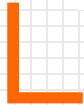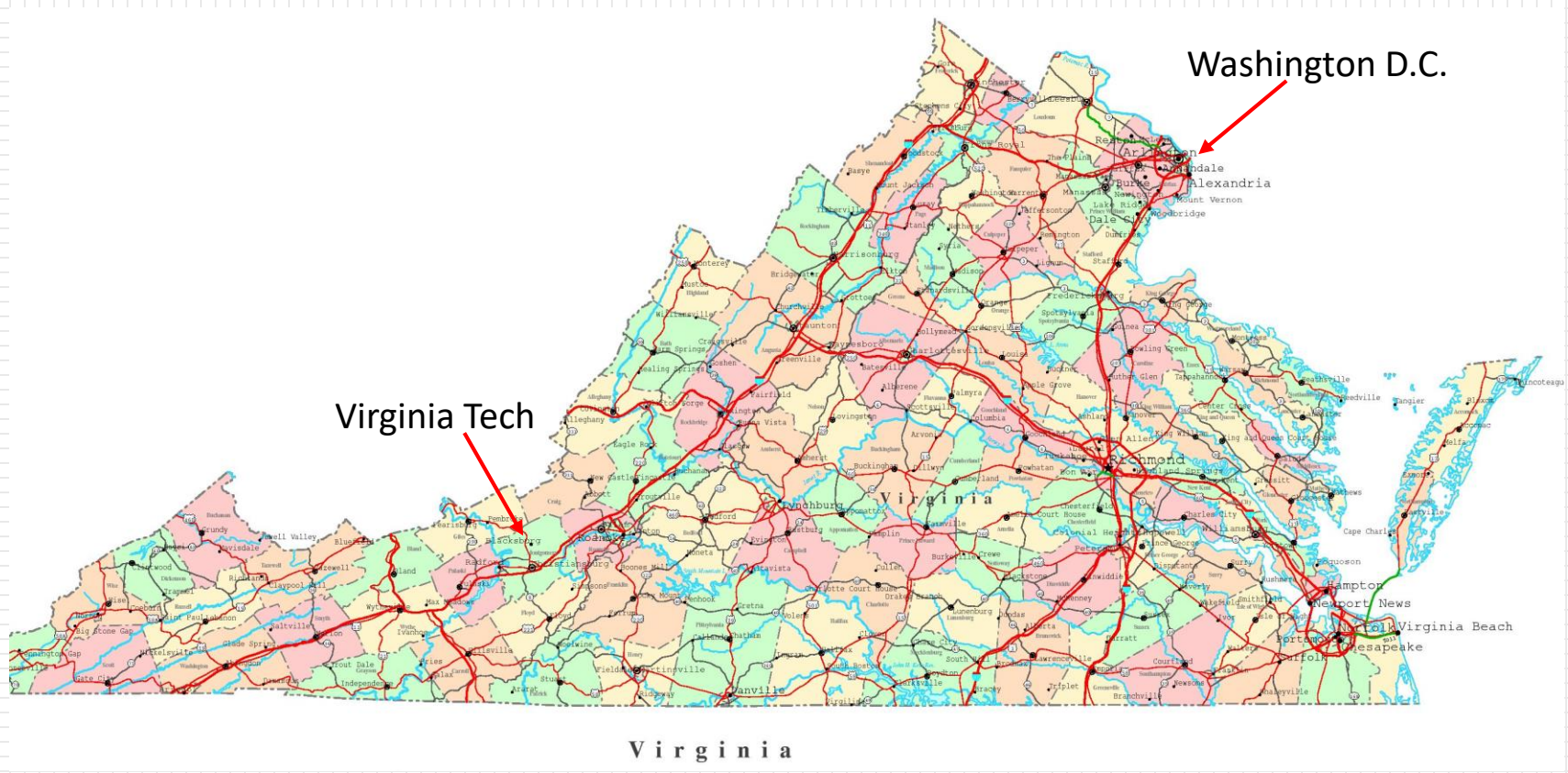# Enabling Innovation in Agricultural Sciences—a U.S. Land-Grant University Perspective

Prof. Tom Thompson
Associate Dean and Director-Global Programs
College of Agriculture and Life Sciences
Virginia Tech

National Research University, Higher School of Economics
Moscow
30 May 2019
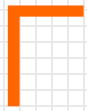
COLLEGE OF AGRICULTURE AND LIFE SCIENCES
GLOBAL PROGRAMS
VIRGINIA TECH.

Washington D.C.

Virginia Tech

Virginia

COLLEGE OF AGRICULTURE AND LIFE SCIENCES
GLOBAL PROGRAMS
VIRGINIA TECH.

Virginia Tech

COLLEGE OF AGRICULTURE AND LIFE SCIENCES
GLOBAL PROGRAMS
VIRGINIA TECH.

Virginia Tech

- A comprehensive U.S. Land-grant university

- 28,000 undergraduates, 6,000 post-graduate students, 1,500 academic staff

- Nine academic colleges, including a Veterinary School and Medical School

- Annually, Virginia Tech has been ranked among the top five to ten U.S. universities for research and development spending for agriculture and life sciences

VT

COLLEGE OF AGRICULTURE AND LIFE SCIENCES
GLOBAL PROGRAMS
VIRGINIA TECH.

College of Agriculture and Life Sciences (CALS)

