

**ЕКОНОМІКА ТА ЕФЕКТИВНІСТЬ  
ВИРОБНИЧО-ГОСПОДАРСЬКОЇ ДІЯЛЬНОСТІ**

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**AGRICULTURE IMPROVEMENT  
ACT OF 2018: SUMMARY AND  
PERSPECTIVE<sup>©</sup>**

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*The Agriculture Improvement Act of 2018, the latest US farm bill, contains no major realignment of spending across its 12 titles. Nevertheless, potentially important programmatic changes are authorized. Payments by commodity assistance programs are more closely tied to current market conditions, including allowing farms to annually change commodity program starting with the 2021 crop. Commitment to using private-public partnerships to address farm environmental issues is increased. US land conservation programs appear to be evolving to a pyramid policy approach composed of (1) conservation farming practices for land cropped annually (2) short term contracts to revitalize soil health, (3) environmental fallow to remove land from production for longer periods, and (4) long term conservation easements. The Research and Extension title had the largest percent increase in mandatory funding. Mandatory funding for US agricultural export programs were increased by double digits. Issues with provisions in multiple titles include organic production, local foods, urban agriculture, food wastes, legalization of hemp production, and programs to assist young, beginning, veteran, and socially disadvantaged farmers.*

**Key Words:** 2018 US farm bill, commodity programs, environmental policy pyramid.

**Fig.: 3. Ref.: 10.**

**ЗАКОН ПРО ВДОСКОНАЛЕННЯ МЕТОДІВ ВЕДЕННЯ СІЛЬСЬКОГО  
ГОСПОДАРСТВА 2018 РОКУ: УЗАГАЛЬНЕННЯ ТА ПЕРСПЕКТИВИ**

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*Закон про вдосконалення ведення сільського господарства від 2018 року, останній законопроект, що стосується сільського господарства США, не містить істотних змін у витратах по 12 пунктах. Проте потенційно важливі програмні зміни внесені. Виплати в межах програм допомоги товаровиробникам більш тісно пов'язані з поточними ринковими умовами, зокрема вони дозволяють фермерам щорічно змінювати товарну програму, починаючи з врожаю 2021 року. Вітається використання приватно-державного партнерства для вирішення екологічних проблем у фермерських господарствах. Очевидно, що програми консервації земель в США розвиваються відповідно до політики піраміди в управлінні, яка включає: (1)*

практику консерваційного землеробства для земель, що засіваються щороку (2) короткострокові контракти для відновлення якості ґрунтів, (3) екологічне тримання земель під паром з метою запобігання їх використання протягом тривалих періодів, і (4) довготривалі періоди відновлення. Розділ «Research and Extension (дослідження та дорадництво)» отримав найбільший відсоток обов'язкового фінансування. Обов'язкове фінансування програм експорту сільськогосподарської продукції США було також значно збільшено. Пункти, фінансування яких збільшилось, включають: органічне виробництво, виробництво місцевих продуктів харчування, урбанізоване сільське господарство, поводження з харчовими відходами, легалізацію виробництва конопель і програми допомоги для молодих, початківців, ветеранів і соціально незахищених фермерів.

**Ключові слова:** закон США про сільське господарство 2018 року, програми товарного виробництва, піраміда екологічної політики.

