

2015 Large-Scale Applied Research Project Competition
Natural Resources and the Environment: Sector Challenges - Genomic Solutions
List of Registrations

No.	Administrative Genome Centre	Co-Lead Genome Centre	Project Leader		Co-Project Leader (s)		Lead Organization	Title of Project	Keywords	
			Last Name	First Name	Last Name	First Name			Research Areas/Questions GELS Questions	Methods Gels methods
1	Genome Alberta		Chua	Gordon	De la Hoz Siegler	Hector	University of Calgary	Genomic Analysis of Native Phototrophic Microbes for Development of Simultaneous Oil Sands Process-Affected Water Remediation and CO2 Fixation Process Estimated Total Budget	Microalgae, cyanobacteria, carbon capture, toxicity, bioremediation oil sands process-affected water.	Genome sequencing, transcriptomics, metabolomics, photobioreactor, toxicogenomics
								Sustainable development, sustainability assessment, "zero-discharge" policy implications	Industry engagement, shareholders survey	
2	Genome Alberta		Dunfield	Peter	Sauvageau	Dominic	University of Calgary	Genomics-assisted science of the methane economy (GASome)	Methane, natural gas, bioconversion, bioproducts, greenhouse gas	Metagenomics, metabolomics, genomics, transcriptomics, synthetic biology
								Environmental impact, global climate change, alternate energy economies, public perception	Computational modeling, life cycle analysis, discourse/media analysis, risk acceptability/tolerances, risk communication	
3	Genome Alberta		Erbilgin	Nadir	Thomas	Barb	University of Alberta	Genomic Resilience to Climate & Pests and its Policy Applications	Genomic selection (economics); Phenotyping; Climate change resilience; Forest health and productivity; Environmental and social sustainability	Linking key phenotypic responses (eg: drought resistance, pest resistance & ecophysiological responses) to key wood quality characteristics to allow for selection of the most resilient, climate adapted parents and genotypes for sustainable forest management in two commercially important tree species. Exploit genomic solutions to reduce selection time, breeding cycles, and fill policy gaps for seed transfer guidelines.
								Determine both the acceptance level of integrated genomic solutions to traditional forestry and current educational capacity/need within forest managers and company CEOs to implement recommendations. Provide government with community based solutions/methods to assist with policy change. Determine economic values for integration of genomic selections into gain and tree improvement valuation.	Survey methodology will be used to determine individual-level and institutional-level perceptions of risk and adaptive capacity. Conduct an economic analysis to understand the value of a shorter rotation time to select, test and deploy well adapted genetic material in reforestation.	
4	Genome Alberta	Genome Atlantic	Gieg	Lisa	Hawboldt Wolodko	Kelly John	University of Calgary	Managing Microbial Corrosion in Canadian Offshore & Onshore Oil Production Operations	Offshore and Onshore Oil Production, Pipelines, Microbially Influenced Corrosion, Sulfide Stress Corrosion, Risk Mitigation	Metagenomics, Chemistry and Electrochemistry, Materials Science, Predictive Modeling, Diagnostic Tools
								Genomics Tools vs. Industry Standard Tools, Environmental Regulations, Genomics Applied in a Corrosion Management Framework	Surveys to evaluate associated safety, environmental and regulatory factors to target research effort and assay consequences for risk assessment	
5	Genome Alberta	Genome Prairie	Hubert	Casey	Stern	Gary	University of Calgary	Genomics for predicting the microbial bioremediation response to oil spills in Canada's Arctic marine environment.	microbial genomics, oil spills, bioremediation, microbial oceanography, benthic ecology, hydrocarbon seepage, organic geochemistry, biodegradation, hydrocarbon chemistry, petroleomics	amplicon sequencing, metagenome sequencing, RT-qPCR, enrichment culturing, temperature physiology, hydrocarbon geochemistry, mass spectrometry
								emergency preparedness, risk assessment, Arctic oil and gas development and regulation (detection, impact and mitigation), social license to operate, first nations engagement, predictive mapping	Schools on board (CCGS Amundsen)	
6	Genome Alberta		Lanoil	Brian			University of Alberta	A Genomics Enhanced Reclamation Index (GERI) for Canada's Oil Sands	Reclamation, Genomics Enhanced Reclamation Index, Oil Sands, Environmental Monitoring, Microbial Biodiversity	Metagenomics, metatranscriptomics, amplicon sequencing, bioinformatics, iTags
								Public engagement, human-environment relations, science and technology studies, scientific expertise and authorization, First Nations	Ethnography, interviews, surveys, qualitative, quantitative	

