

L U C E R N A

HONORS UNDERGRADUATE JOURNAL
The University of Missouri-Kansas City



V o l u m e O n e I s s u e O n e

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The University of Missouri-Kansas City

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C O N T E N T S

(7)	(41)
Editor's Note	Levi J. Winegar The Debate Over Water Fluoridation
(8)	(48)
Chris Green GIS Applications for Ground Level Ozone In Kansas City, MO	Sarah H. Peters Reading Regina: Revisiting the Education of Upper- Class Women In the Middle Ages
(19)	(57)
Daniel Green Command and Cooperation: Lessons Learned In Vietnam and Their Applications In Desert Storm	Rebecca Smith Schumann's Use of Musical Personae in the Eichendorff-Liederkreis, Op. 39, Nos. 1 & 8 "In der Fremde"
(31)	(65)
Jennifer T. Nielson Battle of the Sundance: Religion and the Navaho- Hopi Land Dispute	Toby Lawrence Water Quality at Brush Creek

A N o t e f r o m t h e E d i t o r

Welcome to *Lucerna* the interdisciplinary academic honors journal. *Lucerna's* purpose is to offer an outlet wherein UMKC students can publish outstanding academic research. The journal is blind- and peer-reviewed by members of the UMKC Honors Program and we solicit articles from all undergraduate students at UMKC. Of all the pursuits that make this university so rich, the pursuit of academic excellence should always take center stage. This fundamental conviction was the driving force that first brought the journal's founders together in the fall of 2005. Our inaugural issue is the tangible creation of that collaboration.

The journal aims to reflect the vibrancy indicated by its name, 'lucerna', which is the Latin word for 'lamp'. Light has often been used as a metaphor for knowledge. But knowledge, like light, must have its source. The hope suggested by the journal's title is that UMKC student research should be this source of knowledge this light.

With this then we formally invite you to enjoy our first issue. It features seven essays ranging in subject matter from musicology to environmental research, thereby ultimately capturing the interdisciplinary thrust at the very foundation of this project. The editors of *Lucerna* strive to foster diversity in our approach to knowledge and in our transmission of it. We undertake to encourage debate and bring as many different voices to the table as possible. This is the process that has been the vehicle for intellectual change ever since the first universities in Ancient Greece. We can see this in Aristotle, as he critically examined and then attempted to overcome his teacher Plato's philosophical doctrine. We can also see this same dynamic today as contemporary scholars enter into dialogue on the more serious business of life. *Lucerna* fully embraces and works to capture this longstanding dialectical process.

In the coming years our hope is that this journal will continue to grow in unexpected ways: that the lamp that is UMKC undergraduate scholarship will continue to burn bright.

We would like to extend our thanks to the UMKC Student Government Association for helping to offset the publication costs of *Lucerna*, and our gratitude to Provost Bruce Bubacz and Dean Karen Vorst of the College of Arts & Sciences for their longtime commitment to excellence in undergraduate education at UMKC.

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Joshua Earlenbaugh, Editor-In-Chief

Chris Green
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GIS Applications for Ground-Level Ozone
In Kansas City, MO

There are two types of ozone: tropospheric (ground level) and stratospheric. While stratospheric ozone protects the Earth's surface by absorbing harmful ultraviolet radiation, ground-level ozone is not beneficial. Ground level ozone is formed from nitrogen oxides (NOx) and volatile organic compounds (VOCs) (Stedman, 65). Together these chemical compounds are known as ozone precursors. In a complicated process of meteorological and chemical events, these precursors react with sunlight to form ozone. Anthropogenic sources increase these precursors within urban areas leading to elevated levels of ozone concentration. Over the last 125 years ozone concentrations in the troposphere have been increasing. Measurements taken 100 years ago hit highs at ten to twenty parts per billion (Allen, "Ozone in the Troposphere," para 3.). Ozone concentration levels have now exceeded the former 120 ppb per one hour standard set by the EPA in major metropolitan areas. Ground-level ozone is a toxic environmental substance that causes decreased lung function, asthma, and other respiratory problems. The young, elderly, and those who work or play outside are especially sensitive to elevated ozone levels. Even healthy individuals exposed to the previous EPA safe limit of 120 parts per billion of ozone over a study period of several hours have shown impaired the lung function (Sather, Varns, Mulik, Glen,

Smith, & Stallings, 845). Interestingly enough, a recent study ranked Kansas City as the number two asthma hot spot in the nation (COPD International, #2). Asthma, decreased lung function, and respiratory problems are not the only results of high ground-level ozone concentrations. An increase of just ten ppb has correlated with an increase in total human mortality (Bell, Dominici, & Samet, 436). In addition to health effects, crops and other vegetation can be adversely affected by high levels of ozone.

Urban communities, where residents are mainly minorities and have a lower income, bear a disproportionate risk for disease due to air pollution as compared to suburban communities (American Lung Association, 357). Therefore, Kansas City is an ideal place to study the disproportionate impacts of urban air pollution because of the different social and economic statuses of the residents. Living within Kansas City urban core neighborhoods is 79% of the poverty level African-American metropolitan population (Mid-America Regional Council, Metro Outlook). The median household income for urban core residents is \$37,900, while for suburban residents it is \$52,800 (Metro Outlook). This represents a significant demographic and economic disparity between the urban core and the suburban area. Kansas City is also a regional transportation center. It is a place where east-west and north-south running interstate highways intersect. The transportation network is denser in the urban center where a greater minority, lower-income population lives. While traffic count maps show less traffic on Kansas City urban streets compared to heavily used suburban streets, the sheer number of interstates, collectors, and arterials in the urban core make up for certain exceptions in volume.

Past research done by the EPA and others has suggested that most ozone forms downwind of the source unaffected the nearby populace. Recent studies of hospital-documented respiratory problems in proximity to nearby transportation networks have shown a correlation between the two (Ryan et al, 279). The dynamics of the thousands of VOCs that can form ozone can lead to formation in hours (National Research Council, 33-34). Stagnant air days, with average wind speeds less than five

meters per second, are enough by themselves to warrant a detailed ozone concentration study for Kansas City. These low flow days in the summer lead to ozone concentrations at dangerous levels, because precursors and ozone are not always dispersed by meteorological processes. Exceedances of the EPA 8-hour standard occur, including 24 exceedances in 15 days during 2005 (Mid-American Regional Council, A Clean Air Action Plan).

Ozone concentration data was collected during the summer of 2005. The sampling was collected by a pilot ground-level ozone monitoring study, GLO, conducted by the Laboratory of Climate Analysis and Modeling of UMKC. The purpose of my research was to analyze the raw ozone concentration data from GLO using a geographical information system (GIS). With the aid of ArcGIS version 9.1, I was able to create an ozone concentration surface map. An example is Figure 1. The PSD on Fig. 1 refers to the Passive Sampling Devices which were the ozone samplers. The surface map gives the contiguous ozone concentration for much of Kansas City, Missouri. The major interstates of the Kansas City metro area were then buffered using the GIS to understand the extent of high ozone concentrations in their proximity.

