

2016-19

BUSINESS PLAN

Alberta Innovates
Bio Solutions

PUBLISHED September 2016



Funded by the Government of Alberta

Alberta Innovates Bio Solutions
2016–19 Business Plan

Published September 2016
Printed in Canada

To access this document online, visit www.bio.albertainnovates.ca and search for “2016-19 Business Plan.”

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1. Executive Summary

The Government of Alberta has decided to further streamline Alberta's research and innovation system by amalgamating the four Alberta Innovates corporations into a single entity. The intent of this adjustment is to:

- Build a stronger cross-disciplinary approach to stewarding the research and innovation system for Alberta
- Attract more investment and partnerships to Alberta
- Allow clearer management of research and innovation in multiple focus areas
- More fully support efforts to diversify the Alberta economy

With the announcement of this change, a transition CEO, a transition Board, and a number of transition advisory teams have been structured, and several working teams formed. The new structure and related business plan will be formulated over the upcoming months and are expected to be in place before the next business planning cycle. AI Bio staff are actively participating in the working teams.

In addition, five innovation working groups (collaboratories) were established across the Government of Alberta (GOA)—energy, environment, health, food, and fibre. Through a collaborative approach, these collaboratories are working to create clarity of roles and responsibilities among the Alberta Innovates corporations and relevant government ministries to build on existing strengths and relationships. AI Bio participates in the environment, food, and fibre collaboratories and supports their work through various goals noted in the business plan.

Currently, Alberta Innovates Bio Solutions (AI Bio) has a legislative mandate to provide leadership and coordination for research and innovation that supports the growth and diversification of Alberta's agriculture, food, forest, and life science sectors. The continuing downturn in oil prices reconfirms the importance of a diverse economy. The province's agriculture, food, and forest industries can contribute in a more significant way to strengthening Alberta's economy. Alberta has a significant arable and forested land base (over 55 million hectares) and a favourable climate for producing crops, livestock, and trees. The agriculture and forest industries and the people who work in them form the backbone of Alberta's rural communities.

Growing and diversifying the agriculture, food, and forest industries requires a healthy environment with intact ecosystems that have optimal resilience to threats such as extreme weather, drought, and climate change. Ecosystem services have gained the attention of governments globally. Their development helps resource sectors in Alberta demonstrate social licence to operate, while supporting growth, competitiveness, and diversification of the economy. Release of the Climate Leadership Plan in November 2015, along with an economy-wide carbon-pricing system, has focused additional attention on biological greenhouse gas (GHG) management and the potential to reduce emissions from agricultural production, forestry, and municipal waste streams.

We believe the primary opportunities for Alberta are in developing high-value products from biomass, such as new structural biocomposites, biochemicals, and other biomaterials; driving the design of crops and trees that can adapt to a changing climate; continuing to develop and apply new technology to efficiently produce sought-after major crops; expanding food ingredient production and food processing; promoting sustainable forest practices; creating the economic benefits associated with well-designed, functioning ecosystem service markets; demonstrating excellence in environmental integrity;

reducing greenhouse gas emissions through better management of biological systems; and reducing risks related to prion-based diseases. The AI Bio *2016–19 Business Plan* outlines initiatives that focus on these key opportunities.

AI Bio is in the business of knowledge development along the innovation adoption curve—long-term early research, mid- and short-term applied research, and short-term market-ready research. AI Bio is also in the business of investing in science that informs policy. One of the key criteria considered for investments by AI Bio is the need to demonstrate the strong possibility of high economic benefit and impact. In selecting the research and innovation focuses for the business plan, AI Bio staff considers two additional key criteria: that the investments be of strategic value to Alberta, and that investments maximize opportunities to collaborate. Flexibility is used in decision-making within each business line.

Strategic collaboration is one cornerstone of AI Bio’s operations. The AI Bio approach is to be a leader, an influencer, an initiator, a persuader, and a team player—to bring energy to projects that can meet the goals of our business plan. In 2015-16 AI Bio was managing 182 active multi-year grant agreements with investments of \$61.5 million over the lifetime of the projects, and additional cash leveraging of \$146.8 million from partners. The amount of leverage that AI Bio investments are able to achieve shows that AI Bio has the ability, skills, and connections to successfully partner with other groups.

AI Bio now receives its core funding from Alberta Economic Development and Trade (EDT). It supports a broad range of investments within four business lines: Sustainable Production, Bioindustrial Innovation, Food Innovation, and Ecosystem Services and Biodiversity. Investment dollars flow to the projects of greatest importance, based on AI Bio’s investment criteria.

The Bioindustrial Innovation business line also includes two programs that are special collaborations with EDT: the Driving Conversion of Alberta’s Biomass to Advanced Materials and Chemicals Program (AMCP) and the Alberta Bio Future Program. Both programs are led and managed by AI Bio, with additional funding provided by both AI Bio and EDT.

To date, two additional partnerships have led to the development of business lines that are well aligned with the mandate of AI Bio: the Biological GHG Management Program, funded by the Climate Change and Emissions Management Corporation (CCEMC), and the Alberta Prion Research Institute (APRI), funded by EDT. These two programs are managed by AI Bio with funds dedicated under specific agreements with our funding partners.

AI Bio’s extensive network of partnerships for other investments is detailed in the business plan.

For the current business plan, a long-term goal has been identified within each of AI Bio’s six business lines—Sustainable Production, Bioindustrial Innovation, Food Innovation, Ecosystem Services and Biodiversity, Biological GHG Management, and APRI. These goals are:

- Sustainable agriculture and forest production
- New chemicals, materials, and energy from biomass
- Growth and diversification of Alberta’s food industry
- Growth and diversification through integrated land use and management
- Effective management of GHG emissions arising from biological systems
- Effective management of prion and prion-like neurological diseases

Under each goal, the plan outlines areas of innovation focus as well as specific research and innovation initiatives and a summary of the rationale for these initiatives.

The business plan includes indicators of the results of AI Bio investments for the past three years in terms of:

- Outputs, defined as activities occurring as a direct result of our influence. These include sharing knowledge (with a diverse stakeholder group) and developing highly qualified personnel.
- Outcomes, defined as areas of impact to which we have contributed. These include creating knowledge that results or is likely to result in significant new directions in science, policy, regulation, or practices; or in new products, processes, or services.

As a result of constraint measures by the GOA, the AI Bio budget for 2016–17 has been reduced. AI Bio’s estimate of revenue from all sources for the 2016–17 year is \$20,162,000. See Section 5 for revenue and expenditure details.

2. Mandate

The last business year saw a transition in reporting structure. AI Bio previously reported to Alberta Innovation and Advanced Education but now reports to the Minister of Economic Development and Trade. As outlined in our Mandate and Roles Document:¹

AI Bio will meet the research and innovation priorities of the government by providing leadership and coordination for research and innovation that supports the growth and diversification of Alberta’s agriculture, forestry and life sciences sectors.

The Government of Alberta (GOA) has given AI Bio the following responsibilities as set forth in the *Alberta Research and Innovation Regulation*:

Support for the economic and social well-being of Albertans, bioindustries (life sciences, agriculture and forestry) research and innovation activities aligned to meet GOA priorities, including activities directed at developing and growing the bioindustries sectors, the discovery of new knowledge and the application of that knowledge.