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7	Genome Alberta	Genome BC	Lewenza	Shawn	Yadav	Vikram	University of Calgary	Monitoring and Treatment of Oil Sands Processed Water: Naphthenic Acid Biosensors and Screening of Metagenomic Libraries for Bioremediation Pathways	Naphthenic acids (NA), biosensor, biotechnology, screening NA-enriched metagenomic libraries for bioremediation genes	RNA-Seq Transcriptomics, Transcriptional lux (luminescence) reporters, Metagenomic library construction and screening, Next generation sequencing
									Cost-Effective Water Monitoring Technology, Engineered bacteria for NA degradation and water treatment.	Pathway Engineering, Synthetic Biology, Water treatment
8	Genome Alberta		McKenzie	Debbie	Coltman	David	University of Alberta	Systems Biology and Molecular Ecology of Chronic Wasting Disease	Prions, chronic wasting disease, monitoring, host range, detection	Gene analysis, transgenesis, proteomics, metabolomics, genomics
									Social impact of CWD on aboriginal populations Local/traditional ecological knowledge	Questionnaires Oral assessments
9	Genome Alberta		Sharp	Martin			University of Alberta	Glacial Ice as an Archive: Response of Microbes and Biogeochemistry to Climate Change and Contaminants Over Time	Ice cores, glacier microbiology, biogeochemistry, contaminants, climate change	Metagenomics, amplicon sequencing, biogeochemistry, bioinformatics, ultra clean sampling
									science and technology studies, environmental history, climate history, scientific authority, public engagement in science	Ethnography, historiography, interdisciplinary historical methods, interviews, archival research
10	Genome Alberta		Xu	Zhenghe	Deyholos	Michael	University of Alberta	Bio-Processability of Mined Athabasca Oil Sands by Utilization of Next Generation of Applied Genomics	Oil sands bio-extraction, bitumen bio-upgrading, bio-treatment of oil sands tailings, environment, technology development	metagenomics, eco-genomics, genomics selection gene expression of oil sands-microbes interactions
									Application of suitable microbes in Canadian oil sand industry, economic cost-benefit analysis of genomic selection versus classic phenotypic selection, understanding regulator decision-making processes	policy analysis, cost-benefit analysis, behavioral economics
11	Genome Atlantic		Gagnon	Graham	Beiko	Rob	Dalhousie University	Transforming Drinking Water Safety in Canada's Arctic Communities - Evaluating the Use of DNA-Based Microbial Monitoring Technologies to Enable Rapid Identification of Waterborne Pathogens in Drinking Water Supplies	Drinking water quality in Canadian North, waterborne pathogens, DNA-based environmental monitoring	Remote sample collection, sequence extraction and processing, Illumina and Nanopore sequencing, microbial community analysis
									Perceptions of water quality in the Canadian North, social and legal implications of sensitive monitoring techniques	Structured interviews, community surveys, land use investigation, qualitative methods, population health
12	Genome Atlantic	Genome Alberta	Mkandawire	Martin	Budwill	Karen	Cape Breton University	Microbial Genomic Investigations into Sustainable use of Abandoned In-situ Coal Mines: from conversion to bioreactors to mitigation of Environmental Impacts (Coal Genome Project)	Microbial genomics; Coal conversion efficiency; Coal microbial communities; Mine water characterization, Enhanced bioconversion of coal to methane and value-added products; microbial metabolic pathways.	Pilot trials in in-situ coal mines; Efficient and enhanced coal bioconversion; Bio remediation, Comparative amplicon and metagenomics analyses; Metatranscriptomics and metabolomics for metabolic pathway analyses
									Low coast coal energy; Sustainable coal; Minimum energy generation footprint; Energy for developing countries; Comparing power options	Life cycle analysis; Comparison to Business as Usual; Road mapping; Global energy resources assessment; Technology integration
13	Genome British Columbia	Genome Alberta	Aitken	Sally	Hamann	Andreas	University of British Columbia	New climates, new forests	Climate change, assisted gene flow, local adaptation, fungal diseases, tree breeding	Sequence capture, gene expression, gene-environment association, genotype phenotype association, field common garden experiments
									Public acceptance of climate adaptation strategies for forest management, economics of climate adaptation strategies; impacts of assisted migration and assisted gene flow on forest ecosystem services and community wellbeing	Survey instruments, focus groups, policy analysis, cost-benefit analysis, economics of ecosystem services
14	Genome British Columbia		Bohlmann	Joerg	Russell	John	University of British Columbia	GSF-CEDaR: Genomic Selection and Gene Functions for Cedar Enhanced Durability and Resistance	Western redcedar and yellow-cedar; conifer genome; functional genomics; genomic selection; heartwood durability and resistance against biotic stress	Genome and transcriptome sequencing, genome assembly, bioinformatics, biochemistry, phenotyping
