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Letter from the Editor

North Carolina State University is thriving with students who are innovative, dedicated and visionary. Our talented young scholars conduct graduate-level research / creative projects that are of high quality and that represent a hallmark of the partnership that brings faculty mentors and students together. I am pleased to present just a portion of our students' work.

This is the fourth year since the establishment of the North Carolina State University-Undergraduate Research Journal, a publication that is improving with each passing year. I am proud of this first issue of the 2008 NCSU-URJ and of the research presented. We have a variety of research topics in this issue, ranging from philosophy to fisheries and wildlife, all of which are commendable. The students whose work is featured are examples of the University's exemplary standards that are continuously rising.

It has been a privilege to work with these students and faculty members. Without the generous assistance of everyone involved, including the designer of this issue, Michael Laut, this issue would not have been possible. NC State is one of North Carolina's greatest resources, as Chancellor James L. Oblinger has said, and with the constant dedication from the students, we will continue to be a great resource. I look forward to recruiting the authors for the late spring issue of 2008.



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Maryland Region Meteorologically Adjusted Ground-Level Ozone Trend Analysis

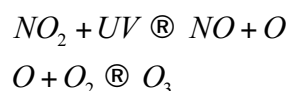
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Abstract

Tropospheric or ground-level ozone trends are often used to determine the impacts of emissions control strategies across the country. The major precursors to ground-level ozone formation are volatile organic compounds (VOCs) and nitrogen-oxides (NO_x). The EPA Nitrogen Oxides State Implementation Plan Call (NO_x SIP Call) began in 2001 in an effort to mitigate the formation of ground-level ozone. Since ozone is strongly affected by the influence of meteorological variables, many different approaches have been taken to determine the trend in ozone by removing the effects of varying meteorology. The purpose of this project was to build a time series model that removes the effects of meteorology, autocorrelation, and seasonal trends based on ozone and meteorological data from the Maryland Department of the Environment. This data spans April through October of 1997-2006 for the measuring sites in the State of Maryland and Washington, D.C. The result of our analysis is a series of models that estimate the reduction in ground-level ozone over this ten-year period.

Introduction

Tropospheric ozone is one of the most important pollutants in today's world. The primary factors influencing ground-level ozone formation are solar radiation, nitrogen oxides, volatile organic compounds, light wind and high temperature (NRC, 1991, Chapter 4). One of the important chemical reactions driving ozone formation is the decomposition of nitrogen dioxide (NO₂) by ultraviolet radiation (UV) into nitrogen oxide (NO) and monatomic oxygen (O), which then combines with diatomic oxygen (O₂) to form ozone (O₃):



Because of its effects on human health and agriculture, government officials have sought to control ozone by setting emissions standards on its precursors, nitrogen oxides (NO_x) and volatile organic compounds (VOCs). The Nitrogen Oxides State Implementation Plan Call (NO_x SIP Call) was implemented in 2001 and requires the reduction of NO_x emissions at electric utilities. While many of these plans have had some effect on the trend of ozone over time, it is a challenge to interpret the success of these plans because of the strong effect of varying meteorological conditions on ozone concentration. Therefore, it is necessary to determine an ozone trend adjusted for varying meteorology in order to determine how effective emission controls, such as the NO_x SIP Call, have been. In this project, we have designed a model that accounts for varying meteorology from ten years of data provided by the Maryland Department of

the Environment, to determine the impact of the NO_x SIP Call in the state of Maryland.

A multitude of statistical techniques exist to account for meteorological variation (Thompson et. al 2000), notably time series filtering (Rao & Zurbenko, 1994), semiparametric modeling (Gao et. al. 1996), regression tree analysis (Huang & Smith, 1999), dynamic linear modeling and general additive modeling (Zheng et. al., 2006), among many others. However, we chose time series linear regression due to its simplicity and straightforwardness of interpretation. Through careful selection of explanatory variables, we were able to construct a model that explained approximately seventy percent of the variance in eight-hour ozone concentrations. This resulted in a statistically significant estimate of the residual trend in ozone concentration over the ten-year period of study.

Methods

Quality Control and Data Conditioning

The data from the Maryland Department of the Environment included both one-hour observations and the forward rolling eight-hour average. Each year contained observations beginning on April 1st and ending on October 31st. We began by reading all of the ozone data from 1997 to 2006 into statistical analysis software (SAS) and then sorting both statistics by site. The daily maximum for both one-hour and eight-hour observations were then extracted and matched with daily meteorological data from Baltimore Washington Thurgood-Marshall International Airport (BWI) and the EPA Clean Air Status and Trends Network (CASTNET) site from Beltsville, Maryland (BEL116). High temperature, resultant wind speed and

resultant wind direction were taken from BWI. High temperature was converted to degrees Kelvin and the wind speed and wind direction were converted into cardinal wind components (North, South, East, and West). Taken from BEL116 site were the maximum solar radiation and the average relative humidity, among other variables from both sites. In using the weather data from these two sites we assumed the variation in those parameters across the region would be negligible, or at least that the observations at those sites would be useful in predicting ground-level ozone in the eastern part of the state.

The ozone data was also checked for data completeness; only sites having ninety percent or better data completeness in each of the ten years were considered for the analysis. There were fourteen sites in the forecasting region that had ninety percent or greater data completeness. Most of the sites with insufficient data completeness began recording data in the middle of the ten-year period between 1997 and 2006. Five sites with ninety percent or greater data completeness and relatively close proximity to the meteorological sites were used in the initial analysis. Out of the many sites in the forecast region, the sites chosen for the initial analysis, based on the completeness criterion and proximity described above, were Padonia, Aldino and Rockville in Maryland, as well as Takoma Park and River Terrace in Washington D.C (Fig 1).

Correlation of Meteorological Variables

Both the one-hour and eight-hour concentrations were log-transformed to increase correlation with the meteorological variables. Using SAS we built the correlation matrix (Table 1), which showed us that solar radiation, high temperature and average relative humidity were the most useful predictors in our model. Since relative humidity is a measure of the amount of water vapor in the atmosphere, we understand that if more moisture is present in the atmosphere then there would be increased condensation. It may be possible that water vapor condensing on NOx and VOC's limits the amount of ozone that can form. We also examined scatter plots of several meteorological variables against the ozone data. As we expected, the temperature (Fig 2) and the average relative humidity (Fig 3) showed strong correlation to the ozone data in the plot as well as mild curvature, which explains the significance of their respective second-order terms. The plot of the raw ozone over time (Fig 4) was as expected, with peaks every summer and dropping off in the fall and spring.

From this list of significantly correlated meteorological variables—including previous day's and current day's wind vectors, interaction terms, and second and third order terms—we used SAS to perform stepwise selection at significance .01 to determine which variables would be appropriate for the model. Though the resultant wind

speed and calculated wind vectors were often significant, they provided little explanatory power (partial R-square of less than one percent) and were subsequently dropped from the model. Therefore, we used the remaining variables to build a general linear model:

$$\log(O_3) = \beta_0 + \beta_1 T + \beta_2 T^2 + \beta_3 H + \beta_4 H^2 + \beta_5 S$$

Where T is daily high temperature, H is average relative humidity, and S is maximum solar radiation.

Seasonal Trend

An unexpected finding occurred in examining model residuals by month (Fig 5); this plot showed that early in the ozone season the model under-predicts the ozone in the spring and over-predicts the ozone in the fall. After all five initial sites displayed the similar seasonal trend, we assessed the best way to account for this within the model. Since we had no explanation for this seasonal trend, we added a day of the year term into the model to neutralize this trend in model (Fig 6). The additional variable 'day' is D=1 on April 1st, D=31 on May 1st and so on. Not only was this variable highly significant when adopted into the model, it explained approximately ten percent of the variability in the residual eight-hour ozone concentration.

Estimation of Overall Trend

To estimate the overall trend, we added a 'year' term, Y. This allowed us to calculate the change in background concentration over time without further adjustment for seasonal variation:

$$\log(Max8hrO_3) = \beta_0 + \beta_1 T + \beta_2 T^2 + \beta_3 H + \beta_4 H^2 + \beta_5 S + \beta_6 D + \beta_7 Y$$

Therefore, if the year slope is negative, the concentration of ozone is decreasing over time. Also, because the concentration is expressed on a logarithmic scale, the value for β_7 approximates the average change in ozone concentration per year (a value of $\beta_7 = -.01$ indicates a decrease of approximately one percent per year). This model was tested for autocorrelation using the Durbin-Watson statistic and multicollinearity using the variance inflation factor. Though multicollinearity was not a significant problem, the presence of autocorrelation was significant enough to justify use of an autoregressive error model.

We proceeded to adjust for autocorrelation present in the general linear model. To account for weekly fluctuations in ozone trends we used an autoregressive error model with a seven day lag using the method of maximum likelihood; lagged terms that were not significant were removed using the Yule-Walker method. The explanatory variables adopted into this model are those that were

chosen via stepwise selection in the general linear model.

Back Trajectory Modeling

We also performed several back trajectories using NOAA's Hybrid Single-Particle Lagrangian Integrated Trajectory Model (HYSPLIT). We used this model to determine where particles of air would be coming from forty-eight hours before the ozone observation occurred. This was done for good and very unhealthy days, before and after the application of the NOx SIP Call.

Results

Overall Trends

Of the eleven sites analyzed in Eastern Maryland, nine showed statistically significant decrease in ozone trends between 1997 and 2006 (Table 2). The three sites in Washington, D.C., in addition to the two remaining sites in Maryland, did not show a significant change. No site indicated an increase in ground-level ozone concentration. The largest decrease occurred at the Fair Hill site with an estimated reduction of fifty-two percent. The explanatory power of the models ranged from sixty-seven to seventy-four percent (adjusted R-Square).

Edgewood Site

Because the Edgewood site consistently ranks as the highest design-value statistic in the region it is of particular interest to our study (the design-value as designated by the EPA is three-year running average of the fourth highest eight-hour concentration for each year). Edgewood also presented us with a unique problem due to its location. Sea breeze is caused by the difference in heat capacity between water and land; the land surface has a much smaller heat capacity than water, therefore the air above the land surface heats and cools much more quickly than over water. The difference in temperature results in the formation of a sea breeze (Figure 7, Piety, 2007). Many studies in the U.S. and abroad have shown the influence of sea breeze on local ozone concentrations (Seaman and Michelson, 1998; McElroy et. al, 1986; Bornstein et. al, 1993; Cheng, 2002; Boucouvala and Bornstein, 2003; Martilli et. al, 2003; Evtugina et. al, 2006; Piety, 2007). Similar to the sea breeze is the bay breeze, in this case off the Chesapeake Bay. While the precise timing of a particular sea breeze or bay breeze is a function of the local conditions, 3:00-4:00pm EST is a standard time for formation of a sea/bay breeze (Stull, 1988). This timing is of note because the maximum ozone levels occur shortly after the bay breeze is believed to form. The Edgewood site is in an ideal location for land-sea interactions. The site stands twenty-three miles northeast of Baltimore, sixty-eight miles northeast of Washington D.C., five miles from Interstate 95 and Maryland State Highway 40, between the Gunpowder River in the north and the

Bush River in the south, and on the western coastline of the Chesapeake Bay. Thus, this site is influenced by both local and regional sources of ozone, and the bay breeze may be consistently preventing typical ventilation from the locale. The location of the site suggests that the bay breeze circulation can exacerbate peak ozone concentrations during regional and local high ozone episodes (Piety, 2007). This makes Edgewood a challenge to adjust to the model and causes the higher eight hour ozone design values than other sites in the state.

HYSPLIT Model

The HYSPLIT model also returned several trajectories for good and bad days, before and after the NOx SIP Call, which point to decreased ozone concentrations for the state of Maryland. Two particular examples will be examined here. On July 14, 1997, the highest recorded ozone observation at the Edgewood site was 136 ppb. These 'very unhealthy' levels of ozone were traced back to the Midwest and the Ohio River Valley (Fig 8). Similarly, on June 26, 2003, the highest recorded observation was 129 ppb; and again HYSPLIT found the air to be coming from the Ohio River Valley (Fig 9). It was a similar result for many of the bad days, and those unhealthy ozone days that were dissimilar resulted from stagnant air preventing at the surface preventing ventilation that would have dissipated the already present ozone and its precursors from previous days. These results from the HYSPLIT indicate that the reductions from the application of the NOx SIP Call have decreased ozone concentrations in Maryland, and many of the days with terrible air quality have come from the Midwest and Ohio River Valley between 24 and 48 hours beforehand. It should be noted that this conclusion is anecdotal, as the only discriminating variable in selecting days for the model is the highest ozone concentration on a specific day, without regards to similar weather patterns between good and bad days.

Conclusion

Overall Trend

It can be concluded that ozone has generally decreased in ozone concentration in Maryland during the implementation of the NOx SIP Call in 2001. However, while the concentration of ozone over time has decreased, we note that the models built in this study do not take into account the emissions of NOx or VOCs, and therefore do not specifically indicate the effect of the NOx SIP Call. Yet, because it does take into account the varying effects of meteorology, the autoregressive error model strongly suggests that the emission reductions resulting from the NOx SIP Call in the Midwest and Eastern part of the U.S have resulted in decreased tropospheric ozone concentrations in the State of Maryland. As we continue to work on the models, we intend to add terms representing NOx emissions and VOC emissions (both biogenic and anthropogenic). Also, as we continue to work with the HYSPLIT

model we hope to account for variation not explained by the autoregressive error model, and in particular during periods of highest ozone concentration by comparing days with similar weather patterns.

Seasonal Trend

We present two possible explanations for ozone seasonality: The first is the possible influence of stratospheric ozone that mixes in as the inversion layer breaks down in the morning, with the mixing being strongest in April and weakest at the end of October. Second is the biogenic VOC emissions from plants are strongest in spring, and weakest in fall. We hope to incorporate the Biogenic Emission Inventory System (BEIS) model to further account for seasonal fluctuations in VOCs that may contribute to seasonal ozone trends.

Acknowledgements

Our research was made possible in part through a National Science Foundation Grant for the Vertical Intergration of Research Education (VIGRE) and the NC Undergraduate Research Office Summer Award. We would like to thank our faculty advisor and mentor, Bill Hunt, Jr., our research colleague Jordan Harris, Dr. Kenneth Walsh, Dr. David Dickey, Dr. Roger Woodard and the NC State University Department of Statistics. Also we would like to thank the Maryland Department of the Environment, in particular Matthew Seybold, David Krask, and Duc Nguyen.

Table 1: Correlation Between Meteorological Parameters and Ozone Concentration, Padonia, Maryland (Pearson Coefficient of Correlation, R)

	Ozone	T	S	H	W _{North}	W _{South}	W _{East}	W _{West}
Ozone	1	.685	.601	-.317	-.278	.17	-.176	.022
T		1	.477	-.0966	-.379	.248	-.284	-.055
S			1	-.542	-.181	.068	-.363	.207
H				1	-.013	.010	.271	-.351

T = Maximum Temperature, S = Maximum Solar Radiation, H = Average Relative Humidity

W = Directional Component of Resultant Wind Vector

Table 2: Estimated Trends in Ground-Level Ozone

Site Name	AQSC	Trend (%)	P-Value	Model R ²	Total Change (%)	99% Confidence Interval
Takoma Pk	110010025	-0.680	0.4242	0.7363	-6.594	(-27.08 , 13.89)
McMillan	110010041	0.105	0.8216	0.6687	1.057	(-11.05 , 13.16)
River Ter	110010043	-1.005	0.0246	0.728	-9.607	(-19.99 , 0.78)
Davidsonville	240030014	-2.420	<.0001	0.7122	-21.730	(-28.67 , -14.79)
Padonia	240051007	-1.193	<.0001	0.6995	-11.308	(-17.47 , -5.15)
E. Maryland	240053001	0.615	0.0755	0.6777	6.327	(-3.10 , 15.75)
South Carroll	240130001	-1.173	0.0003	0.7047	-11.130	(-18.62 , -3.64)
Fair Hill	240150003	-7.068	<.0001	0.7164	-51.953	(-60.89 , -43.02)
So. Maryland	240170010	-1.754	<.0001	0.6661	-16.222	(-25.00 , -7.44)
Edgewood	240251001	-0.526	0.0691	0.691	-5.136	(-12.21 , 1.93)
Aldino	240259001	-1.035	0.0001	0.7167	-9.877	(-15.70 , -4.05)
Millington	240290002	-1.420	<.0001	0.6905	-13.325	(-20.25 , -6.40)
Rockville	240313001	-2.625	<.0001	0.6972	-23.356	(-36.01 , -10.71)
Beltsville	240330002	-2.37	<.0001	0.7087	-21.337	(-31.71 , -10.96)

AQSC = Air Quality Site Code, P-value is the significance of the 'Year' term in the model, Model R² = Adjusted R-Square, Total Change is calculated from the trend, 99% Confidence Interval is calculated using the standard error of the 'year' term.

Figure 1: Map of Selected Sites

See Figure 2 for reference. The design value site, Edgewood is shown as a star. Beltsville EPA-BEL116 (solar radiation data)

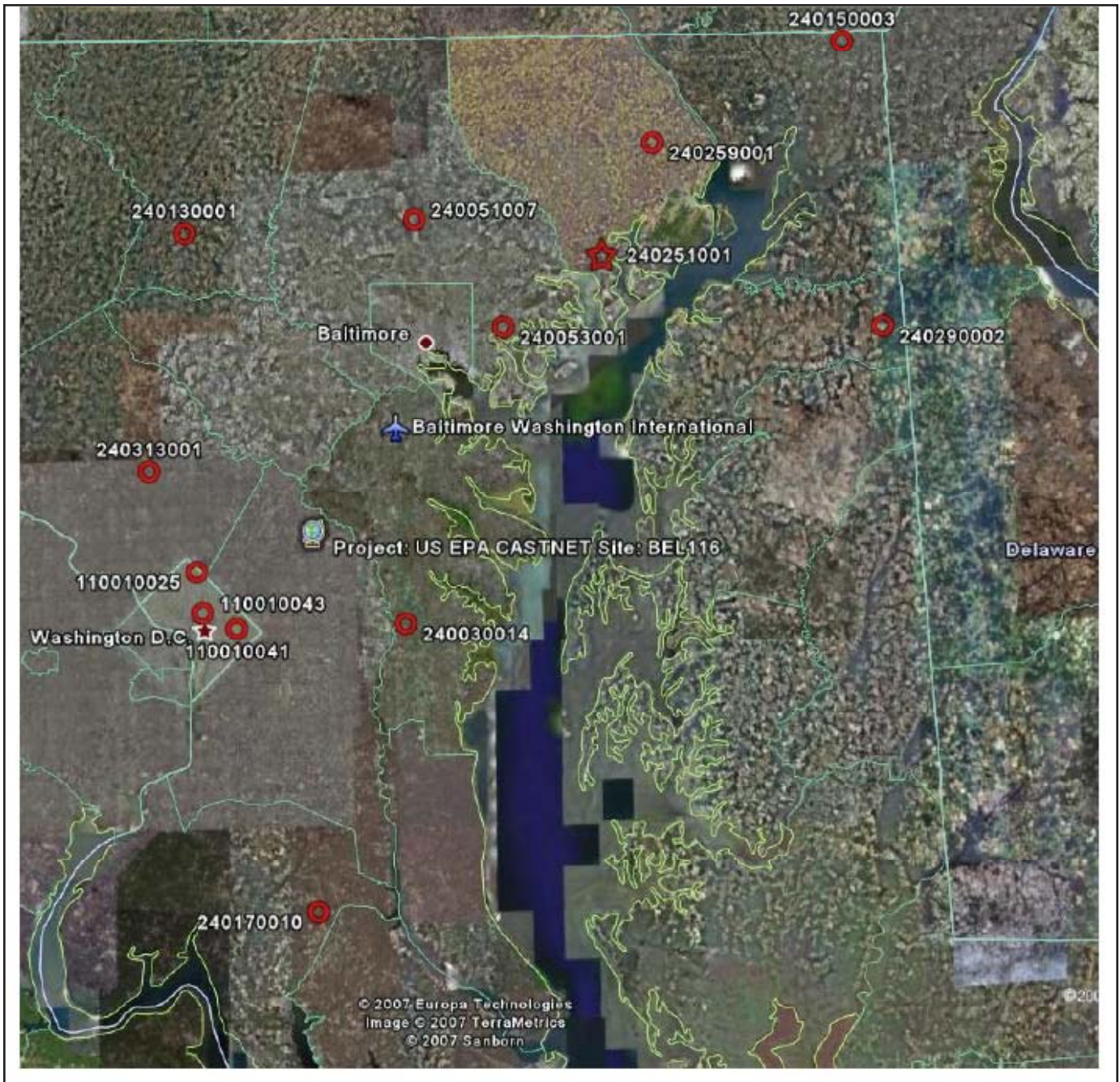
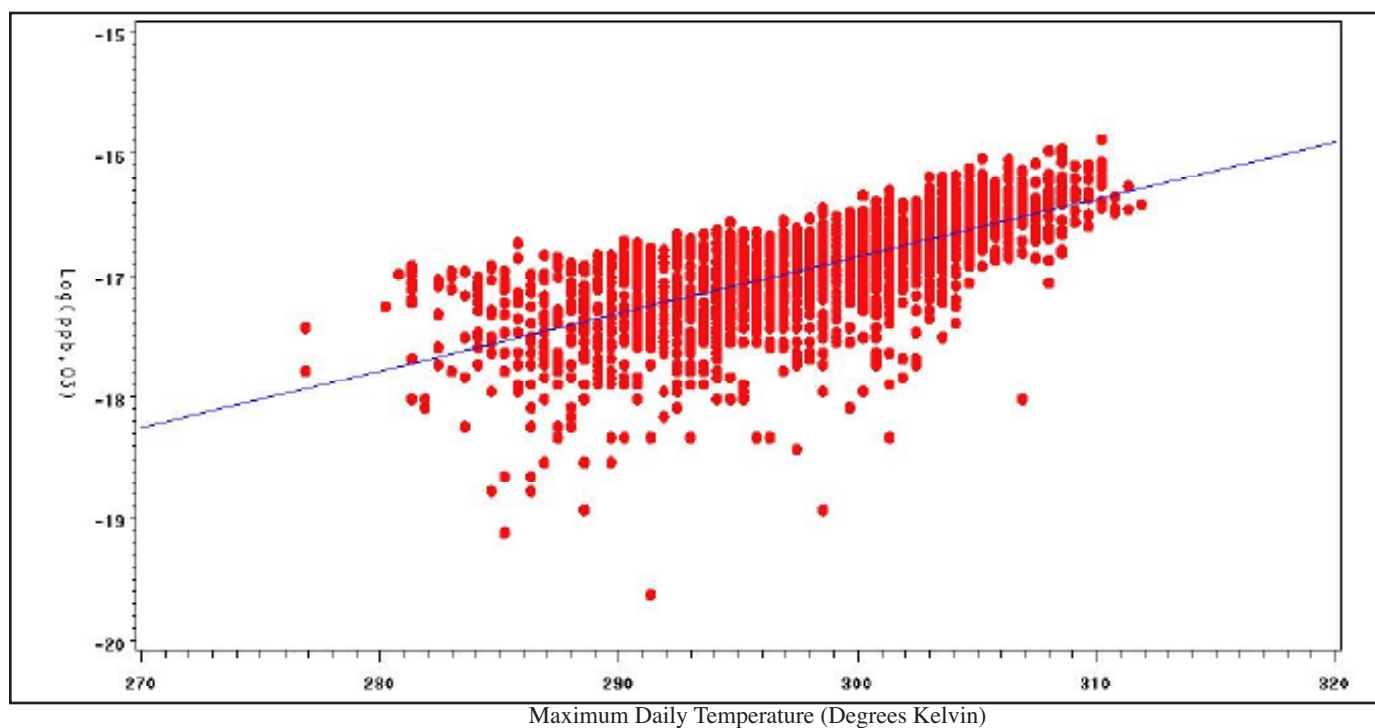


