



CREATING
**Ecosystem Services and
Biodiversity Markets**
IN ALBERTA



ECOSYSTEM SERVICES +
BIODIVERSITY NETWORK



AUTHORS

Alberta Innovates

A research agency funded by the Government of Alberta, Alberta Innovates is an integral part of Alberta's research and innovation system. It works with partners to identify, coordinate and fund research projects and helps solve industry challenges with solutions that deliver economic, environmental and social benefits. Each project highlighted in this booklet has been funded by Alberta Innovates and other funding partners. Funding partners are listed in Appendix A.

Ecosystem Services and Biodiversity Network

The Ecosystem Services and Biodiversity Network is a multidisciplinary group working to build the knowledge and capacity required to implement ecosystem services and biodiversity markets in Alberta. It strives to advance knowledge surrounding ecosystem services and biodiversity and the use of market-based approaches to enhance these services. Members include Alberta Innovates, Alberta Biodiversity Monitoring Institute, Silvacom, Land Stewardship Centre, Alberta Livestock and Meat Agency, and the Government of Alberta.

ECOSYSTEM SERVICES AND BIODIVERSITY NETWORK

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To access this document online, visit ecoservicesnetwork.ca and search for *Creating Ecosystem Services and Biodiversity Markets in Alberta*.



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Ecosystem Services and Biodiversity Markets

IN ALBERTA

Alberta is a national leader in ecosystem services and biodiversity market innovation. We have developed the knowledge and capacity to better understand ecosystem services—the benefits nature provides to Albertans—and how we can best manage the land to get the most value out of those services. This booklet showcases how we have been working toward ecosystem services and biodiversity markets in Alberta.

We believe that ecosystem services and biodiversity markets diversify the economy, enhance environmental integrity, promote sustainable development and increase innovation and competitiveness for Albertans. We hope you will be inspired by reading about the lessons we have learned, the work we have accomplished and the importance of it all for our province.

Ecosystem Services and Biodiversity Markets

Ecosystem services are the benefits that humans receive from nature. Nature provides a broad range of services, from those that are already marketable, such as food and oil production, to those we don't yet attach a dollar value to, such as water purification, pollination and biodiversity.

Ecosystem services and biodiversity markets are markets in which the transactions take place with the goal of improving or maintaining environmental quality or minimizing environmental degradation. Using this type of approach, we see the costs of our actions on the environment and the benefits of preserving it. Market approaches to restoring and enhancing ecosystem services have been shown to cause positive changes in land-use management and bring a number of benefits to individuals, businesses and communities.

Four Categories of Ecosystem Services



PROVISIONING SERVICES:

food, fibre, water, timber, fuel



CULTURAL SERVICES:

recreation, esthetic values, spiritual benefits, education



REGULATING SERVICES:

affecting floods, climate, water quality, wastes, diseases



SUPPORTING SERVICES:

photosynthesis, soil formation, nutrient cycling

How Do Ecosystem Services and Biodiversity Markets Work?

Ideally, ecosystem services and biodiversity markets would result in society as a whole changing the way we look at land use so we can achieve ecological goals. This can be done through regulations, but market-based approaches allow us to move more quickly, as they are voluntary and people benefit from them.

For ecosystem services and biodiversity markets to function effectively, we need credible scientific data that allows us to understand where ecosystem services are on the landscape. Ecosystem services assessment and modelling are providing this information, allowing us to establish supply and demand.

We also need an exchange, where buyers and sellers can come together to exchange credits (units that can be traded for mutual benefit). To get there, we're researching and building market infrastructure, testing market-based instruments that can be used for trading credits and building capacity through networking and education initiatives so that as many people as possible are ready to take advantage of these new markets.



The Ecosystem Services and Biodiversity Network (*SEE PAGE 27*) is working to support the creation of ecosystem services and biodiversity markets in Alberta. Through extensive research and consultation, we've identified five building blocks that are essential for the development of these markets:



ASSESSMENT

PAGE 13

Credible, science-based assessment of ecosystem services across Alberta to better understand how management actions affect the landscape, and to define the unit for exchange

Learning to map, measure and value ecosystem services



MARKET INFRASTRUCTURE

PAGE 9

An integrated system for coordinating and managing market-based instruments that will enable the achievement of economic and environmental outcomes

Using market-based instruments to place a value on ecosystem services



ENABLING POLICY

PAGE 23

The *Land-use Framework* (2008) enables the opportunity for ecosystem services and biodiversity markets to exist in Alberta

Providing an understanding of economic, environmental and social demands



DATA AND INFORMATION

PAGE 18

A publicly accessible, world-class data and information management system to communicate and share data on Alberta's ecosystem services

Managing data and information is critical to managing ecosystem services and to the market system, as buyers and sellers must have confidence that there is integrity in the exchange



CAPACITY BUILDING

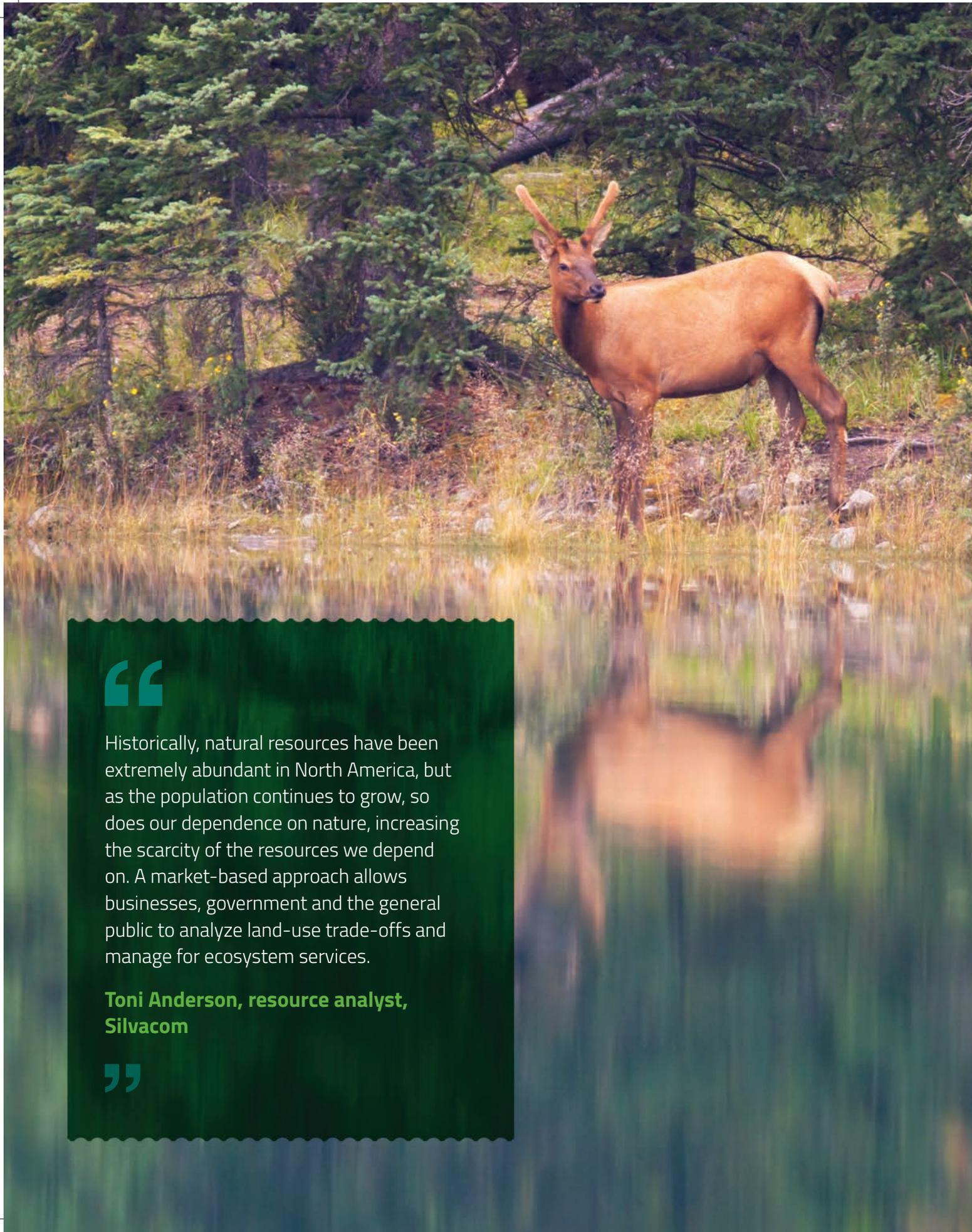
PAGE 26

Networks (*PAGE 26*), decision-support tools, education (*PAGE 39*) and stakeholder engagement (*PAGE 41*) resources that will enhance the implementation of ecosystem services and biodiversity markets in policy and land management

Building capacity in personnel, science, research and policy analysis

.....

The projects conducted through the network support the development of ecosystem services and biodiversity markets by building capacity in each of these key building blocks. *Creating Ecosystem Services and Biodiversity Markets in Alberta* shares stories on what we know so far about how we can implement these markets for the benefit of all Albertans.



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Historically, natural resources have been extremely abundant in North America, but as the population continues to grow, so does our dependence on nature, increasing the scarcity of the resources we depend on. A market-based approach allows businesses, government and the general public to analyze land-use trade-offs and manage for ecosystem services.

**Toni Anderson, resource analyst,
Silvacom**

”

Why Are Ecosystem Services and Biodiversity Markets Important for Alberta?

Environmental stewardship and sustainable development are increasingly important around the world. Alberta is no different.

Environmental excellence is one of our province's priorities, along with economic diversification, and innovation and competitiveness. Ecosystem services and biodiversity markets can contribute to achieving our goals in these three important areas, while providing other benefits as well.

The Benefits of Ecosystem Services and Biodiversity Markets

ECONOMIC DIVERSIFICATION

Alberta needs to diversify its economy to reduce the risk associated with economic fluctuations related to the price of oil and gas. Ecosystem services and biodiversity markets help us do that by providing new business opportunities. For example, agricultural producers can sell improved water quality, providing them with another income stream. Other opportunities include developing new products from available supplies of biomass and creating new businesses with the expertise to assess the benefits of specific land-use management actions.



A Different Approach

Ecosystem services and biodiversity markets benefit the forestry industry in a number of ways, including helping companies ensure a sustainable wood supply, improve forest management planning and retain social licence to operate as they contribute to achieving desired environmental outcomes.

Historically, Alberta has developed policies that have managed resource development in different ways, but not in an integrated way. The result is a heavily fragmented landscape, with linear disturbances and road systems that disrupt continuous forest stands. This has had large impacts on some of the species now at risk, such as caribou.

“There are a couple of ways to remedy that,” says Joerg Goetch, chief forester / general manager of External Affairs, Daishowa-Marubeni International Ltd. “We can continue to use a command and control system where you set policy and direct people to do certain things to restore and rehabilitate, or you can use a market-based approach that incents people to do those things and may get us to a point that surpasses what regulation with a command and control system could have done.”