									Economics of trait improvement by genomics, conditions for deployment of intensive forestry, social acceptance	Economic cost-benefit analysis, policy analysis, directed interviews

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15	Genome British Columbia		Cool	Julie	Griess	Verena	University of British Columbia	APES: A pathway towards economic significance - The use of biomarkers in Canada's sustainable forest industry	Forest management; Wood durability and characteristics; Wood products processing; Genotypic markers; Competitiveness reality check	Growth and yield modelling; Testing of wood samples regarding commercial aspects; Simulation of scenarios (sensitivity analysis)
								Economic assessment; Case studies (e.g. small rural communities, First Nations); Willingness to invest; Testing of the importance of various genotypic markers to favor in future research	People's perception studies; Scenario modelling; Risk modeling and diversification strategy planning; Methods from operations research and modern finance theory	
16	Genome British Columbia		Eltis	Lindsay	Mohn	William	University of British Columbia	Consolidated bioprocesses for lignin valorization	Lignin valorization, biofuels, bioproducts, forest management, biocatalysts	High throughput activity screens for biocatalysts, metagenomics/metatranscriptomic analyses of microbial communities, microbial genomics, metabolic engineering
								Technological, commercial, organizational and social uncertainties; value propositions, translating technology into economic opportunities; sustainability of bioprocesses	Life cycle analysis, techno-economic analysis, key stakeholder interviews and analysis	
17	Genome British Columbia		Fraser	Lauchlan			Thompson Rivers University	Sustainable Mining: A Network of Genomic-Based Biodiversity Outposts to Inform and Direct Ecosystem Reclamation	Biodiversity; Ecosystem function; Metagenomics; Mine reclamation; eDNA	Robust sampling of soils, water, invertebrates; DNA extraction and mineral testing; Amplification and sequencing; Bioinformatics
								How to accommodate First Nation cultural values and aboriginal land title rights in the context of natural resource development? How to bridge the gap between science outcomes and policy development?	Indigenous methodologies; Fair mining practice and policy development; Science engagement practice	
18	Genome British Columbia		Hallam	Steven	Yadav	Vikramaditya	University of British Columbia	The MetaMethane Project: Harnessing Microbial Metabolism for Shale Gas Methane Valorization	Shale gas, methane, resource recovery and transport, environmental monitoring, water management, methane bioconversion	Process rate measurements, isolation and enrichment cultures, environmental genomics, functional screening and bioinformatics, metabolic and process engineering
								What are the economic benefits of methane conversion to LNG versus value-added material production from Canadian shale gas reservoirs?	Life cycle assessment	
19	Genome British Columbia	Genome Quebec	Hamelin	Richard	Porth	Iлга	University of British Columbia	Genomic epidemiology and surveillance to protect forests against pests and diseases in a changing environment	Forest health, Pest and pathogen detection, Fungal genomics, Insect genomics	Whole genome sequencing, Comparative genomics, Target enrichment
								Developing tools from mathematical finance to build a risk sensitive decision support system	Model development integrating uncertainty of pest and disease outbreaks and various management scenarios	
20	Genome British Columbia		Helbing	Caren			University of Victoria	LEAPFROG: Linking Environmental Applications to Foundational Research On Genomics	Natural resource extraction activities; Frogs as sentinel species; Environmental toxicogenomics; Water stewardship; Environmental monitoring	Transcriptomics; RNA-seq, Next Generation Sequencing; Mass spectrometry-based Metabolomics; Metagenomics
								Impact of genomics on current regulatory guidelines and policies; How to incorporate new genomics data to better establish toxicity criteria values; Identify and address current barriers to the uptake of genomics for risk and impact assessments	Surveys; End-user input; Workshops	
21	Genome British Columbia		Juniper	Kim			University of Victoria	Next Generation Marine Monitoring - Genomics tool kit for assessing coastal ecosystem health	Coastal ecosystems, biodiversity-ecosystem functioning, trait-based approaches to microbial ecology, benthic invertebrates, temporal variability versus long-term change	Small subunit ribosomal and functional gene diversity, Environmental (meta-) genomics, Transcriptomics, Proteomics
								Carrying capacity of coastal ecosystems for industrial and urban waste. Recovery trajectory for coastal waters following introduction of waste treatment.	Economic modeling, Ecosystem services economics, Coastal community policy and planning, Community engagement in ocean monitoring.	