Figure 2

Correlation of Temperature vs. Ozone

AQSC=241051007 (Padonia)

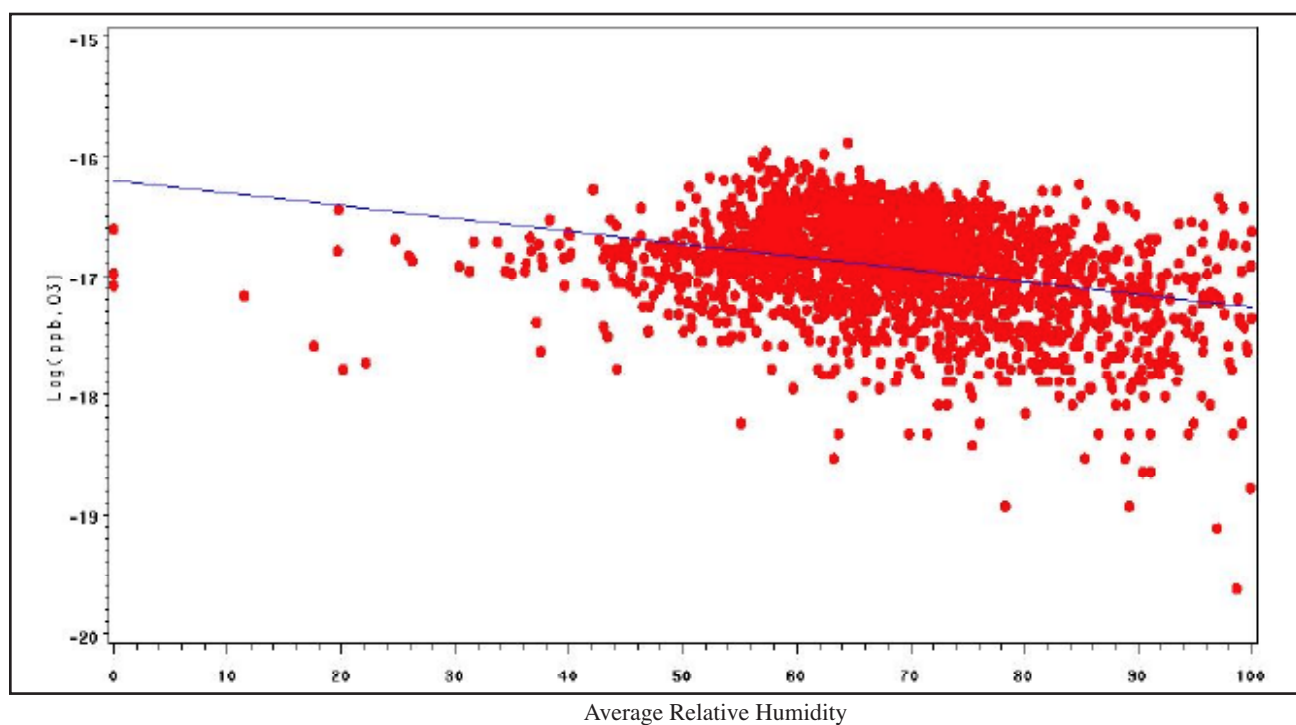


R=.685

Figure 3

Correlation of Humidity vs. Ozone

AQSC=241051007 (Padonia)



R=-.317

Figure 4

Ozone Concentration Over Time

AQSC=241051007 (Padonia)

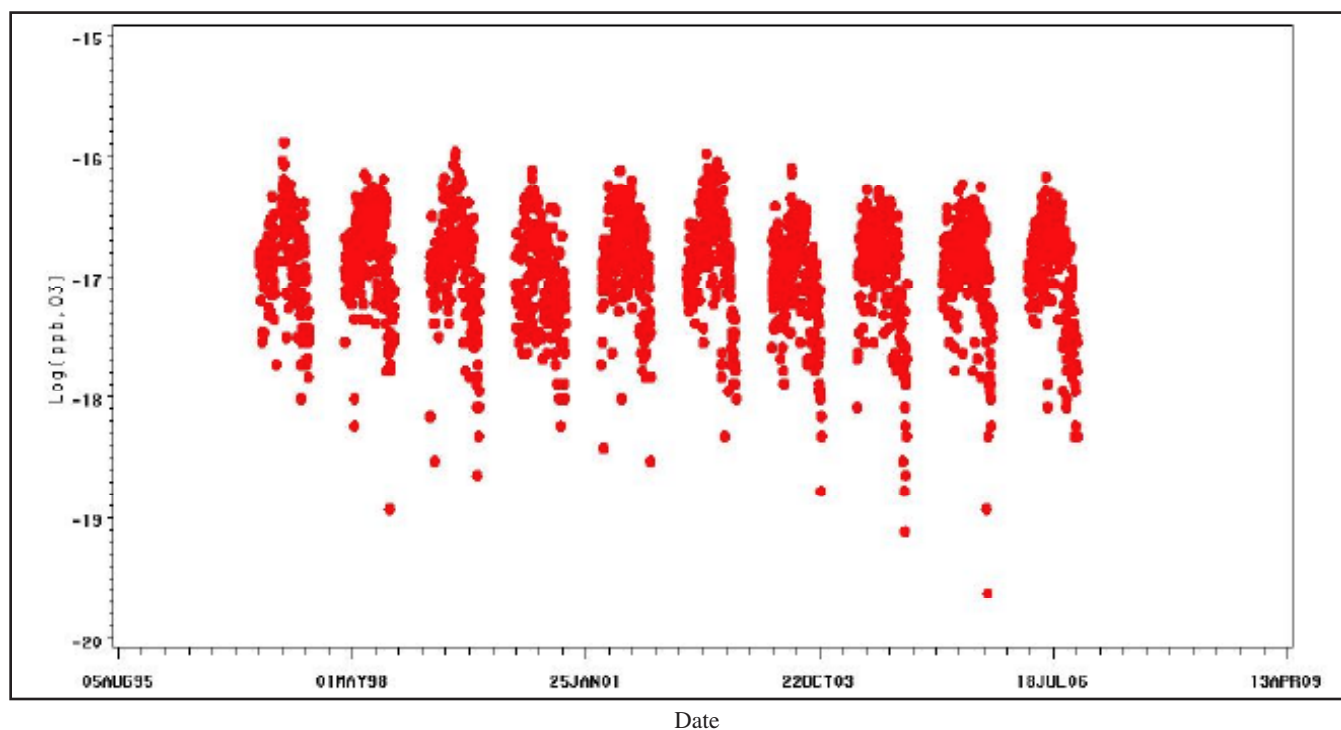


Figure 5

Seasonal Trend in Ozone Residuals

AQSC=241051007 (Padonia)

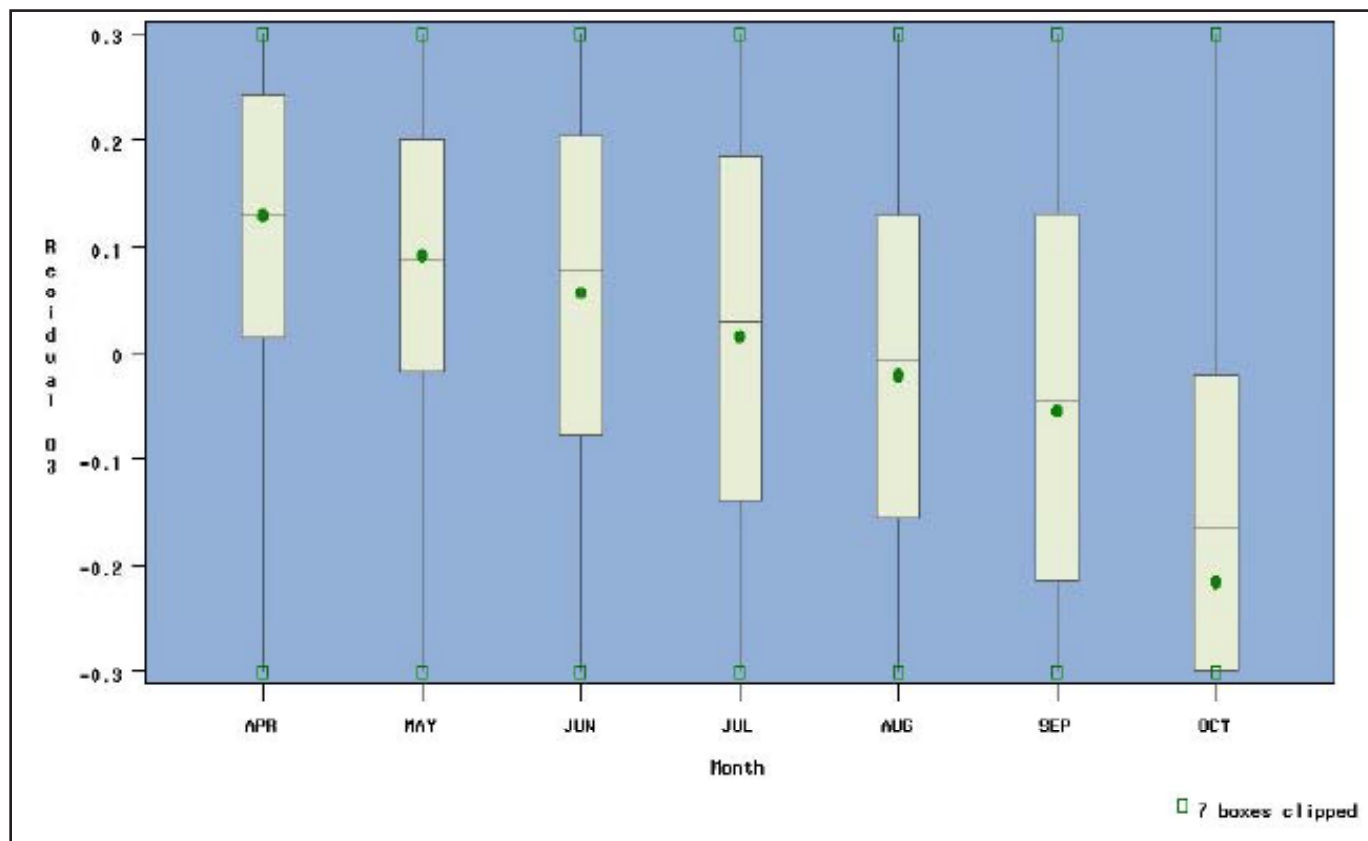


Figure 6

Ozone Trend Adjusted for Seasonality AQSC=241051007 (Padonia)

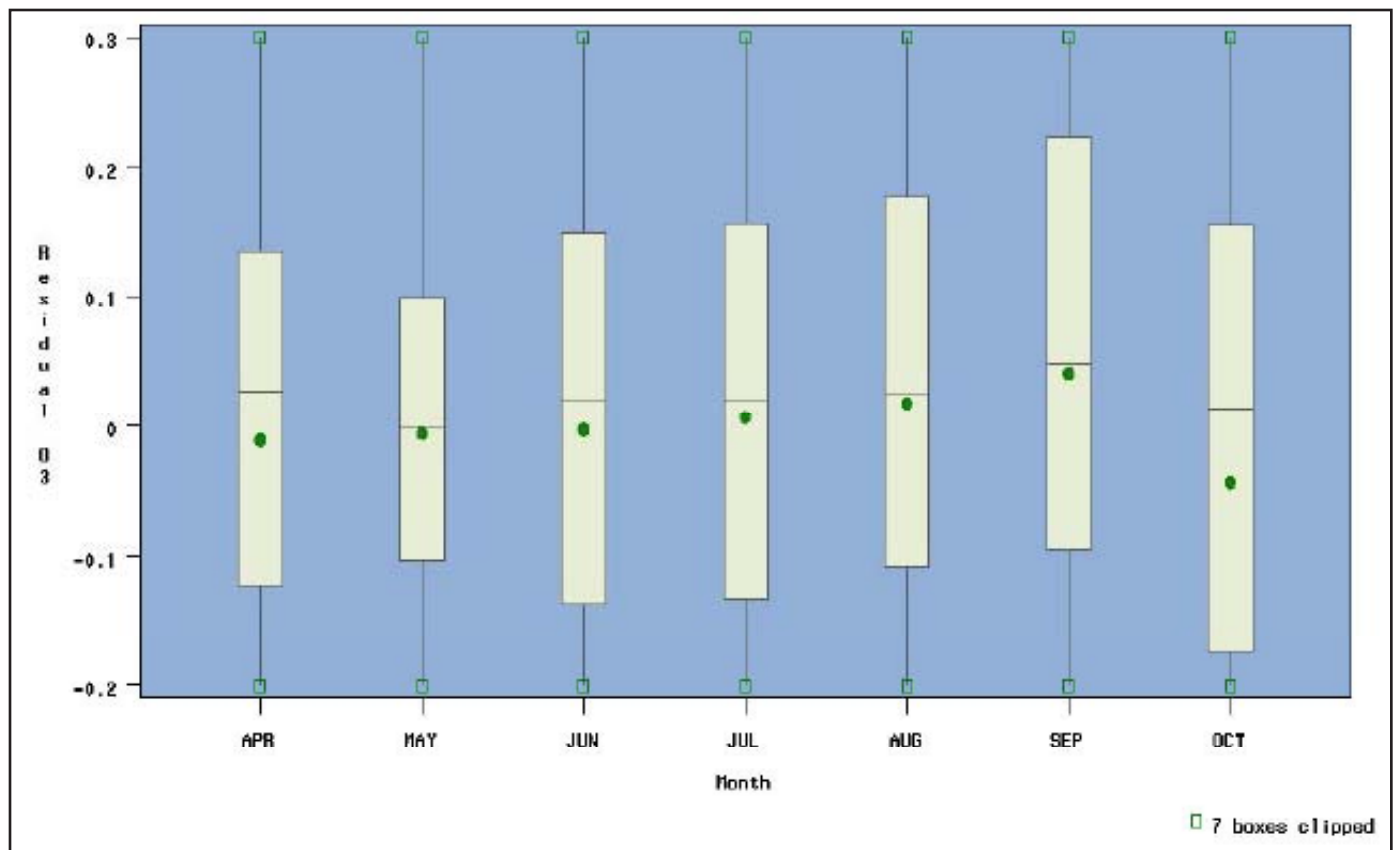


Figure 7

Sea Breeze – the sun heats both ground and ocean at the same rate, but because of the low heat capacity, the ground returns its heat to warm the air. The warmed air rises (1), as it rises it creates weak low pressure (called a thermal low) at the surface (2) and a high pressure forms at about 3,000 to 5,000 feet above it (3). The pressure difference over land, both aloft and at the surface, are greater than over water, so the atmosphere attempts to reestablish equal pressure both on and off shore with a second high and low pressure over the ocean (4 and 5), this creates offshore flow aloft (6), and onshore flow at the surface (7), or the sea breeze circulation. From Peity, 2007 and <http://www.srh.weather.gov/srh/jetstream/ocean/seabreezes.htm>.