ENVIRONMENTAL INTEGRITY

Well-designed ecosystem services and biodiversity markets value the benefits that nature provides, so they inherently protect our environment. By setting environmental targets through policy, we can ensure that markets protect and enhance the environmental attributes Albertans value. The tools developed to support these markets will help us measure, monitor and report on sustainability and manage environmental risks associated with industrial development.

Furthermore, an ecosystem services and biodiversity market approach to environmental management has the potential to help industry increase social licence to operate. These markets combine economic development goals with goals related to protecting and improving our environment so industry can manage environmental outcomes in a way that allows them to continue to develop projects.

BUSINESS INNOVATION

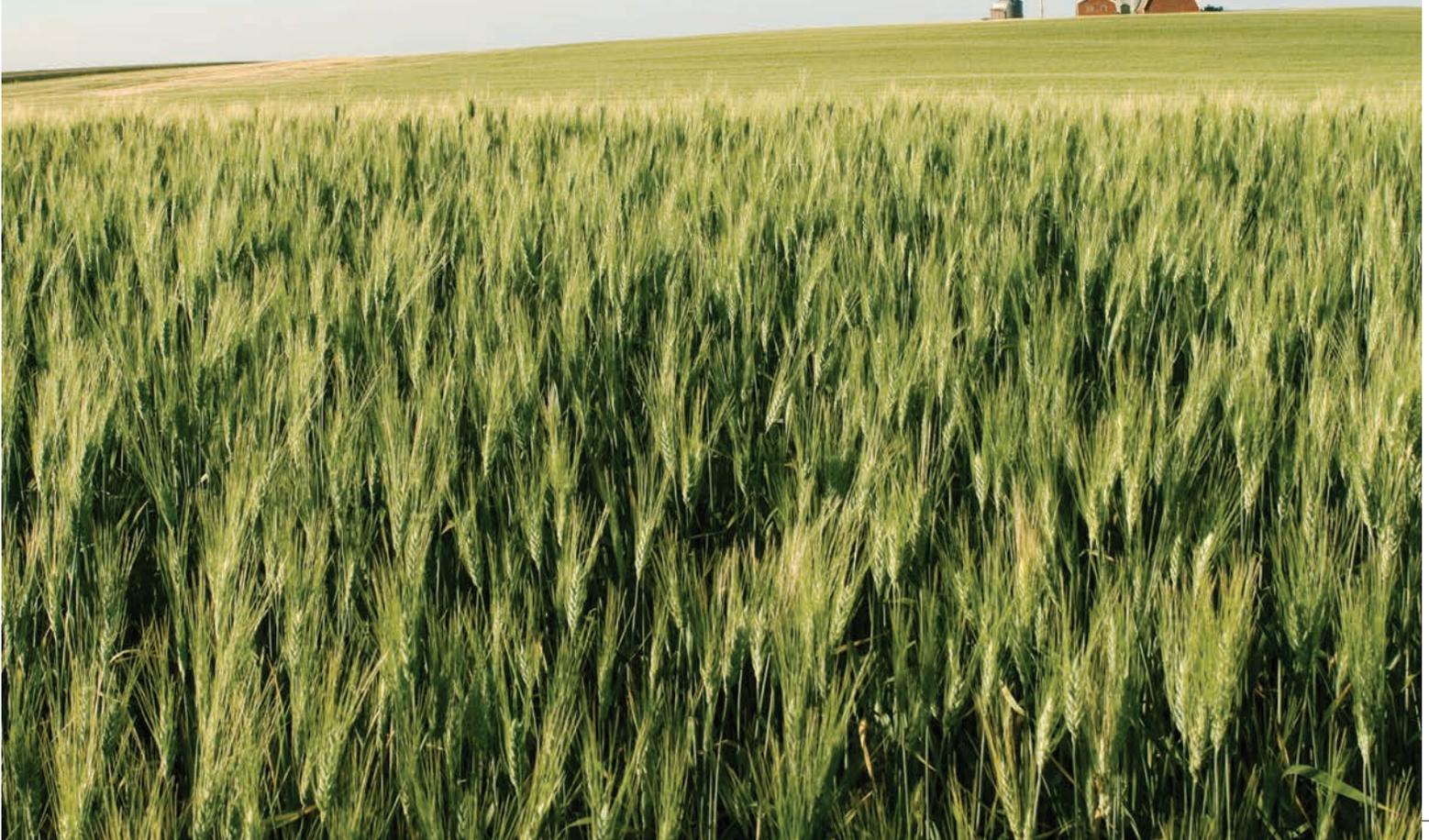
As mentioned above, there will be opportunities to monetize the benefits of ecosystem services. This will translate into new sources of revenue for companies and agricultural producers.

ENHANCED COMPETITIVENESS

In ecosystem services and biodiversity markets, businesses will compete for the revenues they can get for selling these services. Unlike regulatory approaches that stifle innovation, this competition promotes innovation and efficiency as companies work to find the best management practices for achieving their goals.

Seven Reasons for Businesses to Incorporate Ecosystem Services

1. Enhance social licence, which can open up new markets.
2. Reduce the risk of changes in the flow of ecosystem services they rely on.
3. Improve landscape management to gain approvals from regulators.
4. Develop new sources of revenue.
5. Understand the monetary value of everything nature produces.
6. Ensure sustainable development.
7. Leave a healthy planet for future generations.



Some of the Roles in Ecosystem Services and Biodiversity Markets



Buyers

- Buyers are organizations required to offset environmental impacts.
- They are organizations and individuals that want to invest in ecosystem services credits.
- Their role is to buy credits from sellers or work with landowners to create credits.



Sellers

- Sellers are landowners and organizations that restore and manage land for environmental benefits beyond regulatory requirements.
- Examples include farmers, foresters, land trusts, watershed councils and businesses.
- Their role involves using specific land management practices to manage the land to specific outcomes.



Verifiers and Certifiers

- Roles are filled by different actors in the markets.
- Verifiers determine whether conservation actions are producing the ecological benefits that are required to create credits.
- Certifiers confirm that the processes used by the verifiers are valid.



Exchange

- An exchange is an electronic meeting place where buyers and sellers trade credits.
- Price, quantity and other terms can be negotiated.



The Registry

- The registry is an information database that accounts for all credits available within a market.
- It documents the generation, ownership and trade of credits.



Getting the Infrastructure in Place

At any point in time, many individuals and organizations are engaged in activity on the landscape. Farmers are grazing cattle and fertilizing crops, companies are drilling for oil, utilities are building transmission infrastructure, developers are building new neighbourhoods—and all of these activities have an impact on ecosystems and the benefits they provide. Coordinating these activities to manage for a specific environmental outcome is a challenge, to say the least. Ecosystem services and biodiversity markets can provide incentives to reduce the collective impact of our activities on the environment. Putting market infrastructure in place is necessary to coordinate multiple buyers and sellers of ecosystem services and deliver environmental outcomes at a scale that will make a difference.

Market infrastructure consists of the institutional arrangements that bring buyers and sellers together and send the right price signals to help us sustainably manage ecosystems and their services. Infrastructure includes information that translates changes in practice into changes in ecosystem services, as well as a marketplace or exchange that facilitates trading between buyers and sellers. Market infrastructure is necessary because selling or buying a credit for an ecosystem service is not like selling or buying a product like a television.

“That’s because an individual change in practice will not lead to a change in ecosystem services—it’s the collective changes among many people at a larger scale. We need to find ways to send the right signals about the value of services in order to bring significant funding into the marketplace and coordinate investment in ecosystems so that the impacts of our investments are not dissipated, and so that we maximize value,” says Marian Weber, senior researcher, Alberta Innovates.

An exchange provides a way to coordinate investment. By setting up an exchange, we can organize auctions that involve multiple parties buying and selling individual or bundled ecosystem services. The exchange would include a trading platform that allows buyers to easily identify cost-effective solutions for meeting their environmental requirements and sellers to identify opportunities for creating and selling the ecosystem services that will give them the most value. Through an exchange, buyers and sellers would get information about the demand for and availability of ecosystem services as well as prices for those services.

Establishing prices through market infrastructure is critically important. Both buyers and sellers need to understand the value of various ecosystem services in order to be motivated to participate in ecosystem services and biodiversity markets. Researchers are currently working on understanding the socioeconomic aspects of markets, such as the risks and return to sellers who enter into contracts to provide services, as well as who and how much people will pay for ecosystem services.

Market-based Instruments

Market-based instruments are policy or program tools that use markets or economic incentives to change behaviour in order to achieve environmental outcomes.

“Currently the main challenges in using market-based approaches are the lack of specific environmental policy outcomes or objectives that would signal value and support a market, lack of understanding among stakeholders in how ecosystem services markets might work and concerns that they could lead to additional regulation,” says Marian Weber, senior researcher, Alberta Innovates.

Weber leads the Voluntary Market Pilots and Prototype for Exchange project that is exploring how markets for ecosystem services would work. The project will bring together partners to explore market drivers as well as roles and responsibilities of various parties in the market, and how market infrastructure could support ecosystem services and biodiversity markets. The project will also explore how an exchange can be used to support markets for offsets to meet species-at-risk requirements.

“When the project’s complete, we’ll have a better understanding of whether and where there are opportunities to test an exchange, including what specific functions it should have and what sort of governance structure,” says Weber.

Weber also notes that there are examples of market-based approaches elsewhere that we can learn from in Alberta. Australia developed and pilot tested an exchange for native vegetation offsets. Exchanges also have been developed for specific ecosystem services like water trading—for example, Markit is an exchange for trading nutrient credits on Chesapeake Bay.

“But there are not many examples of exchanges that integrate multiple ecosystem services, and that’s what we’re looking for in Alberta,” says Weber.

Components of an Effective Market System

- Transparency
- Competitive mechanism for generating supply and demand and determining price
- Information about prices
- Assessment methods to quantify what is being bought and sold
- Market oversight through government to protect against fraud



Willamette Partnership – Water Quality Trading

The Willamette Partnership is focused on developing solutions to complex conservation problems, building resilience in nature's ecosystems and in the communities that rely on them.

