily used by core crew, however when space is available grad students can take advantage of such transport.
 - Up to 8 ATVs have been necessary for core crew use; owned by Dpt. Renewable Resources (may be accessible to grad students if core crew demand is low).
 - Researchers requiring extensive ATV/Truck use are expected to provide their own units
2. **The EMEND Database and Website**
 - Database is managed by CFS personnel; Access is arranged by written application to Mr. Brad Tomm
 - GS working at EMEND are expected to contribute the geo-referenced raw data from their projects
3. **EMEND Health and Safety(H & S) Program**
 - Participation is mandatory by all personnel including graduate students, scientists, and visitors.
 - EMEND Partners place high priority on maintaining a safe work place
 - Researchers are responsible for their required safety supplies and without them will not be allowed on the worksite

Roles of Parties Involved in GSRF at EMEND

1. **Lead Researcher or Supervisor:**
 - i. Identifying, screening and selecting prospective grad-student candidates
 - ii. Guiding development of research proposal
 - iii. Introducing industry-government partners
 - iv. Strongly encouraging broad student participation and engagement in EMEND

- v. Cooperating with the EMEND Science Lead and EAC/FPM to ensure student data are made available to the database, student progress reports are filed, students participate in knowledge exchange, and clear and accurate financial reports are filed
- 2. EMEND Administrative Coordinator** (reports to the EMEND Science Leads)
 - i. Briefing new graduate students: orientation to the EMEND program and interactive engagement
 - ii. Setting up student engagement meetings and coordinating plans for partner visits
 - iii. Coordinating knowledge exchange product development
 - iv. Coordination of EMEND data management and website
 - v. Development and implementation of health and safety policies
- 3. EMC**
 - i. Review funding proposals to ensure they fit within the themes defined in Appendix I
 - ii. Review grant applications when industry and/or government support is sought for such proposals
 - iii. Incidental support for projects will be provided by the EMEND Partners, as more specifically described in the framework

Engagement Expected of EMEND Graduate Students

- 1. Student Obligations and Deliverables**
 - Students engagement in our highly interactive learning environment and participation in industry-government interaction opportunities (students receiving funding through EMC are required to sign a written agreement accepting their associate obligations (Appendix 2))
 - Exposure to partner operations (forest management business orientation, tours)
 - Presentations to funding partners and practitioners
 - Project Presentations at annual EMEND workshops and external conferences
 - Assistance during EMEND project tours or public events including field presentation about student research projects
 - Project reports; inputs to the EMEND Research Note Series
 - Posters for EMEND website and or partner worksites
- 2. Funding Partners Roles:**
 - Increase staff connection and learning potential through direct exposure to the research programs of graduate students.
 - Improved assurance that grad-students understand the business of forest management
 - Strong encouragement for grad students to think creatively about the management and policy implications of their work and to file such thoughts at the end of their programs
 - Help develop general direction for graduate projects and prioritize projects supported by EMC
 - Engagement with students early in their programs via introduction by lead supervising researchers
 - Student orientation to business forest management
 - Access on-request to forest inventory data where needed to support research
 - Providing opportunity for student progress-presentations at work-sites
 - Participation in development, review, and dissemination of knowledge exchange publications within respective organizations.

Appendix 3: EMEND Core Vehicle Fleet and Equipment

EMEND Vehicle Fleet

Type	Brand	Year	Description	Colour	Condition
Quad	Honda	2003	Fourtrax 250 (Spence Lab)	Red	Poor
Quad	Honda	2003	Fourtrax 250 (Spence Lab)	Red	Poor
Quad	Honda	2004	TE2564 (DMI Donated)	Red	Good
Quad	Honda	2004	TE2564 (DMI Donated)	Red	Good
Quad	Honda	2005	TRX500FES	Yellow	Good
Quad	Honda	2005	TRX500FES	Yellow	Good
Quad	Honda	2005	TRX500FES	Yellow	Good
Quad	Honda	2005	TRX500FES	Yellow	Good
Quad	Honda	2008	Fourtrax 250 (Spence Lab)	1998	Fair
Quad	Honda	2013	TRX420FPE	Red	Excellent
Quad	Honda	2013	TRX420FPE	Red	Excellent
Quad	Honda	2015	TRX420 (NRC)	Red	New
Quad	Honda	2015	TRX420 (NRC)	Red	New
Quad	Honda	2015	TRX420 (NRC)	Red	New
Quad	Honda	2015	TRX420 (NRC)	Red	New
Trailer	RT Trailers	2005	ATV trailer, 16' Long (4 ATV)	Black	Great
Trailer	Scona	1997	10' ATV Trailer (2 ATV)	Black	Good-Fair
Trailer		2015	ATV trailer, 18' foot long (4 ATV)	Black	New
Truck	Chevrolet	2008	Chevrolet Silverado 2500 HD 4x4	White	Great
Truck	GMC	2005	GMC Yukon XL SLE 2500 4x4	White	Good
Snowmobile	Polaris	2015	Indy 550 ES, Electric Start	Red	New
Snowmobile	Polaris	2015	Indy 550 ES, Electric Start	Red	New