**Рис.: 3. Літ.: 10.**

## ЗАКОН О СОВЕРШЕНСТВОВАНИИ МЕТОДОВ ВЕДЕНИЯ СЕЛЬСКОГО ХОЗЯЙСТВА 2018 ГОДА: ОБОБЩЕНИЯ И ПЕРСПЕКТИВЫ

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*Закон о совершенствовании методов ведения сельского хозяйства 2018 года последний законопроект, касающийся сельского хозяйства в США, не содержит существенных изменений в расходах по 12 пунктам. Однако потенциально важные программные изменения внесены. Выплаты в рамках программ помощи товаропроизводителям более тесно связаны с текущими рыночными условиями, в том числе они позволяют фермерам ежегодно менять товарную программу, начиная с урожая 2021 года. Приветствуется использование частно-государственного партнёрства для решения экологических проблем в фермерских хозяйствах. Очевидно, что программы консервации земель в США развиваются в соответствии с политикой пирамиды в управлении, которая включает: (1) практику консервационного земледелия для земель, которые засеваются ежегодно, (2) краткосрочные контракты для восстановления качества почвы, (3) экологическое содержание земель под паром с целью предотвращения их использования в течение длительных периодов и (4) долгосрочные периоды восстановления. Раздел «Research and Extension» (исследования и консультирование) имеет самый большой процент обязательного финансирования. Обязательное финансирование программ экспорта сельскохозяйственной продукции США было значительно увеличено. Пункты, финансирование которых также увеличилось, включают: органическое производство, производство местных продуктов питания, урбанизированное сельское хозяйство, обращение с пищевыми отходами, легализацию производства конопли и программы помощи для молодых, начинающих, ветеранов и социально незащищенных фермеров.*

**Ключевые слова:** закон о сельском хозяйстве США за 2018 год, товарные программы, пирамида экологической политики.

**Рис.: 3. Лит.: 10.**

## Introduction

The *Agriculture Improvement Act of 2018* is the latest US farm bill. Given the size of the US agricultural sector and its role in international trade, interest in the US farm bill extends beyond the US. This article contains a brief review of the 2018 US farm bill. It begins with the budget cost score of the bill. The 4 large spending titles of Commodities, Crop Insurance, Conservation, and Nutrition are reviewed individually. The other 8 titles are reviewed as a group, with a particular focus on issues that cut across more than 1 title, which indicates widespread interest among members of Congress. Specific provisions are discussed, but the big picture that emerges from the farm bill is also discussed.

## Overview: Budget Score

CBO (Congressional Budget Office) projects a baseline score of spending by assuming programs authorized in the existing farm bill with mandatory funds are extended as is. Mandatory funds represent a stronger commitment to fund a program than do authorized funds. Funds authorized by legislation but not as mandatory funds have to be approved for spending by an appropriations bill, which may approve spending that is less than the authorized amount and can be zero.

A budget score covers 10 future Fiscal Years (FY). The cumulative 10-year score sets a total spending limit for new legislation. This paper however uses a 5-year score because the 2018 farm bill covers FY 2019-2023. A new farm bill is currently expected to cover FY 2024 and thereafter, which increases the likelihood that programs will be changed by Congress.

CBO scored the FY 2019-2023 baseline spending outlays for mandatory funded programs in the 2014 farm bill at \$472.3 billion in April 2018 (see Figure 1). The 2018 and 2014 farm bills have the same 12 titles. Nutrition, Crop Insurance, Commodities, and Conservation titles account for over 99% of mandatory outlays. The largest is Nutrition (76%), with most for SNAP (Supplemental Nutrition Assistance Program). The negative budget score for the Credit title largely reflects the interest income and fees earned by the government for loans with which it is involved.

