ANNUAL REPORT

Healthy Landscapes Program Annual Report 2018/19

Annual Report

fRI Research Healthy Landscapes Program

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fRI Research
Informing Land & Resource Management

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Any opinions expressed in this report are those of the author, and do not necessarily reflect those of the organizations for which he works, or fRI Research.

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1.0 Introduction

1.1 Program History and Overview

Under the auspices of fRI Research, the Healthy Landscapes Program (HLP) has been operating since 1996. Since then, more than 30 funding and academic partners have participated in 47 research, tool, communication, demonstration, and educational projects across western boreal Canada. HLP output has been used within virtually all Canadian jurisdictions, as well as certification agencies (i.e., FSC), and the Canadian Boreal Forest Agreement (CBFA).

Since 1996 the HL Program has undergone significant evolution. The original vision of what was then the *Natural Disturbance (ND) Program* was to "*…understand disturbance patterns of all types, at all scales, on the Foothills Model Forest*" (Andison 1998). Within several years, the ND Program project list had expanded well beyond this mandate in terms of geographic extent, the scope of the research, and the types of projects being undertaken. Starting in 2000, each of the annual ND Program work plans, as well as each annual long-term plan revision, defined and tracked projects according to one of three themes: 1) research, 2) communications, or 3) integration. However, while this rapid and early expansion of the Program was encouraging, the evolution was neither agreed upon, nor formally recognized by the Program activity team of the day. This triggered a comprehensive, external Program review in 2012, culminating in a one-day stakeholder workshop. Partner feedback confirmed the value of, and interest in the topic area, but suggested that a new Program vision was in order. The new vision was defined as "…to *understand natural and cultural (forest landscape) patterns, and help partners explore and demonstrate how natural pattern approaches can contribute to sustainable resource management solutions*" (Andison et al. 2012). In so many words, this mandate redefined the focus of the new Program as EBM (Ecosystem-Based Management).

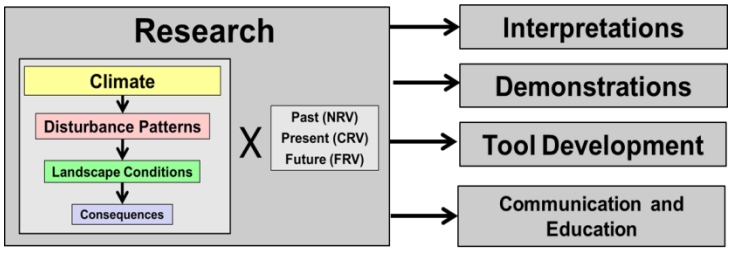

Figure 1. The HL Program elements and long-term strategy.

The Program elements, shown in Figure 1, reflect this new reality. Research remains at the core of the Program, but we now classify all research projects according to:

1) **Level.** Climate, disturbance, conditions, or consequences, and
2) **Era.** Natural (i.e., pre-industrial) range of variation (NRV), current range of variation (CRV) or future range of variation (FRV).

At the same time, the Program themes expanded to four from the original three to become: 1) interpretations, 2) demonstrations, 3) tool development, and 4) communication and education (Figure 1). As the summary of projects in this report will demonstrate, there is a great deal of integration between and within project theme areas.

1.2 FUNDING

Over the 2018/19 fiscal year, the HL Program spent a total of $817,000. Another $163,000 was spent on HLP projects via other agencies that did not flow through fRI Research, and $61,000 was contributed directly as professional time. The total cash value of the HLP invested over the year was just over $1.04 million (Table 1).

Table 1. Overview of funds spent during 2018/19 to each project based on the seven funding types from Section 1.0.

Proj. No.	Project Name	Project Type	Funding for 2018/19								
			Total Spent	% of Total Spent					Other		Total $ Value
				fRI Core	HLP			Other Funding Agencies	HLP Collaborators	Prof. Time Donated	
					Open Ended	Program Based	Project Based				
1	Program management	Strategic	141,000	62	10	28	0	0		50,000	191,000
2	Dedicated HL communications and education Initiative	C&E	9,000	0	60	40	0	0			9,000
3	EBM Dialogue Sessions	C&E	15,000	0	0	0	0	100	5,000	3,000	23,000
4	EBM Workshop	C&E	84,000	0	0	0	0	100	0	0	84,000
5	NEPTUNE spatial decision-support tool	Tool	0	0	0	0	0	0			0
6	LandWeb simulation modelling	Research & Tool	145,000	0	0	0	80	20	50,000	0	195,000
7	Linking NRV concepts with fine-filter values	Research	61,000	0	0	0	0	100	5,000	0	66,000
8	Creating wildfire mortality maps and metrics from Landsat imagery	Research	20,000	0	20	0	80	0	4,000	4,000	28,000
9	Historic fire regimes, water and climate in the foothills	Research	22,000	0	20	0	25	55	4,000	4,000	30,000
10	Landscapes in Motion (LIM)	Research	320,000	0	0	0	0	100	95,000	0	415,000
	TOTALS		**$817,000**						**163,000**	**61,000**	**1,041,000**

Note that Table 1 reflects seven classes of funding to the HLP:

1) fRI Research core funding. fRI Research has a number of partners who contribute funds to a general fRI Research fund each year, the disbursement of which to the various Programs is decided by the fRI Research Board of Directors. The HLP applies each year for general fRI Research core funds to be directed to the HLP via a rigorous work plan process. These monies have been pivotal in providing a long-term strategic foundation for HL Program growth, funding outreach, strategic planning, proposal writing, partner support, project administration, and collaborator support. Our partnership expansion from four partners within the west-central Alberta foothills, to more than 25 across boreal Canada over the last 20 years is largely a consequence of the stable support of the HLP by the fRI Research Board of Directors. In 2018/19, the HLP applied to fRI Research for $151,000, of which $87,000 was approved. The $87,000 represents 8% of the total HLP cash spent in 2018/19.
2) HLP Open-ended. Any funding provided directly to the HLP to be used to support a variety of projects or the Program at the discretion of the Program Lead. AlPac, and Tolko Industries were the Program-based funding agencies for the HLP this year, of which $28,000 was spent in 2018/19 (3%).

3) HLP Program-based. Any funding provided directly to the HLP at the Program level (to be used to support a variety of projects at the discretion of the Program Lead) above and beyond any contributions from those same agencies to fRI Research overall. The GoNWT, GoA, West Fraser, and Tolko Industries were the Program-based funding agencies for the HLP this year, of which $43,000 was spent in 2018/19 (4%).
4) HLP Project-based from partners. Project-based funding partners include: West Fraser Mills (WF), Alberta-Pacific (AlPac), Mercer International, Alberta Newsprint Company, and Tolko Industries. The value of project-based funds to the HLP in 2018/19 was $147,000 (13%).
5) HLP project-based from other funding agencies. The HLP was successful in attracting matching funding this year from a variety of research funding agencies, including NSERC, CFS, FRIAA (Alberta), Alberta Innovates, and Mitacs. Not all of these funds flowed through fRI Research. The value of these funding sources to the HLP in 2018/19 was $521,000 (50%).
6) HLP project-based from research collaborators. Many HLP projects rely on collaborations with other research agencies. The time, travel, and related resources to support HLP projects are highly relevant. Note that this is not 'in-kind' support as it is all directly applicable to the completion of project deliverables. Other collaborators include UBC, U. Vic, CFS, University of Laval, and U of A. The value of these funding sources to the HLP in 2018/19 was $163,000 (16%).
7) Donated time. As above, this category covers direct time and resource allocations to specific research, education, or completion of one or more HLP projects by HLP collaborators who donated time. This list includes Andison, Daniels, Leboeuf, Trout, Vercholuk, McLoughlin, Tew, Donnelly, Greenway and Stadt for a total value of $61,000 (6%).

The HLP had 11 agencies contributing cash to the HLP in 2018/19 (Table 2). Of that there were two government agencies, five forest industry companies, and three research funding agencies. The remaining agency, fRI Research, is funded through nine shareholders.