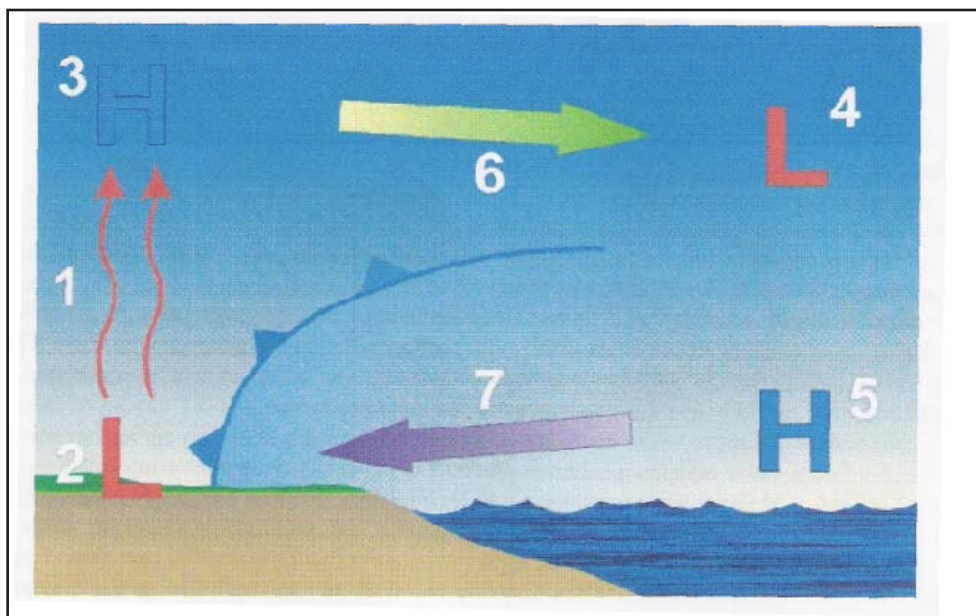


Figure 8
HYSPLIT model results for July 14, 1997

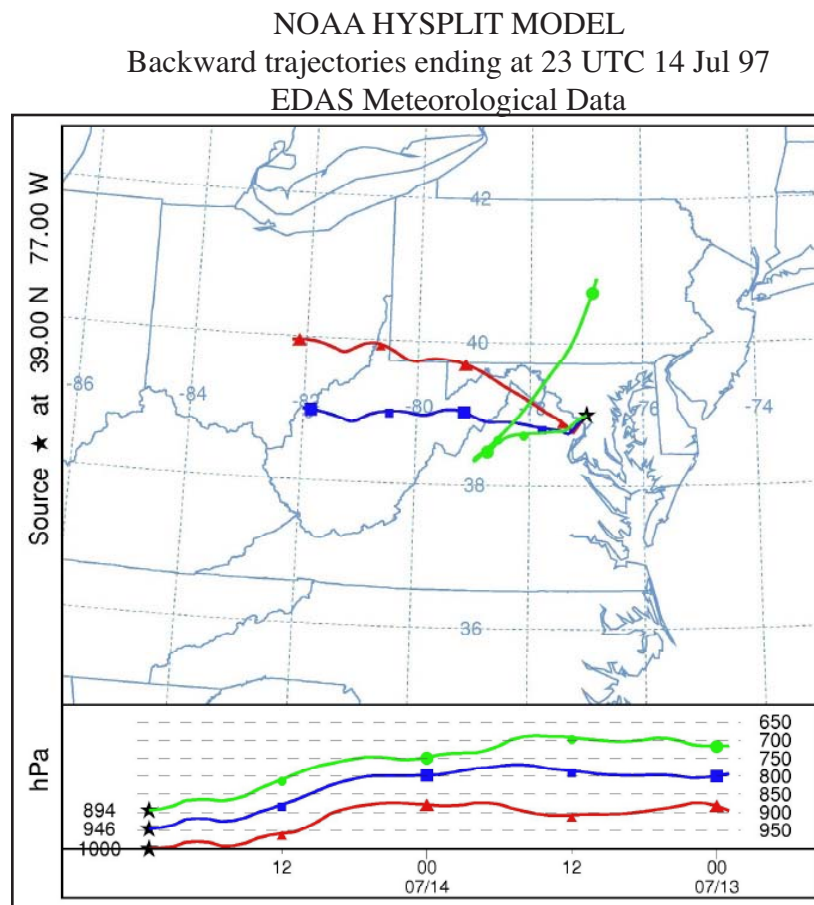
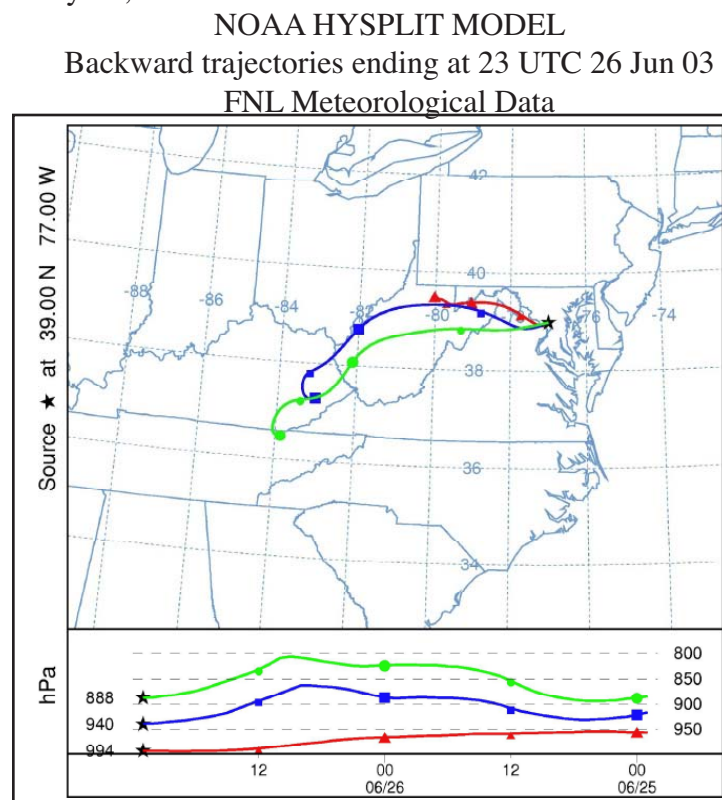


Figure 8
HYSPLIT model results for July 14, 1997



References

- Bornstein, R.d., Thunis, P. and Schayes, G., 1993. Simulation of urban barrier effects on polluted urban boundary-layers using the three dimensional URBMET/TVM model with urban topography-new results from New York City. In: Zanetti, P. (Ed.), *Air Pollution, Computational Mechanics Publications, Southampton, Boston*, 15-34
- Boucouvala, D. and Bornstein, R., 2003. Analysis of transport patterns during an SCOS97-NARSTO episode. *Atmos. Environ.* Vol. 37, #2 S73-S94.
- Cheng, W. L., 2002. Ozone distribution in coastal central Taiwan under sea-breeze conditions. *Atmos. Environ.* Vol. 36, 3445-3459
- Evtugina, M., G., Nunes, T., Pio, C. and Costa, C.S., 2006. Photochemical pollution under sea breeze conditions, during summer, at the Portuguese West Coast. *Atmos. Environ.*, Vol. 40, 6277-6293
- Gao, F., Sacks J., and Welch, J.W., 1996. *Journal of Agricultural, Biological, and Environmental Statistics*, Vol. 1, 404-425
- Huang, Li-Shan and Smith, Richard L., 1999. Meteorologically-Dependent Trends in Urban Ozone. *Environmetrics*, Vol. 10, 103-118
- Martilli, A., Roulet, Y.A., Junier, M., Kirchner, F., Mathias, W.R. and Clappier, A., 2003. On the impact of urban surface exchange parameterizations on air quality simulations: the Athens case. *Atmos. Environ.*, Vol. 37, 4217-4231
- McElroy, M.B. and Smith T.B., 1986. Vertical pollutant distributions and boundary layer structure observed by airborne lidar near the complex California coastline. *Atmos. Environ.* Vol. 20, 1555-1566
- Milanchus, M.L., Rao, S.T., and Zurbenko, G.Z., 1998. Evaluating the Effectiveness of Ozone Management Efforts in the Presence of Meteorological Variability. *Journal of the Air and Waste Management Association*, Vol. 48, 201-215
- NRC (National Research Council), 1991. *Rethinking the Ozone Problem in Urban and Regional Air Pollution*. National Academy Press, Washington.
- Piety, C., 2007. The Role of Land-Sea Interactions on Ozone Concentrations at the Edgewood, Maryland Monitoring Site. *WOE Chapter 6*
- Porter, P.S., Rao, S.T., Zurbenko, I.G., Dunker, A.M., and Wolff, G.T., 2001. Ozone Air Quality Over North America: Part II—An Analysis of Trend Detection and Attribution Techniques. *Journal of the Air and Waste Management Association*, Vol. 51, 283-306
- Rao, S.T. and Zurbenko, I.G., 1994. Detecting and Tracking Changes in Ozone Air Quality. *Journal of the Air and Waste Management Association*, Vol. 44, 1089-1092
- Seaman, N.L. and Michelson, S.A., 1998. Mesoscale meteorological structure of a high-ozone episode during the 1995 NARSTO-Northeast study. *J.App. Metro.*, vol. 39, 384-398.
- Stull, R.B., 1988. *An Introduction to Boundary Layer Meteorology*, Springer Publishing, New York, 150-152
- Thompson, M.L., Reynolds, J., Cox, L.H., Guttorp, P., and Sampson P.D., 2000. A review of statistical methods for the meteorological adjustment of tropospheric ozone. *Atmos. Environ.*, Vol. 35, 617-630
- Zheng, J., Swall, J.L., Cox, W.M., and Davis, J.M., 2006. Interannual variation in meteorologically adjusted ozone levels in the eastern United States: A comparison of two approaches. *Atmos. Environ.*, Vol. 41, 705-716

The Historical Evolution Of Nietzsche's Religious Consciousness

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ABSTRACT:

Friedrich Nietzsche was arguably the most influential and provocative German thinker of the nineteenth century. The sincere passion with which Nietzsche approached religion in both his pious devotions and cynical critiques is essentially non-replicable. The intense emotional and intellectual heights to which his feelings and mind arose in his attitude pertaining to Christianity indicate nothing less than his passionate though never intrusive zeal. Although Nietzsche's religious convictions would radically transform over the course of his life, there is certainly no change in his poignant tone while addressing them. Furthermore, I maintain that Nietzsche's theological beliefs were continuously subject to influence, growing knowledge and personal circumstance and that it appears the former often correlated and changed with the latter. Therefore, it is within the intentions of this paper to critically document and explicitly illustrate the development of Nietzsche's personal attitude and relationship to Christianity as it evolved over the course of his life.

A Pious Childhood

"Like a child I trust in His grace...His holy will be done!"

On 15 October 1844, in the small bucolic town of Röcken, Germany, Nietzsche was born to a family best described as intensely nationalistic, deeply religious, and conservatively orthodox. The Nietzsche family was historically steeped in the prominent and transcendental Lutheran tradition that constituted Germany of that period. In regards to the transcendentalism of Lutheranism in Germany, R.J. Hollingdale (1999) writes, "it holds a special place in the history of German culture and education" (4). Of such tradition, Jörg Salaquarda (1996) states Nietzsche was "proud and aware"(92). Friedrich August Ludwig (Nietzsche's maternal grandfather) advanced in the Lutheran clergy to a position equivalent to a bishop and wrote multiple apologetic defenses of Christianity in his time (Hollingdale 5). Ludwig's wife's father and great-grandfather were also both members of the clergy (Hollingdale 5). Their son, Nietzsche's father, Karl Ludwig Nietzsche, was inevitably destined for the church as well and would later become pastor of a small Röcken church (Hollingdale 5). Though it now deceptively appears that Nietzsche would predominately inherit his early piety from such strong male clerical heritage, it was rather the religious influence of the multiple women by whom Nietzsche was raised that would inevitably shape his attitudes about Christianity.

Tragically, Karl Nietzsche would die while his son, Friedrich, was still quite young at the age of five. Thomas Brobjer believes this familial loss "strengthened" Nietzsche's faith as well as his "determination to emulate" his father (138). Regardless of whether this event strengthened or weakened Nietzsche's faith, the loss

of his father certainly had a profound impact on young Nietzsche. He would later write at age 14 in *Aus Meinem Leben*, "Although I was still very young and inexperienced I had an idea of what death was: the thought that I was forever parted from my beloved father seized hold on me and I wept bitterly" (Hollingdale 9). Much later, in *Ecce Homo*, Nietzsche would write: "I regard it as a special privilege that I had such a father" (Salaquarda. 92). As a consequence of his father's death, Nietzsche would be left to a childhood solely constituted and influenced by women. Such a predominately matriarchal upbringing, Robert Wicks insists, "had a formative and lasting influence on his psyche" (2).

Shortly after Karl Nietzsche's death, the remaining Nietzsche family moved from Röcken to another small town in Germany named Naumburg. It was here that Nietzsche lived from age six to fourteen when he then left for boarding school at Schulpforta. At this point, the Nietzsche family consisted of: Franziska Nietzsche (Friedrich's mother), Augusta and Rosalie Oehler (Friedrich's aunts), Elizabeth Nietzsche (Friedrich's sister), and his grandmother. The early religious influence that such women imposed upon young Nietzsche is critical to understanding his early theological formulations. All of these women were pious, Brobjer asserts, because of their clerical heritage (138). However, it is necessary to clarify that the diversity, which constituted the personal religious attitudes of members within this family, was great. Franziska's faith is best described as practical and simple. Salaquarda posits that she "lacked theological reflection and sophistication entirely" (92). Moreover, Hollingdale writes, "She was the type of Christian who cannot conceive that anyone who has been taught the gospel can ever seriously doubt its truth" (6). On the

other hand, Nietzsche's Aunt Rosalie is documented as having a more rational and cogitated faith. It was she, rather than Nietzsche's mother, Salaquarda maintains, who possessed the more imminent theological presence of the household after Nietzsche's father had died (92).

From an early age, Nietzsche appears to have been expected to continue the clerical tradition and become a Lutheran minister himself. In fact, Wicks goes so far as to assert that Nietzsche was aware of such expectations at a young age and gleefully imagined himself fulfilling them (1). Salaquarda states that it was from practicing with the Bible that Nietzsche had acquired the skills necessary to read and write (94). Before the age of 14, Nietzsche is even reported to have possessed the ability to memorize and cite long passages from the Bible, which earned him the reputable nickname of "the little pastor" (Brobjer 138). Thus, Wicks concludes that from an early age, Nietzsche "was impressed with the concepts of God, death, and the afterlife" (3). All in all, Salaquarda states, "From his early childhood...Nietzsche...knew from his own experience what...prayer, sermon, reading Holy Scripture, blessing...meant to believers, for good or ill" (94). The intimacy with which Nietzsche had been raised in regards to Christianity would provide fecund breeding grounds for his later anti-religious sentiments.

In 1858, at the age of 14, Nietzsche left home for Germany's most prestigious Protestant boarding school of the time, Schulpforta. At this point, Nietzsche had already distinguished himself as one possessing superior intellectual capability and consequently he was awarded free tuition at Pforta (Hollingdale 14). Pforta offered Nietzsche his first exposure to Greek and Latin classics, but religion persisted to be his best subject (Brobjer 138). Here, at Pforta, Nietzsche continued to be, as Wicks puts it, "nurtured on Lutheran values" (2). Brobjer also maintains that Pforta's school regulations were quite religious - chapel and prayer were frequent (138). The apotheosis of Nietzsche's young piety can be traced to the time of his confirmation in March of 1861. Between 1858 and 1861, religious devotion was a prominent feature of Nietzsche's poetry. Nietzsche's close friend at Pforta, Paul Deussen, wrote in regards to he and Nietzsche's pre-confirmation Christian devotion, "We would have been completely ready to, at once, leave this world for the purpose of being with Christ, and all our thinking, feeling, and striving were filled with other-worldly joy" (Brobjer 139). However, it was also at Pforta that Nietzsche would be exposed to new thinkers, ideas, cultures, philosophies, and criticism techniques that would eventually prove themselves as fateful catalysts for Nietzsche's religious skepticism.

The Beginning of the End: Pforta, Bonn, and Leipzig

"Christianity is to be understood as a religion, not the religion."

The official date with which Nietzsche is reported to have first departed from Christianity is of course unknown. Within a year of his own confirmation, Nietzsche would proclaim religion "the product of the people's childhood" (Hollingdale 20). On 25 July 1860, Nietzsche helped found the literary society, Germania, at Pforta, which would prove to be an outlet for student's thoughts and essays (Hollingdale 19). It is critical to now note that it was during Nietzsche's participation within Germania that he was first exposed to one of the greatest influences of his later religious (or irreligious) life, Richard Wagner. Over the course of Nietzsche's stay at Pforta, he would deliver multiple papers to Germania, including *Fate and History* and *On the Childhood of the Peoples*. The latter included statements concerning religion as the attempt to "rob 'this world' of all divinity in favor of the 'next world'" (Hollingdale 24). Brobjer reports that in August of 1861, Nietzsche's private tutor and local pastor Buddensieg had died unexpectedly (139). Furthermore, Brobjer posits that Nietzsche maintained a close relationship with Buddensieg and that his death deeply disturbed Nietzsche's religious psyche - perhaps initiating the questioning of his own Christian faith (139-40). Soon after Buddensieg's death, Nietzsche wished for his birthday in October 1861 two strongly irreligious texts by the philosopher Ludwig Feuerbach (Brobjer 140).

In addition to the potential catalysts of skepticism mentioned above, Nietzsche was becoming increasingly proficient in his historical and scholarly criticism of classical texts (Hollingdale 20). It was his application of such new skills acquired at Pforta to the sacred Scriptures of religion, which he previously adored, that inevitably created further theological doubts within him (Hollingdale 20). Nietzsche himself believed history and science were "the only firm foundation upon which we can build the tower of our speculations" (Hollingdale 25). Hollingdale writes, "he was coming to see that there was no justification for reading the Bible in a slovenly and ignorant way while bringing all the resources of scholarship and historical criticism to bear upon the texts handed down from Greece and Rome" (20). Thus, according to Salaquarda, Nietzsche's historical criticisms of Christian doctrine turned God's fiat into mere human opinions and that "traditional appeals to 'the authority of Holy Scripture,' or to its 'inspiration' and the like, had lost their credibility" (99). The influence that Nietzsche's new talent of scholarly criticism acquired at Pforta had upon his faith cannot and must not be understated, seeing as it would serve as one of his primary and vital arguments against religion until the 1880s (Salaquarda 99). It was most certainly at Pforta that Nietzsche became disillusioned with Christianity - inducing his relentless state of persistent doubt (Hollingdale 25). Moreover, Brobjer reports that in

1879, Nietzsche composed a letter in which he claimed to have become an atheist at Pforta (140). Therefore, Brobjer concludes that Nietzsche's "conversion occurred between 1861 and 1864" (140). Regardless of the unknown specific date of Nietzsche's declared atheism, Salaquarda summons the implications of Nietzsche's new education and religious attitudes best. He writes, "from 1862 or so, Nietzsche was clearly already estranged from Christianity, and in 1865, when he confined his studies exclusively to the classics, he overtly broke with it irrevocably" (92). In September 1864, Nietzsche would graduate from Schulpforta as its top pupil and leave the following month to be a student of philology and theology at the University of Bonn.

In October 1864, when Nietzsche enrolled at Bonn, he appears as one still adhering to the familial influence and perhaps pressure of his becoming a pastor. Brobjer reports that Nietzsche registered for two theology courses at Bonn: "The Gospel of John" and "History of the Church, part 1" (141). However, Brobjer adds on a side note, "his notes from these courses are limited, and he seems to not have been enthusiastic about them" (141). By Easter 1865, Nietzsche, I believe, as a consequence of his growing skepticism, had lost most, if not all, confidence in Christianity and decided to drop theology accordingly. Given that his belief in the validity of religion was now infinitesimal at best, it is logical to concur that Nietzsche must have realized his family's clerical tradition was not well suited for him. Hollingdale notes that when Nietzsche returned home from Bonn for Easter vacation, his informing of such sentiments to his mother greatly upset her (31). Furthermore, Nietzsche refused to attend church on Easter Day and claimed that he was "superior now to such a primitive superstition as Christianity" (Hollingdale 31). His mother would eventually cope with Nietzsche's new attitude on the grounds of belief that it must be God's will for him to behave accordingly and that she must faithfully accept it without question (Hollingdale 31). Elizabeth, on the other hand, was outraged and wrote somewhat of a Christian apology to her brother in light of hoping to persuade him otherwise (Hollingdale 31). Nietzsche's response was so timeless that I must include some extracts in full:

Is it the most important thing to arrive at that particular view of God, world and reconciliation that makes us feel more comfortable? Is not the true inquirer totally indifferent to what the result of his inquiries may be? For, when we inquire, are we seeking for rest, peace, happiness? No, only for truth, even though it be in the highest degree ugly and repellent. (32, MHP)

Every true faith is infallible, it accomplishes what the person holding the faith hopes to find in it, but it does not offer the slightest support for a proof of objective truth. Here the ways of men divide: if you wish to strive for peace of soul and happiness, then believe; if you wish to be a disciple of truth, then inquire. (32, MHP)

It appears that, on the whole, Nietzsche had very little to be enthusiastic about at Bonn. Thus, Hollingdale writes, "Nietzsche thought of his ten months at Bonn as a time wasted" (28). However, it would be a grave injustice to Nietzsche himself if I have established the impression that he was entirely withdrawn intellectually while at Bonn, for that is most certainly not the case. In fact, it was at Bonn in 1865 that Nietzsche critically read David Friedrich Strauss' *Das Leben Jesu* and began to warm to his demythologized historical critique of Christ (Brobjer 141). Later that year, Nietzsche would be captivated by the pessimistic philosophy of Arthur Schopenhauer in his classic work, *The World as Will and Representation* (Brobjer 141). The influence that Schopenhauer would come to have on Nietzsche was gargantuan and his philosophy would essentially prove itself a firm foundation, along with historical criticism, on which Nietzsche could begin to build his irreligious consciousness. Wicks speaks of Nietzsche's time at Bonn as one of a sagacious cultural rebirth. Specifically, Nietzsche "loosened the bonds of the church-related world he inherited from his father and his rural upbringing, and soon developed what turned out to be a lifelong affection for Athens and Rome" (4). Nietzsche would transfer from Bonn on 17 August 1865 after only one year of enrollment at the university. Also leaving Bonn, as a consequence of bureaucratic quarreling, was the famously influential philologist, Friedrich Ritschl. Ritschl was destined for Leipzig and consequentially thus was Nietzsche (29). Hollingdale would come to regard Nietzsche as Ritschl's most famous pupil (29). Moreover, Nietzsche, under Ritschl's influence, would found Leipzig's first philological society (Hollingdale 34). At Leipzig, Nietzsche would not only flourish philologically under Ritschl's influence but he would also continue to read and develop his Schopenhauerian train of thought. Additionally, and perhaps most importantly, it was at Leipzig that Nietzsche would begin his personal association with Wagner. Thus, the cultural, personal, and academic influences that Nietzsche would have been exposed to at Leipzig would later prove themselves as having a tremendous influence in his own philosophy.

Wagnerian, Schopenhauerian, and Darwinian Influence

"Will was an essential step...but he did not know how to deify this will."

