

Value Report

2014-2015

Prepared for
Achievements Supporting Oil and Gas



This value report is a collection of accomplishments of Foothills Research Institute (fRI) programs and associations.

April 1, 2014–March 31, 2015



RESEARCH GROWING
INTO PRACTICE



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Research projects that provide industry and governments with information to better manage ecological issues of concern are a priority for the oil and gas industry. fRI brings value to the oil and gas industry by ensuring effective, efficient research through collaboration with other sectors on land-use related issues, and by providing knowledge and tools applicable in Alberta and beyond. This report showcases the achievements of our programs and associations from April 2014 to March 2015.





Alberta Land-use Knowledge Network

The Alberta Land-use Knowledge Network (LuKN) provides effective land-use knowledge by maintaining an online resource with relevant and timely information from trusted sources. This resource allows those involved in land-use issues to go to one source for answers to their land-use questions. It encourages discussions on land-use challenges such as urban agriculture and watershed health, and supports many individuals and organizations involved in these issues. For example, it offers professional development courses for members of the Alberta Professional Planners Institute.

The LuKN aims to be a go-to source of quality information on issues related to land use in Alberta. It provides information on a broad range of topics of interest to oil and gas, including tailings pond issues, reclamation, and water and air quality monitoring. Program lead Terri McHugh says, “We work hard to stay on top of current issues, seek out trusted sources of information, and find new ways of sharing good content with the people who need it.”

Achievements

- In partnership with the Land Use Secretariat, the LuKN began the process of creating an online course on the topic of complying with regional plans.
- The resource library was further expanded. It now includes over 800 videos on the LuKN YouTube channel, as well as the wide range of resources catalogued on the landusekn.ca website.
- Networking has established new relationships with key associations and organizations involved in land-use management, and maintained ongoing relationships with a wide range of land-use associations.
- The LuKN identified, developed, and presented high-quality information and knowledge resources through the web page and content management system, including videotaping conferences and providing workshop support, with the goals of keeping knowledge resources current and topical, and developing a range of resources to support each major land management issue.



Caribou Program

The Caribou Program does research about caribou, their habitat, and threats to their survival, with the goal of using science-based knowledge to recover this threatened species and support policy for landscape management. The research undertaken in this program also assists industry in making better land management choices, helps to ensure that industry minimizes its environmental impact on caribou habitats, and helps the government execute effective range planning.

Achievements

- The Caribou Program established partnerships and secured funding to carry out new research in west-central and northwest Alberta.
- The program continued to work closely with the Grizzly Bear Program and Mountain Pine Beetle Ecology Program at fRI in order to carry out integrated research.
- The project Predator and Prey Responses to Seismic Lines is in its second of three years and includes close collaboration with other fRI programs (Foothills Land Management Forum and Grizzly Bear Program) and project partners: Alberta Environment and Sustainable Resource Development, the University of Calgary, the University of Alberta, and the University of Montana. This collaboration with other programs, government, and universities makes it possible to analyze the movements of caribou and grizzly bears across a large geographic area.
- The project Direct and Indirect Response of Caribou to Dynamic Forest Landscapes is in the second of three years and provides science-based knowledge to ensure habitat supply and function can be maintained for two threatened species in Alberta. This research is determining how caribou and grizzly bears respond to disturbed habitat at different stages of regeneration. It can be used to identify thresholds of habitat use for both species and helps in sustainable forest management efforts in the boreal forest.
- The project Assessing the Role of Grizzly Bear Predation on Caribou is in its final year of research. It is a joint effort of the Grizzly Bear Program and Caribou Program. An assessment of the extent of grizzly bear predation upon caribou is being completed by linking GPS collar data from both caribou and grizzly bears. This research, conducted in collaboration with Weyerhaeuser, will fill a gap in current knowledge.
- In its first year of two, the study Analysis and Improvement of Linear Features to Increase Caribou Functional Habitat in West-Central and Northwestern Alberta will analyze animal movement data from field surveys and new technologies to build a ranking system to prioritize habitat restoration activities to the benefit of forestry and land managers.





Foothills Growth and Yield Association

The Foothills Growth and Yield Association (FGYA) continually generates information about the growth and yield of lodgepole pine in managed stands. This data is critical for optimal management and long-term sustainability of forests. In this way, the FGYA helps ensure healthy ecosystems in Alberta over the long term. The FGYA's main project is the Regenerated Lodgepole Pine Trial, which began in 2000 and is expected to continue indefinitely. It tracks tree growth from the harvest onward, at regular intervals, and provides the forest industry with knowledge to assist in silviculture planning. It allows industry to make strategic and informed decisions about reforestation.