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22	Genome British Columbia		Mansfield	Shawn			University of British Columbia	TerraTrees: Soil-Tree Remediation and Ecosystem Stabilization	Site phytostabilization and phytoremediation; Plant-microbe belowground interaction and dynamics; Metagenomics; Environmental genomics; Geochemistry	Transcriptomics sequencing; Genome sequencing; Proteomics; Bioinformatics and mass data computation; Marker Aided Selection and Breeding
									Public acceptance; Government policy; Regulatory framework	Community and stakeholder focus groups; Survey; Economic assessment
23	Genome British Columbia	Genome Atlantic	Plettner	Erika	Hillier	Kirk	Simon Fraser University	Chemoreception in reproduction and host plant recognition in the gypsy moth (<i>Lymantria dispar</i>) and the eastern spruce budworm (<i>Choristoneura fumiferana</i>)	Management of invasive and outbreaking species, Olfactory neuroscience, Receptor physiology, Pheromones and feeding deterrents	Transcriptomics and bioinformatics, neurophysiology and insect behavioral assays, bio-organic chemistry, isolation of biotinylated proteins and proteomics, validation of key gene products by RNAi
									Public and stakeholder perceptions of genomic/chemosensory-based technology, policy development, regulatory frameworks, supply chain maps, market analysis	Surveys, interviews, policy review and analysis, market analysis
24	Genome British Columbia		Saddler	Jack			University of British Columbia	Genomic enhancement of the deconstruction enzymes used to convert forest biomass to sugars, used to produce biojet	Genetic engineering, Biomass deconstruction, enzymes, biojet, sugars; alcohol-jet	Molecular modification, Genomics, enhanced enzyme synergism, enhanced amorphogenesis
									Feedstock sustainability, Life Cycle Analysis (LCA), modelling, GHGenius/Carbon balance, supply chain	LCA, survey, technoeconomic modelling
25	Genome British Columbia		Schulte	Patricia			University of British Columbia	Sustaining freshwater recreational fisheries in a changing environment	Sport fishing, Climate change, trout, population genomics, functional genomics	SNP genotyping, RNAseq, bisulfite sequencing
									Economic impacts, social license	Surveys, econometrics
26	Genome Prairie		Cattet	Marc	Janz	David	University of Saskatchewan	A non-invasive, proteomics approach to early detection of declining wildlife health with focus on the conservation management of brown bears in human-dominated landscapes of Canada and Europe	anthropogenic- and natural-caused landscape change, road utilization, assessment of eco-anthrope disturbance regimes, predict future landscape scenarios	Remote sensing, geographic systems mapping, Dynamic Interaction measures, Light Detection and Ranging (LiDAR) data, Bayesian models
									anthropogenic- and natural-caused landscape change, road utilization, assessment of eco-anthrope disturbance regimes, predict future landscape scenarios	Remote sensing, geographic systems mapping, Dynamic Interaction measures, Light Detection and Ranging (LiDAR) data, Bayesian models
27	Genome Prairie		Levin	David	Sparling	Richard	University of Manitoba	Microbial Genomics of Green Chemistry (GreenChemGen)	Waste to value; Microbial conversion platforms; Biopolymers; Neutral lipids; Carotenoids	Genomics; Transcriptomics; Proteomics; Metabolomics; Metabolic modeling
									Bioeconomy; Waste stream inventories; Regulatory barriers; Participation of aboriginal people in the bioeconomy; Repurposing pulp & paper infrastructures	Material flow analysis; Geographical logistics; Life Cycle Assessment; Life Cycle Costing; Techno-economic analyses
28	Genome Prairie		Siciliano	Steven	Peak	Derek	University of Saskatchewan	Minerals, Microbes and Metabolism: The Geometry of Mineral Genomics	Soil hydrocarbon and nitrogen remediation, soil mineralogy, soil mapping, biostimulation with phosphorus, environmental synchrotron spectroscopy	Stable-isotope probing of metagenome Community 16S rDNA characterization Transcriptome analysis Infrared spectroscopy X-Ray spectroscopy
									Cooperative decision-making, risk perception, uncertainty, governance institutions, strategic interdependencies	Survey and interviews; decision mapping; simulations; experimental analysis of decision making
29	Genome Quebec	Genome Prairie	Basu	Niladri	Hecker	Markus	McGill University	Toxicogenomic Solutions for Environmental Stewardship	Ecotoxicology; environmental risk assessment; chemical screening and prioritization; adverse outcome pathways	QPCR arrays; gene expression; bioinformatics; computational toxicology; in vitro methods
									National and international chemicals management and decision-making; economic analyses of policies; cost-effectiveness of toxicity testing; reductions in animal testing; focused ecological risk assessment	Surveys; Delphi polling; cost-benefit analyses; mixed methods research; interviews

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30	Genome Quebec		Bernier	Louis	Kembel	Steven W.	Université Laval	Modelling and manipulating hardwood tree microbiomes for resilience to global changes	Forest health, deciduous tree, microbiome, environmental resistance against biotic and abiotic stresses, response to climate change	Metagenomics, manipulation of microbial communities, experimental evolution, selective breeding
									What are the potential economic benefits of microbial community manipulation? What are the ethical and social dimensions of acceptability of microbial community manipulation in nature in Canada?	Interviews, content analysis, workshop, survey
31	Genome Quebec		Constant	Philippe	Guertin	Claude	INRS-Institut Armand Frappier	GMB-Forest indicators: Genetic multifunctional barcodes to improve ecosystem-based forest management	(1) Forest ecosystem management, (2) boreal forest, (3) taxonomic and functional structure of soil microbiome, (4) molecular indicators	(1) Shotgun metagenomic and PCR-amplicon sequencing, (2) timber productivity and wood quality, (3) monitoring of current indicators for forest integrity (bark beetles, birds, landscape remote-sensing), (4) hydrology, (5) nutrient cycling, (6) trace gas turnover, (7) multivariate statistics and development of a novel genomic multifunctional barcode (GMB indicator) to predict productivity and integrity of ecosystem services in boreal forest
									(1) Elaboration of forest productivity scenarios related to climate change, (2) economic valuation of forest ecosystem services, (3) identification and evaluation of the challenges associated with the integration of genetic tools as a decision tool for sustainable forest management (third-partite certification, policies and general public acceptance).	(1) Life-cycle assessment dedicated to ecosystem services to enhance sustainability of the forestry sector, (2) economic sensitivity analysis of forest ecosystem services, (3) survey on the acceptability and credibility of molecular indicators for ecosystem-based forest management towards industrial and governmental representatives, (4) training of forest certification coordinators for the introduction of "molecular decision tools" for spatial classification and management of landscapes and forest management units, (5) public consultations and conferences.
