

119TH CONGRESS
1ST SESSION

S. 2582

To require the Secretary of Agriculture to conduct research relating to measurement, monitoring, reporting, and verification of soil carbon sequestration, and for other purposes.

IN THE SENATE OF THE UNITED STATES

JULY 31, 2025

Ms. SMITH (for herself and Mr. YOUNG) introduced the following bill; which was read twice and referred to the Committee on Agriculture, Nutrition, and Forestry

A BILL

To require the Secretary of Agriculture to conduct research relating to measurement, monitoring, reporting, and verification of soil carbon sequestration, and for other purposes.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*

3 **SECTION 1. SHORT TITLE.**

4 This Act may be cited as the “Advancing Research
5 on Agricultural Soil Health Act of 2025”.

6 **SEC. 2. DEFINITION OF SECRETARY.**

7 In this Act, the term “Secretary” means the Sec-
8 retary of Agriculture.

1 **SEC. 3. STANDARD SOIL CARBON MEASUREMENT METHOD-**
2 **LOGY.**

3 (a) METHODOLOGY.—

4 (1) IN GENERAL.—Not later than 270 days
5 after the date of enactment of this Act, the Sec-
6 retary shall develop a standardized methodology to
7 directly measure soil carbon for research and con-
8 servation purposes.

9 (2) REVIEW.—In developing the methodology
10 under paragraph (1), the Secretary shall conduct a
11 review of widely used existing methodologies for di-
12 rect soil carbon measurement.

13 (3) CONSULTATION.—In developing the meth-
14 odology under paragraph (1) and conducting the re-
15 view under paragraph (2), the Secretary shall con-
16 sult with—

17 (A) agricultural producers, including so-
18 cially disadvantaged farmers and ranchers (as
19 defined in section 355(e) of the Consolidated
20 Farm and Rural Development Act (7 U.S.C.
21 2003(e)));

22 (B) soil carbon experts;

23 (C) nonprofit organizations;

24 (D) academic researchers; and

1 (E) other stakeholders who reflect the
2 operational, geographic, and socioeconomic di-
3 versity of United States agricultural operations.

4 (4) REQUIREMENTS.—The methodology devel-
5 oped under paragraph (1) shall, to the maximum ex-
6 tent practicable—

7 (A) be usable at any location at which soil
8 carbon can be directly measured;

9 (B) require measurement to a standard
10 soil depth appropriate for the sample site, de-
11 termined using the best available science;

12 (C) measure the soil organic carbon con-
13 centration and any other soil health variables,
14 as determined by the Secretary in consultation
15 with stakeholders described in paragraph (3), to
16 produce a standard set of reporting metrics;

17 (D) produce data that is interoperable with
18 other data collected by the Department of Agri-
19 culture;

20 (E) account for calibration differences in
21 soil analysis between testing facilities;

22 (F) account for differences in uncertainty
23 between different measurement tools; and

24 (G) be usable for voluntary reporting of
25 soil carbon data under subsection (b).

1 (b) VOLUNTARY SOIL CARBON REPORTING.—

2 (1) TECHNICAL ASSISTANCE.—

3 (A) IN GENERAL.—The Secretary, acting
4 through the Chief of the Natural Resources
5 Conservation Service, shall provide to producers
6 described in paragraph (2) technical assistance,
7 including guidance, for voluntarily measuring,
8 monitoring, and reporting to the Secretary soil
9 carbon data using the methodology developed
10 under subsection (a).

11 (B) GUIDANCE.—Guidance provided under
12 subparagraph (A) shall be, at a minimum—

13 (i) available in multiple languages;

14 and

15 (ii) available to producers described in
16 paragraph (2) in both digital and analog
17 formats.

18 (2) APPLICABILITY.—The guidance developed
19 under paragraph (1) shall be applicable to—

20 (A) producers that are recipients of grants
21 under programs described in paragraph (3) to
22 voluntarily measure, monitor, and report to the
23 Secretary soil carbon outcomes under those pro-
24 grams; and

1 (B) any other producer that elects to vol-
 2 untarily report to the Secretary direct measure-
 3 ments of soil carbon.