The science-based knowledge about tree growth generated by the FGYA can be used to enhance the productivity of the forest to help the oil and gas sector mitigate its impact on the landscape.

Achievements

- Historical research trials have provided the forest managers of Alberta with the benefit of long-term field trials that assess the responses of lodgepole pine to nutrition and density management. The FGYA is in the process of improving knowledge of growth, yield, silviculture, and fibre qualities. The data being measured includes stand responses decades after treatments, and they are the only trials in Alberta that allow for such long-term assessment of treatment effects.
- The study Stand Dynamics after Mountain Pine Beetle Attacks in Lodgepole Pine Stands has been monitoring tree plots attacked by mountain pine beetle (MPB) since 2008 and observes the impact of MPB on lodgepole pine stands in Alberta. This research is of great importance to forest managers, aiding in informed and relevant decision making. This project is in the process of assessing the impact of MPB attacks on lodgepole pine stand development with regards to mortality, residual tree growth, tree regeneration, and non-tree vegetation response in the absence of timber salvage or other management interventions.



Foothills Landscape Management Forum

In response to interest on the part of the forest industry, oil and gas companies, and government, fRI facilitated collaboration among a number of industrial operators to create a forum for industrial footprint management within the Little Smoky and A la Peche caribou ranges. Since the Foothills Landscape Management Forum (FLMF) was formed, the cooperative has continued to expand and now includes 14 companies from the forest and energy sectors and one Aboriginal community.

The FLMF advances integrated land management (ILM) in Alberta by providing an opportunity for industry and government to work together to reduce the impact of resource extraction and allow for minimally impacted habitats, healthy watersheds, and reserved space for recreation. It helps to ensure a better balance between furthering economic development and promoting diverse and vibrant ecosystems. Up to 40 individuals from industry and government have played an active role in FLMF access plan development. The accomplishments of the FLMF over the past 10 years are significant and have added value to government, industrial partners, and ILM in Alberta.

Achievements

- The FLMF contributed to the west-central caribou range planning process by sitting at the multi-stakeholder advisory group table at the request of the Government of Alberta.
- FLMF members receive annual reporting on anthropogenic disturbance thresholds and open route densities.
- The access geodatabase was kept up to date (annual and ongoing).
- The Caribou Patrol Program (CPP) was completed. Caribou patrols have been conducted by Aseniwuche Winewak Nation (AWN) in Grande Cache, with assistance from the FLMF, to contribute to recovery efforts for the woodland caribou. This program lets AWN share traditional ecological knowledge in a way that aligns with AWN's core value of protection and preservation of the environment.
 - The public has been engaged in supporting caribou recovery actions, as evidenced by use of the CPP website (www.cariboupatrol.ca) and social media, including Facebook, Instagram, and YouTube.
 - The CPP includes partners such as AWN, Environment Canada (Aboriginal Fund for Species at Risk), and the Government of Alberta (Environment and Sustainable Resource Development), along with the FLMF. This collaboration between First Nations, government, and industry is one example of the work the FLMF does to bring together different groups to help facilitate results.
- Three versions of the Caribou Patrol EduKits were professionally designed and printed for educational purposes—one each for students, industry, and the public. Education and social engagement were furthered through classroom presentations in local schools.
 - In 2014, the EduKits were published with the intention of inspiring interest in the health, safety, and long-term preservation of caribou. Tourists are educated using displays at several tourist information centres in the area. Over 2,000 EduKits were distributed at these visitor centres.
 - More than 400 travellers of Highway 40 North have taken the EduKit booklets from brochure holders placed on billboard-style caribou information signs stationed at the Berland River and Muskeg. The EduKits were featured in regional papers and fRI publications.
 - The EduKits encourage knowledge sharing and inspire people of all ages to participate in the protection of Alberta's woodland caribou. The great interest from teachers in Hinton, Grande Cache, and Fox Creek resulted in the need for a second printing of 5,000 booklets.
 - So far, 34 presentations have been given at seven schools, reaching over 830 students.



