



## Analysis

## Civil unrest and the poaching of rhinos in the Kaziranga National Park, India

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## ABSTRACT

Civil unrest and political instability have been associated with endangered species poaching. This paper accounts for a period of civil unrest in Assam, India, which saw a marked increase in rhino poaching. Census data on the greater one-horned rhinoceros (*Rhinoceros unicornis*) in the Kaziranga National Park in Assam are used to estimate a population growth function. In calibrating the growth function's parameters the census data are used in conjunction with rhino poaching data. The rhino population and poaching data are used to econometrically estimate a harvest function. The relationship between civil unrest and rhino poaching is identified as positive and significant. The analysis factors in the probable relationships between poaching and several additional variables — including black market rhino horn prices, potential size of black markets, and anti-poaching efforts. These variables are seen to have the predicted associations with poaching, and help isolate the latter's relationship with civil unrest in the regression models. The goodness of fit between the data on rhino population and poaching and the estimates from regression models are studied.

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## 1. Introduction

The Kaziranga National Park (KNP), spread over an area of three hundred and seventy eight square kilometers, is located in the north-eastern state of Assam in India. The state of Assam shares international borders with Bangladesh and Bhutan, and is geographically close to Myanmar. A flagship species of the KNP is the greater one-horned rhinoceros (*Rhinoceros unicornis*) — also known as the Indian rhinoceros. Concerns over rhino poaching led to the declaration of Kaziranga as a national park in January of 1974 in accordance with the Assam National Park Act, 1968 (Saikia, 2011). Rhino poaching increased significantly in the 1980s through the mid 1990s in the state of Assam (refer to Table 1). This time period coincided with extensive civil unrest in Assam. The war of independence of Bangladesh (East Pakistan until March 1971) from West Pakistan in 1971 led to an exodus of ten million refugees to neighboring parts of India, including the state of Assam (UNHCR, 2012). The large influx of refugees changed the demographics of Assam and made the task of identifying illegal residents difficult (ICM, 2012). In 1979 mass movements led by native Assamese separatists campaigned for the detection of illegal migrants, for their removal from state voter lists, and for their deportation to Bangladesh (Thakur and Pandey, 2009). Secessionist tendencies began to form amongst the native Assamese in the late 1970s and a militant organization called the United Liberation Front of Assam was established with the goal of separation from the Indian state (ICM, 2012). This network of militant separatists

was speculated to have carried out rhino poaching in Assam during the period of civil unrest in order to fund arms purchases through the illicit sale of rhino horn (Agarwal et al., 1999; Menon, 1996).

During the late 1970s the Assam state government, led by the Congress (I) party, was more favorable to illegal immigrants because the immigrants formed a significant electoral voting block (Thakur and Pandey, 2009). Disagreement between the native Assamese separatists and the state government led to a breakdown of state administration, and Assam was brought under President's rule in December of 1979 (ICM, 2012). In 1980 the Indian Army was deployed in the state to maintain law and order. Talks between the separatists and the central government made no progress between 1980 and 1983. Elections were imposed by the Indian central government in 1983 despite opposition by the Assamese separatists. The Congress (I) party came back to power, but the election result was deemed unacceptable by the separatists. Attempts to force the separatists to accept the election result led to a breakdown of the state administration, and violence led to the deaths of over three thousand people (Thakur and Pandey, 2009).

A peace accord was signed between the separatists and the central government in 1985, which led to the dissolution of the Congress (I) state government, and the agreement to deport illegal immigrants. A new regional political party, the Asom Gana Parishad (AGP), came to power after the signing of the peace accord. Secessionist sentiments remained strong despite the peace accord and new political leadership, which led to the continuation of civil unrest and armed conflict. A lack of clearly defined rules to identify illegal immigrants meant that the provisions of the peace accord were not implemented meaningfully, and this

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**Table 1**  
Empirical data.