3. Business Planning Context

The Government of Alberta has decided to further streamline Alberta’s research and innovation system by amalgamating the four Alberta Innovates corporations into a single entity. The intent of this adjustment is to:

- Build a stronger cross-disciplinary approach to stewarding the research and innovation system for Alberta
- Attract more investment and partnerships to Alberta

¹ Edited Alberta Innovates Bio Solutions Mandate and Roles Document. Minister of Alberta Economic Development and Trade, March 24, 2010. www.alberta.ca/AGS-directory/A/A/ags-Alberta-Innovates-Bio-Solutions-Mandate-and-Roles.pdf.

- Allow clearer management of research and innovation in multiple focus areas
- More fully support the need to diversify the Alberta economy

With the announcement of this change, a transition CEO, a transition Board, and a number of transition advisory teams have been structured, and several working teams formed. The new structure and related business plan will be formulated over the upcoming months and are expected to be in place before the next business planning cycle. AI Bio staff are actively participating in the working teams.

Competitive Context

Revenues from oil and gas production in Alberta declined precipitously over 2015, and have not changed appreciably for the first three months of 2016. This decline has resulted in significant budgetary pressures for the GOA. Despite these pressures, the GOA continues to recognize the need to diversify and grow other sectors, like agriculture, food, and forestry, which make a significant contribution to our economy.

Alberta has a significant arable and forested land base (over 55 million hectares) and a favourable climate for producing crops, livestock, and trees. The agriculture and forest industries and the people who work in them form the backbone of Alberta's rural communities.

Impacts of climate change are being felt around the world. Access to adequate supplies of quality water and arable land is expected to constrain growth of global biomass production. The Prairie provinces are one of the few jurisdictions where productivity improvements at scale could contribute to meeting global demands.

With an anticipated 70-per-cent increase in global food demand by 2050,² Alberta is in a position to respond to growing domestic and export markets for a wide array of agricultural and food products. Improvements in product quality and product safety are being sought by consumers in all markets.

Production value of lumber, pulp and paper, and panel board increased by four per cent from the same period last year.³ Driven, in part, by Canada's falling dollar and the strong housing market across North America, this demand for wood-based products will continue to create opportunities for Alberta's forest industry. The province is also positioned to meet global demand for biobased chemicals, materials, and fuels, from both forest and agriculture biomass.

Growing and diversifying the agriculture, food, and forest industries requires a healthy environment with intact ecosystems that have optimal resilience to threats such as extreme weather, drought, and climate change. A key goal of the GOA is to address greenhouse gas (GHG) emissions, which contribute to anthropogenic climate change. Release of the Climate Leadership Plan in November 2015, along with an economy-wide carbon-pricing system, has focused additional attention on biological GHG management and the potential to reduce emissions from agricultural production, forestry, and municipal waste streams.

Ecosystem services have gained the attention of governments globally. Their development helps resource sectors in Alberta demonstrate social licence to operate, while supporting growth, competitiveness, and diversification of the economy. Benefits accrue from more investment certainty

² "FAO's Director-General on How to Feed the World in 2050." *Population and Development Review* 35.4: (2009): 837–839. doi: 10.1111/j. 1728-4457.2009.00312.x.

³ Alberta Forest Products Association. AFPA Q3 2014 Results. www.albertaforestproducts.ca/news/afpa-general-news/afpa-q3-2014-results.

and a performance-based approach that rewards innovation and improved efficiency. New job opportunities are created as a result of healthier resource industries, increased investment in Alberta's economy, and the formation of new businesses. A 2015 White House Memorandum from the Office of Management and Budget directs all departments to take an ecosystems services approach. The objective is to increase efficiency and the benefits of public funds.

Trends

A number of trends have implications for the types of investment AI Bio will recommend:

- Increasing consumer expectations for verifiably safe, healthy, and nutritious food products
- Increasing consumer demand for social responsibility (e.g., environment, animal welfare, reduced use of antibiotics)
- Better integration of biomass products and services to complement the energy sector
- Continuing development of genomic, proteomic, and metabolomic science and technologies, as well as emerging nanotechnology developments and products with unique functionality
- Increasing recognition of prospects for improved returns on investment through collaborative approaches between the agriculture, food, forest, fibre, and energy sectors
- Diminished influence of the World Trade Organization and a trend toward bilateral or multilateral agreements
- Climate change, which will impact forest and crop adaptation practices
- Increasing demand for energy from different sources
- Increasing international efforts on ecosystem services and biodiversity, to ensure better environmental outcomes
- Growing evidence for prion-like properties in other human diseases, such as Alzheimer's disease

Risks

In 2015, AI Bio undertook a coordinated and integrated approach to managing risk. The staff developed, and the Board approved, an enterprise risk management plan. AI Bio's risk management categories are based on the GOA Reference Guide on risk management and include:

- Governance and business model risks
- Program and policy risks
- Human resources risks
- Financial risks
- Business continuity and emergency management risks
- Information and technology management risks

For internal risks, mitigation strategies were identified and initiated.

The overarching external risk considerations, for which mitigation is not highly achievable, but which bear on the determination of AI Bio's priorities, are:

- GOA reductions to budgets in the research and innovation system, including AI Bio, which threaten the success of GOA economic diversification efforts
- Partners' possible reluctance, in this time of economic downturn, to make financial investments, which in turn may decrease the leverage AI Bio is able to achieve on investments
- Continuing competitive pressure from global jurisdictions, due to low-cost production and processing in developing countries
- Erosion of the province's intellectual capacity and failure to recruit new talent in key areas
- Lack of investment in, and erosion of, natural capital upon which the economy depends
- Transmissible spongiform encephalopathies (like BSE), which continue to be a challenge in the province

Opportunities for Alberta

Based on the environment within which AI Bio's stakeholders operate, a number of opportunities exist to:

- Support economic growth and diversification efforts for the province by shoring up research and innovation investments in biobased sectors
- Demonstrate widespread application for sustainable production technologies and products
- Add value to Alberta's primary agricultural commodities by supporting further processing and development of consumer-driven new ingredients, food, and beverage products
- Decrease costs of production in the short term and increase exports for some biobased sectors due to lower oil prices and the lower Canadian dollar, which may lead to economic growth for companies active in exporting biobased products
- Use genomic technologies and breeding to meet changing consumer expectations
- Use new international agreements, like the Trans-Pacific Partnership and the Comprehensive Economic and Trade Agreement between Canada and the European Union, to create marketable advances in agriculture
- Expand the availability of renewable energy and other biomass-based products
- Implement market-based approaches for ecosystem services to diversify the rural economy, demonstrate environmental integrity, and stimulate innovation in resource-based sectors
- Work with stakeholders to advance the link between bio systems and sound GHG management
- Collaborate with pharma and biotech companies to better understand prion-like human diseases

Competitive Advantage

The province's agriculture, food, and forest industries are an important contributor to Alberta's economy as they currently generate significant revenue. In 2014, these sectors had about \$33 billion in sales,⁴ amounting to 22.6 per cent of the sales of Alberta's energy sector. These biosectors have averaged an annual growth of 6.8 per cent over the last four years.⁵ AI Bio believes research and innovation can help achieve even more growth.

We believe the primary "wins" are from the following: developing high-value products from biomass, such as new structural biocomposites, biochemicals, and other biomaterials; driving the design of crops and trees that can adapt to a changing climate; continuing to develop and apply new technology to efficiently produce sought-after major crops; expanding food ingredient production and food processing; promoting sustainable forest practices; creating the economic benefits associated with well-designed, functioning ecosystem service markets; demonstrating excellence in environmental integrity; reducing GHG emissions through better management of biological systems; and reducing risks related to prion-based diseases.