- Nine academic departments

- More than 3,200 undergraduate students

- 600 post-graduate students

- Annual externally-funded research expenditures of 45-50 million USD

- Eleven Research and Extension Centers throughout Virginia

- Virginia Cooperative Extension has 108 local offices throughout Virginia

CALS Global

The mission of CALS Global is to build partnerships, create opportunities, and empower success, to serve globally.
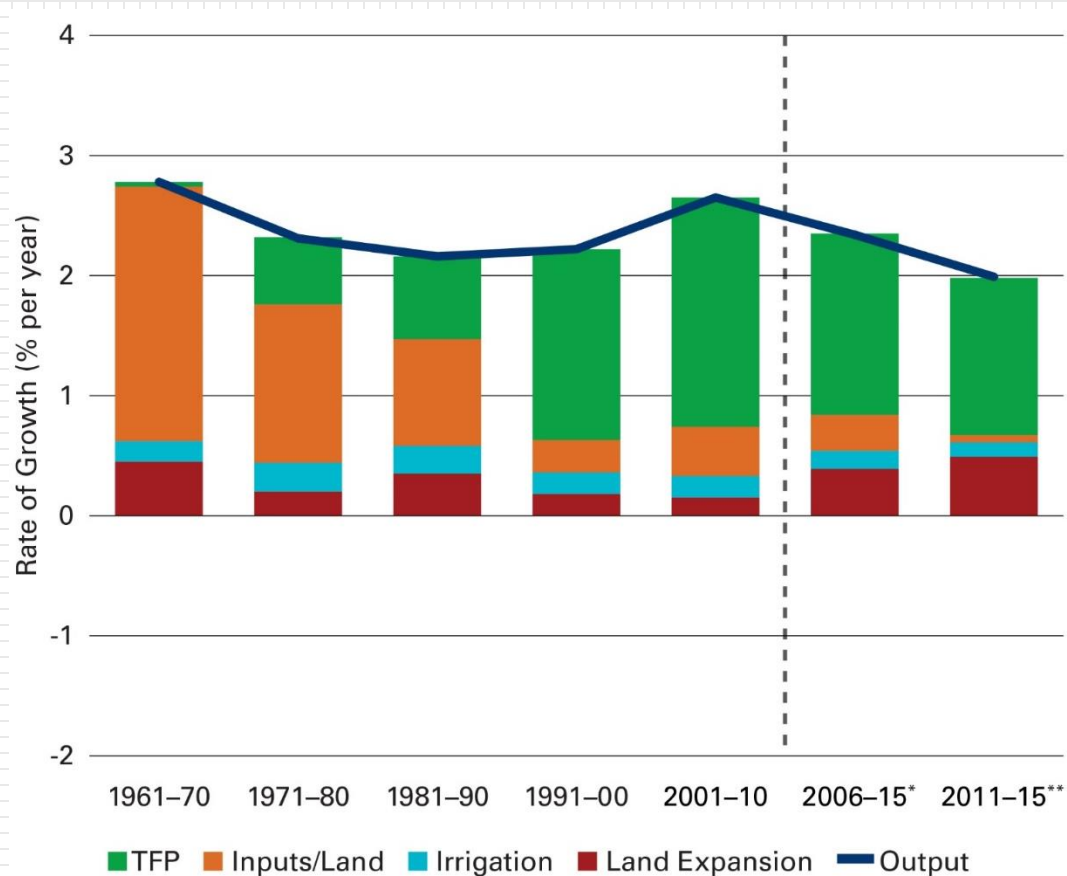
COLLEGE OF AGRICULTURE AND LIFE SCIENCES
GLOBAL PROGRAMS
VIRGINIA TECH.

GlobalAgriculturalProductivity.org

Sources of Growth in Global Ag Output 1961-2015

Rate of Growth (% per year)

Legend: TFP, Inputs/Land, Irrigation, Land Expansion, Output

Periods: 1961–70, 1971–80, 1981–90, 1991–00, 2001–10, 2006–15*, 2011–15**

*Depicts data for the most recent ten-year period.   **Depicts data for the most recent five-year period.
Source: USDA Economic Research Service (2018).

© 2018 Global Agricultural Productivity Report® (GAP Report®)