4 (3) PROGRAMS DESCRIBED.—The programs re-
 5 ferred to in paragraph (2)(A) include—

6 (A) conservation innovation grants under
 7 section 1240H of the Food Security Act of
 8 1985 (16 U.S.C. 3839aa–8);

9 (B) the sustainable agriculture research
 10 and education program under subtitle B of title
 11 XVI of the Food, Agriculture, Conservation,
 12 and Trade Act of 1990 (7 U.S.C. 5801 et seq.);

13 (C) the organic agriculture research and
 14 extension initiative established under section
 15 1672B of that Act (7 U.S.C. 5925b);

16 (D) grants under the Agriculture and Food
 17 Research Initiative under section 2(b) of the
 18 Competitive, Special, and Facilities Research
 19 Grant Act (7 U.S.C. 3157(b)); and

20 (E) such other programs as the Secretary
 21 determines to be appropriate.

22 (c) UPDATES.—

23 (1) IN GENERAL.—The Secretary shall update
 24 the methodology developed under subsection (a)(1)

1 and the guidance issued under subsection (b)(1)(B)
 2 as needed to reflect the best-available science.

3 (2) INTEROPERABILITY.—In making any up-
 4 dates under paragraph (1), the Secretary shall en-
 5 sure that information collected with the updated
 6 methodology remains interoperable with previously
 7 collected measurements.

8 (d) AUTHORIZATION OF APPROPRIATIONS.—There is
 9 authorized to be appropriated to carry out this section
 10 \$2,000,000 for each fiscal year.

11 **SEC. 4. DEVELOPMENT OF NEW MEASUREMENT TOOLS**
 12 **UNDER AFRI.**

13 Section 2(b)(2)(D) of the Competitive, Special, and
 14 Facilities Research Grant Act (7 U.S.C. 3157(b)(2)(D))
 15 is amended—

16 (1) in clause (vii), by striking “and” at the end;

17 (2) in clause (viii), by striking the period at the
 18 end and inserting “; and”; and

19 (3) by adding at the end the following:

20 “(ix) measuring, monitoring, report-
 21 ing, and verifying soil carbon sequestration
 22 and emissions.”.

1 **SEC. 5. SOIL HEALTH AND CARBON DEMONSTRATION**
 2 **TRIALS.**

3 (a) ON-FARM CONSERVATION INNOVATION
 4 TRIALS.—Section 1240H(c) of the Food Security Act of
 5 1985 (16 U.S.C. 3839aa–8(c)) is amended—

6 (1) in paragraph (1)(B)(i), by striking sub-
 7 clause (III) and inserting the following:

8 “(III) soil health management
 9 systems, including—

10 “(aa) systems to maintain or
 11 increase soil carbon levels; and

12 “(bb) cost-effective tools to
 13 measure, monitor, report, and
 14 verify greenhouse gas emissions
 15 and carbon sequestration;”; and

16 (2) in paragraph (3)(D), by striking “3 years”
 17 each place it appears and inserting “5 years”.

18 (b) SUSTAINABLE AGRICULTURE RESEARCH AND
 19 EDUCATION PROGRAM.—Section 1621(e) of the Food, Ag-
 20 riculture, Conservation, and Trade Act of 1990 (7 U.S.C.
 21 5811(e)) is amended—

22 (1) by striking “The Secretary” and inserting
 23 the following:

24 “(1) IN GENERAL.—The Secretary”; and

25 (2) by adding at the end the following:

1 “(2) SOIL CARBON SEQUESTRATION DEM-
 2 ONSTRATION PROJECTS.—In carrying out this sec-
 3 tion, the Secretary shall conduct on-farm demonstra-
 4 tion projects for soil carbon sequestration.”.