The result was that the higher ozone measurements were found outside of all the interstate buffers of a quarter of a mile, one half of a mile, and one mile. The average ozone concentration inside the quarter-mile buffer shown in Figure 2 was 30.51 ppb while it was 34.49 ppb outside of the buffer. The average concentration inside the half-mile buffer shown in Figure 3 was 32.93 ppb while it was 33.62 ppb outside of the buffer. The average for the inside of the one-mile buffer shown in Figure 4 was 33.49 while it was just 33.72 outside the buffer.

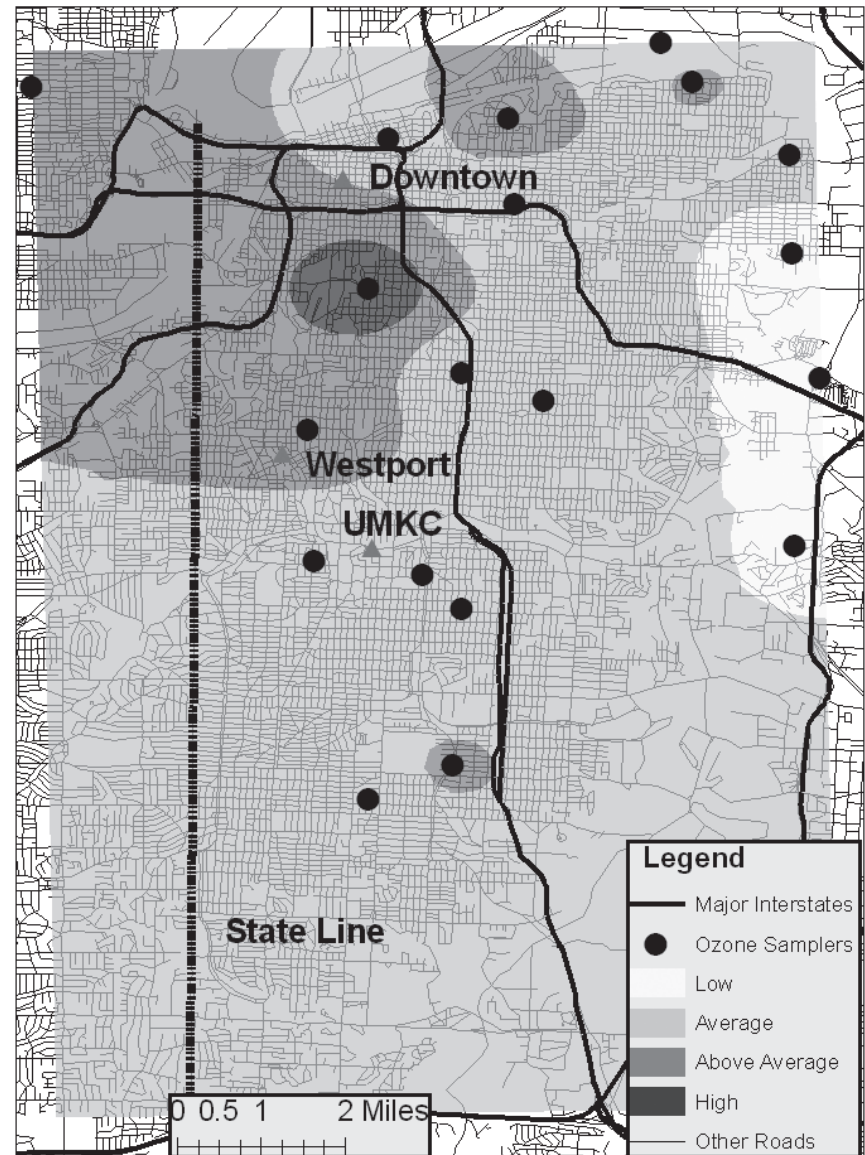


Figure 1: Ozone Concentration Surface Map

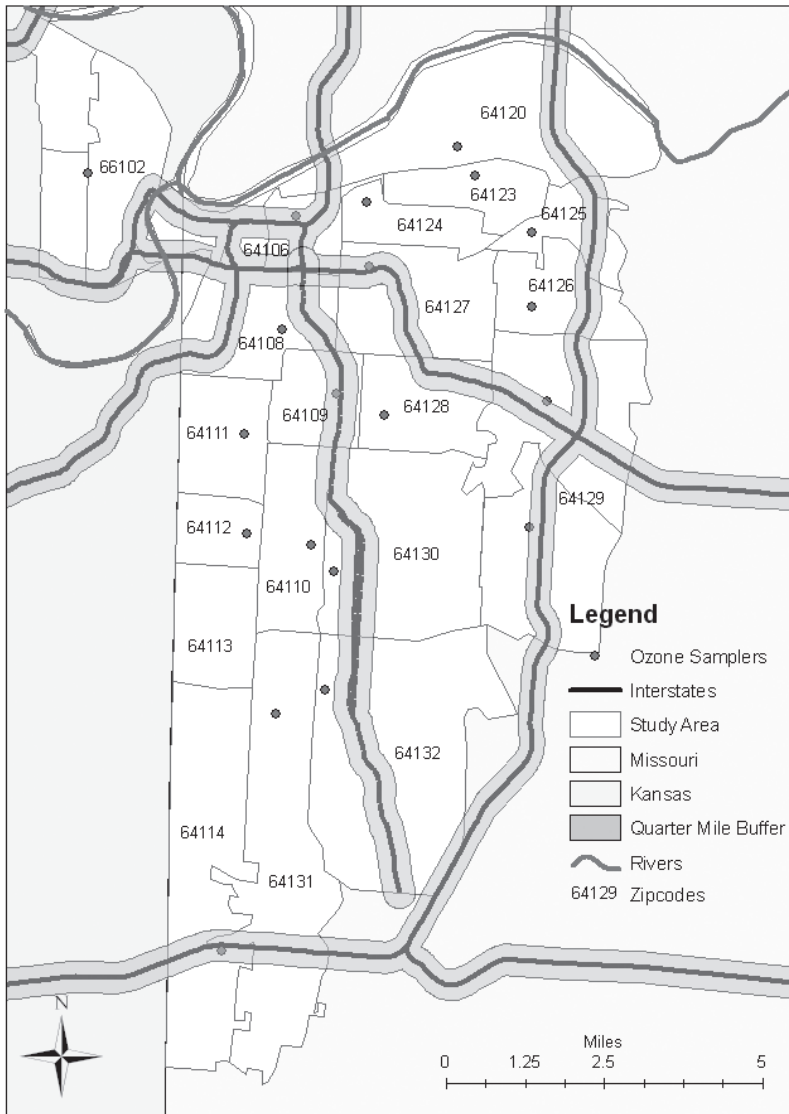


Figure 2: Quarter-Mile Buffer Around Major Interstates

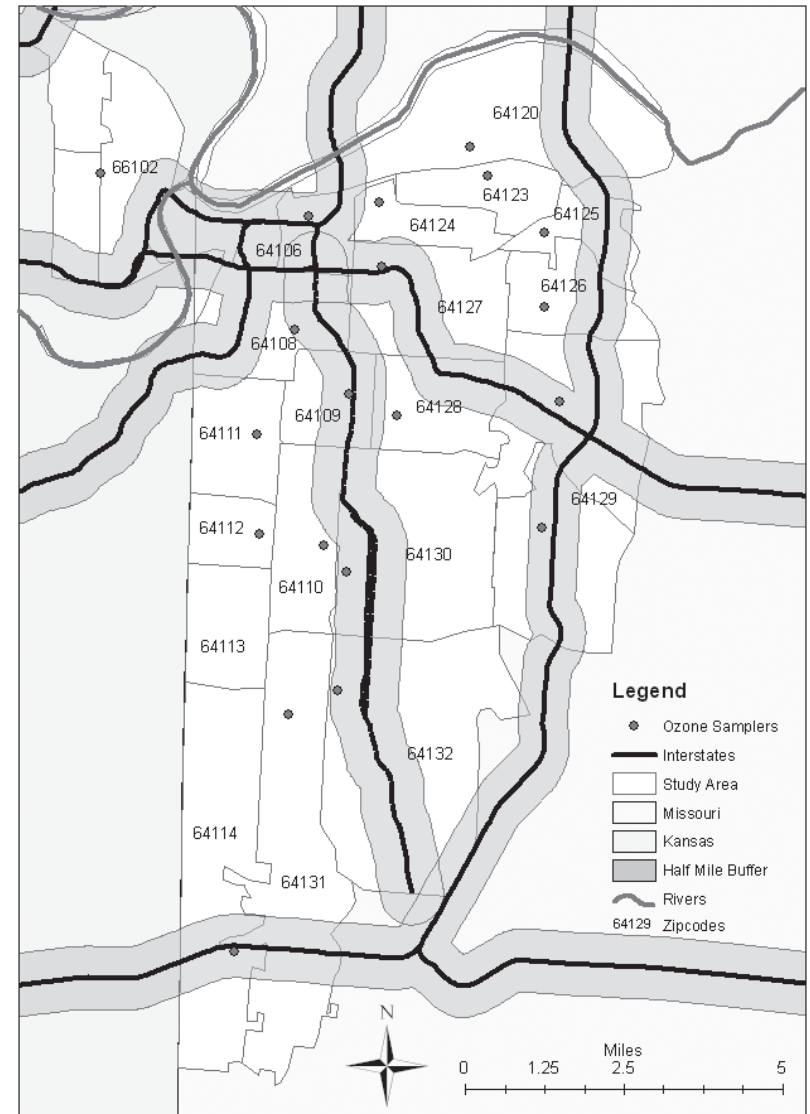


Figure 3: Half-Mile Buffer Around Major Interstates

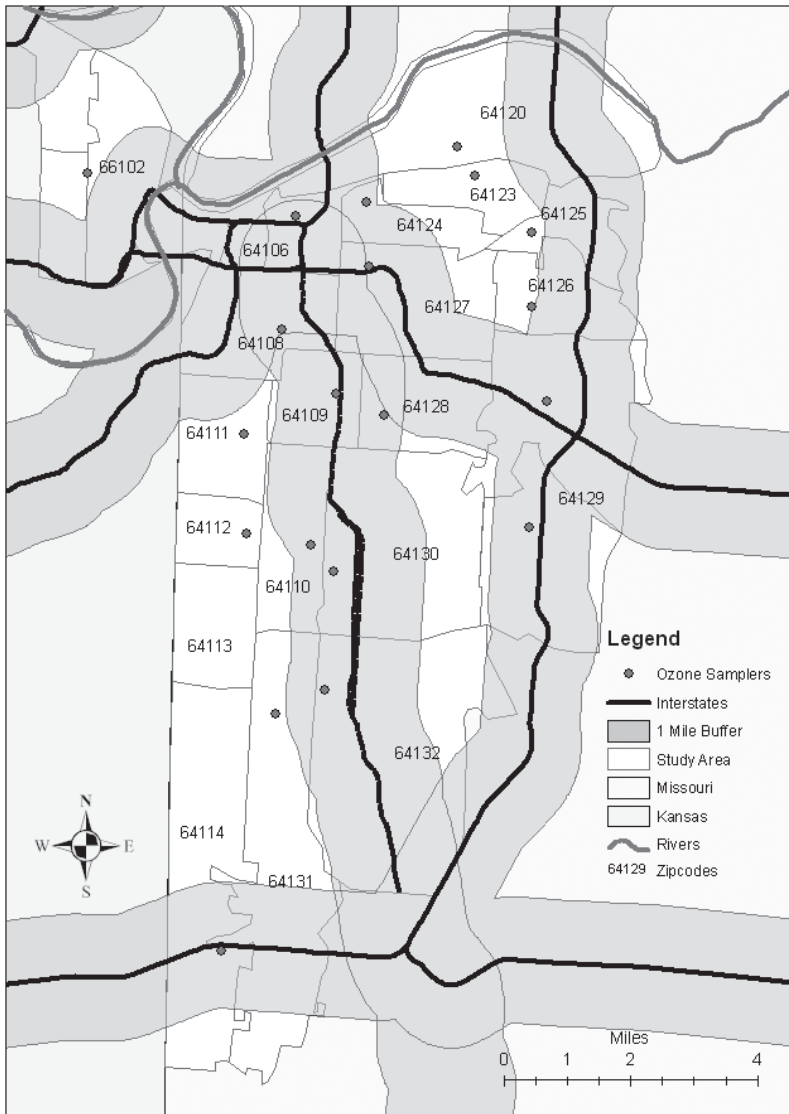


Figure 4: One-Mile Buffer Around Major Interstates

