



A Preliminary Examination of Marcellus Shale Drilling Activity and Crime Trends in Pennsylvania

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Executive Summary

Comparing the pre-Marcellus breakout period (2006-2007) to post-Marcellus breakout period (2008-2010), there were no consistent increases in Pennsylvania State Police incidents/calls for service or Uniform Crime Report (UCR) arrest statistics in the top Marcellus-active counties. However, the trend in PSP incidents/calls for service in the rural counties that have had no Marcellus activity is dissimilar to that of the Marcellus-active counties; specifically, PSP calls for service have been steadily declining in non-Marcellus areas during the post-Marcellus breakout period, but there has been a more variable pattern of both PSP calls and UCR reported arrests in the Marcellus areas. It is imperative to note that it is difficult to detect strong trends within such a short time period, and any observed changes may be due to natural variation. More time will need to elapse in the post-Marcellus era in order to measure the impact on PSP activity or UCR arrest data. Moreover, this study would be enhanced by exploring additional measures of crime and by more specific comparisons to non Marcellus Shale regions.

Introduction

This report explores the issue of whether there is any association between Marcellus Shale drilling activity in Pennsylvania and several measures of crime in the Marcellus Shale drilling regions. Anecdotal accounts have suggested such a relationship, but we were unable to find a previous empirical examination of this question. We first define the time period when new Marcellus Shale drilling era began, as well as the primary regions of the state where Marcellus Shale drilling is occurring. We then explore several indicators of criminal activity in those regions. We use two measures of criminal activity. First, we examine trends in incidents that the

Pennsylvania State Police (PSP) have responded to in Marcellus Shale drilling regions before and after the drilling “break out” period. The PSP is responsible for patrolling large portions of the Marcellus Shale drilling regions, as approximately three-quarters of the municipalities in those regions do not maintain their own police departments. Thus, PSP incident reports are a reasonable proxy for police activity there. Second, we examine Uniform Crime Reports (UCR) for data on actual arrests in those areas. While UCR arrest data may miss some arrests, all law enforcement agencies in the state are expected to report their arrests to UCR. Thus, it represents the most official and readily available source of arrest and other crime data in Pennsylvania. UCR is part of a standardized crime data reporting system managed by the FBI nationally, and by the PSP in Pennsylvania.

Marcellus Shale Drilling in Pennsylvania - Overview

Although the first Marcellus well in Pennsylvania was completed in 2004 in Washington County (with production achieved in 2005),¹ 2008 is recognized as the “breakout” year for Marcellus gas drilling and production in Pennsylvania.² Indeed, the number of Marcellus drilling permits issued and new wells drilled has increased considerably since 2008 (*Table 1, Figure 1*).³

¹ Harper, John A. and Jaime Kostelnik. n.d. The Marcellus Play In Pennsylvania. Pennsylvania Department of Conservation and Natural Resources, Pennsylvania Geological Survey. Retrieved from <http://marcellus.psu.edu/resources/PDFs/DCNR.pdf>

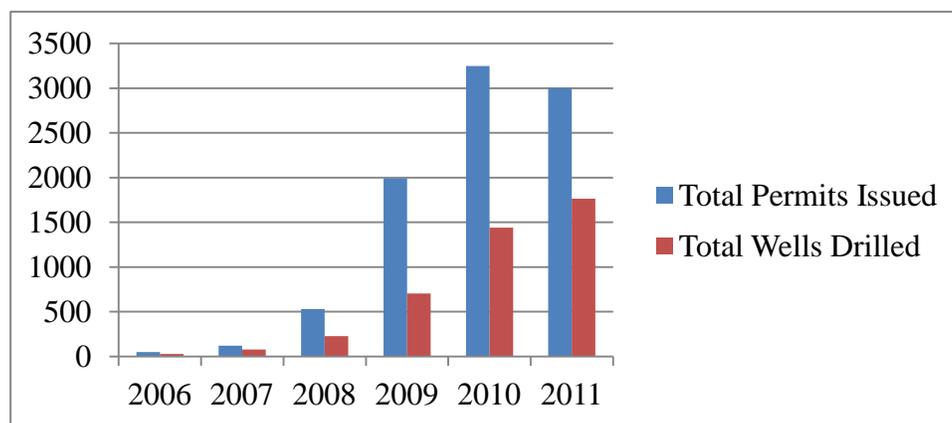
² Engelder, Terry. 2009, August. “Marcellus.” *Fort Worth Basin Oil & Gas Magazine*, 18-22. Retrieved from <http://marcellus.psu.edu/resources/PDFs/marcellusengelder.pdf>