Strategic Collaboration

Strategic collaboration is one cornerstone of AI Bio's operations. The AI Bio approach is to be a leader, an influencer, an initiator, a persuader, and a team player—to bring energy to projects that can meet the goals of our business plan. Connections and relationships enhance our ability to build on each other's strengths, leverage resources, and avoid duplication.

In 2015-16 AI Bio was managing 182 active multi-year grant agreements with investments of \$61.5 million over the lifetime of the projects, and additional cash leveraging of \$146.8 million from partners. By engaging partners, AI Bio is able to increase the value of our investments substantially.

Over the six years of AI Bio's existence, the collaborative philosophy has resulted in different types of partnerships with different models for investment.

A. Core Business

AI Bio has core funding from Economic Development and Trade (EDT) that supports a broad range of investments within four business lines: Sustainable Production, Bioindustrial Innovation, Food Innovation, and Ecosystem Services and Biodiversity. Investment dollars flow to projects of greatest importance, based on AI Bio's investment criteria.

The Bioindustrial Innovation business line also includes two programs that are separate collaborations with EDT: the Driving Conversion of Alberta's Biomass to Advanced Materials and Chemicals Program (AMCP)⁶ and the Alberta Bio Future⁷ Program. Both programs are led and managed by AI Bio, with additional funding provided by both AI Bio and EDT.

⁴ *Highlights of the Alberta Economy Presentation 2014*. Government of Alberta. www.albertacanada.com/SP-EH_highlightsABEconomy.pdf.

⁵ Statistics Canada, Alberta Economic Development and Trade.

⁶ Activities in support of AMCP are funded through a separate grant agreement from EDT, which is outside of AI Bio's grant from this ministry. A separate report will be submitted to the department specific to this funding agreement.

⁷ Activities in support of the Alberta Bio Future Program are partially funded through a separate grant agreement from EDT, which is outside of AI Bio's grant from this ministry. A separate report will be submitted to the department specific to this funding agreement.

B. Strategic Agreements

To date, two additional partnerships have led to the development of business lines that are well aligned with the mandate of AI Bio: the Biological GHG Management Program,⁸ funded by the Climate Change and Emissions Management Corporation (CCEMC), and the Alberta Prion Research Institute (APRI),⁹ funded by EDT. These two programs are managed by AI Bio, with funds dedicated under specific agreements with our funding partners.

The evolution of these business lines within AI Bio recognizes that AI Bio has the ability, skills, and connections to successfully partner with other groups and to lead and administer strategic opportunities.

Alberta Innovates Corporations

The four Alberta Innovates corporations have been the province's only consortium of organizations with a pan-Alberta legislative mandate to fund and perform research, innovation, and commercialization in multiple sectors. In the past, we have reported to the same minister as Campus Alberta institutions. The restructuring to one Alberta Innovates entity, currently underway, is expected to enhance alignment and collaboration on many levels.

AI Bio currently partners with our other Alberta Innovates corporations on a number of programs and projects. For example, AI Bio is working with Alberta Innovates Technology Futures on a number of Alberta Bio Future Program investments, and with Alberta Innovates Energy and Environment Solutions in the area of the environment. This latter work includes identifying priorities and the innovation support required for the Integrated Resource Management System. Many other industry, consulting, and not-for profit entities are also connected with this work.

Government of Alberta

AI Bio aligns with the priorities of the GOA as identified through our mandate and our ongoing strong working relationships with the appropriate departments. Collaborations with Alberta Agriculture and Forestry target investments in biological GHG management, innovation in forest stewardship in southern Alberta, food safety and food innovation, crop production, and understanding consumer preferences in targeted export markets.

Other critical partners in innovation in the biosectors include the Alberta Livestock and Meat Agency, Alberta Land Stewardship Centre, Land Use Secretariat, Alberta Crop Industry Development Fund, Agricultural Boards and Commissions, and Agriculture Financial Services Corporation.

Academia

Alberta's academic and research institutions, colleges, and technical institutes have world-class talent and facilities to deliver research results in a broad range of areas. The University of Alberta-based Biorefining Conversions Network (BCN) is an excellent example of multiagency cross-sector collaboration. Funded by AI Bio, the BCN links researchers from academic institutions with those from other research organizations. The BCN has led the linking of the bioindustrial industry and academia and

⁸ Activities in support of the Biological GHG Management Program are funded through a separate grant agreement from the CCEMC, which is outside of AI Bio's grant from EDT. A separate detailed business plan for this program will be submitted to the CCEMC.

⁹ Activities in support of APRI are funded through a separate grant agreement from EDT, which is outside of AI Bio's grant from this ministry. A separate report will be submitted to the department specific to this funding agreement.

resulted in many new projects and collaborations—for example, with the 2015 BCN–AI Bio conference, Bioindustrial Innovations: Unlocking Value and Tackling Climate Change.

Another area where academia and industry meet and AI Bio provides support is in the NSERC Industrial Research Chair in the Industrialization of Building Construction. This work focuses on the industrialization of the building construction process through the development of modular and offsite construction technologies and includes the use of advanced wood products.

With the University of Alberta’s Alberta Land Institute, AI Bio is delivering a joint three-year wetlands project directed at research priorities related to specific ecosystem services. The University of Alberta is also a partner in developing and commercializing a rapid test for detecting major food safety pathogens.

In addition, AI Bio is working with the University of Lethbridge to develop a joint project on testing some of the market requirements for ecosystem services.

We value our partnership with the University of Alberta in continued support of Livestock Gentec, an Alberta Innovates Centre that provides global leadership in the application of genomic tools focused on improving efficiency in livestock production as well as improving meat quality and safety. Other vital academic partners include the Alberta Biodiversity Monitoring Institute, Institute for Land Use Innovation, Poultry Research Centre, and Dairy Research and Technology Centre.

Industry

AI Bio engages with a wide array of industry associations and commodity groups to understand industry issues, address opportunities, and assist in scanning for new science and technology opportunities. For example, the Alberta Food Processors Association has been a partner in designing an internship program for undergraduate food science students, a conference on issues critical to the food industry, and future workshops connecting the food industry with researchers.

We support research and innovation led or delivered by private businesses in order to stimulate economic success and growth.

APRI continues to promote targeted research through its Innovation and Delivery (IDeal) Program, which enables direct collaboration between industry and researchers. AI Bio will be providing support to the Alberta Association for Conservation Offsets, a consortium of industry and non-government organizations working collaboratively to provide advice to the GOA in the development and implementation of land-use policies.

Through the Ecosystem Services and Biodiversity Network, guided by AI Bio, Alberta has the capacity to engage a broad range of stakeholders from many disciplines, across sector boundaries, to focus on solving common, complex problems that require collaboration between research and management.

AI Bio, forest companies, and provincial and federal governments are all collaborating funders in a project designed to investigate strategies for recovery of forests decimated by the mountain pine beetle.

AI Bio is also an active participant in the Agriculture Funding Consortium. Members of this consortium collaboratively receive, evaluate, and fund research projects focused on accelerating primary production and yields, improving product quality and safety, developing new value-added products, or improving current processes and practices.

Additional National and International Partners

AI Bio's expertise is requested by national and international research and technology networks, and these connections increase our knowledge of the global context for Alberta initiatives. We have a number of established international funding partnerships, including one collaboration that involves the German Centre for Neurodegenerative Diseases, three universities, and the Canadian Food Inspection Agency. This collaboration focuses on research to inform risk assessments for chronic wasting disease.

APRI has joined the Canadian Consortium on Neurodegeneration in Aging led by the Canadian Institutes of Health Research and involving 13 other Canadian and international agencies, including the Alzheimer Society of Canada.