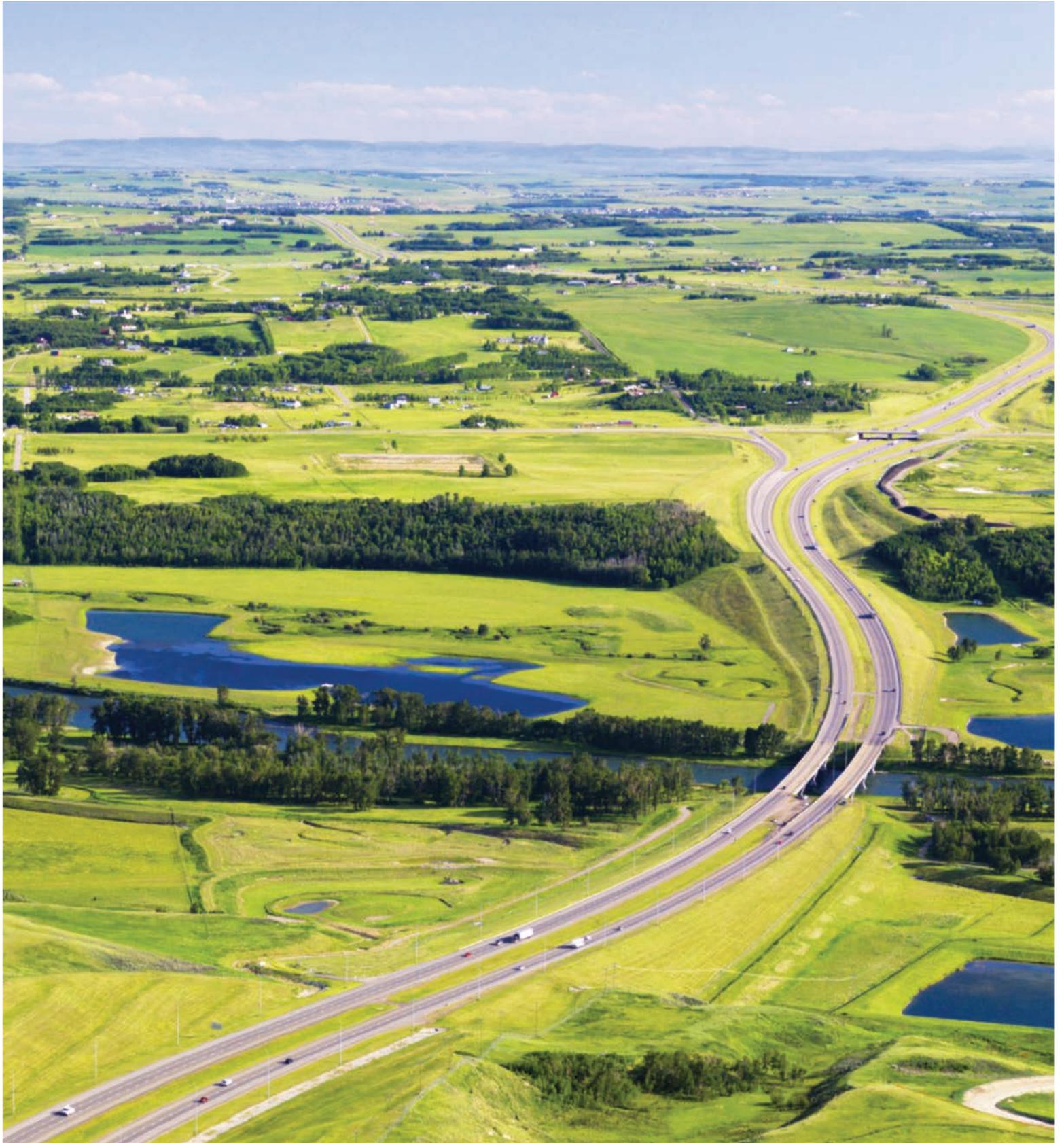
The partnership has collaborated with several partners to build and implement the National Network on Water Quality Trading with the goal of developing programs that aim to restore fishable swimming waters, supporting clean water for the health of both communities and economies.

The idea is that wastewater and stormwater facilities could buy water quality benefits from sellers, such as agricultural producers who are going above and beyond requirements to reduce pollution.

In *Building a Water Quality Trading Program: Options and Considerations*, the National Network on Water Quality Trading identifies 11 characteristics of a successful trading program:^{*}

1. Identifying and establishing regulatory instruments to support trading;
2. Defining who is eligible to trade, where trading can occur, and what is being traded;
3. Determining eligibility for participants in the trading program;
4. Quantifying water quality benefits;
5. Managing risk and uncertainty in the trading program;
6. Defining credit characteristics;
7. Establishing project implementation and assurance guidelines;
8. Establishing procedures for project review, certification, and tracking;
9. Ensuring compliance and enforcement;
10. Establishing adaptive management guidelines for ongoing program improvement and performance tracking; and
11. Defining roles, responsibilities, transaction models, and stakeholder engagement processes.

^{*} Willamette Partnership, World Resources Institute, and the National Network on Water Quality Trading, 2015. *Building a Water Quality Trading Program: Options and Considerations*. <http://willamettepartnership.org/wp-content/uploads/2015/06/BuildingaWQTProgram-NNWQT.pdf>, p. 3.



Assessment, Value and Credits

Clearly, in any market, players need to understand what is being bought and sold, as well as the value of the product or service. As a simple example, consider a grocery store selling food products to the consumer. The players—buyers (consumers) and sellers (the grocer)—understand that food is being bought and sold and that the food has a value, which is reflected in the price.

The challenge before us is assessing the supply and value of ecosystem services. Canadians are relatively lucky; our ecosystem services are still plentiful. But every action we take on the landscape has an impact, and as the population and activity on the landscape increase, we need to make decisions that take these valuable services into account.

“Many of those services we already sell through markets, like wheat, timber and energy, and the market provides signals on the value of those goods and the scarcity of them,” says Vic Adamowicz, professor, Resource Economics and Environmental Sociology, University of Alberta. “Other types of ecosystem services are valuable; we value carbon and biodiversity—pollinator species are important to us because they affect crop outputs—but they don’t get priced in markets, so there isn’t as much information on the importance of those services, on the way they should be produced or supplied, or the demand for the services.”

Assessing and Valuing

In order to implement ecosystem services and biodiversity markets, all players need to understand the supply and demand of the services that would be bought and sold. The Alberta Biodiversity Monitoring Institute (ABMI) has developed an ecosystem service assessment (ESA), which assesses the supply of ecosystem services across the province. Once the supply is assessed, the value can be calculated. This value is determined based on the benefits humans receive.

The ABMI uses spatially explicit or location-specific models to calculate the supply and value of each service. “Ecosystems are complex and not fully understood. Models can push us to be clear about what we think we know, because they need us to represent species, ecological processes and human influences using numbers. If we’re transparent about which numbers we use for model inputs, then others can review them and comment on the accuracy of a model’s predictions,” says Dan Farr, director, Application Centre, ABMI.

The assessment determines the supply of services at local, regional and provincial scales and is ultimately critical for determining the site-specific credit to be traded. Using models to simulate the future supply and value of ecosystem services in a landscape allows people to make more informed land-use decisions by predicting the likely outcome of a management action. For ecosystem services and biodiversity markets, these simulations could be used to estimate the supply and value of ecosystem services, reducing transaction costs of a site visit to every potential buyer and seller.

The ecosystem services assessment and its models combine information on the environmental conditions of specific locations on the landscape with socioeconomic information and produce a series of maps. A lot of data, calculations and analysis are entered into the tool to get an estimate of the supply and value of ecosystem services.



Understanding what's happening across the whole province lets us better play to our strengths and understand which regions can provide the most of each ecosystem service and how they can be balanced across those regions to provide benefits for all Albertans.

**Tom Habib, research coordinator,
Ecosystem Services, ABMI**



"It's not just 'Where is there something useful being produced on the land, whether it's trees or clean water?' but also 'Where are the people who are using it and how much does it cost to receive those natural products?' The models compile biophysical and economic information from credible, scientific sources into one platform and produce maps at the end. We are doing that for different services at the same time so we can see the whole suite being produced across the region," explains Tom Habib, research coordinator, Ecosystem Services, ABMI.

The ESA project is a basic building block needed to implement ecosystem services and biodiversity markets. So far, the ABMI has assessed the supply and value of water purification, pollination, forest timber production and carbon storage, rangeland forage production and carbon, and biodiversity. More ecosystem services will be assessed in the future.

Assessing ecosystem services at the local level is also important for landowners and managers seeking information about the impact of management practices. At the regional level, the ESA project contributes to the Alberta *Land-use Framework's* regional planning system, in which environment-related targets or outcomes for ecosystem services are specified at the scale of a large region.



How Much Credit?

Assessing and valuing the services nature provides is a very important step, but other issues need to be worked out as well, such as how much credit land management actions should be worth. Provincially and federally, there are a number of market mechanisms for ecosystem services. The question is, if a single site generates more than one type of benefit, should it produce a credit in more than one system?

Whether to allow credit stacking isn't an easy question to answer. "The predominant thinking is that if it all arises from a single action, you probably shouldn't be able to receive credit in more than one form. But if there are related actions, like if you put a different type of plant in your wetland or regulate water flow a little differently, you should be able to get a greater range of credits," says Dave Poulton, executive director, Alberta Association for Conservation Offsets.

Stacking Versus Bundling



CREDIT STACKING:

Selling separate credits for each ecosystem service that results from a single land management practice on the same piece of land. E.g., by restoring a wetland, you may provide wildlife habitat, water filtration, flow regulation, carbon capture and more and could sell credits for each of these services.



CREDIT BUNDLING:

Selling one type of credit that combines several different types of services arising out of an action.

Land Use: The Problem *and* the Solution



Fish are dying in Isle Lake, 80 kilometres west of Edmonton. Low oxygen levels in the lake kill hundreds of fish in the winter and affect thousands more. What's happening?

The ABMI's maps show that most of the watershed draining into Isle Lake has, over time, been converted from natural grassland to agriculture and residential land. The result of choosing this form of land use on such a large scale is a decline in the lake's water quality.

The ESA project is developing spatial models to discover which areas of watersheds:

- Have the largest impact on water quality
- Have the greatest potential to filter out extra nutrients before they reach places such as Isle Lake

With this information, those who manage the land can prioritize where they should implement actions that contribute to better water quality. A variety of land uses can continue while specific land uses in key areas help solve the problem.



On the con side of credit stacking, there is a risk of double-counting the credits. For example, the plants growing in a wetland provide wildlife habitat, regulate flow and take nutrients out of the water, which are all beneficial. But they are also all aspects of having plants in water; you can't do one without the others happening.

"If you count that as three separate benefits, then you are giving three times the credit for what amounts to a single benefit," says Poulton. "That's the danger; the blurred lines between the ecosystem services lead to double-counting. That assumes, of course, that there are markets for each of those services, which there currently aren't."

Stacking is a matter that should be dealt with in policy, but it could also be made in each individual credit market in the absence of clear policy. That, says Poulton, is when there is a very high risk of double-counting.



Providing Scientifically Credible Information

The ABMI monitors changes in wildlife and habitats across Alberta, from border to border. It continually provides relevant, reliable information to help people make responsible land-use decisions now and into the future.

Visit abmi.ca.

Managing and Integrating a Wealth of Information

Developing integrated ecosystem services assessment platforms is critically important to developing effective ecosystem services and biodiversity markets. With all the data in a single platform, the cost of future market transactions is lowered because we don't need to collect data for every single project—it's all there. Just as importantly, the data is all of the same quality.



A centralized data system provides stakeholders with the assurance that the data has been collected or produced in the same way and can therefore be accurately compared, which is important in valuing ecosystem services. It helps develop trust in the values we ultimately place on these services, which is necessary for trading in a marketplace.