5 **SEC. 6. SOIL CARBON INVENTORY AND ANALYSIS NET-**
 6 **WORK.**

7 Chapter 5 of subtitle D of title XII of the Food Secu-
 8 rity Act of 1985 is amended by inserting after section
 9 1240M (16 U.S.C. 3839bb) the following:

10 **“SEC. 1240N. SOIL CARBON INVENTORY AND ANALYSIS NET-**
 11 **WORK.**

12 “(a) DEFINITIONS.—In this section:

13 “(1) CONSERVATION ACTIVITIES.—The term
 14 ‘conservation activities’ has the meaning given the
 15 term in section 1240I.

16 “(2) ELIGIBLE LAND.—The term ‘eligible land’
 17 means public and private cropland, rangeland,
 18 pastureland, and wetlands in the United States.

19 “(3) PROGRAM.—The term ‘program’ means
 20 the program established under subsection (b)(1).

21 “(4) REGIONAL RESOURCE AREA.—The term
 22 ‘regional resource area’ means a contiguous area of
 23 eligible land that has similar resource characteris-
 24 tics.

1 “(5) RESOURCE CHARACTERISTICS.—The term
2 ‘resource characteristics’ means—

3 “(A) geographic, long-term weather pat-
4 tern, natural resource, and soil type character-
5 istics; and

6 “(B) any other characteristics that the
7 Secretary determines to be appropriate for the
8 purpose of carrying out the program.

9 “(6) SECRETARY.—The term ‘Secretary’ means
10 the Secretary, acting jointly through the Chief of the
11 Natural Resources Conservation Service and the Ad-
12 ministrator of the Agricultural Research Service.

13 “(b) ESTABLISHMENT.—

14 “(1) IN GENERAL.—The Secretary shall estab-
15 lish a program to inventory, monitor, and analyze
16 soil carbon changes on eligible land in the United
17 States.

18 “(2) PURPOSES.—The purposes of the program
19 are—

20 “(A) to analyze soil properties, including
21 soil organic carbon, across space, time, and
22 depth;

23 “(B) to analyze the impacts of land man-
24 agement strategies, including conservation ac-
25 tivities, on soil carbon sequestration; and

1 “(C) to inform any tools of the Secretary
2 designed to predict the impacts of different land
3 management practices, including implementing
4 conservation activities, on soil carbon and asso-
5 ciated environmental outcomes, such as resil-
6 ience to extreme weather, reduced farm inputs,
7 or other environment impacts, as determined by
8 the Secretary, across the United States.

9 “(3) CONSULTATION.—In carrying out the pro-
10 gram, the Secretary shall consult with the Director
11 of the National Institute of Food and Agriculture,
12 the Chief of the Forest Service, the Chief Data Offi-
13 cer, the Administrator of the Environmental Protec-
14 tion Agency, the Secretary of Energy, and the head
15 of any other department or agency that the Sec-
16 retary determines to be appropriate.

17 “(c) SAMPLING.—

18 “(1) SAMPLE SITES.—The Secretary shall select
19 sample sites under the program by taking into con-
20 sideration—

21 “(A) the accessibility of sites;

22 “(B) the ease of collecting repeated meas-
23 urements over time; and

24 “(C) such other factors as the Secretary
25 determines to be appropriate.

1 “(2) PREFERENCE.—In selecting sample sites
2 under paragraph (1), the Secretary shall give pref-
3 erence to sites that have been used for soil testing
4 previously.

5 “(3) NUMBER OF SAMPLE SITES.—The Sec-
6 retary shall select sufficient sample sites under para-
7 graph (1) to analyze changes in soil carbon across
8 regional resource areas, as determined by the Sec-
9 retary, over time, taking into account the geo-
10 graphical size and heterogeneity of each regional re-
11 source area.

12 “(d) SOIL CARBON INVENTORY.—

13 “(1) IN GENERAL.—Every 5 years, the Sec-
14 retary shall prepare an inventory of soil carbon
15 stocks on eligible land, under which the Secretary
16 shall collect measurements at each sample site se-
17 lected under subsection (c).

18 “(2) METHODOLOGY.—The Secretary shall en-
19 sure that the methodology developed under section
20 3(a) of the Advancing Research on Agricultural Soil
21 Health Act of 2025 is used for purposes of con-
22 ducting measurements at each sample site under the
23 program.