EMEND Core Field Equipment

Amount	Type	Brand	Condition	Need/Replace
1	Chainsaw	Husquvarna	Good	No
1	Chainsaw	Stihl	Good	No
2	Handheld GPS	Garmin	Excellent	2 more
1	Snowmobile Ramp		New	No
1	ATV Ramp		Good	No
2	Digital Measuring Sticks		Great	No
1	Computer	Dell	Poor	Yes
1	Printer	Brother	New	No
1	Laptop	Dell	Poor	Maybe
4	PDAs (Pocket PC)	Dell	Poor	Yes
4	Digital Clinometers	Vertex	Excellent/New	No
7	Handheld Radios	iComm	New	No
2	Calipers		Poor	Yes
5	Handheld Radios	Kenwood/Motorola	Poor	No
1	Repeater		New	No
12	Field First Aid Kits		Great	No
4	Emergency ATV Tire Repair Kit		Great	Maybe
6	Winch Kits		Great	No
12	Fire Extinguishers		Excellent	No

Appendix 4: Proposed EMEND Projects/ Costs

Camp Facilities:

- More lab space/ATV storage is needed on site;
- Control of the noxious invasive weeds at camp; and,
- Camp night lighting enhancement or motion sensor to capture site incursions from the roadway beyond the gravel pad
- Increased accommodations, washroom facilities, dining room for increasing number of graduate student needs
- Lab roof repairs
- Fire Alarm/Safety system needs to be serviced
- Furnace in back trailer heat does not work but air does
- Extra storage (small shed) for grad equipment
- Recycling bin with garbage bin

Field Infrastructure:

- Trail and bridge maintenance
- Better trail signage
- Repeater antenna up and active
- Spread of prohibited noxious and noxious weeds at the EMEND site. Canada Thistle, Scentless Chamomile, and Knapweed
- Fenced lot at old camp for storage and for overnight safety (perhaps a tent frame or two)

EMEND Core Field Equipment:

- Purchase of at least 2 new handheld GPS devices, compasses.
- Need new PDA's (field hand held computers)
- Consider bar code scanners to reduce human error
- Small digital cameras for the documentation of samples, and have an image of PSP through time, group photos, etc.
- Renewal of the Core Crew vehicle fleet as the fleet is aging and over the coming years will need to be replaced.
- Winch kits for trucks and ATVs (have all the tools needed to successfully use the winches)

Safety:

- Creation of a safety video, website, or other medium to standardize participants orientation experience

Appendix 5: Prioritized Project Equipment Needs

Priority	Amount Needed	Item	Approximate Cost (each)	Comment
High	2-3	Handheld GPS device	\$500	Commercial Solutions
High		Shelter for Water tank (steel roof)	\$4000	
High	Assorted	ATV/SM safety gear (winch kits, tire kits, helmets)	\$1000-2500	Approximate cost for all items
High	4	PDA's	\$300	
High	Assorted	Yearly Field Supplies	\$1000-3000	Approximate cost for all items
High -Mod	Assorted	Yearly First Aid/Safety Gear	\$1000-2500	Approximate cost for all items
High-Mod	1	Computer / Laptop	\$5000	
Mod-High	4	Bar code Scanner (example CN51)	\$3000	BarcodesInc.com
Mod-High	1-4	Security Lighting at Camp		
Mod-High	3	Tents	\$1200	
	3	Frames	\$400	
	12	bed frames	\$300	
Mod - High	1	ATCO trailer Bedrooms + washroom		
Mod	1	Extra outdoor storage		
Mod	2	'Permanent' Tent frames at Old Camp	\$2500	
Mod	2	ATVs with winches	\$10,000	
Mod		Security fencing		
Mod-Low	1	4X4 Truck with trailer breaks		
Nice to have	1	Movable field trailer (RV for Old Camp) with generator	\$25,000	Used
Nice to have	Assorted	Extra indoor storage		