TOTAL FACTOR PRODUCTIVITY (TFP)
TFP INCREASES WHEN OUTPUTS RISE

GROSS CROPS

GROSS LIVESTOCK

WHILE INPUTS REMAIN CONSTANT

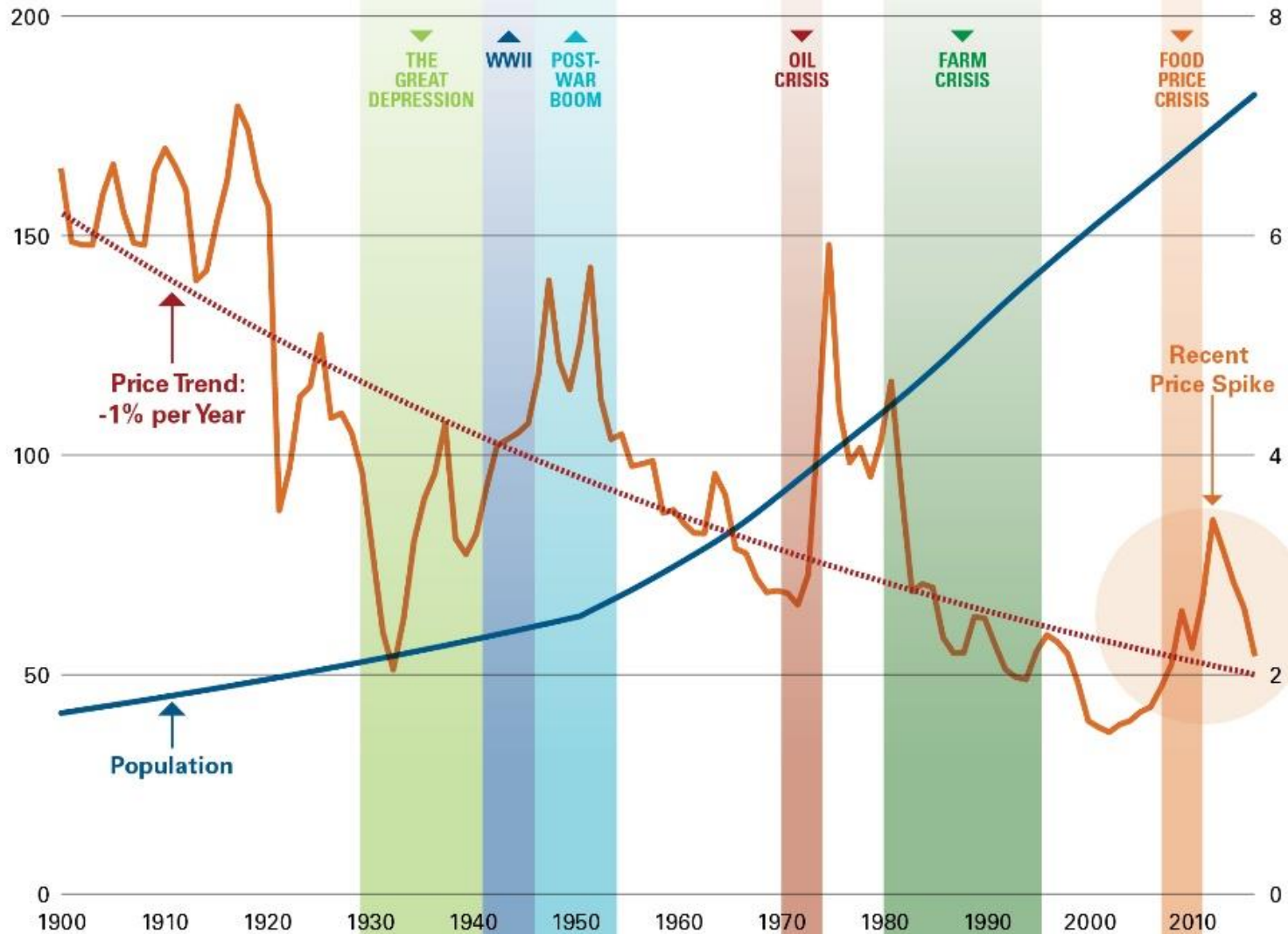LAND

LABOR

FERTILIZER

FEED

MACHINERY

LIVESTOCK

© 2018 Global Agricultural Productivity Report® (GAP Report®)

COLLEGE OF AGRICULTURE AND LIFE SCIENCES
GLOBAL PROGRAMS
VIRGINIA TECH.

Real Ag Price Index (1977–79=100) vs World Population (billions), 1900–2010. Annotations: THE GREAT DEPRESSION, WWII, POST-WAR BOOM, OIL CRISIS, FARM CRISIS, FOOD PRICE CRISIS. Price Trend: -1% per Year. Population. Recent Price Spike.
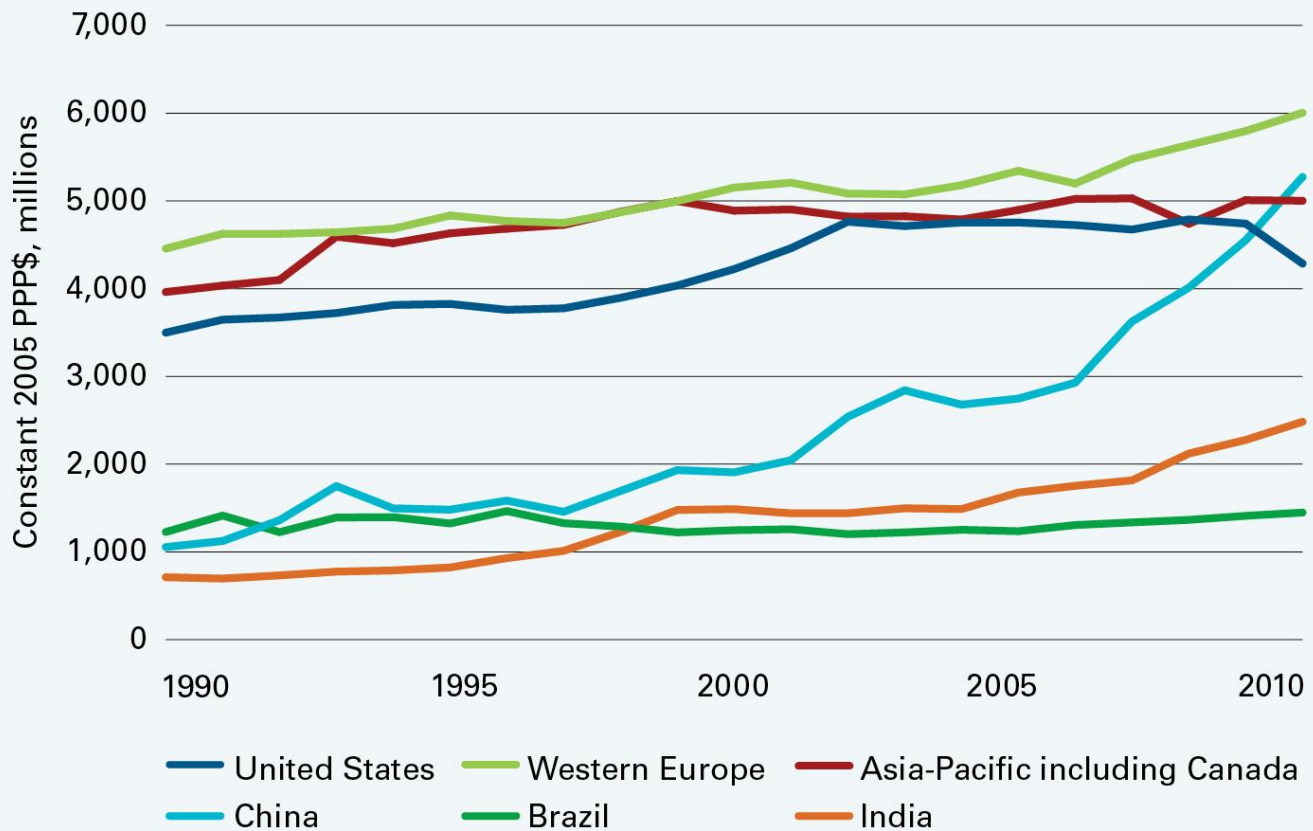
COLLEGE OF AGRICULTURE AND LIFE SCIENCES
GLOBAL PROGRAMS
VIRGINIA TECH.