Foothills Stream Crossing Partnership

The Foothills Stream Crossing Partnership (FSCP) improves the management of stream crossings to ensure successful fish passage, enabling crossing owners from the forestry and energy sectors to work together and invest in resources that will benefit industry and contribute to healthy streams over the long term.

The FSCP has specialized skills and experience in stream crossing management and trains representatives from member companies in inspection protocol. It maintains an extensive database used by member companies to develop watershed management plans so repairs to stream crossings can be prioritized based on fish habitat, fish passage, sedimentation, and government priorities.

The FSCP coordinates industry-driven watershed-level stream crossing remediation, using established protocols to identify priorities on the landscape. It provides service to member companies anywhere in the province, benefiting oil and gas companies that have stream crossings across large sections of Alberta.

Achievements

- The Roadway Watercourse Crossings Remediation Directive was developed to facilitate the FSCP's watershed remediation planning. This new policy, implemented in February 2015, arose from a groundbreaking collaboration between industry and the regulators.
- A manual describing the FSCP's standard operating procedures has been created for use on a tablet and for inclusion in a full training manual, to help outside users collect and upload data correctly.
- The evolution of the FSCP online data management and landscape planning tool has been a success.
- We added 1,113 new inspections, and the landscape management tool has been used by our members to better prioritize and plan stream crossing remediation.





Forest History Program

Guided by the idea that we can shape our future by learning from our past, the Forest History Program (FHP) strives to seek out the antecedents and foundations of sustainable forest management programs in west-central Alberta in a wide range of landscapes, from working forests to parks and protected areas. These foundations—cultural, ecological, and scientific—offer important and relevant information to land managers, policy makers, park managers, the general public, and those consulting with Aboriginal groups. For the energy sector, the program’s work provides well-researched information about ecological issues of concern that can help oil and gas companies in their efforts to mitigate environmental footprint and maintain the social licence to operate.

The program has produced four books and a series of reports in pursuit of its mission. The most recent is *The Hinton Forest 1955–2000: A Case Study in Adaptive Forest Management*. This ebook reports on the development of the industrial forest management program in Hinton, which was a model of collaboration between industry and government through a shared interest in stewardship and sustainability of the forest.

Achievements

- The Columbia Trail project will be complete by March 2016. Peter J. Murphy, with assistance from Tom Peterson and Mike Dillon of Parks Canada, has been researching the history of logging up the Whirlpool River Valley along the Columbia Trail. When completed in 2016, this report will include maps, photos, and a discussion of key players and their relevance to the evolution of Parks policy. The report is expected to add knowledge to the history of Jasper National Park for Parks Canada.
- The *TransCanada Ecotours® Northern Rockies Highway Guide* app for iPhones is now available through the iStore, and the iPad app is expected to be complete in 2015.
- Two of the books the FHP has published (*Learning from the Forest* and *Mountain Trails*) have been converted into ebooks and are available on the fRI website. Another (*TransCanada Ecotours® Northern Rockies Highway Guide*) is available through the iStore. *A Hard Road to Travel* will be converted to an ebook after the correction of some errata.
- The ebook version of *The Hinton Forest 1955–2000: A Case Study in Adaptive Forest Management* has been completed. This major update and rewrite of one of the FHP’s earlier projects is now available on the fRI website, along with a companion volume, *A 50-Year History of Silviculture on the Hinton Forest 1955–2005: Adaptive Management in Practice*.



Geographic Information Systems Program

The Geographic Information Systems (GIS) Program works with fRI researchers and partners to store, manipulate, analyze, and communicate data generated by projects. The program manages large spatial datasets, performs complex spatial analysis, and maintains fRI tools and applications, allowing researchers and partners to attain in-depth understanding of data and ensuring such knowledge is presented effectively.

Achievements

- The GIS Program built an improved and detailed background map for the Forest History Program's *TransCanada Ecotours® Northern Rockies Highway Guide* app, which raises public awareness of ecological issues and how some of these are being addressed by land managers in the Northern Rockies region.
- Workflows for requests, services, and support were improved.
- The program successfully recruited a second GIS analyst, Joshua Crough.
- Program lead Julie Duval became a certified ArcGIS Desktop Professional in the fall of 2014. This complements her GIS Professional certification, obtained in 2010.
- The program continued to provide exceptional day-to-day GIS and data management support for fRI staff and researchers.