The unquestionable philological talent Nietzsche possessed would earn him both a professorial position at Basel University on 13 February 1869 and a doctoral degree from Leipzig on 23 March 1869 at the remarkably young age of 24

(Hollingdale 34). Furthermore, his position at Basel would grant him admission into the higher bourgeois intelligentsia of the historic German town (Hollingdale 49). Though his time at Basel was relatively limpid, it would be sorely interrupted by a brief military commitment and plagued with terrible sickness (as was his entire life). Hollingdale profoundly states of Nietzsche's medical woes, "from 1871 onwards...he was engaged upon a day-to-day battle with ill health" (55).

After asking for and returning from a leave of absence in hopes of a physical recovery, Nietzsche would then begin to visit Wagner on a regular basis (Hollingdale 56). The impression that Wagner himself had upon Nietzsche was incredulous. Hollingdale writes about Nietzsche, "his eyes were opened to the possibilities of greatness that still existed in human nature. He learned the meaning of genius and strength of will" (56). Anyone even slightly familiar with Nietzsche will recognize that the "strength of will" that Hollingdale mentions would later become perhaps the most prominent component of Nietzsche's *Übermensch* philosophy. Furthermore, it is critical to note the impression of Wagner's strong will was probably influenced by and certainly complimentary to Schopenhauer's philosophy, of which Wagner and Nietzsche were both aficionados. However, it would also later be their estranging Schopenhauerian interpretations that would cause Wagner and Nietzsche to exuberantly part their ways forever.

Returning to the central purpose of this paper, Nietzsche's religious attitude at this time was dominantly influenced by Schopenhauer; however, it also appears that now Charles Darwin would have an effect on Nietzsche's consciousness. The primary implications of the *Origin of Species* would clearly have an impact on Nietzsche's philosophical thought as is illustrated in later texts like *The Gay Science* (Hollingdale 72-3). First, however, it is necessary to understand Schopenhauer's influence in the development of Nietzsche's atheism.

Between the eight-year period of 1866 and 1874, Brobjer believes Nietzsche's religious psyche is best described as "Schopenhauerian" (142). It is clear that at this point in Nietzsche's life, *The World as Will and Representation* had a demonstrable effect on his once Christian conscious. Salaquarda writes, "Of deep and lasting influence for Nietzsche's understanding of the Judeo-Christian tradition was Arthur Schopenhauer" (95). Schopenhauer's philosophy is infamously pessimistic and the crux of his beliefs hinge upon his theory of the will and its evil desires. This evil will, as Hollingdale explains, "is the primary force of life...the will is essentially desire for life, will to live" (68-9). According to Schopenhauer, the only real good is death because it equates to the relieving extinction of such an evilly invigorating will. What appealed to Nietzsche from this cynical man was that in Schopenhauer's philosophy he had found a replacement to fill the hole that God had left when Nietzsche would embrace atheism. Wicks maintains that Schopenhauer "substituted a blind, aimless, and fundamentally senseless...will" for "an all-powerful, all-knowing, and all-good God" (5-6). Nietzsche's theory of the will to power was almost certainly a product of Schopenhauerian influence, though the vast differences between his will to power and Schopenhauer's will to live must be stressed. Of such differences in theory, Hollingdale maintains, "the two principles have virtually nothing in common except the world 'will'" (67). Eventually Nietzsche would depart from Schopenhauerian thought, and as Hollingdale states, he "took from Schopenhauer what he could use and left the rest behind...for Schopenhauer's philosophy he did at last lose all respect..." (66-7). Nietzsche himself would later write in *Thus Spoke Zarathustra*:

"Indeed the truth was not hit by him who shot at it with the word of the 'will to existence': that will does not exist. For, what does not exist cannot will; but what is in existence, how could that still want existence? Only where there is life is there also will: not will to life but – thus I teach you – will to power." (41, CC)

With the self-elimination of Schopenhauer's metaphysics, Nietzsche's interpretation of religion was strictly concerned with the phenomenal realm - everything "beyond" had ceased to exist and for Nietzsche, Darwin had proved it.

It was natural selection, Hollingdale explains, that permanently freed Nietzsche from all metaphysical considerations (73). That Darwin had proven the origins of man to actually be from the dust of the Earth and not from divine intervention, Nietzsche was now quite confident in asserting that God almost certainly did not exist. Nietzsche himself writes in *Daybreak*:

Formerly one sought the feeling of the grandeur of man by pointing to his divine origin: this has now become a forbidden way, for at its portal stands the ape, together with other gruesome beasts, grinning knowingly as if to say: no further in this direction!(92, NTG)

Darwinian natural selection utterly convinced Nietzsche to think that "the 'divine' attributes of man had in reality descended to him from the animal" and that "the universe and the earth were without meaning" (Hollingdale 73). It is critical to interpret "meaning" as it is included in the previous quotation as an exclusive reference to divine purpose. Nietzsche believed there was meaning to the world but that it simply did not come from "beyond". Though he would

embrace Darwinism, Nietzsche would never succumb to nihilism. Instead, he would attempt to construct a philosophy that would grant humans absolute value in the face of natural selection.

Polemical Infancy

"What are these churches now if they are not the tombs and sepulchers of God?"

Beginning around 1875, Nietzsche would initiate his polemical critique of Christianity that he would readily develop the rest of his life. Schopenhauer's atheism had persuaded him that all things metaphysical were actually phenomenal and Darwin's theory of natural selection conclusively convinced him. It must be noted that between 1865 and 1875 an extensive critique of Christianity from Nietzsche does not really appear. Though his religious consciousness was still succumbing to outside influence and consequential evolution, it seems that Nietzsche's atheism had been more passive (Brobjer 148). However, this would soon change as Nietzsche would move beyond once influential figures such as Schopenhauer, Wagner, and Kant only to replace them with Enlightenment figures such as Descartes and Voltaire as well as fields such as science and psychology (Brobjer 148). As a consequence of such substitutions, Nietzsche would inevitably conclude that religion was nothing more than corrosive degeneracy of one's intellect. In *Human, All Too Human*, Nietzsche would write, "What is certain...given the current state of knowledge, one can no longer have any association with it [Christianity] without incurably dirtying one's intellectual consciousness" (Brobjer 150).

The first great advocate of psychology in Nietzsche's life was a young and intelligent atheist named Paul Rée. Rée, though only 27, wrote *The Origin of the Moral Sensations* in Sorrento, Italy alongside Nietzsche who was currently working on *Human, All Too Human* (Hollingdale 90). Rée believed religious experiences could occur independently of and, more importantly, without God's existence. That is, he could explain them as subjective phenomenon by a means of psychology (Hollingdale 90). Such a theory would prove so influential that Nietzsche would proclaim in 1878 his new thoughts as products of "Réalism" (Hollingdale 90). Rée would eventually fall captive to personal disparity, as he could not overcome his own intuitions concerning the meaninglessness of existence (Hollingdale 91). Nietzsche, on the other hand, interpreted Rée's psychological conclusions as liberating catalysts that would serve as firm foundations for his prospering atheistic philosophy (Hollingdale 91). Essentially, Rée would put into words what Nietzsche had been thinking for sometime now – that God was nothing more than one of man's most grandeur ideas.

It is important to note that Nietzsche did not find this belief (or non-belief) as despairing as most would or Rée did, but instead he passionately sought a philosophical replacement of meaning. In *Dawn*, Nietzsche refers to God as "man's vanity, lust for power, impatience, and terror," moreover as, "man's delighted and terrible delusion" (Salaquarda 101). However, it would be an infamously heroic proclamation in *The Gay Science* that would perhaps become Nietzsche's most famous and misinterpreted line of all time – that God is dead. Thus it is vital to the purposes of this paper to deliberately clarify what exactly Nietzsche meant by this statement. To accept the statement literally as it is would be theologically and philosophically ignorant. That God is dead is to be understood entirely as metaphor. Furthermore, God, in this sense, is solely symbolic of the one true foundation of morality. Thus, when Nietzsche maintains that God is dead, he simply means, as Hollingdale states, that "the world has lost its old value; if there is no 'beyond', the pillars which have hitherto supported the moral world have collapsed" (202). Moreover, what Nietzsche sought to explain was that if one no longer believed in God then one could no longer accept religion as his moral basis. In *Twilight of the Idols*, Nietzsche would clarify that "When one gives up Christian belief, one thereby deprives oneself the right to Christian morality...Christian morality is a command; it possesses truth only if God is truth – it stands or falls with the belief in God" (Hollingdale 99). Thus, for Nietzsche, the intricate task of creating and revaluating values, which would bring all meaning back to this world, became his predominant objective. Naturalistic substitutes of meaning and morality were now needed for the absence left by all those metaphysical.

The Anti-Christ

"What is more harmful than any vice...Christianity"

The infantile polemical critiques to which Nietzsche had hitherto ascribed to religion were by 1880 paramount. It was during the 1880's that Nietzsche would ultimately reach the apogee of his negative theological attitudes. Not only would he substitute philosophies of his own for those of religion but he would also concentrate his critiques of religion on Christianity directly. Nietzsche's natural substitutes for previously religious concepts are precisely described by Hollingdale when he writes: "instead of God, the superman; instead of divine grace, the will to power; and instead of eternal life – the eternal recurrence" (164). The eternal recurrence, to briefly explain, is Nietzsche's concept of immortality. What it essentially implies is that the universe and time are repetitive. Thus, the current state of the universe is really just the repetition of the state that preceded it, and that state, the state before it. In other words, as Hollingdale explains, "all events must recur an infinite number of times" (167). For anyone longing for an eternity with

God in Heaven, an earthly eternal recurrence would equate to nothing less than personal devastation. However, for Nietzsche's superman who finds meaning within and consequently overcomes his or herself, the eternal recurrence is to be viewed as the most comforting and embracing idea yet. Nietzsche would write in *Thus Spake Zarathustra*:

Did you ever say Yes to one joy? O my friends, then you said Yes to all woe as well. All things are chained and entwined together...if ever you said: 'You please me, happiness, instant, moment!' then you wanted everything to return! (p. 167, MHP)

The consummating manifesto of Nietzsche's Christian critique is *The Anti-Christ* written in 1888. In *The Anti-Christ*, Nietzsche launched a hyperbolic attack upon Christianity that was more often than not *ad hominem*. His critique of Christianity in this work touches almost every corner stone of its faith, including: God, Christ, its origins, the apostles (especially Paul), conversions (or corruptions), priests, theologians, morals, sacraments, and even future implications. In *The Anti-Christ*, I assert, Nietzsche would strongly yet subtly emphasize that Christianity was the antithesis of his *Übermensch* philosophy. Christianity, Nietzsche would stress, "has waged a war to the death of this higher type of man" (Hollingdale 204). More than anything else though, Nietzsche would come to despise institutional Christianity and its founder, Paul. Why? Hollingdale writes, "because it was a reversion to a primitive miracle-and-salvation religion of the kind Jesus himself had left behind" (209). As for Jesus himself, Nietzsche had great respect. In *The Anti-Christ*, he would write of him, "in reality there has only been one Christian, and he died on the cross" (Hollingdale 209). Earlier, however, in *Human all too Human*, Nietzsche would state, "... a Jew crucified two thousand years ago who said he was the son of God. There is no evidence to support such an assertion" (Hollingdale 204). Nietzsche viewed Jesus as a saintly anarchist who was simply an insurrectionist against the religious and political status quo of his day – a man who did not die for the sins of others but simply for his own. Other than additional minute religious commentary in later texts, it was with *The Anti-Christ*, I maintain, that Nietzsche essentially complete his life-long critique of religion in general, and Christianity in specific. He would die only two years later on 25 August 1900, just six weeks short of his 56 birthday (Hollingdale 253).

References

- Brobjer, T. H. (2001). "Nietzsche's Changing Relation with Christianity". In W. Santaniello (Ed.), *Nietzsche and the Gods* (pp. 137-157). Albany: University of New York Press.
- Hollingdale, R. J. (1999). *Nietzsche: The Man and His Philosophy*. New York, NY: Cambridge University Press.
- Salaquarda, J. (1996). "Nietzsche and the Judeo-Christian Tradition". In B. Magnus, & K. M. Higgins (Eds.), *Cambridge Companion to Nietzsche* (pp. 90-118). New York, NY: Cambridge University Press.
- Wicks, R. (2002). *Nietzsche*. Oxford, England: Oneworld Publications.

Too Much of a Good Thing?

Phytoestrogens Act Through Estrogen Receptors to Increase Anxiety

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ABSTRACT:

Phytoestrogens are estrogen-like compounds found in plants. Because these compounds are structurally similar to estrogens found in the human body, they can either block or enhance normal estrogen activity. Estrogen has been shown to improve mood but it is not known if phytoestrogens have the same effect. The focus of our experiments was to determine the effects of phytoestrogens equol (EQ) and resveratrol (RES) on anxiety in intact Long-Evans male rats. There are two types of receptors through which estrogen act: estrogen receptor beta (ER- β) and estrogen receptor alpha (ER- α). Diarylpropionitrile (DPN), an ER- β agonist, and propylpyrazole-triol (PPT), an ER- α agonist, were used to determine the receptor subtype responsible for mediation of anxiety. Adult rats were first injected and tested at low doses of EQ, RES, oil (control), DPN, and PPT. Several weeks later, the same substances were administered and tested at higher doses. To test developmental effects, DPN, PPT, EQ, and oil were administered for five days after birth and tested on postnatal days 56-61. DPN appeared to increase anxiety in both adult and juvenile rats. Males treated neonatally showed anxiogenic behavior when tested as juveniles, suggesting that DPN has a developmental effect on the brain. EQ appeared to have anxiogenic effects in both neonates and adults. When administered at low doses, EQ showed a tendency to decrease anxiety. When given at higher doses, the anxiogenic behavior was significantly higher, indicating a dose-dependent effect. RES had significant anxiogenic effects when administered at higher doses.

Background

Plants contain estrogen-like compounds referred to as phytoestrogens. These compounds can enhance or inhibit normal estrogen activity in the human body because they are structurally similar to human estrogen. Phytoestrogens are found in soy and red wine. Within soy is a phytoestrogen called daidzein, which is further metabolized in the body to EQ. RES is a phytoestrogen found in red wine. These phytoestrogens are often taken for health benefits; however, their effect on mood is unknown. Estrogen has been shown to improve mood (Grigoriadis and Kennedy 2002) but it is not known if phytoestrogens have the same effect.

Daidzein is a phytoestrogen compound found in soy. Through digestion, most individuals are able to convert daidzein to EQ. Soy is increasingly thought to have many health benefits and human populations are consuming more of it because soy and soy products are so heavily advertised. Lower cancer rates and cardiovascular benefits have been associated with soy consumption (Adlercreutz 1995). However, it is important to understand and question the potential adverse effects of soy. It is essential to understand the effects of such compounds so productive measures

can be taken to increase the favorable health effects of soy while minimizing the adverse health effects. It is particularly important now, as the population is consuming increasing amounts of soy. Since it has been demonstrated that dietary soy supplements increase anxiety in male rats (Patisaul et al 2005), we expect that EQ will increase anxiety.

RES is another phytoestrogen found in red wine that is frequently consumed by humans. RES has the potential to inhibit carcinogenesis (Jang et al 1997). In addition, red wine consumption is often correlated with cardiovascular benefits (Spinney 2006). Studies have shown that RES is the compound responsible for these benefits (Fitzpatrick et al 1993). It has not yet been determined if RES has an effect on anxiety behavior. However, because RES has been found to enhance stress resistance (Baur et al 2006), we hypothesize that it will decrease anxiety.

There are two types of estrogen receptors found in the human body: estrogen receptor alpha (ER- α) and estrogen receptor beta (ER- β). Previous studies suggest that ER- β may be responsible for anxiety behavior mediation (Lund et al 2005). While these experiments used castrated animals, we will be studying intact

animals in order to make our results more applicable to humans. To distinguish through which estrogen receptor estrogen acts, two compounds were tested in our experiment: diarylpropionitrile (DPN) and propyl-pyrazole-triol (PPT). These compounds were chosen because DPN is an ER- β agonist while PPT is an ER- α agonist. We hypothesized that DPN would decrease anxiety while PPT would have no effect (Lund et al 2005).

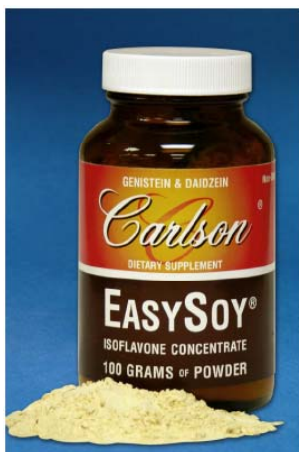
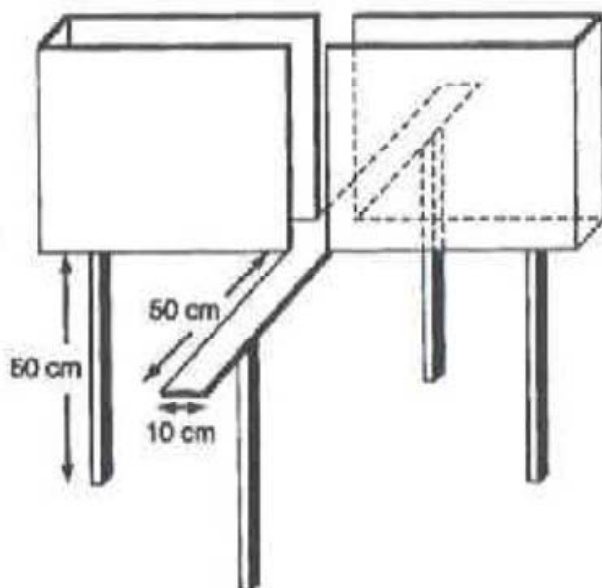
Experiments and Methods

Our study contained three components. The first of these was an experiment designed to determine how low doses of EQ, RES, DPN, and PPT effect anxiety behavior in intact Long-Evans male rats. Forty intact males were used for this

experiment. Three mg/kg of EQ and RES, and .5 mg/kg of DPN and PPT were each dissolved in .2 mL of oil. We used .2 mL of oil as a control substance. Eight rats were placed into each experimental group and half (4) of each group was injected subcutaneously for five days, while the remaining half were injected for six days. On days six and seven, the rats were placed on an elevated plus maze for 10-minute trials and videotaped. The tapes were later scored in order to quantify the rats' behavior. Testing was conducted at the peak of the rats' activity cycle.

The second component of our study was designed to determine how high doses of EQ, RES, DPN, and PPT affect anxiety behavior in intact Long-Evans male rats. Fifty-one days after the low dose testing, 40 intact male rats were injected with higher doses of EQ, RES, DPN, and PPT. Subcutaneous injections were given on a daily basis for three days. Twenty mg/kg of EQ and RES, and 1 mg/kg of DPN and PPT were each dissolved in .2 mL of oil. We again used .2 mL of oil as a control substance. On the fourth day, the rats were placed on an elevated plus maze for 10-minute trials and the videotape of these trials was later scored. Testing was conducted at the peak of the rats' activity cycle. The last component of our study addressed whether or not developmental effects could be observed when DPN, PPT, and EQ were administered to neonates (and later tested as adults). Subcutaneous injections were given every day for four days following birth. A total of 27 neonatal rats were used. Twelve rats were injected with .05 mL of oil (control), seven received 1 mg/kg of DPN and PPT dissolved in .05 mL of oil, and the remaining six received 10 mg/kg EQ dissolved in .05 mL of oil. The rats' behavior was tested postnatal days 56-61 for 10-minute trials at the peak of their activity cycle.

An elevated plus maze was used to quantify the behavior of the rats.



Results

The ANOVA shows there was an effective treatment group with the low dose experimental group ($p\text{-value} \leq .04$). Fischer's Least Significant Difference Post-hoc Test showed that EQ had a trend to decrease anxiety in the low dose treatment group (Fig. 1). An effective group was shown in the high dose group ($p\text{-value} \leq .03$). The Fischer's Least Significant Difference Post-hoc Test demonstrated that EQ and RES both increased anxiety (Fig. 2). The neonate experimental group also had an overall effect ($p\text{-value} \leq .001$). DPN, PPT, and EQ all increased anxiety (Fig. 3).