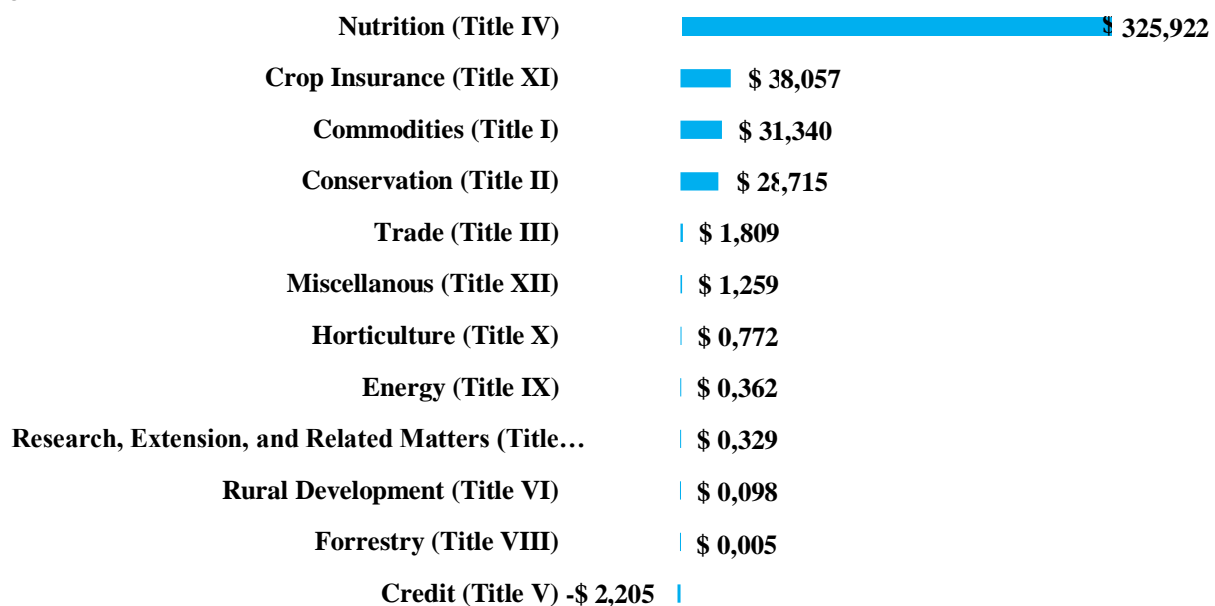
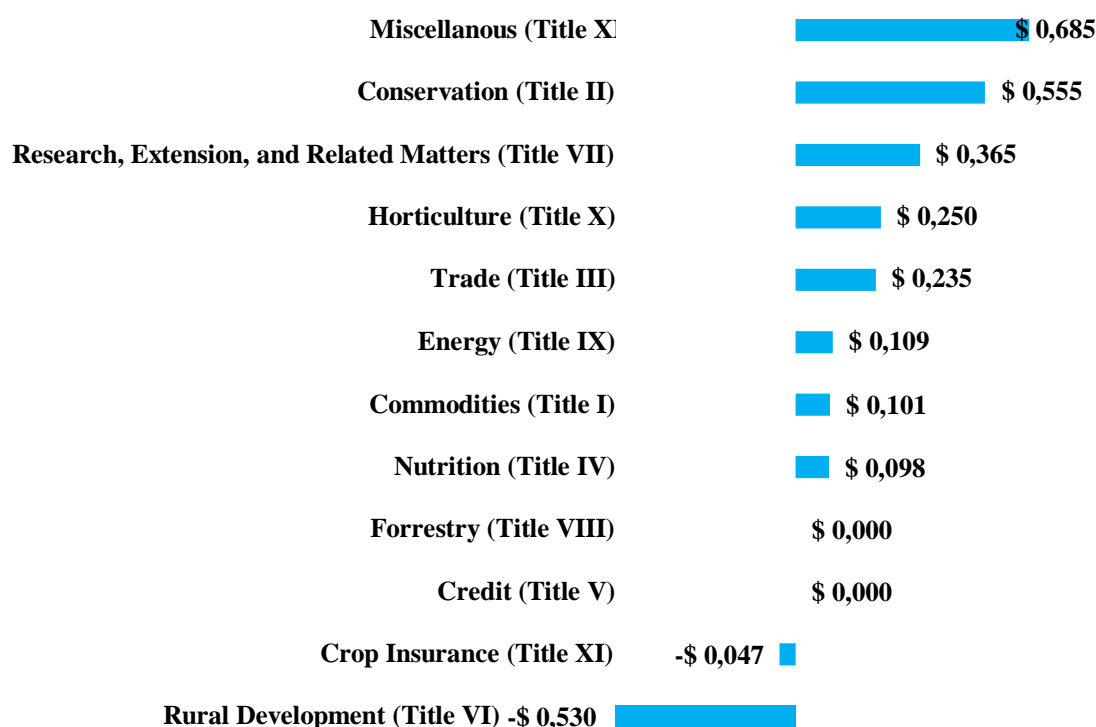


Fig. 1. Mandatory outlays by farm bill title, Congressional Budget Office  
April 2018 baseline, billion \$, US, 2019-2023 Fiscal Years