Appendix 6: Documented Near Misses / Incidents 2014

#	Date	Grouping	NM, I, A	Those involved	Near Miss / Incident Description	Causes			Ways to decrease/eliminate
						Direct	Indirect	Root	
						-At Risk behaviours -Unsafe Work Conditions	-People -Work Process/Task -Mats, Equip, Env't	-Management System	
1	5/22/14	Transporting ATVs	NM	Hayden, Jacklin, Domahidi	During a regular trailer inspection on our trip from Edmonton to Peace River we found one of the ratchet straps to have loosened quite a bit				Do regular checks of the straps. Mark the strap--if consistently loosening, dispose of these straps.
2	5/23/14	Transporting ATVs	NM	Hayden, Anderson, et al.	After doing a trailer and truck inspection prior to leaving Edmonton for Peace River we realized that the trailer had low air in one of the tires. We approached VP employee to borrow his air hose. When he brought the air hose out to help us fill the tire he realized that the tire had been put on backwards. He sent us over to south campus to be assisted by the mechanics there.		Worker did not know how to change a tire properly.	No directive for what to do in case of a flat tire	Add an attachment to the Safety Plan on how to properly change a tire.
3	Early June	Wildlife Encounters	I	Alam, Campos, et. Al.	Walking up road into G bear refused to leave area even after using air horns (occurred multiple times), bear was not interested in them at all, was foraging on vegetation in the ditch	unsafe work conditions	not 100% sure of SOP, did not have all necessary equipment, extreme fear of wildlife	International Students need to ensure they fully understand our Safety Program as well as the Laws of Canada	I have suggested the purchase and train how to use bear bangers before they go out in the field again and that they look into renting ATVs to decrease amount of time in the area
4	Early June	Wildlife Encounters	I	Alam, Campos, et. Al.	While walking back to their vehicle from G they could hear grunting noises from somewhere behind/side them (at least 10m)	unsafe work conditions	not 100% sure of SOP, did not have all necessary equipment, extreme fear of wildlife	International Students need to ensure they fully understand our Safety Program as well as the Laws of Canada	I have suggested the purchase and train how to use bear bangers before they go out in the field again and that they look into renting ATVs to decrease amount of time in the area
5	Early June	Other	NM	Alam, Campos, et. Al.	Was so afraid of previous event entered vehicle clutching bear spray while they drove away	at risk behaviours	not 100% sure of SOP, extreme fear of wildlife	International Students need to ensure they fully understand our Safety Program as well as the Laws of Canada	Informed again that bear spray should never be transported in vehicles, (Wildlife encounters SOP). Told them they all needed to practice using bear spray, and bear bangers

6	June	Extreme Weather Events	I	Alam, Campos, et. Al.	While working in G a fast storm approached them and bypassed quickly only having 2-3 thunder rumbles. 1 individual felt that it was too dangerous to work. Hosen told him if he felt it was unsafe that he could walk back to the vehicle and stay there, while he continued working.	unsafe work conditions	not 100% sure of SOP, fear of extreme weather	International Students need to ensure they fully understand our Safety Program as well as the Laws of Canada	Informed supervisor that no employee by law can be forced to work in any environment if they feel unsafe, it is their responsibility as their supervisor to halt work until all workers safety concerns have been met, also referred them to the Extreme weather SOP
7	6/3/14	Infrastructure/ Equipment Failure	NM	Silvia, Linhao, Jeff, Jessica	While returning to camp the check engine light came on and started flashing. When returned attempted to fix the problem as per the manual. The light stopped flashing but remained on. Amy took in for repairs in Peace River.	unsafe work conditions	Equipment malfunction, Environmental conditions (dust), past experiences		regular maintenance was performed on the vehicle, followed manual directives, then took to shop when did not resolve self, did exactly as they should have
8	6/3/14	Infrastructure/ Equipment Failure	NM	Ronzani, Hayden, et. Al	When students went into the lab trailer they realized that the roof was leaking in a number of places including out of the light fixtures. The came to get me. We turned off all the lights, and the breakers to them. Later that day I called our caterer who is responsible for hiring contractors	excessive rain, and high snow melt	malfunctioning equipment, flat roof	Had not been assessed or fixed for a while	Need to add maintenance checks of building roofs, windows, etc. to the camp startup/shut down check lists
9	6/3/14	General Field Work	NM	Ronzani, Iltgen	While crossing the beaver dam into H Ronzani went to jump over a small opening with running water, she missed and landed with one foot on the upstream side of the dam (wet) and the other in the right spot.	unsafe work conditions, dam was no longer cross able, at risk behaviour, did not find another way around even when this way was no longer safe	need to get from road into H, shortest way is over dam or through swamp	Only provide a tool to make appropriate field safety decisions do not discuss this.	Talk about making safety decisions in the field, build bridge?
10	6/4/14	Driving	NM	Ronzani, Hayden	Deer jumped out of the bush and onto the road in front of car. No contact, just quick breaking, and a horn blast to get the animal off the road.				Ensure drivers stay focused on driving, and know proper measures to take when wildlife is on the road.
11	6/5/14	Wildlife Encounters	NM	Ronzani, Iltgen	Spotted Bear (might have been a grizzly) about 100m down the road from them. Stopped, watched, got out bear deterrents, and waited for it to leave the area.		in bear territory		Did as they should have. Were ready to give it more space if it required it, however, it left the area quickly. They spent little time in the area and informed others of the bears location

