

Long-term Sustainability of Research Capacity Developed through EPSCoR: Lessons from EPSCoR Evaluations

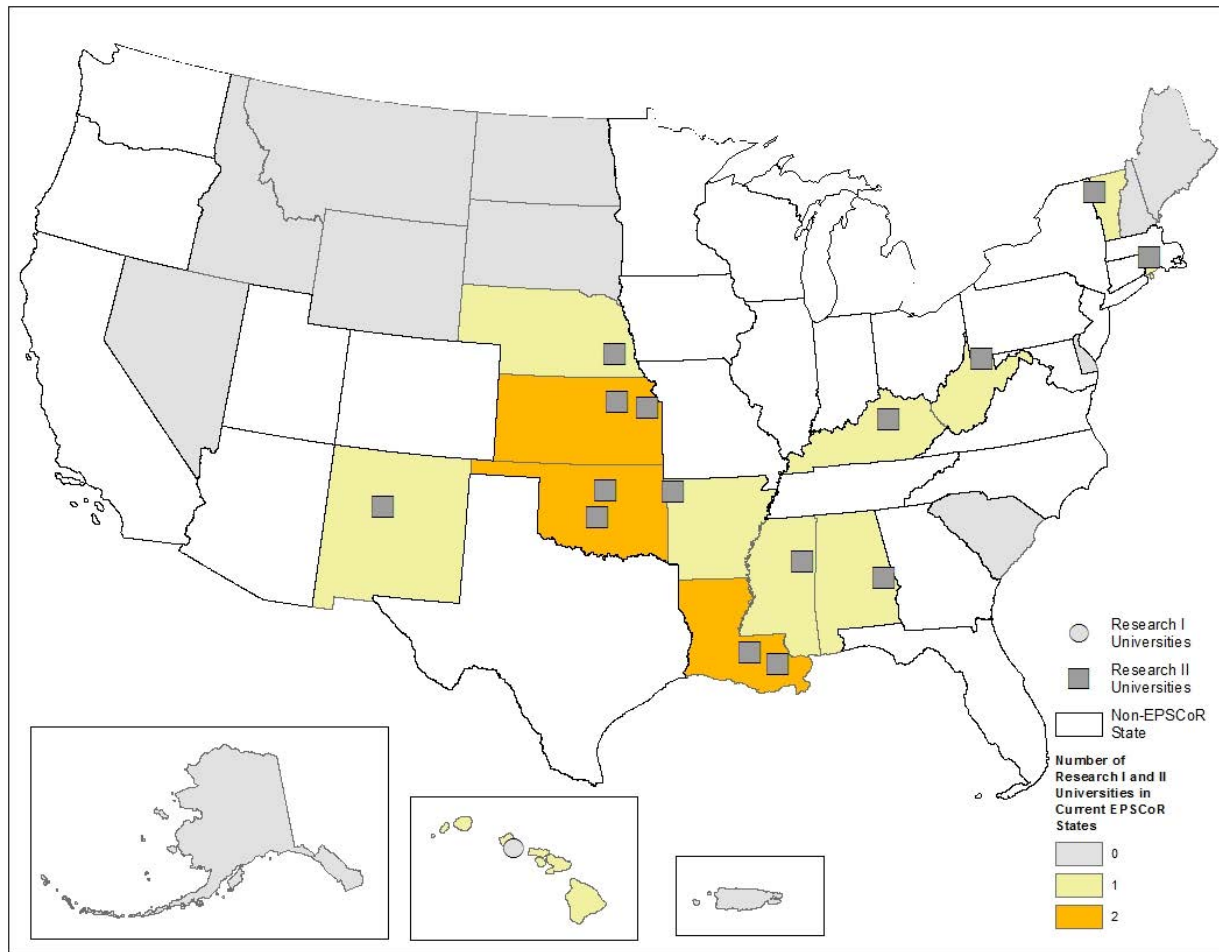
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STPI's Evaluation of the EPSCoR Program