AI Bio is also partnering with organizations such as the National Research Council Canada, the Canadian Standards Association, and Forest Products Innovation to develop regulations and product standards for new bioindustrial materials. These include cellulose nanocrystals, hybrid building products, and new building systems.

Food safety and food product development projects with organizations like the Fraunhofer Institutes in Germany are in planning and evaluation stages while other project such as those with Agriculture and Agri-Food Canada and the Canadian Wheat Alliance are already underway.

4. Goals, Outcomes, and Performance Measures

For the current business plan, a long-term goal has been identified within each of AI Bio's six business lines—Sustainable Production, Bioindustrial Innovation, Food Innovation, Ecosystem Services and Biodiversity, Biological Greenhouse Gas (GHG) Management, and the Alberta Prion Research Institute (APRI). Under each goal, we have outlined areas of innovation focus as well as specific research and innovation initiatives and a summary of the rationale for these initiatives.

AI Bio is in the business of knowledge development along the innovation adoption curve—long-term early research, mid-/short-term applied research, and short-term market-ready research. AI Bio is also in the business of investing in science that informs policy. One of the key criteria considered for investments by AI Bio is the need to demonstrate the strong possibility of high economic benefit and impact. In selecting the research and innovation focuses for the business plan, AI Bio staff considers two additional key criteria: that the investments be of strategic value to Alberta, and that investments maximize opportunities to collaborate. Flexibility is used in decision-making within each business line.

In 2014, the GOA established five key focus area “collaboratories” for energy, environment, health, food, and fibre to advance efforts to diversify and strengthen the economy and support social prosperity. Through a collaborative approach, these collaboratories are working to create clarity of roles and responsibilities among the Alberta Innovates corporations and relevant government ministries to build on existing strengths and relationships. AI Bio participates in the environment, food, and fibre collaboratories and supports their work through various goals noted in the business plan.

Business Line: Sustainable Production

Goal: Sustainable agriculture and forest production

- A. Market-driven traits and products
- B. Sustainable production systems

Research and Innovation Initiatives (over the Next Three Years)

1. Support research and innovation to:
 - 1.1. Increase the yield of Alberta's major crops by improving the efficiency of nutrient and water use and resistance to pests
 - 1.2. Identify and/or adapt new crops to Alberta's growing conditions
 - 1.3. Advance the adaptation of forest species to a changing climate
 - 1.4. Inform forest management practices for species at risk, pest control, and restoring disturbed forest lands
 - 1.5. Optimize environmentally sustainable management in agriculture and forestry
2. Continue AI Bio investment in research, development, knowledge translation, and commercialization activities at Livestock Gentec, an Alberta Innovates Centre, as well as in other AI Bio-supported initiatives

Research and Innovation Initiatives: Rationale

For the world's population to be food secure, the Food and Agriculture Organization (FAO) of the United Nations and other global agriculture entities forecast that agricultural productivity will need to increase by at least 30% in the next 15 years. These upsurges in global demand pose huge challenges for food production systems, which will need to increase yields while maintaining environmental integrity. Canada is one of the few jurisdictions in the world with the arable land base needed to supply the volume and quality of food required. This is both a social responsibility and an economic opportunity.

Sustainably increasing agriculture productivity in Alberta will require maximizing outputs while maintaining environmental integrity through ecologically based management practices, increased crop yields, judicious use of crop chemicals and antibiotics, and improvements to livestock through targeted breeding and production practices. AI Bio will focus on projects that aim to enhance the efficiency of nutrient or water use in traditional crops and will support the adaptation of traditional and new crops like grain corn, and soybeans to Alberta's changing growing conditions.

Alberta is in a position to capitalize on the growing global middle-class demand for safe, high-value red meat. AI Bio will leverage core funding we provide to Livestock Gentec, an Alberta Innovates centre located at the University of Alberta, to accelerate industry adoption of new genomic technologies for improved feed efficiency, health, safety/traceability, and quality of livestock and livestock products, as well as reduction of GHG emissions related to cattle production.

A changing global climate is another factor that will impact Alberta, where mean annual temperatures are expected to rise. To preserve Alberta's forest resource for generations to come, foresters want to ensure that the trees selected for reforestation today will adapt. AI Bio will work with Alberta Agriculture and Forestry to support research focusing on identifying appropriate tree genetics for

reforestation, recovering forests damaged by mountain pine beetle, and improving resistance to current and anticipated forest pests and disease. AI Bio will also work with Alberta Agriculture and Forestry to identify and bridge gaps where science-based policy can enhance forest management sustainability.

By building on their strengths—harnessing Alberta’s discovery capacity; commercializing inventions; and improving products, processes, or services—the agriculture and forest industries have the potential to accelerate diversification and the growth of Alberta’s economy.

Business Line: Bioindustrial Innovation

Goal: New chemicals, materials, and energy from biomass

- A. New bioindustrial products and processes
- B. Bioindustrial sector growth
- C. Green building materials and modular construction

Research and Innovation Initiatives (over the Next Three Years)

1. Invest in advancements in science and innovation that lead to bioindustrial growth opportunities in three broad areas: biomaterials, biochemicals, and bioenergy
2. Provide data and analysis for science-based policy recommendations that will improve or reduce policy constraints that affect bioindustrial development in Alberta
3. Foster relationships and networks to spur cross-sector innovation between the agriculture, forest, manufacturing, and oil and gas sectors, and communities (e.g., Bioeconomy Alberta team, Biorefining Conversions Network, Modular Construction Network, Canadian Bioenergy Association)
4. Support establishment of a bioindustrial cluster
5. Invest in science, innovation, and networks that are focused on developing green building materials and new approaches to construction, including modular construction (e.g., the NewBuilds network, the NSERC Industrial Research Chair in Modular Construction)

Research and Innovation Initiatives: Rationale

The availability of large amounts of biomass in Alberta not only sustains existing agriculture and forest industries but also provides opportunity for economic diversification. Alberta’s bioindustrial research and commercialization investments have provided a solid platform to support the growth of the province’s bioindustrial sector. Value-added products, including biomaterials, biochemicals, and bioenergy, hold significant potential to establish competitive niches that can grow and diversify agriculture and forest-driven economies. Investments in these areas also help to improve environmental performance in Alberta’s natural resource industries.

Some technologies and processes being explored through AI Bio that may broaden Alberta’s economic base while balancing conservation, biodiversity, and ecological resilience are state-of-the-art biomass estimation systems, innovative biomass conversion technologies such as lignin extraction and lignin applications development, cellulose nanocrystal extraction and applications development, extraction and purification of numerous high-value-added bioproducts, bioremediation of oil sands tailing ponds,

new approaches to building construction and developing new building products and systems, and new codes and standards related to biocomposites.

Collectively, investment in these projects stimulates the development of bioindustrial research activity and a cluster of companies in Alberta. Some of these projects are supported through the Driving Conversion of Alberta's Biomass to Advanced Materials and Chemicals Program (AMCP).¹⁰ The focus of the AMCP is to advance innovation and commercialization in scale-up and commercialization of new technologies using Alberta's rich renewable biomass resources.

AMCP investments have focused on innovative, competitive products and technologies for the Canadian and global marketplace, such as cosmetics, personal-care products, pharmaceuticals and plastics, renewable diesel, and a lignin recovery plant that will displace components in commercial glues used for manufacturing plywood, oriented strand board, and laminated veneer lumber.

With financial support from EDT, AI Bio has initiated a new multi-year program, the Alberta Bio Future Program. The program has a strong industry emphasis and focuses on developing new and improved bioproducts and technologies in the areas of discovery, developmental research, testing and commercializing, and feedstock assessment and characterization.