In addition, collecting data on a project-by-project basis is expensive. Integrating data can lower costs for industry and government because it reduces redundancy and puts all the information in one place so that anyone can access it.

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If you want to make good decisions, you have to have comparable data to compare and contrast opportunities. For example, if you're looking at how we are going to use this area of land and you have very good, precise data about a certain potential resource but very poor data about the other resources on that land, you might make decisions that aren't optimal. You need a common process and data set to represent all the values you are looking to include in an area.

John Peters, director of Energy and Environment, Silvacom

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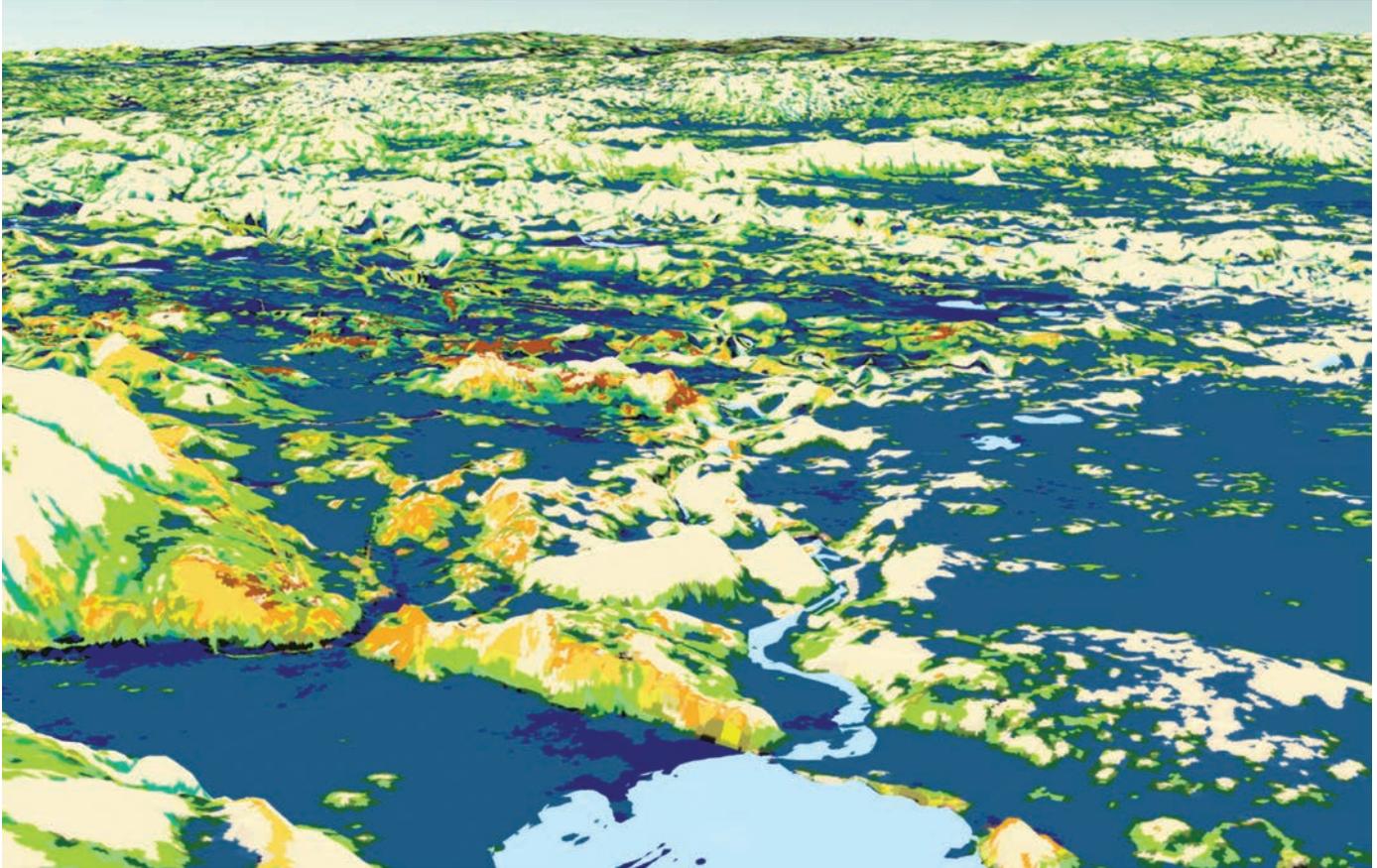


Photo: Silvacom

Data Collection and Ecosite Mapping

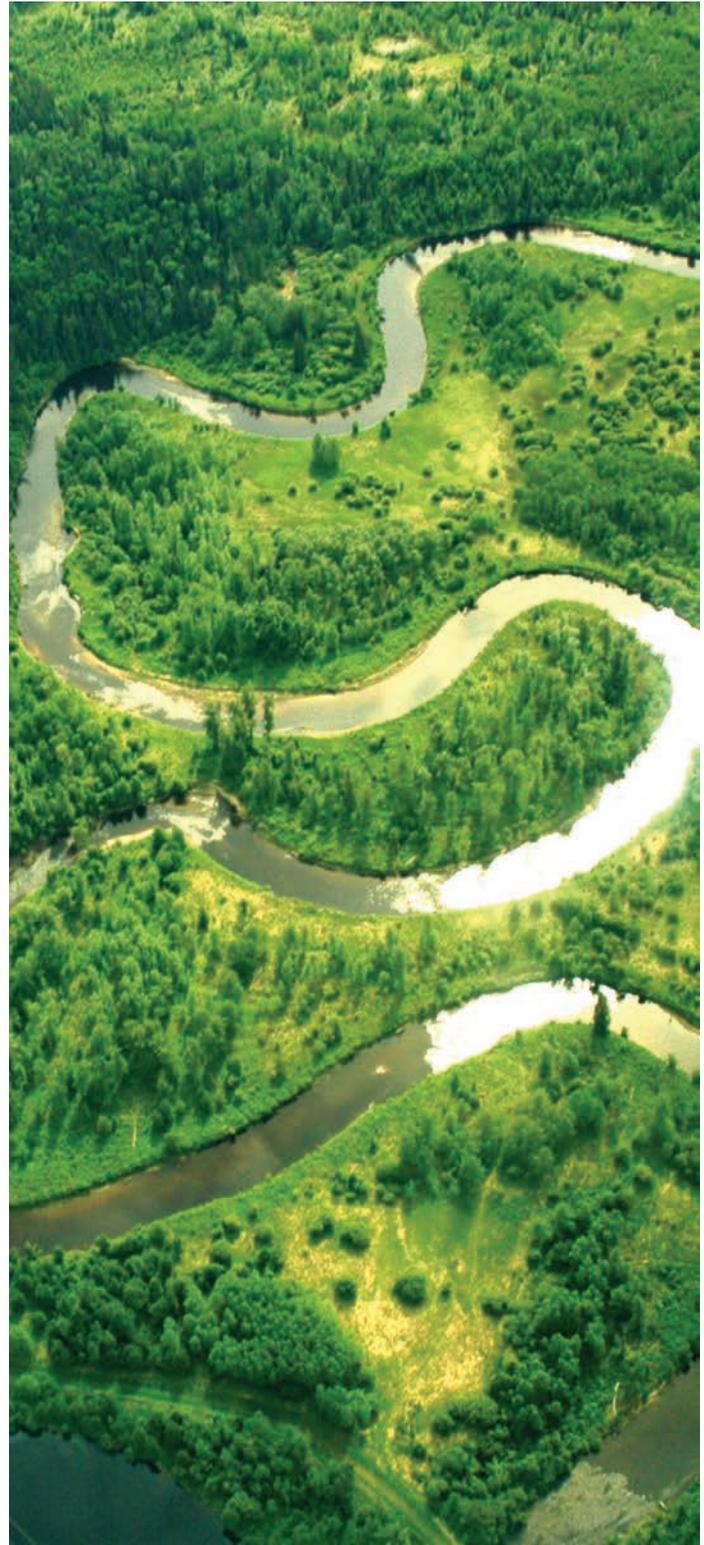
Predictive ecosite mapping could enhance our ability to manage the landscape by making data collection much more cost-effective for industry while ensuring the data is standardized and more credible. Ideally, maps of ecosites need to be as detailed as possible to support operational needs, so mapping through conventional approaches, such as photo interpretation or collecting a large number of field samples, is cost-prohibitive. Instead, researchers are using data collected by industry, the Alberta Biodiversity Monitoring Institute (ABMI) and others to predict the kinds of ecosites that exist in various areas.

“If you try to figure out what kind of ecosystem services can be generated off a landscape, the most basic thing you can start with is the ecosite. The ecosite captures the relationships between vegetation, soil, landform and climate that contribute to the formation of plant communities, soil development and thus the very ecological nature of any given site. Using ecosite information, without even being on the site, you can predict what the ecology of an area is,” says Kirk Andries, managing director of the ABMI and former managing director of the Climate Change and Emissions Management Corporation (CCEMC).

Industry has to collect pre-development ecosite data about the site for each of its development projects. This inventory approach is very costly as it requires a lot of fieldwork. An accurate and reliable predictive system with a strong science foundation that meets regulatory obligations could enable us to not only manage our landscapes more effectively, but also reduce industry's regulatory costs, resulting in a "win-win" for everyone. In addition, a standardized system enables consistency and accessibility by making the information available in one place. The information generated is also valuable to government and the forestry industry, reducing costs for the Province and contributing to sustainable forestry management.

The developers want to make sure the platform is financially self-sustaining for the next 30 years. "Another really important part of the project was coming up with a governance and operating model for the mapping platform," explains Craig Aumann, senior scientist, Ecosystem Management, Alberta Innovates. "It needs to be neutral, trustworthy and credible, so people believe the results that come out of it, while also supporting the work of the experts who will keep advancing the science and practice of ecosite classification in the future. I see the predictive mapping platform and associated governance and operating model as a template for producing other natural resource inventories in the province and across Canada."

Through the Alberta Data Partnership, the results from the mapping platform will be tested to get feedback and to identify and overcome any regulatory obstacles to deploying the platform across the province.



Supporting Business Decisions

Data integration supports business decisions by providing real, accurate information about land use and the supply of ecosystem services, reducing uncertainty. It also provides a framework to share data and tools for analyzing various scenarios. In addition, having one integrated data source helps facilitate collaboration between sectors.

The Bio Resource Information Management System (BRIMS) project is one example. It's integrating data from multiple sources to map forestry, agriculture and municipal solid waste biomass across the province. When it's complete, a publicly available web-based application will allow users to access information about natural resources, ecosystem services and land use, and search based on their interests.



"For example, potential investors looking to use biomass in the province will be able to identify the best place to locate it and determine the amount of biomass the location would supply for biorefining or bioenergy or whatever the end product is," says John Peters, director of Energy and Environment, Silvacom. "We're also seeing municipalities, counties and other regional areas using BRIMS to create a prospectus to shop to the world, saying we have this kind of bioresource available in our area and we'd like to use it for economic development or job creation."

