

The Federal Brain Drain

Impacts on Science Capacity, 2016–2020

Appendix: Methodology

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Data Collection

We began the project by identifying science-based agencies that would likely employ staff with scientific and/or specialized technical expertise. From a search for these types of agencies, we identified and compiled a list of 26 federal government agencies that fit these criteria. We then requested from these agencies—via the Freedom of Information Act (FOIA)—total staff records and attrition, by fiscal year and quarter, job series, position title, federal grade or level, appointment type, and programmatic or regional office. Many of these FOIA requests have not yet been completed; we intend to update these analyses as new data are received. Raw data received on staff numbers and attrition are available upon request.

The results we have received vary, depending on agency records and processes. Some agencies narrowed the date range of our search (e.g., EPA); expedited the process by omitting FOIA-exempt job series, like police officers (e.g., NASA); or sent us data organized by pay period instead of quarter (USGS). These variations mean that, for each agency, our data analyses differed slightly.

Once we received total staffing data, we identified individuals considered to be “scientific experts” from the full agency staffing lists we received. To do so, we used the Office of Personnel Management (OPM) Handbook of Occupational Groups and Series. We considered positions to be “scientific” if they belonged to a job series that involves some scientific training or expertise, including but not limited to research, operations, modeling, inspection and oversight, and science policy. The OPM series have an affiliated four-digit OPM series code and series name (e.g., John Doe, a chemist, belongs to OPM Series 1320: Chemistry Series) that allowed us to assign a corresponding series to each staff listing ([see here for an example](#)). We identified 197 series from the OPM handbook that we thought could include “scientific experts” (see table at end).

Data Analyses

The data we received were organized either by fiscal year (FY) and either FY quarter or, in the case of EPA and USGS, federal pay period. We consolidated these data, which were usually spread across worksheets, and then used formulas in Excel to filter out those staff entries that met our definition of “scientific experts.” These filtered data were the core of our analyses (see [table for a sample](#)).

Sample of Staffing Data Received

F	G	H	I	J	K	L	M	O	P	Q	R	S
Name Whole	Pay Plan	Occupational Series	Grade	Step or Rate	Position Title Opm	Type Of Appointment	Location	Year	Quarter	Occupation Name	CODE	Sci Staff?
BOUDREAU, LAWRENCE	GS	1350	13	08	GEOLOGIST	CAREER (COM	JEFFERSON, LOU	12	Q1	Geology	1350	Y
JOHNSON, PETER P.	GS	1313	12	10	GEOPHYSICIST	CAREER (COM	ANCHORAGE, AL	12	Q1	Geophysics	1313	Y
ANDERSON, JAMES G.	GS	560	15	10	BUDGET OFFICER	CAREER (COM	WASHINGTON, I	12	Q1	Budget Analysis	560	N

Data sample from BOEM records received from our FOIA request (several columns omitted for concision). Headers in blue indicate raw data we received; headers in orange indicate our added formulas and filters. Note the OPM occupational series title in column Q, the OPM occupation series code in column R, and our scientist/non-scientist filter in column S.

We were able to calculate quarterly averages for most agencies, but not all: The data received from USGS and FWS, for example, included one pay period of each FY quarter only. As a result, these pay periods were deemed representative of each FY quarter for these agencies. Additionally, we have not yet received data from some quarters. For FWS, we have only received data for the first quarter of 2018 so far; thus, the “average” reflects only the first quarter (but will be updated as new data are received).

We used pivot tables to analyze trends in staffing by FYs and quarters, job grades, OPM job series, agency office, and other metrics. To generate annual averages, the four quarters of each FY were averaged, and the resulting numbers were used to calculate both change in raw numbers and percent change from 2016 to 2020—for example, the percent change, from 2016 to 2020, of the number of EPA scientists in each regional office (2016 annual average subtracted from the 2020 annual average, then divided by the 2016 annual average). To compare staffing across agencies, we calculated percent change between 2016 and each consecutive year.

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White-Collar OPM Jobs that Employ Scientific Experts

Note: We considered positions “scientific” if they belonged to a job series that involves some scientific training or expertise, including but not limited to research, operations, modeling, inspection and oversight, and science policy. Blue-collar OPM jobs have been omitted.

Occupation Name	OPM Code
Miscellaneous Occupations Group	000
Explosive Safety	17
Safety and Occupational Health Management	18
Safety Technician	19
Community Planning	20
Community Planning Technician	21
Park Ranger	25
Environmental Protection Specialist	28
Environmental Protection Assistant	29
Fingerprint Identification	72
Security Administration	80
Fire Protection and Prevention	81
Emergency Management	89
Social Science, Psychology, and Welfare Group	100
Social Science	101
Social Science Aid and Technician	102
Economist	110
Economics Assistant	119
Foreign Affairs	130
International Relations	131
Foreign Agricultural Affairs	135
International Cooperation	136
Workforce Research and Analysis	140
Workforce Development	142
Geography	150
Civil Rights Analysis	160

History	170
Psychology	180
Psychology Aid and Technician	181
Sociology	184
Social Work	185
Social Services Aid and Assistant	186
Social Services	187
General Anthropology	190
Archeology	193
General, Administrative, Clerical, and Office Services Group	300
Government Information	306
Records and Information Management	308
Program Management	340
Management and Program Analysis	343
Natural Resources Management and Biological Sciences Group	400
General Natural Resources Management and Biological Sciences	401
Microbiology	403
Biological Science Technician	404
Pharmacology	405
Ecology	408
Zoology	410
Physiology	413
Entomology	414
Toxicology	415
Plant Protection Technician	421
Botany	430
Plant Pathology	434
Plant Physiology	435
Horticulture	437
Genetics	440
Rangeland Management	454