Business Line: Food Innovation

Goal: Growth and diversification of Alberta's food industry

- A. New food ingredients, food products, beverages, functional foods, and natural health products
- B. Technologies, products, and processes to control food-borne pathogens

Research and Innovation Initiatives (over the Next Three Years)

1. Invest in research and innovation leading to new or improved food ingredients, food products, beverages, functional food, or natural health products that:
 - 1.1. Are competitive in the domestic and global marketplace
 - 1.2. Respond to domestic and/or international consumer demand
 - 1.3. Add value to Alberta livestock and crop commodities
 - 1.4. Promote wellness and/or prevent or treat chronic diseases
2. Invest in research and innovation that:
 - 2.1. Contributes to reducing pathogenic *E. coli*, *Salmonella* spp., *Listeria* spp., and *Campylobacter* spp. in Alberta livestock, crops, and food and beverage products
 - 2.2. Leads to new food safety policies and enhanced consumer confidence and market access

¹⁰ Activities in support of AMCP are funded through a separate grant agreement from Alberta Economic Development and Trade, which is outside of AI Bio's grant from this ministry. A separate report will be submitted to the department specific to this funding agreement.

Research and Innovation Initiatives: Rationale

Alberta has a rich agriculture industry, which produces a variety of crops and livestock products that can be processed into ingredients, food products, beverages, functional foods, and natural health products. An increase in value-added processing of agricultural commodities will boost Alberta's economy. In 2014, food and beverage processing industries represented the second-largest manufacturing sector in Alberta (17 per cent of total manufacturing sales) after petroleum and coal product industries (29 per cent). Reaching a record of \$13.7 billion in 2014, food and beverage manufacturing sales increased 9.7 per cent over 2013, and marked the fifth consecutive annual gain.

The Alberta food manufacturing sector consists of branch plants of large multinational companies and over 500 small and medium-sized enterprises. In recent years, the food industry has been challenged by high transportation costs, fluctuating input costs, shortages of skilled labour, strong global competition, increasing energy costs and a fluctuating Canadian-dollar exchange rate. Additional production costs arise from increasing food service, retail, and consumer demands for formal programs such as those that focus on ethical treatment of animals, environmental sustainability, and continual improvement in food safety processes.

The declining value of the Canadian dollar may positively impact those Alberta businesses that are engaged in export sales as Alberta products can be more competitive in the global marketplace in the short term. However, there is a great deal of uncertainty about how long this competitive advantage will continue. The continuing low oil prices provide some relief in transportation costs.

The Alberta Innovates *Food Innovation Plan 2014–17* guides AI Bio's investments in food research and innovation. The *Food Innovation Plan* is based on extensive external and internal analysis of market demand, Alberta's core strengths in agriculture, and the province's research and industry capacity. It identified the following as the most promising areas for AI Bio investment:

- Ingredients, food, and beverage products that add value to Alberta's major crops
- Functional foods and natural health products to promote wellness
- Food safety, with a focus on meat safety

Genomics and metabolomics as well as nanotechnology are emerging platform technologies in which Alberta has considerable strength. These technologies can be applied to develop unique ingredients, foods, beverages, functional foods, and natural health products that can give Alberta companies a competitive advantage.

Business Line: Ecosystem Services and Biodiversity

Goal: Growth and diversification through integrated land use and management

- A. Demonstrate the use of market-based instruments to manage priority ecosystem services and biodiversity to stimulate diversification of Alberta's rural economy
- B. Apply interdisciplinary science to inform policy, planning, programs, and management
- C. Support measuring and monitoring of provincial biological resources to demonstrate environmental integrity

Research and Innovation Initiatives (over the Next Three Years)

1. Develop, apply, and demonstrate the science and tools required for successful market-based approaches, planning, and monitoring
 - 1.1 Continue to enhance and expand the ecosystem services assessment and the relationship of ecosystem services and biodiversity to management changes
 - 1.2 Lead the development and delivery of multidisciplinary, cross-sector, applied proofs of concept (pilots) to test and evaluate the system components
 - 1.3 Invest in prototypes to support the necessary market infrastructure, and support socioeconomic assessment to quantify the economic value to Alberta, including by developing the business case for investment to stimulate diversification and growth of the rural economy
 - 1.4 Implement the ecosystem services and biodiversity engagement and outreach strategy to catalyze knowledge exchange; support network information sessions, roundtables, websites, and other activities that grow the network and build common understanding and approaches across sectors
 - 1.5 Update the ecosystem services and biodiversity innovation strategy to support investment for the next five years

Research and Innovation Initiatives: Rationale

Ecosystem services are the measurable benefits that ecosystems have to our well-being and health, including air filtration, water filtration, fresh water, carbon sequestration and storage, energy, food, fibre production, and recreation. Biodiversity represents the foundation of the ecosystem and is required in varying degrees for the delivery of many ecosystem services. It is thus fundamental to understanding and using an ecosystem services approach.

An ecosystem services market refers to any market in which the transactions taking place are aimed at improving or maintaining environmental quality or minimizing environmental degradation. It allows us to see the full costs of using our environment and the full benefits of preserving it (sustainable prosperity). Implementing an ecosystem services and biodiversity market is a **paradigm shift** that requires new systems and processes and relies on cross-sector collaboration. It is a system where all parties involved have a voice, as industry, government, First Nations, and academia from various disciplines work together. A market-based approach for managing ecosystem services relies on market forces to regulate their supply and demand.

This approach is putting a spotlight on natural capital, which is the “infrastructure” from which all natural resource-based goods and services flow and upon which business and society rely. Given the breadth and growing depth of public sector work on ecosystem services globally, it is increasingly clear that this approach has the potential to shape future policy and regulations, and government expectations of the private sector, particularly on public lands.

Globally, there are more than 45 compensatory mitigation programs (banks and offsets) with over 30 more in development, and the annual market size is US\$2.4 billion to US\$4.0 billion. North America dominates the market with more than 15,000 hectares in compensatory mitigation annually. U.S.

mitigation banking is still growing, with 1,044 active and sold-out wetland, stream, and conservation banks.¹¹

Offsets have the potential to slow the loss of natural ecosystems, which are valued at \$100 trillion per year globally.¹² The Wildlands Mitigation Bank is the largest bank in the U.S. and reports over a \$40-million profit annually. All the mitigation banks in the U.S. (a total of 122) are listed at www.speciesbanking.com. They estimate global payments per year to be from \$1.8–\$2.9 billion.

Ecosystem service valuation can provide companies with access to new revenue streams, which adds value to the market. For example, in the U.S., Weyerhaeuser and Potlatch (forestry) sell recreational permits for people to have access to the private land.¹³

In another of many examples from the U.S., Allegheny Power leveraged ecosystem services for land valuation when it sold over 12,000 hectares to the U.S. federal government for conservation. The land was appraised at \$16 million. However, accounting for the ecosystem services the land provided, the value of the property was estimated to be more than \$32 million. The federal government paid the appraised price (\$16 million) but allowed Allegheny Power to claim the remaining \$16 million as a charitable donation, recognizing that the traditional property appraisal did not account for the value the property provided with respect to ecosystem services.

In Canada, the federal environmental protection order (EPO) for sage grouse used an existence value of \$40.8 million annually, applied to the 1,200 square kilometres covered by the EPO, which works out to approximately \$136 per acre per year. A 2008 Environment and Parks report on carbon storage stated that Alberta's native rangelands store the equivalent of three years' total GHG emissions, which translates to about \$22 billion of carbon at \$30 per ton.