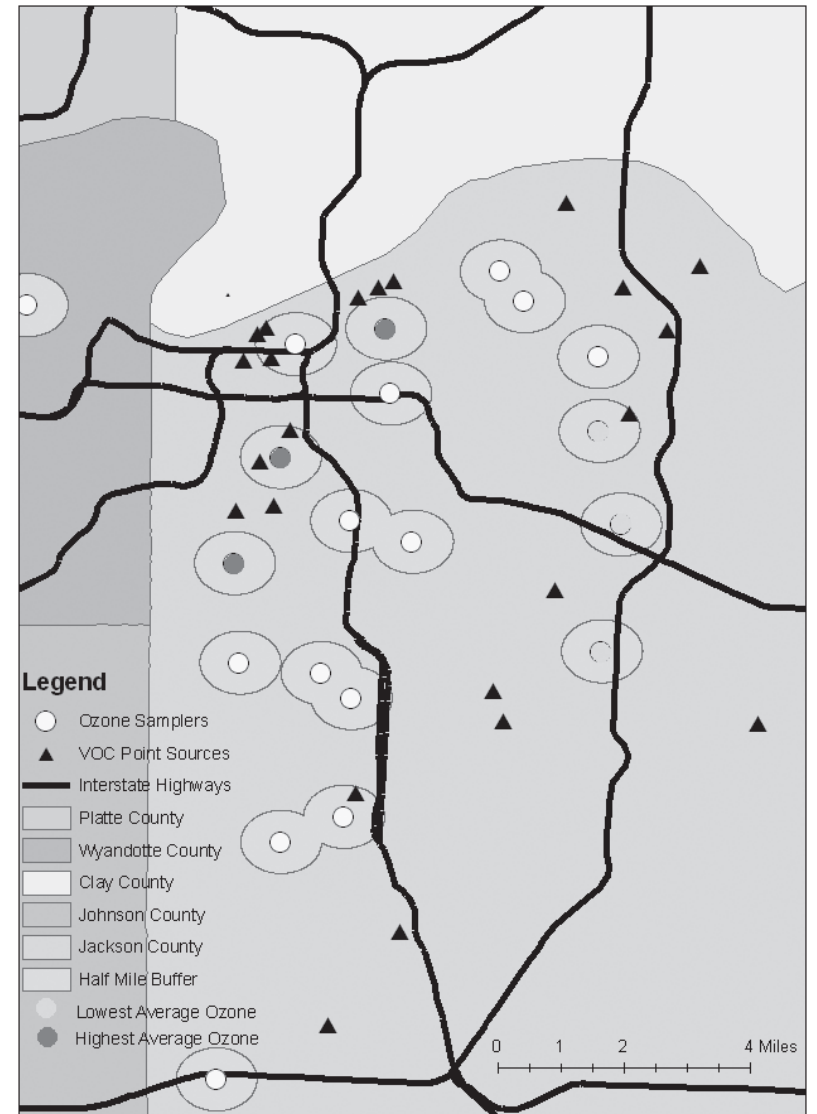


Figure 5: VOC Polluting Point Sources of the GLO Study Area.

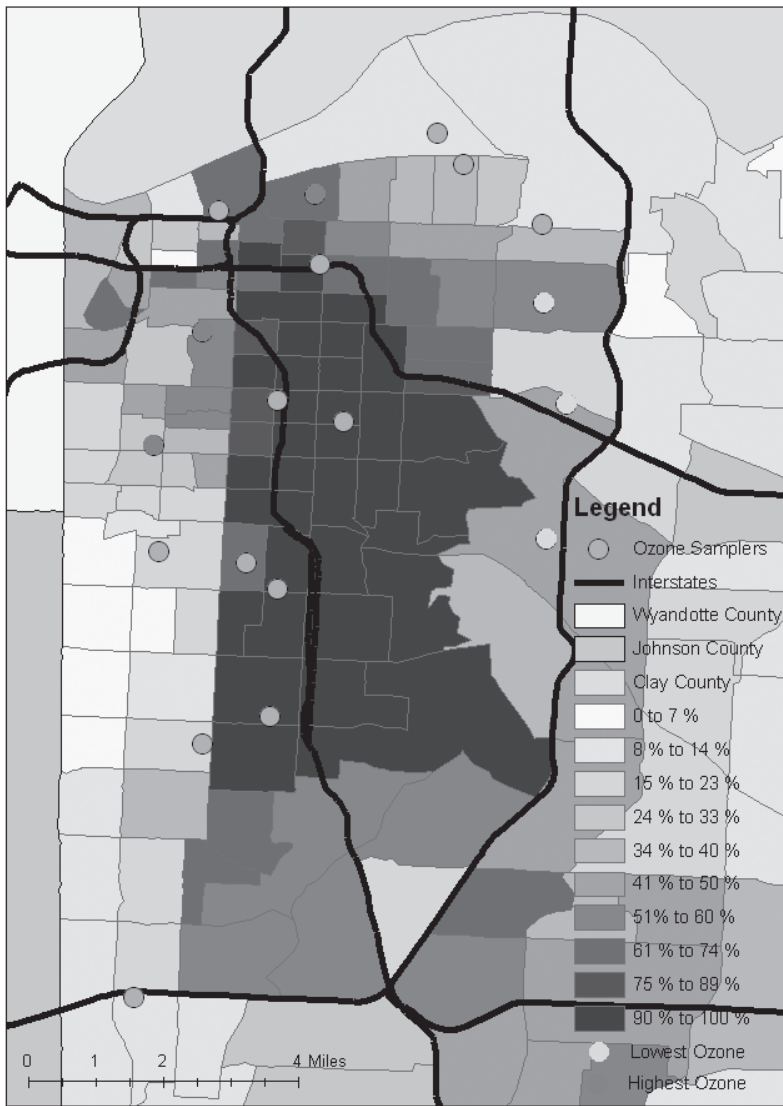


Figure 6: Minority Populations of the GLO Study Area

Further analysis of local point sources of VOCs was undertaken. Data for the point sources were drawn from the EPA National Emissions Inventory using EPA AirData's Facility Emissions Reports. A layer of point sources for ozone precursors applied on the GIS revealed dense clusters of industry in the northeast corner of the GLO study area as shown in Figure 5. Several buffers were applied around the ozone samplers to find if there was a spatial relationship between high average ozone concentration and VOC polluting industries. The three highest ozone sampler averages which were in the GLO study area's northeast corner had a cumulative average of 41 ppb. The three lowest ozone sampler averages were in the eastern part of the study area and had a cumulative average of 28 ppb. Buffer analysis showed no direct relationship between the location of VOC point sources and high ozone concentrations.

To examine the possibility that low-income and minority groups were more likely to experience high ozone levels, Census Bureau Tract data from the year 2000 was analyzed. Used in a GIS, the Census Tract 2000 data easily identified minority areas in the study area as shown in Figure 6. Census tracts were divided into two groups. One group was the census tracts where minority groups comprised 25% or more of the local population. The other group was the census tracts where minority groups comprised less than 25% of the local population. The 25% or more group of tracts had an average ground-level ozone concentration that was three parts per billion higher than the less than 25% group.

