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A PERSPECTIVE ON AGRICULTURE: HOW WE FEED OURSELVES

HIGHLIGHTS

- Agriculture is a complex and vitally important economic sector. It is an area of constant experimentation and evolution. Using technology is at its core along with massive productivity improvements. Today's technology looks different from the past. But without continued advances in technology and agricultural knowledge, it will not be possible to adequately feed 7.5 billion people on earth, let alone the additional 2 billion people expected to join them by 2050.
- B.C. has a sizable and vibrant agri-tech sector, with at least 150 companies of all sizes. Collectively, these companies add to the more traditional agricultural base in the province and represent a significant augmentation of B.C.'s traditional agricultural competitive advantages. They will also support the expansion of the current suite of over 300 agricultural commodities produced in B.C.
- Taking the next steps to support and encourage the sector's growth means coming to terms with romanticised views that agriculture is mostly small artisanal farms. While they greatly enhance the richness and diversity of B.C.'s food products, these small ventures cannot meet our food requirements or enable the province to remain a significant exporter of agri-food products.
- The introduction of more technology in agriculture production means B.C. will also need to revisit Agricultural Land Reserve policies. Since agri-tech is part of agriculture, it can and should be enabled within the ALR.
- Given existing land use pressures and the growing need for food, having ALR land shift to green belts rather than to food production would be unfortunate. Over time this would lead to greater reliance on food imports, reduced economic activity, and a foregone opportunity to enhance food security and build a component of B.C.'s wider clean technology economy.

***The farmers who succeed
are the ones who are going to
incorporate new technologies.***

Stan Blade¹

INTRODUCTION

Agriculture is changing. But what exactly is meant by the term? After all, the production and consumption of food is a basic building block of life and human society. Yet we have an idealized view of agriculture — a small farm located on an imaginary piece of land with a family sitting

on the porch after a hard day's work tending to their crops and animals. This heuristic is outdated. It may have been true in pre-1900's North America, but it provides little insight into how the world feeds itself in the 21st century.²

The dictionary definition of farming is the activity of growing crops or keeping animals on a farm. The term is often used interchangeably with words such as agriculture, cultivation, husbandry, and land management. Modern agriculture is more scientific, efficient, and productive, with longer

growing seasons, often indoors, and with better animal welfare. The industry supplies an increasingly diverse collection of products ranging from basic foodstuffs to organic fruits and vegetables, seafood, meats, and much else besides. Today, harvesting crops is sometimes carried out by people who do not live year-round on a farm but — in the case of Canada and B.C. — are temporary foreign workers or hired via employment agencies. Robots, drones, and automated systems are used to

¹ Dean of the Faculty of Agricultural, Life and Environmental Sciences at the University of Alberta.

² Ricciardi, Vincent. Ramankutty, Nevin. Mehrabi, Zia. Jarvis, Larissa. Chookolingo, Brenton, [How much of the world's food do smallholders produce?](#) Science Direct, 2018.

Arable Land

Arable land includes land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned because of shifting cultivation is excluded.

Source: Food and Agriculture Organization.

monitor crops and animals, feed livestock and water fields or things grown in greenhouses. Some farms are parts of vertically integrated businesses — vineyards attached to wineries or feedlots attached to slaughterhouses. And some farms also derive income from activities that are not necessarily farming, such as agritourism or energy production.

The United Nations Food and Agriculture Organization includes activities related to crops, animal husbandry, managed fisheries/aquaculture, and forestry in its (expansive) definition of agriculture. No matter what definition is used, agri-food counts as one the world's largest economic sectors.

The practice of agriculture is both an art and a science involving growing, harvesting, and transforming plants and animals into consumable products sold in a complex and ever-growing global marketplace. Humans have been perfecting the process since -11,000 BC, with animal domestication beginning around 6,000 BC. The picture is of a long journey of evolution and innovation that will continue as we find new ways of feeding a hungry, growing, and a more affluent global population.