12	6/16/14	General Field Work	I	Ronzani, Iltgen	While working in the field Whitbeck tripped over a log and reinjured a previous hamstring injury. They were able to easily get her out of the field and to a doctor.		had previous injury, was in wet/slippery forest		Ensure everyone has proper footwear
13	6/17/14	ATVing	NM	Iltgen, Ronzani	While ATVing down Canfor road Iltgen momentarily lost control of her ATV after hitting a rut. Unable to right the ATV, Iltgen jumped away from the machine, which went back on 4 tires and stopped a little ways away. Iltgen tucked and rolled and did not hurt herself, she did not hit her head/helmet and there was no damage to the ATV	at risk behaviour--driving too fast for the road conditions	road had a number of ruts that had dried quite a bit	Continue to enforce drive to your comfort and the road and weather conditions	lower speed on the Canfor Road when ruts are large
14	6/20/14	Driving		Schroeder, Leinmuller, Jeske, Hayden, Appleby-Millette, Domahidi, Anderson, Iltgen	Received a call from Ellen requesting assistance for one of her crews that was close to EMEND that had gotten their vehicle stuck in some mud. I agreed and took Julien with me, so I would not break the working alone rule. We got in touch with the crew via sat phone and were able to figure out where they were and how to get there. Using Google earth we made a map of the best way to get to this forestry road. When we found them we stopped before the wet road started to assess the situation. The winch was not long enough to get to the truck so we plotted out a route to bring our truck through that seemed firm. However, a truck length in our vehicle also got stuck. We attempted to winch ourselves out, with a bit of luck, however with evening fast approaching we decided to call camp for more assistance. Our truck was easily winched out by the other vehicle; we collected the other crew's overnight bags and valuables and took them to camp to spend the night. The other vehicle was retrieved 2 days later by tow-truck.	Went into an area they should not have been in; made assumptions that we should not have	very wet road, that should not have been attempted, clay mud that was stickier than normal mud,	they should have had a guideline that would help them make decisions about where to drive/where not to attempt	Make a guideline re: when to winch/when not to winch

15	6/21/14	General Field Work	NM	Ronzani, Iltgen	While walking between PSP in F Ronzani and Iltgen needed to cross a stream, they found a few logs that had fallen across the stream banks. Iltgen crossed first; when Ronzani crossed she lost her footing and ended up the shallow stream. No injuries were sustained, just wet.			need more information regarding traversing dead wood and making informed safety decisions in the field	Policy regarding walking on dead wood? Go over how to make safety decisions in the field
16	6/21/14	General Field Work		Appleby-Millette, Domahidi, Hayden, Shire	Appleby-Millette reacted more so than normal to mosquito bites. He has taken an antihistamine which seems to be helping the itching		did not have protective equipment that was suggested (bug net)		
17	6/25/14	Wildlife Encounters	NM	Ronzani, Iltgen	grouse flew out of bush at Ronzani, no contact was made		work in natural environment, not making enough noise		
18	6/25/14	Other	NM	Baydack, Franklin	Baydack and Franklin were working in C when Baydack became quite ill. Franklin was able to get liquids in her. And after sitting for a bit Baydack felt good enough to attempt the ATV drive back to old camp. They were able to slowly make it back to camp safely		no idea what cause the illness, no one else was sick at camp or became sick after		Ensure staff are aware that if needed they can take time out of the field to recover from illness
19	6/26/14	ATVing	I	Anderson, Iltgen, Ronzani	While exiting off the S. Not. Anderson slowed down to enter a large puddle and as he entered the puddle the CV joint popped out. This ATV has just been into the mechanic to be fixed for this problem. He was not hurt in any way.		miscommunication at the repair shop, mechanic did not actually fix the problem that the ATV was taken in for,	No mechanic sign off when equipment if fixed	create mechanic check list to ensure accountability of shop where ATVs are maintained