Alberta has an opportunity to be a leader in both environmental excellence and economic diversification by embracing a market-based approach for enhancing priority ecosystem services. Well-designed and well-managed market-based approaches for providing priority ecosystem services and promoting biodiversity allow new business opportunities and provide a way to better protect and recognize the value of ecosystem services that contribute to Alberta's high quality of life.

Business Line: Biological GHG Management Program

Goal: Effective management of GHG emissions arising from biological systems

- A. Reduce emissions from agricultural production, forest operations, and municipal waste management
- B. Enhance biological carbon sequestration to reduce net GHGs in the province
- C. Assess emission-reduction opportunities to determine where both environmental effectiveness and affordability can be achieved

¹¹ *Alberta Conservation Offsets Workshop Report* (draft). November 12-13, 2013.

¹² R. Costanza et al. "Changes in the Global Value of Ecosystem Services." *Global Environmental Change* 26 (2014): 152-158. www.sciencedirect.com/science/article/pii/S0959378014000685.

¹³ recreation.potlatchcorp.com/id/.

Research and Innovation Initiatives (over the Next Two Years)

1. Deliver a biological GHG management program and projects, in partnership with and with funding support from the Climate Change and Emissions Management Corporation (CCEMC), to reduce net GHG emissions
 - 1.1. Invest in applied research, development, and demonstration-scale projects
 - 1.2. Establish credible data to inform industry and government decision-making
 - 1.3. Gather and disseminate relevant GHG management information

Research and Innovation Initiatives: Rationale

As a global energy producer, Alberta is faced with significant industrial emissions of GHGs, which must be reduced to meet the goals of the new Climate Leadership Plan, released November 22, 2015. Along with specific policies, the GOA has articulated the need for all sectors to contribute to emission-reduction goals. Agriculture and forestry have much to offer. Emission reductions in production areas are under study now. And as producers of biomass, they can contribute to reductions in the largest industry-emission areas, as well as the fastest growing, provided that knowledge gaps can be addressed and technologies refined and implemented.

To date, the CCEMC's Biological GHG Management Program, which is delivered through a partnership with AI Bio, has identified projects that will address emissions related to livestock production, crop production and fertilizer management, municipal waste handling, and material switching. Projects are supported all along the research and development continuum—from applied research through to commercial demonstration and deployment—and focus on reducing emissions and generating knowledge. Each project is developed by bringing together a proponent team, along with funders from the public and private sectors, to address a specific emission-reduction opportunity. Results from the projects are publicly available, with the expectation that they will serve as a model for industry and make a significant contribution to the climate change goals of Alberta.

In addition, the Biological GHG Management Program serves as a node of expertise that provides critical analysis; factual information; a database of local, national, and international experts; and readily available answers to immediate questions on GHGs, emission reduction, climate change, and current activities. Communications from this business line serve government, industry, and academics alike.

Business Line: Alberta Prion Research Institute

Goal: Effective management of prion and prion-like neurological diseases

- A. Reduced risk management costs of prion diseases in livestock industries and wild cervid management
- B. Research leadership in prion and human neurodegenerative diseases

Research and Innovation Initiatives (over the Next Three Years)

1. Improve understanding of the processes involved in prion diseases to inform risk management and policy around managing these diseases
2. Target investment toward the problems of livestock industries and wildlife managers to reduce industry costs, more effectively control disease in the wild, and develop new products

3. Build on Alberta's strengths and opportunities to develop new insight into prion-like neurodegenerative diseases, with the potential for long-term application in prevention, treatment, and products
4. Build on Alberta's expertise in prion and protein misfolding research to strengthen Alberta's position as an international leader in these fields
5. Attract additional funding to leverage AI Bio's investment in prions

Research and Innovation Initiatives: Rationale

This business line operates under the name Alberta Prion Research Institute (APRI) or the Prion Institute. It supports research that is highly beneficial to Alberta livestock industries (such as animal prion disease risk management) and environmental stewardship. Information continues to emerge about prion diseases, reminding us of the need to remain flexible in how we regard these diseases and to bring the best available science to management of risks from the diseases.

To deal with BSE, it is necessary to understand at least three forms of this disease: the "classical" form that was caused by giving contaminated feed to animals and two "atypical" forms, described more recently, that are likely spontaneously occurring manifestations of the disease (occurring naturally without any infectious agent). To determine whether the spontaneous disease could become a source of infection for other cattle or people, we need to know much more about the nature of prions and their infectivity—for example, whether the disease could be spread through environmental contamination as well as through feeding. Currently, our understanding of these "atypical" or spontaneous diseases and whether they progress in the same way as the "classical" disease is sparse.

How prions tend to change their infectious characteristics as they pass from one host species to another is not well understood. Prions last a very long time in the environment, but we know little about how environmental components influence their infectivity in new animals. We also do not yet know enough about how cervid (deer family) behaviour influences transmission of the disease. These and other questions need to be answered to develop risk assessments and management plans for reducing the spread of chronic wasting disease in Alberta.

APRI's investments are also highly relevant to dealing with the scourge of dementias in elderly humans. In recent years, it has become apparent that important characteristics of diseases such as Alzheimer's, Parkinson's, and frontotemporal dementias are very prion-like. Alberta can leverage its investments in prion research and collaborate with other research centres to move toward global leadership in understanding and treating these devastating diseases. APRI provides funding for research that increases our understanding of these common mechanisms.

Previous investments in infrastructure, recruitment, and operations research have been highly impactful and have yielded new and relevant information on prion diseases. Considering that the disease processes are extremely slow, Alberta can be particularly satisfied with the high quality and amount of new information that is becoming available in a relatively short period. By leveraging APRI investments with contributions from our various partners, and by delivering programs effectively, we achieve high efficiency in delivering on the Alberta investment.

During the 2016–17 year, the Prion Institute will follow up on observations and opportunities identified in the summative evaluation carried out in 2015–16. In 2015–16, the Prion Institute received renewed investment of \$27.5 million from the GOA to support research and related activities in its mandated areas for another five years.

The Prion Institute will reinvigorate its successful programs and seek to modify and introduce others to facilitate more targeted and applied research. Over the next period, it will also investigate additional partnerships with the livestock and food industries, and especially with the biotechnology and pharmaceutical industries, so that it can play an additional role in potential diversification within the province.

Separate Grant Agreements

Activities in support of the Alberta Bio Future Program, the Driving Conversion of Alberta's Biomass to Advanced Materials and Chemicals Program (AMCP), the Biological GHG Management Program, and APRI are funded via separate grant agreements that are outside of AI Bio's core grant from EDT. Separate reports will be submitted to the department specific to the Alberta Bio Future Program, AMCP, and APRI. For the Biological GHG Management Program, a separate detailed business plan will be submitted to the CCEMC.