National Ag R&D Expenditures 1990-2010

Figure 1.2: National Agricultural Research & Development (R&D)
Expenditures: 1990–2010

US Ag R&D Funding Sources (Public-Private) 1970-2012

Figure 16: U.S. Agricultural R&D Funding Sources, 1970–2012
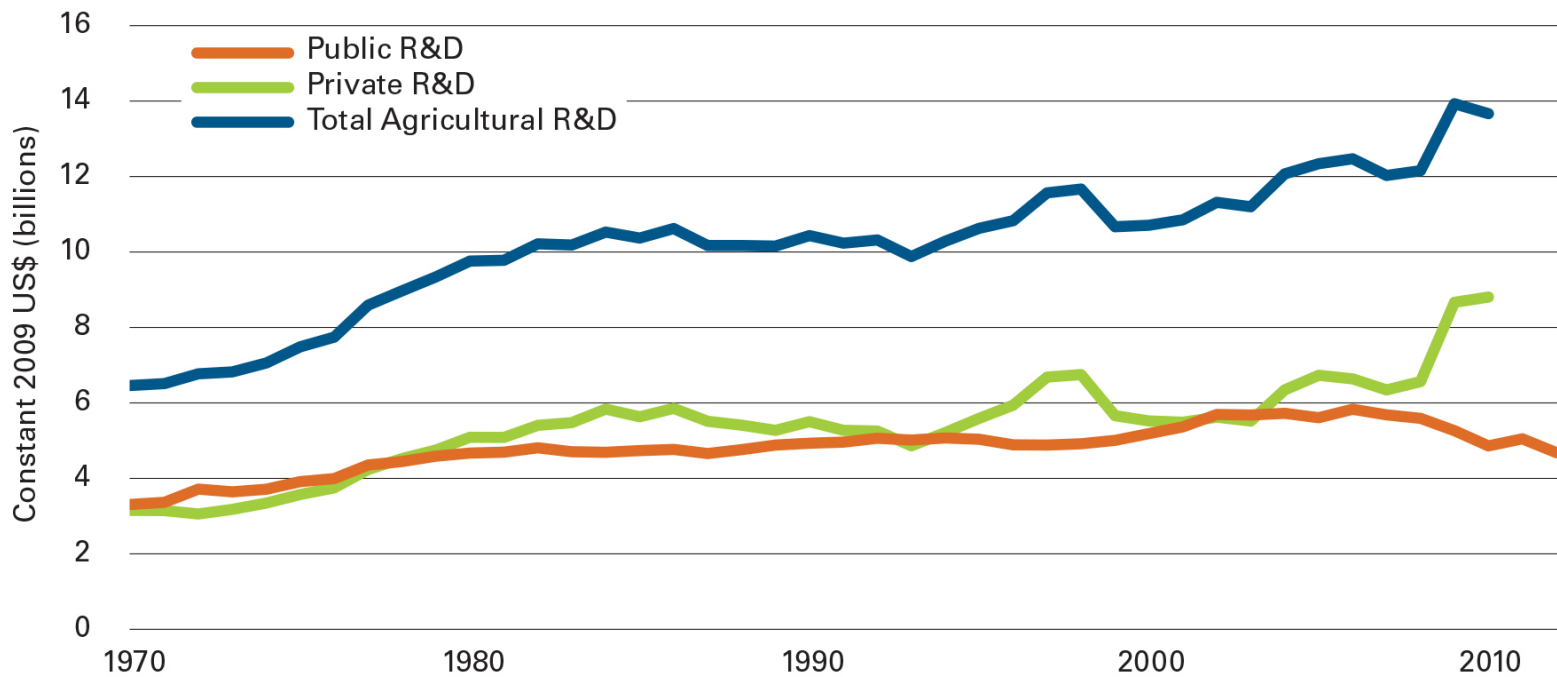
Note: Public sector data for 2010–12 are preliminary. Data from 2007–2009 revised from earlier series. Private sector data for 2008–10 are preliminary.

Source: USDA, ERS based on data from National Science Foundation, USDA's Current Research Information System (CRIS), and various private sector data sources. Data are adjusted for inflation by using an index for agricultural research spending developed by ERS. See the documentation for details.

Figure 17: Composition of U.S. Private Sector Agricultural Research, 1970 and 2010
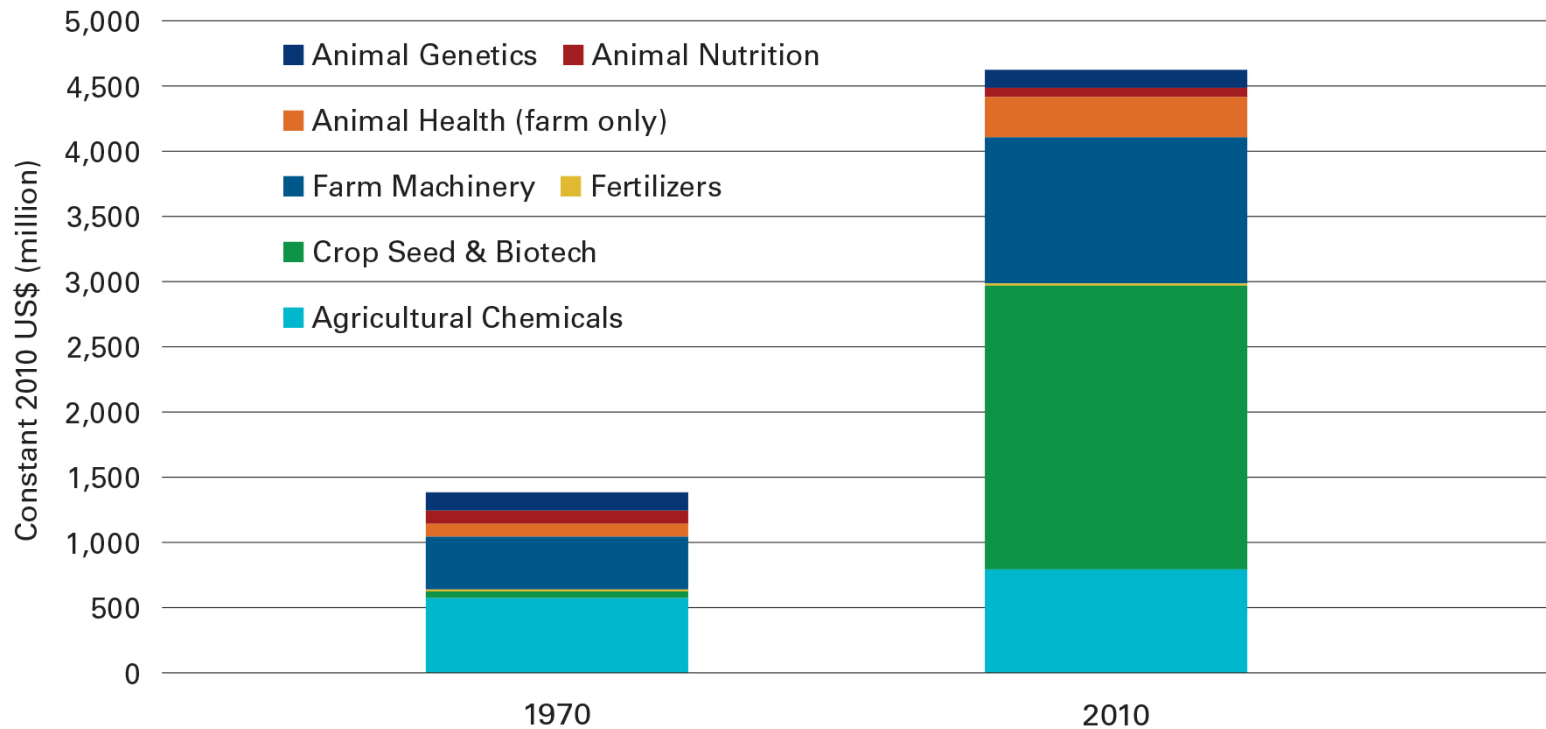
Legend:
- Animal Genetics
- Animal Nutrition
- Animal Health (farm only)
- Farm Machinery
- Fertilizers
- Crop Seed & Biotech
- Agricultural Chemicals