Source: Congressional Budget Office

While the other 8 titles account for less than 1% of mandatory outlays, they are important to the farm bill process, in part because they facilitate building broad support needed to pass the bill. This role is particularly evident in the 2018 farm bill. Of the 4 high outlay titles, only Conservation is among the 6 titles with the largest increase in outlays (see Figure 2). Largest increase is for the Miscellaneous title. When the increase in outlays is expressed as a share of baseline outlays, 5 titles had double digit increases: Research, Extension, and Related Matters (+111%), Miscellaneous (+54%), Horticulture (+32%), Energy (+30%) and Trade (+13%). None is a large outlay title. The negative budget score for Rural Development indicates budget savings for this title. They are achieved by reducing the cost of interest credited to the Rural Utility Service Borrowers' Cushion of Credit accounts.



**Fig. 2. 2018 farm bill's estimated change in outlays from Congressional Budget Office April 2018 baseline, billion \$, US, 2019-2023 Fiscal Years**

*Source: Congressional Budget Office*

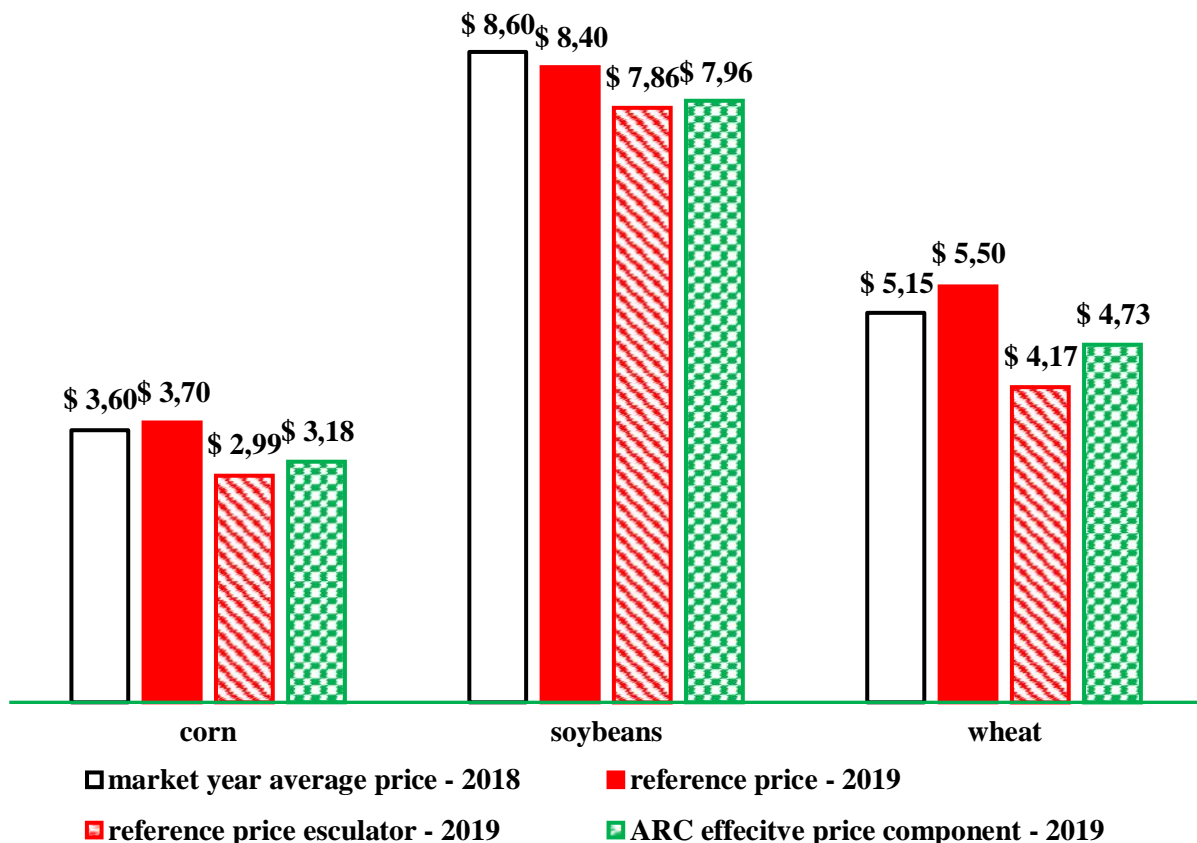
### Commodity Programs

The 2018 farm bill retains the 2 commodity assistance programs for crops enacted in the 2014 farm bill. They are ARC (Agriculture Risk Coverage) and PLC (Price Loss Coverage). ARC provides assistance against low revenue where low is defined as revenue less than [86 percent times (Olympic average (removes high and low) price for the 5 prior crops times Olympic average yield for the 5 prior crops)]. PLC provides assistance against low price where low is defined as a price less than a reference price specified by Congress in the farm bill. ARC has 2 versions: county and individual farm.

In a major change from past farm bills, farms will not have to choose between ARC or PLC for the entire farm bill period of the 2019 through 2023 crops. Instead they will choose a program for the 2019 and 2020 crops, then, starting with the 2021 crop, be able to annually change program. Farms will thus be able to choose the program they think is best for the upcoming year, which may vary from year to year.

The 2018 farm bill permits ARC yields to be adjusted for historical trends and permits a 1-time update for fixed PLC yields. The PLC yield update option for a program commodity is (90% times a farm’s average 2013-2017 yield) times (average US 2008-2012 yield divided by average US 2013-2017 yield). While the US yield ratio deflates 2013-2017 yields to the 2008-2012 period used in the 2014 farm bill update, PLC payment yield will likely be higher for farms whose yield increased faster than US yield between 2008-2012 and 2013-2017. Farms whose yield increased slower than US yield will elect not to update and keep their higher, current PLC yield. The update formula in particular allows farms that experienced a yield-reducing event, such as drought, during 2008-2012 to potentially update yield to a period without a yield-reducing event.