20	6/28/14	ATVing	NM	Franklin, Baydack	ATV stuck in mud in back of C/D, needed to winch out		in experience	limited experience choosing safe lines through difficult terrain/mud	better knowledge of how to read the landscape, creation of training/document to help users know safe routes to go
21	June 29 to July 27, 2014	other		Alam	Ramadan--following religious traditions such as fasting and no drinking of water from sun up to sun down while doing field work. Would not alter work schedule or take reduced work load. Field assistant was nervous to be with him in the field			no system to help manage religious traditions, little help from university administration	need to create a policy regarding religion/tradition and field work safety
22	7/2/14	ATVing	NM	Shire, Domahidi, Appleby-Millette,	While traveling down an ATV trail in A Shire lost control of her ATV and drove 1/2 ATV into the bush	got confused over break and throttle	unwillingness to admit that she was not as comfortable with the ATVs as everyone else	Need better direction for leaders to ensure that speeds are kept to a minimum until all staff are comfortable on the ATVs	Directed all staff to reduce speed while traveling with new riders until riders felt comfortable on the ATV
23	7/3/14	ATVing	I	Shire, Domahidi, Appleby-Millette,	Shire was attempting to skirt around a large puddle/depression in the trail (A). She observed 2 people go around. Unfortunately she ran into a small tree with her front left tire while going very slowly. This caused the ATV to tip slightly, and because she was unbalance on the ATV it tipped over		inexperience	Management did not ensure that riders were all comfortable on ATVs before sending them into the field	Do in-house assessment of new ATV riders to prove skill, Will take Shire out for a one on one instruction so that she can become more comfortable on the ATV.
24	7/8/14	ATVing	NM	Wu, Anderson	ATV stuck in mud in I, need winch to get the machine out		in experience	limited experience choosing safe lines through difficult terrain/mud	better knowledge of how to read the landscape, creation of training/document to help users know safe routes to go
25	7/8/14	Extreme Weather Events	NM	Shire, Domahidi, Appleby-Millette,	While working with Fatima she became light headed. Zoltan and Julien got her to drink water and rest. After about 30 minutes they decided to end the work	not willing to admit that she was not feeling well	Warm day, not used to field work	need better communication of Extreme Weather, and ensure users understand that their health is more important than the field work	after the first heat issue, leaders were careful to keep an eye on employees to ensure there continued health
26	7/12/14	ATVing	NM	Ilitgen, Ronzani	ATV stuck in mud hole in A while assisting to push the ATV out, Ilitgen lost her footing and landed in the mud	bad trail conditions	deep ruts, small ATV, poor footing	no document explaining proper ways of pushing	proper pushing techniques document and exercise

								out ATV, or hands on experience	
27	7/15/14	Wildlife Encounters	NM	Ronzani, Iltgen	Heard crashing around in the bush, believed it was a moose in the area. Decided not to continue onto the PSP would return another time	moose territory			did exactly as they should have
28	7/17/14	Extreme Weather Events		Bravo, Alma	Due to the amount of smoke and dust in the air Bravo was having difficulties with his allergies and asthma.	smoke and dust	not aware of Canadian labour laws, more focused on his work then his people	supervisor forced work on staff,	should add a bit about smoke/dust into SOP
29	7/19/14	Extreme Weather Events		Appleby-Millette, Domahidi, Shire	The smoke and dust induced an asthma attack. After using his puffer and providing him with water and a break, the group decided to finish the day and get Julien out of the field. No medical attention was needed	smoky conditions, dusty road			Users were informed of bad smoke days and were cautioned to reduce activity, especially if they had allergies/asthma. Put Julien on light-duty at camp. Suggested bandanas when dust became a problem on the roads; however it was not very effective for them. Need dust masks they can wear on ATVs?
30	7/22/14	Extreme Weather Events		Bravo, Alma	Alam would not allow Bravo to finish his lunch break, Bravo has been suffering from allergies and asthma due to the smoke and dust in the air	smoke and dust	not aware of Canadian labour laws, more focused on his work then his people	supervisor forced work on staff,	should add a bit about smoke/dust into SOP
31	7/31/14	ATVing	I	Iltgen, Ronzani	While ATVing down a trail, due to tall grass she did not see a logs end sticking out of the bush a little. She ran her back tire into the tree which caused the ATV to tip over. Jessica jumped off. No damaged occurred to the ATV and no injuries were sustained by Iltgen	poor trail maintenance	long grass made it difficult to see hiding objects	lack of maintenance	better trail maintenance is needed
32	8/4/14	Extreme Weather Events	NM	Shire, Domahidi, Appleby-Millette,	While working in C/D Zoltan noticed that Fatima was swaying a little. He asked her if she was all right and she said she felt fine. Zoltan decided to stop for a break and urged her to drink and eat something. Even after a break and the snack Fatima's responses seemed slightly off so Zoltan decided to end the day's work. They were able to get out to their	inability to admit when something is wrong	Warm day, not used to field work	short season, limited selection, no trail period for staff,	after the first heat issue, leaders were careful to keep an eye on employees to ensure their continued health