Y-axis: Constant 2010 US$ (million) — 0, 500, 1,000, 1,500, 2,000, 2,500, 3,000, 3,500, 4,000, 4,500, 5,000

X-axis: 1970, 2010

Productivity Growth in Russia 1994-2013
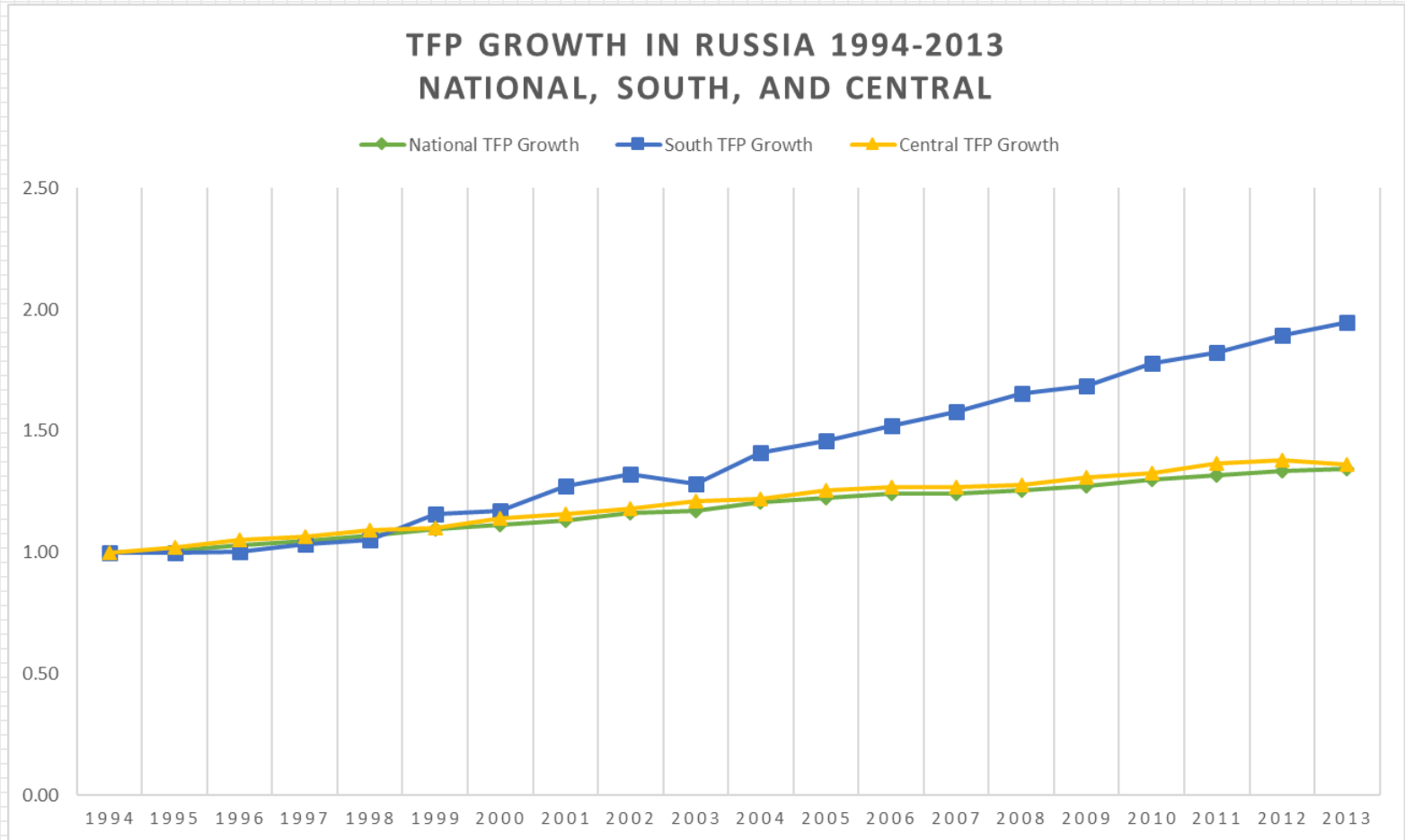
Adapted from Rada, N., Liefert, W., and Liefert, O. (forthcoming)
Evaluating Agricultural Productivity and Policy in Russia. Journal of Agricultural Economics.

Virginia Tech's Challenge

- Overall U.S. food and agricultural research spending growth is slowing, especially public funding

- This threatens the pace of public agricultural research innovation

- Private R&D funding has increased, but will this continue?

- Public research facilities are aging and in need of improvement

- How do we fully support emerging and future needs in commercial digital agriculture?

- Solutions?

COLLEGE OF AGRICULTURE AND LIFE SCIENCES
GLOBAL PROGRAMS
VIRGINIA TECH.

Our Solution

- Convene stakeholders from across our state and across industry segments.

Virginia Agriculture and Natural Resources Summit, 2018

- The purposes of the summit were:
  - to create a shared vision about how to further grow the No. 1 private industry in Virginia (agriculture), create jobs and develop a strong workforce
  - to identify opportunities and challenges
  - provide a setting for Virginia Tech to highlight outcomes and impacts of research and development at the university.
  - advocate for more state funding to upgrade infrastructure (facilities, technologies) on campus and at field research locations to attract talent and industry partners
- More than 100 leaders from agriculture, industry, commodity groups, state agencies and Virginia Tech attended

COLLEGE OF AGRICULTURE AND LIFE SCIENCES
GLOBAL PROGRAMS
VIRGINIA TECH.