32	Genome Quebec		Cristescu	Melania	Thomas	Bureau	McGill University	Ecological and evolutionary impact of climate change on aquatic ecosystems: bridging experimental ecology and environmental genomics	Ecological genomics, metagenomics, metabarcoding, experimental evolution, aquatic environments, productivity	DNA isolation, DNA sequencing, bioinformatics
									What are the benefits of bridging experimental ecology and ecological genomics on aquatic productivity under global climate change?	Economic framework, comparative statics, risk and uncertainty assessment
33	Genome Quebec		Fournier	Michel	Lemarchand	Karine	ISMER (Institut des Sciences de la mer de Rimouski)	Use of genomic approaches and sentinel species to monitor impacts of human activities on aquatic ecosystems	Characterization of coastal ecosystems; damage to habitats by invasive species; determination of the presence and activity of pollutants including toxic algae; determination of the impacts of climate change; assessment of impacts of municipal wastewater effluent on the receiving environment	Metagenomic (metabarcoding) for determination of habitat biodiversity; qPCR arrays with selected genes as markers of organism response to stressors; markers of health status
									Policy implementation; determination of regulatory success; ethical aspects linking genomics and nature; transfers of new knowledge to students and general public with special care for targeted communities.	Research activities; discussion groups; seminar, conference and public meetings; exhibits in Museum; website.
34	Genome Quebec		Frigon	Dominic	Côté	Caroline	McGill University	Antimicrobial resistance genes in the environment and water infrastructures: Genomic monitoring tools and control technologies	Persistence of antimicrobial resistance genes; treatment of wastewaters and manures; ARG transport in watershed; sources protection and production of drinking water; genomic monitoring tools for exposure assessment	Meta-genomic sequencing and gene-network analyses; enhanced waste solids anaerobic digestion; advanced disinfection; mathematical modeling; laboratory and field experimentations

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									Cost of investments in control technologies vs. societal benefits of reduced resistance; reduction of excess complications; productivity losses; continued stakeholders' responsible antimicrobial usage vs. technology control of resistance; sustainable analysis of control of resistance vs. recovery of resources from waste treatments.	cost-benefits analysis; survey of stakeholders; epidemiology; meta-analyses; public economics.
35	Genome Quebec		Galvez-Cloutier	Rosa	Corbeil	Jacques	Université Laval	Eco-engineering and genomics for the valorisation and recuperation of soils and residues	Mining residues, petroleum contaminated soils	Bioremediation, biolixivation, microbial identification, genomic sequence
								Public acceptance, waste revalorization, waste re-use	Natural remediation, eco engineering, biotechnologies	
36	Genome Quebec		Garnier	Alain	Gagnon	Phillippe	Université Laval	Development of bio-reagents for flotation in mineral processing	Mining, Flotation, Bio-reagent, Sulfide ore flotation, Reduction of process toxicity	Large-scale screening and fractionation, Bio-sourcing, Recombinant technologies, Interaction modeling, Electro-ultra-filtration
								Social license to operate, institutional pressures, environmental performance, stakeholders relationships, biodiversity	Case studies, corporate communication, sustainability reporting, content analysis, interviews	
37	Genome Quebec		Hallenbeck	Patrick C.			Université de Montréal	Novel enzymes and pathways for clean energy and green chemical production	Environmental metagenomics, novel bioconversion and biosynthetic capacities/pathways, bioenergy from renewable feedstocks, lignocellulose, conversion to medium to high value green chemicals	Metagenomics, bioinformatics, high-throughput protein expression, enzymatic screening, metabolic pathway analysis
								Determining the public perceptions of risks and benefits and consumers' level of receptiveness and acceptance of GMOs; What would be the socio-economic impacts on farmer and the forestry industry; Addressing critical resource allocation choices between food and fuel imperatives.	Determining regulatory challenges associated with deliverable uptake; Polling public acceptance of product or assay or technology	
38	Genome Quebec		Labrecque	Michel	Hijri	Mohamed	Université de Montréal	ECOGENOMIX: Taking advantage of plant-soil-microbe interactions to improve the revegetation of highly anthropized sites	Holobionts, Bioremediation, Contaminated Sites, Rehabilitation	Genomics, Transcriptomics, Metabolomics, Systems Biology
								What are the economic benefits of phytotechnologies over traditional techniques, taking into account Life-cycle analysis (LCA) and ecosystem benefits delivered by green technologies, including land capitalization based on increased value Gained after rehabilitation?	LCA, Economical Analyses	