Although most of the funds contributed to the HLP were at the Project level, there was a noticeable increase in support at the Program level by HLP partners from previous years.

Table 2. Overview of partner participation level in the HLP during 2018/18

Agency	Support Level	
	Program	Project
fRI Research	yes	no
Gov't of Alberta	yes	no
Gov't of NWT	yes	yes
Tolko	yes	yes
Mercer	no	yes
AlPac	yes	yes
West Fraser	yes	no
Alberta Newsprint Co	no	yes
Mitacs	no	yes
Alberta Innovates	no	yes
FRIA of Alberta	no	yes

2.0 THE 2018/19 HLP PROGRAM

2.1 HLP PROGRAM OVERVIEW

During the 2018/19 fiscal year, the HLP had 10 active projects, including one for ***Program Management***, no ***Interpretation*** projects, three ***Communication and Education*** projects, no ***Demonstration*** projects, one ***Tool*** project, and five ***Research*** projects (Table 3). The total output produced over the year included 9 funding proposals, 49 formal Program and Project team meetings (minutes available upon request), three published plus five submitted manuscripts, 32 formal presentations either in person or via webinars, 17 blogs, two podcasts and another 30 other products, including workshops, informal reports, theses, field and lab sampling, work plans, and HLP team updates (Table 3). This list represents a significant expansion over the output from any previous years.

Table 3. Summary of deliverables and output of the Healthy Landscapes Program during 2018/19

Proj. No.	Project Name	Project Type	Output Type							
			Funding proposals	Team Meetings	Papers Pub. / Sub.	Presents / Webinars	Reports	Blogs	Podcasts	Other Products
1	Program management	Strategic	5	25	0/2	3	2			15
2	Dedicated HL communications and education Initiative	C&E				6				2
3	EBM Dialogue Sessions	C&E		7	0/1		1			
4	EBM Workshop	C&E		4		6	1		2	1
5	NEPTUNE spatial decision-support tool	Tool								
6	LandWeb simulation modelling	Research & Tool	2	5		7	1			3
7	Linking NRV concepts with fine-filter values	Research	2	5		1				1
9	Creating wildfire mortality maps and metrics from Landsat imagery	Research		1	1/1		1			1
10	Historic fire regimes, water and climate in the foothills	Research			2/1	2				
11	Landscapes in Motion (LIM)	Research		2		7	1	17		7
	TOTALS		**9**	**49**	**3/5**	**32**	**7**	**17**	**2**	**30**

Of the nine funding proposals submitted in 2018/19, seven were successful for a total of $336,000; 87k from fRI Research, 60k from Mitacs (over the next two years), 45k from Mercer, 45k from Tolko, 25k from Alberta Newsprint Company, 24k from Alberta Pacific, 20k from West Fraser, 20k from Tolko, and 10k from GoA.

2.2 2018/19 HLP PROJECTS

This section provides a detailed summary of the accomplishments and deliverables of each HLP project. All of the documents, presentations, webinars, podcasts listed in this document are available on the fRI Research website. For information on any other documents or products, please contact Dr. David Andison (andison@bandaloop.ca)

2.2.1 Program Management

This Project represents the coordination of the current list of HLP projects in terms of writing funding proposals and coordination and administration including contracts, developing new partnerships, new project approvals, fRI Research requirements with respect to quarterly updates and budgets, meetings, and workshops, developing annual work plans, bi-annual HLP activity team meetings, compiling the annual HLP report, updating the long-term and strategic plans, and responding to partner requests and updates as they arise. During 2018/19 this project also included two new elements, both of which were specifically identified as future challenges in the 2018/19 HLP Annual report:

1) Re-evaluating the funding and support model of the HLP as it relates to strategic function. This involved two related components:
    a. Program-level funding shortfall for 18/19. As predicted by the previous two annual reports, the funding for Program-level activities was insufficient to keep the Program running for the entire year. This was a combination of two things. First, the funds from fRI Research for Program-level functions declined again, widening the gap between the ask (151k) that provided (87k). Given the size of the gap, unlike previous years, the Program Lead (PL) was unable to find enough partner funding at the Program level to backfill the shortfall. The HLP Activity Team was informed in the spring of 2018 that the shortfall would be 40k.

    b. Strategic capacity challenges. A longer-term funding model was needed to prevent future Program level shortfalls. Moreover, the requirements of Program-level activities have been compromising the ability of the PL to deliver on all of the promised output for several years.

2) The completion and ratification (by both the HLP Activity Team and fRI Research) of new governance and terms of reference (TOR) documents for the HLP. The large size of, and irregular attendance by the HLP Activity Team after the shift from NDP to HLP in 2012 was making it increasingly difficult to get decisions made, projects chosen, and funding secured. Recognizing this, in 2013, and again in 2015, comprehensive new governance and funding models were developed by two different Activity Team sub-committees and presented to the HLP Activity Team. There was no uptake on either effort. Early in 2017, a new, small Executive Committee was formed to help streamline decision-making, but also to continue work on new governance. Over the next 18 months, they created at a new governance model draft.

In service of addressing both of these challenges more directly and immediately, the HLP struck a new committee in 2018 called the Interim Executive Committee (IEC). Spearheaded by West Fraser via Tom Daniels and Laura Trout, it was made clear to all potential IEC members that the expected time commitment was considerable, and it needed to be consistent. During the latter part of 2018/19 the IEC, and a smaller TOR sub-committee, worked hard to deliver on both challenges.

The Interim Executive Committee (IEC) included:

Tom Daniels, WF (chair)
David Andison, Bandaloop
Laura Trout, WF
Margaret Donnelly, AlPac

Neal McLoughlin, GoA
Jules Leboeuf, GoA
Trina Vercholuk, Tolko
Ryan Tew, fRI Research
Ken Greenway, fRI Research
John Stadt, GoA

The TOR sub-committee included:

David Andison, Bandaloop
Jules Leboeuf, GoA
Neal McLoughlin, GoA
Ryan Tew, fRI Research

The summary of activities and outcomes for the 2018/19 fiscal year are as follows:

- Funding model (of $141,100 spent):
  - 62% #1 (fRI Research core)
  - 10% #2 (HLP open ended from AlPac)
  - 28% #3 (HLP Program-based from West Fraser, Tolko, GoA)
  - Another ~$50,000 in other support was provided from WF, GoA, AlPac, and Tolko as part of the work of both the IEC and TOR sub-committees.
- Funding proposals:
  - Support for Program-level coordination and administration:
    - fRI support for the 2018/19 work plan. Submitted to the fRI BoD Jan. 2019. ***Partially successful*** ($87,000 approved of the $151,000 requested)
    - AlPac contributed $24,000 to help with Program Management.
    - GoA contributed $10,000 to help with Program Management
    - West Fraser Mill contributed $10,000 to help with Program Management
    - Tolko contributed $10,000 to help with Program Management
- Products:
  - Andison, D.W. 2019. The HL Program annual 2018/19 work plan. fRI Research, Hinton, Alberta. Jan. 18, 2019.
  - The HLP Interim Executive Committee. 2019. TOR for the Healthy Landscapes Program. Jan. 6, 2019.
  - The HLP Interim Executive Committee. 2019. Healthy Landscapes Program governance. March 1, 2019.
  - Draft budget and proposal to support a three-year contract for a Program Coordinator position with HLP
  - 2017/18 fRI Research annual report.
  - HLP text for the annual fRI Research “value-report”
  - HLP text for the 2018/19 fRI Research annual report
  - Quarterly reports to the fRI BoD (x4)

- Quarterly financial updates to the fRI BoD (x4)
- Trout, L. 2018. Survey results of HLP Partners' needs. Internal report. August, 2018.
- HLP Interim Executive Committee. 2018. Communique making the business case to HLP partners to fund a full-time Program Coordinator.