³ Throughout this report, Marcellus shale 2011 permits issued data retrieved from <http://www.dep.state.pa.us/dep/deputate/minres/oilgas/RIG11.htm> (previous years’ data available via hyperlinks listed on that website). Marcellus shale new wells drilled data files were provided by Roger Dietz, System Coordinator, Pennsylvania Department of Environmental Protection, Office of Oil & Gas Management, personal communication, November 30, 2011. Note that recent media reports indicate that DEP’s drilling data may be compromised by inaccuracies in data collection in management (see, e.g., <http://www.post-gazette.com/pg/12008/1202172-503.stm>). Any subsequent research would need to verify these figures.

Table 1: Total Number of Marcellus Drilling Permits Issued and Wells Drilled, by Year

Year	Permits Issued	Wells Drilled
2006	49	27
2007	121	77
2008	529	227
2009	1991	702
2010	3249	1440
2011	3001 ⁴	1765 ⁵

Figure 1: Total Number of Marcellus Drilling Permits Issued and Wells Drilled, by Year



Seven counties can be identified as those most involved in Marcellus activity based on the criteria that they were either among the top five counties with permits issued, or among the top five counties with new wells drilled, during the 2008-2011 period (*Table 2, Table 3*). These counties are: Bradford, Fayette, Greene, Lycoming, Susquehanna, Tioga, and Washington.

⁴ As of November 23, 2011.

⁵ As of November 30, 2011.

Table 2: Top Five Counties with Marcellus Permits Issued

2008	Permits Issued	2009	Permits Issued	2010	Permits Issued	2011⁶	Permits Issued
Washington	106	Bradford	431	Bradford	830	Bradford	739
Susquehanna	62	Tioga	300	Tioga	568	Tioga	430
Greene	55	Washington	209	Lycoming	257	Lycoming	382
Bradford	52	Greene	182	Washington	251	Greene	373
Lycoming	48	Susquehanna	155	Susquehanna	231	Washington	329

Table 3: Top Five Counties with Marcellus Wells Drilled

2008	Wells Drilled	2009	Wells Drilled	2010	Wells Drilled	2011⁷	Wells Drilled
Washington	53	Bradford	113	Bradford	376	Bradford	377
Greene	27	Tioga	112	Tioga	260	Lycoming	258
Susquehanna	26	Washington	111	Washington	139	Tioga	244
Fayette	20	Greene	84	Lycoming	109	Susquehanna	186
Bradford	17	Susquehanna	59	Susquehanna	90	Washington	144

Thus, we have established both when Marcellus Shale activity can be said to have taken off, and where this is primarily occurring.

⁶ As of November 23, 2011

⁷ As of November 30, 2011

PSP Activity and UCR Arrest Trends in the Marcellus Shale Regions

The percentage of municipalities within each of these counties that relies on the Pennsylvania State Police (PSP) for full, partial, and no coverage is shown below in *Table 4*.⁸

Table 4: Percentage of Municipalities Relying on PSP Services, by Level of Service and County

County	Full-Time PSP Coverage	Partial PSP Coverage ⁹	No Official PSP Coverage
Bradford	82%	2%	16%
Fayette	58%	35%	7%
Greene	82%	14%	4%
Lycoming	71%	3%	26%
Susquehanna	80%	18%	3%
Tioga	77%	18%	5%
Washington	32%	38%	30%

Noting 2008 as the breakout year for Marcellus activity, total PSP incidents/calls for service prior to 2008 can be compared with those in 2008 and beyond to determine how PSP activity was impacted (*Table 5, Figure 2*). PSP incidents/calls for service are generated by troopers for each incident they are involved in. Thus, it is a comprehensive measure that includes activity related to violent crimes, traffic incidents, and general patrol duties.