Key Summit Recommendations

- Develop more public-private research and innovation partnerships

- Create a university-industry R&D consortium

- Hold periodic mini-summits to address emerging issues

- Design and deliver continuing educational programs to create technologically advanced workforce

- Develop and showcase cutting-edge technologies

- Fill gaps of Virginia Tech expertise in cutting-edge technologies

- Increase state investment in agricultural R&D

Virginia's Agency 229

- Virginia Agricultural Experiment Station and Virginia Cooperative Extension
  - College of Agriculture and Life Sciences
  - College of Natural Resources and Environment
  - Virginia-Maryland College of Veterinary Medicine

Virginia Tech

- A global land-grant university with a vast network of people and programs
- Blacksburg campus, Roanoke, and National Capital Region
- 11 Agricultural Research and Extension Centers (ARECs)
- 107 local Extension offices across Virginia

Economic development

- A new generation of leaders in agriculture and natural resources
- For every $1 invested by the state, Agency 229 generates an additional $1.68 for programs

Experiential learning

- A destination for students preparing to be future leaders
- Experiential learning and development of technical, critical-thinking, and problem-solving skills
- Internships that lead to careers
- Global opportunities
- Purpose-driven, "VT-shaped" students
- Destination Areas that cut across all sectors of science, business, and technology
- Entrepreneurship and innovation

Industry partnerships

- Agricultural and Natural Resources Innovation Summit
- A destination for industry collaboration with university researchers and educators
- Corporations
- Large and small producers
- Producer and commodity organizations
- Government agencies

Discovery and innovation

- Translational research that fuels economic growth
- Ranked No. 7 in research expenditures for agricultural sciences by NSF
- In the past five years there have been 111 invention disclosures, 42 license and option agreements, 212 patent applications, 131 patents and certificates issued, and three start-up companies created

Virginia **ANR** Initiative

VT COLLEGE OF AGRICULTURE AND LIFE SCIENCES **GLOBAL PROGRAMS** VIRGINIA TECH.

SmartFarm
Innovation
Network

SmartFarm Innovation Network

- Very broad in concept, including plants, animals and environment; Basic and applied research
  - Precision (animal and plant) agriculture
  - Continuous monitoring and diagnosis of plant and animal production systems (temperature, moisture, diseases, etc.)
  - Technologies such as drones, autonomous vehicles, variable irrigation systems, vertical agriculture
  - Precision feeding of animals, protection and management decisions
  - "Big data" management and analytics
  - More…

COLLEGE OF AGRICULTURE AND LIFE SCIENCES
GLOBAL PROGRAMS
VIRGINIA TECH.

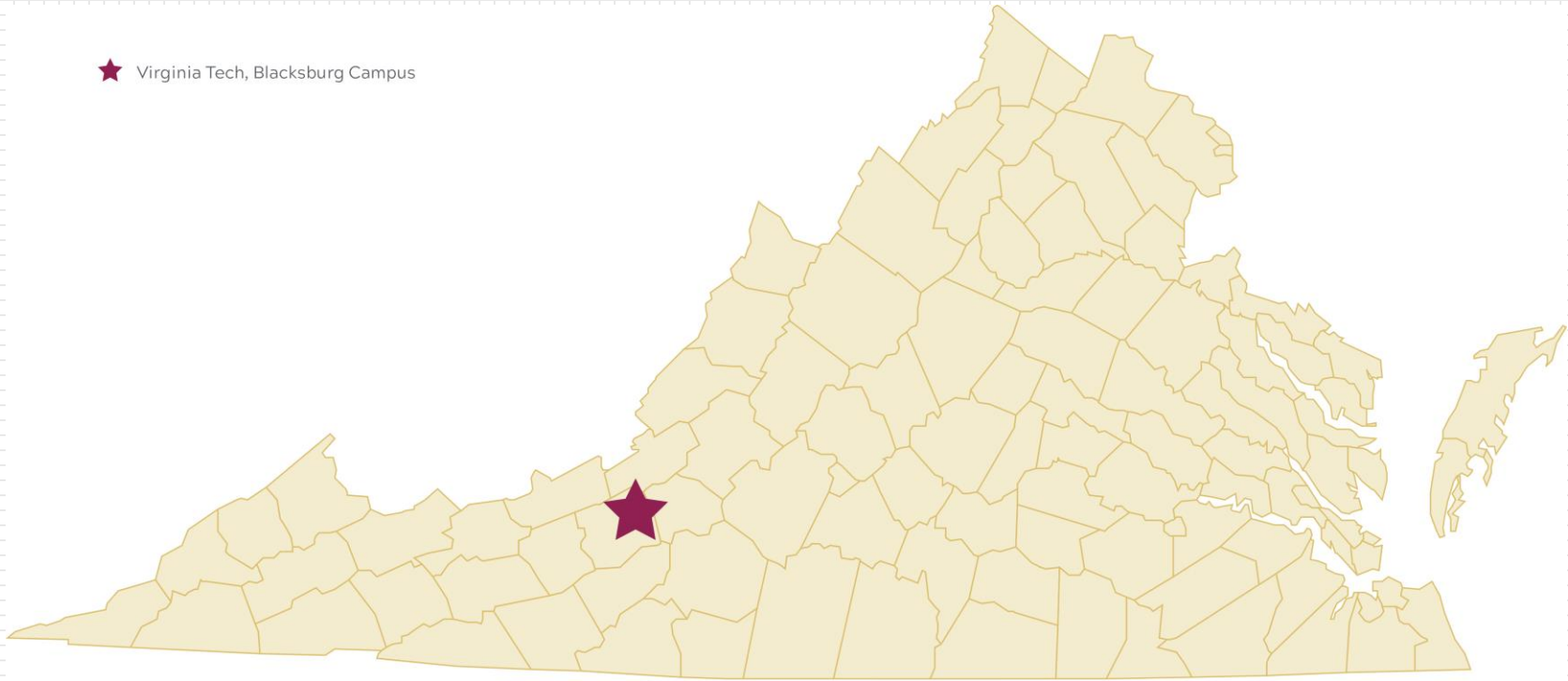# *Some new faculty to be hired soon…*

- Autonomous systems
- Animal biosensors
- Image-based digital phenotyping
- Agricultural data analytics
- Analytics of animal genetics
- Digital international trade
- Smart food packaging
- More…