- Papers: (*Note that no funds have been assigned to completing these papers, so it may take another year or more to complete and submit them*).
  - Andison, D.W. (in draft). A scorecard approach to measuring progress towards EBM. To be submitted to Landscape Ecology.
  - Andison, D.W. (in draft). A grid-based alternative indicator for fire size. To be submitted to Forest Ecology and Management.
- Presentations:
  - Andison, D.W. 2018. How healthy are Alberta's forest landscapes? Presentation at the Forest Forum, April 24, 2018, Edmonton, Alberta.
  - Andison, D.W. 2018. The Healthy Landscapes Program: (Why) should I care about landscape health? Presentation at the fRI Information Forum. June 26, 2018, Calgary, Alberta.
  - Andison, D.W. 2018. Deploying the tools for effective decision-support. Presented at the Forest insects and fire: Forecasting with MPB-SpaDES (MPB). Feb. 22, 2019, Edmonton, Alta.
- Meetings: (minutes available upon request)
  - HLP Activity Team meetings:
    - April 10, 2018. Edmonton, Alberta
    - June 10, 2018. Edmonton, Alberta
    - July 3, 2018. Remote meeting
    - Nov. 6, 2018. Edmonton, Alberta
    - March 12, 2019. Edmonton, Alberta
  - HLP Interim Executive Team
    - Nov. 16, 2018. Edmonton, Alberta
    - Dec. 14, 2018. Edmonton, Alberta
    - Jan. 15, 2019. Remote meeting
    - Feb. 21, 2019. Remote meeting
    - Mar. 2, 2019. Remote meeting
  - HLP TOR sub-committee
    - Nov. 6, 2018. Remote meeting
    - Nov. 11, 2018. Remote meeting
    - Dec. 20, 2018. Remote meeting
    - Jan. 7, 2019. Remote meeting
    - Jan. 11, 2019. Remote meeting
    - Jan. 29, 2019. Remote meeting
    - Feb. 14, 2019. Remote meeting

- Feb. 20, 2019. Remote meeting
- fRI Research Program Lead (PL) meetings x6. (April 5, 2018, May 29, 2018, Oct. 18, 2018, Nov. 29, 2018, Dec. 5, 2018, Jan. 31, 2019)
- Nov. 20, 2018. fRI Research staff meeting. Remote meeting

- Status:
  - Working versions of both the new governance and TOR documents ready to be approved by the HLP Activity Team at the June 2019 AGM.
  - The Program-level funding shortfall identified at the start of the 2018/19 fiscal year has been addressed via the support of GoA, West Fraser, AlPac, and Tolko.
  - Working versions of a job description and budget for a full-time HLP Program Coordinator.
  - Three new project proposal drafts to be presented to the HLP AGM in June 2019 for approval and funding.

2.2.2 Dedicated Communication and Education Initiative

In 2013, the HL Activity Team has directed the HL Program to invest more resources and effort into communication and education on the topic of EBM / Healthy Landscapes. This resulted in the first draft of a HL Program C&E plan, which has been updated annually since. At the direction of the HLP Activity Team in 2016, Andison developed and presented: "*Small project shopping list for 2016/17 Healthy Landscapes Program"* that included overviews of 11 different C&E projects, including support and upgrading our new www.lessonsfromnature.ca website, a regular webinar series, canned presentation material, the revival of the *Quicknote* series, and more. A summary of activities and outcomes during the 2018/19 fiscal year are as follows:

- Funding model (of $9,000 spent):
  - 60% #2 (Open-ended funds from AlPac, GoNWT)
  - 40% #3 (Program-based funds from AlPac, West Fraser, GoA, Tolko)
- Funding proposals:
  - None.
- Products:
  - Maintenance and minor upgrades to the HLP www.Lessonsfromnature.ca website as required
  - Final draft of HLP/EBM universal slide-deck
- Papers:
  - None
- Presentations:
  - Chavardes, R., L.D. Daniels, and D.W. Andison. Altered fire regimes reduced montane diversity. 2018. HLP Webinar Wednesday series. Webinar, fRI Research. April 4, 2018.
  - Vinge, T., S. Trenchard, K. Lindsay, M. Donnelly, K. Rymer, B. Christian, and T. Gooding. 2018. Do the birds and the bees like NRV? A simulation experiment. fRI Research, May 2, 2018.

- Parkins, J., D.W. Andison, M.P. Pyper, and J. Leboeuf. 2018. Can people change in a day? Measuring impacts on public dialogue on EBM in Alberta. HLP Webinar Wednesday series. Webinar, fRI Research. June 6, 2018.
- Andison, D.W. 2018. Building a better mousetrap: An alternative to using fire size as a coarse filter indicator Online. HLP Webinar Wednesday series. Webinar, fRI Research. Sept. 5, 2018.
- Andison, D.W., 2018. How much old forest is too much? Understanding historical landscape patterns in the Upper Peace region of Alberta. HLP Webinar Wednesday series. Webinar, fRI Research. Dec. 12, 2018.
- Pyper, M.P., S. Odsen, J. Leboeuf, and D.W. Andison. 2019. Results from the "Creating a roadmap for EBM in Alberta and beyond" workshop. HLP Webinar Wednesday series. Webinar, fRI Research. Mar. 20, 2019.

- Meetings:
  - None.
- Status:
  - The lessons from nature (LFN) website attracted 245 users, with a total of 501 page views from April 1, 2018 to March 31, 2019. The flow of visits and page views was fairly constant over the year, but slightly lower than in 2017/18.
  - The Webinar Wednesdays series was initiated in 2018/19, and has proven popular, and will become a regular quarterly HLP deliverable, pending funding.
  - Plans to restart the HLP Quicknote series in 2017/18 did not happen (but will become a part of the 2018/19 plan)

2.2.3 EBM Dialogue Sessions

Another element of the HLP C&E plan was to host a series of dialogue sessions, designed to explore the source(s) of both support and discomfort with the concept and application of EBM principles. The sessions were open to any stakeholders or members of the public, but specifically targeted senior managers and policy-makers. The idea of dialogue is to introduce an active listening component, as opposed to more of a workshop style event where lectures are given on EBM. These sessions are designed to help understand the nature of what is often a highly uneven acceptance level of EBM across Alberta and beyond. The EBM Dialogue Team included David Andison (fRI/Bandaloop), John Parkins (U of A), Jules Leboeuf (GoA), and Matthew Pyper (FUSE consulting). A summary of activities and outcomes during the 2018/19 fiscal year are as follows:

- Funding model (of $15,000 spent):
  - 100% #5 (Other research funds via Alberta FRIAA Open Funds initiative)
  - An additional $3,000 was donated as professional time between Andison, Leboeuf and Pyper, and $3,000 in professional time from Parkins.
- Funding proposals:
  - None.

- Products:
  - Andison, D.W., J.R. Parkins, M.P. Pyper, and J. Leboeuf. 2019. Understanding EBM through dialogue. Final Report. fRI Research, Hinton, Alberta. Mar. 1 2019, 62p.
- Papers:
  - Parkins, J. Andison, D.W., Leboeuf, J. and Pyper, M. (in prep). Can people change in a day? Measuring impacts on public dialogue on EBM. To be submitted to a social science journal.
- Meetings:
  - Project Team meeting. April 2018, Remote meeting
  - Project Team meeting. June, 2018, Edmonton, Alberta
  - Project Team meeting. Sept. 2018. Remote meeting
  - Project Team meeting. Nov. 2018. Edmonton, Alberta
  - Project Team meeting Jan. 2019. Remote meeting
  - Project Team meeting. Feb. 2019. Remote meeting
  - Project Team meeting. March 2019. Remote meeting
- Status:
  - The final report has been completed, submitted and approved by the funding agencies
  - Work has begun on a manuscript

2.2.4 EBM Workshop

At the May 2017 HLP meeting, the group agreed that a workshop was needed to help bridge between the science, interpretation, and application of EBM. The team also agreed that there were valuable lessons to be learned from other jurisdictions such as Ontario and Quebec. A first draft of a workshop outline was completed by Jim Witiw, Tom Daniels, Shereen Trenchard, and Tim Vinge in Sept. 2016. The HLP Activity Team agreed to ask the PL to write and submit an EOI (expression of interest) to FRIAA Open funds toward this. This was submitted Dec. 2016, and it was approved to move to a full proposal. A full proposal was written and submitted May 2017, and approved in July of that same year.