Outputs, Outcomes, and Performance Measures

AI Bio Outputs, Outcomes, and Performance Measures for 2013–14								
Business Line	Projects ¹ with Outputs or Outcomes	Outputs			Outcomes			
		Knowledge management occurs with academia. ²	Knowledge management occurs with industry, government, and others. ³	Highly qualified personnel are developed. ⁴	Knowledge results in significant new directions in science or innovation. ⁵	Knowledge is likely to lead to policy or regulation change.	Knowledge is likely to lead to practice change.	Knowledge is likely to lead to a new or improved product, process, or service, or improved market access. ⁶
Sustainable Production	15	402	169	262	12		4	14
Bioindustrial Innovation	9	84	30	76	5	3		3
Food Innovation	8	248	250	144	4		3	9
Ecosystem Services and Biodiversity (incl. BioGHG)	8	5	7		2	3	8	
APRI	11	138	20	118	5	4	4	5
Total	51	878	476	600	28	10	19	31

AI Bio Outputs, Outcomes, and Performance Measures for 2014–15

Business Line	Projects ¹ with Outputs or Outcomes	Outputs			Outcomes			
		Knowledge management occurs with academia. ²	Knowledge management occurs with industry, government, and others. ³	Highly qualified personnel are developed. ⁴	Knowledge results in significant new directions in science or innovation. ⁵	Knowledge is likely to lead to policy or regulation change.	Knowledge is likely to lead to practice change.	Knowledge is likely to lead to a new or improved product, process, or service, or improved market access. ⁶
Sustainable Production	7	68	21	46	2		3	12
Bioindustrial Innovation	6	11	13	26	8		2	26
Food Innovation	6	58	20	25	4		2	9
Ecosystem Services and Biodiversity	4	5	7	13	5	3		
BioGHG ⁷	2	2	4	1	2		1	2
APRI	14	54	8	106	16	4	4	21
Total	39	198	73	217	37	7	12	70

AI Bio Outputs, Outcomes, and Performance Measures for 2015–16

Business Line	Projects ¹ with Outputs or Outcomes	Outputs			Outcomes			
		Knowledge management occurs with academia. ²	Knowledge management occurs with industry, government, and others. ³	Highly qualified personnel are developed. ⁴	Knowledge results in significant new directions in science or innovation. ⁵	Knowledge is likely to lead to policy or regulation change.	Knowledge is likely to lead to practice change.	Knowledge is likely to lead to a new or improved product, process, or service, or improved market access. ⁶
Sustainable Production	10	83	48	55	7	1	5	18
Bioindustrial Innovation	5	1	4	13	3	1		8
Food Innovation	13	139	55	50	4	1	2	21
Ecosystem Services and Biodiversity	1	19	15	10	2			6
BioGHG ⁷	3	5	5		3	2	3	2
APRI	3	40	2	10	3	1	3	2
Total	35	287	129	138	22	6	13	57

¹ **Measure:** The number of projects, programs, or initiatives supported by AI Bio for which the final report was received in the calendar year or which are otherwise considered closed.

² **Measure:** Over the life of a project, program, or initiative, the number of published peer-reviewed papers, abstracts, or book chapters, or scientific conference program or poster presentations, etc., for which the audience was mainly from academia.

³ **Measure:** Over the life of a project, program, or initiative, the number of seminars or workshops coordinated, presentations delivered, articles published in non-academic publications, newsletter editions issued, active websites developed, crop walks or tours coordinated, etc., for which the audience was from industry, government, or other sectors.

⁴ **Measure:** The number of individuals involved on a project, program, or initiative who are supported by a grant or contract and who are undergraduate students, graduate students, postdoctoral fellows, or post-secondary graduates with a diploma or degree.

⁵ **Measure:** The number of confirmed proofs of concept, new avenues opened for exploration, new memoranda of understanding, etc. (e.g., *Identified 300 organic compounds residing in the soil throughout the growing season of wheat and canola, which may lead to new farming practices and products*).

⁶ **Measure:** The number of potential or actual patents, licence agreements, registrations, etc. (e.g., *Registered a new dry-bean cultivar*).

⁷ **NOTE:** BioGHG is the short name for the Biological Greenhouse Gas Management program.

AI Bio Outputs, Outcomes, and Performance Measure Targets for 2016–17

Business Line	Projects ¹ with Outputs or Outcomes	Outputs			Outcomes			
		Knowledge management occurs with academia. ²	Knowledge management occurs with industry, government, and others. ³	Highly qualified personnel are developed. ⁴	Knowledge results in significant new directions in science or innovation. ⁵	Knowledge is likely to lead to policy or regulation change.	Knowledge is likely to lead to practice change.	Knowledge is likely to lead to a new or improved product, process, or service, or improved market access. ⁶
Sustainable Production	9	101	94	65	18	1	18	19
Bioindustrial Innovation	11	49	36	32	11	6	14	19
Food Innovation	12	42	35	82	17	4	16	14
Ecosystem Services and Biodiversity	4	3	15	10	4	1	4	5
BioGHG ⁷	4	9	2	4	4	1	3	2
APRI	25	25	3	102	3	2		7
Total	65	229	185	295	57	15	55	66

¹ **Measure:** The number of projects, programs, or initiatives supported by AI Bio for which the final report may be received in the calendar year or which are otherwise considered closed.

² **Measure:** Over the life of a project, program, or initiative, the number of published peer-reviewed papers, abstracts, or book chapters, or scientific conference program or poster presentations, etc., for which the audience would mainly be from academia.

³ **Measure:** Over the life of a project, program, or initiative, the number of seminars or workshops coordinated, presentations delivered, articles published in non-academic publications, newsletter editions issued, active websites developed, crop walks or tours coordinated, etc., for which the audience would mainly be from industry, government, or other non-academic sectors.

⁴ **Measure:** The number of individuals involved on a project, program, or initiative who would be supported by a grant or contract from Alberta Innovates and who are undergraduate students, graduate students, postdoctoral fellows, or post-secondary graduates with a diploma or degree.

⁵ **Measure:** The number of confirmed proofs of concept, new avenues opened for exploration, new memoranda of understanding, etc. (e.g., *Identified 300 organic compounds residing in the soil throughout the growing season of wheat and canola, which may lead to new farming practices and products*).

⁶ **Measure:** The number of potential or actual patents, licence agreements, registrations, etc. (e.g., *Registered a new dry-bean cultivar*).

⁷ **NOTE:** BioGHG is the short name for the Biological Greenhouse Gas Management program.

5. Budget and Resource Requirements

AI Bio recognizes the role Alberta Economic Development and Trade (EDT) plays as a service provider for AI Bio. The corporation receives financial processing, IT, and facility (office space) services from EDT. AI Bio also shares payroll, reception, and legal expenses with Alberta Innovates Energy and Environment Solutions. These are valuable cost-saving measures for AI Bio.