SPATIAL CONSIDERATIONS

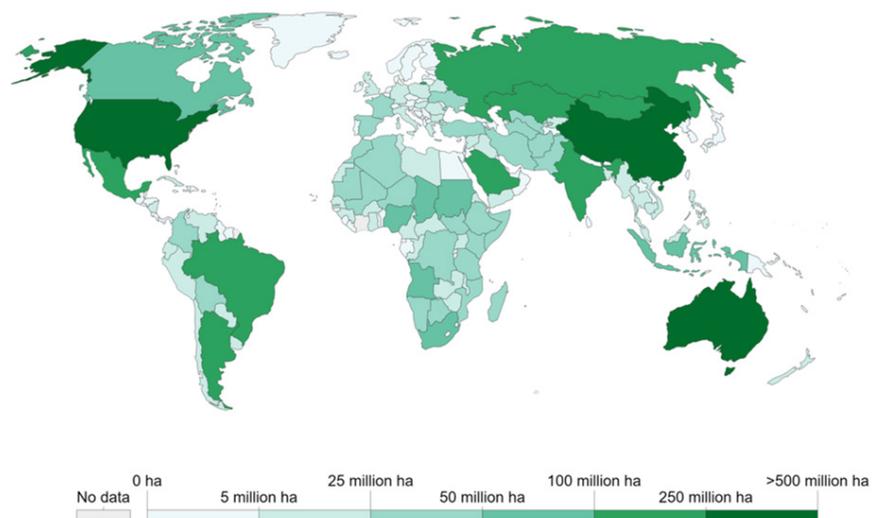
What we often either do not know or forget is that feeding the world takes place on only a modest slice of earth's surface. Land occupies only ~26% of the total area of the globe; the rest is water, mostly salty. Of earth's land, about two-fifths can be used for agriculture with about one-third of that being arable. The remaining two-thirds are used for other purposes.³

For some spatial perspective, Table 1 shows total land area and the proportions of agricultural and arable land for Canada and British Columbia relative to the rest of the world. Despite being the second biggest country in the world, Canada has a small amount of agricultural land and an even smaller quantum of arable land. Saskatchewan and Alberta have the most agricultural land in the country. Proportionately, B.C.'s agricultural land base is small and its arable land base tiny. The term agricultural land is a much broader

designation that can include many more types of activities. Arable land is an important concept because this is land that's suitable for cultivating plants grown as food crops for humans and animals.

British Columbia is a large area geographically. About 5% of the province's land base is used for agricultural purposes or ~47,000 km² and is mostly located within a unique category of land called the Agricultural Land Reserve (ALR).⁴ This land is "protected" under the *Agriculture Land Commission Act*. The area in question is slightly less than the 6% of land in B.C. that is classified as private. Of land in B.C. deemed suitable for agricultural use, about half is private and half is Crown. This means about one third of all private land in the province is set aside for a single industry — food production. The ALR is primarily, although not exclusively, used to produce food for human and animal consumption. Activities that can

FIGURE 1: AGRICULTURAL LAND USE, 2018 (1 HA = 0.01 KM²)



Source: Food and Agriculture Organization of the United Nations, OurWorldInData.org/land-use.

³ UNFAO and <https://ourworldindata.org/agricultural-land-by-global-diets>.

⁴ <https://www.alc.gov.bc.ca/alc/content/alr-maps/maps-and-gis>.

take place on the ALR are varied — from crops (e.g., grains, vegetables, berries, fruit tree, nuts, etc.) and raising livestock and poultry to greenhouses, ornamental plants, and agroforestry.⁵ Regulations also permit activities like wineries, timber production, harvesting and silviculture, and equestrian facilities.⁶

On an area of land slightly larger than the Netherlands (see the section on the Future of Agriculture below), B.C.’s varied topography and climates have created opportunities to produce over 200 agricultural products — grains and seeds, fruit and wine, animals for meat — and at least 100 different seafood species throughout the province.