39	Genome Quebec	Ontario Genomics Institute	Lang	B. Franz	Langley	Sean	Université de Montréal	Combining mine tailing restoration, municipal waste recycling and biomass production	Mine waste rehabilitation; Soil microbial diversity assessments; Contaminant fate; Ecosystem productivity; Carbon sequestration;	Genomics; transcriptomics; ribo-typing; dendrochronological stand reconstruction methods; carbon budget modelling; chemical and mineralogical characterization of reclaimed mine waste profiles; metal uptake into tree leaves
								Benefits & risks relative to conventional reclamation approaches; enhancing environmental stewardship opportunities; informing mine managers and regulatory bodies regarding options for mine closure planning; potential for utilization of mine waste areas for enhanced biomass production	Critical benefit risk analysis; end-user surveys on applicability & barriers to new reclamation approaches; trade-off analysis regarding new reclamation approaches	
40	Genome Quebec		Lovejoy	Connie	Whyte	Lyle	Université Laval	Metagenomics enabled discovery of applications and processes of the Arctic Microbiome (MEDAPAM)	Arctic, genome exploration, renewable resources, microbial biodiversity, bio-surfactants, cold tolerant enzymes, polyunsaturated lipids	Genomics, metagenomics, isolation and culturing of psychrotrophic microorganisms, metabolic pathway identification / optimization through genetic engineering, product confirmation, large volume fermentation

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									Identification of legal framework for harnessing Arctic microbial biodiversity; Socio-economic benefits of bio industries; Sustainable northern development; Conservation and protection of vulnerable ecosystems; Integrating local knowledge into an international framework	Formulate the details of the scientific research plan along GE3LS optics as follows. 1) Identification of all regulatory and quasi regulatory oversight mechanisms and pressure points likely to be triggered by the research plan. 2) Secure regulatory permissions and input from indigenous community organizations necessary for the project to proceed. 3) Develop templates for sequential information framework and information requirements. 4) Elucidate protocols to assist future Canadian Arctic project proponents and partnerships. 5) Present and subject these protocols to the wider Arctic constituency for consultation review and refinement.
41	Genome Quebec	Ontario Genomics Institute	Martin	Vincent	Mahadevan	Krishna	Concordia	Sustainable Bioprocesses for Manufacturing Renewable Chemicals using Synthetic Biology	Difunctional Chemicals, Protein Engineering, Computational Strain Design, Enzyme Discovery, Metabolic Engineering	Synthetic Biology, Metabolic Modeling, Systems Biology, Biosensors, Genetic circuits
									Ethics, Sustainable Development, Environmental Impact	Techno-economic analysis, Life cycle Analysis
42	Genome Quebec	Ontario Genomics Institute Genome Alberta	Robert	Claude	Mastromonaco Musiani	Gabriela Marco	Université Laval	Caribou conservation and preservation	Caribou, Environment, Climate change, Genetic diversity, Population management	Genomics, DNA methylation, Functional genomics, Epigenomics, Bioinformatics
									Cultural and ecological value, First Nations, Natural resources development, Ethics, Acceptability	Survey and stakeholders interviews, meta-analyses, ethical matrix analysis
43	Genome Quebec		Sauvé	Sébastien	Shapiro	Jesse	Université de Montréal	Moving North: Preventing, Predicting and Managing Harmful Algal Blooms in the Face of Global Change	Cyanobacteria blooms; cyanotoxins; climate change, nutrient management; northern development	Biodegradation; biomonitoring; water treatment; metagenomics; mesocosm experiments
									Climate change and basin development; Global change and the risk of harmful cyanobacterial blooms; Risk control strategies in agricultural practices; Economic benefits and impacts; Acceptability of nutrient capture strategies;	Socioeconomic benefits of ecological services; Socioeconomics of riparian strips and permaculture; Cost-sharing mechanisms; Public perception and acceptability of subsidy; Cost-benefit and cost-effectiveness analysis
44	Ontario Genomics Institute	Genome BC	Edwards	Elizabeth A.	Baldwin Papangelakis	Susan A. Vladimirov	University of Toronto	Elements of Bio-Mining (EBM): Improving recovery and reducing environmental footprint of the Natural Resource sector by harnessing microbially-mediated geochemical transformations	Mining waste treatment; Selenium, sulfur; Ni Bioleaching; Tailings stabilization; Acid mine drainage	Enrichment culturing; Microbial consortia engineering; Metagenomics, Enzyme screening; Systems biology for bioreactor design and process control
									How well do economic incentives work to meet sustainability obligations?	Life-cycle-assessment of existing and emerging technologies