STATEMENT OF OPERATIONS (in thousands of dollars)	2014–15 ACTUALS	2015–16 BUDGET	2015–16 FORECAST	2016–17 ESTIMATES	2017–18 TARGET	2018–19 TARGET
REVENUE						
Grants from EDT						
Base operating grant	\$11,049	\$10,331	\$10,671	\$7,021	\$10,671	\$10,671
Alberta Prion Research Institute (APRI)	4,990	4,645	4,228	4,199	5,000	5,500
Advanced Materials and Chemicals Program	436	1,780	1,522	560		
Alberta Bio Future Program	71	3,550	1,211	4,433	3,650	3,650
EDT Targeted Investments	1,013	840	150	200	50	
Other Government of Alberta revenue						
Grant funding support for APRI (ALMA)	403	556	556	95	219	
Food Safety Program (ALMA)	350	302	302	37		
Environment and Sustainable Resource Dev.	1,200	10	9			
Alberta Agriculture and Forestry			30			
Biological GHG Management Program	603	830	496	700	700	700
Alberta Innovates Technology Futures		12	13	100		
Other revenue sources	716		160			
Alzheimer Society of AB and NWT (ASANT) (APRI/ASANT Joint Research Program)	144	100	459	455	342	
Interest earnings	282	200	225	200	175	175
TOTAL REVENUE	\$21,257	\$23,156	\$20,032	\$18,000	\$20,807	\$20,696
EXPENSE						
Business lines / priority areas						
Sustainable Production	4,270	3,727	2,100	3,139	2,488	1,877
Bioindustrial Innovation	4,145	3,434	2,972	4,381	2,215	2,040
Advanced Materials and Chemicals Program	436	1,780	1,522	560		
CNC Challenge 2.0				100		
Alberta Bio Future Program	71	3,550	1,211	4,433	3,650	3,650
Food Innovation	2,376	2,617	2,269	2,158	1,551	1,435
Ecosystem Services and Biodiversity	1,893	3,006	3,027	3,154	2,148	1,348
Biological GHG Management Program	603	830	487	700	700	700
APRI	5,684	5,301	5,293	4,749	5,561	5,500
Emerging opportunities	175	175		75	1,014	2,666
Corporate services						
Internal administration	657	930	578	905	905	905
Contractual administration	175	175	50	175	175	175
Board expenses	215	150	75	25		
Communications	401	400	283	400	400	400
TOTAL EXPENSES	\$21,101	\$26,075	\$19,867	\$24,954	\$20,807	\$20,696
Surplus (deficit) for this fiscal year	\$156	\$(2,919)	\$165	\$(6,954)	-	-
Accumulated surplus at beginning of year	8,483	8,639	8,639	8,804	1,850	-
AI Bio surplus (deficit) at end of year	8,639	5,720	8,804	1,850	1,850	-
Contingency / transition costs					1,850	-
TOTAL AI BIO SURPLUS (DEFICIT) AT END OF YEAR	\$8,639	\$5,720	\$8,804	1,850	-	-

NOTE 1: All revenues are reported on the accrual basis of accounting. Cash received for which goods or services have not been provided by year-end is recorded as unearned revenue. Externally restricted revenue is recognized as revenue in the period in which the resources are used for the purpose specified. Funds received prior to meeting the criterion are recorded as unearned revenue until the resources are used for the purpose specified.

NOTE 2: Although AI Bio shows a deficit in fiscal year 2016-17, this deficit is a strategic and planned use of available funds that have been carried over from previous years and does not impact the viability or sustainability of AI Bio. It is the nature of a publicly funded entity, such as AI Bio, to derive the maximum value from the funds it is allocated and ensure the funds are fully expended delivering the intended business outcomes.

ALBERTA INNOVATES BIO SOLUTIONS

RESEARCH AND INNOVATION INITIATIVES (in thousands of dollars)	TOTAL 2016–17 ESTIMATES	KEY OUTCOMES OF THE ALBERTA RESEARCH AND INNOVATION SYSTEM			
		Drives the growth and diversification of the economy	Enables the cost-effective discovery, development, and production of natural resources	Mitigates environmental impacts	Enhances the health and well-being of Albertans
Sustainable Production	\$3,139	\$2,354	\$785		
Bioindustrial Innovation	\$4,481	\$4,481			
Advanced Materials and Chemicals Program	\$560	\$560			
Alberta Bio Future Program	\$4,433	\$4,433			
Food Innovation	\$2,158	\$1,942			\$216
Ecosystem Services and Biodiversity	\$3,154	\$2,366		\$788	
Biological GHG Management Program	\$700			\$700	
Alberta Prion Research Institute	\$4,749	\$2,137		\$617	\$1,995
Emerging Opportunities	\$75	\$75			
TOTAL	\$23,449	\$18,348	\$785	\$2,105	\$2,211

6. Capital Planning and Leasing Arrangements

AI Bio has no capital projects or commercial leasing arrangements at this time.

Appendix: Summary of AI Bio Goals 2016–19

Sustainable Production

Sustainable agriculture and forest production

- Market-driven traits and products
- Sustainable production systems

Bioindustrial Innovation

New chemicals, materials, and energy from biomass

- New bioindustrial products and processes
- Bioindustrial sector growth
- Green building materials and modular construction

Food Innovation

Growth and diversification of Alberta's food industry

- New food ingredients, food products, beverages, functional foods, and natural health products
- Technologies, products, and processes to control food-borne pathogens

Ecosystem Services and Biodiversity

Innovation, growth, and diversification through markets for ecosystem services and biodiversity

- Apply interdisciplinary science to inform policy, programs, and management
- Support measuring and monitoring of provincial biological resources to demonstrate environmental integrity
- Use market-based instruments to manage priority ecosystem services and biodiversity

Biological Greenhouse Gas Management Program

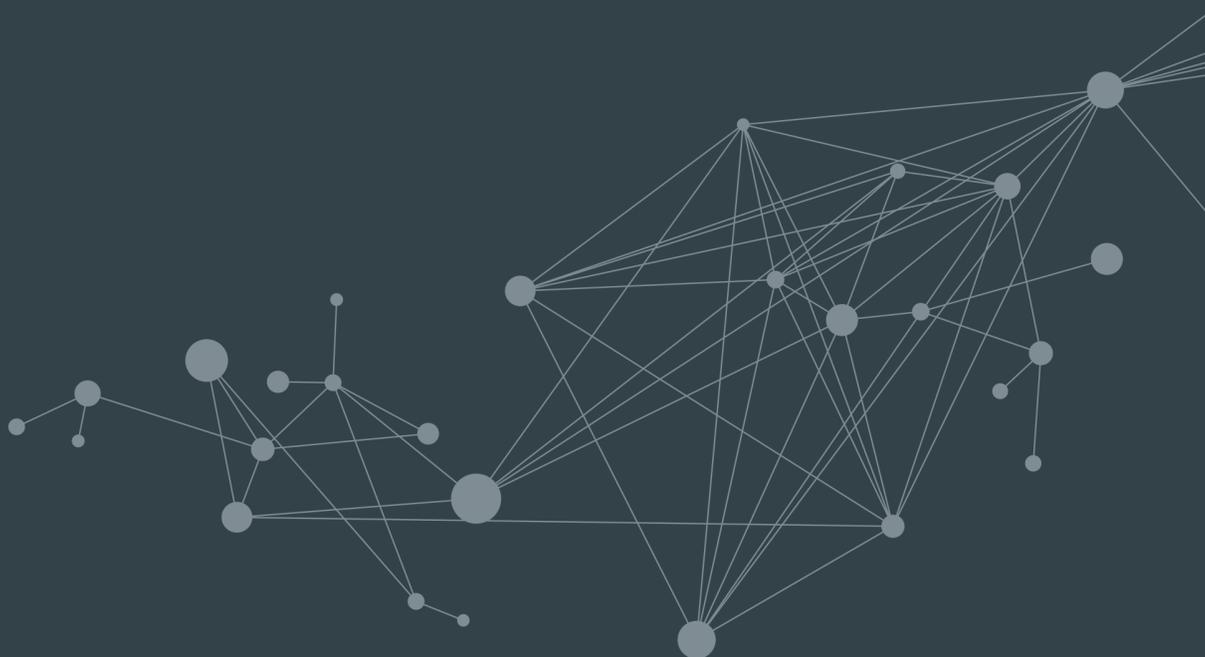
Effective management of GHG emissions from biological systems

- Reduce emissions from agricultural production, forest operations, and municipal waste management
- Enhance biological carbon sequestration to reduce net GHGs in the province
- Assess emission-reduction opportunities to determine where both environmental effectiveness and affordability can be achieved

Alberta Prion Research Institute

Effective management of prion and prion-like neurological diseases

- Reduce risk management costs of prion diseases in livestock industries and wild cervid management
- Research leadership in prion and human neurodegenerative diseases



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