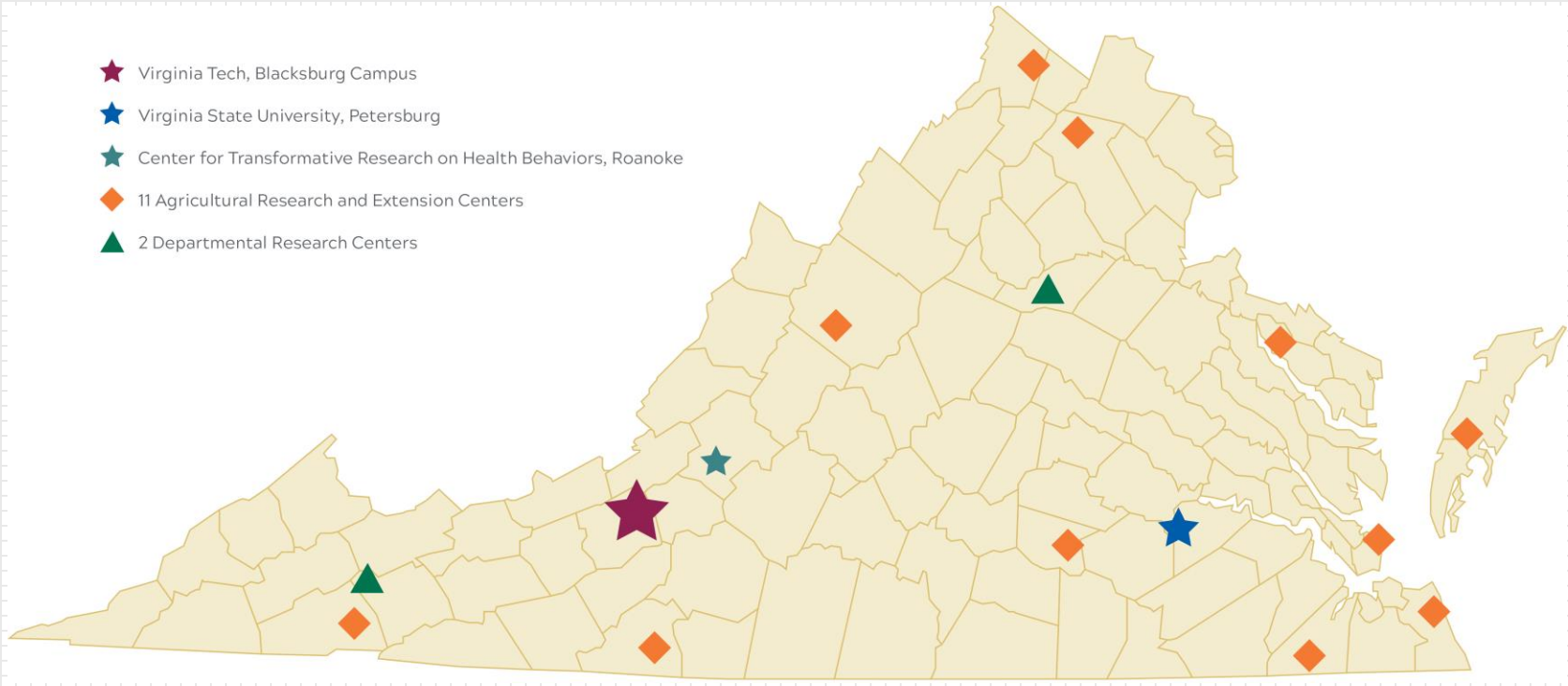COLLEGE OF AGRICULTURE AND LIFE SCIENCES
GLOBAL PROGRAMS
VIRGINIA TECH.

Impacts in Virginia – and around the world

Virginia Tech, Blacksburg Campus

COLLEGE OF AGRICULTURE AND LIFE SCIENCES
GLOBAL PROGRAMS
VIRGINIA TECH.

Impacts in Virginia – and around the world

★ Virginia Tech, Blacksburg Campus

★ Virginia State University, Petersburg

★ Center for Transformative Research on Health Behaviors, Roanoke

◆ 11 Agricultural Research and Extension Centers

▲ 2 Departmental Research Centers

COLLEGE OF AGRICULTURE AND LIFE SCIENCES
GLOBAL PROGRAMS
VIRGINIA TECH.