The workshop took place June 19–20, 2018 at the Coast Edmonton Plaza in Edmonton, Alberta. The core planning team included David Andison, Matthew Pyper, Jules Leboeuf, and Sonya Odsen.

- Funding model (of $84,000 spent):
  - 100% #5 (Other research funds via Alberta FRIAA Open Funds initiative plus workshop fees)
  - Another $3,000 was contributed by HLP partner assistance
- Funding proposals:
  - None
- Products:
  - Planned and hosted a two day workshop: *Creating a roadmap for Alberta and beyond*, Edmonton, Alberta. June 19–20, 2018.

- Odsen, S.G., M. Pyper, J. Leboeuf, and D.W. Andison. 2019. Creating a roadmap for Alberta and beyond. Workshop summary report by the Healthy Landscapes Program. fRI Research, Hinton, Alberta. March 7, 2019. 31p.
- Podcast. Grumbine, E. 2018. A new way forward (EBM) with Ed Grumbine. *YourForest Podcast* with Matthew Kristoff. July 11, 2018. https://friresearch.ca/resource/new-way-forward-ecosystem-based-management-ed-grumbine-podcast
- Podcast. Andison, D.W. 2018. A new way forward (EBM) with David Andison. *YourForest Podcast* with Matthew Kristoff. July 17, 2018. https://friresearch.ca/resource/new-way-forward-ecosystem-based-management-david-andison-podcast

- Papers:
  - None.
- Presentations. Available online at http://frireseach.ca/resource/ebm-workshop-proceedings:
  - Atnikov, B. 2019. Solving complex problems using stretch collaboration. Presentation at the Roadmap for Alberta and Beyond workshop. fRI Research. June 19, 2018, Edmonton, Alberta.
  - Pyper, M.P. 2019. Understanding different perspectives on EBM through dialogue. Presentation at the Roadmap for Alberta and Beyond workshop. fRI Research. June 19, 2018, Edmonton, Alberta.
  - Breinesse, M. 2019. EBM experiences in Ontario. Presentation at the Roadmap for Alberta and Beyond workshop. fRI Research. June 19, 2018, Edmonton, Alberta.
  - Jette, J.P. 2019. EBM experiences in Quebec. Presentation at the Roadmap for Alberta and Beyond workshop. fRI Research. June 19, 2018, Edmonton, Alberta.
  - Van Damme, L. 2019. EBM experiences in Nova Scotia. Presentation at the Roadmap for Alberta and Beyond workshop. fRI Research. June 19, 2018, Edmonton, Alberta.
  - Morford, S. 2019. EBM experiences in Oregon. Presentation at the Roadmap for Alberta and Beyond workshop. fRI Research. June 19, 2018, Edmonton, Alberta.
- Meetings:
  - EBM workshop planning team. April 20, 2018. Remote meeting
  - EBM workshop planning team. May 3, 2018. Remote meeting
  - EBM workshop planning team. May 21, 2018. Remote meeting
  - EBM workshop planning team. June 11, 2018. Remote meeting
- Status:
  - All final products delivered.

2.2.5 NEPTUNE SPATIAL DECISION-SUPPORT TOOL

NEPTUNE (Novel Emulation Planning Tool for Understanding Natural disturbance Events) is a web-based decision-support tool designed to help planners create more “natural” disturbance events. NEPTUNE uses the spatial language published by Andison (2012) to create disturbance “events” from input shapefiles of disturbed and residual patches. It then calculates 10 pattern metrics from the input data, and compares the results to that of NRV based on the work of Andison and McCleary (2014). NEPTUNE, and its associated research, meet and/or exceed the requirements of

provincial regulations, FSC, and the CBFA for any and all within-fire metrics. NEPTUNE is calibrated for all of Alberta and central Saskatchewan, and the ultimate goal is to expand NEPTUNE calibration to other areas.

NEPTUNE is uniquely administered as a shareholder entity. There are eight shareholders at this time; West Fraser, Parks Canada, GoA, GoS, Mistik Management, ANC, AlPac, and Bandaloop. Any employee or designate of a shareholder can request access to NEPTUNE via the web portal and sign-in protocols. NEPTUNE shareholders are also responsible for making decisions on all model changes or upgrades. The current cost for a new shareholder is $40,000.

There was no money spent, or funds collected, during 2018/19 on this project. In terms of activities, the model was accessed only three times during the year. The project currently carries a negative balance of ~$6,850. This was to be offset by investments in new shareholders. Although several agencies expressed interest in the model, none panned out during 2018/19. The future of NEPTUNE should be re-evaluated by the shareholders in 2019/20.

2.2.6 LandWeb simulation modelling

The objective of the LandWeb project is to define historical NRV conditions at landscape scales across ~125 million ha of the western boreal from spatially explicit simulation modelling. The output will provide NRV for landscape scale metrics such as seral-stage levels and old forest patch sizes that will be CBFA, FSC, and all provincial regulations compliant. There are 16 partners involved in LandWeb; the GoA, GoS and GoNWT, West Fraser, Mercer, AlPac, Mistik Management, Alberta Newsprint Company, Millar Western, Canfor, Tolko, Weyerhaeuser, Louisiana Pacific (Manitoba and BC), Vanderwell Contractors, and Ducks Unlimited.

In 2014, the HLP formed a partnership with the CFS at the Pacific Forestry Centre and the University of Laval to develop the model. The framework in which LandWeb was developed is called SpaDES (Spatially Discrete Event Simulation). SpaDES is actually not a model, but rather a modelling framework in which other existing or new models and modules can “talk” to each other.

As of this time, the LandWeb deliverables will be about 20 months overdue. There are several reasons for the delays, including late delivery of critical spatial data, personnel changes to the modelling team, lack of delivery on the original fire spread module, and requests for additional app functionality by the LandWeb partners. However, the majority of the delays was simply due to under-estimating the sheer magnitude of the work to not just build and validate a model, but to (at the same time) develop and test an entirely new modelling platform. Even 20 months late, it is a notable accomplishment. For perspective, there is no other spatially-explicit, Monte-Carlo based landscape dynamics model that operates across such a vast area (~125 million ha) at such a fine level of resolution. Moreover, the legacy in terms of both model access (via a free app with an easy to use interface) and the opportunities for using the larger (and also free) SpaDES modelling environment (to expand the questions being asked via adding and/or developing new modules for species, climate, carbon, MPB, etc) is already proving to be invaluable.

In any case, the delays and challenges were foreseen before the start of the 2018/19 year, and the LandWeb team responded by developing and distributing a two-year phase II LandWeb proposal to the original partners to a) ensure both the model and the app were fully functional, and all results completed, and b) provide on-site presentations and

interpretations of results, and ongoing technical support and interpretation services for app users. Although the full version of the LandWeb expansion was not approved, thanks to Tolko, Mercer, and ANC, the HLP was able to offer Dr. Alex Chubaty (one of the model developers) a one year contract with fRI in 2018/19.