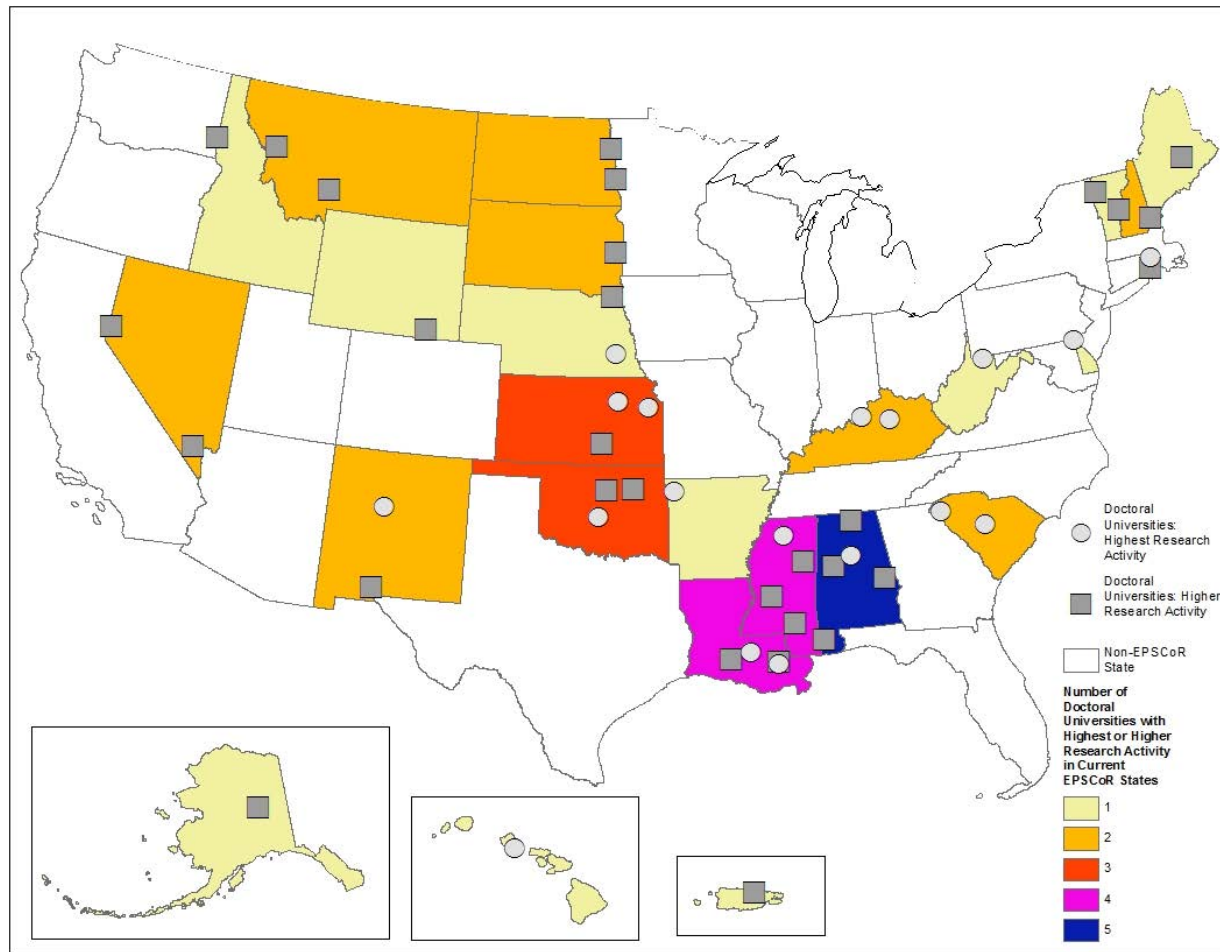
- In 2011, the National Science Foundation (NSF) asked the IDA Science and Technology Policy Institute (STPI) to conduct an evaluation of the NSF EPSCoR program, with the objective of performing an in-depth, life-of-program assessment of NSF EPSCoR activities and of the outputs and outcomes of these activities
- Final report was released December 2014 (<https://www.ida.org/idamedia/Corporate/Files/Publications/STPIPubs/2015/P-5221.ashx>)
- Evaluation serves as the source for today's talk