Range Technician	455
Soil Conservation	457
Soil Conservation Technician	458
Irrigation System Operation	459
Forestry	460
Forestry Technician	462
Soil Science	470
Agronomy	471
Fish and Wildlife Administration	480
Fish Biology	482
Wildlife Refuge Management	485
Wildlife Biology	486
Animal Science	487
Medical, Hospital, Dental, and Public Health Group	600
General Medical and Healthcare	601
Physician	602
Physician Assistant	603
Nursing	610
Practical Nurse	620
Nursing Assistant	621
Medical Supply Aide and Technician	622
Dietetics and Nutrition	630
Occupational Therapy	631
Physical Therapy	633
Kinesiotherapy	635
Rehabilitation Therapy Assistant	636
Recreation/Creative Arts Therapy	638
Health Aid and Technician	640
Nuclear Medicine Technician	642
Clinical Laboratory Science	644
Medical Technician	645
Pathology Technician	646

Diagnostic Radiologic Technologist	647
Therapeutic Radiologic Technologist	648
Medical Instrument Technician	649
Respiratory Therapist	651
Pharmacy	660
Pharmacy Technician	661
Optometry	662
Speech/Language Pathology and Audiology	665
Orthotist and Prosthetist	667
Podiatry	668
Dentistry	680
Dental Assistant	681
Dental Hygiene	682
Dental Laboratory Aid and Technician	683
Public Health Program Specialist	685
Sanitarian	688
Industrial Hygiene	690
Consumer Safety	696
Environmental Health Technician	698
Veterinary Medical Science Group	700
Veterinary Medical Science	701
Animal Health Technician	704
Engineering and Architecture Group	800
General Engineering	801
Engineering Technical	802
Safety Engineering	803
Fire Protection Engineering	804
Materials Engineering	806
Landscape Architecture	807
Architecture	808
Construction Control Technical	809
Civil Engineering	810

Survey Technical	817
Environmental Engineering	819
Construction Analyst	828
Mechanical Engineering	830
Nuclear Engineering	840
Electrical Engineering	850
Computer Engineering	854
Electronics Engineering	855
Electronics Technical	856
Bioengineering and Biomedical Engineering	858
Aerospace Engineering	861
Naval Architecture	871
Marine Survey Technical	873
Mining Engineering	880
Petroleum Engineering	881
Agricultural Engineering	890
Chemical Engineering	893
Industrial Engineering Technical	895
Industrial Engineering	896
Business and Industry Group	1100
Grants Management	1109
Public Utilities Specialist	1130
Trade Specialist	1140
Commissary Management	1144
Agricultural Program Specialist	1145
Agricultural Marketing	1146
Agricultural Market Reporting	1147
Industrial Specialist	1150
Production Control	1152
Financial Analysis	1160
Physical Sciences Group	1300
General Physical Science	1301

Health Physics	1306
Physics	1310
Physical Science Technician	1311
Geophysics	1313
Hydrology	1315
Hydrologic Technician	1316
Chemistry	1320
Metallurgy	1321
Astronomy and Space Science	1330
Meteorology	1340
Meteorological Technician	1341
Geology	1350
Oceanography	1360
Navigational Information	1361
Cartography	1370
Cartographic Technician	1371
Geodesy	1372
Land Surveying	1373
Geodetic Technician	1374
Forest Products Technology	1380
Food Technology	1382
Textile Technology	1384
Document Analysis	1397
Library and Archives Group	1400
Librarian	1410
Library Technician	1411
Technical Information Services	1412
Archivist	1420
Archives Technician	1421
Mathematical Sciences Group	1500
General Mathematics and Statistics	1501
Actuarial Science	1510

Operations Research	1515
Mathematics	1520
Mathematics Technician	1521
Mathematical Statistics	1529
Statistics	1530
Statistical Assistant	1531
Cryptanalysis	1541
Computer Science	1550
Education Group	1700
General Education and Training	1701
Education and Training Technician	1702
Education and Vocational Training	1710
Training Instruction	1712
Vocational Rehabilitation	1715
Education Program	1720
Public Health Educator	1725
Education Research	1730
Education Services	1740
Instructional Systems	1750
Inspection, Investigation, Enforcement, and Compliance Group	1800
General Inspection, Investigation, Enforcement, and Compliance	1801
Compliance Inspection and Support	1802
Investigative Analysis	1805
General Investigation	1810
Criminal Investigation	1811
Air Safety Investigating	1815
Mine Safety and Health Inspection	1822
Aviation Safety	1825
Wage and Hour Investigation	1849
Agricultural Warehouse Inspection	1850
Equal Opportunity Investigation	1860
Consumer Safety Inspection	1862

Food Inspection	1863
Customs and Border Protection Interdiction	1881
Import Compliance	1889
Customs Entry and Liquidating	1894
Customs and Border Protection	1895
Border Patrol Enforcement	1896
Transportation Group	2100
Transportation Industry Analysis	2110
Railroad Safety	2121
Motor Carrier Safety	2123
Highway Safety	2125
Traffic Management	2130