In the future, Silvacom will be mapping other ecosystem services, adding more layers to the models it creates. That will allow for analyzing the trade-offs to land-use decisions and taking other environmental values into account.

"You could then see what other environmental values will also be affected if we take this biomass off the landscape. That could create an offset market so that those environmental values have a dollar value associated with them. Depending on their value, you might want to preserve them to sell in a different (offset) market, or you could say the amount of biomass I'm taking off the land is worth it," explains Toni Anderson, resource analyst, Silvacom.



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If we do have a system, it has to be efficient and tied to measurable outcomes. In my experience, for any ecosystem services and biodiversity market system to work effectively, you need to know what you are trying to achieve.

Tracy Scott, head of Industry and Government Relations – Alberta, Ducks Unlimited Canada

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The Challenge With Policy Integration

There are a number of provincial and federal policy drivers for ecosystem services and biodiversity markets in Alberta. Today, the *Alberta Land-use Framework (LUF)* is the guiding policy framework for implementing ecosystems services and biodiversity markets. The *LUF* is a provincial policy governing how land and natural resources are managed, and it's supported by the *Alberta Land Stewardship Act*, which allows for the use of market-based instruments. But because of the vast array of ecosystem services available to us, and the many areas governed by various policies that are impacted, policy integration is a challenge.

The LUF

The *LUF* outlines the process of land-use planning to achieve economic, environmental and social outcomes—*what* we are trying to achieve. It identifies three provincial outcomes related to a healthy economy, healthy ecosystems and communities with recreational and cultural opportunities. These outcomes are supported by regional plans and objectives that recognize trade-offs may be required between the outcomes. Ecosystem services and biodiversity markets with decision-support tools and credible science can help Albertans make trade-off decisions, develop clear objectives and implement regional plans successfully.

Ecosystem services and biodiversity markets could help government target program funds toward sites and practices that provide the most ecosystem services and the maximum benefits to Albertans. Tools such as the assessment maps and models could be used to identify areas of conservation, or support ecosystem health tracking and reporting.

"We have outcomes we want to achieve in the regional plan for biodiversity, water and air, and we also want to continue to enable the stewardship of landowners and economic objectives. An ecosystems services market approach hits all those objectives. Our government supports green jobs and how we can have a greener, more sustainable economy from both an environmental and social perspective; to me this fits into that wheelhouse. The regional plans are the place where we start to set out those outcomes we want. There is provincial policy, but in terms of putting provincial policy into practice, it starts at the regional plan scale," says Scott Milligan, executive director, Planning Branch, Alberta Environment and Parks.

The *LUF* also provides for guidance for municipal planning and enabling continued access for land uses that support the economy, such as oil and gas, forestry and tourism.

In Alberta, ecosystem services and biodiversity markets could be used to support implementation of the management of cumulative effects through environmental management frameworks. “On the environmental side, there are many strategies related to water management and air management, but the key environmental strategies are cumulative effects frameworks for air, water and biodiversity. That is where we set thresholds,” says Milligan.

What Milligan is referring to are not the kind of environmental controls put on, for example, industry, but rather indicators for ambient environmental quality at a broader level. When triggers are reached, Alberta Environment and Parks is obliged by the regional plan to investigate and put an action plan in place to fix the issue, if necessary or possible.

Cumulative Effects



Alberta Environment and Parks defines cumulative effects as “the combined effects of past, present and foreseeable human activities, over time, on the environment, economy and society in a particular place.”

These limits can help establish the demand in ecosystem services and biodiversity markets. “Triggers signal scarcity,” says Marian Weber, senior researcher, Alberta Innovates. “You know you’re approaching a threshold and will have to undertake management action to deal with that or risk being shut down—there is recognition that there will be costs to addressing the problem. Companies will be willing to pay for things like offsets in order to continue operating under the threshold.”

The demand may come from regulated entities seeking alternatives for compliance. For example, a water quality trigger might be a certain amount of phosphorous. If a trigger is crossed and there are concerns with phosphorus levels, operators can either implement practices that reduce phosphorous loading or continue their practices and buy credits from someone who is reducing phosphorous loading. Similarly, companies might be willing to invest to minimize land disturbance to support management of biodiversity and species such as caribou.

The *Wetlands Policy* is an example that is already working. There is a limit on the loss of wetlands so people who need to destroy wetlands now have to compensate for the loss. (See *A Market-based System That Works*, page 31.)

While many landowners already take excellent care of the land and the services it provides, incenting that activity would increase the success of meeting the objectives described in the regional plans.

“People who currently own good grassland have that ethic, but having a market incentive in place provides a way to encourage that stewardship ethic and provides assurance that the land will remain in a sustainable state well into the future,” says Milligan.



The Need for Policy Integration

“In moving towards an ecosystem services perspective, we are asking people to break out of traditional ways of thinking and from some of the incentive structures that have been in place for a very long time. That can be uncomfortable and lead to resistance. The firm guidance that regulation can allow can give people the direction to make those changes rather than relying on their volition and comfort level,” says Dave Poulton, executive director, Alberta Association for Conservation Offsets.

Poulton believes that an ecosystem services and biodiversity market approach encourages various areas of governance, such as economic development, agriculture, natural resources and health care, to all adopt complementary language and tools, which would ease integration between them and with nature conservation. “That would give us a common framework to refine thinking in all those different areas. The idea is, if we can come up with a solid framework that makes sense, it can be adapted by other parts of government,” he says.

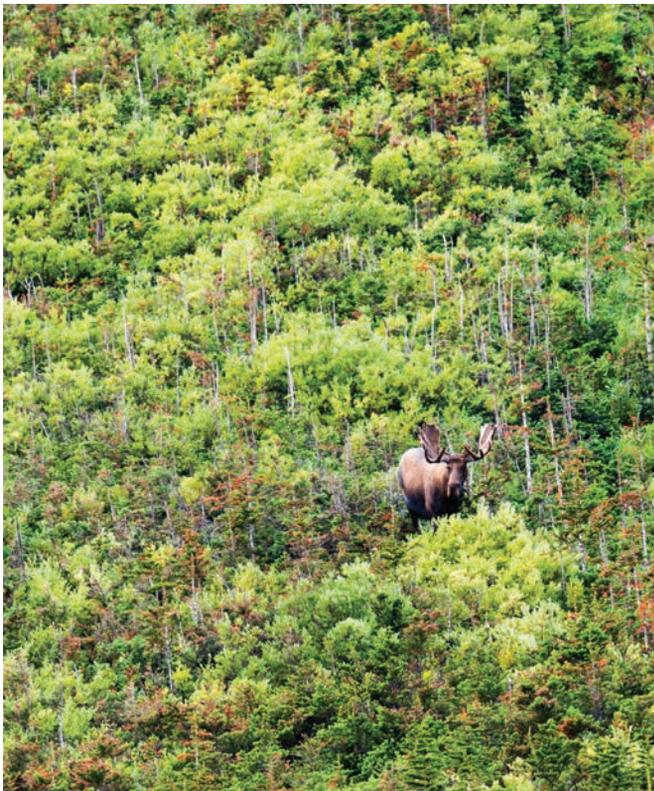
Of course, Alberta isn’t in a bubble; it’s part of Canada, and federal policies around the environment and resources affect what’s done with respect to ecosystem services. These too may need to be adapted to integrate with provincial policies. While it’s a major task, small steps and growing awareness can eventually lead to evolutions in policy that take the environment into account.

Conversations About Conservation

The Alberta Association for Conservation Offsets is a multi-stakeholder forum formed in early 2014 to allow for discussion and education in the area of conservation offsets. Although it was formed without any involvement from the provincial government, Alberta Environment and Parks policy-makers showed interest and have been very involved. Visit aaco.ca to learn more.

Casting a Wide Net

Knowledge networks are an effective approach to facilitating the collaboration of researchers, industry members and policy analysts working across similar issues. Working together streamlines efforts across similar areas of interest and reduces duplication in work. It also promotes alignment in thinking and in investments.



“Working together is important for various reasons. Historically, we would take a particular component of the environment that we’re interested in, maybe water or a particular bird species, and get so focused on that, we lost sight of the fact that that attribute of the environment is connected to so much more,” says Kirk Andries, managing director, Alberta Biodiversity Monitoring Institute (ABMI), and former managing director, Climate Change and Emissions Management Corporation (CCEMC).

On the ecology side, we now know that you can’t manage the land for a single environmental attribute because there is a need to understand the relationships between species and their relationships to everything else in the environment. On the land management side, we can’t achieve desired outcomes if we don’t understand the full range of science and stakeholder values. Economics, business interests and government objectives also need to be considered when developing ecosystem services markets.

“It’s not the same, but it’s a bit similar to work around climate change in managing carbon,” explains Andries. “When you calculate whether to introduce a new management practice to reduce greenhouse gas emissions, you have to have a whole systems view because you may promote a reduction at some point in a manufacturing process, but in doing that, you may increase emissions in another part of the process.”



The Ecosystem Services and Biodiversity Network

Since 2010, Alberta Innovates and others in the province have supported and carried out much work in the area of ecosystem services. The foundational work captured in the *Ecosystem Services Roadmap* was facilitated by Alberta Innovates Bio Solutions through the former Institute for Agriculture, Forestry and Environment and other partners. The roadmap describes five building blocks of ecosystem services and biodiversity markets—assessments, market infrastructure, enabling policy, data and information and capacity building. The Ecosystem Services and Biodiversity Network is helping to build capacity, engaging a broad range of stakeholders from many disciplines to advance Alberta’s knowledge surrounding ecosystem services, biodiversity and the use of market-based approaches.

The network was formalized in 2015. It is guided by a working group led by Alberta Innovates, Alberta Biodiversity Monitoring Institute, Silvacom, Land Stewardship Centre, Alberta Livestock and Meat Agency, and the Government of Alberta. This group provides expertise in ecological and biophysical science, data and information management, socioeconomics, policy and outreach.

“The people in the working group bring in expertise to work on innovation projects. Those people become part of this network, where we are connecting and sharing knowledge, and from there we are reaching out to get others involved,” says Carol Bettac, executive director, Alberta Innovates. “I expect it will become really robust and self-sustaining, with individuals and organizations identifying as part of the network and sharing what we are doing as well as communicating their activities and knowledge.”

Ultimately, the network will allow those involved in ecosystem services and interested in building markets to carry out pilot projects and proofs of concept. Interested parties can build exchanges and set up the infrastructure at a local level, such as at the watershed or municipal level, to test market-based instruments. While the objective will be environmental enhancement, the very nature of the markets means that they will lead to business opportunities.



The Ecosystem Services Roadmap

The *Ecosystem Services Roadmap* was developed based on the research and knowledge generated through the Institute for Agriculture, Forestry and the Environment. It provides strategic guidance with respect to the knowledge, information and capacity required to support a successful market for ecosystem services and biodiversity.