A Retrospective on Sustainability

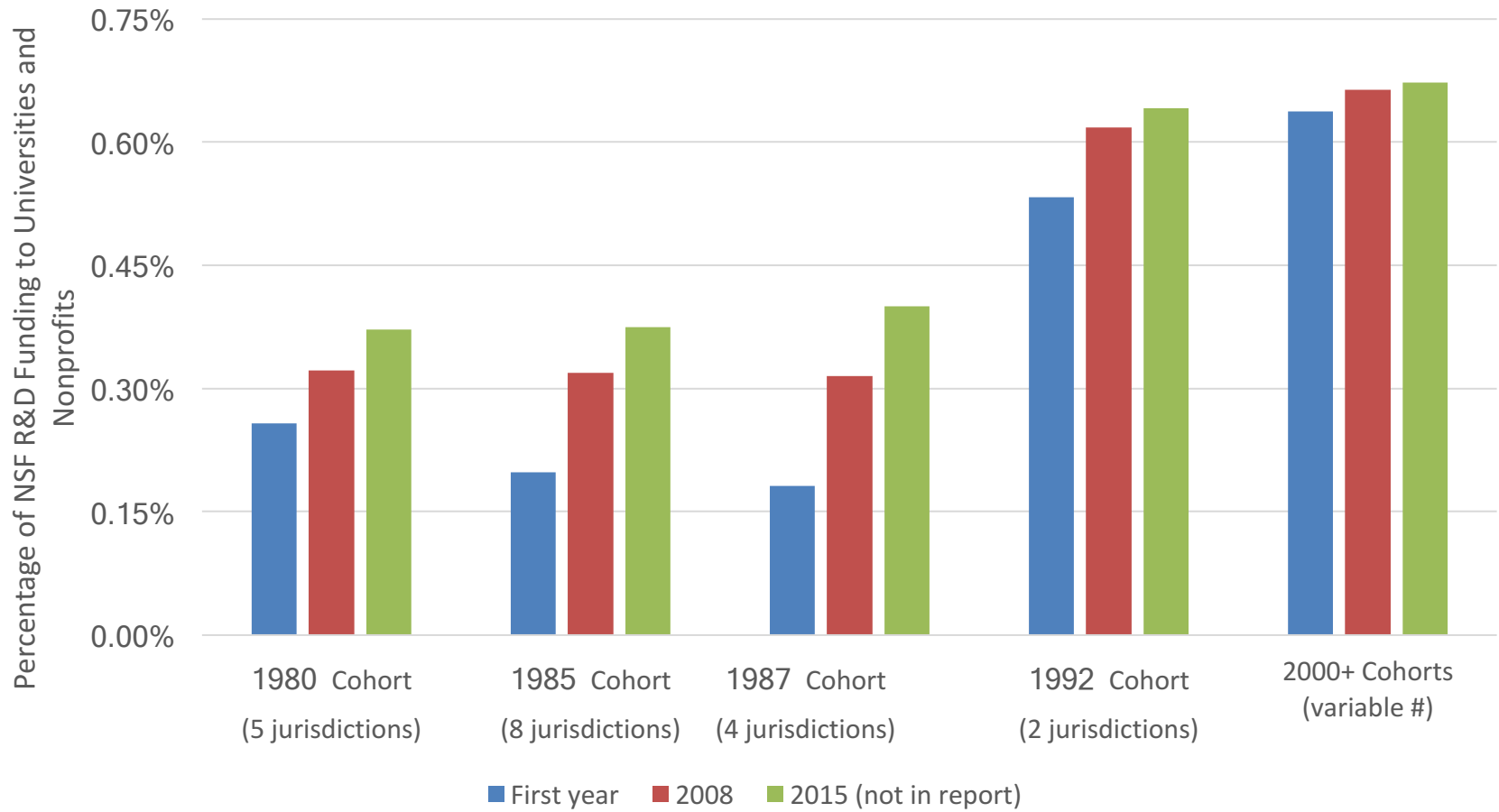


As of the beginning of EPSCoR, 15 Research Two and 1 Research One Universities in 13 current EPSCoR jurisdictions