A summary of activities and outcomes during the 2018/19 fiscal year are as follows:

- Funding model (of $145,000 spent):
  - 80% #4 (HLP project-specific from the partners)
  - 20% #5 (other research from FRIAA)
  - An additional $50,000 was spent from professional time spent from CFS and Laval staff
- Funding proposals:
  - Support and development of a spatial simulation decision-support tool for understanding and integrating pre-industrial landscape-scale patterns into strategic planning. Phase II of the LandWeb project. Funding proposal to the LandWeb partners. April 30, 2018. $322,000 over two years. ***Unsuccessful.***
  - Building capacity for a new spatial simulation DS tool for landscape-scale planning: Phase II of the LandWeb project. Funding proposal to Alberta FRIP (via Tolko, Mercer, and ANC). June 1, 2018. $115,000. ***Successful.***
- Products:
  - One year contract to Dr. Alex Chubaty to complete the app and deliver outputs. June 4, 2018.
  - LandWeb project output Q&A #1. Briefing note to the LandWeb partners. April 9, 2018. 2p.
  - The LandWeb team. 2018. Getting to know LandWeb. #1. Introducing LandWeb. What does it mean for you? Briefing note. fRI Research, Hinton, Alberta. Oct. 9, 2018. 2p.
  - Andison, D.W. 2018. Historical landscape condition benchmarks for western boreal Canada (LandWeb). Final report to FRIAA. fRI Research, Hinton, Alberta. April 30, 2018. 12p.
- Papers:
  - None
- Presentations:
  - Andison, D.W., A. Chubaty, and E. McIntire. 2018. LandWeb and SpaDES update. Webinar. August 11, 2018.
  - Andison, D.W. 2018. LandWeb update to Louisiana Pacific. Webinar. Sept. 10, 2018.
  - Andison, D.W., and A. Chubaty. 2018. Modelling historical landscape patterns on the Mercer FMA. Presentation to Mercer. Peace River, Alberta. Sept. 26, 2018.
  - Andison, D.W., and A. Chubaty. 2018. Modelling historical landscape patterns on the Tolko FMAs of Alberta and Saskatchewan. Presentation to Tolko. Edmonton, Alberta. Sept. 29, 2018.
  - Andison, D.W. 2018. LandWeb and bears. Presentation to fRI Research. Oct. 23, 2018. Webinar.
  - Andison, D.W., and A. Chubaty. 2019. Modelling historical landscape patterns on the ANC FMA. Presentation to ANC. Edmonton, Alberta. Feb. 21, 2019.

- Andison, D.W. 2019. Models, LandWeb, SpaDES, and world peace. LandWeb partner meeting. Edmonton, Alberta. March 11, 2019.

- Meetings:
  - LandWeb partner meeting and update. April 9, 2018. Edmonton, Alberta
  - Ad-hoc LandWeb discussion by HLP IEC. May 14, 2018. Remote meeting
  - LandWeb partner meeting and update. June 11, 2018. Edmonton, Alberta
  - LandWeb partner meeting and update. Nov 7, 2018. Edmonton, Alberta
  - LandWeb partner meeting and update. March 11, 2019. Edmonton, Alberta
- Status:
  - Although the model was technically completed at the start of the year, it took a full year of work to address the many requested partner upgrades, make the app fully functional, deal with all glitches, complete the full analyses for all partners, and present and deliver the final modelling results to a small group of partners.
  - The new delivery date for all final reports is March 31, 2020.

What could we have done differently? On the eve of the final year of this project, it is hard to imagine how the LandWeb roll-out could have been expedited given the many technical and data challenges. The research team took extraordinary measures to identify people, funding, and creative solutions in response to the various challenges. Where we could have done better is keeping the LandWeb partners more informed in an open and more consistent way.

2.2.7 Linking EBM concepts with fine-filter values

The differences between (the historic) value-based approach, and an EBM approach to forest land management are exemplified by the contrast in perspectives on disturbance. In a classic value-based approach, disturbance is generally considered to be negative influence on the provision of habitat, services, or human values. An EBM perspective suggests that disturbance is not only a regular, natural phenomenon, but one that is critical to the long-term sustainability and health of the ecosystem. Unfortunately, the debate is still largely based on opinion rather than facts. This project is designed to objectively address this gap by capturing the impact of disturbance on a range of fine filter values directly, and quantitatively.

This is technically the second phase of a project that began three years ago as a GoA project known as BURNDS (Biodiversity Using Range of Natural Disturbance Strategically). In the first phase, scenario modelling was used to explore the fine-filter implications of moving landscapes towards the conditions defined by NRV. Not surprisingly, the results suggested that pushing landscapes towards NRV by introducing greater levels of disturbance actually created higher levels of overall biodiversity.

This second phase of the project will be completed under the auspices of a Master's degree of Mr. Tim Vinge at U of A. The HLP project team includes Dr. Scott Nielsen, Dr. David Andison (Bandaloop and fRI), Matthew Pyper (FUSE), Neal McLoughlin (GoA), and Laura Trout (HWP). Tim's MSc committee includes Dr. Nielsen, Dr. Andison, and Dr. Erin Bayne.

- Funding model (of $61,000 spent):
  - 100% #5 (FRIAA Open Funds)
  - Another $5,000 from collaborators (U of Alberta)
- Funding proposals:
  - Proposal to ANC and West Fraser for project funding for $10,000 each via FRIAA. ***Successful.***
  - Proposal to Devon for project funding for $20,000. Verbal agreement secured, but voided after Devon was bought by another company. ***Still pursuing this.***
- Products:
  - Draft MSc thesis proposal by T. Vinge.
- Papers:
  - None
- Presentations:
  - Webinar by T. Vinge (see above)
  - Vinge, T. 2018. MSc research overview. Presentation given to GoA staff. July 14, 2018.
- Meetings:
  - Project team meeting. April 11, 2018. Edmonton, Alberta
  - Committee meeting. July 24, 2018, Edmonton, Alberta
  - Project team meeting. July 27, 2018, Edmonton, Alberta
  - Ad-hoc committee meeting. Oct. 3, 2018. Remote meeting
  - Committee meeting. Dec. 11, 2018, Remote meeting
- Status:
  - The start of this project was delayed for personal reasons by the Principal Investigator. The new delivery date is March 31, 2021.

2.2.8 Creating wildfire mortality maps and metrics from Landsat imagery

The "Burning patterns of natural wildfires" research project was completed in 2016, but now includes data and historic NRV results for all of Alberta and central Saskatchewan. The detailed database of 129 wildfires is the largest and most precise of its kind in the world, and has thus far generated seven published papers and at least as many scientific conference presentations. It is also one of the cornerstones of the collective NRV requirements at the event-scale for provincial governments, the FSC, and the CBFA. Unfortunately, these data have been expensive and time-consuming to create using historical aerial photos. The reliance on finding timely, high quality aerial photos before and after each fire event also limits the utility of this method geographically. Landsat has become the tool of choice for most other burn severity projects since it is free and full spatial coverage exists since the mid-1980's. However, until now, the ability of Landsat procedures to predict mortality from wildfires has been poor to moderate, which makes it unsuitable in its current form as being scientifically-defendable (as per most forest management NRV requirements).

This project attempted to manage this knowledge gap by building a methodological bridge between photo-based and imagery-based interpretations of fire mortality maps. A PhD student (Mr. San Miguel) under the supervision of Dr. Nicholas Coops, UBC Forestry looked at this question. The GoNWT agreed to fund the last phase of this work into NWT. This project was largely completed this year. A summary of activities and outcomes for the 2018/19 fiscal year are as follows:

- Funding model (of $18,000 spent):
  - 20% #2 (HLP Open-ended)
  - 80% #4 (project specific funding from GoNWT)
  - Another $4,000 was spent from professional time at UBC
  - Another $4,000 was donated by professionals (Bandaloop)
- Funding proposals:
  - None.
- Products:
  - San Miguel, I. 2018. Assessing historical landscape patterns following fire in the Canadian boreal forest using remote sensing data. PhD thesis. August 9, 2018. UBC, Vancouver, BC. 144p.
  - San Miguel, I. and D.W. Andison. 2018. Final report: Wildfire event patterns in the Northwest Territories. fRI Research, Hinton, Alberta. Oct. 4, 2018. 28p.
- Papers:
  - San Miguel, I, D.W. Andison, and N.C. Coops. 2018. Quantifying local fire regimes using the Landsat data archive: A conceptual framework to derive detailed fire pattern metrics from pixel-level information. Int. J. of Digital Earth. April 18, 2018. https://doi.org/10.1080/17538947.2018.1464072.
  - San Miguel, I, N.C. Coops, R.D. Chavardes, D.W. Andison, and P. Pickell. (under review). What controls fire patterns: Predictability of fire characteristics in the Canadian boreal plains ecozone. *Submitted to Ecosphere March 2018.*
- Presentations:
  - Webinar Wednesday (see above).
  - None
- Meetings:
  - PhD thesis defence. August 9, 2018
- Status:
  - Project has been completed.
  - The last manuscript remains under review.