					ATVs and up to the vehicles at old camp, slowly without any incident				
33	8/6/14	Extreme Weather Events		Appleby-Millette, Domahidi	Julien started to feel unwell due to the smoke and dust in the air so the group decided to leave the field for the day	smoke and dust	thought he would be ok that day, worse than expected		Julien generally was good at telling us if his asthma was acting up. All camp users were informed of the air quality warning put out by EC and were told to reduce their activity if needed
34	8/13/14	Extreme Weather Events	NM	Shire, Jacklin	While working with Fatima Meghan noticed it was quite warm out, knowing her history, Meghan called a break and prompted Fatima to drink, when asked how she was feeling Fatima replied she felt fine. Less than an hour later, Meghan noticed Fatima slowing down and swaying a bit. She stopped them again, called Zoltan on the radio and they discussed the situation. They decided that Meghan and Fatima would continue their break while Fatima consumed more water and fruit. Zoltan and Julien went to old camp to get the truck. They girls met the guys at the road, where they loaded Fatima in, got her ice cold water from the cooler. Julien and Meghan took the other ATVs to old camp and met up with the truck. By the time the two groups met up again Fatima showed considerable positive change, however the group decided to call it a day.	inability to admit when something is wrong	Warm day, not used to field work	short season, limited selection, no trail period for staff,	after the first heat issue, leaders were careful to keep an eye on employees to ensure their continued health
35	8/15/14	Extreme Weather Events	NM	Jacklin, Shire, Alam	The wind in the stand picked up substantially. Jacklin made the call to get out of the stands, as did 2 of the other crews. Only Alam's group continued to work.	working after the wind picked up	focused on the task, not what the forest was doing	need a better way to contact people in the field	
36	8/17/14	General Field Work	NM	Appleby-Millette, Domahidi, Shire, Jacklin	While working in the burn stand in H, Julien was traversing over a number of logs that were fallen over each other. The logs were slippery and he lost his footing and fell on his butt. No injuries were sustained		slippery logs,		dead wood policy

37	8/22/14	Transporting ATVs	I	Bergeron, Spence, Lee, Wu	While hauling a trailer with ATVs down the P220 290 kicked up a rock which ricochet off the trailer (metal bar at front) and smashed the back window of the vehicle		bar across front of trailer, need bigger mud flaps on truck		See about bigger mud flaps on truck
38	8/22/14	Infrastructure/ Equipment Failure	NM	Whitbeck & Echiverri	Whitbeck and Echiverri missed their evening check in, to ensure their safety Hayden & Domahidi decided to start an initial search. While driving up the P220 road they encountered the pair around km210, however we were unable to hear them on the radio.		broken radio	radio check protocol only requires radio checks between crews	require truck radios in vehicles to get better distance, require regular radio checks with manager to ensure they know all radios are working
39	8/23/14	Transporting ATVs	NM	Hayden, Spence, Domahidi	While traveling back to Edmonton and hauling a trailer, a passing vehicle waved us to pull over. Once safely pulled over a trailer inspection resulted in finding a broken ratchet strap, the other straps had caught the ATV, and however the ATV had moved on the trailer. A new ratchet strap was put on and all other ratchet straps were checked over.		ratchet strap broke at seam		Hayden did regular checks of ratchet straps during the drive, try different ratchet straps
40	8/28/14	Transporting ATVs	I	Dawne, William, Cassandra, Jennifer	While loading ATVs, group forgot to attach trailer appropriately to truck. When first ATV got onto trailer it tipped the single axle trailer. Rider and observers were all ok, trailer was not damaged, however damage was done to the tailgate of the vehicle	did not re-familiarized themselves with SOP before participating in a task that they were inexperienced in	inexperience, one axle trailer behaves different then 2 axle trailer,	Need check list?	Create a check list for loading ATVs?
41	9/8/14	Other	NM	Hayden, et. Al	After returning the rental car to VP received a call regarding damage to the car's hood. No one who had used the car during the summer recalled any damage occurring to it. However it was often parked in one other the car parkade, and the damage looked like someone had dropped something heavy on the car.				

Appendix 7: Expected Project Funding

Funding Project	2012	2013	2014	2015	2016	Total Grant \$
NSERC-CRD	\$ 208,612.00	\$ 380,300.00	\$ 439,513.00	\$ 381,150.00	\$ 263,475.00	\$ 1,673,050.00
NSERC-Strategic--WAM	n/a	n/a	\$ 268,400.00	\$ 276,400.00	\$ 217,500.00	\$ 762,300.00
FRI Legacy Funding	\$ 173,000.00	\$ 110,350.00	n/a	n/a	n/a	\$ 283,350.00
U of A VP Grant	n/a	\$ 56,000.00	\$ 30,000.00	\$ 30,000.00	n/a	\$ 116,000.00
FRIAA FRIP Fund	n/a	n/a	\$ 150,000.00	\$ 150,000.00	n/a	\$ 300,000.00
AESRD Funding	n/a	n/a	\$ 133,000.00	?	n/a	\$ 133,000.00
NRC an Funding	n/a	n/a	\$ 250,844.00	n/a	n/a	\$ 250,844.00
Grand Totals	\$ 208,612.00	\$ 436,300.00	\$ 1,271,757.00	\$ 837,550.00	\$ 480,975.00	\$ 3,235,194.00