A price escalator feature is added to the reference price, which is used by both ARC and PLC. The effective reference price is the higher of (a) the reference price stated in the bill (called statutory reference price) or (b) 85% of a program commodity’s Olympic average US price for the 5 most recent crop marketing years. The effective reference price cannot exceed 115% of the statutory reference price. For the forthcoming 2019 crop year, it is unlikely the reference price escalator will be effective for corn, soybeans, and wheat as it is well below the statutory reference price using currently available prices from the US Department of Agriculture (see Fig. 3).



**Fig. 3. Commodity program price parameters for 2019 crop and projected 2018 market year price, corn, soybeans, and wheat, US**

Source: 2018 farm bill and USDA, February WASDE

Figure 3 also suggests PLC will likely be the choice of corn, soybean, and wheat farms for 2019 and 2020. Using the simple forecast of assuming current price continues into the future, the 2018 crop year price is materially above ARC's effective price component for each crop but below PLC's effective statutory reference price for corn and wheat and close to it for soybeans. ARC's effective price component is 86% of its Olympic 5-year average price because 86% is ARC's coverage level. PLC's effective price component is 100% of the effective reference price since payments start when US market year price is below the effective reference price. Consistent with Figure 3, CBO's April 2018 baseline estimated that 85%, 28%, and 82% of corn, soybean, and wheat program acres, respectively, will elect PLC for the 2019 and 2020 crop years. The shares will likely be higher in the next baseline because the international tariff war has raised price uncertainty and likely lowered prices. For the 2014 farm bill signup, comparable PLC share were 7%, 3%, and 42%. The stark change in program enrollment underscores the potential importance of allowing US farms to choose a program annually.

In response to dairy producers' financial stress in recent years, Congress materially enhanced the Dairy Margin Coverage (DMC) program, first in the Tax Cuts and Jobs Act of 2017 and then the farm bill. DMC, the renamed Dairy Margin Protection Program, provides assistance based on a US milk price minus US feed cost margin. The 2 bills expand covered milk production that qualifies for Tier I protection by 25% (5 vs. 4 million pounds), substantially reduce Tier I premiums (for example, by 79% at the \$8.00 per 100 pounds (cwt.) coverage margin), add Tier I coverage margins of \$8.50, \$9.00, and \$9.50 per cwt., and expand coverage options from 25%-90% to 5%-95%. Covered milk production is the largest production in 2011, 2012 or 2013. Zulauf and Wolf (2018) estimate these changes would have materially increased payments over the 2014 farm bill period and thus could materially increase future payments.