2.2.9 Historic fire regimes, water and climate

The genesis of this project is worth noting as an example of the benefits of investing in a research ***Program***, as opposed to individual projects. In 1999, the first results of the *Island Remnants Project* (which became the *Historical*

Fire Patterns project) suggested that the amount of surviving remnants from historical wildfires in the Rocky Mountain foothills ranged from very high to very low. The expansion of this work to other parts of the western boreal confirmed these findings, suggesting that the western boreal may not be a simple stand-replacing ecosystem. This spawned a pilot study in the northwestern area of the Hinton Wood Products FMA to look at the fire history of specific sites using dendrochronology (i.e., tree-ring) methods, which would allow us to extend fire history much further back in time. The results confirmed that some historical fires burned at lower levels of severity, and on a higher frequency than previously assumed (Amoroso et al. 2011).

So now we knew there were some lower-severity fires in the central foothills area historically, but there was not enough evidence to make conclusive statements about the degree to which a "mixed severity fire regime" (MSFR) was operating in the area. However, the HLP Team agreed that it was enough to justify expanding the scope of the study. With the support of the HLP Activity Team, in 2011, a team of four Principal Investigators (PIs) from four different Canadian Universities (Drs. Lori Daniels, Ze'ev Gedalof, Mike Pisaric, and Katrina Moser) submitted a proposal to NSERC to look for evidence of a MSFR across the southern Rockies (including study sites in both BC and Alberta) using both dendroecology (i.e., tree ring) and paleo-ecological (i.e., lake sediment) sampling methods.

This project is largely completed. The one exception is the extension of the work of Mr. Raphael Chavardes who continued his work with a PhD at UBC, who will finish next year. A summary of activities and outcomes during the 2018/19 fiscal year are as follows:

- Funding model (of $22,000 spent):
  - 20% #2 (Open-ended funding from AlPac)
  - 25% #4 (Project-based from roll-over HLP partner funding)
  - 55% #5 (Other funding agencies, including Mitacs & UBC)
  - Another $4,000 in support provided by professional time at UBC
  - Another $4,000 in professional time donated by Bandaloop
- Funding proposals
  - None.
- Papers:
  - Chavardes, R.D., L.D. Daniels, Z. Gedalof, and D.W. Andison. 2018. Human influences superseded climate to disrupt the 20th century fire regime in Jasper National Park, Canada Dendrochronologia 48: 10-19.
  - Davis, E.L., C.C. Mustaphi, and M.F.J. Pisaric. 2018. Forests, fire histories, and the future of Columbian and Rocky Mountain forests, western Canada. Nov. 2018. Western Geography 23 (3-11).
  - Chavardes, R., L.D. Daniels, B. Eskelson, and P. Pickell. (under revision). Monthly derivatives of the drought code reveal nuanced fire-0climate associations in montane forests with a mixed severity fire regime. *Submitted to Int. J. Wildland Fire.*

- Presentations:
  - Chavardes, R., L.D. Daniels, D.W. Andison, B. Eskelson, and Z. Gedalof. 2018. Fire-synchrony and its climate drivers in the southern cordillera of western Canada. Presentation given at fRI Research, Hinton, Alberta. Sept. 30, 2018.
  - Chavardes, R., L.D. Daniels, D.W. Andison, J.E. Harvey, B. Eskelson, and Z. Gedalof. 2018. Fire-synchrony and its climate drivers in the southern cordillera of western Canada. University of Alberta research seminar and webinar. Edmonton, Alberta. Oct. 1, 2018.
- Status:
  - Raphael will defend this PhD thesis and complete the last paper by the end of next year.

2.2.10 Landscapes in Motion *(AKA: Mixed-severity fire regimes in the southern foothills of Alberta)*

In 1998, empirical evidence that not all fires in the Alberta foothills were stand-replacing started to grow. The HLP project "*Burning patterns of natural wildfires*" was the first to note that the proportional of surviving vegetation "remnants" was well above the classic 20% threshold. This spawned the support and completion of the Berland pilot study under the auspices of the HLP, which found that indeed lower severity fires on more frequent intervals could occur (Amoroso et al. 2011). However, a simple pilot study says nothing about the prevalence, or influence of local conditions on the larger landscape. The only way to know for sure is to understand the relationship(s) between the severity, size, and frequency of historical fires over both time and space. The methods necessary to capture these regime dynamics are very specific: intensive field sampling to create a standard tree-ring chronology over one or more extended areas of a landscape. In other words; the sampling must reflect the need to understand not just fire mortality, but also fire size, fire frequency, and the main fire weather and fuel conditions. Although many pieces of this puzzle have been studied, no one has attempted to solve it as a whole.

A second component of this project is the development of a partial-severity burn module. There are several landscape scenario simulation models right now that can re-create natural wildfire conditions – but they all include fire modules that assume complete mortality of a given pixel or cell. This is a function of both convenience and knowledge. We now have enough new knowledge to suggest that fire burning modules should be capturing partial mortality. The final module will be SpaDES and LandWeb compatible, and we plan on using the research from part I of this study to calibrate it for the southern Alberta foothills study area.

A third part of this study is the analyses of photo pairs from the Mountain Legacy Project (MLP) to evaluate vegetation change over the last century. This part of the project is being managed by Dr. Eric Higgs, U. Vic.

The fourth and final element of this project is a stand-alone communication and education (C&E) plan that includes a dedicated website, tours, and presentations.

- Funding model (of $320,000 spent):
  - 100% #5 (other funding agencies including Alberta Innovates, FRIAA, and Mitacs)
  - Another ~$95,000 was invested in this project by our research partners, including UBC, U. Vic., U. Laval, and the CFS Pacific Forestry Centre.

- Funding proposals:
  - Mitacs Elevate application for PDF support for the fire modelling position (Barros)***. Successful ($60,000 over two years).***
- Products:
  - Full-day field tour of field sites. 30 participants. Sept. 12. 2018.
    - Three presentations, one each by C. Naficy, C. Baros, and C. Stockdale / J. Fortin (see below).
  - Naficy, C. E., P. E. Higuera, M. Parisien. 2018. Assessing resilience to wildfires across the social-ecological spectrum. Special session co-organizer and moderator for 18 speakers at the Fire Continuum Conference, International Association of Wildland Fire & the Association for Fire Ecology. Missoula, MT. May 21-24, 2018.
  - Blogs. During 2018/19, we posted 17 new blogs to the website dedicated to this project (http://www.landscapesinmotion.ca). We had an average of 80 users / month and 275 page-views / month during 2018/19, which is slightly lower than the numbers we had in year one, but still impressive numbers.
  - Tweeting. LIM tweets reached an average of 7000 people / month. Most followers (36%) are very local, suggesting we are connecting with our target audience. The next highest follower audience is BC (21%).
  - Alberta Innovates annual update report. May 2018.
  - Field sampling in the summer of 2018 included 80 plots, ~1,200 tree samples, and 261 fire scars
  - Processed and cross-dated 1) all 2018 samples, 2) 1350 samples from 2017 field sampling, 3) 472 samples from the work of MP Rogeau, and 4) 428 samples from S. Jevons.
  - Umrysh, C.A. 2018. Evidence of mixed- severity fire regime in *Pinus contorta* forests of the southern Alberta Foothills: implications of fire suppression. Undergraduate honors thesis. Department of Forest & Conservation Sciences, Faculty of Forestry, University of British Columbia.
  - Saelle, D. 2018. Fire Chronology, Tree Recruitment and Growth in the foothills of Alberta's Rocky Mountains from 1860–2010. Undergraduate honors thesis. Department of Forest & Conservation Sciences, Faculty of Forestry, University of British Columbia.
- Papers:
  - None
- Presentations:
  - Naficy, C. E. 2018. A multi-century, transboundary perspective on the fire ecology of the Crown of the Continent. 15th Annual Waterton-Glacier Science and History Day; Waterton Lakes National Park, Canada. July 24, 2018.
  - Naficy, C. E., T. T. Veblen, P. F. Hessburg, & L. D. Daniels. 2018. Fire-fire interactions and multi-scale controls on fire severity in historical mixed-severity fire regimes of the northern

U.S./southern Canadian Rockies. Special session. Fire Continuum Conference, International Association of Wildland Fire & the Association for Fire Ecology. Missoula, MT. May 21-24, 2018.