Appendix 8: EMEND's Funding and In Kind Support

			2012		2013					2014							
			FRI-Legacy*	NSERC-CRD Grant	FRI-Legacy*	NSERC-CRD Grant	U of A VP Grant	FRIP-VSA	Other	NSERC-CRD Grant	U of A VP Grant	NSERC-Strat-WAM	AESRD Core Funds	FRIP-VSA	FRIA-FRIP	Other	
Funding Bodies	Agency	\$	\$ 173,000	\$ 121,112	\$ 110,350	\$ 205,300	\$ 56,000	\$ 79,000		\$ 264,513	\$ 30,000	\$ 268,400	\$ 133,000		\$ 150,000		
	Industry Contributions	\$		\$ 175,000		\$ 175,000				\$ 175,000							
		In-Kind		\$ 26,210		\$ 16,710		\$1,440		\$ 24,892		\$ 12,740		\$540	\$ 12,229		
	Other	\$															\$ 250,844
		In-Kind				\$ 48,400			\$ 28,700	\$ 59,400		\$ 206,000					\$15,500
Total			\$ 173,000	\$ 322,322	\$ 110,350	\$ 397,010	\$ 56,000	\$ 80,440		\$ 464,405	\$ 30,000	\$ 487,140	\$ 133,000	\$ 540	\$ 162,229	\$ 250,844	
Years Combined			\$ 495,322		\$ 643,800.00					\$ 1,528,158.00							

*FRI Legacy Funding is audited April 1 to March 31; therefore there is a small amount of funding left over for 2014

			2015				2016	
			NSERC-CRD Grant	U of A VP Grant	NSERC-Stat--WAM	FRIA-FRIP	NSERC-CRD Grant	NSERC-Stat--WAM
Funding Bodies	Agency	\$	\$ 206,150	\$ 30,000	\$ 276,400	\$ 150,000	\$ 88,475	\$ 219,500
	Industry Contributions	\$	\$ 175,000				\$ 175,000	
		In-Kind		\$ 16,710		\$ 12,740		\$ 16,710
	Other	\$						
		In-Kind						
	Total			\$ 397,86	\$ 30,000	\$ 289,140	\$ 150,000	\$ 280,185
Years Combined			\$ 867,000.00				\$ 512,425.00	

Appendix 9: Funding Important Dates

Date	What	Grant	Who
January 1, 2014	YER out to partners	ALL	U of A-Amy
January 1, 2014	Invoice FRIAA for -\$150,000	FRIAA-FRIP	DMI
January 1, 2014	First FRIAA Payment--\$150,000	FRIAA-FRIP	FRIAA
January 1, 2014	CRD Financial Statement Due	NSERC-CRD	U of A-FOR
January 1, 2014	Invoice to NSERC--\$205,300	NSERC-CRD	U of A-FOR
January 1, 2014	CRD Payment --\$205,300	NSERC-CRD	CRD
February 1, 2014	Invoice to DMI--\$87,500	NSERC-CRD	U of A-FOR
February 1, 2014	CRD Payment DMI--\$87,500	NSERC-CRD	DMI
March 31, 2014	Project Funding Closure	FRI-Legacy	U of A / FRI
March 31, 2014	Final Report to FRI	FRI-Legacy	U of A-Amy
April 1, 2014	Invoice NSERC--\$132,257	NSERC-CRD	U of A-FOR
April 15, 2014	Annual technical report into DMI	FRIAA-FRIP	U of A-Amy
April 30, 2014	Annual audited financial report and technical reports due	FRIAA-FRIP	DMI-Jim
May 2014-August 2014	Monthly Safety Reports to DMI and FRIAA as needed/requested	FRIAA-FRIP	U of A-Amy
June 1, 2014	Invoice to DMI--\$87,500	NSERC-CRD	U of A-FOR
June 1, 2014	CRD Payment DMI--\$87,500	NSERC-CRD	DMI
July 1, 2014	Gazebo Structure complete	FRIAA-FRIP-VSA	CanFor-Jim
July 15, 2014	Project Closure	FRIAA-FRIP-VSA	CanFor-Jim
July 30, 2014	Quarterly technical report into DMI	FRIAA-FRIP	U of A-Amy
July 30, 2014	Quarterly unaudited financial report and technical reports due	FRIAA-FRIP	DMI-Jim
October 1, 2014	CRD Progress Report 2 Due	NSERC-CRD	U of A-Amy
October 30, 2014	Quarterly technical report into DMI	FRIAA-FRIP	U of A-Amy
October 30, 2014	Quarterly unaudited financial report and technical reports due	FRIAA-FRIP	DMI-Jim
November 2014-January 1, 2015	EMT Meeting to report on Progress	ALL	U of A-Amy
November 2014-January 1, 2015	Draft Year End Report out to Partners for Feedback	ALL	U of A-Amy
November 2014-January 1, 2015	YER Feedback returned to Amy	ALL	Partners
December 31, 2014	Inform of Continued Financial Support by DMI	NSERC-CRD	DMI-Jim
January 1, 2015	YER out to partners	ALL	U of A-Amy
January 1, 2015	File Progress Report with DMI	FRIAA-FRIP	U of A-Amy
January 1, 2015	Invoice FRIAA--\$120,000	FRIAA-FRIP	DMI
January 1, 2015	Invoice NSERC--\$132,257	NSERC-CRD	U of A-FOR
January 1, 2015	CRD Payment --\$132,257	NSERC-CRD	NSERC
January 1, 2015	Invoice DMI-\$175,000?	NSERC-CRD	U of A-FOR
January 1, 2015	CRD Payment DMI--\$175,000?	NSERC-CRD	DMI
January 15, 2015	File Progress Report with FRIAA	FRIAA-FRIP	DMI-Jim
January 15, 2015	2nd FRIAA Payment--\$120,000	FRIAA-FRIP	FRIAA
April 1, 2015	CRD Payment --\$132,257	NSERC-CRD	NSERC
April 15, 2015	Annual technical report into DMI	FRIAA-FRIP	U of A-Amy
April 30, 2015	Annual audited financial report and technical reports due	FRIAA-FRIP	DMI-Jim
May 2015-August 2015	Monthly Safety Reports to DMI and FRIAA as	FRIAA-FRIP	U of A-Amy