24 “(3) MINIMUM NUMBER OF SAMPLES.—The
25 Secretary shall measure a sufficient number of sam-

1 ples to analyze changes in soil carbon at each sample
 2 site selected under subsection (c) for each inventory
 3 under paragraph (1).

4 “(4) CHARACTERISTICS.—In preparing the in-
 5 ventory under paragraph (1), the Secretary shall
 6 document the following characteristics for each sam-
 7 ple site selected under subsection (c):

8 “(A) Soil type and texture.

9 “(B) Land use history, including conserva-
 10 tion activities.

11 “(C) Environmental characteristics, such
 12 as temperature and precipitation.

13 “(D) Other characteristics, as determined
 14 by the Secretary.

15 “(e) INDIVIDUAL PROTECTIONS.—

16 “(1) PROTECTION OF PRIVATE PROPERTY
 17 RIGHTS.—Before selecting a sample site under sub-
 18 section (c) or conducting any measurement under
 19 subsection (d)(1), the Secretary shall obtain author-
 20 ization from the owner of the eligible land.

21 “(2) VOLUNTARINESS REQUIREMENT.—The
 22 Secretary may not require authorization under para-
 23 graph (1) or any other participation in any activity
 24 under this section as a condition on receipt of any

1 benefit under a program administered by the Sec-
2 retary.

3 “(3) DATA PRIVACY PROTECTION.—In carrying
4 out the program, the Secretary shall ensure that
5 data is collected and analyzed while respecting rel-
6 evant privacy safeguards and does not include any
7 identifiable, proprietary, or personal information of
8 individual land owners or operators.

9 “(f) SOIL CHARACTERISTICS INVENTORY.—

10 “(1) IN GENERAL.—Survey and analysis infor-
11 mation collected under the program shall be main-
12 tained in a soil characteristics inventory operated by
13 the Secretary.

14 “(2) PARTNERSHIPS.—The inventory described
15 in paragraph (1) may be operated in partnership
16 with 1 or more of the following entities, if the entity
17 complies with paragraph (4):

18 “(A) An 1862 Institution (as defined in
19 section 2 of the Agricultural Research, Exten-
20 sion, and Education Reform Act of 1998 (7
21 U.S.C. 7601)).

22 “(B) An 1890 Institution (as defined in
23 that section).

24 “(C) A 1994 Institution (as defined in sec-
25 tion 532 of the Equity in Educational Land-

1 Grant Status Act of 1994 (7 U.S.C. 301 note;
2 Public Law 103–382)).

3 “(D) Institutions of higher education with
4 expertise in predictive modeling, large-scale
5 data collection, soil carbon research, or agricul-
6 tural conservation management practices.

7 “(E) Federal research centers.

8 “(3) APPLICATIONS.—An entity described in
9 any of subparagraphs (A) through (E) of paragraph
10 (2) seeking to enter into a partnership to manage
11 the inventory described in paragraph (1) shall sub-
12 mit to the Secretary an application at such time, in
13 such manner, and containing such information as
14 the Secretary may require.

15 “(4) REQUIREMENTS.—The inventory described
16 in paragraph (1) shall—

17 “(A) use the industry standard protocols
18 to protect identifiable, proprietary, or personal
19 information of individual land owners or opera-
20 tors;

21 “(B) ensure that individual producer infor-
22 mation is not sold through the inventory; and

23 “(C) comply with all applicable privacy re-
24 quirements, including—

1 “(i) section 1770 of the Food Security
2 Act of 1985 (7 U.S.C. 2276);

3 “(ii) section 1619 of the Food, Con-
4 servation, and Energy Act of 2008 (7
5 U.S.C. 8791);

6 “(iii) section 502(c) of the Federal
7 Crop Insurance Act (7 U.S.C. 1502(c));
8 and

9 “(iv) section 552 of title 5, United
10 States Code.