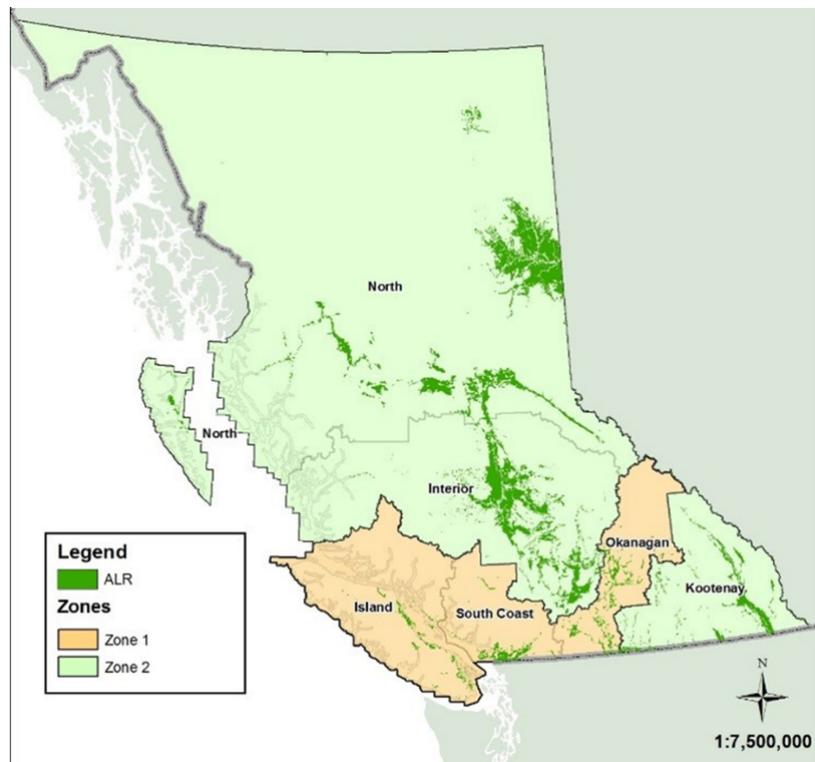
- The prairies of B.C.’s Peace region are ideal for growing grains and seeds.
- The range land of the Southern, Central Interior and Kootenay areas is suitable for cattle and other livestock operations.
- The Southern Interior (i.e., Okanagan) is well known for a rich mix of fruits, grapes, and wine.
- Coastal communities produce a plethora of marine products such as oysters, clams, prawns, kelp, and salmon.
- The Fraser Valley and Vancouver Island have some of B.C.’s most productive farmland, producing diverse vegetables, berries, ornamental plants and artisanal farms. These two areas are also home to 60% of B.C.’s population.
- Throughout the province, Indigenous people manage and harvest a range of Indigenous traditional foods.

TABLE 1: ARABLE LAND COMPARISONS - GLOBAL, CANADA AND B.C.

	km ²	% of total global	% of global arable	km ² /person arable 2020
Total surface of earth (land and sea)	510,000,000			
Total global land area	130,030,000	25.5%		
Agricultural land	48,890,000	37.6%		
Arable	14,953,450	11.5%		0.017
Canada (<i>% of Canada</i>)	9,984,670	7.7%		
Agricultural land	647,497	(6.5%)	1.3%	
Arable	430,839	(4.3%)	2.9%	0.011
British Columbia (<i>% of B.C.</i>)	944,735	0.7%		
Agricultural land	47,237	(0.1%)	0.1%	
Arable	28,342	(0.2%)	0.2%	0.006

Source: FAO, Government of Canada, Province of B.C., World in Data.

FIGURE 2: AGRICULTURAL LAND RESERVE



Source: Agricultural Land Commission.

⁵ Agroforestry is a land management approach that purposefully integrates the growing of trees with crops or livestock. <https://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/agricultural-land-and-environment/agroforestry>.

⁶ https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/30_2019.

CONTRIBUTIONS TO THE ECONOMY

Globally, agriculture accounts for 4% of world domestic product (GDP). In some developing countries the share can be five times higher.

In Canada, the agriculture sector represents ~3.3%⁷ of all economic activity. In fact, agri-food processing is the second largest manufacturing industry in Canada.⁸ In B.C., using the broad definition of agriculture noted above and including food processing/manufacturing, the sector amounts to about 2.5% of total provincial GDP. In 2020, agriculture contributed \$3.1 billion towards provincial GDP. Including food and beverage manufacturing increases this to ~\$6.1 billion⁹ and accounts for about 65,000 jobs or ~3% of total employment in B.C.