- Barros, C. 2018. Including fire vegetation feedbacks for modelling mixed-severity fire regimes at large spatial scales. Presentation at the ESA conference, New Orleans, Louisiana. August. 2018.
- Fortin, J. 2018. What can we learn from Mountain Legacy Project photo pairs? Presentation to junior rangers. Bragg Creek, Alberta. July 2018
- Naficy, C. E. & L. D. Daniels. 2018. Detailed fire history patterns and landscape reconstruction from aerial photos. Landscapes in Motion field tour. September 12, 2018. Sheep River Provincial Park, Alberta, Canada.
- Barros, C, E. McIntire, and D.W. Andison. 2018. Spatial modelling partial morality; why it matters. Landscapes in Motion field tour. September 12, 2018. Sheep River Provincial Park, Alberta, Canada.
- Stockdale, C. and J. Fortin. 2018. Using oblique photos to understand historical vegetation patterns. Landscapes in Motion field tour. September 12, 2018. Sheep River Provincial Park, Alberta, Canada.

- Meetings:
  - Project team meeting. May 23, 2018. UBC, Vancouver. BC
  - Project team meeting. Sept. 21, 2018. University of Victoria, Victoria, BC
- Status:
  - Adjusted the final deliverables date for all funding agencies to align on March 31, 2020.

3.0 Unfinished Business

The HLP manages a large and diverse group of projects each year. Some have logical and clear end points. Others spawn new phases. Still others either a) create extensions that are either unforeseen at the time of the original proposal, b) were completed (in part) without a formal proposal, or c) failed to make the cut in previous years of new project voting. The following is a list of projects that fall into this third category for which the HLP may consider future investment.

3.1 Planning for Healthy Landscapes Short Course – Part II

In 2010, the HLP Activity Team and fRI Research Board approved funding of a professional short course to help planners design cultural disturbance events (from harvesting, fire, or other activities) that look and feel more like natural disturbances. The course was intended to use the spatial language developed by Andison (2012), which is also that used in the NEPTUNE DSS tool, as well as the 12 years of research results from the Wildfire Patterns Study and its many phases. In 2010, a course DACUM (Developing a Curriculum) developed with a focus group, and fRI Research

contracted WOLF (Woodlands Operations Learning Foundation) in 2014 to create the course. The course has been given several times online by WOLF over the next several years, and parts of the content borrowed for several others.

The HLP Activity Team agreed that, while this was a good foundation level course, there is a need for training of how to design more "natural" disturbance events on a more technical level for more advanced students (such as planners and GIS specialists). While the HLP new project list did not include this second course over the last several years, informal discussions and comments suggest that this topic remains a priority for some partners.

3.2 Tracking the Evolution of EBM in the Canadian Boreal Forest

As part of ongoing philosophical deliberations and updates to the HLP Activity Team, the HLP Program Lead drafted an fRI Research report that attempted to break down the complex problem of a creating a *Healthy Landscape* into more manageable elements, and use a scoring system matrix to rank progress towards the that goal (Andison 2016). The technical bits of the matrix and scoring system were developed as part of ongoing discussions with the HLPAT, but the report summarizing it was completed 100% on donated time.

Given the fact that this matrix more or less defines the HL Program, there remains some unfinished business. First, the relationship between "Healthy Landscapes" and EBM requires reconciliation. As the Andison et al (2012) report suggests, the Healthy Landscapes concept was always intended as an interpretation of EBM, but the specifics of the overlap need to be more fully explored, presented and shared. The second piece of unfinished business is a published manuscript describing the concept and value of an EBM matrix.

3.3 A More Robust Method of Capturing Meso-scale Natural Patterns

One of the more glaring gaps between the concept and the reality of using wildfire patterns as guides for forest management is disturbance event sizes. The challenge lies in setting an artificial upper threshold of 1,000-10,000 ha by provincial and international standards for event sizes. Research clearly shows that applying such a threshold approach creates very different landscapes than those created under more "natural" conditions.

A demonstration project under the auspices of CEMA developed an alternative grid-based indicator system based on 60+ years of natural wildfire patterns in northern Saskatchewan that does much the same thing, but eliminates the drawback (Andison et al. 2015). The final products for this project were delivered, but the nature of the project was such that there was no accommodation made for publishing this work in a journal. A partial draft of a manuscript exists via donated time from Dr. Andison over the last two years.

3.4 A Comparison of Harvesting and Wildfire Patterns

The origins of this particular piece of unfinished business go back almost ten years to the original Wildfire Patterns project. There has been considerable research on natural wildfire patterns using a unique spatial language developed by the HLP research team (e.g., Andison and McCleary 2014), as well as exploration of anthropogenic patterns using that same spatial language (e.g., Pickell et al. 2013). However, we still lacking is a direct comparison of these disturbance patterns with those of both a) traditional (two-pass) harvesting patterns, and b) wildfire-inspired

harvesting patterns. Towards this, the spatial analyses of four case studies have been completed, and a partial first draft of a manuscript completed from donated time by Dr. Andison.

4.0 2018/19 IN REVIEW

The list of accomplishments of the HLP in 2018/19 exceeded those of any previous years. Not only did the list of deliverables grow in numbers, but also in breadth. For example, the HLP expanded opportunities for stakeholder communication and HLPAT interaction via internal team updates, blogs, podcasts, webinars, and field tours. Feedback suggests that these tools are well received both internally (to HLP partners) and externally. Moreover, there were no significant issues with Program budgets, funding, staff, personnel, safety, sub-contractors, or output quality. The single exception to this was the 40k Program-level funding shortfall identified very early in the year, and ultimately resolved before the end of the year — without compromising on either the quality or quantity of HLP deliverables.

In terms of project timelines, the majority of the projects delivered their products on time. There were only two exceptions. The first was the *Linking NRV concepts with fine-filter values* project, which will be delayed by at least a year due to unforeseen personal circumstances of the project PI (see Section 2.2.7 for details). The other exception is the LandWeb project, which will end up finishing about 20 months past the original deadlines (see Section 2.2.6 for details). The contrast in the strategies for the two projects provides a valuable lesson in the value of clear and consistent communications with funding partners. When LandWeb began in 2013, it did not include the formation of a Project Team. Rather, it relied on semi-annual (one-day) meetings to provide updates and solicit feedback from all of the funding partners that attend. The many months between meetings was magnified by inconsistent attendance at these meetings by the partners.

In contrast, the *Linking NRV concepts with fine-filter values* project formed a Project Team consisting of three volunteers from the HLP Activity Team upon approval of the funding. The Project Team was very active in the first year, providing input and partner perspectives to the research team, but also getting regular updates on the nature and magnitude of any project challenges that may ultimately affect the timelines.

In hindsight, a Project Team for LandWeb may have helped shorten some of the delays, but more importantly, it would have provided a means of maintaining a more consistent two-way conversation with LandWeb partners about project progress, challenges, deliverables, changes to methods and personnel - and timelines. Also, a small, mobile, and knowledgeable Project Team could also have helped us more effectively communicate with the larger LandWeb partnership at the semi-annual meetings.

