

Ambient Temperature and Crime in Bihar

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Abstract - Crimes are always been common in many parts of India. But, now a days, they have been increased in number. It has been noticed that number of crimes against person remain higher than number of crime against property during summer season in comparison to winter season. According to National Crime Records Bureau (NCRB) Report, 2016, Uttar Pradesh, Maharashtra, Madhya Pradesh, Rajasthan, Bihar, and West Bengal are some of the most vulnerable states in India. This study focuses on finding relation between crime rate and change in temperature during different season. This research paper analyzes quantitative data of crime in Bihar. According to research, change in temperature and crime have been found to have a significant correlation. After analyzing data from different research paper this was found that increase in temperature was directly proportional to crime against person.

Key Words: correlation, crime type, quantitative data, temperature, Bihar

1. INTRODUCTION

Everyday crimes such as murder, dacoity, burglary, robbery, rape, kidnapping, and theft have become prevalent in most parts of the country. The rate of crime is growing with every passing day. Though survey shows no healthy statistics in all parts of the country, some states are more vulnerable than others. According to National Crime Records Bureau (NCRB) Report, 2016, Uttar Pradesh, Maharashtra, Madhya Pradesh, Rajasthan, Bihar and West Bengal are some of the most vulnerable states in India.

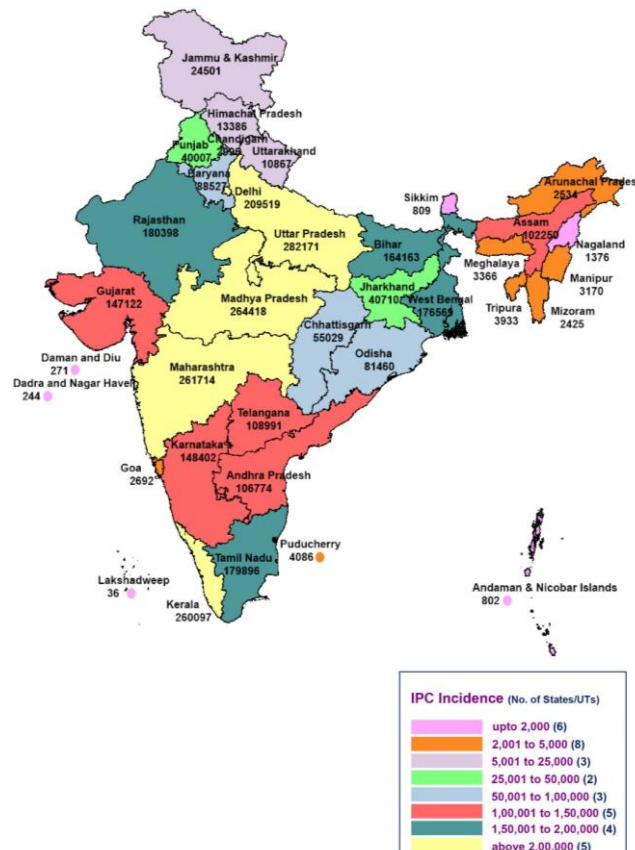


Fig -1: Crime in India during 2016

Source: National Crime Records Bureau (NCRB) Report, 2016

Along with criminal activities, the factors driving them need same level of attention as well. There are number of factors such as quality of life indices, economic growth, and property prices etc. One of the factors that is believed to influence criminal activities is change in temperature. Change in temperature and crime have been found to have a significant correlation. This paper investigates whether this relationship holds in India. Bihar state has been chosen for the research study due to limited availability of data.

This paper employs secondary data collection on monthly crime activities in Bihar from 20011 to 2018. The first five district having highest urban population (as per census 2011) have been taken for the study and analysis. The district wise urban population in Bihar state are as follows:

S. N.	District	Total	Rural	Urban	Urban % of Bihar total popn.
1	Patna	5838465	3323875	2514590	2.42
2	Bhagalpur	3037766	2435234	602532	0.58
3	Gaya	4391418	3809817	581601	0.56
4	Begusarai	2970541	2400718	569823	0.55
5	Muzaffarpur	4801062	4327625	473437	0.45
6	Nalanda	2877653	2419759	457894	0.44
7	Rohtas	2959918	2532153	427765	0.41
8	Purba Champaran	5099371	4698028	401343	0.39
9	Pashchim Champaran	3935042	3541877	393165	0.38
10	Bhojpur	2728407	2338546	389861	0.37
11	Darbhanga	3937385	3554057	383328	0.37
12	Munger	1367765	987645	380120	0.37
13	Saran	3951862	3598660	353202	0.34
14	Purnia	3264619	2921614	343005	0.33
15	Katihar	3071029	2797207	273822	0.26
16	Aurangabad	2540073	2303219	236854	0.23
17	Vaishali	3495021	3261942	233079	0.22
18	Nawada	2219146	2003567	215579	0.21
19	Sitamarhi	3423574	3233076	190498	0.18
20	Siwan	3330464	3147551	182913	0.18
21	Araria	2811569	2642792	168777	0.16
22	Buxar	1706352	1541853	164499	0.16
23	Gopalganj	2562012	2399207	162805	0.16
24	Madhubani	4487379	4325884	161495	0.16
25	Kishanganj	1690400	1529277	161123	0.15
26	Saharsa	1900661	1744121	156540	0.15
27	Samastipur	4261566	4113769	147797	0.14
28	Jamui	1760405	1615072	145333	0.14
29	Lakhisarai	1000912	857901	143011	0.14
30	Jehanabad	1125313	990117	135196	0.13
31	Sheikhpura	636342	527340	109002	0.10
32	Supaul	2229076	2123518	105558	0.10
33	Madhepura	2001762	1913301	88461	0.08
34	Khagaria	1666886	1579727	87159	0.08
35	Banka	2034763	1963450	71313	0.07
36	Kaimur (Bhabua)	1626384	1560813	65571	0.06
37	Arwal	700843	648994	51849	0.05
38	Sheohar	656246	628130	28116	0.03
	Total Bihar	104099452	92341436	11758016	11.29

Source: Census 2011

The urban population is 2.42%, 0.58%, 0.56%, 0.55% and 0.45% for Patna, Bhagalpur, Gaya, Begusarai and Muzaffarpur district respectively. Two broad categories of crime are analyzed: property crime and violent crime. Violent crimes include crimes against persons, also called personal crimes, murder, aggravated assault, rape, kidnapping and robbery. Property crimes include crimes against property i.e. theft of property without bodily harm, such as burglary, larceny, auto theft. Evidence is found to suggest that temperature has a significant effect on criminal activity.