In conclusion, ArcGIS 9.1 was found to be a very valuable tool in understanding Kansas City ozone concentrations and their spatial relationships to transportation, industry, and demographics. The effectiveness of buffers in determining any sort of connection between variables is questionable. As a visual aid however, this GIS was useful in searching for spatial relationships between transportation networks, VOC point sources, and minority populations and ozone concentrations. Ozone samplers that were in the midst of dense transportation networks or VOC point sources were easily identified. The concentration data could then be extracted from attribute tables, and statistical analysis could then be conducted in Microsoft Excel.

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Command and Cooperation: Lessons Learned In Vietnam and Their Applications In Desert Storm

Secretary of Defense Robert S. McNamara stands over a pile of memorandums and notes detailing the past day's events in a jungle on the other side of the world. To him these events occur as he reads them. Until he or his staff reads these bulletins, soldiers who in another world have been dead for a day are alive in their home country. He contemplates putting the pile in the fireplace in his boss's office, sparing the dead who were killed at the hand of the enemy a second death at home.

Another time, and a world apart, Secretary of Defense Richard Cheney watches a satellite feed from CNN of his country's armed forces celebrating an overwhelming victory only one hundred hours after the true conflict began. Though his Western Excursion never materialized he stands strong with a feeling of confidence in his fellow civilian and military leaders (Schwartzkopf, 1992, p. 368). They have learned the lessons required of them as the leaders of a new, post-Cold War America. But what lessons had America taken out of the Vietnam debacle? How was the strategy used in Desert Storm a direct result of these lessons? And finally, what lessons have the civilian-controlled American military taken out of Vietnam that could serve as the antidote to poisoned relations experienced during the late 1960's and the whole of the 1970's (Weigley, 1993, p. 56)?

“If you know the enemy and know yourself, you need not fear the result of a hundred battles. If you know yourself and not your enemy, for every victory gained you will also suffer a defeat. If you know neither the enemy nor yourself, you will succumb in every battle.” (Tzu, 2003, p. 17)

From his office in Washington, President Lyndon Johnson was literally half a world away from the events of Vietnam. This situation is inherent given that one cannot through will or work rearrange the continents. But Johnson was at this same moment in June of 1965, half a world away from understanding that there existed a great divide between the war his military was losing, and the war being waged by the North Vietnamese and Vietcong. This distance was no one’s fault but his.

The failure to understand the motives behind the war in Vietnam was a major undoing for Johnson’s military campaign. Johnson and his staff saw the action in Vietnam as conducive to the greater struggle against Communism the world over. Ho Chi Minh was a puppet of China and the Soviet Union, and America stood alone to prevent the dominoes from beginning a chain reaction into tyranny. Of course, no one told the Vietnamese this. From the first rumbles of war in the late 1950’s, Ho Chi Minh’s forces saw the United States as a new colonial power, coming to replace the French and force the Vietnamese people back into submission beneath their boot (Morris, 2004). America struggled desperately to keep the direct combat in Vietnam somewhere less than a “real war,” and still give the United States a façade of strength against Communism (Clancy & Horner, 2000, p. 88). At the same time, and on the same fields of battle, the North Vietnamese Army and Vietcong insurgency continued an already twenty year old struggle against foreign colonial powers.

This lesson was hard in the mind of the executive branch and the military during Desert Storm. General Norman Schwarzkopf commanded all United States forces in Iraq during Desert Shield and Desert Storm. In doing so, he worked

closely with Secretary of State Cheney as well as Chairman of the Joint Chiefs General Colin Powell to ensure that every angle of the operations in the Middle East would step on as few toes as possible. The Coalition was to function in two regards. The broader Coalition’s (including Arab states) function was to house and give a base to the combat troops, while the troops would serve in Desert Shield to prevent Hussein from further invading the oil fields of Saudi Arabia and the United Arab Emirates (Schwarzkopf, 1992, p. 332). These combat troops consisted of American, British, and French soldiers. The reasoning was that if Israel were to act, the Coalition would break down, leaving the combat troops with nowhere from which to stage their eventual attack to liberate Kuwait. President Bush and his cabinet, along with the Joint Chiefs explored other possible scenarios that could lead to disaster. Had one or any Arab state been asked to participate militarily in the liberation of Kuwait, the Coalition would have collapsed due to cultural standards of conduct. If Secretary of Defense Cheney’s more adventurous plan (referred to earlier as the Western Excursion) been allowed to be carried out, and Baghdad and other cities within the border of Iraq were attacked or captured, the Coalition would have collapsed. Also, had the United States decided to attack Baghdad, it is speculated that France would not have participated in the fighting. Because of the Geneva and Hague Conventions the United States would be responsible also for the costs of a military occupation and the war could have lasted for many years after the initial invasion in 1991 (Schwarzkopf, 1992, p. 498).

President Johnson’s mishandling of the reasoning behind Vietnam severely inhibited the country’s ability to see a clear objective to aim for. The United States as a whole, as well as Vietnam, did not understand enough about the general scenario they were fighting in to have any chance of winning. In Desert Storm, the troops and leadership had a clear understanding of what scenario they were entering when they began planning Desert Shield and Desert Storm. It is important that the leadership behind both sides of a war understand what situation they are in, and understand it from both sides. It is

not, however, enough to understand only where a nation stands as it comes to a war situation. The United States must have a clear objective in battle, a point after which combat is no longer needed and the troops and leadership can begin coming home to victory parades and the warm embrace of their loved ones.

“There is no instance of a country having benefited from prolonged warfare.” (Tzu, 2003, p. 12)

Before his untimely assassination in November of 1963, John F. Kennedy planned to remove all 16,000 military advisors from Vietnam within two years (Morris, 2004). After his assassination, however, President Johnson decided that his view, which was kept quiet in the past, was now to be the view of the nation: “You can have more war or more appeasement” (Morris, 2004). Johnson did not establish an end goal or objective. His staff and military leadership were silent when Johnson presented flawed plans for the continuation and escalation of the war (Clancy & Horner, 2000, p. 87). McNamara attempted to explain Operation: Rolling Thunder—the largest bombing campaign in the history of the world—as an attempt to win the “hearts and minds” of the people of South Vietnam by “guaranteeing their security” (Morris, 2004). But the bombing, meant to devastate the North Vietnamese into submission, may have seemed pragmatic to a President unsure about the idea of mass American casualties on the ground. But it was an unsound strategy to bomb an enemy already hardened by decades of war. Had the Joint Chiefs done their job as military strategists, they would have called for the invasion and destruction of North Vietnam on the ground (Clancy & Horner, 2000, p. 103). Though Johnson went into Vietnam with no long-term plans to leave, nor with any real handle on the basics of modern warfare, the situation only deteriorated once American troops had landed and were fighting in the jungles. Secretary of Defense McNamara’s plan of “Graduated Pressure”—basically a plan best characterized by America’s flexing technological muscle—attempted to persuade the North Vietnamese that they could not win (Clancy

& Horner, 2000, p. 85). But with no objective in sight, and with Ho Chi Minh’s strategy to beat America by outlasting instead of outkilling her, McNamara’s attempt to minimize the amount of force used failed miserably (Schwartzkopf, 1992, p. 181).