A Retrospective on Sustainability



NSF R&D Funding to Colleges, Universities, and Nonprofit Institutions, by EPSCoR Cohort, Change Between Initial Year of Eligibility, 2008, and 2015



Source: Data from NSF Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions.

Note: Comparison for the 2000+ cohorts is to the funding level in 2000 regardless of exact year of entry.

EPSCoR's Historical Role in Promoting Institutional Support for Research

Jurisdiction	Faculty Salary/ Startup Funds Hiring Policy	Faculty Release Time/ Research Incentives	Faculty Tenure and Promotion Policy	Technology Transfer Offices and Policy	Graduate Student Support	Indirect Cost Policy	New/Expanded Research Support Offices
1980 Cohort							
Arkansas	✓	✓		✓			✓
Maine	✓			✓			✓
Montana		✓		✓			✓
South Carolina		✓			✓		✓
West Virginia	✓	✓	✓	✓			✓
1985 Cohort							
Alabama							
Kentucky						✓	✓
Nevada				✓			
North Dakota							✓
Oklahoma							
Puerto Rico	✓	✓	✓	✓		✓	✓
Vermont		✓		✓			✓
Wyoming	✓			✓		✓	✓
1987 Cohort							
Idaho		✓	✓	✓	✓		✓
Louisiana				✓			
Mississippi	✓	✓		✓			✓
South Dakota	✓	✓	✓	✓	✓		✓
1992 Cohort							
Kansas							✓
Nebraska				✓			
Later Cohorts							
Alaska		✓			✓	✓	✓
Delaware				✓			
Hawaii	✓	✓				✓	✓
New Hampshire							✓
New Mexico		✓					✓
Rhode Island		✓		✓	✓		✓
U.S. Virgin Islands		✓				✓	✓

- EPSCoR jurisdictions attributed EPSCoR support for institutional policy changes related to research
- 19 jurisdictions have also built institutional capabilities at master's-level and baccalaureate institutions.

Potential Definitions of “Sustainable” Research Capacity Currently Relevant

- EPSCoR Role in Hiring Faculty
- Support for Research Centers/Large-Scale Research Projects
- Training/Supporting the Next Generation of Scholars

EPSCOR ROLE IN HIRING FACULTY

Overall Findings from Evaluation

- Hiring faculty has been an effective EPSCoR strategy.
- Self-reporting through EPSCoR annual progress reports and data calls identified 1,346 tenure-track faculty members hired in whole or in part using RII funds.
- As of summer 2013, 78% remain on faculty at a university in the original jurisdiction, including more than 60% of those hired during the 1980s and 1990s.
- Faculty hired with EPSCoR support have had more than their “pro-rata” effect on NSF funding in their jurisdictions.
- Although representing only 4%–6% of S&E faculty in the 1980, 1985, and 1987 cohort jurisdictions, the percentage of NSF funds awarded to EPSCoR-hired investigators over the last decade has exceeded 10% and sometimes has approached 15% for the 1980 and 1987 cohorts, while the percentage is 5%–10% for the 1985 cohort.