2. LITERATURE STUDY

"Crime against persons are more numerous in summers, crime against property are more numerous in winters." (Falk, [8]). The probability of a riot increased steadily with temperature rising up to 85* F. Cohn also found a positive relationship between temperature and assault rate (Rodrigo Murataya, Daniel R. Gutiérrez, [16]). Evidence showed a positive relationship between heat and crime when the probability of riot steadily increased with the temperature rise up to the mid-90's which gave the conclusion that collective violence tends to increase with the rise of temperature (Cohn, [6]). Cohn (1990) also analyzed the relationship between heat and robbery, homicide, domestic violence, and rape. Robbery and homicide did not show relevant correlation with heat in the studies (Cohn, [6]).

Feldman and Jarmon (1979) found no significant correlations between ambient temperature and homicide in Newark over twelvemonth and fifteen-year periods (Feldman H. S., Jarmon R. G., [9]). Michael and Zumpe (1983a, 1983b) found no significant correlations between monthly temperature and the monthly mean number of homicides in thirteen of the sixteen locations they examined (Michael R. P., Zumpe D., [14]). Perry and Simpson (1987) found no significant relationship between the monthly homicide rate and the monthly minimum temperature in Raleigh during a ten-year period (J. D. Perry, M. E. Simpson, [12]).

Michael and Zumpe (1983a, 1983b) found significant positive correlations between the monthly mean temperature and the monthly mean number of rapes (Spearman $r=.64$ to $.97$) in thirteen of their sixteen locations (Michael R. P., Zumpe D., [14]). Perry and Simpson (1987) also found a significant positive correlation between the monthly average minimum temperature and the monthly rape rate ($r=.26$) (J. D. Perry, M. E. Simpson, [12]). Anderson and Anderson (1984) have suggested that this may be because robbery is motivated primarily by economic need and is not a truly aggressive crime (Anderson, C. A., and Anderson, D. C., [1]). DeFronzo (1984) also found a significant positive association between temperature and burglary (DeFronzo, [7]).

Jacob, Lefgren, and Moretti (2006) find that a 10°F increase in average weekly temperature is associated with a 5% increase in violent crime (B. Jacob, L. Lefgren, E. Moretti, [2]). Using monthly data from England and Wales, Field (1992) finds that temperature is positively and significantly correlated with violent crime, sexual offences, and criminal damage (Field, [10]). Cohn and Rotton (2000b) use data on complaints about disorderly behavior from Minnesota over two years and find that temperature is significantly correlated with the number of complaints (Cohn E and Rotton J, [5]).

Jacob, Lefgren, and Moretti (2006) find that a 10°F increase in the average weekly temperature is correlated with a 3% reduction in property crime (B. Jacob, L. Lefgren, E. Moretti, [2]). Field (1992) finds that burglary, theft and robbery are all positively and significantly correlated with temperature (Field, [10]). Cohn and Rotton (2000a) analyzed theft, burglary and robbery in Minneapolis over two years using calls for service to measure criminal activity and found that theft is negatively correlated with temperature and that both burglary and robbery are positively correlated with temperature (Cohn E and Rotton J, [4]). The temperature has a significant effect on the number of violent crimes recorded and temperature has a significant effect on the number of property crimes recorded (J. Horrocks, A. K. Menclova, [13]).

3. METHOD OF THE RESEARCH & DATA COLLECTION

Quantitative approach is used to analyze the relationship between crime rate and season. The hypothesis of this research is to see whether the crimes rates increases/decreases as the temperature increases/ decreases.

Secondary data, collected from different sources is used in this research. Eight years (2011-2018) of month wise data is collected from Bihar Police Website. Temperature in Bihar is 43-30 degree C in the month of April, May, June & July and temperature in Bihar is 21-5 degree C in the month of November, December, January and February.

4. DATA ANALYSIS

The data collected for this research was analyzed using MS – excel. The values of the research variables used in this study are listed in Tables 1 to 5

4.1 Patna district

Table -1: Crime in Patna, 2011-2018

Crime	Year/Month	2011	2012	2013	2014	2015	2016	2017	2018
Murder	Apr to Jul	113	131	109	135	117	80	74	100
	Nov to Feb	78	111	101	94	87	75	56	97
Dacoity	Apr to Jul	26	18	17	18	11	12	17	15
	Nov to Feb	17	18	10	17	23	17	18	17
Robbery	Apr to Jul	61	43	67	76	67	57	54	60
	Nov to Feb	69	47	55	52	65	32	50	86
Burglary	Apr to Jul	172	172	187	206	238	267	205	275
	Nov to Feb	197	165	202	223	253	170	154	246
Theft	Apr to Jul	1155	1293	2113	1488	1719	1505	1331	2117
	Nov to Feb	1251	1281	1403	1550	1654	994	1281	2179
Roits	Apr to Jul	187	196	235	239	347	262	171	289
	Nov to Feb	162	162	165	177	249	177	164	181
Kidnapping	Apr to Jul	122	147	221	256	355	342	326	483
	Nov to Feb	110	122	151	257	331	210	274	372
Rape	Apr to Jul	14	15	35	30	30	29	22	48
	Nov to Feb	16	18	13	21	28	11	16	36