Low Dose Had Mild Effect on Anxiety

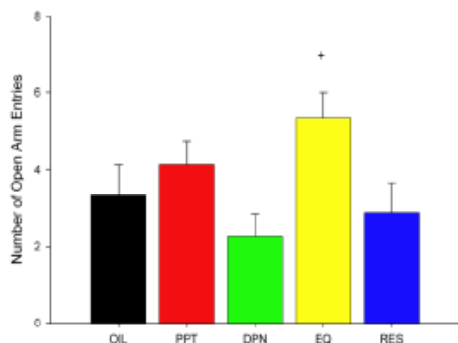


Fig. 1: The increased number of open arm entries implies that at low doses EQ has a tendency to relieve anxiety (+ $p < .07$)

High Dose Phytoestrogens Increase Anxiety

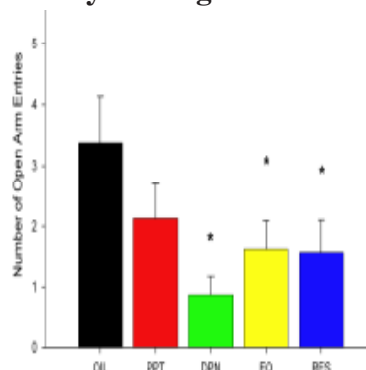


Fig. 2: The decreased number of open arm entries indicates that high doses of DPN, EQ, and RES increase anxiety (* $p < .03$)

DPN, PPT, and EQ Show Organizational Anxiogenic Effects

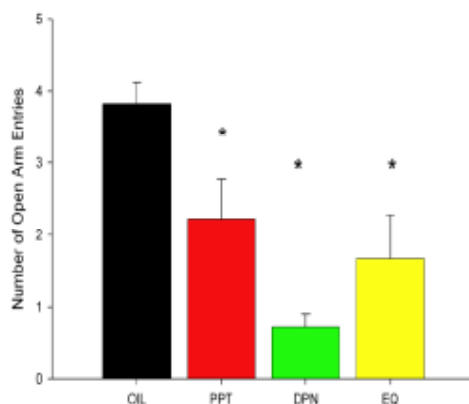


Fig. 3: Decreased open arm entries indicate permanent changes in development when injected postnatally with DPN, PPT, and EQ (* $p < .015$).

Conclusions and Discussion

Phytoestrogens have acute effects as well as more permanent effects on anxiety.

The effect of EQ on anxiety appears to be dose dependent. At low doses EQ had a tendency to decrease anxiety, while at higher doses an increase in anxiety was observed. Similarly, higher doses of RES increased anxiety. Furthermore, significantly fewer entries after administration of DPN suggests that EQ and RES act through ER- β . In adults, PPT had no significant effect on anxiety behavior, suggesting that action through ER- α is not the primary mechanism of estrogen action on anxiety. In addition, the results suggest that EQ causes permanent developmental changes in the brain. It is not conclusive through which receptor estrogen acts during development since DPN and PPT were both statistically significant. It is possible that ER- α plays a key role during development, whereas ER- β is primarily responsible for mediation of anxiety behavior in adulthood. To follow up on our study, blood samples were taken and testosterone levels will be analyzed via radioimmunoassay (RIA). This information will be used to conclude if the behavior change observed in the rats can be attributed to altering endogenous androgen levels. Brain slices have been cut and mounted in order to determine receptor location and organization. In situ hybridization and autoradiography will be used to determine distribution of corticotropin releasing factor and ER- β . Further

investigation of the organizational effects could determine through which receptor estrogen acts during development.

References

Adlercreutz H, 1995: "Phytoestrogens: epidemiology and a possible role in cancer protection." *Environmental Health Perspectives*, Vol. 7, pp. 103-112.

Baur et al, 2006: "RES improves health and survival of mice on a high-calorie diet." *Nature*, Vol. 444, pp. 337-342.

Fitzpatrick, D.F., Hirschfield, S.L., and Coffey, R.G., 1993: "Endothelium-dependent vasorelaxing activity of wine and other grape products." *American Journal of Physiology – Heart and Circulatory Physiology*, Vol. 265, pp. 774-778.

Grigoriadis, Sophie and Kennedy, Sidney H., 2002: "Role of Estrogen in the Treatment of Depression." *American Journal of Therapeutics*, Vol. 9, pp. 503-509.

Jang, Meishiang, Cai, Lining, Udeani, George O., Slowing, Karla V., Thomas, Cathy F., Beecher, Christopher W. W., Fong, Harry H. S., Farnsworth, Norman R., Kinghorn, A. Douglas, Mehta, Rajendra G., Moon, Richard C., Pezzuto, John M., 1997: "Cancer Chemopreventive Activity of RES, a Natural Product Derived from Grapes." *Science*, Vol. 275, pp. 218-220.

Lund, Trent D., Rovis, Tomislav, Chung, Wilson C.J., and Handa, Robert J., 2005: "Novel Actions of Estrogen Receptor- β on Anxiety-Related Behaviors." *Endocrinology*, Vol. 146, pp. 797-807.

Patisaul, Heather B., Blum, Adele, Luskin, Jordan R., and Wilson, Mark E., 2005: "Dietary Soy Supplements Produce Opposite Effects on Anxiety in Intact Male and Female Rats in the Elevated Plus Maze." *Behavioral Neuroscience*, Vol. 119, pp. 587-594.

Spinney, Laura, 2006: "Gerontology: Eat your cake and have it." *Nature*, Vol. 441, pp. 807-809.

Perspectives on Tiger Conservation in India: A Comparison of Local and Global Viewpoints

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ABSTRACT:

For centuries, tigers (*Panthera tigris* spp.) have been revered by cultures and civilizations as a symbol of power, pride and majestic beauty (Baine and Baine 1975; Norris 2005). Tigers once ranged across Europe and Asia, from Afghanistan and Turkey to the islands of Java and Bali in Indonesia (Nowell and Jackson 1996; Luo et al. 2004). However, through unregulated commercial hunting and poaching, populations have been reduced and three of the nine subspecies of tigers are extinct [i.e., Bali (*Panthera tigris balica*), Javan (*Panthera tigris sondaica*), and Caspian (*Panthera tigris virgata*)]. The six remaining subspecies [i.e., Bengal (*Panthera tigris tigris*), Indo-Chinese (*Panthera tigris corbetti*), Siberian (*Panthera tigris altaica*), South China (*Panthera tigris amoyensis*), Sumatra (*Panthera tigris sumatrae*), and Malayan (*Panthera tigris jacksoni*)] are endangered and critical steps are needed to conserve these important predators (Herrington 1987; Weber & Rabinowitz 1996).

In India, the Bengal tiger is the most abundant of the remaining subspecies in the world (Jackson 1993; Nowell and Jackson 1996). However, like all tiger populations, the Bengal tiger faces threats from poaching (Kumar and Wright 1999; Wright 1999; Kenney et al. 1995; Nowell and Jackson 1996; Marshall, 2006) overhunting of prey base (Karanth and Stith 1999), habitat loss and fragmentation (Smith and McDougal 1991; Marcot 1992; Nowell and Jackson 1996), and the resource demands of India's burgeoning human population (Panwar 1987; Marcot 1992; Dinerstein and Wikramanayake 1993).

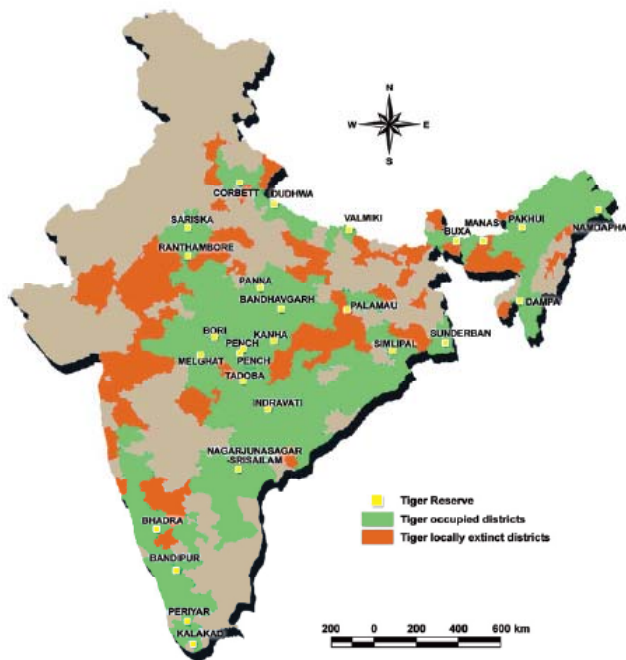
In 1973, India instituted a management framework for tiger conservation (i.e., Project Tiger). Project Tiger established tiger reserves comprised of a core area with no human activity and a buffer zone with limited human activity (Indian Board for Wildlife 1972; Panwar 1987). Today in India, Project Tiger is responsible for the establishment of 29 tiger reserves encompassing 38,620 km² (Wildlife Institute of India 2007) of habitat (Figure 1) and is home to ~3,642 Bengal tigers (Project Tiger 2007). However, many international researchers have raised questions about whether Project Tiger, in its current form, can conserve tigers and many believe the reserves established by Project Tiger are too small and prevent sufficient genetic exchange between tigers (Smith et al. 1987). Small reserves and lack of connectivity can imperil tigers (Seidensticker 1987; Rabinowitz 1993; Wikramanayake et al. 1998; Wikramanayake et al. 2004) and many researchers believe the census methods (i.e., pugmark) used by Project Tiger to determine population size yields inaccurate data (Karanth 1987; Karanth

et al. 2003) and that trends are more useful than precise numbers (Wikramanayake et al. 1998).

In 2004, after several years of reporting stable populations, it was determined that Sariska Tiger Reserve, an early Project Tiger reserve, had no tigers (Sankar et al. 2005). After the discovery, a task force convened by the government determined ineffective management, poaching, local hostility, and negligent census techniques were responsible for the loss of tigers in Sariska (Project Tiger 2005). Although the incident generated global support for tiger conservation, the effectiveness of Project Tiger was questioned. Also, the ineffective handling of the population estimates in Sariska created distrust between local government officials and the global research community.

The laws to protect wildlife in India vary on the federal and state level. The Wildlife Protection Act of 1972 is the main federal law in India protecting wildlife. The act ranks wildlife according to their status and distribution (Government of India, 1972) and gives state governments the authority to control protected areas (Singh 1996). Laws such as the Rajasthan Wildlife Act govern forest and wildlife preservation on a state level and punishment for poaching varies depending on the animal poached and can result in maximum imprisonment of 7 years. However, poachers have to be caught in the act of poaching or with skins and body parts to be prosecuted. Nevertheless, suspected poachers are often prosecuted under the Arms Act for possessing illegal weapons and can be sentenced to jail (D. Khandal, TigerWatch, pers.

Figure 1. Project Tiger Reserves in India (The Telegraph 2006).

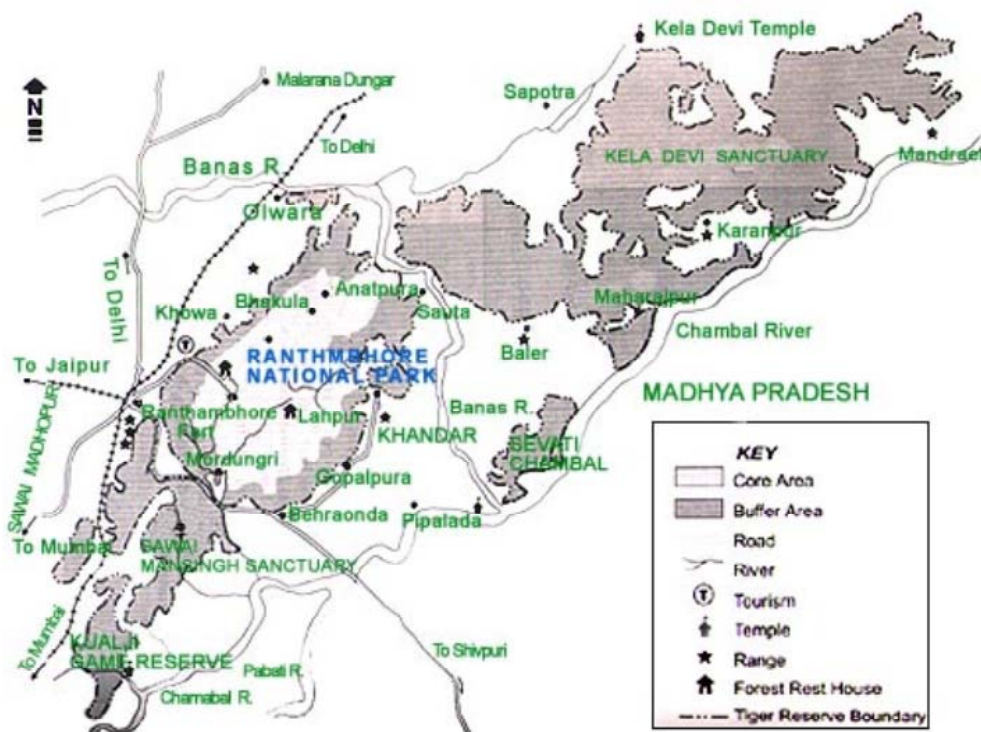


comm.; A. Singh, The Ranthambhore Bagh, pers. comm.).

Established in 1973, Ranthambhore National Park and Tiger Reserve in Rajasthan, India, is one of the oldest Project Tiger reserves. Ranthambhore was established to protect the diminishing population of wild tigers in Rajasthan and the Aravali Hills. Ranthambhore encompasses 1,394 km² and is divided into a core area (640 km²) with no human presence and a buffer zone (754 km²) with minimal human presence (Figure 2) (Tyagi et al. 2002). The dry deciduous forests and hills of Ranthambhore are home to a number of species including Bengal tigers, jackals (*Canis aureus*), leopards (*Panthera pardus*), sambar deer (*Cervus unicolor*), chital (*Axis axis*), nilgai (*Boselaphus tragocamelus*), chinkara (*Gazella bennetti*), langur monkeys (*Presbytis entellus*), and over 250 species of birds (Bagchi et al. 2003). The area was once prime tiger hunting ground for the British and the royalty of India. However, in 1970, hunting was stopped when research indicated that fewer than 2,000 Bengal tigers remained in India, down from the nineteenth century estimate of 30,000 to 40,000 tigers (Prynn 2004; Krishnan 2006).

The burgeoning human population near the periphery of Ranthambhore has turned the National Park into an ecological island (Tyagi et al. 2002). Within two kilometers from the periphery of the park, about 96 villages exist. The closest town is Sawai Madhopur, which is located 13 km from the park boundaries. The town is host to over 25 hotels and lodges, many of which line Ranthambhore Road. The surrounding communities depend directly on the natural resources of Ranthambhore for survival and income. Due

Figure 2. Ranthambhore National Park and Tiger Reserve, Rajasthan, India (India Wildlife).



to limited availability of resources, local villagers often enter the park and illegally collect firewood and timber, illegally graze livestock, and poach within the reserve (Tyagi et al. 2002). These actions degrade and reduce forest areas that can sustain viable populations of tigers.

The objectives of our research were to evaluate the perceptions of tiger conservation among local officials and residents working in and around Ranthambhore National Park and Tiger Reserve and non-government tiger researchers from around the world. Local respondents (LR) were interviewed on tiger conservation issues at Ranthambhore, while non-government respondents (NGR) who had background in tiger research, conservation, and reserves, were asked to discuss their perceptions of tiger conservation throughout India.

Methods

We surveyed two groups of researchers and officials who have expertise related to India and tiger conservation. Survey questions focused on issues directly related to Bengal tigers including poaching issues and laws, habitat and ecology, the interaction with people, and conservation outlook. Given the political nature of tiger conservation in India and throughout the world, and fear of retribution, many respondents chose not to answer certain questions. Therefore, results are presented based on the percent respondents for each question.

Survey of LR in Ranthambhore National Park:

To conduct research in Ranthambhore National Park and Tiger Reserve, permission was obtained from the Commissioner of Tourism, Government of Rajasthan. Upon receipt of a letter granting permission, one of the authors (S.S.) traveled to Sawai Madhopur from 21 – 28 December, 2006. One-on-one surveys were conducted with forest officials working in Ranthambhore National Park and Tiger Reserve (n=7), three Wildlife Institute of India (WII) researchers who answered as one respondent (n=1), a nature guide (n=1), and a hotel manager located in Sawai Madhopur (n=1). Each interview was recorded via a digital voice recorder and the responses were transcribed. For interviewees who did not speak English, an interpreter was employed.

Survey of NGR:

One of the authors (M.T.) contacted 41 international researchers and administrators in the global conservation community with expertise on India and tiger conservation. One-on-one surveys focusing on the political, social and biological climate of tiger conservation were conducted by phone or e-mail. Of 41 individuals contacted, 8 (20%) completed the survey.

Results

Interviewees were asked if the current laws in India are adequate to protect tigers (Figure 3). Of NGR, 12% (n=1) did not respond. Of NGR respondents, 100% (n=7) believed India's laws are adequate to protect tigers, whereas 60% (n=6) of LR believed laws are adequate.

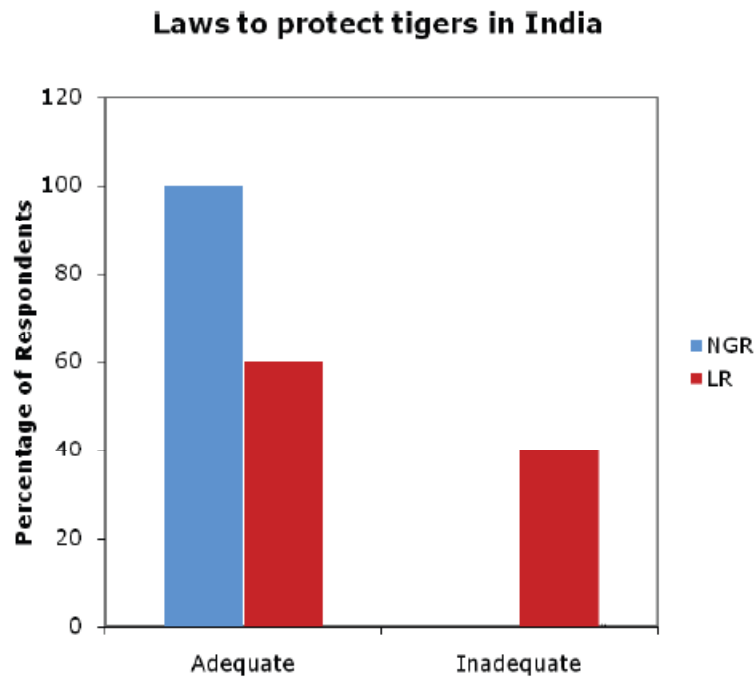


Figure 3. Respondents’ views on whether current laws are adequate or inadequate to protect tigers in India and Ranthambhore National Park and Tiger Reserve.

Interviewees were asked if enforcement of India’s laws is adequate to protect tigers (Figure 4). Of NGR, 12% (n=1) did not answer. Of NGR respondents, 86% (n=6) indicated enforcement of laws was inadequate to protect tigers, whereas 60% (n=6) of LR believed enforcement was inadequate to protect tigers.

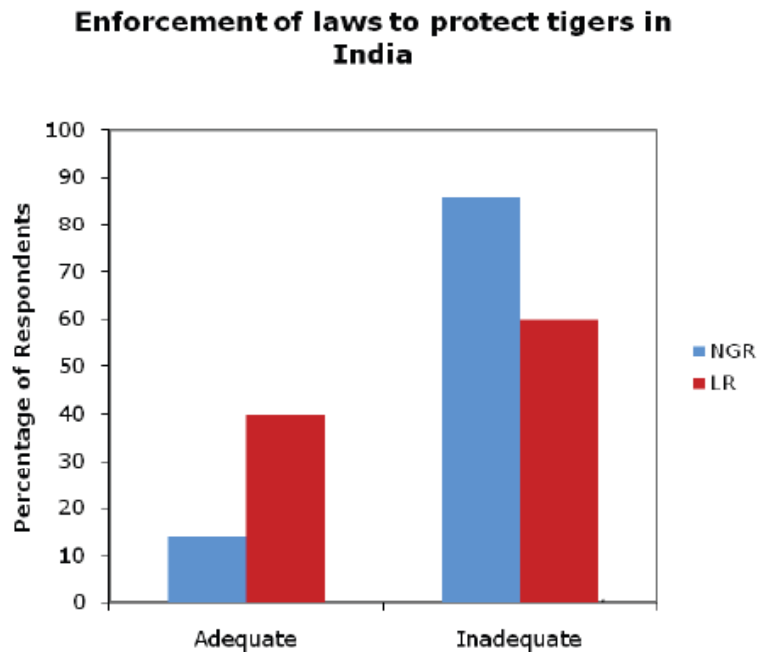


Figure 4. Respondents’ views on whether enforcement of current laws is adequate or inadequate to protect tigers in India and Ranthambhore National Park and Tiger Reserve.

Interviewees were asked if poaching was a threat to tigers in India (Figure 5). Of NGR, 88% believed poaching is a threat to tigers in parts of India they have worked and 12% were unsure but were conducting ongoing research into tiger mortality. Of LR, 10% did not reply. Of LR respondents, 67% (n=6) believed poaching was a threat to tigers in Ranthambhore National Park and Tiger Reserve.

Is poaching a threat to tigers in India (NGR) and in Ranthambhore (LR)?