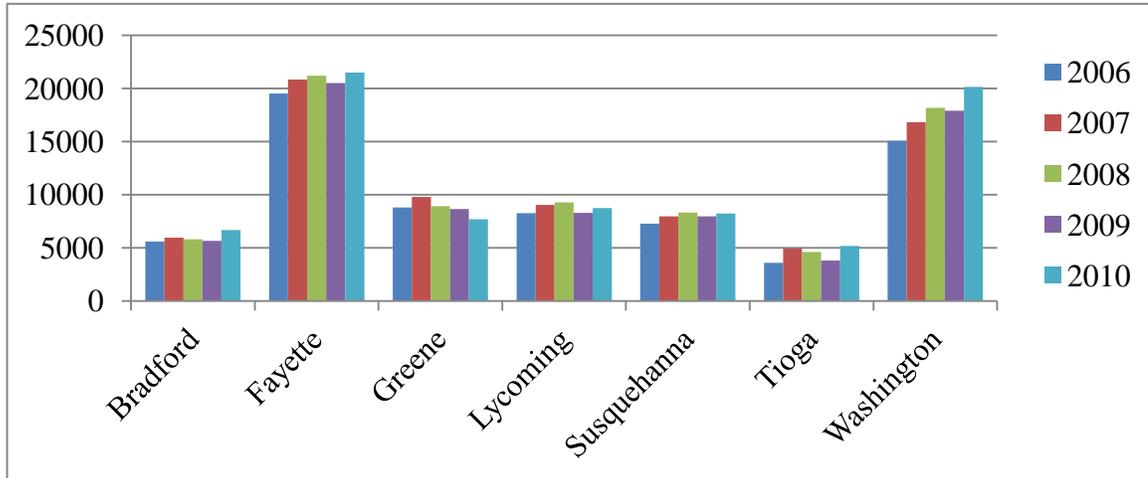
⁸ Pennsylvania State Police, Bureau of Research and Development, 2011. Calculations are based on 2006-2010 averages. PSP data were unavailable for 2011.

⁹ There are no part-time PSP troopers. Partial PSP coverage refers to reduced coverage due to municipalities that field a part-time local police department and, therefore, rely on full-time PSP troopers to provide law enforcement services during gaps in local police coverage.

Table 5: Total PSP Incidents/Calls for Service In Top Marcellus-Active Counties

		Year				
		2006	2007	2008	2009	2010
County	Bradford	5611	5970	5821	5652	6678
	Fayette	19514	20853	21207	20506	21516
	Greene	8807	9804	8926	8656	7699
	Lycoming	8261	9061	9288	8308	8747
	Susquehanna	7288	7965	8340	7977	8246
	Tioga	3614	4940	4604	3811	5173
	Washington	15072	16845	18175	17910	20143

Figure 2: Total PSP Incidents In Top Marcellus-Active Counties

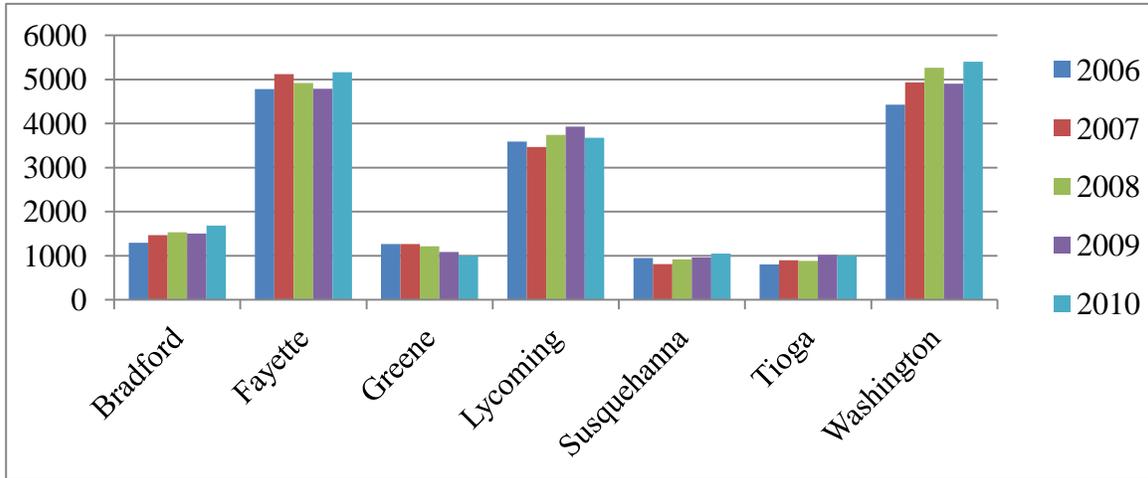


The second measure of impact is to compare changes in UCR arrest statistics prior to 2008 with those in 2008 and beyond (*Table 6, Figure 3*). UCR data covers all arrest data in the state, but excludes traffic violations and other patrol duties that are included in PSP incidents.