B.C. is self sufficient in milk and eggs and chicken, all with year-round production. And despite importing ~50% of our food (for example, \$1.2 billion each year from California in leafy greens and small fruit), British Columbia has sizable and growing agricultural exports. In 2019, the value of these exports reached \$3.2 billion, with most of this destined for the United States.¹⁰ Seafood and fish product exports added another \$1.4 billion to the value of B.C.'s food exports. Further development of indoor, technology assisted agriculture could increase both B.C.'s food self reliance and the value of agricultural exports.

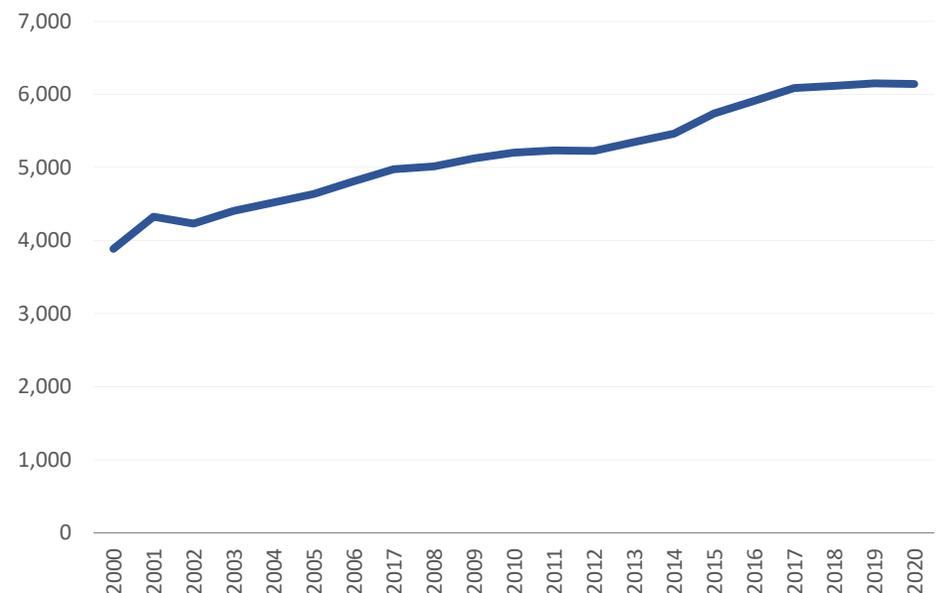
The overall trend for B.C. agri-food exports is upwards,¹¹ almost doubling in value since 2010. This

FIGURE 3: CANADA GDP FROM AGRICULTURE (MILLIONS)



Source: TradingEconomics.com; Statistics Canada.

FIGURE 4: B.C. GDP FROM AGRICULTURE AND AGRI-FOOD (MILLIONS)



Source: Statistics Canada.

⁷ Statistics Canada, Table: 36-10-0434-01, Gross domestic product (GDP) at basic prices, by industry, monthly (x 1,000,000).

⁸ Business Development Bank of Canada. Food and Beverage Industry Outlook. February 2021.

⁹ Statistics Canada Table: 36-10-0402-01.

¹⁰ Study of the British Columbia Agriculture Sector Prepared for the B.C. Agriculture Council and the Investment Agriculture Foundation, September 2020, MNP.

¹¹ British Columbia Agriculture, Seafood, Food and Beverage International Exports Highlights year in review 2019. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/statistics/market-analysis-and-trade-statistics/2019_bc_agrifood_and_seafood_export_highlights.pdf.

bodes well for the future. B.C.'s west coast location, remarkable array of agriculture products, creative people, and excellent port infrastructure are significant strategic assets. Existing trading relationships with several Asian countries including China, South Korea, Japan, and Taiwan provide a pathway for growth of the sector. Asia and Africa will account for almost 90% of future world population growth. Meeting a more populous world's increased demand for agri-food products, including proteins, will put immense pressure on the global food production system.

Cash receipts are often used when measuring agriculture activity. It is money received by a company or individual farmer for goods shipped and is representative of the level of activity. From an accounting perspective, B.C.'s fruit production generates the largest share of farm

Greenhouses:

Greenhouses are an important source of vegetables and some fruit. Most B.C. greenhouses are in the ALR in the Lower Mainland. There are also a small number of greenhouses on Vancouver Island and in the Interior.