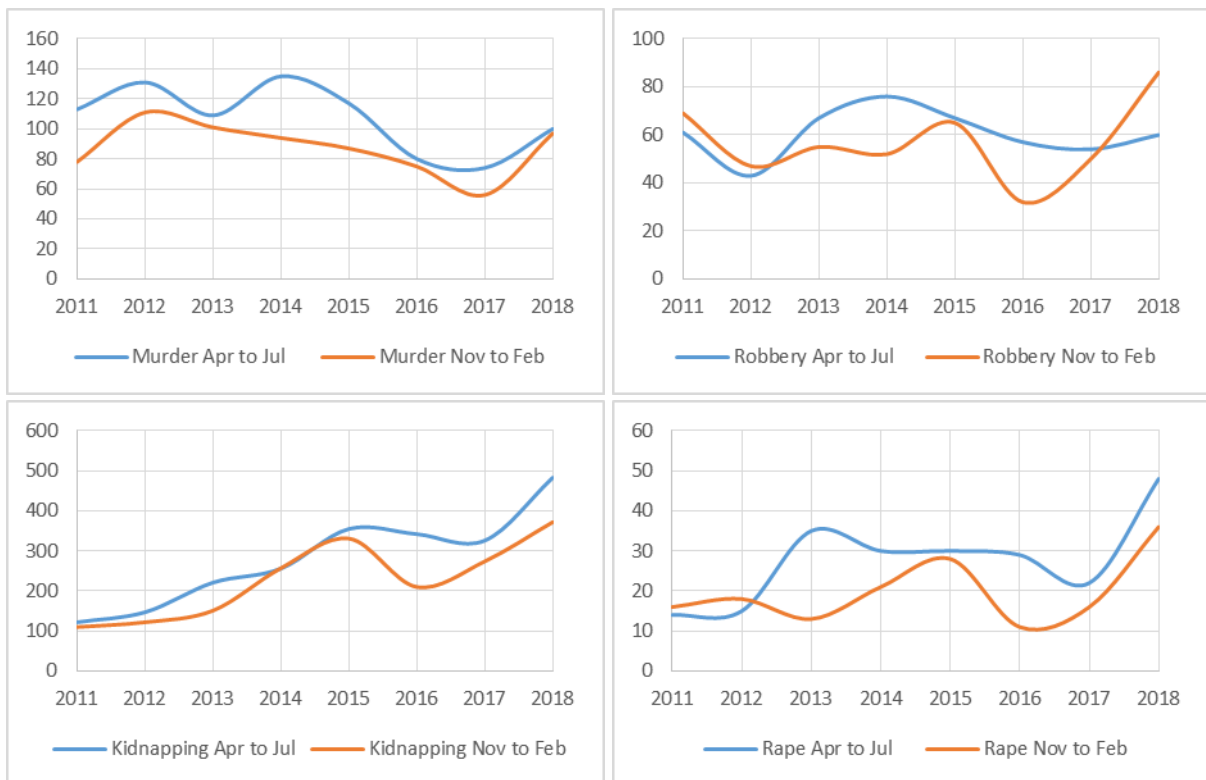


Chart -1: Crime against person in Patna, 2011-2018

In almost all the cases of Patna, crime against person in the month of November to February is less than crime in the month of April to July.

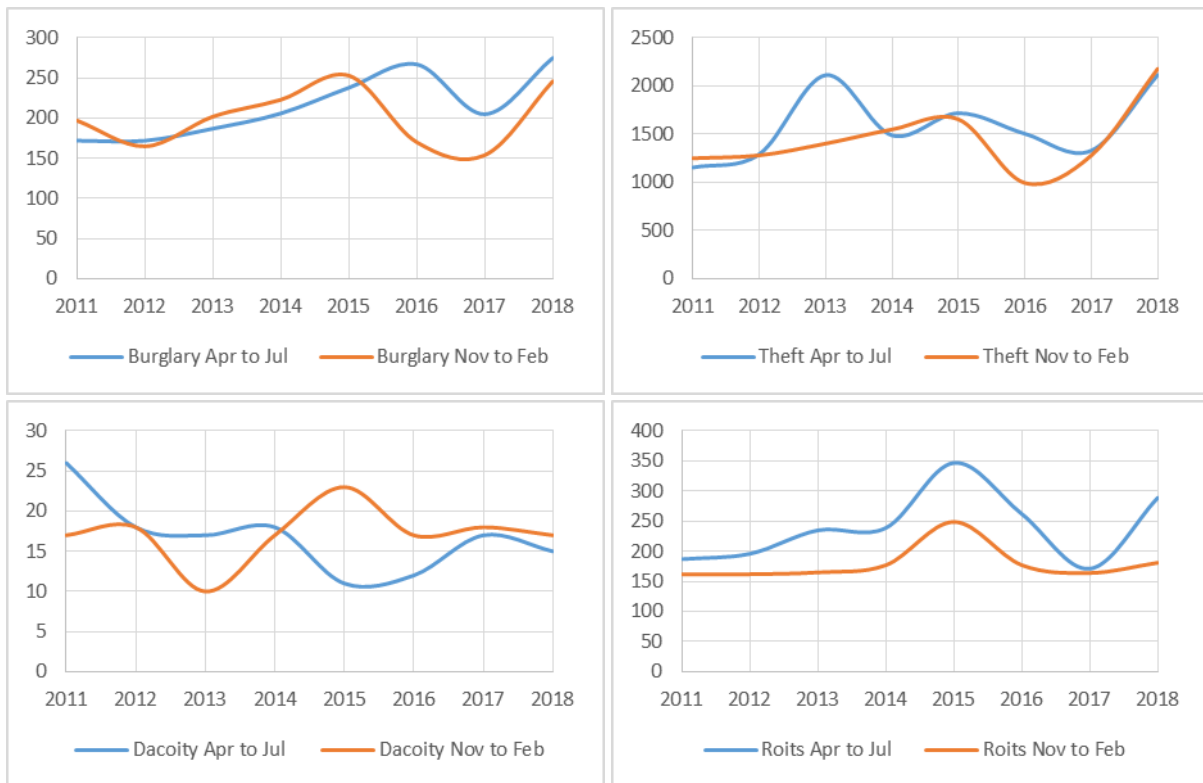


Chart -2: Crime against property in Patna, 2011-2018

4.2 Bhagalpur district

Table -2: Crime in Bhagalpur, 2011-2018

Crime	Year/Month	2011	2012	2013	2014	2015	2016	2017	2018
Murder	Apr to Jul	24	34	28	35	31	26	21	19
	Nov to Feb	29	25	42	28	24	23	15	23
Dacoity	Apr to Jul	1	3	3	6	3	3	3	4
	Nov to Feb	3	1	1	3	2	2	4	5
Robbery	Apr to Jul	9	19	12	11	12	6	13	19
	Nov to Feb	13	11	6	18	15	11	14	19
Burglary	Apr to Jul	47	46	41	79	67	71	57	58
	Nov to Feb	45	45	53	67	74	40	37	64
Theft	Apr to Jul	120	112	134	201	243	225	249	301
	Nov to Feb	153	121	148	228	244	162	197	286
Roits	Apr to Jul	70	117	106	124	153	127	133	130
	Nov to Feb	69	71	70	91	109	71	62	115
Kidnapping	Apr to Jul	38	46	69	71	50	76	102	123
	Nov to Feb	29	44	41	52	30	68	60	91
Rape	Apr to Jul	5	12	21	14	16	14	22	23
	Nov to Feb	8	8	17	17	5	11	14	12