Example: Mark Young, Montana State University

- Hired by Montana State University with support from EPSCoR during 1993 award iteration (9350546).
- PI on NSF awards in 1997 (9723752) and 2001 (0132156)
 - MSU forms Thermal Biology Institute in 1999
 - 2001 award is Microbial Observatories: Viruses from Yellowstone Thermal Acidic Environments
 - First NIH award as PI in 2001
- Co-PI on 2003 EPSCoR RII award; PII on 2007 and 2011 EPSCoR RII awards
- Continuing NSF, NIH support throughout career



Tracking Impact of Faculty Hiring

- Keep cumulative list of all faculty hired, including their current institution and title to track retention/sustainability
 - Benefits from differentiating providing full support for hiring/startup package and partial support (if relevant)
 - Benefits from social media searches (e.g., Google Alerts, LinkedIn)
- Keep record of how faculty names appear in NSF, other Federal agency databases to make links with downstream funding



SUPPORT FOR RESEARCH CENTERS/LARGE-SCALE RESEARCH PROJECTS

Overall Findings from Evaluation

- Of the 11 NSF center awards (e.g., STCs, ERCs, and MRSECs) to jurisdictions in the 1980 to 1992 cohorts, 10 were attributed by EPSCoR awardees, at least in part, to EPSCoR, including all 3 STCs, 3 of the 4 ERCs, and all 5 of the MRSECs.
- EPSCoR helped to create 66 research centers that are still in existence, 38 of which have existed for at least 10 years, and either created or upgraded 83 laboratory facilities that are still operational today.

Example: Industrial Mathematics Institute at the University of South Carolina

- 1992 SC EPSCOR RII (9108772) includes funding to launch eight research clusters, of which five were sustained for 10+ years
- One (Industrial Mathematics Initiative) leads not only to follow-on NSF funding but also DoD funding
 - Ronald DeVore of IMI PI on eight DoD EPSCoR awards (most of any investigator) as well as DoD MURI award (2007)
 - IMI DEPSCoR-supported wavelet compression research incorporated into DoD applications

Source: STPI NSF EPSCoR evaluation; Assessment of the Defense Experimental Program To Stimulate Competitive Research (DEPSCoR): Final Report, IDA-D-3649, October 2008.

Tracking Impact of Support for Research Centers/Large-Scale Research Projects

- Because research centers and large-scale research projects evolve over time, tracking EPSCoR impact is facilitated by detailed historical record-keeping:
 - “During the mid-1980s, Drs. Colin Bennett, Ronald A. DeVore, and Robert Sharpley, Department of Mathematics, University of South Carolina, recognized that their research had great potential for application to industrial problems.... This was the inception of the Industrial Mathematics Initiative (IMI)....
 - ***A major impetus to the IMI came through a National Science Foundation EPSCoR grant*** awarded to the Department of Mathematics in 1992.... This award, which launched the Industrial Mathematics Initiative, ***was the first in a series of large grants obtained by the Department***, and supported the creation of five positions in applied mathematics to address mathematical research directed at industrial problems.”

It is much easier to identify EPSCoR impact if a center’s history acknowledges EPSCoR directly



TRAINING/SUPPORTING THE NEXT GENERATION OF SCHOLARS

Overall Findings from Evaluation

- EPSCoR has supported the creation of 123 degree programs (including 64 PhD programs, largely at public universities), 6 departments, and 2 schools
- 186 academic courses were developed based on EPSCoR activities
- 5,874 graduate students and 964 postdoctoral researchers were identified as being supported by EPSCoR
- All RII Track-1 awards from 1997 onward have included an undergraduate research program