There are about 328 hectares of greenhouse production. The .B.C. greenhouse vegetable industry had a farmgate sales value of \$300M in 2020 and exports approximately 70% of its production.

Greenhouse growing is a sustainable way of helping to feed the world on less land with higher yields while minimizing environmental impacts. Greenhouse growers are interested in adopting new technologies that are fully researched and ready for commercialization.

Source: B.C. Greenhouse Growers Association.

cash receipts in Canada. Greenhouse vegetables, mushrooms, floriculture, nursery crops and legal cannabis combined rank second, followed by supply managed products like dairy, chicken, turkey, and eggs.¹² In aggregate, B.C. is third in Canada in the value of manufacturing shipments of food and beverages. Year over year these receipts continue to increase. The cash receipt amounts do not capture non-market transactions and therefore miss some agricultural activity, which includes self-production and food that is shared or gifted.¹³ While these types of non-market agriculture exchanges do exist in B.C. they are dwarfed by market-based or industrial agriculture activities.

The agri-food sector, according to a recent study, could be one of the province's biggest industries by 2030.¹⁴ But getting there will require a determined focus on and investment in innovation to raise productivity — increasing output per unit of input — while also managing the associated environmental impacts and greenhouse gas emissions. In fact, agriculture can be a positive part of the net zero equation and part of this depends on innovation in the sector.

THE FUTURE OF AGRICULTURE

Two billion more people by 2050. Higher urban populations and multiple mega-cities on every continent. The thing they will all need is food. The question is how? The answer is increasing productivity and

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making greater use of technology — this is both a challenge and an opportunity for British Columbia. Importantly, “[g]lobal food security and agricultural land management represent two urgent and intimately related challenges that humans must face.”¹⁵ The opportunity may well come from a change in what and how we produce food — less land intensive, and with more focus on fruits, vegetables, and meat substitutes. Agri-tech will be key to this transition.¹⁶

Agriculture will still include what we do now — land-based activities — but increasingly it will be informed by emerging technologies or undertaken in different ways. This includes vertical farming in cities, making greater use of genetically modified plants (something humans have done since the very beginning of plant and animal domestication), and the development of dense, highly nutritious new foods like plant protein meat substitutes. Farmers of the future may also spend more time inside than outside, relying on sensor technology and robotics to create

¹² Agriculture and Food. Year in Review, 2018, Province of BC, Canadian Agricultural Partnership, Canada.

¹³ Bliss, Sam. The Case for Studying Non-Market Food Systems. MDPI. May 2019. <http://www.mdpi.com/journal/sustainability>.

¹⁴ Farmer 4.0, RBC, 2019.

¹⁵ Rizvi, Sarah, Pagnutti, Chris, Fraser, Evan, Bauch, Chris T. Anand, Madhur. Global land use implications of dietary trends. 2018 PLOS ONE. <https://doi.org/10.1371/journal.pone.0200781>.

¹⁶ *ibid.*

the ideal growing conditions and minimize waste, and deploying new approaches for pest management.¹⁷

Turning to the segment of the larger agri-food sector referred to as agri-tech, B.C.'s Food Security Task Force articulated the opportunity for the province. Quite simply, this emerging industry needs recognition as a sector, space to expand — this requires rethinking the ALR — a simplified regulatory process suitable for an emerging industry, and funding to enable growth.

Focusing on land, ALR regulations currently do not identify agri-tech as a permitted land use. This is odd since the agri-tech at its core is the application of technology in agriculture, horticulture, and aquaculture with the aim of improving yields, efficiency, and profitability for farm managers and growers. This already happens. The difference is today's agri-tech looks different from the past and, in some cases, perhaps more like a factory rather than an idealized view of a farming operation.