When the Coalition of Western and Middle Eastern powers began planning what would eventually be known as Desert Storm, there was never a second of doubt as to the objective. General Schwartzkopf was to remove Saddam Hussein’s forces from Kuwait, and reestablish Coalition control of the state. The only occupation of Iraq was to last until the safety of Kuwait could be guaranteed (Schwartzkopf, 1992, p. 386). Where President Johnson’s failed air campaign required more bomb tonnage than was used in the whole of Western Europe during World War II (Morris, 2004), President George H.W. Bush was able to employ advanced precision technology to limit collateral damage and ensure the destruction of those targets deemed necessary by General Schwartzkopf and the Air Force (Schwartzkopf, 1992, p. 318). By destroying command targets, the Iraqi army had no chance of organizing against the wave of Coalition ground forces that followed the massive air campaign. Though the United States clearly learned its lesson about defining and understanding the objectives and enemy in a conflict, not every mistake of Vietnam was fully corrected in Desert Storm.

“The sight of men whispering together in small knots or speaking in subdued tones points to disaffection amongst the rank and file.” (Tzu, 2003 p.40)

Throughout Johnson’s presidency, he and Secretary of Defense McNamara gave specific orders to the generals in charge of the military as to specifically which targets to bomb on any given day (Schwartzkopf, 1992, p. 368). This situation in Washington created very low morale, especially among pilots, in Vietnam.

The targets chosen by President Johnson were political targets, not meant to be strategically important. Instead these targets were meant to force the North Vietnamese into submission. The situation became so bizarre that Johnson set new

rules of engagement that deemed not only North Vietnamese supply camps and warehouses off-limits to American aircraft, but also enemy airfields as well (Clancy & Horner, 2000, p. 88). When pilots were told they could not preemptively destroy the same fighters that would soon take to the sky and attack them, a new unwritten system emerged. Pilots would intentionally bomb targets that they found to be more strategically important than the mission given, and then report that all munitions had successfully been launched at the originally assigned target. The pilot would also report that he did not have a successful view of damages to report, and later that day reconnaissance photos would show the original target intact, and mysteriously, a nearby target of strategic importance completely destroyed (Clancy & Horner, 2000, p. 98). In the interim period between Vietnam and Desert Storm, a significant piece of legislation, known as the Goldwater-Nichols Department of Defense Reorganization Act of 1 October 1986, gave the Joint Chiefs of Staff the right to participate in any and all deliberations of the National Security Council (Weigley, 1993, p. 57). In doing so, the legislature prevented much of the top-down policy making that led to the silence of the members of the Joint Chiefs during Vietnam. In Desert Storm, this problem of overwhelming control by the President and his cabinet was mostly resolved, but as alluded to earlier, one major mishap occurred, reminding all in command of the military of the not-so 'good old days of Vietnam.'

In late October, 1990, General Schwartzkopf received a message from Chairman of the Joint Chiefs General Colin Powell that Secretary of Defense Richard Cheney had submitted a new plan of attack. Named "The Western Excursion" by Army analysts, this plan involved invading Iraq from the west, capturing a city in Iraq, and holding it for ransom until Hussein pulled out of Kuwait. Not only was this plan strategically and tactically unsound, it would have also destroyed the Coalition because it was so far reaching into Iraq territory. Although the plan was eventually dropped, Cheney and the rest of the cabinet brought "The Western Excursion" back multiple times, revised

but still too risky to the Coalition (Schwartzkopf, 1992, p. 368).

Aside from the western excursion, each entity functioned within its correct realm of control: The President set the political goals, the Secretary of Defense set the general military policies, and the military handled the plans for the ground war (Schwartzkopf, 1992, p. 368).

"All warfare is based on deception." (Tzu, 2003 p. 9)

The dishonesty displayed by pilots in Vietnam could be construed as a lack of honor. But this dishonest behavior was instead the expression of frustration by subordinates prevented from doing what they feel is their best duty to win the war. And while one person's perspective may not always be correct, generally the person closest to the event in question has a better feel for what is needed to improve the current situation.

The dishonest behavior in Vietnam was not limited to pilots however. Officially, the ground war in Vietnam began after the destroyer Maddox was shelled by the North Vietnamese on 2 August 1965 (Morris, 2004). Johnson took this opportunity to ask Congress for the power to wage war, which was granted to him in the Gulf of Tonkin Resolution on 7 August 1964.

The Gulf of Tonkin incident may seem like proper justification for the beginning of a ground war, especially when considering Johnson's perspective that the shelling was the forced escalation that would not end without a clear victor (Morris, 2004).

The tapes from the Johnson White House, however, paint a different picture. On 10 March 1964, five months before Tonkin, Johnson is quoted as saying "I want... plans to trap... [and to] kill some of them. That is what I want to do." To which McNamara replied "I'll try and bring something back that will meet that objective (Morris, 2004)."

The feeling that America was being misled by its leadership abounded during the years of Vietnam. The Pentagon papers raised questions as to whether Johnson deceived the people of the United States when he brought the country to Vietnam. The loss of citizen support that followed had the same

impact as “being rejected by one’s parents (Schwartzkopf, 1992, p. 181).” Schwartzkopf also attributes the overall disenchantment of the soldiers and civilians during Vietnam to the fabricated body counts and unceasingly optimistic view of a distant “light at the end of the tunnel (Schwartzkopf, 1992, p. 344).” The images of frustration among soldiers that made the nightly news helped to fuel the destruction of the army’s public image (Clancy & Franks, 1998, p. 85). It was this unrest at home that was predicted by Ho Chi Minh as the best course to victory: “We’re going to win the war against America the same way we won the war against the French: not on the battlefield but in the enemy’s homeland (Schwartzkopf, 1992, p. 181).” This quote mirrors the words of General Fred Franks (ret.): “[America was] an army never defeated on the battlefield (Clancy & Franks, 1998, p. 85).”

The support for American soldiers in Iraq never ceased during Desert Storm. President George H.W. Bush made it a clear priority to build a strong case and strong coalition for the war. The American citizens still weary from Vietnam two decades earlier overcame their hesitation towards war, and learned to “separate the politics” of a war situation from their concern for the safety and morale of the soldiers involved (Schwartzkopf, 1992, p. 379).