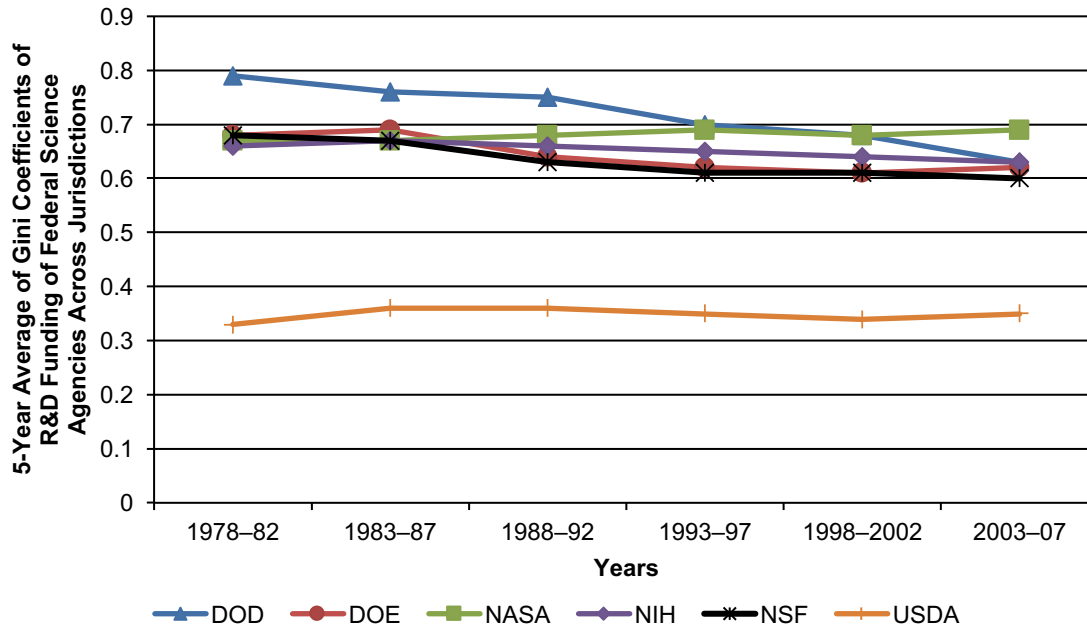
Tracking Educational Impacts Is More Complex than Tracking Faculty

- Similar number of postdocs, and many more graduate students/undergraduates
 - Postdocs and students likely to be more mobile than faculty
 - Could try same strategy (database plus follow-up/alerts) but will require more effort to achieve results
- For jurisdictions with small number of research universities, might be able to track percentage of participating undergraduates who go on to complete STEM degrees
- Another strategy might be to use national data for benchmarking:
 - Department of Education IPEDS data (<https://nces.ed.gov/ipeds/Home/ReportYourData>) to compute ratio of participating EPSCoR undergraduates/graduate students to total number of STEM graduates in jurisdiction
 - NSF Science and Engineering State Profiles (<https://www.nsf.gov/statistics/states/interactive/show.cfm>) incorporates data that also might be useful for benchmarking