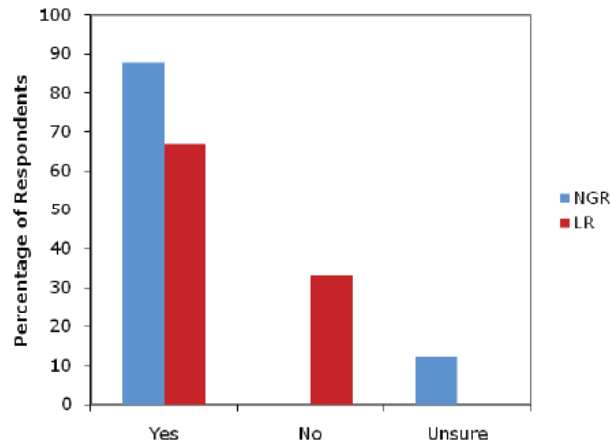


Figure 5. Respondents' views on whether poaching is a threat to tigers in India and Ranthambhore National Park and Tiger Reserve.

Interviewees were asked if they believe official Project Tiger census data was accurate (Figure 6). Of NGR, 38% (n=3) did not respond. Of NGR respondents, 80% (n=4) believed Project Tiger estimates were inaccurate; 20% (n=1) believed the current Project Tiger data (not yet released) was accurate but that past figures (prior to 2004-05) overestimated tiger numbers. Of LR, 70% (n=7) believed estimates were inaccurate.

Are Project Tiger estimates accurate?

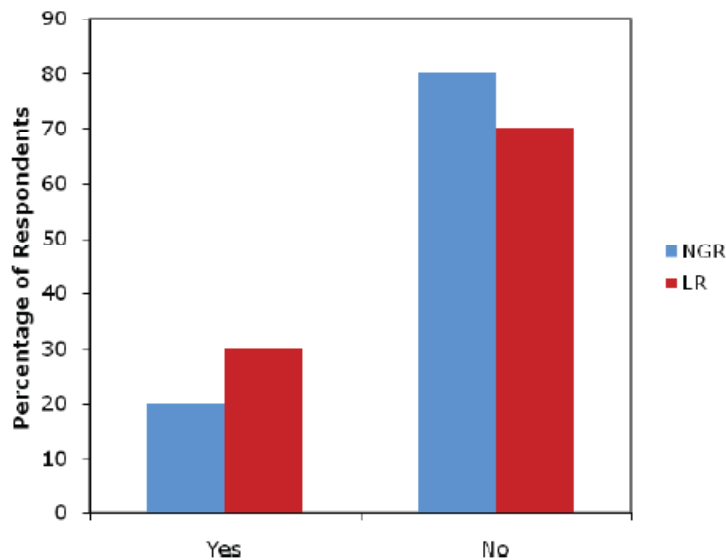


Figure 6. Respondents' views on accuracy of Project Tiger population estimates in India and Ranthambhore National Park and Tiger Reserve.

A majority of LR and NGR believed Project Tiger benefited or somewhat benefited tiger conservation in India (Figure 7). Of NGR, 13% did not reply. Of NGR respondents, 57% (n=4) believed Project Tiger benefited tiger conservation and 43% (n=3) believed Project Tiger somewhat benefited tiger conservation. Of LR, 70% (n=7) believed Project Tiger benefited tiger conservation and 10% (n=1) believed Project Tiger somewhat benefited tiger conservation.

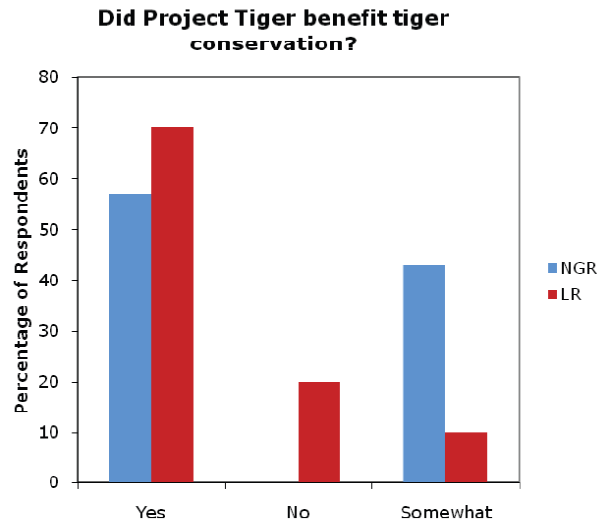


Figure 7. Respondents' views on the benefit of Project Tiger to tiger conservation in India and Ranthambhore National Park and Tiger Reserve.

Interviewees were asked whether they believed the outlook for tigers in India (NGR) or in Ranthambhore (LR) is positive or negative (Figure 8). Of NGR, 50% (n=4) believed the outlook was negative, whereas 78% (n=7) believed the outlook for the tiger in Ranthambhore is positive.

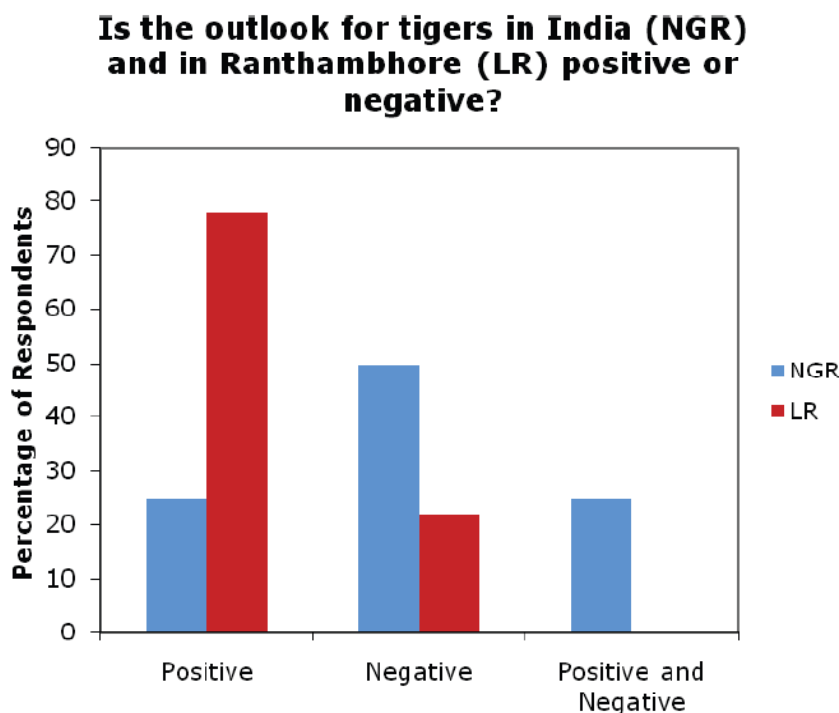


Figure 8. Respondents' views on the outlook for tigers in India and Ranthambhore National Park and Tiger Reserve.

Discussion

The tiger is a cultural icon in India (Jackson 1999; Thapar 2002), and serves as a flagship species in conservation of Indian forests (Marcot 1992). Although NGR work to advance tiger conservation in pockets across India, Project Tiger, in concert with the LR (the on-the-ground representatives), is the government mechanism that unifies efforts and enforcement across India (Panwar 1987). Both NGR and LR have valuable but different perspectives on these issues. NGR have the benefit of global objectivity and do not share the economic interests that are important to LR. However, LR carry out the day-to-day work of implementing tiger management policies and have a close vantage point to observe how well Project Tiger policies translate into tiger conservation. We acknowledge that our small sample size

makes it difficult to identify broad trends and conclusions, but we believe survey respondents offer important insight and perspectives into the status of tigers, Project Tiger, and tiger conservation in India.

The majority of NGR and LR believed laws were adequate to protect tigers. However, a number of LR believed laws needed to be more stringent, particularly regarding poaching, and that protection of tigers outside of core areas needed to be expanded. A majority of both groups believed enforcement of India's tiger conservation laws was insufficient. Obviously, LR have a vested interest in advancing a positive perspective on tiger conservation and some LR work in law enforcement. Also, although NGR have an outside perspective, they may not work closely enough with LR to fully understand the enforcement challenges, failures, and successes.

Poaching of tigers and their prey and anti-poaching enforcement were identified as primary areas of concern between both groups of respondents. A majority of both groups believed poaching is a threat to tigers, but some LR indicated there was no evidence of poaching around Ranthambhore. However, the size of Ranthambhore and limited resources, equipment and staff make patrolling difficult, particularly at the periphery of the park. The prospect of poaching near the park's boundary highlights the problems facing tigers residing outside of India's protected areas. All NGR respondents believe poaching is a problem in India and some believe anti-poaching patrollers are often not sufficiently trained and cases are often not prosecuted. Valmik Thapar, noted tiger conservationist, believed 95 percent of tigers outside parks had been wiped out as of August 2007 (Rabinowitz 2007). If laws related to tiger conservation outside protected areas are weak, survival and genetic exchange between reserves could be hindered (Kenney et al. 1995; Thapar 1999). A prominent lawyer in Ranthambhore believes the judicial system is slowly working to prosecute poachers in India. People are becoming more fearful of going against the law but problems lie with officials posted to implement wildlife laws and who are not held accountable for their actions. For example, after the Sariska failure, none of the officials in charge were held accountable and none of their posts were terminated.

A majority of LR and NGR believed Project Tiger population estimates are not accurate and the pugmark census method that had been used across India is not scientifically sound. Scientific literature indicates the pugmark method yields inflated estimates (Karanth 1987, Karanth 2003). The case of Sariska illustrates the peril of overestimating tiger populations (Sankar et al. 2004). It is possible accurate data would have allowed scientists to implement more aggressive management and save Sariska's tigers. Although scientists have questioned the validity of the pugmark method, as of December 2006, it remains the primary technique to evaluate tiger popula-

tion dynamics. Although scientists conducting research in the park have employed other methods to study tigers (e.g., cameras), Indian forest officials told us they have not incorporated the data into population estimates or future conservation strategies. It appears there is a gap between scientific data and tiger management and conservation. Currently, using modern census techniques, many NGR we spoke with estimate the tiger population in India is less than 2,000.

A majority of survey participants believed Project Tiger benefited tigers by creating valuable infrastructure, but some believed the approach must be updated. Some respondents believed the push for modernization has marginalized environmental issues and that people and tigers can no longer coexist in India. Others highlighted areas of need, particularly resources for patrollers, community development in local villages and public outreach. Overall, LR were more optimistic than NGR about the future of tigers. Some LR believed tiger reserve personnel are efficient in monitoring tigers, and they indicated Ranthambhore is one of the best habitats for tigers due to strong prey base and suitable geography. However, many believed the Indian Forest Department wastes money and places emphasis on tourism at the expense of conservation. NGR, who believed the outlook for tigers is negative, blamed poaching, habitat destruction and insufficient political will in India to save tigers. Further, many NGR believed it is unlikely India's tigers will not persist in areas where they exist today.

It is important to assess perceptions of tiger conservation among different groups because sound scientific data and a clear, uniform understanding of the status of tigers should be the foundation of conservation management (Karanth and Nichols 1998, Dutt 2001, Karanth et al. 2003, Madhusudan et al 2006). If Ranthambhore and all of India are to effectively conserve tigers, better population data is needed to develop management plans, and NGR and LR should share data and resources to improve tiger management and conservation. For example, NGR indicated Project Tiger was very successful in its early years, but tigers have begun to decline. A critical look at this conservation policy and implementation is warranted before more tiger reserves lose this important species.

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References

- Bagchi, S., S. P. Goyal, and K. Sankar. 2003. Prey abundance and prey selection by tigers (*Panthera tigris*) in a semi-arid, dry deciduous forest in western India. *Journal of Zoology* 260:285-290.
- Baine, M. R. and R. M. Baine. 1975. Blake's Other Tigers, and 'The Tyger'. *Studies in English Literature (Rice)* 15:563-578.
- Dinerstein, E., and E. D. Wikramanayake. 1993. Beyond "hotspots": How to prioritize investments to conserve biodiversity in the Indo-Pacific region. *Conservation Biology* 7:53-65.
- Dutt, S. 2001. Beyond 2000: A management vision for the Kalakad-Mundanthurai Tiger Reserve. *Current Science* 80:442-447.
- Government of India. 1972. Retrieved 11 October 2007, from <http://www.envfor.nic.in/legis/wildlife/wildlife1.html>
- Herrington, S. 1987. Tigers of the world: The biology, biopolitics, management and conservation of an endangered species. Pages 51-60 in R. L. Tilson, and U. S. Seal (eds.), *Subspecies and the conservation of Panthera tigris*. Park Ridge: Noyes Publications.
- India Wildlife. 2007. Retrieved 16 October 2007, from <http://indiawildlife.org/wildlife-maps-india/ranthambore-wildlife-map.html>
- Indian Board for Wildlife. 1972. Project Tiger: India – 1972. A planning proposal for preservation of tiger (*Panthera t. tigris* Linn.) in India. New Delhi: Government of India publication.
- Jackson, P. 1993. The status of the tiger in 1993 and threats to its future. Gland: IUCN
- Jackson, P. 1999. The tiger in human consciousness and its significance in crafting solutions for tiger conservation. Pages 50-54 in J. Seidensticker, S. Christie, and P. Jackson (eds.), *Riding the Tiger*. London: Cambridge University Press.
- Karanth, K. U. 1987. Tigers in India: a critical review of field censuses. Pages 18-132 in R. L. Tilson and U.S. Seal (eds.), *Tigers of the World*. Park Ridge: Noyes Publications.
- Karanth, K. U., J. D. Nichols, J. Seidensticker, E. Dinerstein, J. L. D. Smith, C. McDougal, A. J. T. Johnsingh, R. S. Chundawat, and V. Thapar. 2003. Science deficiency in conservation practice: The monitoring of tiger populations in India. *Animal Conservation* 6:141-146.
- Karanth, K. U. and B. M. Stith. 1999. Prey depletion as a critical determinant of tiger population viability. Pages 100-114 in J. Seidensticker, S. Christie, and P. Jackson (eds.), *Riding the Tiger*. London: Cambridge University Press.
- Kenney, J.S., J. L. D. Smith, A. M. Starfield, and C. W. McDougal. 1995. The long-term effects of poaching on population viability. *Conservation Biology* 9:1127-1133.
- Krishnan, M. 2006. Looking back on Project Tiger. Pages 227-236 in V. Thapar (ed.), *Saving Wild Tigers, 1900-2000: The Essential Writings*. Delhi: Permanent Black.
- Kumar, A., and B. Wright. 1999. Combating tiger poaching and illegal trade in India. Pages 243-251 in J. Seidensticker, S. Christie, and P. Jackson (eds.), *Riding the Tiger*. London: Cambridge University Press.
- Luo, S. J., J. H. Kim, W. E. Johnson, J. van der Walt, J. Martenson, N. Yuhki, D. G. Miquek, O. Uphyrkina, J. M. Goodrich, H. B. Quigley, R. Tilson, G. Brady, P. Martelli, V. Subramaniam, C. McDougal, S. Hean, S. Q. Huang, W. Pan, U. K. Karanth, M. Sunquist, J. L. Smith and S. J. O'Brien. 2004. Phylogeography and genetic ancestry of tigers (*Pan-*

thera tigris). Public Library of Science, 2:e442.

Madhusudan, M. D., K. Shanker, A. Kumar, M. Charudutt, A. Sinha, R. Arthur, A. Datta, M. Rangarajan, R. Chellam, G. Shahabuddin, R. Sankaran, M. Singh, U. Ramakrishnan, and P. D. Rajan. 2006. Science in the Wilderness: The predicament of scientific research in India's wildlife reserves. *Current Science* 91:1015-1019.

Marcot, B. G. 1992. Conservation of Indian forests. *Conservation Biology* 6:12-16.

Marshall, A. 2006. Making a killing. *Bulletin of the Atomic Scientists* March/April:36-42.

Norris, K. M. 2005. Born to be wild: tiger persecution and advocacy from 1800 to the present doctoral dissertation, Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Nowell, K., and P. Jackson. 1996. Wild Cats: Status Survey and Conservation Action Plan. Gland: IUCN.

Panwar, H. S. 1987. Project Tiger: the reserves, the tigers and their future. Pages 110-117 in R. L. Tilson and U.S. Seal (eds.), *Tigers of the World*. Park Ridge: Noyes Publications.

Project Tiger. 2005. The report of the Tiger Task Force: joining the dots. Retrieved 7 July 2007, from http://projecttiger.nic.in/TTF2005/pdf/full_report.pdf

Project Tiger. 2007. Retrieved 7 July 2007, from <http://projecttiger.nic.in/populationinindia.asp>

Prynn, D. 2004. Amur tiger. Edinburgh: Russian Nature Press.

Rabinowitz, A. 1993. Estimating the Indochinese tiger *Panthera tigris corbetti* population in Thailand. *Biological Conservation* 65:213-217.

Sankar, K., S. P. Goyal and Q. Qureshi. 2005. Assessment of status of tiger (*Panthera tigris*) in Sariska Tiger Reserve, Rajasthan, India. Dehradun: Wildlife Institute of India.

Seidensticker, J. 1987. Managing tigers in the Sundarbans: experience and opportunity. Pages 416-426 in R. L. Tilson and U.S. Seal (eds.), *Tigers of the World*. Park Ridge: Noyes Publications.

Singh, S. 1996. India. Pages 29-42 in E. Lutz and J. Caldecott (eds.), *Decentralization and Biodiversity Conservation: A World Bank Symposium*. Washington D.C.: World Bank Publications.

Smith, J. L. D., and C. McDougal. 1991. The contribution of variance in lifetime reproduction to effective population size in tigers. *Conservation Biology* 5:484-490.

Smith, J. L. D., C. Wemmer, and H. R. Mishra. 1987. A tiger geographic information system: the first step in a global conservation strategy. Pages 464-474 in R. L. Tilson and U.S. Seal (eds.), *Tigers of the World*. Park Ridge: Noyes Publications.

Thapar, V. 1999. The tragedy of the Indian tiger: starting from scratch. Pages 296-306 in J. Seidensticker, S. Christie, and P. Jackson (eds.), *Riding the Tiger*. London: Cambridge University Press.

Thapar, V. 2002. The cult of the tiger. New Delhi: Oxford University Press.

The Telegraph. 2006. Retrieved 28 March 2007, from http://www.telegraphindia.com/1060723/asp/look/story_6507295.asp

Tyagi, R., D. Bhatnagar, G. V. Reddy, R. G. Soni, M. L. Daima and A. Sen. 2002. Ranthambhore tiger reserve management plan 2002-2011. Sawai Madhopur: Forest Department, Government of Rajasthan, India.

Weber, W., and A. Rabinowitz. 1996. A global perspective on large carnivore conservation. *Conservation Biology* 10:1046-1054.

Wikramanayake, E. D., E. Dinerstein, J. G. Robinson, U. Karanth, A. Rabinowitz, D. Olson, T. Mathew, P. Hedao, M. Conner, G. Hemley, and D. Bolze. 1998. An ecology-based method for defining priorities for large mammal conservation: The tiger as case study. *Conservation Biology* 12:865–878.

Wikramanayake, E. D., M. McKnight, E. Dinerstein, A. Joshi, B. Gurung, and D. Smith. 2004. Designing a conservation landscape for tigers in human-dominated environments. *Conservation Biology* 18: 839–844.

Wildlife Institute of India. 2007. Retrieved 16 July 2007, from <http://www.wii.gov.in/nwdc/tigerreserves.htm>

Wright, B. 1999. Tiger poaching statistics in India. Pages 243-251 in J. Seidensticker, S. Christie, and P. Jackson (eds.), *Riding the Tiger*. London: Cambridge University Press.

British and American Interests in Iraq: The Rhetoric and Reality of Imperialism; Lessons Learned?

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(Mentor)

Abstract

"Over the six millennia of recorded history, Iraq was frequently invaded and conquered, leading to the dynamic heritage, vibrant cultural tapestry," and persistent violence characterizing the nation today (1). Despite international efforts to transform the reality perpetuating this identity, the violence and chaos continue today. Throughout the first half of the twentieth century, Britain attempted to construct national institutions and administrations. The British failed. Since 2003 the US-led Coalition has undertaken a similar endeavor. To date, the Coalition has not succeeded in its attempts at nation-building in Iraq. Why did these substantial allocations of both British and American resources prove ineffective in stabilizing Iraq? An answer may lie in examining the history of the British experience in Iraq and extrapolating these insights into the current American involvement.