Grizzly Bear Program

The data generated by science-based research from the Grizzly Bear Program (GBP) guides and supports grizzly bear recovery efforts in Alberta. It guides land management and government policies to help recover grizzly bears to sustainable population levels and minimize the impacts of human activities on this threatened species.

Program lead Gord Stenhouse elaborates: “Our integrated, multidisciplinary research team has focused on documenting and understanding how changing landscapes and grizzly bear habitats have affected the distribution, abundance, demographics, and health of grizzly bear populations in Alberta.”

The GBP brings significant value to the energy sector by providing knowledge and tools that help industry improve environmental stewardship, thereby maintaining its social licence to operate.

Achievements

- The GBP research team published 18 papers in peer-reviewed scientific journals in 2014, with four other papers still in review.
- A repeat grizzly bear population inventory in Bear Management Area 3 (Yellowhead) was completed. This was the first area where the GBP team determined population size in 2004. The 2014 survey represents the first time a full repeat survey has been completed, as was suggested in the provincial grizzly bear recovery plan. This comparison data allows population trend and distribution information within a landscape influenced by resource extraction and human use to be evaluated and assessed. This project was undertaken in collaboration with the forestry sector and Alberta Environment and Sustainable Resource Development. It is an example of academia, government, and industry working together to conduct important research about a species at risk.
- The GBP conducted the first grizzly bear survey of the southern half of Jasper National Park this past field season (2014).
- Research completed for Alberta Innovates: Research to Support Recovery and Long Term Conservation of Grizzly Bears in Alberta is contributing to the development of science-based population recovery targets estimated from grizzly bear habitat capabilities and grizzly bear landscape energy requirements. The project is also contributing to the development of innovative non-invasive techniques for monitoring and a greater understanding of grizzly bear reproductive performance.
- Researchers monitored and measured landscape conditions and changes within Alberta’s grizzly bear range.
- The program continued to strengthen ties with the academic community at the University of Alberta, the University of Victoria, the University of Saskatchewan, and the University of British Columbia, as well as to collaborate with the Washington State University Bear Centre.
- Research has been completed to help understand how and why food affects grizzly bear growth and reproduction.
- Non-invasive methods of measuring and monitoring reproductive state have been applied. This information will be used to investigate the effect of long-term stress on reproduction.
- In working on the International Collaboration – Phase Three GB Health, the GBP continued to add to the extensive dataset of grizzly bear information collected, such as dispersal, survival, reproductive rates, habitat use, and genetic relationships.
- As part of the project Citizen Science and the Grizzly Bear Population Inventory, DNA scat collection was completed in the fall of 2014 to monitor grizzly bear population. Interested local citizens volunteered to collect the scat to aid in grizzly bear monitoring.





Healthy Landscapes Program

The Healthy Landscapes Program works under the premise that we are most likely to maintain a sustainable flow of all ecosystem services and values when we align our collective cultural activities and land management policies with Mother Nature. This valued concept has attracted 13 industry, government, and NGO partners across four provinces and territories, allowing for the critical examination of current land management activities related to the energy sector, forestry, water, wetlands, and wildfire management. The vast scope and detail of this research allow for a scientifically defensible baseline for everyone, upon which new policies and priorities for ecosystems can be built.

One of the larger goals of this program is to end the fragmented way in which natural resources are allocated and managed. Instead, the healthy landscapes approach focuses on imposing natural pattern benchmarks to assess sustainability across entire ecosystems.

Achievements

- Research conducted over the past year as part of the project Natural Wildfire Patterns – Phase IV has contributed to understanding the details of what vegetation burns and why. This information is important for furthering our knowledge of biodiversity. Existing wildfire pattern research was expanded to better understand how and where residual vegetation exists in wildfires.
- The project Historical Event Patterns is assessing the nature and importance of the gap between pre- and post-industrial disturbance patterns on three Alberta landscapes. The project involves Hinton Wood Products, West Fraser Mills Ltd.; Alberta-Pacific Forest Industries Inc.; and Alberta Newsprint Company. Researchers are collaborating with the UBC Faculty of Forestry to gain a better understanding of the extent and ways that historical and cultural disturbance activities relate to pre-industrial natural disturbance patterns.
- The LANDWEB Western Canada Boreal Landscape Dynamics project is using spatial simulation modelling to generate the historical range of landscape conditions across western boreal Canada. The research team has expertise in several areas, including spatial data and satellite imagery, fire regimes, spatial modelling, fire-climate interactions, and wildfire behaviour.
- This research is quantifying the pre-industrial natural range of variation for critical landscape condition patterns, such as old-forest levels, old-forest patch size, potential habitat levels for caribou, and wildfire risk.
- The best way to foresee the impact of future land-use decisions is to understand the relationship between past disturbance activities and past landscape conditions. The project aims to assess this relationship.
- Based on the understanding that the Canadian boreal forest is divided into many different policy requirements—from full access to resource use and full wildfire suppression, to no access and limited suppression—a significant goal is to understand the cumulative impacts of such policies on a regional basis.
- This project is of interest to policy makers and strategic planners, as well as the general public and public consultation groups.