The purpose of the roadmap is to bring together an expert network of stakeholders to jointly put in place the systems, tools and knowledge to better understand ecosystem services approaches and how they can be applied throughout Alberta. The goal is to bring Alberta to the forefront of innovation in the provision of ecosystem services to achieve green growth and sustainable development in our province.

Read the roadmap at
ecoservicesnetwork.ca.

Proving the Concept

Ecosystem services and biodiversity markets do work, and there are many operating around the world. But Alberta is a unique environment, both ecologically and culturally, and we have to design markets that work for Albertans. Here's a look at some of the projects that are proving the concept in our province.



Ecosystem Services on the Farm

In an interesting pilot project, Alberta Innovates is developing tools to assess ecosystem services benefits from beneficial management practices on farms, and is evaluating the potential for markets for ecosystem services from agricultural lands. The project “Development of Information and Science to Support the Provision of Ecosystem Services on Agricultural Lands” is integrating science, bringing in and engaging landowners, and coordinating and applying the research at a farm-level scale in a way that ultimately can be used to facilitate the development of markets.

Agriculture is a primary land use in Alberta and thus offers many opportunities for maintaining and improving ecosystem services. “Prairie grassland and wetlands offer the greatest opportunities for restoration, and both are dominant in agricultural land in southern Alberta,” says Marian Weber, senior researcher, Alberta Innovates.

For markets to work, it's necessary to identify how management actions translate into quantifiable ecosystem services benefits that could be traded. Farmers and ranchers aren't just going to jump into these markets; they need information so they can understand the costs and impacts of various management actions on their farm operations and how they can manage risks.

Through a survey, researchers will try to understand the public's willingness to pay for biodiversity, water quality and storage, and carbon. “The idea is to look at whether a market is feasible, where the early opportunities are for investing in ecosystem services that can be extended later on,” says Weber.

The Living Lab: Evaluating Mechanisms for Wetland Restoration and Retention

Wetlands provide a wide range of ecosystem services that benefit the public, but most of them are on private agricultural land and are often viewed by landowners as nuisances. Alberta's *Wetland Policy* requires those who need to destroy wetlands to pay a fee for the restoration of those ecosystem services elsewhere. The Living Lab project is integrating economic and scientific data to determine how that might be done on a larger scale than it is today, testing how policy can be applied on the ground.

On the economic side, researchers are working with landowners to determine what it really costs to restore a wetland, looking at not just the technical costs for restoration but all other costs, including those to the landowner for negotiation. On the scientific side, they're gathering data about the ecosystem services the wetlands provide.

"We have some idea from the literature, but this will give us more information and it will be specific to the locations we're working in," says Vic Adamowicz, professor, Resource Economics and Environmental Sociology, University of Alberta.

Why is local data important? Local farming practices, the proximity to urban centres and the values, customs and norms of landowners all affect the costs of providing ecosystem services and wetland restoration.

"The value of agricultural land in terms of production, or the land value because of proximity to Calgary, or the measurement of value through a program that is new and uncertain to landowners can all affect the costs of restoring wetlands or the amounts that will have to be paid to generate restored wetlands," explains Adamowicz.

The project is testing how a reverse auction might work to promote wetland restoration. The reverse auction is a mechanism that develops a platform under which landowners compete for a limited budget to provide ecosystem services.

"The central question is 'How much is a landowner that owns a drained basin willing to accept in compensation to provide that basin to the wetland restoration agent to bring it back?'" says Peter Boxall, professor and chair, Department of Resource Economics and Environmental Sociology, Faculty of Agricultural, Life and Environmental Sciences, University of Alberta. "The government has a budget to purchase wetland restoration services, and we want to stretch that dollar and make it go as far as we can in either gaining basins or gaining services that are derived from restored basins."

Stakeholder engagement has been very important in raising awareness of selling ecosystem services as a new income source and interesting landowners in participating in the auction. The project is also highly interdisciplinary, with ecologists, economists, landowners and government at the municipal and provincial level all working together.



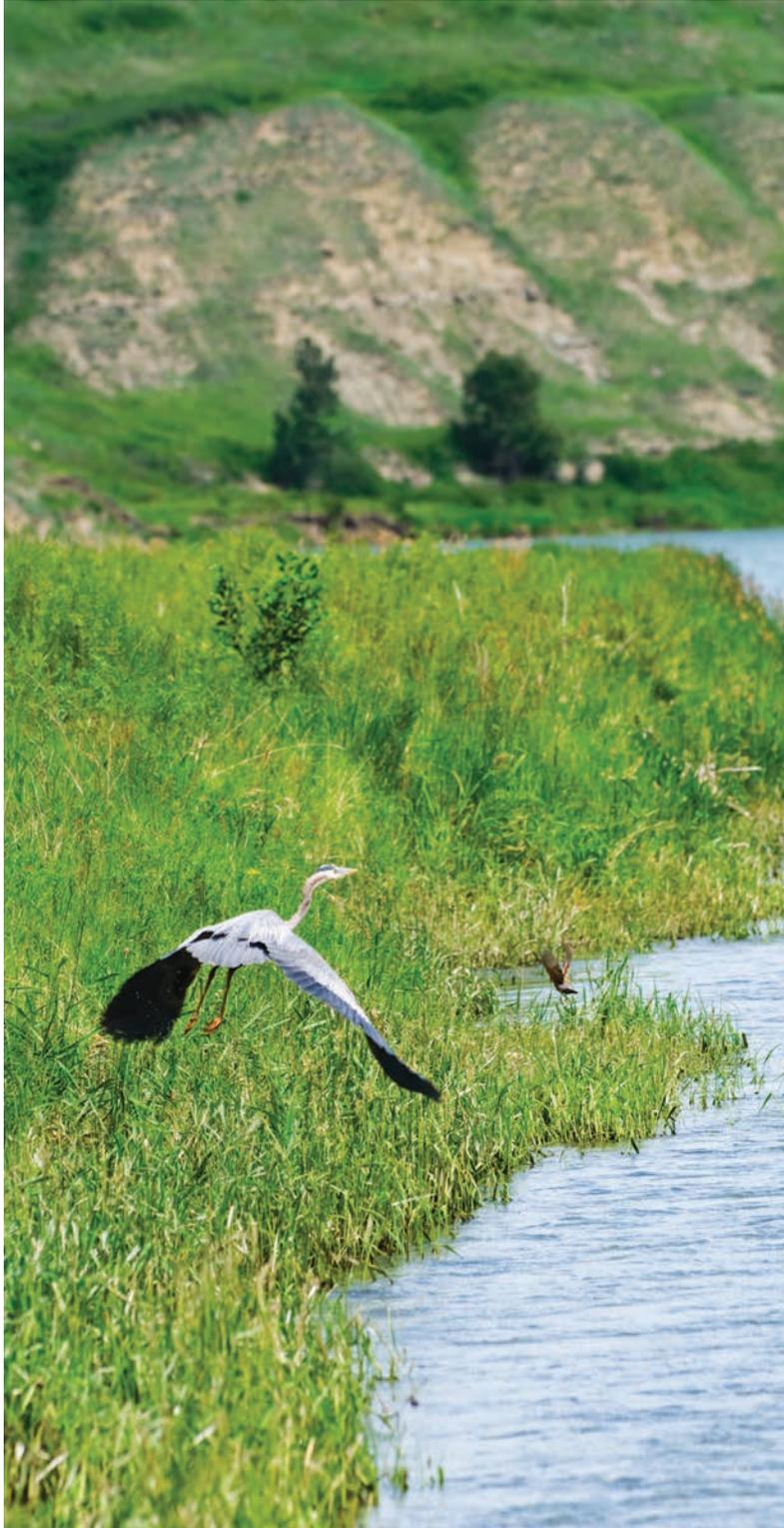
A Market-based System That Works

There is already a market-based system in existence in Alberta for wetland-associated ecosystem services. While there's always room for improvement, it's working, illustrating the success we can achieve with market components such as assessment, policy instruments and an exchange that brings buyers and sellers together.

"Thanks to the *Alberta Wetland Policy*, we already have a pretty well-established and functional system to offset unavoidable loss of wetland-associated ecosystem services. Where avoidance and minimization can't be achieved, restorative replacement is triggered. Through the wetland mitigation process, the restoration of lost wetlands elsewhere is being funded, thus replacing lost ecosystem services. Because the new *Alberta Wetland Policy* is function- and value-based rather than just area-based, it is fair to say that it is an ecosystem services policy," says Tracy Scott, head of Industry and Government Relations – Alberta, Ducks Unlimited Canada (DUC).

The new policy allows for the use of a rapid assessment tool to assess the value of a broad range of wetland functions both on the impacted wetland and the restored wetland. Where compensation is required, DUC uses the funds paid for mitigation to identify drained wetland restoration opportunities, compensate landowners who wish to restore their wetlands, and restore those wetlands to replace the lost ecosystem services.

DUC has also undertaken a major initiative through the Watershed Restoration and Resiliency Program (WRRP) to conduct wetland restoration focusing on the ecosystem services of flood and drought mitigation. After the 2013 flood, Scott offered to help the Province understand how to apply natural watershed-based methods in dealing with future flooding events.



DUC provided a paper to the Province outlining the science and cost-effectiveness of wetland conservation and restoration in flood and drought mitigation. As a result, the Province invited organizations to submit proposals for non-engineered solutions, and DUC was a successful applicant. It is now providing funding through WRRP to landowners who wish to restore previously lost wetlands—and the ecosystem services they provide—on their land.

Scott supports the idea of ecosystem services and biodiversity markets, as they provide a way for landowners to benefit from the provision of ecosystem services. DUC is also talking to the Province about the role of wetlands in carbon sequestration and the fact that wetland conservation and restoration are critical components of Alberta's Climate Leadership Plan.

"The neat thing about wetlands is you can make a strong case for any one of the ecosystem services they provide; but when you look at the full suite of co-benefits, it's a pretty benefit-rich package," says Scott.

Quantifying Carbon Storage

Alberta's grasslands provide a wide range of ecosystem services, including carbon storage. Applied research such as the Carbon Market Benchmarking of Alberta Grassland project quantifies the size and distribution of the carbon pool within diverse native grasslands across the province. The project is integrating data and testing assessment models to improve our understanding of the role these agro-ecosystems play in reducing greenhouse gases to lay a foundation for developing innovative policies rewarding livestock producers for this service.

In addition to assessing vegetation and soil carbon, the study is comparing carbon stocks among alternative land uses and evaluating how long-term exposure to livestock grazing may alter carbon stocks.

While the positive relationship between plant growth and ecosystem carbon accumulation is generally well understood, how carbon stocks in northern temperate grasslands are specifically impacted by soil properties, plant community type, climatic conditions, land-use conversion and ongoing grazing remains less apparent. The study is evaluating this relationship at over 100 sites representing at least 6 different agro-climatic regions, and should improve our estimates of the total amount of carbon stored in grassland. The results can be used with information from other studies to model how contrasting land-use scenarios and management actions affect soil carbon storage.