In *The Rhetoric of Empire*, David Spurr identifies "basic rhetorical features" found in British imperial literature emphasize "modern, civilized human beings" who aid the weak or uncivilized (2). Spurr highlights the particular language that facilitates imperial influence by assigning overt humanitarian motivations to actions that in reality are motivated by imperial security and economic concerns. The pervasive disconnect between the rhetoric and reality of the British Empire mirrors current American rhetoric. Since the early eighteenth century, British agents "manned a trade outpost in Basra" and quickly "became very powerful and influential advisors to the Ottoman pasha" who governed "the area between two rivers," Mesopotamia (3). British interests in Iraq grew throughout the nineteenth century and, by the turn of the twentieth century, Iraq was critical to British imperial geo-strategic perceptions. After World War I, the British international influence declined, yet Britain desired, for strategic and economic reasons, to construct modern Iraqi institutions and infrastructure.

However, in the twilight of its imperial prowess, Britain could not establish any form of sustainable Iraqi authority on a national level despite the significant resources and manpower London directed towards this endeavor from 1914 through 1932. At the conclusion of WWI, the Allies divided Central interests in the Near East, and Britain obtained formal authority over Mesopotamia in the form of the Mandate System, "designed to establish the universal ideal of a sovereign state with comparatively open markets and a politically independent government" (4). This system fit well with the long-standing British idealist, humanitarian rhetoric, establishing a degree of informal imperialism that secured influence in Iraq until well after the British physical departure in 1932. The British failed, however, to construct a stable independent authority through the

Mandate System protocol due to its "rigid views about who could undertake change, what sort of conditions and changes were necessary, and how much could be done" (5).

In *The Pattern of Imperialism: The United States, Great Britain, and The Late Industrializing World Since 1815*, Tony Smith argues that British financial and military resources promoted "a framework for world order through defending certain basic principles designed to regulate conduct among the great powers as well as between the strong and the weak" (6). British interest in Iraq was also driven by domestic economic concerns. As J.A. Hobson first argued in 1902, imperialism becomes necessary when domestic capital "cannot find any profitable investment" at home and "it is to the advantage of the nation that they should be employed as largely as possible in lands where they can be utilized in opening up markets for British trade and employment of British enterprise" (7). Both geo-strategic and economic imperial arguments are evident in the British presence in Iraq.

Rhetoric and reality, thus diverging in the British experience in Iraq, both served British purposes. Although British rule justified itself by rhetorical arguments, the United States does not enjoy similar rhetorical success. With several exceptions that will be addressed at a later point, problems that thwarted British efforts in Iraq continue to plague the US-led Coalition forces. Therefore, current Coalition Forces in Iraq should not be surprised that they continue to founder. To date, 3,329 American service men and women have died while participating in Operation Iraqi Freedom, and the violence and civil unrest continue to escalate (8). In *Inventing Iraq: The Failure of Nation Building and a History Denied*, Toby Dodge warns "the United States in

Iraq today must understand that it is both living with the consequences of that [British] failure and is in danger of repeating it" (9). Unfortunately, as of May 2007, history repeats itself in Iraq; however, the final outcome is yet to be decided. By noting similarities and differences behind the motivations for British and American involvement in Iraq, one may assess the future of international involvement and an outcome of Operation Iraqi Freedom that is not a foregone conclusion: To achieve Coalition success, several elements discussed must be addressed sufficiently; surprisingly, several of these have little to do with Iraq itself.

What Caused the British to Enter Iraq?

The Ottomans ruled Mesopotamia from 1534 until they lost control to the British in WWI (10). British trade enterprises, beginning in the seventeenth century and remaining insignificant under the Ottomans, gradually grew in size and in revenue. As a result of the Industrial Revolution, Middle Eastern oil deposits became valuable commodities, necessary to fuel the enormous industrialization at the end of the nineteenth century. Prior to WWI, British imperial mechanisms developed and increased with the growing commerce and interest in oil. British diplomatic relations with all nations in the Near East were tenuous at the turn of the twentieth century, but WWI opened the area to formal British control under the mandate system, built on the new rhetoric of the era. Spurr's "basic rhetorical features" are found in the Proclamation to the People of Baghdad, given by General Maude on March 19, 1917, which assists considerably in explaining British expectations in this capacity. Though preceding the League of Nations Mandate system, this document, composed in London, offers insight into what British rhetoric needed to address to appease the international community and the Iraqis. The document also highlights what they understood was unacceptable rhetoric and thus was omitted. General Maude proclaimed, "Our armies do not come into your cities and lands as conquerors or enemies, but as liberators...Your citizens have been subject to the tyranny of strangers... It is the wish not only of my King and his peoples, but it is also the wish of the great Nations with whom he is in alliance, that you should prosper" (11).

In this document the British proclaimed its humanitarian intent and made no mention of the possibility of any financial or strategic motives. However, as early as 1908 David Lloyd George, Chancellor of the Exchequer, had asserted in a confidential report entitled "British Trade in Mesopotamia," that "Mesopotamia, whose potential riches are almost without parallel" deserves the "most attention on the part of His Majesty's Government" because "none of this wealth is being exploited except in a desultory and primitive fashion by the native people" (12). George furthers his argument by listing numerous

"urgent measures to be taken both by Government as well as by the British trader" so that "British hands" can successfully "check" the "great menace to [their] commercial superiority," the Germans (13). Such motives had, by 1917, by no means disappeared; yet no mention is made of these financial and strategic desires because they were not palatable to either the international community or to the Iraqis. The rhetoric and reality of the British Empire were very different.

Arguably the most influential and respected British diplomat in Iraq, Gertrude Bell, recognized the commitment of both time and resources necessitated by Britain's imperial undertaking; she wrote, "we've shouldered a gigantic task, but I don't see what alternative there was" (14). The rhetoric London offered as justification for its presence in Iraq purported its goal to be simply "to build a liberal, modern, sustainable state capable of reshaping the lives of the Iraqi people" (15). The motivation behind the British presence was extremely complex, yet three elements exerted the greatest influence on the decision to embark on this action. In order of importance to the Crown, they were India, oil, and the imperial rivalries of Germany and France. It must be noted, however, that oil and imperial rivalries are arguably of equal significance. Lord Curzon, Viceroy of India, summed up the importance of India to the British by asserting "as long as we rule India we are the greatest Power in the world," and he "declared [a] need 'to safeguard all the routes leading to India'" (16). Mesopotamia, present-day Iraq, was the fastest combined land and sea route from England to India. Longitudinal movement of commercial goods through Mesopotamia was facilitated by the Baghdad Railway; through a joint Ottoman-German enterprise the majority of the Baghdad Railway was completed by 1904 (17). The Mesopotamian commercial route was second only to the exclusively water route through the Suez Canal.

Iraqi oil reserves were coveted by the British. In 1912, as First Lord of the Admiralty, Winston Churchill switched the fuel powering the world's largest navy from coal to oil (18). In so doing, Churchill made the fleet, which habitually served as a means of securing British international interests, entirely dependent on this foreign commodity. A 1922 Admiralty memorandum illustrates this dependence by acknowledging "from a strategic point of view the essential thing that Great Britain should control [are] the territories on which the oil is situated" (19). German and French actions paralleled the British by depending heavily on oil as the fuel to drive their respective imperial programs. Iraq served as the proxy stage on which these parties sought to secure their oil rights. The 1916 Sykes-Picot Agreement between Britain and France sought to establish "zones of influence" for imperial nations throughout the Middle East (20). In effect, this agreement distributed the territory of the Ottoman Empire to the eventual Allied victors and

set the stage for the political birth and demarcation of several nations that did not previously exist. Iraqi oil reserves stimulated American interest when in 1920 John W. Davis, an American diplomatic liaison in London, wrote to Curzon questioning the British "treatment of the economic resources" in particular "the deposition of petroleum produced in Mesopotamia." In typical imperial rhetoric, Curzon affirmed "the oil deposits in Mesopotamia will be secured to the future Arab state" (21).

At the conclusion of WWI, "a few Allied leaders" met at San Remo in April 1920 and "allocated the former German shares in the Turkish Petroleum Company to the French," but, more importantly to the Empire, the company was "placed under permanent British control" (22). Theoretically, the San Remo conference established territorial allocations, or mandates, to be administered by the Allies until each mandate was able to stand alone and enter the League of Nations; however, this process of national maturation resulting in sovereign status was not realized in Iraq. In *Churchill's Folly: How Winston Churchill Created Modern Iraq*, Christopher Catherwood points out the "inherently artificial nature of the boundaries" of Palestine, Lebanon, Kuwait, and Iraq created during the Conference, which all continue to be problematic (23). Whatever the focus of the mandate under the League guidelines, British motivations in Iraq continued to reflect classical imperial motivations for securing available avenues for international trade, minimizing the requisite capital needed to procure specific resources, and undermining rival imperial expansion and acquisitions.

The Reality Britain Faced in Iraq

From 1914 to 1918, WWI pitted the Allied Powers (Britain, France, and Russia) against the Central Powers (Germany, Italy, and the Ottoman Empire). Although only battles in a larger global war, the conflict between the forces in Mesopotamia would decide which nation controlled it and its resources. The British military arrived in Iraq on November 6, 1914, and within two weeks was fleeing from Central soldiers who had allied with regional tribes (24). After five months of fighting, Central forces, bolstered by tribal manpower and intelligence, had devastated British forces who were on the retreat towards Basra (25). Fearing defeat in Iraq, the British forces negotiated critical tribal support, previously enjoyed by Central forces, with the aid of Thomas Edward Lawrence. Acting as a hybrid diplomat-guerilla liaison, he brokered a deal between Britain and tribal leaders; tribal alliances were granted in return for the promise of future independence. As a result, by 1917 British forces under the command of General Maude secured Mesopotamia and laid the foundation of British influence that would remain for decades.

No British personnel in Iraq enjoyed more Iraqi support

and influence than did Bell and Lawrence. "[T]he Uncrowned Queen of Iraq" and "Lawrence of Arabia" both played instrumental roles in stimulating grass roots acceptance of British existence. Bell, who repeatedly communicated to London that "the country is entirely out of hand, the reins of government were all dropped," facilitated political discourse between the Middle East and the West to a degree as yet unrivaled (26). Resulting from her total immersion in Iraqi society and culture, Bell understood that "tribal connections" were "more useful" than any established by the government and "pray[ed] that the people at home [in England] may be rightly guided and realize that the only chance here is to recognize political ambitions from the first, and not try to squeeze the Arabs into our mould" which would ignite "the chaos to overwhelm Mesopotamia" (27). Unfortunately her cautions fell on deaf ears and by the end of 1922, Bell lamented "the underlying truth of all [Iraqi] criticism"; although the British "promised self-governing institutions," Bell noted, they had been "busily setting up something entirely different" (28). Bell was understandably frustrated that her own government "had promised an Arab Government with British Advisors, and had set up a British Government with Arab Advisors" (29).

"Lawrence of Arabia" fostered Iraqi loyalties differently, yet proved vital to the British during WWI in a hybrid capacity, both as a guerilla fighter and a diplomatic liaison, who was remembered by a Bedouin sheik as "the man with the gold" (30). As Niall Ferguson points out, Lawrence's "affinity with the Arabs was to prove invaluable," (31) and Lawrence's guerilla escapades are notorious. In his essay "Demolitions Under Fire," Lawrence infamously describes explosions as "most beautiful, for the sleepers rise up in all manner of varied forms, like the early buds of tulips" (32). The violent and uncertain experiences of "Lawrence of Arabia" represent the reality the British faced while in Iraq more than the accounts of Bell who, due to her gender and official position under Sir Percy Cox and Sir Henry Dobbis, merely read correspondence that recounted these outbreaks of violence. "Lawrence of Arabia" was also instrumental in combating growing resentment of British presence that had religious undertones, but Lawrence eventually resigned his position with the British after it became apparent that Arab independence, which he had promised to gain their allegiance, was not forthcoming.

Violence and civil unrest plagued the British presence in Iraq. The insurrection of 1920 symbolizes the unfortunate nature of the British experience and highlights several of the larger problems the British faced. Perhaps most startling to the British was the insurrection "marked the first time that Sunnis and Shiites banded together and cooperated to attempt to free their country from a foreign overlord" (33). This fairly widespread Iraqi rebellion erupted for two main reasons: the "Indianization" of their country, and the absence of progress towards independence. Most British leaders regarded Iraqi

personnel "as lazy and feckless, imbued with a peculiarly optimistic fatalism destructive of all progress"; therefore, the British filled most administrative positions in Iraq with personnel from India (34). Sir Percy Cox believed he "had no alternative...but to create provisional administration from the only sources available, namely British and British Indian personnel drawn from the Army or borrowed from India" (35). The reliance on Indians to fill these positions infuriated the Iraqis who felt themselves fully capable. The introduction of the Indian rupee as the Iraqi currency further alienated indigenous inhabitants who saw yet another foreign presence. The "Indianization" of Iraq illustrates the British were implementing its classic imperial model with which it had succeeded in India; however, as several Iraqi manifestations would make painfully evident, success in Iraq was not attainable.

As a result of the ongoing problems and growing civil unrest, Bell never achieved her goal to "rope together the young hotheads and the Shiah obscurantists, the enthusiasts, polished statesmen, and the scholars" and "make them work together and find their own salvation for themselves" (36). However, to brand the British presence in Iraq as purely negative is inaccurate. The 1921 Conference of Cairo named Faisal I the first King of Iraq and started the Hashemite monarchy, which endured until 1958; during this era a single constitution and parliament existed (37). Although Bell wrote "Faisal had been elected King by 96 percent of the people of Mesopotamia," (38) Winston Churchill wrote to the Prime Minister in a "PERSONAL AND SECRET" transmission that "Feisal [sic] offers far away the best chance of saving our money" (39). King Faisal granted a 20-year treaty under which British "advisors" were consulted on foreign affairs, fiscal policy, and anything that could potentially affect British "interests" (40). King Faisal and the Hashemite monarchy were seen by Iraqis as British puppets dependent on the Empire.

On October 3, 1932, Iraq became independent and joined the League of Nations (41). Nominally, the British mandate was thus a success. But the legacy of British involvement in Iraq, as Catherwood writes, was something different. "Fifty-eight governments in 37 years is a sure sign of chronic, unresolved instability, and that was exactly the case with Iraq under the monarchy from 1921 until its violent overthrow in 1958" (42). This is the reality that preceded the increase in American interests that continues today.

What Caused the United States to Enter Iraq?

In *Globalization and Empire: The U.S. Invasion of Iraq, Free Markets, and the Twilight of Democracy*, Hartnett and Stengrim argue that "liberty, freedom, and democracy have been turned into powerful rhetorical instruments justifying globalization and empire" (43).

The American usage of rhetoric as a means to facilitate empire is very similar to the British application of the classic colonial model. With a similar intended international audience as the British Proclamation to the People of Baghdad, the Coalition Mission Statement, published July 1, 2003, deploys American rhetoric, which seeks to address concerns of the international community through Spurr's model (44). The goal of the Coalition is "to help the Iraqi people rebuild their country" and after "ensuring a safe and stable country," the troops will "withdraw" (45). "The US and its Coalition partners are dedicated to returning Iraq to the people as soon as possible" (46).

American motives for its current presence in Iraq are just as complex as earlier British motives and reflect a tension between legitimizing rhetoric and reality of American interest. In congruence with the British, current US involvement is motivated to some degree by geo-strategic and socio-economic concerns. As Max Boot argues in his lecture entitled, "Does America Need an Empire?," the US needs desperately to acknowledge its international role as "global policeman," or "Globo-Cop," because "the job of policing these distant lands...ultimately falls to [America], which means that whether we like it or not, liberal imperialism appears to be our future" (47). In parallel with its British predecessors, the US recognizes the strategic significance of Iraq in the context of a perceived pan-Islamic threat to Western interests. As Smith's argument highlights, both imperial titans saw stabilizing Iraq as an integral part of the larger structure of world-wide security. In relation to Hobson's argument that economic factors motivate empire, the current Iraqi population of 26 million combined with the proven fiscal potential made evident under the Ba'athists can be interpreted as a sizable population of consumers of American goods and services. "Iraq possesses significant resources that are underutilized" and "the country has great potential for growth in oil" (48).

American rhetoric, like the preceding British version, throughout the twentieth century offered universal freedom and modernization as the humanitarian motivation for an escalating international influence. In the years after World War II, this was strongly influenced by the Cold War and has also influenced the American-led activity in Iraq. Although it may be an overstatement on Hartnett's part, it is arguable that "fighting Communism served as the rhetorical cover obscuring the fact that post-WWII free trade imperialism was deeply linked to a global military empire" (49). American mechanisms of influence are evident in that "at the height of the Cold War the US maintained as many as 800 facilities around the globe" (50). Therefore it is reasonable that "the chant of free trade has been remarkably persuasive for justifying globalization and forwarding [American] empire" (51). The Cold War had numerous proxy engagements that transpired in the Middle East,

in particular the Iran-Iraq War from 1980 to 1988. As a result of these events, American influence was felt to some degree in Iraq continuously from the turn of the twentieth century to the present.

The terrorist attacks of September 11, 2001, and the resulting "War on Terrorism," along with the erroneous possibility that Saddam Hussein had Weapons of Mass Destruction, were the most significant influences that brought the US-led Coalition to Iraq. But the current US rhetorical message is less clear than the earlier British message. This rhetorical ambiguity is the result of two concurrent international campaigns led by the US; on the one hand the Coalition Mission Statement cites non-violent humanitarian motivations that are strikingly similar to previous British motivations. On the other hand the rhetoric pertaining to the War on Terror contains aggressive preemptive military warnings to a militant Islamic foreign enemy. The War on Terror and US-led Coalition undertaking have in combination published duplicitous American rhetoric pertaining to their current involvement in Iraq. On September 16, 2001, President Bush made a blunder in imperial rhetoric by claiming "This crusade, this war on terrorism is going to take a long time" (52). His usage of the term "crusade" confirmed the worst fears of Muslims the world over and effectively polarized anti-American sentiment in the Middle East. The US and its leaders are not the savvy imperial rhetoricians that their earlier British counterparts were.

Hussein wrote an open letter to the "American and Western Peoples" entitled "America reaps the thorns its rulers sowed in the world" on September 18, 2001, in which he compared the events of September 11th to "what [American] government and their armies are doing in the world, for example, the international agencies have stated that more than one million and a half Iraqis have died because of the blockade imposed by America and some western countries" (53). Hussein's remarks are biased propaganda, but demonstrate a school of thought that exists in the Middle East. The perception of Western presence in this area, in particular Iraq, is reminiscent of the first Christian crusades 800 years earlier, and this subverts any attempts at Iraqi nation-building today. The crippling economic sanctions leveled against Iraq from 1991 through 2003 further implanted the negative Iraqi perception of Western interference (54). Dodge refers to this period of Iraqi sanctions as "10 years of the most comprehensive economic blockade in modern history with its incalculable toll in human suffering" (55). Under the rule of Hussein, many Iraqis felt American sanctions and embargoes showed a lack of compassion for their suffering.

The British also experienced this negative reception by the collective Iraqi sentiment, yet as Lila Rajiva points out, mass media in the twenty-first century is a viable socio-political instrument. In her text, *Language of*

Empire: Abu Ghraib and the American Media, Rajiva highlights the "direct contradiction of the patriotic rhetoric of Americanism" made evident by Hussein broadcasting images of civilian dead and widespread collateral damage (56). Hussein's usage of the media successfully violates the idea that rhetoric serves as plausible cover for the reality of imperial motivations. Regardless of the merit of Rajiva's argument that American media is completely controlled by the mechanisms of empire, the British were not faced with a similar situation or overt rhetorical undermining by a foreign antagonist. As a result of the 2001 events, militant Islam and the term jihad have become media buzz words throughout the West.

A significant portion of the international community feels President Bush has instituted Pax Americana, in which "U.S. military might, economic power, and cultural norms spread across the globe in the name of defending both US national security and civilization at large" (57). Washington understands concerns like these need to be appeased in order to sway the international community in favor of American actions. Obviously, this is not an easy task and unfortunately the National Security Strategy of the United States (NSSUS), made public in September 2002, did nothing to lessen anti-American sentiment. The NSSUS offers "overarching themes" of a preemptive American military state and a promise of benign universalism to spread American goods through capitalism" (58). To some the 2002 NSSUS is a return to traditional British imperial practices in that it justifies the US inserting its military anywhere deemed a threat and justifies American free trade as the best fiscal course for all nations. However, these possibilities are foreclosed if related to the War on Terror rhetoric. The 2002 NSSUS cannot be classified within the parameters of Spurr's "basic rhetorical features" of imperialism. The proud British Empire never hesitated to use skillfully its rhetoric as camouflage to hide the true motivations and influences for its actions.

The US rhetoric pertaining to the War on Terror is composed of language that does not conform to Spurr's model. Acting as an imperial entity, any deviation from Spurr's linguistic model is catastrophic as is tragically evident in Iraq today. The US-led Coalition, continuously dwindling in the number of member nations, is actively taking steps to accomplish its mission; however, violence and civil unrest are rampant and Iraq currently exists in a fragile balance between rule and anarchy. American attempts to balance geo-strategic and socio-economic interests in Iraq are proving to be extremely difficult and American domestic acceptance regarding its presence in this area steadily declines.