45	Ontario Genomics Institute		Friesen	Vicki			Queen's University	Genomics-Based Policy and Management Tools for Species on the Edge in Canada	Biodiversity conservation, First Nations, landscape genomics, peripheral populations, socioeconomics	Bioinformatics, GIS, RADseq, transcriptomics, whole genome sequencing/re-sequencing
46	Ontario Genomics Institute		Hajibabaei	Mehrdad	Hebert	Paul	University of Guelph	Genes to Ecosystems (G2E): Advancing ecological assessment through genomics to support responsible resource development	Biomonitoring; ecological assessment, ecosystem health, biodiversity, molecular ecology	High-throughput sequencing, DNA barcoding, transcriptomics, environmental DNA (eDNA) analysis, Bioinformatics
									Citizen science; schools; aboriginal youth; partner-based monitoring networks	Stakeholder outreach; focus studies; surveys
47	Ontario Genomics Institute		Horsman	Geoff	Smith	Scott	Wilfrid Laurier University	Harnessing Environmental Metabolic Capacity to Recover Wastewater Phosphorus	Metagenomic identification of organophosphorus-degrading enzymes, wastewater phosphorus recovery, phosphate sustainability, clean water, biocatalysis	Constructing and screening metagenomic libraries, genomic analysis of organophosphorus degradation, biocatalytic phosphorus recovery, wastewater treatment

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									What are the economic impacts on Canada of improved phosphorus removal and recovery? What are the trade implications of enhanced phosphorus recovery from wastewater? What regulatory and/or market incentives are required to develop and commercialize biocatalysts from metagenomic libraries?	
48	Ontario Genomics Institute		Koivisto	Bryan			Ryerson University	A Genomic Approach to Solar Energy Production: Modifying Cyanobacteria to Create Photovoltaic Dyes from CO2	Genomics, Energy, Photovoltaics, cyanobacteria, organic dyes	DNA sequencing, bioinformatics, genome annotation, CRISPR-Gas9
49	Ontario Genomics Institute		Liu	Xudong	Novakowski	Kent	Queen's University	Cumulative Effects of Land use on the Environment	Microbial biome, metagenomics, surface water, groundwater, compounds of emerging concern Community impacts, socioeconomic status, economic burden or advantage, marginalized populations	Metagenomics, data mining, geospatial analysis Stakeholder involvement, community-based investigations, government and non-government policy development
50	Ontario Genomics Institute		Lougheed	Stephen C.	van Coeverden de Groot Dyck	Peter Markus	Queen's University	The Icon of Climate Change: Genomics Tools for Baseline and Real-time Monitoring of Polar Bears (Ursus maritimus)	Polar Bear baseline, real time non-invasive Polar Bear Monitoring, climate change implications, microbiome Inuit Traditional Ecological Knowledge, Western Science Integration; Climate Policy Integration	ddRAD seq, QPCR, stable isotopes, contaminant analyses Workshops, Geomatics, Strategic Planning
51	Ontario Genomics Institute	Genome BC	Master	Emma	Brumer	Harry	University of Toronto	ABEL: Advanced Bioproducts and Economic Landscapes	High-value bioproducts for forest sectors; cell-free biocatalytic cascades; synthetic biology; bioproduct recycling; microbial remediation of biorefining effluent specialty forest product markets; uniqueness of Canada's forest resource; place of high-value forest products in knowledge-based economies; role of SMEs in small forest-reliant communities; environmental impact of growing bioeconomies	Gene synthesis; meta-transcriptomics; microbial community analysis; functional genomics; analytical and synthetic chemistry techno-economic modeling and life cycle assessment; value-chain analyses taking into account geographically discrete areas in Canada; quantitative assessment of post-industrial and post-consumer residues; identification of infrastructure that could be leveraged for bioproduct development
52	Ontario Genomics Institute		McKelvie	Jennifer	Neufeld	Josh D.	Nuclear Waste Management	Genomics Assessment of a Deep Geological Repository for used Nuclear Fuel	Microbiologically influenced corrosion, Bentonite clay, Low permeability sedimentary rock, Canadian Shield rock, Deep geological repository for used nuclear fuel Social and ethical: Can Indigenous knowledge and genomics be integrated to improve our understanding of 1) antimicrobial properties of bentonite clay, 2) corrosion resistance of copper, and 3) suitability of host rocks? Economic and social: Can we benefit the local First Nation/Métis communities and build technical capacity in their community through their involvement in the field work? Environmental: Can we minimize the environmental footprint of our research by using local First Nation/Métis field guides?	Genomics for identification of microbial species; Metatranscriptomic/metabolomics for identification of microbial activity; Biomarker methods for benchmarking; Isotope geochemistry for identification of microbial processes; Pressure cell modules in deep boreholes Documentation of Indigenous knowledge through collaboration with First Nations/ Métis Elders and academics. Involvement of local First Nation/Métis communities in the field work. Community engagement: Open Houses, Workshops, Round Tables.