Impacts in Virginia – and around the world

Virginia Tech, Blacksburg Campus

Virginia State University, Petersburg

Center for Transformative Research on Health Behaviors, Roanoke

11 Agricultural Research and Extension Centers

2 Departmental Research Centers

6 4-H Educational Centers
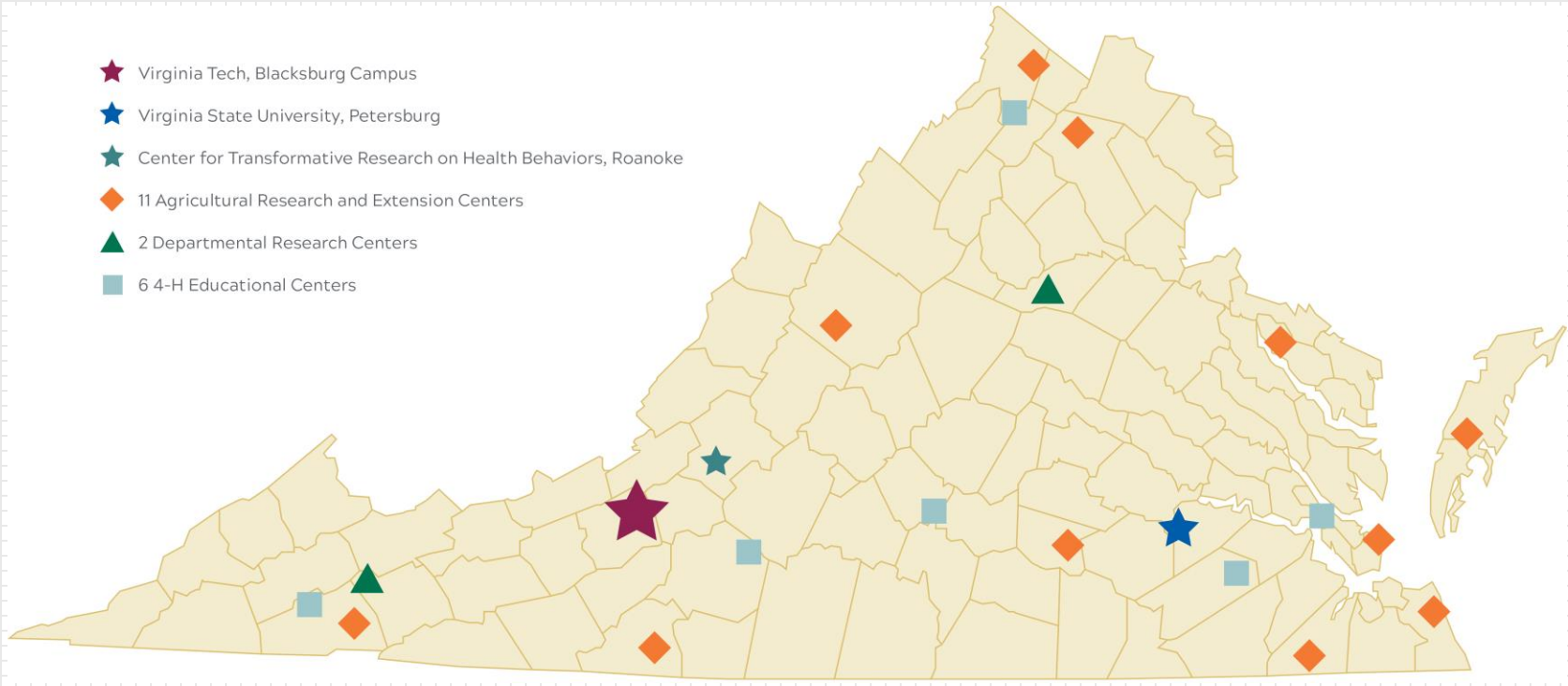
COLLEGE OF AGRICULTURE AND LIFE SCIENCES
GLOBAL PROGRAMS
VIRGINIA TECH.

Impacts in Virginia – and around the world

- ★ Virginia Tech, Blacksburg Campus
- ★ Virginia State University, Petersburg
- ★ Center for Transformative Research on Health Behaviors, Roanoke
- ◆ 11 Agricultural Research and Extension Centers
- ▲ 2 Departmental Research Centers
- ■ 6 4-H Educational Centers
- ● 108 Local Extension Offices

COLLEGE OF AGRICULTURE AND LIFE SCIENCES
GLOBAL PROGRAMS
VIRGINIA TECH.

SmartFarm Innovation Network

Building a network of interconnected
technology centers to spark a new economy

Virginia Tech
ARECs
Extension offices
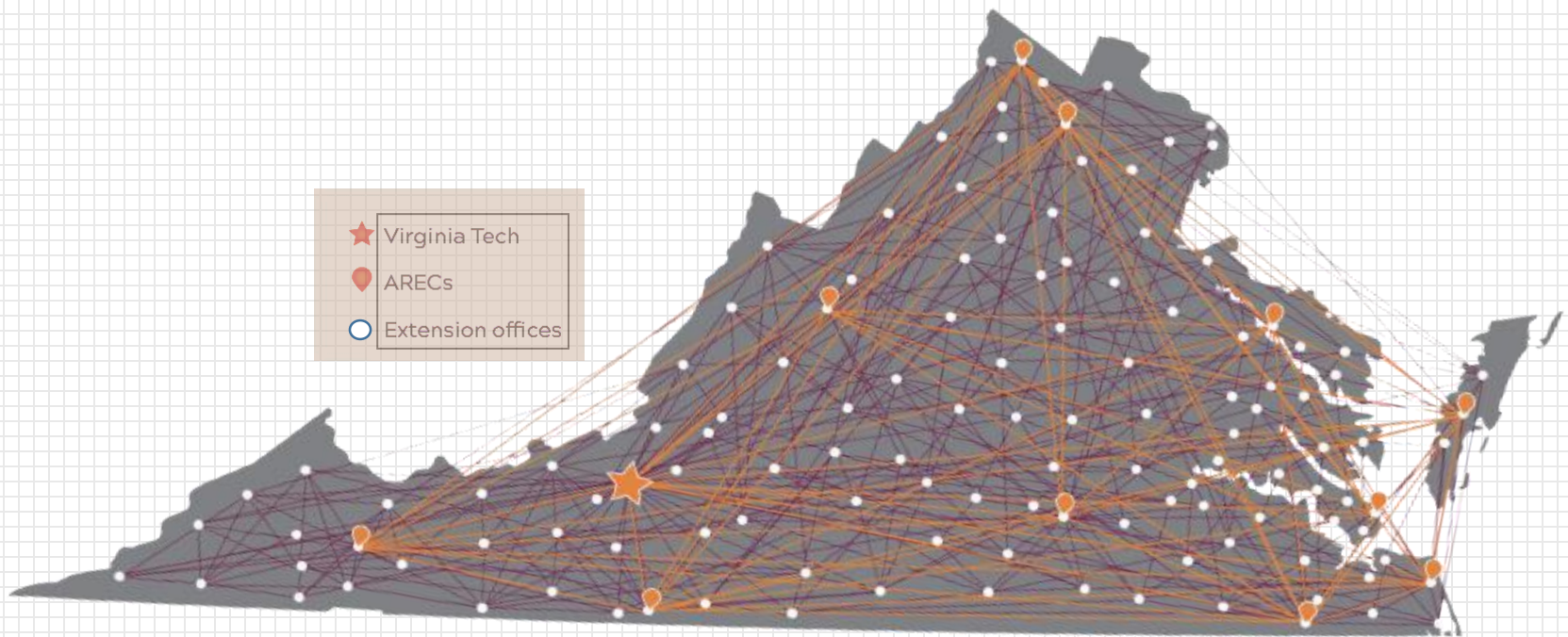
Спасибо!

Tom Thompson

tlthomps@vt.edu

COLLEGE OF AGRICULTURE AND LIFE SCIENCES
GLOBAL PROGRAMS
VIRGINIA TECH.