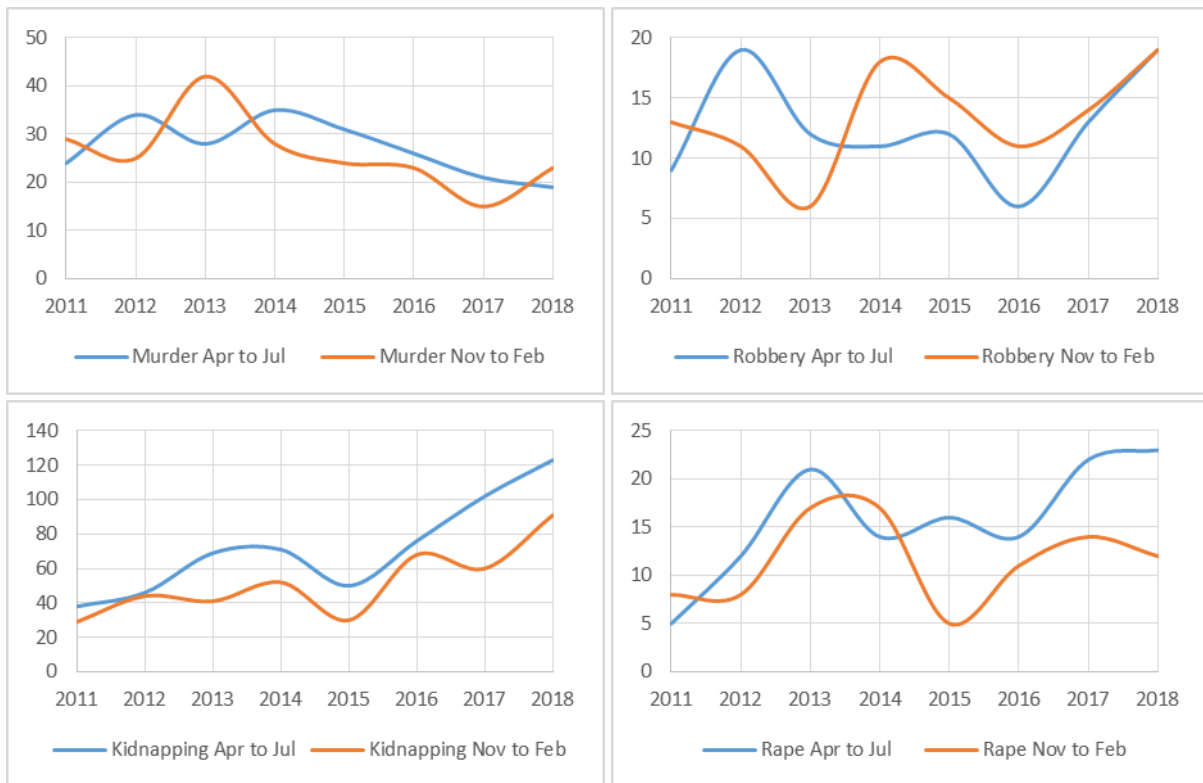


Chart -3: Crime against person in Bhagalpur, 2011-2018

In most of the cases of Bhagalpur, crime against person in the month of November to February is less than crime in the month of April to July.

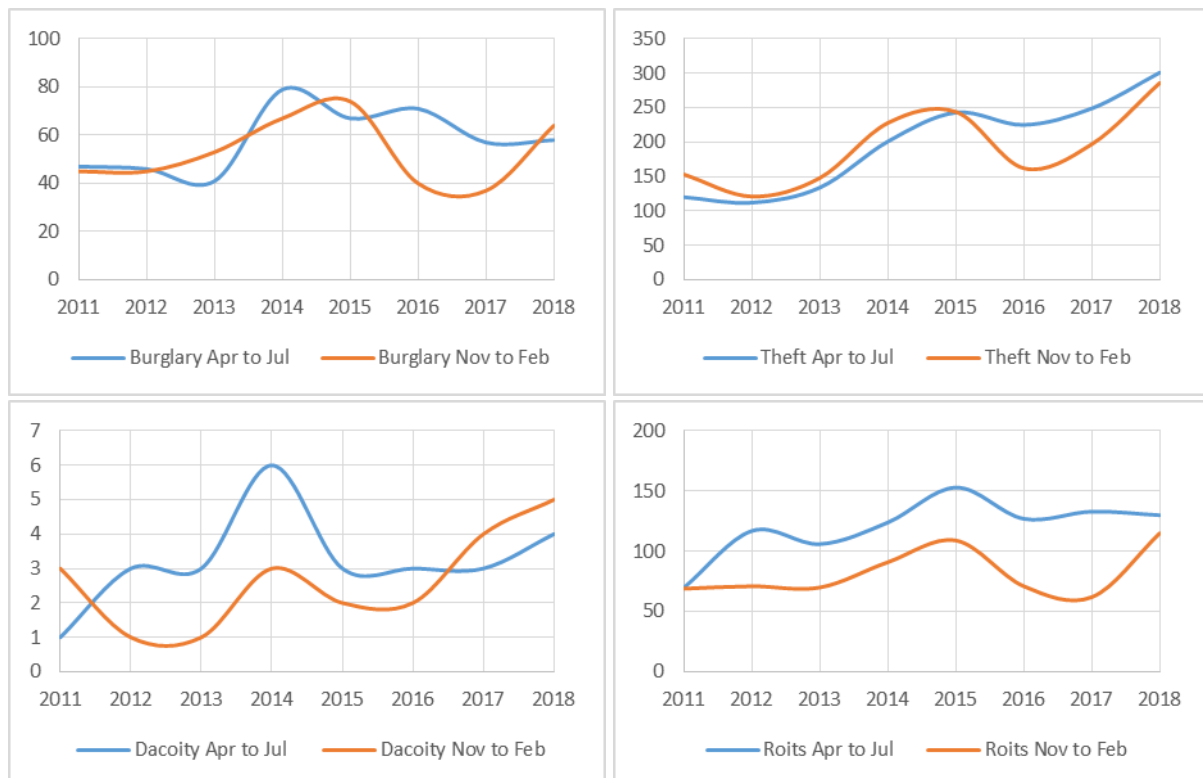


Chart -4: Crime against property in Bhagalpur, 2011-2018

4.3 Gaya district

Table 3: Crime in Gaya, 2011-2018

Crime	Year/Month	2011	2012	2013	2014	2015	2016	2017	2018
Murder	Apr to Jul	58	58	68	59	67	50	39	61
	Nov to Feb	42	39	56	43	40	33	39	43
Dacoity	Apr to Jul	13	7	15	21	8	8	4	7
	Nov to Feb	15	12	9	22	11	7	8	5
Robbery	Apr to Jul	20	12	26	27	28	27	19	28
	Nov to Feb	30	18	21	24	28	19	19	22
Burglary	Apr to Jul	55	62	87	57	65	73	44	63
	Nov to Feb	55	41	49	69	63	56	47	58
Theft	Apr to Jul	251	202	369	361	345	265	358	451
	Nov to Feb	263	265	458	601	362	242	323	548
Roits	Apr to Jul	90	143	231	219	267	255	225	400
	Nov to Feb	69	96	113	144	185	182	139	151
Kidnapping	Apr to Jul	59	60	96	95	100	134	104	137
	Nov to Feb	51	49	53	80	98	76	72	107
Rape	Apr to Jul	7	8	12	23	9	26	17	23
	Nov to Feb	10	9	13	12	6	7	10	17