### **Crop Insurance**

Congress continues to expand the US crop insurance program in a variety of ways. Research and development is mandated to improve existing policies or create new policies for Whole Farm Revenue Protection, tropical storms or hurricanes, loss of quality, citrus crops, hops, sorghum, subsurface and limited irrigation practices, rice irrigation practices, greenhouse crops, and local foods. A new liaison position is created in each regional insurance office to facilitate developing contracts for specialty crops. Data collected by NAP (Noninsured Crop Disaster Assistance Program), which is administrated by the Farm Service Agency not the Risk Management Agency, is to be provided for improving crop insurance coverage. One interpretation of this requirement is that Congress prefers insurance take over responsibility for at least some risk assistance NAP now provides. The farm bill also permits separate insurance policies for crops grazed and mechanically harvested on the same acre during the same growing season. An example is grazing cattle on wheat in the fall, and harvesting the wheat for grain the following spring.

A key US farm policy initiative during the 1980s and 1990s was to replace assistance authorized after a crop disaster occurred, called *ad hoc* disaster assistance, with crop insurance (Coppess, 2018). Congress however continues to provide *ad hoc* assistance, most recently in 2017 and 2018 for tropical storm and hurricane damaged crops even when farms had bought insurance but at low coverage levels. In the Conference Report that accompanies the farm bill, its Congressional managers state they expect policies to be identified to provide cost effective insurance for catastrophic weather events to alleviate the need for

future *ad hoc* disaster assistance. The managers also note in the Conference Report that Whole Farm Revenue insurance can potentially provide vital risk assistance to farms underserved by crop insurance as well as potentially enhance options for existing insurance users. Combining these statements suggests that (1) incentivizing farms to buy higher coverage levels may emerge as a future issue and (2) future farm bills may explore the option of replacing current crop specific insurance contracts with contracts that insure more than one crop or the whole farm.

### **Conservation**

Commitment to using private-public partnerships to address farm environmental issues is increased. Mandatory funds for RCCP (Regional Conservation Partnership Program) are tripled to \$300 million/year for FY 2019-2023 from the \$100 million/year for FY 2014-2018 when RCCP was created by the 2014 farm bill. Key RCPP objectives are to focus on local issues and leverage public funds with private funds.

CRP (Conservation Reserve Program) generated considerable discussion. In the Conference Report, the bill's Managers express the hope that a higher acreage cap and lower rental rates will allow CRP to better serve one of its fundamental purposes of retiring the most environmentally sensitive land while not competing with local farmland rental markets. A specific hope expressed is that highly productive land not be taken out of production while remaining affordable for those who wish to farm it. CRP's acreage cap is raised from 24 to 27 million acres by FY 2023, with 8.6 million acres in continuous CRP practices and the rest in general CRP 10-to-15 year land retirement contracts. The Bill also creates a pilot program for CLEAR (Clean Lakes Estuaries and Rivers) practices that uses 30-year contracts to assess demand for longer-term CRP contracts. Annual rental rates for general and continuous CRP are limited to 85% and 90%, respectively, of the county average rental rate. Share of establishment costs paid by the government is also reduced.

Considerable discussion occurred over the future of CSP (Conservation Stewardship Program) after the House of Representatives' farm bill eliminated it. CSP is combined with EQIP (Environmental Quality Incentives Program) under the same chapter, but their authorization remains separate with distinct purposes. The Secretary of Agriculture is directed to manage CSP to enhance soil health to the maximum extent feasible. EQIP's role remains to help farms meet Federal, state and local regulatory requirements.

### **Nutrition**

Nutrition was arguably the most controversial title, but ended up with few changes. The controversy resulted from the House farm bill's proposal to increase work eligibility requirements for SNAP assistance in buying food. The final farm bill did not contain the House provision, but a number of provisions did address employment and training for individuals receiving SNAP benefits, suggesting the debate could reemerge in the next farm bill.