CONSIDERING LONG-TERM SUSTAINABILITY

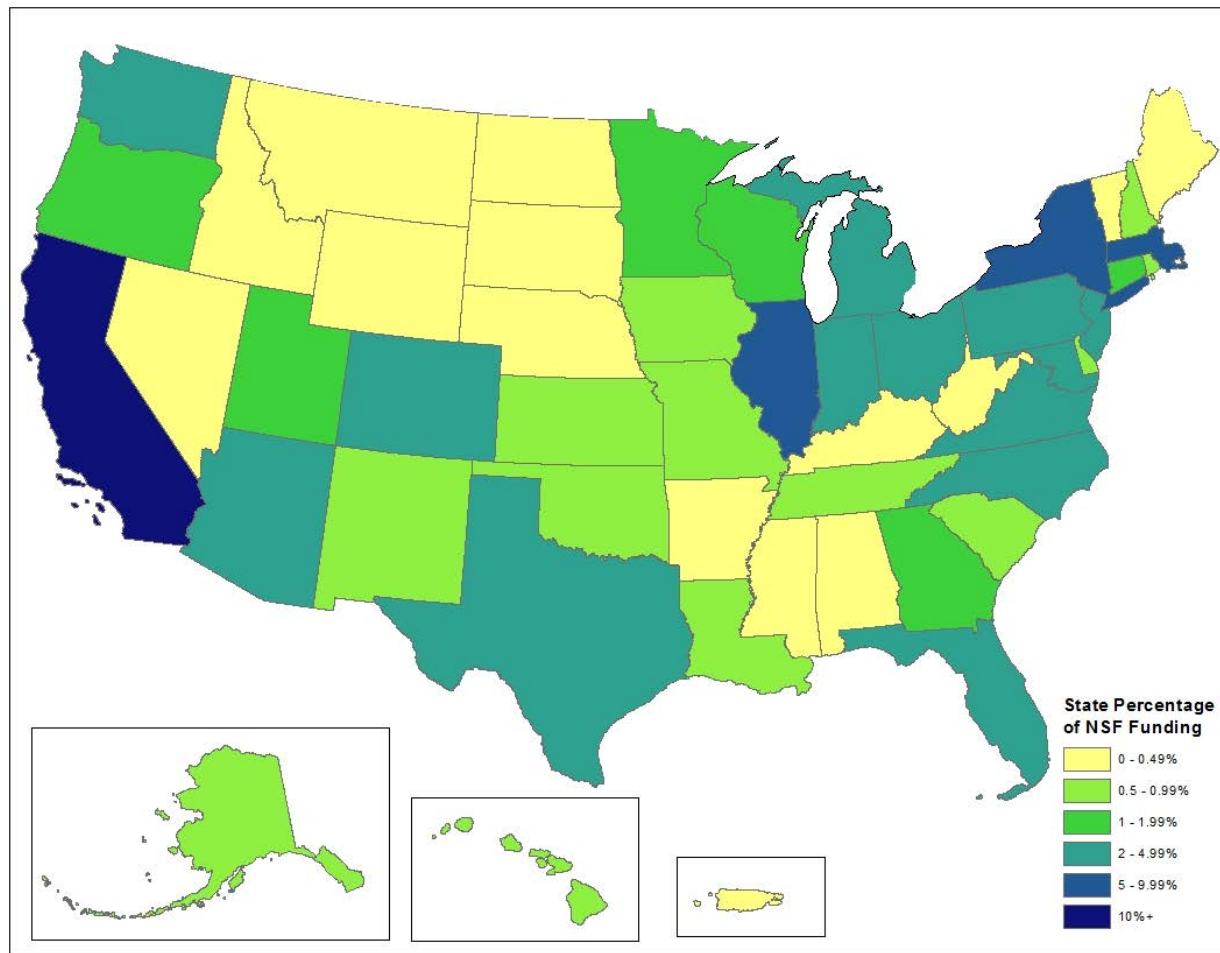
Findings from Evaluation



Gini coefficients are used to measure inequality (generally income inequality)