Mountain Pine Beetle Ecology Program

The Mountain Pine Beetle Ecology Program collaborates with partners to research and participate in knowledge transfer to deal with emerging effects of the mountain pine beetle (MPB) infestations in the pine forests of Alberta. Science-based knowledge generated from this program contributes to the competitiveness of the forest industry, and to the continued health of Alberta's forests. The program collaborates with universities to conduct valuable research to help the forestry sector, land managers, and policy makers with the information they need to make informed decisions. Its value to the energy sector lies in improving the management of ecological concerns that are of interest to energy companies.

The beetle has been shown to be spreading northward to the Northwest Territories and eastward into Saskatchewan. In these novel habitats dominated by jack pine, decision makers cannot rely entirely on current knowledge. "With nearly six million hectares of pine forests at risk in Alberta the urgency of understanding the evolving ecology of the MPB and developing new and innovative approaches to control is paramount," says program lead Dr. Keith McClain.

Achievements

- Research during 2014–2015 focused on monitoring strategies and attractants, population dynamics in novel habitats, approaches for assessing the effectiveness of mitigating tactics, and cold tolerance of beetles. In addition to focusing on the beetle, the program evaluates specific strategies for rehabilitating an increasing area of damaged pine stands. It also assesses post-beetle vegetation succession and changes in hydrology, as subtle changes in these site factors will have long-term impacts on future forest productivity and the flow of other ecological services.
- Among the many accomplishments in 2014, the Information Exchange Forum remains pivotal to the exchange of scientific information between scientists, practitioners, and community representatives. The April 2014 forum attracted nearly 75 participants, who heard from guest speakers from British Columbia, Colorado, and Saskatchewan that Alberta is not alone in the battle against unprecedented infestations along with threats from fire and post-beetle infestations.
- One of many outcomes from the MPB research projects was the development of a more effective attractant by the Erbilgin Lab at the University of Alberta. This attractant will be field-tested at the leading edge of the MPB infestation.
- Documenting beetles at very low densities provides a major advantage to forest health officers as they can develop operational strategies to curb the development of epidemic populations.
- The Interaction of Prescribed Fire and Beetle Populations project is in the process of determining whether MPB will be successful at locating and breeding in fire-injured trees. It is also assessing the quality and quantity of beetle offspring emerging from fire-injured trees (relative to those emerging from MPB-killed trees in unburned control stands), and understanding the role of prescribed fire in MPB population growth in both burned and neighbouring unburned stands.
 - This information will be useful in understanding the role of prescribed fire in the short- and long-term population dynamics of MPB, and will be invaluable for using fire as a tool for MPB management.
 - This research is also expected to determine whether MPBs preferentially locate and breed in fire-injured trees in burned stands, whether prescribed fires predispose burned and unburned stands to MPB attack, and whether prescribed fire indices are correlated to MPB attack on fire-injured trees.





- The Cold Tolerance of Mountain Pine Beetle: Impact on Population Dynamics and Spread in Canada project is increasing understanding of the factors influencing the spread of the beetle in Alberta and Canadian boreal pine forests. This study examines how insect mortality varies with the severity and duration of cold exposure. The research will generate data to improve annual predictions of winter mortality and population trends based on actualized weather, enhance the identification of areas at risk in the future through refinement of climatic suitability indexes, and develop parameters to improve the existing U.S. MPB winter survival model for use in northern Alberta and the boreal forest.
- The research that has been undertaken in 2014–2015 will give government, industrial practitioners, and policy makers the necessary information to develop appropriate responses to slow the spread of the MPB.