With this in mind, every new HLP project (starting in 2017/18 actually) will have a dedicated Project Team, made up of 2-5 members of the HLP Activity Team who function on behalf of the HLP Activity Team providing input, advice, and feedback, and being responsible for reporting back to the larger Activity Team. In fact, the HLP already has extensive experience with Project Teams including (for example) the Hwy40 Demo project, the Upper Athabasca

Healthy Landscapes project, LIM, and the EBM workshop. Thus, the idea of a Project Team is not new to HLP — only the decision to have one for ALL future HLP projects.

One of the most notable highlights of 2018/19 is the increased involvement of the HLP partners in the ***Program***. Over the last six months alone of 2018/19 the IEC (Interim Executive Committee) met five times, and the TOR sub-committee another eight times. The output from these teams includes 1) next generation versions of governance and TOR documents, 2) a proposal to support a three year Program Coordinator, and 3) a commitment to backfill 40k in Program level funding to eliminate this funding gap noted at the start of the year. The various documents for items 1 and 2 will all be presented to the HLP Activity Team at the June 2019 AGM for approval. It is also noteworthy that of the $1,041,000 spent on HLP projects, the HLP partners contributed 208k. This represents about 20% of the HLP funding, which is far above the annual average for partner contributions over the last five years. The significant time, effort, and funding commitment by the HLP partners in 2018/19 strongly suggest that the Program is still relevant and important to the HLP partnership – which bodes well for the future.

Other highlights of the 2018/19 year for the HLP include:

1) Raphael Chavardes' research (Section 2.2.9) on the relationship between fire regimes, climate, and human influence in the Alberta front-range is ground-breaking and receiving international attention. Raphael's PDF (post-doctoral fellow) position in Quebec with Yves Bergeron's fire lab bodes well for future, broader research collaborations with fRI to explore these relationships further. Given the fact that Alberta is the most likely Canadian candidate to be impacted by climate change as regards forest dynamics, pursing the climate-fire-vegetation relationship is a logical priority.
2) Ignacio San Miguel's research (Section 2.2.8) on fire mortality mapping using satellite imagery represents a legitimate science-based challenge to the validity of virtually all satellite-based fire mortality mapping studies. In other words, the output from many studies using Landsat imagery on fire residual levels is highly questionable on methodological grounds. Ignacio's research provided a new, alternative, and more accurate methodology, and added another 500+ fires to the HLP natural wildfire database.
3) The EBM Workshop output provided some clear and important messages as regards the future of EBM in western Canada:
    a. Virtually everyone agreed that EBM was a valuable paradigm across the full spectrum of partners and stakeholders,
    b. The interpretation of what EBM "is" varied — largely by agency / personal philosophy,
    c. ***ALL*** past efforts of implementing EBM in Canada and beyond have met with significant opposition — in some cases fatally so,
    d. ***ALL of the invited EBM experts*** agreed that the most important ingredient for translating EBM principles into practice was continual, open, and honest communication AND engagement with any and all stakeholders and partners.
4) The timeline challenges aside, the LandWeb project has gained considerable (positive) attention beyond fRI Research across Canada. Other than the modules created by the LandWeb group, other groups have developed SpaDES modules for woodland caribou, mountain pine beetle, carbon, and economics. Courses

and seminars on using SpaDES are being offered at universities and through the CFS. Given its momentum, this could become one of the most valuable decision-support tools of the next decade to explore questions ranging from climate change to fire risk to caribou. The LandWeb partners are well positioned to take full advantage.

5) Our first substantial foray into creating regular blogs on the LIM website, and our first couple of podcasts, were both very successful. For example, of our two dedicated websites, we have far more traffic on the www.landscapesinmotion.ca website than we do the www.lessonsfromnature.ca website — which has had no updates or changes over the last 12 months. This is a valuable lesson for us as regards the dynamics of digital communication moving forward.
6) Similarly, the popularity of the new Webinar Wednesdays series suggests that it will become a regular commitment of the HLP from this point forward.
7) The rise of the Project Team as an HLP staple. As described above, the success of past and current Project Teams suggests that it should, and will, become a regular feature of the HLP moving forward. Experience suggests that although adding Project Teams to each project does in fact require more administrative time and effort to manage, that is more than offset by the benefits more continual engagement with partners.

5.0 LOOKING AHEAD

The HL Program continues to push at the leading edge of forest land management paradigms in western boreal Canada. The Quebec version of EBM has already manifested itself in the form of a new provincial policy exemplified by their tagline: *Closer to Nature*. Ontario has similarly adopted its own forest management approach inspired by EBM principles. Armed with the wisdom gained from both provinces, in addition to the feedback from both the Dialogue Sessions and the EBM Workshop, we now have a better understanding of the nature of some of the obstacles to EBM implementation. In short, the challenges of translating EBM concepts into reality lies more with resistance to change and mistrust as it does a lack of science / evidence.

The three new projects that were identified and ranked the highest during the HLP annual project review process for the 2019/20 fiscal year of the HLP during 2018/19 were all meant to address this challenge. The first is an *EBM Demonstration Cooperative*, which will provide a structured method of showcasing, organizing, and including others in attempts at integrating various EBM elements. The second new project will evaluate *EBM Barriers*, which essentially completes the story started by output from both the Dialogue Sessions and Workshop in terms of where and why certain aspects of EBM get any uptake, or not. The missing ingredient in this story is the more formal one of hard and soft P policies across the many institutions and agencies involved. The third and final new project will look at the ecological *Benefits of Disturbance* – largely because the vast majority of the discourse as it relates to disturbance has been negative, and thus biased. Each project will involve both standard data gathering methods combined with surveys and/or interviews of partners and stakeholders.

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APPENDIX A: ABBREVIATIONS USED IN THIS REPORT

AlPac	Alberta Pacific Forest Industries Inc.
ANC	Alberta Newsprint Company
Bandaloop	Bandaloop Landscape-Ecosystem Services Ltd.
BC	British Columbia
BURNDS	Biodiversity using range of natural disturbance strategically
CBFA	Canadian Boreal Forest Agreement
Canfor	Canfor Corporation
C&E	Communication and education
CFS	Canadian Forestry Service
CRV	Current range of variation
DU	Ducks Unlimited
EBM	Ecosystem-based management
EOI	Expression of interest
fRI	fRI Research
fRI BoD	fRI Research board of directors
FRIAA	Forest Resource Improvement Association of Alberta
FRV	Future range of variation
FSC	Forest Stewardship Council
GoA	Government of Alberta
GoNWT	Government of the Northwest Territories
GoS	Government of Saskatchewan
LandWeb	Landscape dynamics of western boreal Canada
LIM	Landscapes in motion
LFN	Lessons from nature (website)
HLP	Healthy Landscapes Program
HLP C&E	Healthy Landscapes Program Communication and Education strategy
HLPAT	Healthy Landscapes Program Activity Team
LP	Louisiana Pacific Corporation
MW	Millar Western Forest Products Ltd.
Mercer	Mercer International (Peace River Pulp)
Mitacs	Mitacs Canada (research grants)
MLP	Mountain Legacy Project
MSFR	mixed severity fire regime
NEPTUNE	Natural Emulation Pattern Tool for Understanding Natural Events
NSERC	Natural Sciences and Engineering Research Council of Canada
NDP	Natural Disturbance Program
NRV	Natural range of variation
PDF	Post-doctoral fellow

SpaDES	Spatially discrete event simulation
Tolko	Tolko Industries Ltd.
TOR	terms of reference
U of A	University of Alberta
UBC	University of British Columbia
U. Laval	University of Laval
U. Vic	University of Victoria
Vanderwell	Vanderwell Contractors (1971) Ltd.
WF	West Fraser Mills Ltd.
Weyco	Weyerhaeuser Company
WOLF	Woodlands Operations Learning Foundation