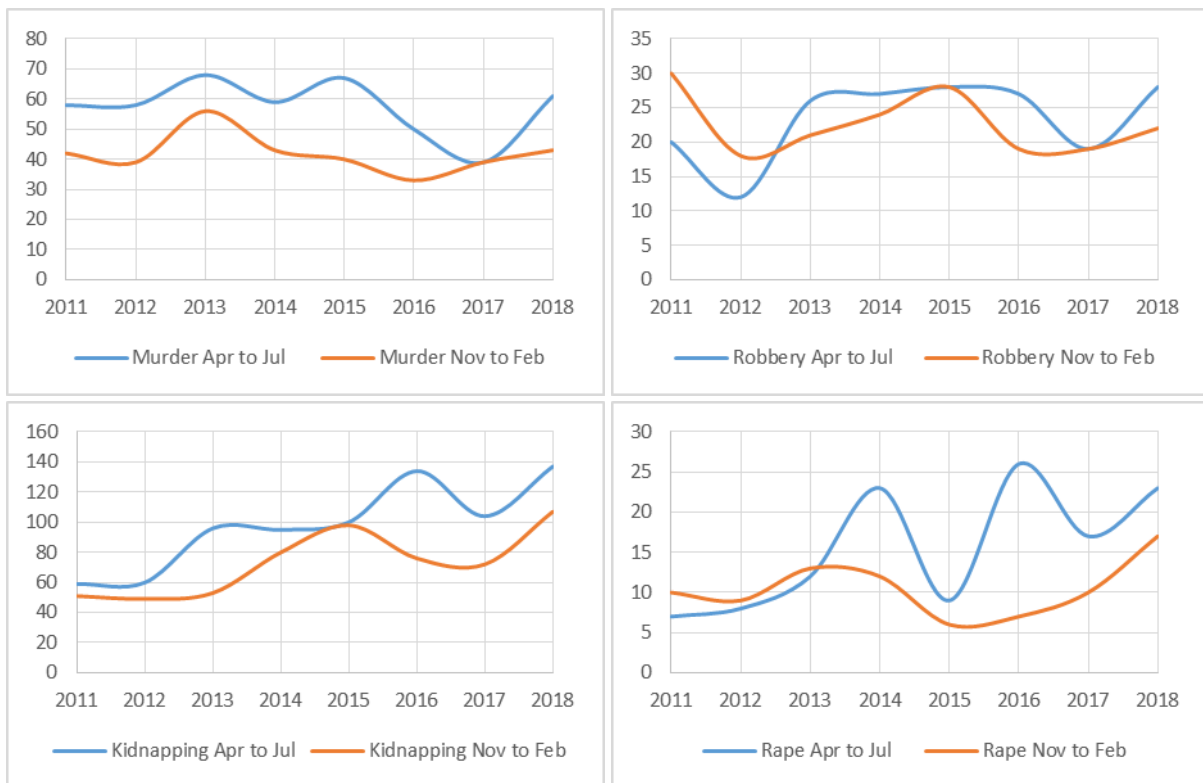


Chart -5: Crime against person in Gaya, 2011-2018

In most of the cases of Gaya, crime against person in the month of November to February is less than crime in the month of April to July.