Another myth about agriculture in B.C. is that 100% of farmland is currently used at full productive capacity. In fact, much of the land set aside in the ALR is either unused or underused, even in the Lower Mainland. For example, in the Metro Vancouver region only 50% of the land in the ALR is used fully or for its intended purpose. In some municipalities like Maple Ridge only 25% is used for agricultural production; in more remote parts of B.C. utilization is even lower.¹⁸

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Advocates have requested an infinitesimal set aside of ALR land to support the growth of the nascent agri-tech industry. To be exact, 0.25% of land or about 11,700 hectares (or 117.5 km²) of the 4.7 million hectares currently in the ALR. Moreover, the request notes a preference for land with the least productive soil classification, meaning land in the ALR that is now unused or underused for farming. Alternatively, B.C. could loosen regulatory constraints on the types of uses for land with poor soil classification. These agri-tech activities need not stray from an agricultural purpose but must be forward looking. Some have suggested agri-tech businesses locate on industrial lands in the Lower Mainland. This is not a sensible option as industrial land in the region is insufficient and under great pressure. We cannot feed ourselves on romantic notions of agriculture. Agri-tech is agriculture, just in a different way.

The benefits of a change in perspective seem obvious. B.C. could spur the growth of an emerging economic sector based on innovation, meeting a clear government policy

objective. Such a path will also create spillovers from experimentation that will enhance existing agricultural operations via new tools adapted to help manage costs of production and maintain farmers' margins. If doing more with less is important, supporting experimentation and better ways to produce food is critical. Regardless of sector, improvements in productivity (i.e., output per unit of input) and gains from technology — working smarter not harder — is the only way to boost real GDP per person and enable B.C. to manage the dramatic jump in public sector debt caused by the pandemic.

Not capitalizing on the momentum of the "150 [B.C.] companies ... developing and producing world-class agri-tech solutions"¹⁹ would be a failure of innovation for B.C., including for a government notionally committed "to grow B.C.'s technology sector, champion innovation, nurture small businesses, support economic development throughout the province, and promote B.C. internationally as a preferred place to invest and do business." Former B.C. Innovation Commissioner Alan Winter put it concisely in his 2020 report: "To remain competitive and provide a high quality of life for the people who live here, we need to put a greater focus on innovation. Then, we need to do a better job of capturing the value of those innovations by growing B.C. companies, expanding our markets, and keeping our talent in B.C."²⁰ Investment in and a greater economic development focus on agriculture is an obvious choice.

¹⁷ The Future of B.C.'s Food System. Findings and recommendations. B.C. Food Security Task Force. 2020.

¹⁸ Personal communication, Dr Lenore Newman, <https://www.ufv.ca/food-agriculture-institute/meet-the-team/lenore-newman.htm>.

¹⁹ The Future of B.C.'s Food System. Findings and recommendations. B.C. Food Security Task Force. 2020.

²⁰ https://www2.gov.bc.ca/assets/gov/government/final_ic_report_2020.pdf.

If we do not seize the opportunity, others will. The Netherlands is an example. The entire country is slightly smaller than B.C.'s ALR. Yet, it is a major global exporter of agriculture products, valued at \$USD31 billion compared to total Canadian agriculture exports of \$USD44 billion. Other provinces, including Alberta, are moving with speed in agri-tech. In July 2021, Alberta Innovates announced funding to support a Smart Agriculture and Food Digitalization and Automation program.²¹ Other provinces including Saskatchewan²² and Ontario²³ are proactively supporting development of the sector. B.C. should follow suit.

CONCLUSIONS

Agri-tech undeniably is part of agriculture. Growing food has evolved from the time humans began to domesticate animals and plants. Today's technology solutions are different from those in the past but with similar objectives. B.C. has all the elements to grow a vibrant agri-tech sector satisfying multiple aspirations to build clean industrial activities, promote innovation, attract creative and talented people who can solve challenges, and contribute to the economy. Failing to nurture and support B.C.'s agri-tech sector will be a significant lost opportunity.²⁴ We should not let it pass us by.

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²¹ <https://albertainnovates.ca/programs/smart-agriculture-and-food-innovation/smart-agriculture-and-food-digitalization-and-automation-challenge/>.

²² <https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/agribusiness-farmers-and-ranchers/agricultural-research-programs/technology-commercialization-and-transfer/agriculture-demonstration-of-practices-and-technologies>.

²³ <http://www.omafra.gov.on.ca/english/about/agritechinnovation.htm>.

²⁴ <https://financialpost.com/news/economy/these-two-farming-methods-can-feed-the-planet-and-help-the-environment-but-they-need-to-get-along>.