“On ground of intersecting highways, join hands with your allies.” (Tzu, 2003, p. 48)

President Bush made it a point to get the United Nations behind him. The nine UN resolutions that the Coalition received allowing military action against Iraq added an international legitimacy that Vietnam never possessed. Vietnam was a completely unilateral war. America made Vietnam the location of its next great stand against Communism, but had no allies standing with it against the will of the Vietnamese people. “If you cannot convince allies of similar values of the merit of a cause, you should reconsider your reasoning (Morris, 2004).” Johnson’s America never took the time to reexamine the reasoning behind the war in Vietnam, which could have prevented some of the confusion over the objectives of the war.

The reasoning from Washington during Desert Storm, however, needed no reexamination. Iraqi president Saddam Hussein attempted to frame the coming war between the Coalition of the United States, Great Britain and France as nothing more than an attack by friends of Israel. Hussein alleged that the Coalition intended not to free Kuwait from the grips of a foreign power but instead to attack and destroy the only Arab state willing and able to destroy Israel (Schwartzkopf 498). Despite this attempt to disrupt the greater Coalition, which included the above mentioned states as well as Saudi Arabia and other Arab powers, Hussein was unable to break the bonds that had been forged by a multilateral diplomatic plan of action.

“It is the rule in war, if our forces are ten to the enemy’s one, to surround him; if five to one, attack him... If equally matched we can offer battle; if slightly inferior in numbers, we can avoid the enemy; if quite unequal in every way, we can flee from him.” (Tzu, 2003, p. 16)

Graduated Pressure, mentioned in passing earlier, was the hallmark of McNamarian warfare. Secretary McNamara was appointed after the election of John F. Kennedy in 1960. As of October 1963, 16,000 American troops dotted the landscape of Vietnam in the role of military advisor. It was Kennedy’s commitment to remove them all within two years (Morris, 2004). After the assassination of President Kennedy in November 1963, President Johnson decided to continue the “commitment to Vietnamese freedom (Morris, 2004)” that the United States has made under President Dwight D. Eisenhower half a decade earlier.

After the Gulf of Tonkin resolution allowed Operation: Rolling Thunder to occur, Johnson is heard on the White House tapes on 26 February 1965 contemplating the war as a game “in the fourth quarter, and... 78 to nothing. [But I am] scared of ground forces, and I am also scared of losing planes for lack of security (Morris, 2004).”

By 10 June 1965, Johnson had given the order for thirteen battalions to make the move to Vietnam. General Westmoreland,

Commander of all American forces in Vietnam, asked for an additional ten battalions. McNamara suggested to President Johnson that Westmoreland receive at most an additional five (Morris, 2004). McNamara's resistance to move manpower to Vietnam en masse resulted in a slow start in the beginning stages of the war.

Beyond the simple lack of manpower in the region, the complex rules of engagement mentioned earlier made it physically impossible to prevent North Vietnamese reinforcements from arriving in the south. Though under President Nixon the military did eventually bomb and invade Cambodia, through which the so-called "Ho Chi Minh trail" ran, by that time the war was already too long lost (Clancy & Franks, 1998).

The failure of Graduated Pressure was in the front of the minds of the leadership during Desert Storm. In the six month buildup of forces during Desert Shield, 300,000 American troops gathered and prepared for the liberation of Kuwait. It took nearly four years of combat for the same number of Americans to reach Vietnam (Schwartzkopf, 1992, p. 391).

The bizarre rules of engagement during Vietnam prevented the military from accomplishing its objectives. Sites in North Vietnam such as airfields and warehouses were off-limits (Clancy & Horner, 2000, p. 88). In Iraq, the Coalition air force was charged with not only preventing defensive attacks from Iraqi jets, but also with the destruction of significant airfields and many other logistically significant buildings (Clancy & Horner, 2000, p. 504).

The strategy in Vietnam was to bomb North Vietnam into submission. In Desert Storm the Coalition used "Shock and Awe" tactics and precision attack aircraft to destroy the command and control structure of Iraq, basically decapitating the enemy command, while sparing civilian casualties. Without the ability to contact the units under his command, a general is useless. And after the power grid, air defense network, and radio towers were destroyed in Iraq, there were many useless generals in the Iraqi military (Clancy & Horner, 2000, p. 504). When the Iraqi army was cut off and surrounded to the satisfaction of the Coalition leadership, the ground forces of the Coalition struck together with the endorsement of the free world

(through UN resolutions) and removed Saddam Hussein's army from Kuwait in less than five days (Schwartzkopf, 1992, p. 498).

The success of the Coalition and of America in Desert Storm is undeniably linked to the United States' experience in Vietnam. Many harsh lessons were learned about the new face of warfare after World War II. But lessons were also learned about the reenergized struggle between civilian leadership's commitments to politically acceptable solutions to conflict and the military's commitments to sound strategic and tactical decision-making. Desert Storm combined the brute and overwhelming force that Vietnam lacked, with a set of rules of engagement and objectives that were attainable without unnecessary risk and without extracted combat. The command structure of the United States held up well, with the President and his cabinet making the policies that the Joint Chiefs and generals in the field followed in preparing for the liberation. The objective was completed swiftly, with minimal casualties, and most importantly, it was completed fully. There should exist no lingering regrets in the minds of the leaders during Desert Storm.

Today the United States is once again fighting in Iraq. But some of the lessons learned through the blood of American boys in Vietnam are not currently being heeded by America's leadership. A Coalition of a handful of countries and a UN resolution gained through false evidence does not make a true endorsement. After all, if America cannot convince other countries with similar values of the justness of our cause, perhaps it is time to reexamine our reasoning (Morris, 2004).

"Hence the enlightened ruler is heedful, and the good general full of caution. This is the way to keep a country at peace and an army intact." (Tzu, 2003, p.57)

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Battle of the Sundance: Religion and the Navaho-Hopi Land Dispute

8:00 A.M. August 17, 2001, Big Mountain, AZ. The land is barren and wasted; the plastic tape looped around the property reads POLICE LINE DO NOT CROSS. Altars, sweat lodges, a sundance arbor, and a sacred cottonwood tree are demolished, and the trample remains of tobacco lies, prayer flags, eagle feathers, and flesh offerings are scattered across the ground. Police cars, trailer vehicles, and a front-end loader are parked outside the mess.

This desolation is all that remains of Camp Ana Mae, which earlier that morning had been the site of the 16th annual Navajo sundance at Big Mountain, on Hopi-partitioned territory. During predawn hours of morning, the Hopi Land Commission entered the camp and destroyed the religious ceremony site with a front-end loader, wood chipper, and chain saws (Zoellner, 2001). Several Navajo "trespassers" at the ceremony site were arrested by the Hopi police. Earlier in the week, five elderly female ceremony participants had been arrested for entering Camp Ana Mae without Hopi government permission (Ghioto, 2001).