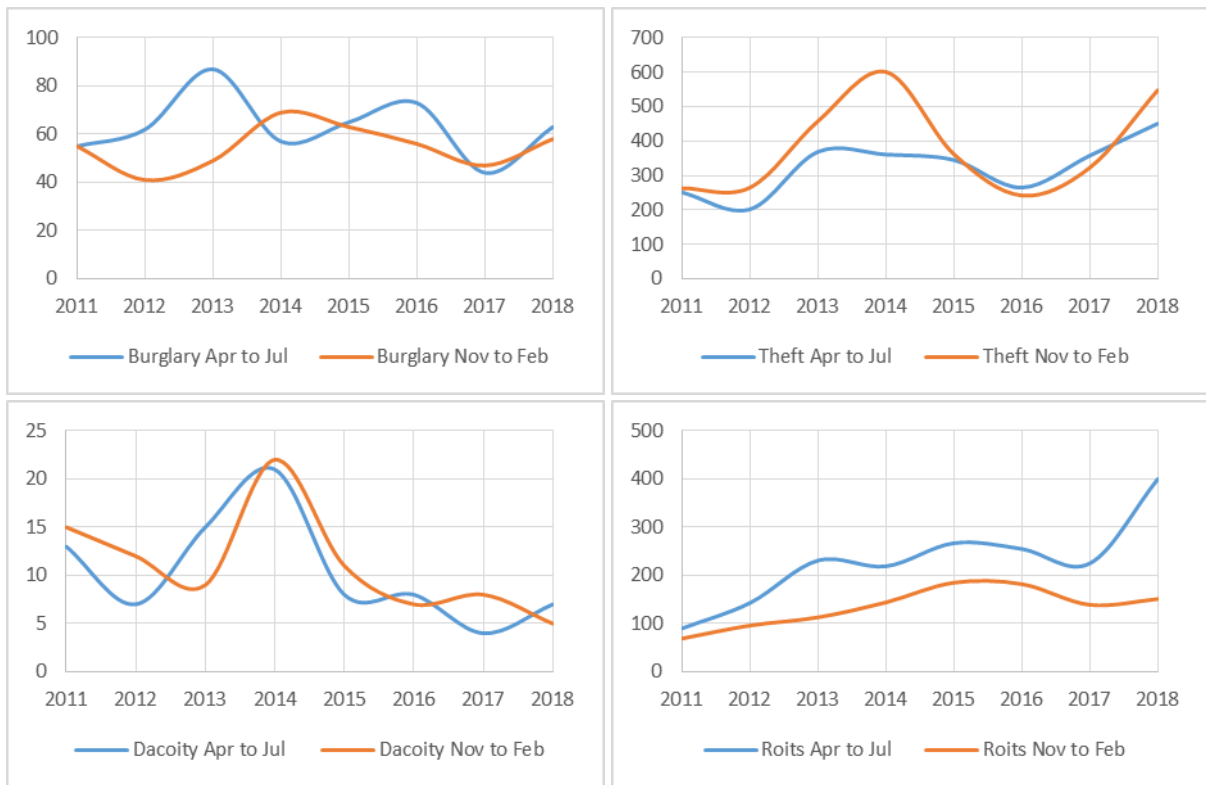


Chart -6: Crime against property in Gaya, 2011-2018

4.4 Begusarai district

Table -4: Crime in Begusarai, 2011-2018

Crime	Year/Month	2011	2012	2013	2014	2015	2016	2017	2018
Murder	Apr to Jul	9	17	17	9	9	15	8	6
	Nov to Feb	16	12	13	8	5	6	6	7
Dacoity	Apr to Jul	1	2	0	1	0	0	0	0
	Nov to Feb	1	0	0	1	1	1	0	0
Robbery	Apr to Jul	2	3	4	2	1	3	1	2
	Nov to Feb	5	4	2	2	2	2	1	2
Burglary	Apr to Jul	14	14	8	5	21	9	3	8
	Nov to Feb	13	20	9	9	9	8	10	7
Theft	Apr to Jul	37	44	66	47	28	26	24	15
	Nov to Feb	46	47	50	51	47	22	37	37
Roits	Apr to Jul	57	47	37	43	57	12	28	45
	Nov to Feb	45	53	27	37	27	14	28	19
Kidnapping	Apr to Jul	22	29	28	22	33	24	29	27
	Nov to Feb	15	22	17	29	31	22	18	21
Rape	Apr to Jul	4	6	8	5	2	1	5	4
	Nov to Feb	5	2	2	5	1	2	3	2

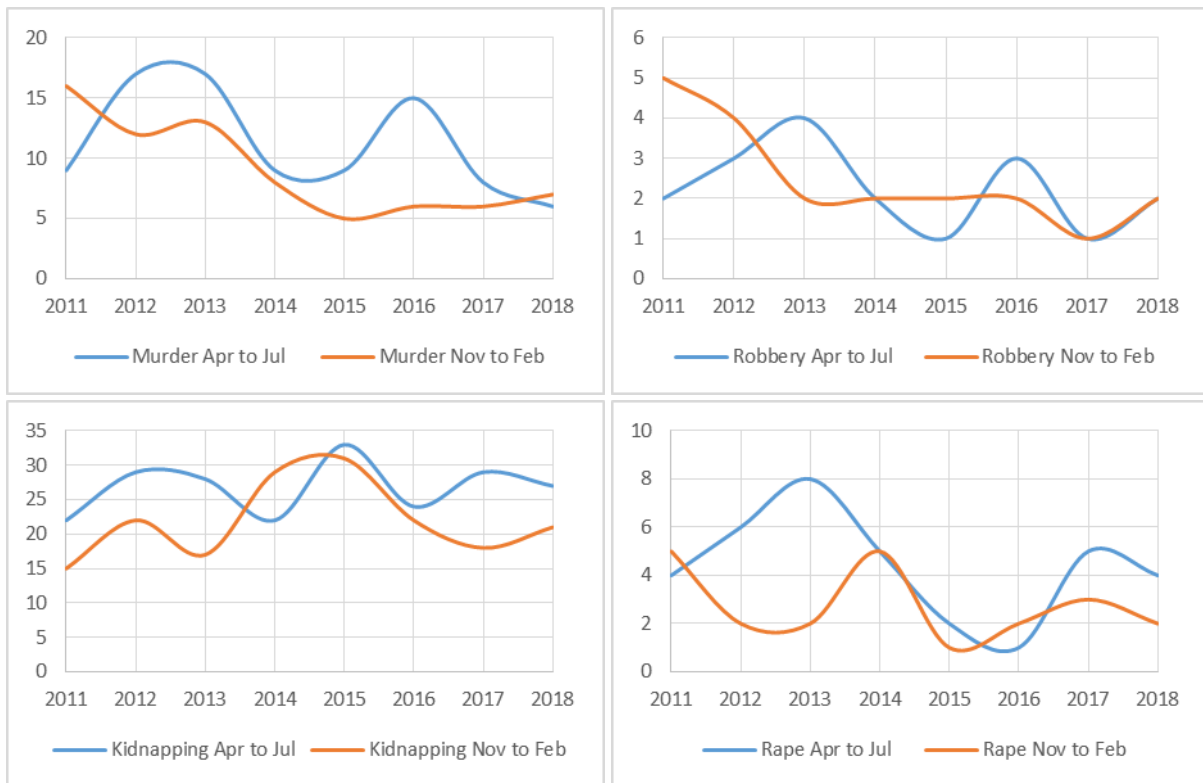


Chart -7: Crime against person in Begusarai, 2011-2018

In most of the cases of Begusarai, crime against person in the month of November to February is less than crime in the month of April to July.