A number of provisions also address nutritional quality of the diet of low income individuals. They include pilot and small programs to provide incentives for SNAP participants to buy fluid milk, fruits, and vegetables. These programs are consistent with the slow evolution of US food assistance from a calorie to nutrition focus. The 1996 farm bill renamed the food stamp title, the nutrition title. The 2008 farm bill renamed the food stamp program, the Supplemental Nutrition Assistance Program. Names of titles and programs are rarely happenstance. A change in name can capture historical changes, but often signals a desired future change.

A nutrition provision that may have long-term significance requires the Secretary of Agriculture to create a longitudinal interstate database. Short-term objective is to prevent duplicate, simultaneous receipt of SNAP benefits in two or more States. Long-term objective is to establish a research database to be used to improve SNAP design and performance.

### **Other Titles and Cross-Title Issues**

President Trump's Administration has made trade imbalances it considers unfair a policy focus. In particular, the US has imposed tariffs on a variety of imports from a number of countries. These countries have often targeted US agricultural exports with counter-tariffs. Given the resulting focus on agricultural trade, it is not surprising that the Trade title increases mandatory funds for US agricultural export programs by \$255 million over 5 years.

Given widespread concern about the financial position of US farms, it is not surprising that the Credit title expanded limits on farm loans made by the government (called direct loans) or made by commercial institutions but guaranteed by the government (called guaranteed loans). Limit on a direct operating loan is raised to \$400,000 from \$300,000, on a direct ownership loan to \$600,000 from \$300,000, and on a guaranteed operating or ownership loan to \$1,750,000 from \$700,000. Aggregate loan authority is raised to \$10.0 from \$4.2 billion per year.

The initial paragraph in the Conference report section for the Research, Extension, and Related Matters title contains the following statements: "The Managers recognize that Federal investment in public agricultural research has been trending downward in real dollars since 2003. .... We are at a critical juncture and must reverse this trend to reassert our nation's global leadership in agricultural research." Consistent with these statements, the Research and Extension title had the largest percent increase in mandatory funds (+111%).

The Energy title confirms on-going Congressional interest in expanding the US bioenergy sector. In particular, several statutory definitions are expanded, which in turn expands the scope of programs that use the statutory definition to determine eligibility. "Biobased product" and "biorefinery" are amended to include "renewable chemicals." "Renewable energy system" is amended to include storage and distribution infrastructure. In a different type of program expansion, algae is made eligible for the Biomass Crop Assistance Program.

The Horticulture title removes the ban on hemp production, a provision that has attracted widespread attention. Industrial hemp is also made eligible for certain research and extension programs and the Crop Insurance title allows hemp to be added to the list of insurable crops.

Other issues with provisions in multiple titles include organic production, local foods, urban agriculture, food wastes, and young, beginning, veteran, and socially disadvantaged farmers. Organic production provisions are in the Conservation, Research and Extension, Horticulture, and Crop Insurance titles, including mandatory funds that increase to \$50 million in FY 2023 and thereafter for the Organic Agriculture Research and Extension Initiative. Local food and urban agriculture provisions are in the Rural Development, Research and Extension, Horticulture, and Miscellaneous titles, including mandatory funds of \$50 million per year for the Local Agriculture Market Program in the Horticulture title. Food waste provisions are in the Nutrition and Miscellaneous titles, including programs to direct food to be discarded but usable into feeding programs for the poor. Assistance for young, beginning, veteran, and socially disadvantaged farmers is in the



Commodity, Conservation, Credit, Crop Insurance, and Miscellaneous titles, including mandatory funds that increase to \$50 million for FY 2023 and thereafter in the Miscellaneous title.

### **Concluding Observations**

The *Agriculture Improvement Act of 2018* contains no major realignment of spending across its 12 titles. Nevertheless, potentially important programmatic changes are authorized.

The common feature of changes to the ARC and PLC commodity assistance programs is to more closely tie their payments to current market conditions. A more contemporary measure of yield is authorized for both programs and a price escalator allows the reference price to increase when market price exceeds it. Perhaps even more important, farms will be allowed to annually change the program in which they enroll starting with the 2021 crop. This will allow farms to better match the program with current market conditions. These changes are at odds with decoupled assistance that has been a feature of US commodity policy for crops since the 1996 farm bill and is a cornerstone of World Trade Organization's rules for measuring and monitoring domestic support for agriculture (Orden, Paarlberg, and Roe, 1999). The recoupling of US support for crops to current market conditions needs assessment and bears watching going forward.