	needed/requested		
July 30, 2015	Quarterly technical report into DMI	FRIAA-FRIP	U of A-Amy
July 30, 2015	Quarterly unaudited financial report and technical reports due	FRIAA-FRIP	DMI-Jim
October 1, 2015	CRD Progress Report 3 Due	NSERC-CRD	U of A-Amy
October 30, 2015	Quarterly technical report into DMI	FRIAA-FRIP	U of A-Amy
October 30, 2015	Quarterly unaudited financial report and technical reports due	FRIAA-FRIP	DMI-Jim
November 2015-January 1, 2016	EMT Meeting to report on Progress	ALL	U of A-Amy
November 2015-January 1, 2016	Draft Year End Report out to Partners for Feedback	ALL	U of A-Amy
November 2015-January 1, 2016	YER Feedback returned to Amy	ALL	Partners
December 31, 2015	Inform of Continued Financial Support by DMI	NSERC-CRD	DMI-Jim
January 1, 2016	YER out to partners	ALL	U of A-Amy
January 1, 2016	File Report with DMI	FRIAA-FRIP	U of A-Amy
January 1, 2016	Invoice FRIAA for \$30,000	FRIAA-FRIP	DMI
January 1, 2016	Final Report and deliverables to DMI	FRIAA-FRIP	U of A-Amy
January 1, 2016	CRD Financial Statement Due	NSERC-CRD	U of A-FOR
January 1, 2016	CRD Financial Statement Due	NSERC-CRD	U of A-FOR
January 1, 2016	Invoice NSERC--\$206,150	NSERC-CRD	U of A-FOR
January 1, 2016	CRD Payment--\$206,150	NSERC-CRD	NSERC
January 1, 2016	Invoice DMI-\$175,000?	NSERC-CRD	U of A-FOR
January 1, 2016	CRD Payment DMI--\$175,000?	NSERC-CRD	DMI
January 15, 2016	Final Report and deliverables Filed with FRIAA	FRIAA-FRIP	DMI-Jim
January 15, 2016	3rd FRIAA Payment--\$30,000	FRIAA-FRIP	FRIAA
January 15, 2016	File Report with FRIAA	FRIAA-FRIP	DMI-Jim
October 1, 2016	CRD Progress Report 4 Due	NSERC-CRD	U of A-Amy
November 2016-January 1, 2017	EMT Meeting to report on Progress	ALL	U of A-Amy
November 2016-January 1, 2017	Draft Year End Report out to Partners for Feedback	ALL	U of A-Amy
November 2016-January 1, 2017	YER Feedback returned to Amy	ALL	Partners
January 1, 2017	YER out to partners	ALL	U of A-Amy
January 1, 2017	Invoice NSERC--\$88,475	NSERC-CRD	U of A-FOR
January 1, 2017	CRD Payment--\$88,475	NSERC-CRD	NSERC
February 28, 2018	CRD Final Report Due	NSERC-CRD	U of A-Amy