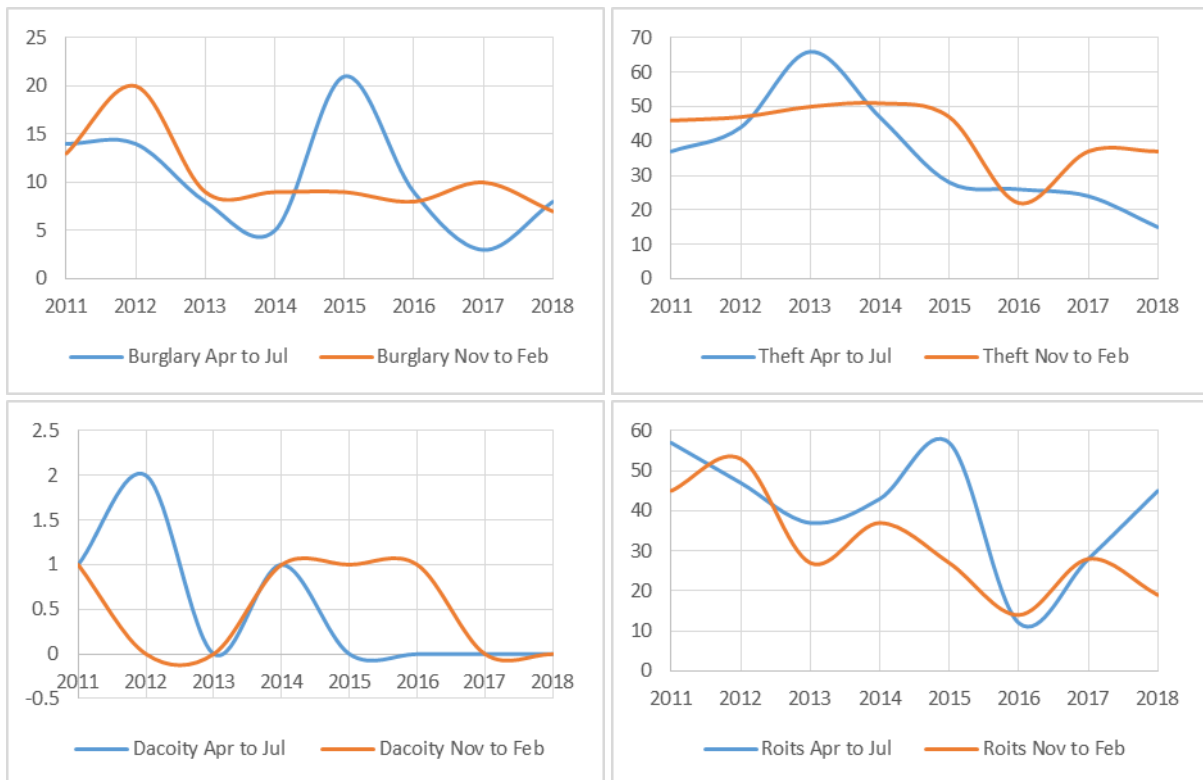


Chart -8: Crime against property in Begusarai, 2011-2018

4.5 Muzafarpur district

Table -5: Crime in Muzafarpur, 2011-2018

Crime	Year/Month	2011	2012	2013	2014	2015	2016	2017	2018
Murder	Apr to Jul	66	78	80	86	52	49	43	49
	Nov to Feb	43	65	62	49	38	28	28	33
Dacoity	Apr to Jul	10	15	22	10	14	8	1	7
	Nov to Feb	16	17	16	11	7	8	3	7
Robbery	Apr to Jul	42	33	37	63	53	42	26	59
	Nov to Feb	22	20	51	40	34	16	34	37
Burglary	Apr to Jul	66	83	81	97	119	131	101	114
	Nov to Feb	68	93	84	81	105	81	47	85
Theft	Apr to Jul	445	526	706	818	721	747	659	1073
	Nov to Feb	447	596	727	859	841	645	638	944
Roits	Apr to Jul	199	173	226	254	244	157	139	189
	Nov to Feb	98	127	151	190	124	54	72	101
Kidnapping	Apr to Jul	100	106	155	164	97	175	151	267
	Nov to Feb	80	77	99	118	94	75	97	205
Rape	Apr to Jul	23	12	19	19	13	9	15	48
	Nov to Feb	18	13	12	12	12	7	8	21

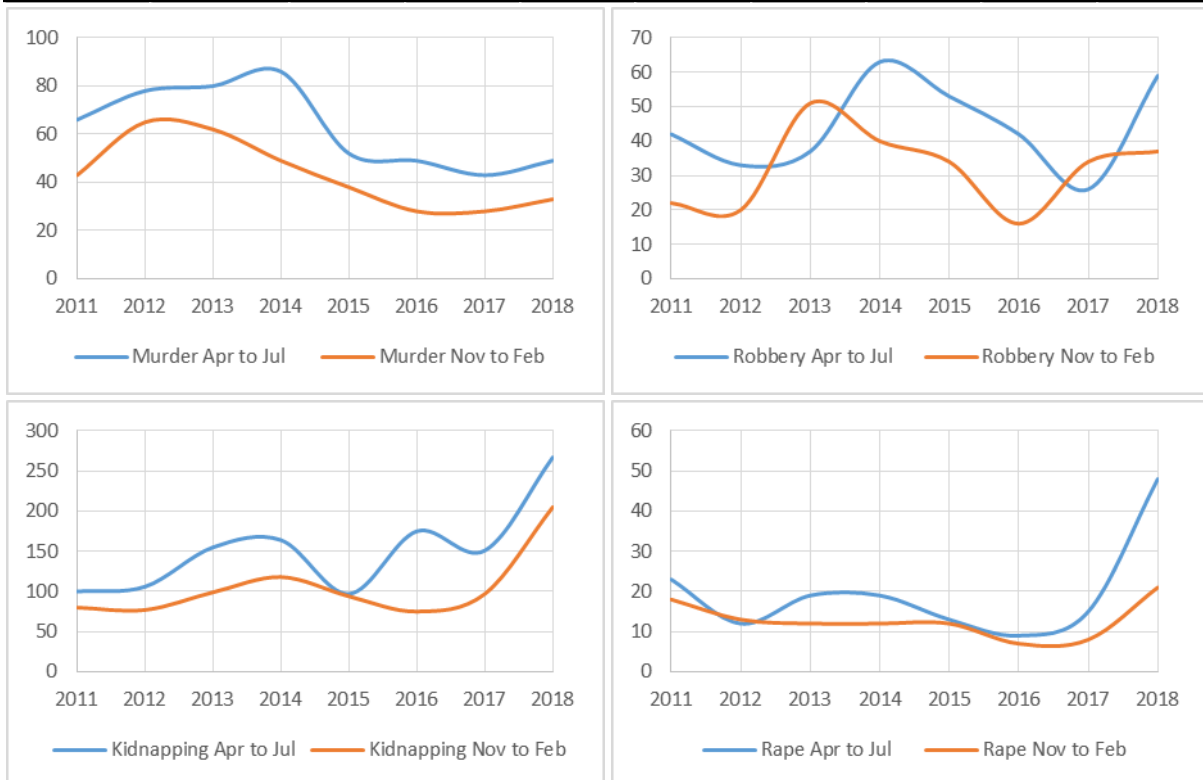


Chart -9: Crime against person in Muzaffarpur, 2011-2018

In most of the cases of Muzaffarpur, crime against person in the month of November to February is less than crime in the month of April to July.