53	Ontario Genomics Institute		Mykytzcuk	Nadia	Blowes	David	Laurentian University	Genomic Solutions to Improve Bioleaching Technologies for Environmentally-Sustainable Treatment of Base and Precious Metal Mine Wastes in Cold Climates	Mine wastes, remediation, bioleaching, microbial consortia, genomics solutions	Metagenomics, targeted microbial enrichment, passive treatment, metabolic modelling

No.	Administrative Genome Centre	Co-Lead Genome Centre	Project Leader		Co-Project Leader (s)		Lead Organization	Title of Project	Keywords	
			Last Name	First Name	Last Name	First Name			Research Areas/Questions GELS Questions	Methods Gels methods
									How do we increase understanding of the potential use of new genomics tools for bioleaching and management of mine wastes within the mining industry, First Nations communities, and the general public?	Science communication methodology, educational video/teaching modules, mining industry engagement, First Nations engagement
54	Ontario Genomics Institute		Poulain	Alexandre	Chan	Laurie	University of Ottawa	Biosensing Tools for the Sustainable Prosperity of Northern Resource Extraction in Canada	Environmental Microbiology, Ecotoxicology, Environmental Monitoring, Regulatory Compliance, Geochemistry	Biosensing, metagenomic libraries, experimental and directed evolution, Electrochemistry, Synthetic Biology
									Sustainable Prosperity, Environmental Health and Stewardship, contaminant exposure	Qualitative Research; Focus Group; Interviews; Participatory Research
55	Ontario Genomics Institute		Sargent	Edward	Yakunin	Alexander	University of Toronto	Translating Genomics-, Metagenomics- and Structural Proteomics-derived Discovery of Enzymes into Sustainable solar-derived fuel technologies	Solar fuels; photosynthesis; metagenomes and genomes; structure-function studies of enzymes; protein engineering.	Metagenome libraries; enzymatic screening and biochemical characterization; protein crystallography and engineering; molecular modeling; materials synthesis.
56	Ontario Genomics Institute		Schellhorn	Herb	Gupta	Radhey	McMaster University	Application of DNA Source Tracking Technology to Improve Evaluation of Watershed, Source Water and Wastewater Quality	Microbiological watersheds, source water and waste water; microbiological pathogen analysis, prokaryotic toxins and ecotoxicology, environmental safety	Next-generation sequencing technology, metagenomic and 16S rRNA gene analysis, conserved signature proteins (CSPs) and indels, bioinformatics and software development, microfluidic device fabrication
									watershed monitoring, wastewater, bioinformatics, metagenomics, public health safety	Next Generation DNA sequencing, metagenomics, DNA isolation
57	Ontario Genomics Institute		Warren	Lesley A.	Banfield	Jillian F.	McMaster University	Mine Wastewater Solutions: Next Generation Biological Treatment through Functional Genomics	Mine wastewater, biological treatment, acid mine drainage, sulfur biogeochemical cycling, thiosalts	Pilot scale test pond, functional metagenomics, bioinformatics, transcriptomics, integrated microbial and geochemical investigation
									Water stewardship, policy development, regulatory uncertainty, environmental liability	pilot scale test pond, functional metagenomics, bioinformatics, transcriptomics, integrated microbial and geochemical investigation
58	Ontario Genomics Institute		Wilson	Paul	Bowman	Jeff	Trent University	Next-generation Population Genomic Surveys of Rapidly-Evolving Genes Associated with Adaptation to Climate Change	Functional Genomics, Population Genomics, Adaptive Genomics, Climate Change, Species Hybridization	BestRAD sequencing, Transcriptomics, Gene-Capture, Next-generation Genotyping with Individual-specific Tagging, Bioinformatics for Genome Annotation
59	Genome British Columbia Genome Quebec		Bohlmann Bousquet	Joerg Jean			University of British Columbia Université Laval	Spruce-Up: Advanced spruce genomics for productive and resilient forests	Spruce genome sequence, Genomic architecture, Functional genomics, Genomic Selection, Productivity and resilience traits	Sequencing, Bioinformatics, Genotyping, Expression profiling, Quantitative genetics
									Profitability of trait improvement by genomics, Carbon market, Conditions for deployment of intensive forestry, Social acceptance	Cost-benefit analysis, Macro-economics, Policy analysis, Directed interviews