The Reality America Faces in Iraq

Operation Iraqi Freedom began in March 2003 with the "shock and awe campaign" and two months later

President Bush declared "Mission accomplished"; by December, Hussein had been captured outside Tikrit (59). On June 28, 2004, the Coalition Provisional Authority, the transitional administrative body, transferred sovereignty to the Iraqi Interim Government and in October 2005 an Iraqi constitution was ratified (60). In March 2006, a permanent Iraqi Government was seated with President Jalal Talabani, Vice-Presidents Adil Abd-al-Mahdi and Tariq al-Hashimi, and Prime Minister Nouri Al-Maliki (61). The commonality between the British and the US-led Coalition is startling. Both used the rhetoric of liberators; both calculated their necessary involvement in relatively short terms; both saw their involvement as part of a larger structure of world-wide security; both were pushed to varying degrees by economic interests; both had interests in Iraqi oil, both in terms of supply and as a commodity facilitating the transition of Iraq to a consumer market; both recognized the strategic significance of Iraq in the context of perceived pan-Islamic threats to Western interests; and both covered their strategic and economic interests with a rhetoric of eventual self-determination and democratization.

There are also critical differences between the two experiences. The US has taken the imperatives of nation-building and the establishment of self-governing institutions far more seriously than the British. This is in part because the US, unlike the British during its involvement, can employ resources and manpower that are without rival. The staffing of newly created positions throughout Iraq by Iraqis is vital to legitimizing the Coalition presence in terms of nation-building. When acting in a similar capacity, the British "Indianization" of these positions was devastating to its efforts. The existence of an Iraqi form of currency, the dinar, has allowed the coalition to stimulate the worth of the dinar rather than introducing a foreign form of currency as the British did with the rupee. At best, the continued circulation of the native dinar perpetuates Iraqi nationalism. Although the capital the Ba'athist era generated did not benefit the masses, Iraqis understand they have the fiscal ability to stand alone as a sovereign nation.

The US has made significant progress in Iraq in several areas. As of March 5, 2007, the US-led Coalition has completed 2,845 of 3,481 reconstruction projects to strengthen the Iraqi infrastructure and 2.5 million barrels of oil are produced daily (maximum Iraqi capacity is 3.0 MBPD) (62). The International Monetary Fund reported in March 2007 that "inflation increased to 65 percent in 2006" and "economic growth was below target because" of "lower than planned investment, the lack of security, and the ongoing insurgency" (63). However, the Iraqi GDP has increased each year of coalition involvement, reaching 41,741 million in 2006, and the projections for 2007 are in excess of 60 million (64). The US-led Coalition has succeeded in initiating the reconstruction of

Iraqi infrastructure, yet the violence has not decreased.

Perhaps the most significant differences between British and US-led Coalition efforts are related to the rhetoric of both experiences which, to a large extent, failed. Both offered written statements intended for both the international community and the Iraqis; the British gave the Proclamation to the People of Baghdad and the Coalition published the Coalition Mission Statement. The US is also engaged in the War on Terror, which has its own rhetoric that does not conform to Spurr's "basic rhetorical features" of imperialism. In his article, "Seeking Honesty in U.S. Policy," Ambassador Joseph Wilson, referencing a speech given by President Bush on September 7, 2003, argues that Bush stating "Iraq is the center of our battle against terrorism" is an "example of the administration's concerted efforts to misrepresent reality" (65). Ambassador Wilson is correct that the coalition "attack on Iraq—and our bungling of the peace—led to guerilla insurgency that is drawing jihadists from around the Muslim world"; however, the true 'bungling' has occurred due to the lack of clear language describing the actions related to the War on Terror and Coalition nation-building attempts (66). Currently Iraq is on the brink of civil war and violence erupts daily in the form of suicide bombers and guerilla fighting. Numerous terrorist factions have answered the call of jihad aimed at removing the Western infidel.

Conclusions

It is obvious that the rhetoric pertaining to the War on Terror subverts the Coalition efforts of Iraqi nation-building. Although British rhetoric espoused noble aspirations for its involvement in Iraq, the reality of its experience illustrated its true desires to maximize its socio-economic influence in Iraq and the Middle East. British informal imperialist influence vacated Iraq only when its Empire crumbled and the Ba'athists revolted against the Hashemite monarchy, left powerless without its British big brother in 1958. Unlike the current American presence in Iraq, attempting both to nation-build and fight the War on Terror, the British involvement was addressed under one single campaign. Regardless of the geo-strategic and socio-economic interests that undoubtedly motivated the current US-led Coalition presence, the lack of a clear distinction between the two proclaimed objectives is counterproductive to both campaigns. Therefore the greatest benefit America can offer Iraqis is to clearly divide the War on Terror from the US-led Coalition. As Ambassador Wilson promotes, "the internationalization of the reconstruction effort" is vital to Coalition success in Iraq (67). Actions such as this offer a two-fold benefit to the United States by separating the reality of the War on Terror from nation-building and relieving American resources that are presently deployed in Iraq.

Historically, British and American experiences in Iraq are similar because both empires offered rhetoric to Iraqis and the international community to camouflage certain motivations. Although the British did not fulfill its rhetoric, it allowed the Empire to perpetuate a national façade that accepted British informal influence over Iraq for decades. The British rhetoric legitimized its presence globally. The duplicitous American rhetoric is progressively delegitimizing the US-led Coalition in Iraq. The US has succeeded in considerably more nation-building than its British predecessors; however, American War on Terror rhetoric has alienated both Iraqis and the international community. The War on Terror rhetoric is not a shared international goal, or arguably even a shared American goal. In order for the US-led Coalition to facilitate a sustainable Iraqi nation, there must be a clear distinction made between the War on Terror and the Coalition mission to nation-build. Only then can the achievements that have already been made serve their intended purpose and facilitate a sustainable independent Iraq.

References

- 1 Courtney Hunt, *The History of Iraq* (Westport, Connecticut: Greenwood Press, 2005) p. 3.
- 2 David Spurr, *The Rhetoric of Empire: Colonial Discourse in Journalism, Travel Writing, and Imperial Administration* (Durham, NC: Duke University Press, 1993) p. 1.
- 3 Hunt p. 58.
- 4 Dodge p. 1.
- 5 Matthew Elliot, *Independent Iraq: The Monarchy and British Influence 1941-1958* (London: Tauris Academic Studies, 1996) p. 165.
- 6 Tony Smith, *The Pattern of Imperialism: The United States, Great Britain, and the late industrializing world since 1815* (Canada: Cambridge University Press, 1981) p. 1.
- 7 J.A. Hobson, *Imperialism: A Study* (London: George Allen Publishing, 1902) p. 31.
- 8 "Casualty Notes" [online fact sheet] available at www.globalsecurity.org/military/ops/iraq_casualties.htm and at www.centcom.mil/sites/uscentcom2/casualties/ldata.htm, viewed on April 30, 2007.
- 9 Dodge p. xii.
- 10 Hunt p. 47.
- 11 "Proclamation to the People of Baghdad," excerpt appears in Edward W. Miller, "Christmas in Baghdad" [article online] available at www.rojname.com/show-all-last-minute-news.php?nuce=159521.htm, viewed on April 1, 2007, p. 2.
- 12 Bourne ed., Part I, Series B, Vol. 16, "Mesopotamia" p. 101, "most" p. 122, and "none" p. 108.
- 13 Bourne ed., Part I, Series B, Vol. 16, p. 176.
- 14 Gertrude Bell, *The Letters of Gertrude Bell*, Vol. II (New York: Boni and Liveright, 1928) p. 410.
- 15 Dodge p. xii.
- 16 Geoff Simons, *Iraq: From Sumer to Post-Saddam* (New York: Palgrave Macmillian, 2004) p. 182.
- 17 Hunt p. 58.
- 18 Niall Ferguson, *Empire: The Rise and Demise of the British World Order and the Lessons for Global Power* (New York: Basic Books, 2002) p. 248.
- 19 Ferguson p. 263.
- 20 Hunt p. 61.
- 21 Bourne ed., Part II, Series B, Vol. 2, p. 72.
- 22 Christopher Catherwood, *Churchill's Folly: How Winston Churchill Created Modern Iraq* (New York: Carroll & Graf, 2004) p. 68.
- 23 Catherwood p. 223.
- 24 Hunt p. 59.
- 25 Hunt p. 60.
- 26 Rosemary O'Brien ed., *Gertrude Bell: The Arabian Diaries, 1913-1914* (Syracuse: Syracuse University Press, 2000) p. 102.
- 27 Bell "tribal" p. 444 and "pray" p. 478.
- 28 Bell p. 502.
- 29 Bell p. 503.
- 30 Simons p. 195.
- 31 Ferguson p. 260.
- 32 T. E. Lawrence, "Demolitions Under Fire," appearing in *The Royal Engineers' Journal*, Vol. XXIX, No. 1, January 1919 [article online] available at www.telawrence.net/telawrencenet/works/articles_essays/1919_demolitions_under_fire.htm, viewed on March 12, 2007, p. 7.
- 33 Hunt p. 63.
- 34 Bourne ed., Part I, Series B, Vol. 16, p. 100.

35 Sir Percy Cox, "Letter to Lady Bell," mother of Gertrude Bell, reprinted verbatim in *The Letters of Gertrude*
 36 *Bell*, Vol. II, p. 523.
 37 *Bell* p. 572.
 38 Hunt p. xvii.
 39 *Bell* p. 620.
 40 Bourne ed. Part II, Series B, Vol. 2, p. 311.
 41 Hunt p. 66.
 42 Simons p. 228.
 43 Catherwood p. 217.
 44 Hartnett p. 5.
 45 Mark LeVine, Viggo Mortensen, and Pilar Perez eds., *Twilight of Empire: Responses to Occupation* (Santa
 46 Monica: Perceval Press, 2005) p. 103.
 47 LeVine ed., p.103.
 48 LeVine ed., p.103.
 49 Max Boot, "Does America Need an Empire," lecture at UC Berkeley, March 12, 2003 [transcript online]
 50 available at www.berkeley.edu/news/berkeleyan/2003/03/19_boot-transcript.html, viewed on January 24,
 51 2007.
 52 "The New Iraq Country Facts" [online data sheet] available at www.mnf-iraq.com/index.php?option=com_content&task=view&idItem8.htm, viewed on March 29, 2007, p. 6.
 53 Stephen John Hartnett and Laura Ann Stengrim, *Globalization and Empire: The U.S. Invasion of Iraq, Free*
 54 *Markets, and the Twilight of Democracy* (Tuscaloosa: The University of Alabama Press, 2006), p. 9
 55 Hartnett and Stengrim p. 9.
 56 Hartnett and Stengrim p. 8.
 57 Hartnett and Stengrim p. 101.
 58 Saddam Hussein, "America reaps the thorns its rulers sowed in the world" (Baghdad: Al-Hurriya Printing
 59 House, 2001) p. 16.
 60 Hunt p. 97.
 61 Dodge p. xv.
 62 Lila Rajiva, *The Language of Empire: Abu Ghraib and the American Media* (New York: Monthly Review Press,
 63 2005) p. 181.
 64 Hartnett and Stengrim p. 137.
 65 Hartnett and Stengrim p. 86-87.
 66 Hunt p. xix.
 67 "The New Iraq Country Facts" p. 3.
 "The New Iraq Country Facts" p. 4.
 Daily, John and Emily LaMarsh, "Iraq Reconstruction Report" [online monthly publication] (Washington, D.C.:
 Department of Defense, PCO, 2007) available at www.mnf-iraq.org/report/03/07.html, viewed on April 15,
 2007, p. 3.
 "Iraq Prospectus for 2006," International Monetary Fund [document online] available at www.imf.org/reports/_2006_iraq.56778.html, viewed on April 15, 2007, p. 8.
 International Monetary Fund p. 14.
 Ambassador Joseph Wilson, "Seeking Honesty in U.S. Policy," in *Twilight of Empire* p. 66.
 Wilson p. 66.
 Wilson p. 68.

About The Authors...

Ruth Hinkle

Ruth Hinkle is from Badin, NC. She attended North Stanly High School, where she was an active member of chorus, vice president of the National Honor Society, and played on the varsity basketball squad. In Fall 2003, she began studying zoology at N.C. State University. While there, she completed the University Scholars Program, the University Honors Program, and was inducted into the National Society of Collegiate Scholars, Phi Sigma Theta, Phi Eta Sigma, and Gamma Sigma Delta. Through the National Society of Collegiate Scholars Program, Ruth was able to travel to Brazil in Summer 2005 as a member of a delegation on the environment. It was there that she met Katherine Burke, her research colleague. She also traveled to Australia in Summer 2007 as a member of a delegation on medicine. Ruth graduated in May 2007 and is planning to attend Physician Assistant School. She feels confident her research experience under Dr. Heather Patisaul will be of great use as she pursues a career in the medical field.

Katherine Burke

Katherine Burke is from Mount Airy, NC. She attended Mount Airy High School where she was student body president and captain of the girl's golf, swimming, and softball teams. Katherine began at N.C. State University in Fall 2003 majoring in zoology. As a freshman, she was inducted into Phi Eta Sigma, Collegiate Scholars, and University Scholars. As a sophomore she was inducted into Gamma Beta Phi, and the National Society of Collegiate Scholars. She was also initiated as a sister in Zeta Tau Alpha sorority. In 2005, she traveled to Brazil along with other diplomats as part of the National Scholars Laureate Program, where she met Ruth Hinkle, her partner and colleague for the research presented. Katherine graduated in May 2007 and will be attending the Royal Veterinary College in London. She is confident the research under Dr. Heather Patisaul led to her acceptance into Veterinary School.

Adrienne Wooten

Adrienne Wooten was born in Carmel, NY in 1986 but has lived in Maryland with her family since 1990. She attended Fallston High School from 2000-04. In 2003, she became a certified National Weather Service Skywarn spotter, and upon graduation received the State of Maryland's Unique Major Award for use in meteorology at N.C. State University. She served on the Women in Science and Engineering student council in 2006, earning the WISE Lifesaver Award for Service to the program. Since 2004, she has been a member of the NCSU Student Chapter of the American Meteorological Society, and became a student member of the National Chapter of the AMS in 2007. She also researches diurnal patterns of thunderstorm convection under the direction of Dr. Sethu Raman. She is now working on ozone trend research for the State of North Carolina and continuing her research with Dr. Raman. She plans to pursue a graduate degree in meteorology after graduation in May 2008.

Warren Hynson

Warren Hynson is from Cary, North Carolina. He is a former graduate of St David's School and is currently a junior at North Carolina State University. Warren is pursuing a major in history as well as a minor in both philosophy and religious studies. As a two-time recipient of an undergraduate research award, he has ample undergrad experience as an independent researcher of philosophy. In the spring of 2007 Warren was chosen to present one of his research papers in Oregon at the Pacific University Undergraduate Philosophy Conference. At NC State, Warren's extracurricular hobbies include participating in an environmental student organization known as GREEN and writing editorials for the Technician. In the summer of 2007 he participated with Breakthrough Collaborative as a seventh-grade writing teacher in San Jose, California. Warren is confident that his undergraduate research experience will prove beneficial in both graduate school and in the professional realm where he aspires to be a teacher.

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Melissa Turner

Melissa Turner is a student in the Fisheries and Wildlife Science Program at N.C. State, where she has been a student since Fall 2006. She has a previous bachelor's degree in English Language and Literature from Smith College in Mass, and spent a semester studying documentary writing at the Salt Center for Documentary Field Studies. She grew up in Deer Isle, Maine, and moved to North Carolina after college to pursue a career in journalism. Melissa has served as an intern, copy editor, page designer and features writer for the News & Record in Greensboro. Melissa is a fellow at the North Carolina Museum of Natural Sciences where she, along with colleague Swarnatara Sivamani, educates the public about ecological roles and sociological context of large carnivores. Melissa and Tara are developing a conservation-focused organization focused on international problems in conservation and innovative solutions to benefit wildlife and people. Melissa began her career shift to the sciences several years ago, and plans to pursue a master's degree and Ph.D. in the field of wildlife biology.

Swarnatara (Tara) Sivamani

Swarnatara (Tara) Sivamani is a third year undergraduate student in Biological Sciences with a minor in Wildlife Sciences. After graduation, she plans on traveling and pursuing a Masters degree and Ph.D. in her field. Eventually, she hopes to better understand conservation issues around the world in order to develop effective, long-term solutions that allow humans and wildlife to coexist with minimal conflict in their natural habitats. Tara is from Chennai, India and has lived in England, Malaysia and various parts of the US and India. In Summer 2007 she interned at the Cheetah Conservation Fund in Namibia, Africa. Currently, Tara and her colleague, Melissa Turner, are in the process of starting an organization focused on understanding the complexities behind conservation. Tara is a Caldwell Fellow and member of the University Scholars Program. She is an ambassador for the College of Agriculture and Life Sciences, serving as a liaison between the college and CALS students and alumni. She is also a Museum Fellow at the Museum of Natural Sciences.

Christopher DePerno

Christopher DePerno is an Assistant Professor/Wildlife Extension Specialist in the Fisheries and Wildlife Sciences Program in the Department of Forestry and Environmental Resources and the College of Natural Resources at N.C. State University. He obtained his B.S. in pre-graduate biology from Central Michigan University (1990), M.S. in behavioral biology from Purdue University (1994), and Ph.D. in wildlife management from South Dakota State University (1998). Prior to joining the NCSU faculty, he was a Research Scientist with the Minnesota Department of Natural Resources Wildlife Populations and Research Group from 1999-2004. He is committed to undergraduate and graduate student research and part of his duties include managing the daily operations of the 6000 acre Bull Neck Swamp Research Forest owned by NCSU. He is a Certified Wildlife Biologist and has been a member of the Wildlife Society since 1994. For contact information, please visit his website: <http://cnr.ncsu.edu/fer/direct/deperno.html>.

Marina F. Bykova

Marina F. Bykova is Associate Professor of Philosophy in the Department of Philosophy and Religion at N.C. State University. She received her Ph.D.(1985) and Dr.Habil.(1993) from the Institute of Philosophy of the Russian Academy of Sciences in Moscow. Her main field of interest is the 19th-century Continental philosophy, with a special focus on German idealism and theories of subject and subjectivity. She was awarded an Alexander von Humboldt Fellowship (1989-90, Germany) and a Lisa Meitner Fellowship (1995, Austria). She taught at the Institute of Philosophy of the Russian Academy of Sciences and held visiting professorships at the Moscow Lomonosov University (Russia), University of Marburg (Germany), and University of Vienna (Austria). At N.C. State she teaches a variety of courses including The 19th Century History of Philosophy, Existentialism, Introduction to Philosophy, Practical Reasoning, and an honors seminar in Kantian Ethics. For more information, including a complete CV, see <http://www2.chass.ncsu.edu/bykova>

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William F. Hunt Jr.

William F. Hunt, Jr. is the former Director of the U. S. Environmental Protection Agency's Emissions, Monitoring and Analysis Division in the Office of Air and Radiation. In March 1999, Mr. Hunt started a new assignment as a Visiting Senior Scientist in the Department of Statistics at N.C. State University. Since the spring of 2000, his students have given 177 professional presentations at research symposia, professional technical and societal meetings and have written over 40 reports for their clients. Mr. Hunt received his B.A. in mathematics with minors in economics and natural science from Rutgers (1966), and his M.S. in applied and mathematical statistics in 1968. He received the Outstanding Service Extension Award from NCSU in 2007, was selected for Who's Who Among America's Teachers in 2005, and was honored with the 20th Century Distinguished Service Award for Work in Environmental Statistics and Ecological Statistics at the Ninth Lukacs Symposium in 1999. He is also an Editorial Group Member of the Journal of Environmental Statistics. He is the former chair of the Environmental Measurements Division of the Air and Waste Management Association.

Heather Patisaul

Heather Patisaul is an Assistant Professor in the Department of Zoology in the College of Agriculture and Life Sciences at N.C. State University. She obtained her B.S. in zoology from the University of Florida (1995), and Ph.D. in population biology, ecology, and evolution from Emory University in Atlanta, GA (2001). Upon the completion of her Ph.D., she served as a postdoctoral fellow in the Center for Behavioral Neuroscience at the Yerkes National Primate Research Laboratory at Emory University (2001 – 2004). After an additional year of postdoctoral training at the CIIT Centers for Health Research in RTP, NC (2004 - 2005) she became a staff scientist at CIIT in 2005. She joined the faculty at NCSU in 2006. Dr. Patisaul is a member of the Society for Neuroscience and the Society for Behavioral Neuroscience and is committed to undergraduate research in the areas of neuroanatomy, neurotoxicology and behavioral neuroscience. For more information, visit her website at <http://www4.ncsu.edu/~hbpatisa/>.