11 “(5) LIMITED RELEASE OF INFORMATION.—
12 The Secretary may release or disclose information
13 maintained in the inventory described in paragraph
14 (1) pursuant to section 1619(b)(3)(A)(i) of the
15 Food, Conservation, and Energy Act of 2008 (7
16 U.S.C. 8791(b)(3)(A)(i)) to researchers for the pur-
17 poses of statistically analyzing the information.

18 “(g) PUBLIC AVAILABILITY.—On completion of each
19 inventory under subsection (d)(1), the Secretary shall
20 make publicly available—

21 “(1) the statistical or aggregated form of data
22 collected from measurements under that subsection;

23 “(2) information regarding the methodology
24 used to collect that data; and

1 “(3) any analysis made of the measurements
2 described in paragraph (1).

3 “(h) REPORTS.—On completion of each inventory
4 under subsection (d)(1), the Secretary shall prepare, pub-
5 lish, and make available to the public a report that—

6 “(1) contains a description of soil carbon
7 trends, including by incorporating measurements
8 conducted under subsection (d) during the 5 years
9 covered by the report;

10 “(2) contains an analysis of the impact of dif-
11 ferent land management practices, including imple-
12 menting 1 or more conservation activities, on soil
13 carbon levels;

14 “(3) contains an analysis of the effect of short-
15 and long-term weather variability on the observed
16 trends;

17 “(4) contains an analysis of how land manage-
18 ment practices, including conservation activities,
19 that influence soil carbon sequestration may affect
20 the rate of increase in atmospheric carbon and other
21 gases in the agricultural sector, including methane
22 and nitrous oxide; and

23 “(5) establishes a benchmark for the baseline
24 soil carbon absent additional conservation activities.

1 “(i) STRATEGIC PLAN.—Not later than 1 year after
 2 the date of enactment of the Advancing Research on Agri-
 3 cultural Soil Health Act of 2025, the Secretary shall pre-
 4 pare and submit to Congress a strategic plan to implement
 5 and carry out this section, which shall describe in detail—

6 “(1) the organization and procedures necessary
 7 to implement and carry out this section; and

8 “(2) the plan for measurements in each re-
 9 gional resource area under subsection (d)(1) for the
 10 first 5-year interval, including the schedule and the
 11 number of samples collected from each sample site
 12 selected under subsection (c).

13 “(j) AUTHORIZATION OF APPROPRIATIONS.—There
 14 is authorized to be appropriated to carry out this section
 15 \$17,500,000 for each fiscal year.”.

16 **SEC. 7. PREDICTIVE MODELS.**

17 (a) IN GENERAL.—The Secretary shall develop and
 18 maintain a modeling tool (or combination of tools) that
 19 shall predict the impacts of different land management
 20 practices, including implementing conservation activities,
 21 on atmospheric carbon, methane, and nitrous oxide and
 22 soil carbon sequestration across the United States.

23 (b) CONSULTATION.—In developing the modeling tool
 24 or tools under subsection (a), the Secretary shall consult
 25 with—

1 (1) the Secretary of Energy;

2 (2) the Administrator of the Environmental
3 Protection Agency;

4 (3) agricultural producers, including socially
5 disadvantaged farmers and ranchers (as defined in
6 section 355(e) of the Consolidated Farm and Rural
7 Development Act (7 U.S.C. 2003(e)));

8 (4) soil carbon experts;

9 (5) nonprofit organizations;

10 (6) academic researchers;

11 (7) private companies with expertise in soil car-
12 bon sequestration or in atmospheric carbon, meth-
13 ane, and nitrous oxide monitoring for agricultural
14 operations; and

15 (8) other stakeholders, including the heads of
16 other appropriate Federal agencies or non-Federal
17 entities, who reflect the operational, geographic, and
18 socioeconomic diversity of United States agricultural
19 operations.