Year	Rhino population <sup>a</sup>	Rhino poaching <sup>a</sup>	Civil unrest <sup>b</sup>	Civil unrest (non-binary) <sup>c</sup>	Agricultural wage rate <sup>d</sup>	Assam GDP per capita <sup>e</sup>	Poaching penalty <sup>f</sup>	Anti-poaching camps <sup>g</sup>	Poachers arrested/killed <sup>g</sup>	GDP (China + Vietnam) <sup>h</sup>	Rhino horn price for poachers <sup>i</sup>	Political party <sup>j</sup>	Muslim population <sup>k</sup>
1972	658	5	0	1	4.79	2533	20319	75	0	74631	–	INC_Sinha	3710117
1973	–	3	0	1	5.27	2712	20553	75	0	86135	–	INC_Sinha	3828326
1974	–	3	0	1	5.74	3494	20793	75	0	85198	–	INC_Sinha	3946535
1975	–	5	0	1	6.61	3853	23753	75	0	91601	–	INC_Sinha	4064745
1976	–	1	0	1	6.61	3588	20897	75	0	82273	–	INC_Sinha	4182954
1977	–	3	0	1	6.85	3447	19696	75	0	88973	–	INC_Sinha	4301163
1978	939	5	0	2	7.56	3640	19099	75	0	105517	308	JP_Borbor	4419372
1979	–	2	0	2	7.76	3874	19625	75	0	122980	355	JP_Borbor	4537582
1980	–	11	1	8	8.44	4953	20726	75	0	133278	477	Pres_rule	4655791
1981	–	24	1	8	7.52	5651	20258	75	0	122001	530	Pres_rule	4774000
1982	–	25	1	9	8.78	7468	21376	75	0	120191	–	INC_Kesab	4933167
1983	–	37	1	10	10.03	7026	18171	75	0	126167	–	Pres_rule	5092333
1984	946	28	1	10	11.29	8144	18131	75	0	124809	–	INC_Saikia	5251500
1985	–	44	1	7	15.36	8660	16759	75	4	114418	1159	INC_Saikia	5410667
1986	–	45	1	8	17.87	8987	16022	75	4	103845	–	AGP_Mhnta	5569834
1987	–	23	1	9	18.81	8980	15023	75	4	104884	–	AGP_Mhnta	5729000
1988	–	24	1	9	19.44	9124	13750	75	4	117522	–	AGP_Mhnta	5888167
1989	–	44	1	9	19.44	8530	12087	75	4	106249	–	AGP_Mhnta	6047334
1990	–	35	1	10	20.59	8815	10664	75	4	86874	–	Pres_rule	6206501
1991	1129	23	1	10	26.65	8952	9447	75	4	88419	–	Pres_rule	6365667
1992	–	49	1	7	29.16	8667	8354	75	4	99156	–	INC_Saikia	6553162
1993	1164	40	1	6	29.78	8704	7760	75	4	115255	800	INC_Saikia	6740656
1994	–	14	0	2	32.92	8867	6936	75	4	88236	–	INC_Saikia	6928151
1995	1200	27	0	2	36.58	9127	6271	75	4	94350	–	INC_Saikia	7115645
1996	–	26	0	2	38.10	8973	5672	75	4	100301	–	AGP_Mhnta	7303139
1997	1250	12	0	1	37.49	10041	5964	75	4	104314	1200	AGP_Mhnta	7490634
1998	–	8	0	1	32.28	9665	5381	121	5	109815	–	AGP_Mhnta	7678128
1999	1552	4	0	1	31.77	9899	5000	121	20	117166	1400	AGP_Mhnta	7865622
2000	–	4	0	1	31.25	12763	4808	121	15	127801	–	AGP_Mhnta	8053117
2001	–	8	0	1	30.09	12782	4630	121	4	140447	–	AGP_Mhnta	8240611
2002	–	4	0	1	43.00	12149	4300	121	4	155508	400	INC_Gogoi	8379680
2003	–	3	0	1	41.16	14401	9147	121	4	176249	–	INC_Gogoi	8518750
2004	–	4	0	1	52.88	14881	8814	121	4	201834	–	INC_Gogoi	8657819
2005	–	7	0	1	46.50	15859	8455	121	4	230910	–	INC_Gogoi	8796889
2006	1855	7	0	1	59.74	16357	7965	150	9	277064	–	INC_Gogoi	8935958
2007	–	16	0	1	33.70	16495	7488	150	24	336632	–	INC_Gogoi	9075027
2008	–	6	0	1	44.92	16474	6911	150	4	408553	–	INC_Gogoi	9214097
2009	2048	6	0	1	52.99	16696	6234	150	7	450563	–	INC_Gogoi	9353166
2010	–	5	0	1	51.49	16803	55660	150	11	516367	–	INC_Gogoi	9492236
2011	–	3	0	1	48.80	16287	48805	152	8	603790	–	INC_Gogoi	9631305
2012	2290	11	0	1	45.66	16664	45656	152	19	661713	4581	INC_Gogoi	9770374