The creation of clear market mechanisms to allow producers to receive a payment for storing and even increasing grassland carbon, potentially coupled with other environmental goods and services like pollination, wildlife habitat retention and biodiversity conservation, could drastically change how we look at and ultimately manage these land bases.

Edward Bork, professor and Mattheis Chair in Rangeland Ecology and Management in the Department of Agricultural, Food and Nutritional Science at the University of Alberta



"There has been a large reduction in the size of the carbon pool associated with conversion of native grassland into annual cropland and introduced pasture. Our numbers from the study sites across Alberta suggest this decline is around 40 per cent. It's a sizable amount of carbon that has been lost from these agro-ecosystems by converting them to another land use," says Edward Bork, professor and Mattheis Chair in Rangeland Ecology and Management, Department of Agricultural, Food and Nutritional Science, University of Alberta.

Using current market estimates of the value of carbon, these past losses of carbon from native grasslands can be valued at several billion dollars. Continued future land conversion away from native grassland carries a risk of releasing additional amounts of carbon valued in the billions.



Simplifying Assessment

The Algar Ecosystem Services Approach Proof of Concept project is taking an ecosystem services assessment (ESA) framework that's based on science and simplifying it for use on the ground to help industry make decisions when doing restoration or development work. The project is developing a seven-step process for working with stakeholders and prioritizing the ecosystem services that need to be created or enhanced in an area.

"We are making assessments as simple and efficient as possible so industry can pick up the process and do it themselves if they choose," says Toni Anderson, resource analyst, Silvacom. "We are building off of academic processes and bridging the gap so that private industry can do assessments easily and efficiently and hopefully encourage more linear restoration work or even just help industry look at the full basket of goods when they're doing a development project."

The process includes reaching out to the stakeholders in the area that may be affected by a land management alternative, such as community members, industry, government, watershed groups and NGOs, and asking what they care about. That information is then linked back to the ecosystem services that have been identified through an ESA, and then the user is able to prioritize based on a selection criteria template.

"This is not about pitting values against other values. It's considering all values in identifying the optimum solution, because if you're going to access some values in a landscape, that will impact other values," explains John Peters, director, Energy and Environment, Silvacom. "By quantifying and looking at the flow of those values over time, we can identify minimums for positive values and maximums for negative values to ensure we have meaningful levels of values through time to capture the uses that are out there."





Crossing Disciplines to Help Make Trade-off Decisions on Water

The majority of the water Albertans use comes from our forested landscapes. How we manage that land is critically important to the provincial water supply, and we need to know the pressures on those regions as well as the impact of various landscape disturbances, which can deteriorate water quality. A very large interdisciplinary project led by Uldis Silins, professor, Renewable Resources, University of Alberta, is collecting data on the impacts of wildfires and forest harvesting practices on water quality to help ensure good water quality in the future.

“We know that landscape disturbances can be catastrophic for drinking water supply and treatment—we have seen this in many parts of the world. However, we have also recently learned that Alberta’s unique geology and landscape must be managed with care because of potential long-term legacy effects on water quality, which can last for decades,” says Monica Emelko, professor, Civil and Environmental Engineering at the University of Waterloo.

The project illustrates the need to bring together data from multiple disciplines when making trade-off decisions. “This is a big integrated project tackling the broader issue of integrated source water management from source to tap,” says Silins. “You need to have a transdisciplinary look at these problems. You can’t do so within any particular small area of science, or engineering or resource economics. It needs to be across all of those disciplines.”

Researchers are documenting how water quality changes from headwaters to larger basin scales and the broader regional impact to watersheds, and what that means to drinking water treatment. At the same time, resource economists are putting those changes into economic terms.

While the project will contribute to knowledge in a variety of ways, one of the most interesting is how landscape management might be integrated into drinking water safety plans and potentially reduce the amount of spending on water treatment facilities.

“Colorado is an interesting example. They had a set of major fires that generated impacts on water quality, affecting the reservoirs, and they incurred significant costs in water treatment. They’ve worked with the U.S. Forest Service and environmental NGOs such as the U.S. Nature Conservancy to re-vegetate some regions and spend money on forest management to try to reduce the risks of having those high-cost impacts on water facilities,” explains Vic Adamowicz, professor, Resource Economics and Environmental Sociology, University of Alberta. “In a sense, they are investing in green infrastructure rather than gray infrastructure because it’s a more cost-effective way to address those risks.”



The Land Stewardship Centre

The Land Stewardship Centre implements programs that promote land stewardship for landowners and land managers. It does a significant amount of stakeholder engagement, reaching out to individuals and organizations to provide education and extension through grant opportunities, seminars, communication materials, online searchable databases and more, all with the goal of advancing conservation and stewardship.

Learn more at landstewardship.org.

Making It All Make Sense

“When it comes to implementing ecosystem services and biodiversity markets in Alberta, we don’t have all the answers, but we’re working to identify priorities and to build accordingly. It’s critical that everyone work together to build understanding and knowledge with stakeholders, including land managers and government. The Ecosystem Services and Biodiversity Network welcomes questions, interest and funding from new stakeholders,” says Carol Bettac, executive director, Alberta Innovates.

“There’s a lot of scientific information on the different ecosystem services, including concepts of how the markets could work and what market-based instruments we might use. The information and concepts for ecosystem services and biodiversity markets are new to most people,” says Carrie Selin, ESA project manager, Alberta Biodiversity Monitoring Institute. “The importance of outreach is to take all that information and explain it in a way that will make sense to others.”

The goal is to create a community of shared understanding around ecosystem services and biodiversity and market-based instruments. Through engagement initiatives, the Ecosystem Services and Biodiversity Network is striving to help landowners understand the demand for ecosystem services and who will pay, the cost and potential supply of ecosystem services, and the use of various tools for participation in ecosystem services and biodiversity markets. Industry can use this information to develop management systems, practices and opportunities to participate.

Brian Ilnicki is executive director of the Land Stewardship Centre. He says further research into developing ecosystem services and biodiversity markets provides the opportunity to help quantify these services and to explore options to create incentives, whether financial or otherwise. However, generating more awareness is necessary.

“There’s an opportunity to develop a suite of programs, including extension-based programs, that assist landowners to become more aware of what they currently have and how they can manage those assets in a manner that aligns with the policies developed at a higher level,” says Ilnicki. “Part of this education program could be to connect buyers and sellers. Sellers need to understand the assets they have; buyers need to understand their opportunities for purchasing or acquiring the assets, and how those acquisitions can help them either implement projects, mitigate for existing projects or align with provincial or federal policy initiatives.”



Get in the Game

Eco-Earner is a fun way for stakeholders from all walks of life to learn about ecosystem services and how participating in markets might benefit them. For example, an agricultural producer or forester can learn about various land management practices that can enhance or create an ecosystem service and the role a verifier would play in a market, verifying the ecosystem services that have been enhanced.

The adult learning tool is designed for anyone interested in ecosystem services and biodiversity markets, especially foresters, ranchers, land trusts, government, the oil and gas industry and farmers. Its key messages are that ecosystem services have value and that the things you do on the land to create or enhance them also have value. It also illustrates the difference between a management action and an ecosystem service because not all management actions lead to the creation of an ecosystem service.

“A game is a fun, interactive way for people to learn. It breaks down difficult concepts so they are easy to understand. Today, people use digital technology more and more in everyday life, and we’re engaging them that way,” says Carrie Selin, ESA project manager, Alberta Biodiversity Monitoring Institute.

Play the game at eco-earner.com.

Spreading the Word

Stakeholder engagement is a necessary component of implementing ecosystem services and biodiversity markets because they require a multidisciplinary, integrated network of experts, shared participation and collaboration. The Ecosystem Services and Biodiversity Network is reaching out to anyone interested in ecosystem services and the markets that could advance them.



What's Involved?

There's more to engagement than just bringing key players together. It also involves increasing the number of people interested in ecosystem services and increasing the amount of collaboration. Key objectives are to share information and stimulate new ideas, science and innovation that will build capacity for ecosystem services and biodiversity markets.

Engagement is beneficial for stakeholders because they can ensure their needs and interests are considered as markets are developed. They are also able to incorporate innovative ideas and market-based tools into their decision-making processes. These tools can be used to develop new business approaches within communities.

“

The intent is to help create a system for multiple stakeholders to share information, align goals and invest together. The ultimate objective is to position Alberta as a leader in the understanding of ecosystem services and the use of markets and market-based instruments

**Carol Bettac, executive director,
Alberta Innovates**

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“The benefit for the working group is that we are able to put more effective strategy in place and deliver a program that's aligned with stakeholder and community needs,” says Elisa Valade, Stakeholder Engagement and Outreach, Ecosystem Services and Biodiversity Network. “It gives us greater capacity to innovate, and it builds stakeholder confidence in the projects we're taking on.”

To build knowledge and advance innovation, members from industry, government and academia alike are looking for:

- Open data and science regarding ecosystem services initiatives
- Greater collaboration among industry, academia and government
- A common understanding of ecosystem services and biodiversity concepts
- A central location to share this information and build open, transparent communication with the community

To provide these, the working group launched ecoservicesnetwork.ca, a website dedicated to sharing the knowledge and science of ecosystem services and biodiversity. The Ecosystem Services and Biodiversity Toolkit, an interactive component of the website, allows for easy information sharing and collaboration across sectors. It brings ecosystem services and biodiversity research together in the form of key definitions, concepts, initiatives, programs and projects. Anyone can create a profile and contribute expertise and information.

“The website toolkit is intended to function as a virtual network, a place where experts in ecosystem services can access information, post their findings or project results and share a broad range of information related to ecosystem services,” says Valade. “Its success depends on the engagement of stakeholders; the more people who interact with the website, the better the chance they will find something useful.”



Through ecoservicesnetwork.ca, Twitter, LinkedIn and Facebook, people can find out what's happening in terms of research, science and events. The network is also planning to communicate through information bulletins and face-to-face information sessions.

A key advantage of the network is that it allows those involved to ensure that everyone is on the same page, providing a shared understanding around ecosystem services, ecosystem services and biodiversity markets, and what they could look like in Alberta. Two-way communication and information sharing helps the working group understand what the stakeholders need and how parties can work together. It creates opportunities for collaboration, enhanced efficiency and advancing results.

To get involved, visit ecoservicesnetwork.ca.



Appendix A

The following organizations are involved with innovative projects related to ecosystem services through the Ecosystem Services and Biodiversity Network:

Agri-Environmental Partnership of Alberta
Alberta Association on Conservation Offsets
Alberta Biodiversity Monitoring Institute
Alberta Innovates
Alberta Land Institute
Alberta Livestock and Meat Agency
Alberta-Pacific Forest Industries Ltd.
AltaLIS
Canadian Cattlemen’s Association
Canadian Oil Sands Innovation Alliance
Climate Change and Emissions Management Corporation (CCEMC)

Crop Logistics Working Group
fRI Research
Government of Alberta
Intensive Livestock Working Group
National Sciences and Engineering Research Council
Silvacom
Social Sciences and Humanities Research Council
Spray Lake Sawmills
University of Alberta
Waterton Biosphere Reserve Association



Appendix B

The *Ecosystem Services Roadmap* has guided the development of a series of research-based projects, pilots and proofs of concept. This work is helping build knowledge and capacity around the provision of ecosystem services through the use of market-based approaches.