Social Economic Program

The Social Economic Program is studying the social and economic implications associated with resource management and the need to understand and consider the human factor when making decisions. As more contentious decisions are being made for resource development, greater consideration has to be given to people's values and expectations. As the program develops, researchers hope to address issues of trust, social licence, communications, values, and trade-off approaches. Finding ways to integrate social science effectively into decision making is important. The scope of the program's work is expected to expand and be refined as it develops.

Achievements

Based on work that was initiated a number of years ago, several reports have been prepared, but have not yet been published:

- *Public and Land Manager Views on the Mountain Pine Beetle Activity and Management in Alberta* by Dr. Bonita MacFarlane, NRCan, CFS, Northern Forestry Centre. This report "examines public perceptions of risks, attitude toward the MPB, acceptability of management options, satisfaction with response to the MPB infestation, trust in government and the forest industry, awareness of MPB and its management, and sources of MPB information" (excerpted from abstract).
- *Expert Judgments and Media Framing of a Large-Scale Environmental Risk Issue: Insights from Mountain Pine Beetle Management in Alberta, Canada* by Drs. Bonita MacFarlane (NRCan), John Parkins (U of A), and Sharon Romanowski (AEMA). This report describes a study that

"explored media content and expert perspectives on the role of media within a large-scale environmental risk issue in western Canada. Focusing on the mountain pine beetle (MPB) epidemic the authors examined how the media framed the MPB issue and to what extent MPB media coverage was consistent with expert views of the media" (excerpted from abstract).

- *An Assessment of Vulnerability to Climate Change in Forest-Based Communities of Alberta* by Dr. Debra J. Davidson (U of A). This report describes emerging key findings from a study of climate change vulnerability in forest-based communities in Alberta, based on a comparative case study of Hinton, Jasper, Manning, and Peace River. "Forest-based communities are considered to be particularly vulnerable to climate change due to their economic reliance on climate-sensitive industries, such as forestry and tourism" (excerpted from abstract).



Tree Improvement Alberta

Tree Improvement Alberta (TIA) is a consortium of forest industry, academic, and provincial government representatives working together to facilitate the delivery of programs or projects related to forest genetics in Alberta. TIA manages the Tree Species Adaptation Risk Management Project funded by the Climate Change and Emissions Management Corporation (CCEMC). This project aims to help ensure the sustainability of forest ecosystems. It was designed to inform possible revision of existing policy or creation of a new policy governing use of seed and vegetative material for reforestation and reclamation on Crown land in a way that reduces negative impacts of climate change.

TIA benefits the oil and gas sector by identifying seeds and clones that are likely to succeed in reclamation, helping companies maintain social licence.

Achievements

- TIA developed three coniferous test sites and one deciduous test site throughout the province with one additional coniferous and three additional deciduous test sites in progress. These test sites, once planted and subsequently measured, will provide the data necessary to adjust existing policy or create new policy around the use of seed and vegetative material for reforestation and reclamation on Crown land in a changing climate.
- TIA reviewed the controlled parentage program plans for twenty-one conifer and three deciduous programs to determine the risks and opportunities associated with adaptation to a changing climate. Recommendations for seed and vegetative material transfers across provincial deployment zones have been analyzed, and a matrix has been developed to help practitioners make decisions on best deployment options for well-adapted trees for the future.
- The CCEMC Tree Species Adaptation Risk Management project will evaluate the risk climate change poses to individual tree breeding programs and consider how separate programs can work together to address the challenges of climate change.





Water Program

The Water Program aims to create and share science-based tools and knowledge to better secure the long-term health of Alberta's forested watershed. Through partnerships, research, and information sharing, the Water Program focuses on protecting water resources, as well as land, and helps government and industry maintain social licence and attain environmental sustainability commitments.

Achievements

- The Water Program's continued growth based on the business model of individual science and applied research projects has led to a strong partnership with the University of Alberta, new staff, and new industry partners joining in 2015.
- In 2015, the program saw meaningful headway on several key projects. For example, it initiated watershed assessment procedures in the foothills.
- The project Watershed Cumulative Effects Assessments for the Green Area: Groundwater/Surface Water Interaction in a Headwater Catchment in the Eastern Slopes: Implications for Hydrological Response of Forestry and Forest Disturbance is currently testing the hypothesis that the groundwater and surface interactions in the eastern slopes are likely the processes muting the response to change. This work has implications for characterizing the hydrological change following forest disturbance in the cumulative effects assessments for the eastern slopes.