Table 6: Total UCR Arrest Reports In Top Marcellus-Active Counties

		Year				
		2006	2007	2008	2009	2010
County	Bradford	1296	1466	1530	1506	1684
	Fayette	4781	5118	4917	4787	5161
	Greene	1262	1265	1217	1088	1001
	Lycoming	3588	3467	3738	3926	3673
	Susquehanna	946	812	916	965	1051
	Tioga	805	900	881	1021	1004
	Washington	4426	4930	5266	4905	5403

Figure 3: Total UCR Arrest Reports In Top Marcellus-Active Counties



Generally, PSP incidents/calls for service and UCR arrest reports increased in Bradford, Susquehanna, and Washington; decreased in Greene; and remained fairly stable in Fayette, Lycoming, and Tioga. Combining the incidents and arrest reports across all seven counties, incidents and arrests generally increased from 2006-2010, but much of this increase occurred in

the pre-Marcellus breakout period (2006-2007), and there was no consistent trend in the post-Marcellus breakout period (2008-2010) (Figure 4, Figure 5). Specifically, counties' combined totals on both measures actually decreased between 2008 and 2009, and then increased in 2010.

Figure 4: Combined PSP Incidents In Top Marcellus-Active Counties, by Year

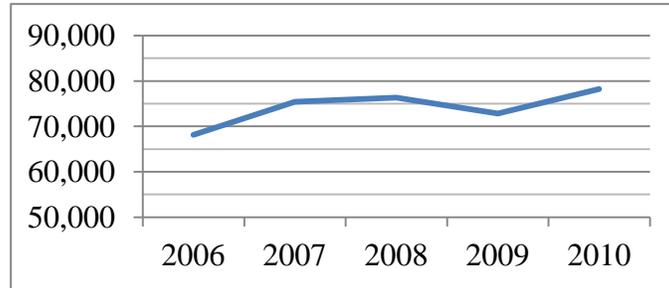
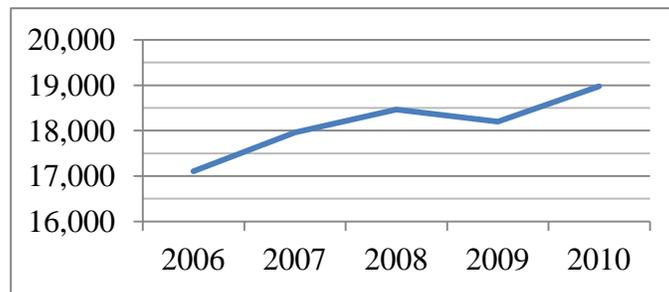


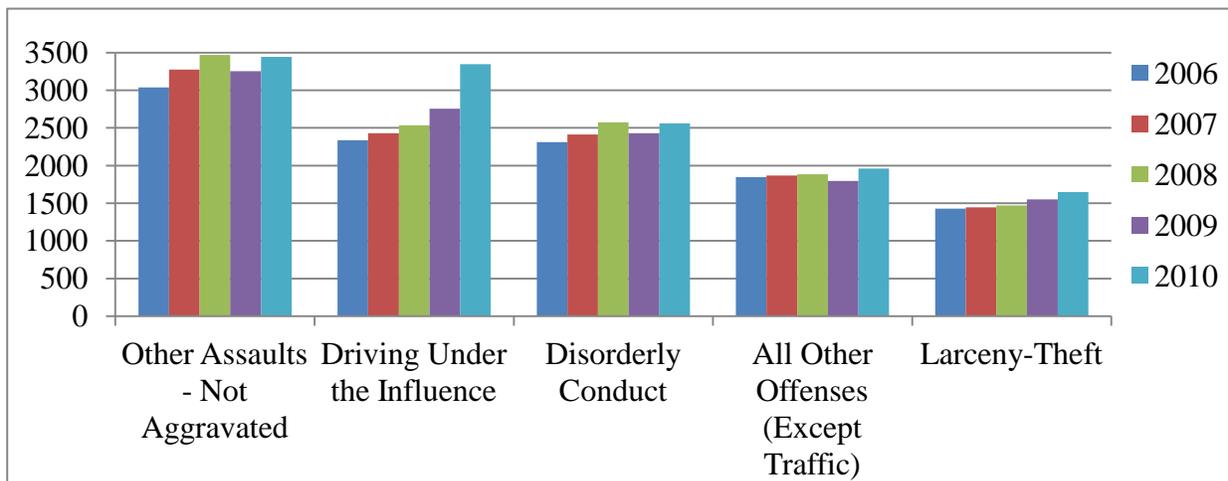
Figure 5: Combined UCR Arrest Reports In Top Marcellus-Active Counties, by Year