20 (c) REQUIREMENTS.—The modeling tool or tools de-
21 scribed in subsection (a) shall—

22 (1) be anchored in direct measurements of land,
23 including soil sampling, such as under the program
24 established under section 1240N of the Food Secu-

1 rity Act of 1985 and the programs described in sec-
 2 tion 3(b)(3);

3 (2) account for differences that could impact
 4 land management outcomes, including—

5 (A) soil type;

6 (B) type of land use;

7 (C) type of crop;

8 (D) geography and local long-term weather
 9 patterns;

10 (E) geographic size of the land-use oper-
 11 ation;

12 (F) ongoing or existing conservation activi-
 13 ties; and

14 (G) such other items as the Secretary de-
 15 termines to be appropriate;

16 (3) allow a user of the tool to estimate the
 17 changes in atmospheric carbon, methane, and ni-
 18 trous oxide or soil carbon sequestration, and the un-
 19 certainty of those estimated changes, that occur as
 20 a result of implementing 1 or more conservation ac-
 21 tivities; and

22 (4) be user-friendly and accessible—

23 (A) to producers and researchers; and

24 (B) in multiple languages.

25 (d) REVIEWS AND UPDATES.—

1 (1) REVIEWS.—Not less frequently than annu-
 2 ally, the modeling tool or tools described in sub-
 3 section (a) shall be reviewed to determine if an up-
 4 date is required to reflect the best available data and
 5 science.

6 (2) UPDATES.—If it is determined that an up-
 7 date is required under paragraph (1), the update
 8 shall be made not later than 1 year after the date
 9 of that determination.

10 (e) PARTNERS.—

11 (1) IN GENERAL.—In analyzing data, con-
 12 ducting research, and developing and maintaining
 13 the modeling tool or tools under subsection (a), the
 14 Secretary may partner with—

15 (A) an Institution described in paragraph
 16 (2);

17 (B) an institution of higher education with
 18 expertise in predictive modeling, large-scale
 19 data collection, soil carbon research, or agricul-
 20 tural conservation management; or

21 (C) a Federal research center.

22 (2) INSTITUTIONS DESCRIBED.—An Institution
 23 referred to in paragraph (1)(A) is any of the fol-
 24 lowing:

1 (A) An 1862 Institution (as defined in sec-
2 tion 2 of the Agricultural Research, Extension,
3 and Education Reform Act of 1998 (7 U.S.C.
4 7601)).

5 (B) An 1890 Institution (as defined in
6 that section).

7 (C) A 1994 Institution (as defined in sec-
8 tion 532 of the Equity in Educational Land-
9 Grant Status Act of 1994 (7 U.S.C. 301 note;
10 Public Law 103–382)).

11 (f) REPORTING.—Not later than 2 years after the
12 date of enactment of this Act, and annually thereafter,
13 the Secretary shall submit to Congress a report that—

14 (1) describes the progress of the Secretary in
15 developing the modeling tool or tools under sub-
16 section (a);

17 (2) contains an assessment of the accuracy with
18 which a user will be able to use the tool to determine
19 the permanence and additionality of atmospheric
20 carbon, methane, and nitrous oxide reduced or car-
21 bon sequestered;

22 (3) describes the models and survey and anal-
23 ysis information that the Secretary has developed or
24 collected, or intends to develop or collect, as applica-

1 ble, for purposes of developing or maintaining the
2 tool;

3 (4) describes—

4 (A) whether it was determined that an up-
5 date was required under subsection (d)(1); and

6 (B) if an update was required, the specifics
7 of the update; and

8 (5) includes any other information that, as de-
9 termined by the Secretary, is relevant to—

10 (A) the efficacy of the tool;

11 (B) the intended applications of the tool;

12 or

13 (C) the determination of—

14 (i) changes in atmospheric carbon,
15 methane, and nitrous oxide or soil carbon
16 sequestration associated with producer
17 land-use practices; or

18 (ii)(I) estimates of the impacts of land
19 use practices, including conservation activi-
20 ties, on atmospheric carbon, methane, and
21 nitrous oxide and soil carbon sequestration;
22 and

23 (II) the measurement error of the
24 tool.

1 (g) AUTHORIZATION OF APPROPRIATIONS.—There is
2 authorized to be appropriated to carry out this section
3 \$500,000 for each fiscal year.

○