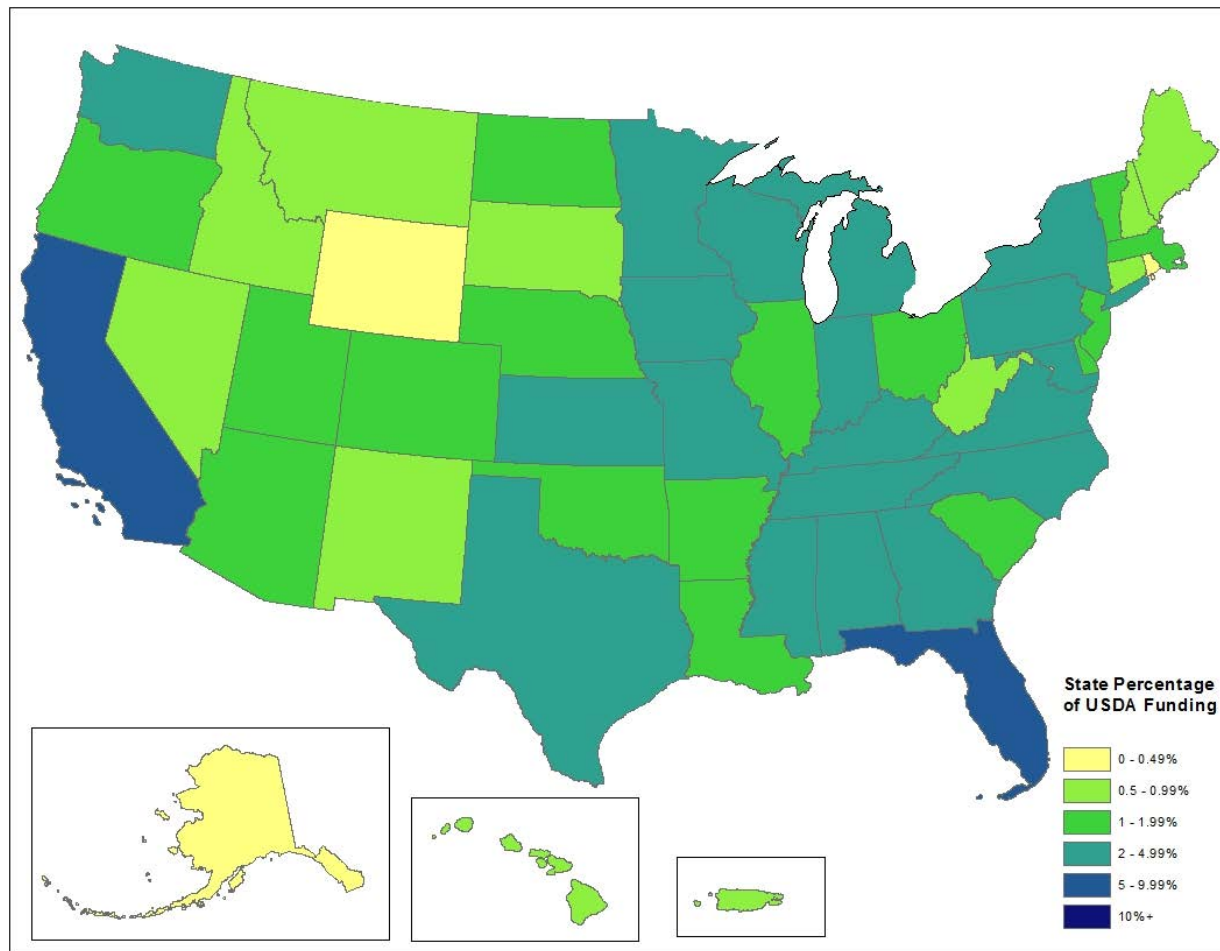
Used R&D funding to universities and colleges from 1978 to 2007 across U.S. States, the District of Columbia, and Puerto Rico to calculate Gini coefficients. Concentration of NSF R&D funding decreased by approximately 10% (from a Gini coefficient of 0.68 to 0.60) between 1978 and 2007. USDA R&D funding is much less concentrated.

Another Way to Visualize Concentration of Research Funding



- Current concentration of NSF R&RA funding (2017 EPSCoR eligibility)
- IL, MA, NY > 5%; CA > 10%

Another Way to Visualize Concentration of Research Funding



- More even distribution of USDA funding to universities (2015)
- 12 of 25 current NSF EPSCoR jurisdictions above 1% of USDA funding
- 2 non-NSF EPSCoR jurisdictions below 1% (DC, CT)
- No jurisdictions above 10%

Source: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Federal Funds for Research and Development, FYs 2015–17. Table 104

Why Might USDA Research Concentration Be Different?

- Funding for agricultural experiment stations begins in 1887
 - Under direction of land-grant universities
 - For first 50 years funding distributed to states unweighted
 - Formula funding 1930s-1970s varies, including by total population, by farm/rural population, unweighted
 - USDA does not implement competitive grants programs until 1977
 - Formula funds often used by smaller states to support research into locally-relevant agricultural problems relative to research with national appeal
- Evidence that formula-based funding at least as strong contributor to agricultural productivity as competitive grant-based funding

Wallace E. Huffman and Robert E. Evenson, "Do Formula or Competitive Grant Funds Have Greater Impacts on State Agricultural Productivity?" *Amer. J. Agr. Econ.* 88(4) (November 2006): 783–798

Implications for NSF EPSCoR

- EPSCoR-like programs serve to embed research into mission of states' universities
- Building research capacity takes time – 40 years of EPSCoR versus 130 years of USDA agricultural extension research funding
- EPSCoR-like programs as complement to, rather than replacement for, other forms of funding