Furthermore, the types of UCR arrests reported in the Marcellus Shale regions did not change between the pre-Marcellus breakout period (2006-2007) and post-Marcellus breakout period (2008-2010). Specifically, the top five arrest classifications remained unchanged: “Other Assaults – Not Aggravated,” “Driving Under the Influence,” “Disorderly Conduct,” “All Other

Offenses (Except Traffic),” and “Larceny-Theft.”¹⁰ While these top five arrest types did not change, the absolute number of arrests between pre- and post-Marcellus periods appear to have increased for “Driving Under the Influence,” “Larceny – Theft,” and, to some extent, “Disorderly Conduct” and “Other Assaults – Not Aggravated” (*Figure 7*). The miscellaneous arrest type of “All Other Offenses (Except Traffic)” remained fairly stable, even decreasing in 2009.

Figure 7: Combined UCR Arrest Reports in Top Marcellus Counties for the Top Five Arrest Types, by Year

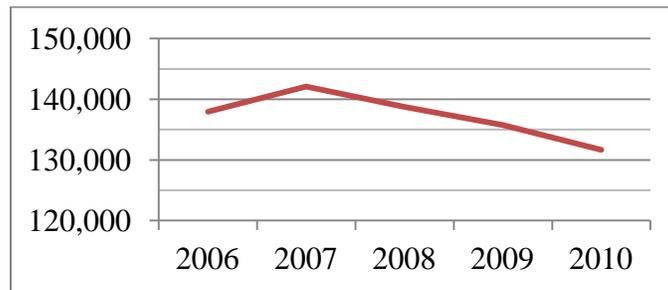


By way of comparison to rural regions of the state that are not involved in Marcellus Shale drilling, combined PSP incidents in the 16 rural Pennsylvania counties that have had no Marcellus activity increased between 2006-2007 as was the case in the seven Marcellus counties, but PSP incidents then decreased between 2007-2008, and continued to decline in the post-Marcellus breakout period (2008-2010) (*Figure 6*). It is important to note, however, that the non-

¹⁰ Note that “Other Assaults - Not Aggravated” was always the highest number of arrests; “Driving Under the Influence” was always second or third; “Disorderly Conduct” was always second or third; “All Other Offenses (Except Traffic)” was always fourth; and “Larceny-Theft” was always fifth.

Marcellus counties may differ in important ways from the top Marcellus areas, and this analysis offers only a crude and limited comparison. It was beyond the scope of the current project to examine UCR arrest trends in the 16 non-Marcellus counties, but those statistics might provide another valuable comparison to the seven Marcellus counties.

Figure 6: Combined PSP Incidents In Rural *Non*-Marcellus-Active Counties, by Year



Conclusions and Limitations

While the analysis presented here is a limited, initial exploration, we find no clear association at this time between Marcellus Shale drilling activity and criminal activity as measured by PSP incident calls and UCR arrest data. Although PSP incidents and UCR arrests increased slightly during the 2009-2010 period in Marcellus areas at the same time that PSP incidents decreased in non-Marcellus rural counties, the measured change in Marcellus counties was not consistent during the post-Marcellus breakout period (2008-2010), actually showing a decrease between 2008-2009. It is worth noting, too, that the Pennsylvania Commission on Sentencing conducted a preliminary analysis of sentencing data (including misdemeanors, county intermediate punishment, and probation) in Marcellus and non-Marcellus counties between 2008-2010, finding similar directional trends as we reported above: In Marcellus counties, there was a decrease in the sentencing measures between 2008-2009, followed by an

increase in 2010; in non-Marcellus counties, there was an uninterrupted decrease in sentencing measures across 2008-2010.

This report's findings must be tempered, though, by several limitations to our analysis. First, trends are difficult to detect within the very short time frame that characterizes the development of Marcellus Shale drilling activity in Pennsylvania. Any trends discovered may be the result of natural variation or factors external to Marcellus Shale drilling. A longer term study would be needed before any strong conclusions could be reached about Marcellus Shale drilling and criminal activity.