The 2018 farm bill increases the commitment to using public-private partnerships as a path for addressing farm environmental issues. It also suggests US land conservation programs are evolving to a pyramid policy approach. The 4 sides are (1) conservation farming practices to improve environmental performance of land cropped annually (continuous CRP, CSP, and EQIP); (2) soil revitalization using short-term contracts to enhance soil health (CSP); (3) environmental fallow to remove land from production for longer periods to achieve environmental benefits (general CRP); and (4) long term conservation easements of 30 or more years to protect natural resources (ACEP, Agricultural Conservation Easement Program).

Given the expression of Congressional concern over the declining trend in public funding of agricultural research, it is not surprising the Research and Extension title had the largest percent increase in mandatory funds. Given intense discussion surrounding agricultural trade, it is not surprising mandatory funds for US agricultural export programs increased by double digits. Given widespread concern about the financial position of US farms, it is not surprising the Credit title expanded limits on farm loans made or guaranteed by the government. Another indicator of Congressional interest is issues with provisions in multiple titles. They include organic production, local foods, urban agriculture, food wastes, legalization of hemp production, and programs to assist young, beginning, veteran, and socially disadvantage farmers. Monitoring issues favored with increased funding and programing will provide early insights into issues outside of the 4 large funded titles that will frame the debate over the 2024 US farm bill.

### **References**

1. Coppess, J. (2018). *The Fault Lines of Farm Policy: A Legislative and Political History of the Farm Bill*. University of Nebraska Press: Lincoln and London.
2. The National Agricultural Law Center. February 2019. Contains all US farm bills. Available at: <http://nationalaglawcenter.org/farmbills/>.
3. US Congress. 115<sup>th</sup> Congress. December 2017. *Tax Cuts and Jobs Act of 2017* (formal title is H.R.1 - An Act to provide for reconciliation pursuant to titles II and V of the concurrent resolution on the budget for fiscal year 2018). Available at: <https://www.congress.gov/bill/115th-congress/house-bill/1>.

4. US Congress. 115<sup>th</sup> Congress. December 2018. *Agriculture Improvement Act of 2018*. Available at: <https://www.agriculture.senate.gov/imo/media/doc/CRPT-115hrpt1072.pdf>.
5. US Congress, Congressional Budget Office. April 2018. CBO's April 2018 Baseline for Farm Programs. Available at: <https://www.cbo.gov/sites/default/files/recurringdata/51317-2018-04-usda.pdf>.
6. US Congress, Congressional Budget Office. December 11, 2018. Letter to Honorable K. Michael Conway, "Direct Spending and Revenue Effects of the Conference Agreement for H.R. 2, the Agriculture Improvement Act of 2018". Available at: [https://www.cbo.gov/system/files?file=2018-12/hr2conf\\_0.pdf](https://www.cbo.gov/system/files?file=2018-12/hr2conf_0.pdf).
7. US Department of Agriculture, Farm Service Agency. February 12, 2019. "ARC/PLC Program – ARC/PLC Election Data." Available at: [https://www.fsa.usda.gov/programs-and-services/arcplc\\_program/index](https://www.fsa.usda.gov/programs-and-services/arcplc_program/index).
8. US Department of Agriculture, National Agricultural Statistics Service. February 12, 2019. *QuickStats*. Available at: <http://quickstats.nass.usda.gov/>.
9. US Department of Agriculture, Office of the Chief Economist. February 8, 2019. *World Agricultural Supply and Demand Estimates*. WASDE-585. Available at: <https://www.usda.gov/oce/commodity/wasde/index.htm>.
10. Zulauf, C. and C. Wolf (shared senior authorship). December 17, 2018. "Dairy Provisions in 2018 Farm Bill." *farmdoc daily* (8):232. Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign. Available at: <http://www.farmdoc.illinois.edu/>.

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