<sup>a</sup> Talukdar (2000, 2002, 2003, 2006), Vigne and Martin (1998), and various Forest Department Annual Reports.<sup>b</sup> Agarwal et al. (1999); Thakur and Pandey (2009).<sup>c</sup> Integer variable indicating extent of civil unrest based on Assam's history. Higher values indicate periods of President's rule, Indian Army deployments, and civilian deaths due to unrest. Lower values (1–2) indicate time periods of relative political stability in Assam.<sup>d</sup> Real daily agricultural wage rate in 2005 Indian Rupees (INR); time-series data on wage rates are available from various census reports for Assam. Conversion to real rates using consumer price indices (CPI) for Assam (Directorate of Economics and Statistics, various years; Jose, 1988; Rao, 1980).<sup>e</sup> GDP per capita (2005 INR; sources – various Assam state population and economic census reports). With no population census conducted in 1981 the population estimates are interpolated using growth rates between the 1971 and 1991 Census.<sup>f</sup> Poaching penalties (2005 INR) as per Indian Wildlife Protection Act (1972) Section 51 and its Amendments in 2003 and 2010 (MoEF, 2013).<sup>g</sup> Assam's Forest Department set up 152 anti-poaching camps in KNP by 2012 (Gray, 2013) and 121 camps during the late 1990s and early 2000s (Mathur et al., 2005). In the 2000s there were improvements made to the anti-poaching camps' infrastructure and equipment; additional staff/guards were also employed – this doubled from three armed guards per camp in earlier periods to six armed guards per camp in the 2000s (sources: AFD (2008); Gray (2013), and author's personal communication with Principal Chief Conservator of Forests (Wildlife) Assam office). Given this doubling of number of armed guards per camp the number of anti-poaching camps in earlier periods is taken to be half of that in the 2000s to reflect the improvement in KNP's anti-poaching efforts. In 2006 KNP was declared a tiger reserve, which facilitated additional staff employment (Dutta, 2013). Information on poachers arrested/killed based estimates from AFD (2008), Dutta (2013), Gray (2013), and Talukdar (2000).<sup>h</sup> GDP ('0,000,000 s US\$) of China and Vietnam in 2005 CPI prices: [http://www.ers.usda.gov/datafiles/International\\_Macroeconomic\\_Data/Historical\\_Data\\_Files/HistoricalCPIsValues.xls](http://www.ers.usda.gov/datafiles/International_Macroeconomic_Data/Historical_Data_Files/HistoricalCPIsValues.xls) (accessed September 2013).<sup>i</sup> Reports of rhino horn prices (US\$/kg) available to poachers: 1978–1981, 1985 (Sas-Rolfes, 1997); 1993 (Milliken et al., 1993); 1997 (Vigne and Martin, 2000); 2002 (Talukdar, 2002); and 2012 (Eustace, 2012; Sas-Rolfes, 2012). Missing data interpolated using linear trends. US\$ converted to 2005 INR using exchange rates (<http://fx.sauder.ubc.ca/etc/USDpages.pdf> (accessed September 2013)).<sup>j</sup> Political party ruling Assam; INC\_Sinha: Congress (I) under S.Sinha; JP\_Borbor: Janata Party under G.Borbor; INC\_Kesab: Congress (I) under K.Gogoi; INC\_Saikia: Congress (I) under H.Saikia; AGP\_Mhnta: Asom Gana Parishad under P.Mahanta; Pres\_rule: President's rule; and INC\_Gogoi: Congress under T.Gogoi.<sup>k</sup> Assam census reports and Sachar et al. (2006).

only strengthened the secessionist sentiment. In 1990, President's rule was once again enforced and the Indian Army was used to subdue the militant separatists (Thakur and Pandey, 2009). In 1993 another peace accord was signed between the state government (under the Congress (I) party) and the separatists, wherein army operations were suspended and amnesty was granted to surrendering militants.

The remaining militant separatists moved across the international border to Myanmar and Bhutan (ICM, 2012).

This paper studies an important but inadequately understood relationship between civil unrest and endangered species protection. Animal species in tropical countries have been subject to poaching in regions that have witnessed political instability and civil unrest.

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