Second, while the PSP is responsible for patrolling large portions of the Marcellus Shale regions, other parts of those regions are patrolled by municipal police departments. Our conclusions may have been different if we had access to incident response data from those local police agencies. Collecting such data would require a significant expenditure of effort, which was beyond the resources available for this current report. Moreover, it would also be valuable to conduct qualitative interviews with local police and municipal officials to further explore changes in policing burdens associated with Marcellus Shale activity that may not be captured in UCR or other official data sources.

Third, the UCR data we examined was limited to arrest statistics only. Not all arrests get reported into UCR, and not all police incidents result in an arrest, or even in an official report. Moreover, we did not include reported crimes that did not result in arrests, nor did we examine unreported crimes. While it is reasonable to assume a strong relationship between arrests and overall crime trends, it is possible that arrests may not be a reasonable proxy for overall crime in this case. As part of a more comprehensive study, we could examine UCR data on reported crimes that did not result in an arrest, as well as data on unreported crimes from crime

victimization surveys. This imposes a more significant data collection burden that was beyond the scope of the current report.

Finally, while we compared crime trends in the seven Marcellus Shale drilling counties to overall trends in 16 Pennsylvania rural counties where no drilling activity has occurred, this is at best a crude comparison group. A more rigorous approach would be to create a comparison group of seven counties that are more finely matched to the seven Marcellus Shale counties examined in this report on important characteristics such as population, economics, and other key variables.

With additional support, we would be able to address the limitations noted above and produce a more comprehensive examination of crime trends in the Marcellus Shale region.

About the Justice Center for Research and the Authors

The Justice Center for Research (<http://www.justicecenter.psu.edu/>) at The Pennsylvania State University is a cooperative venture of the College of the Liberal Arts and University Outreach's Justice and Safety Institute. The Justice Center's mandate is to initiate, encourage and conduct applied research in criminology and criminal justice that informs public debate, and assists local, state, federal and international communities with justice-related policy decisions. In keeping with the University's tradition of service to the justice community, the Justice Center for Research was created to complement other University initiatives and affiliates, including the Department of Sociology/Crime, Law and Justice, the Justice and Safety Institute, the Pennsylvania Commission on Sentencing, the International Center for the Study of Terrorism, and The Dickinson School of Law. It serves as a grant acquisition and management resource for faculty and students University-wide, as they seek to answer critical questions about criminal justice issues at work in 21st century society.

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Dr. Gary Zajac is Managing Director of the Justice Center for Research and Senior Research Associate at The Pennsylvania State University, and a member of the graduate faculty in the College of the Liberal Arts. He is currently Principal Investigator or Co-Investigator on six Justice Center projects focusing on courts, corrections, sentencing and policing, including a national evaluation of Honest Opportunity Probation with Enforcement (HOPE) Demonstration Field Experiment, funded by the National Institute of Justice and the Bureau of Justice Assistance. Prior to joining the Justice Center, Dr. Zajac was Chief of Research and Evaluation in the Pennsylvania Department of Corrections for nearly thirteen years, where he initiated and oversaw the most ambitious program evaluation agenda of any state corrections agency. While at the PADO, he initiated and lead numerous studies and evaluations of PADO programs (including one of the largest reentry program evaluations ever undertaken by any state DOC) and related topics, partnering with external researchers and funders. The research partnership model that Dr. Zajac developed within the PADO won a 2008 *Innovations Award* from the Council of State Governments, being recognized as a model for knowledge creation and transfer. During Dr. Zajac's tenure in the PADO, this model resulted in 18 major grant supported studies totaling

over \$4 million in external support, and promoted the diffusion of evidence-based practice within the PADO. Dr. Zajac has served for many years as a peer reviewer for the National Institute of Justice and the Pennsylvania Commission on Crime and Delinquency, and for journals including: *Drug and Alcohol Dependence*, *The Prison Journal* (also board member) and *Criminology and Public Policy*. His scholarly work has appeared in many journals and books, including *Criminology and Public Policy* and *Crime and Delinquency*. He has advised dozens of state, local and international corrections agencies and organizations (including the Council of State Governments Reentry Policy Council) on the development of research capacity and the implementation of research-based practice, including reentry policies and programs.