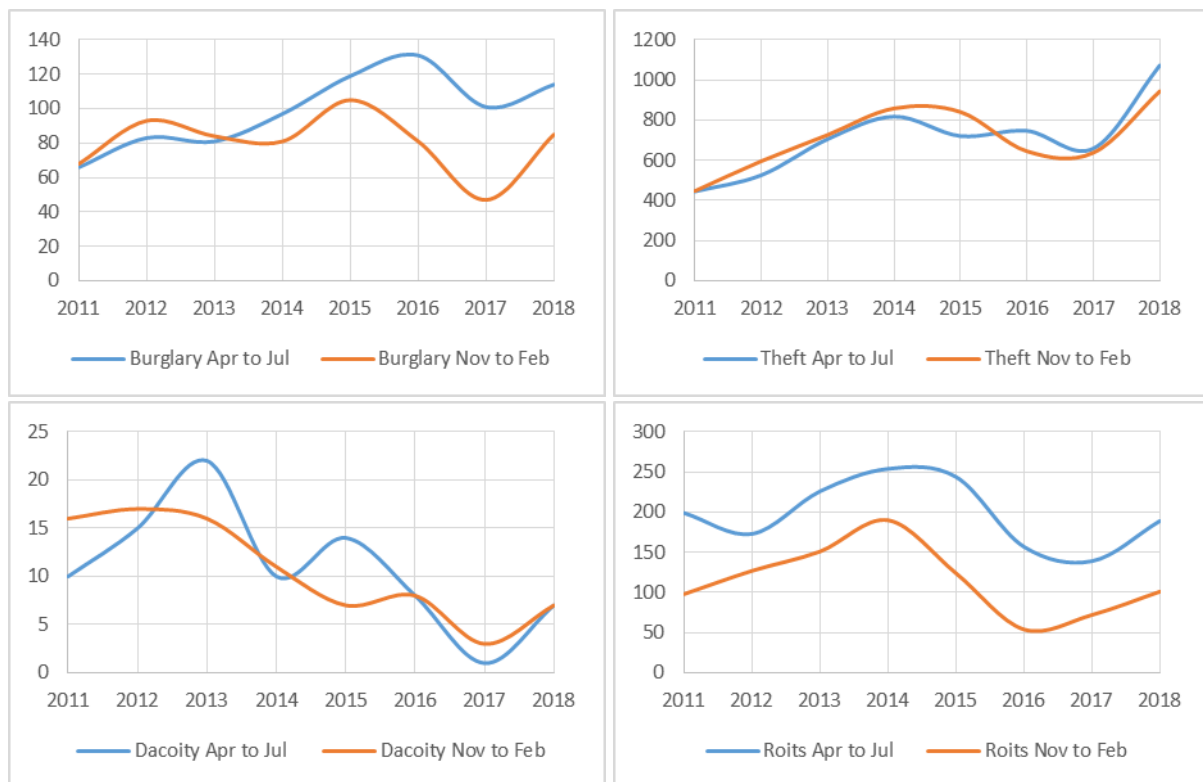


Chart -10: Crime against property in Muzaffarpur, 2011-2018

5. CONCLUSIONS

On one hand, in each of the above table number of dacoity, burglary and theft in the month April to July is less than number of dacoity, burglary and theft in the month of November to February which are negatively (-) correlated, that means as the temperature increases the number of dacoity, burglary and theft decreases in the five districts of Bihar. On the other hand, in each of the above table number of murder, robbery, riot, kidnapping and rape in the month April to July is more than number of murder, robbery, riot, kidnapping and rape in the month November to February which are positively (+) correlated, that means as the temperature increases the number of murder, robbery, kidnapping, rape and riot also increases. This research suggests that temperature is an important determinant of the number of criminal offences recorded in any place. Temperature have a significant effect on the number of violent crimes as well as on the number of property crimes recorded. The monthly data of crime and temperature will help in finding the correlation between them of other cities and states which is not available in present day.

Temperature increase or decrease is dependent on the location, geography, and urbanization. However, crime happening in states and cities may also depend on the behavior change or aggressiveness of a person due to too high and low temperature. Everyone must have recognize the general fact that certain atmospheric conditions, such as the dryness of the air, stimulates the human system while other conditions, such as moist air, relax the human system. This is not only experienced by man, but, also with other animals and plants.

In various studies, it is identified that hot weather may be one of the aspects for the violence. The fact may be observed by many of the sources and from various geographical areas. And as per the various observations it can be said that uncomfortable temperatures cause increase in aggressive motivation, and under the right conditions, in aggressive behaviour. The heat effect has influence on increase in aggressive behaviour in hot temperatures. It is noted that people believe that hot temperatures increase feelings of anger and hostility, decrease alertness and energy, and increase aggression and violence. Cold temperatures exhibit exactly the opposite effects. Researchers from Ohio State suggest that those who live in hot climates might have less self-control. Researchers from Iowa State University combined global warming data with statistics on violent crime in the USA between 1950 and 2008 and noted a sharp increase as temperatures get higher.

Researchers said hot weather can speed up a person’s heart rate and create an increase in testosterone, which can cause aggression. It is also found by another research that when people spend more time outdoors in warm weather, there are more opportunities for conflict.

6. RECOMMENDATION

- As an Environmental Planner I would say that we can maintain temperature in our cities by reducing consumption of resources which will result in decreasing temperature as we all want a safe city.
- Identify and reduce the environmental stressors in the lives of the people (hot temperatures, loud noise, crowded conditions), Reduction in environmental stress would be expected to yield reduction in social conflict within interpersonal and intergroup relationships.
- Reduce air pollution by upgrading energy use and alternative transport systems.
- Plant trees and incorporate the care of city green spaces as a key element in urban planning.
- In India the people who enter the house are served with a glass full of water reason being water being is a natural cooling agent which calms down the person, dehydration causes anxiety, panic attacks, depression, restlessness the high usage of the natural cooling agents like “WATER” as it helps maintaining the blood pressure, pushes in a better mood, Serving people with water is a behavioural change aspect.
- In Delhi nearby India Gate shed and mud pots filled with water are provided for the purpose of supplying water to passengers.



Fig -1: Mud pot near India Gate, 2016

Source: By Author, 2019

- Physical and mental act of well-being such as practice of meditation and physical exercises helps in reduction of violent aggression.
- It is need of an hour to understand and realize the importance of nature and do the acts according to the well-being of nature, as well being of the beings depend on the well-being of the nature and vice-versa. The simple recommendations followed may lead to the astonishingly positive outcomes, small is big viz. Small and simple changes implemented may result in the wholesome transformation. By mere making the people drink water can reduce crimes than nothing like it!

7. SCOPE FOR THE FURTHER RESEARCH:

- Other cities can also be analyzed using the method.
- Examine the effects of increased water consumption on moods of the prisoners.
- The effects of increased water consumption on the city’s personal crime.
- The effects of increased water consumption on property crime.

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