 = initiatives that are complete

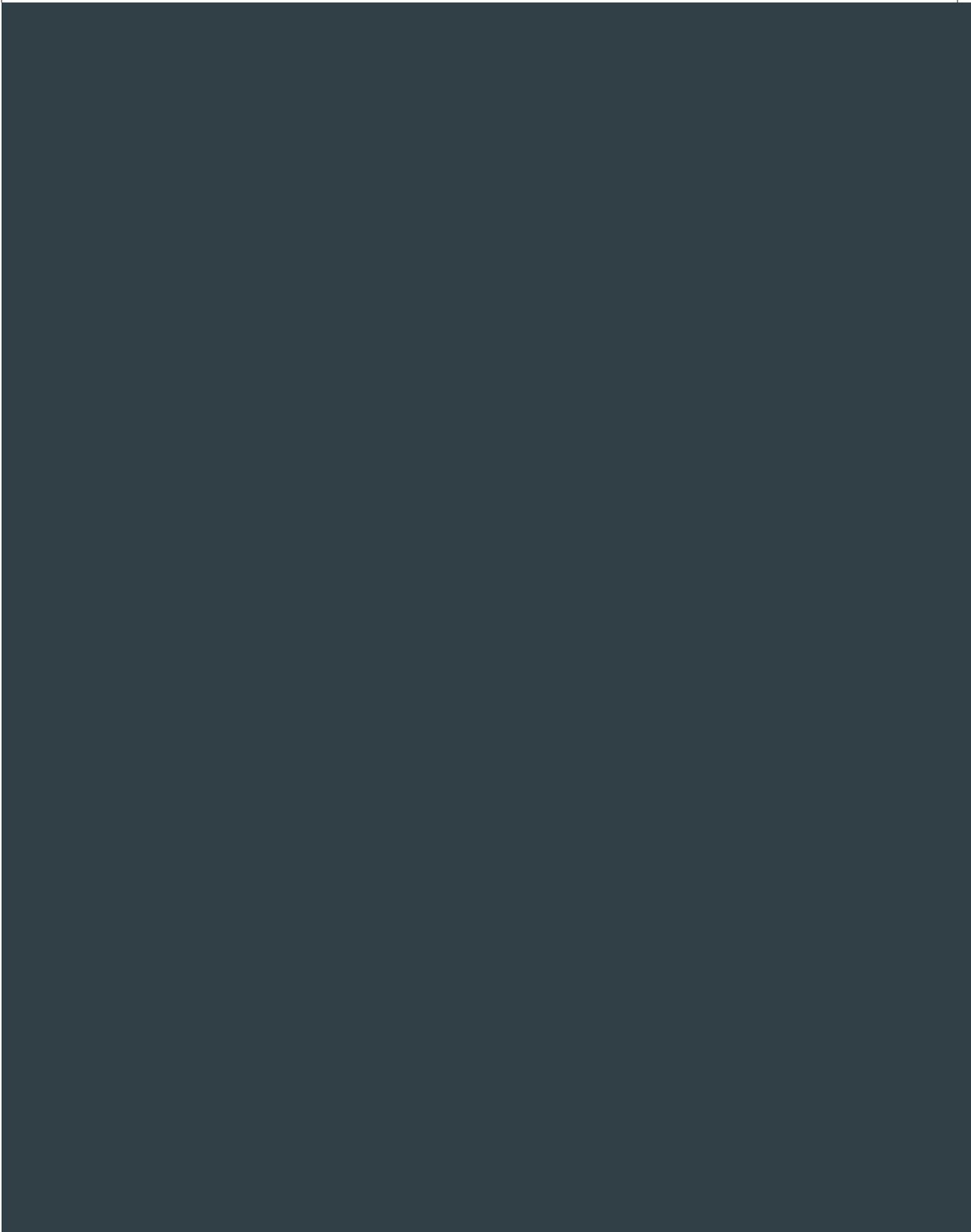
 = initiatives in progress

ACHIEVEMENT	SUMMARY
Ecosystem Services Assessment Project	Mapping and measuring the supply of ecosystem services and valuing them is essential to learning how to manage and make decisions regarding Alberta’s landscape.
 Phase 1	<i>Phase 1 measured and mapped Alberta’s ecosystem services, determined the supply of each service, evaluated the economic value based on how it’s used by Albertans and contributed to understanding the impact of various policies.</i>
 Phase 2	<i>Phase 2 is demonstrating the value of ESA for the design and implementation of new markets, evaluating the sustainability of forestry and agriculture industries, and using land-use planning to achieve desired ecological outcomes for people.</i>
Algar Ecosystem Services Assessment Proof of Concept	Assessing the potential for conservation offsets to be a driver in land reclamation and restoration, the proof of concept is devising frameworks for assessing ecosystem services and biodiversity benefits from linear restoration of legacy seismic lines.
 Phase 1	<i>Phase 1 created a proof of concept framework to use data and analytical tools to assess the ecosystem service and biodiversity benefits of projects similar to the LEAP Algar Caribou Habitat Restoration project.</i>
 Phase 2	<i>Phase 2 is developing a repeatable, transferable and implementable approach to evaluating the net benefit of restoration activities in the Boreal region and assess the potential for conservation offsets from LEAP and similar processes.</i>

ACHIEVEMENT	SUMMARY
Bio Resource Information Management System (BRIMS)	Development of a world-class Bio Resource Information Management System to guide policy, business and local decision making related to the bioeconomy.
 Phase 1	<i>Phase 1 focused on collating data to support a biomass inventory for the province.</i>
 Phase 2	<i>Phase 2 focused on providing a world-class web-based application to support spatial data scanning and provide improved biomass data, as well as a business plan and implementation strategy for the long-term viability of BRIMS.</i>
 Phase 3	<i>Phase 3 is focused on completing the BRIMS data framework, including additional biomass constituents and a prospectus generator, providing a world-class functional system.</i>
 Innovation and Science to Support the Provision of Ecosystem Services from Agricultural Land	Developing science and decision-support tools for the creation of ecosystem services programs and markets. Focusing on quantifying the costs and benefits of best management practices and the risk of participating in ecosystem services markets and identifying a tradable unit of exchange.
 Alberta Biodiversity Chairs	Established two biodiversity conservation chairs to provide dedicated science capacity to link monitoring outcomes with policy outcomes and strategic planning.
 Bears, Wolves and Ecosystem Health	Ecosystem-scale monitoring of population trends in grizzly bears and wolves in southwestern Alberta. There are two distinct initiatives: the Southwest Alberta Grizzly Bear Monitoring Project and the Wolf Population Monitoring Framework in Southwest Alberta.
 Bioindustrial Options and Environmental Services	This project assisted Alberta Innovates in understanding bioindustrial opportunities and environmental services, broadening the earlier jurisdictional advantage assessment to include all of agriculture, and developing public communication tools.
 Building Capacity for Using Innovative Economic Approaches to Manage for Ecosystem Services in Alberta	Developed the Centre for Market-Based Instruments (CMBI), a collaborative network that bridges theory and practice in applying market-based approaches to conservation and stewardship in the areas of water, land use, energy, forests and agriculture.

ACHIEVEMENT	SUMMARY
<p>Creating and Commercializing Predictive Ecosite Classification Platform for Alberta</p>	<p>Enabling ecosite classification information to be created in Alberta, through a predictive, consistent ecosite classification platform.</p>
<p> Phase 1</p>	<p><i>Phase 1 is focusing on initial design, piloting and testing.</i></p>
<p> Developing Priorities for Ecosystem Services Marketplace Infrastructure in Alberta</p>	<p>A series of workshops held to engage ecosystem service stakeholders in discussions regarding the opportunities for developing ecosystem services and biodiversity market infrastructure and commercialization.</p>
<p>Diffusion of Innovation – Engagement and Outreach</p>	<p>Facilitating a system for information sharing, alignment and co-investment among a multi-stakeholder network of experts.</p>
<p> Phase 1</p>	<p><i>Phase 1 formalized the network and associated working group, and built communication tools and platforms.</i></p>
<p> Phase 2</p>	<p><i>Phase 2 is focusing on further stakeholder analysis, managing the network and executing engagement and outreach activities.</i></p>
<p> Evaluating Mechanisms for Wetland Restoration and Retention in Alberta</p>	<p>Exploring an innovative, market-based approach to wetland restoration through a living laboratory, allowing for unprecedented restoration efforts in Alberta.</p> <p>Using reverse auctions, in which landowners submit bids for wetland restoration work on their property.</p>
<p> Jurisdictional Advantage Assessment Communication Tool</p>	<p>Highlighting the province’s strengths, which Alberta can leverage to reduce risk, increase success and build upon for a sustainable economic advantage.</p>
<p> Market-Based Instruments Program Repository and Offsets White Paper</p>	<p>Creating a common information repository to understand the extent and design of market-based instrument practices in Canada.</p> <p>White paper: Conducting a scan of how pre-compliance offsets are handled in other jurisdictions and applying lessons learned to the Alberta context.</p>

ACHIEVEMENT	SUMMARY
 Towards Integrated Source Water Management in Alberta	Addressing knowledge gaps related to the impacts of forest management through harvesting on water, and comparing these impacts to those associated with wildfires.
 Using Decomposition Rates and Microbial Activity to Understand Grazing Impacts on Nutrient Cycling and Carbon Sequestration on Alberta Rangelands	Quantifying the influence of regulatory mechanisms capable of altering decomposition and nutrient cycling by soil microbes. Providing a basic understanding of how grazing can alter grassland carbon stores and, in turn, providing insight into how managers can optimize carbon storage.
 Voluntary Market Pilots and Prototype for Exchange	Building information necessary for establishing an offset market, especially the tools to support a conservation clearinghouse and exchange system.



Ecosystem Services and Biodiversity Network

*Building knowledge and capacity in ecosystem services
and biodiversity markets across Alberta.*

We are a multidisciplinary group of experts working collectively to develop the knowledge and capacity required to implement ecosystem services and biodiversity markets in Alberta. Through the network, coordinated efforts are creating a system for information sharing and collaboration across sector boundaries. By working together, we have the potential to build capacity and drive greater innovation in science, data and information management, socioeconomics and policy to support the creation of an ecosystem services and biodiversity market system, bringing Alberta to the forefront of economic diversification, environmental excellence and sustainable development.

Visit the Ecosystem Services and Biodiversity Network website to learn more.

ecoservicesnetwork.ca

Contact us by email at admin@ecoservicesnetwork.ca.

WORKING GROUP PARTNER ORGANIZATIONS