In a response to the destruction, Navajo Nation President Kelsey Begaye stated that "The Hopi government appears to be persecuting these families for their religious beliefs, as well as for their heartfelt desire to stay on their ancestral lands and to continue their traditional ways" and demanded for the Hopi government to apologize for their "violent

action” in “the politics of destruction” (qtd. in Zoellner, 2001).

Cedric Kuwaninvaya, chairman of the Hopi Land Commission, refused to express regret. “The Hopi will never again tolerate a situation where our lands our stolen, our people are abused, and our laws ignored,” he said. “We will protect our lands and our rights. When so-called religious ceremonies become little more than political rallies, both the Hopi and the Navajos lose. The actions of the resistors do not support peace between the two tribes” (qtd. in Zoellner, 2001).

A Brief History of the Conflict

The destruction of the sundance religious site in August 2001 is just one recent battle-scene in the still-unfolding (but little-reported) ethnic land battle known as the Navajo-Hopi Land Dispute. The battle takes place in northeastern Arizona, where the Navajo tribe of 180,000 resides on a large reservation which land-locks a much smaller reservation of 9,000 Hopi tribespeople (Zoellner, 2001).

The squall formally began on paper around 1882, when President Chester A. Arthur set aside a rectangle of land in Arizona for the use of the Hopis and “such other Indians as the Secretary of the Interior may see fit to settle thereon” (qtd. in Benedek, 1992, p. 395). The Navajo--or Diné--tribe happened to make up most the “other such Indians” which settled there, and the borders between the Hopi and Navajo land were not clearly partitioned.

The roots of the conflict are much more complicated, however, than Arthur’s ambiguous executive order; the first intertribal clashes had actually begun much earlier, sometime after the Navajo were first historically noted to have come into Hopi territory in 1680 (Clemmer, 1995, p. 33). By the time of Arthur’s executive order, ...the Navajo [had] not only intensified their raids on Hopi villages and mesas, but also penetrated ever deeper into territory long considered by the Hopi to be their own ... as late as 1837 a massive Navajo raid on Oraibi, at that time by far the largest of Hopi villages, killed or scattered virtually the entire population ... especially heartbreaking to

the Hopi were the scalping and slave raids ...Hopi young people brought high prices in the extensive slave trade carried on in Santa Fe and elsewhere” (James, 1974, p. 71-72)

By the year 1934, formal boundaries were finally established for the Navajo Reservation, and in 1962, as a result of the Hopi lawsuit *Healing v. Jones*, the United States government created a joint-use area for both tribes (Benedek, 1992, p. 395). In 1974, the “Navajo-Hopi Land Settlement Act” was passed by Congress, and shortly thereafter the joint-use area was partitioned into strictly Navajo and strictly Hopi areas (Benedek, 1992, p. 395). Several Indian families literally found themselves on the wrong side of the fence and a relocation program was put into affect. The Navajos on Big Mountain were among the most severely affected, and several Navajo families, including the Bennallys who helped to sponsor the 2001 sundance, have refused to move and still occupy the Hopi-partitioned territory today. A 1996 Settlement Act offered a temporary land lease option to the Navajo families, while otherwise basically reiterating the 1974 Act (Cheyfitz, 2000, p. 270). The Navajo families have rejected the lease offer while staying on the land in spite of eviction threats.

Conspiracy theories have abounded as to the “real” reason for the Acts’ requested tribal relocation. Many who tout such theories, including English professor Eric Cheyfitz, admittedly do so in order to claim that the Hopi-Navajo dispute is not real in and of itself, but rather manufactured by the United States government and third parties such as the Peabody Coal Company (which has notably expressed interest in digging on areas such as Black Mesa on Big Mountain). Navajo resistors and Navajo-sympathetic scholars tend, in general, to focus the most on such theories, while Hopi and Hopi-sympathizers tend to blame Navajo encroachment. Some Hopi tribespeople counter-claim that the Peabody story is a Navajo concoction to divert attention away from their own guilt.

While it is undeniable that multitudinous political and socio-economic factors have affected this dispute, it is equally obvious to an unbiased onlooker that a longstanding conflict does exist between the tribes themselves. Fur-

thermore, as sociologists such as Richard Clemmer have noted, tribes have utilized and manipulated oil companies and outside forces to their own benefit (Clemmer, 1995, p. 301).

The Navajo-Hopi Land Dispute remains a clash of ethnicities. And while religion is hardly the mono-causal focus of the disagreement, as the sundance exemplified at the beginning of this piece, religious ideology and practice has had an essential—and as we shall see, evolving and perhaps increasing—role to play in the unfolding saga. As recently as 1988, Lee Phillips filed a suit in Federal District Court claiming that the 1974 Settlement Act violated the Navajo's First-Amendment rights to worship (Benedek, 1992, p. 395), and both tribes have made claims that their religious activities have been precluded by the other tribe. Furthermore, the land itself is viewed by both tribes as a primary manifestation of a sacred reality.

Religion as an inherent aspect to the conflict

The Navajo and Hopi tribes are both devoutly religious peoples with differing spiritual beliefs and practices. The Hopi are traditionally a ceremonialist tribe with religious emphasis on seasonal calendar-based rituals with universalistic overtones. The more individualist Navajo religious system often builds itself around the sacred “*hogan*” (residential, spiritual dwelling place) and the sacredness of the everyday. Until recent times, Navajo religion has dealt primarily with need-based, non-calendar centered healing rituals. Traditionally, Navajos “don't believe in the letting of blood” (Benedek, 1992, p. 5). Both tribes have complex creation myths involving deities which dictate the importance of the land and the tribes' place upon the land.

As Native Studies scholar Emily Benedek explains, “The Hopis are an ancient farming people; they have lived in the same spot for more than 1,000 years. They believe they are the caretakers of the earth. Through the performance of their intricate and demanding religious ceremonies, they believe they keep the world in balance” (Benedek, 1993, p. 58).

The Navajos have not occupied the land on Big Moun-

tain for as long as the Hopis—a “mere” several hundred years—but they, too, believe that their land and homes are sacred. For many of the Navajo tribespeople occupying land outside the boundaries of the 1974 settlement, relocation is simply not an option—for them, to quote a common outcry, “Relocation is genocide.” For the Navajo, the experience of ancestral land and home is a necessary part of worship. As Asdzaa Yazhi Bedoni, a Navajo tribesman, put it, “I am well known among the hills, among the ditches, rivers, streams, plants. I have touched them in various ways and they have touched me the same. There is no place but here” (Benedek, 1992, p. 1). And as an old Navajo woman explained, if she had to relocate to another piece of land, “The wind won't know me there. The Holy People won't know me. And I won't know the Holy People. And there's no one left who can tell me” (Benedek, 1992, p. vii).

Today, both tribes vie for specific religious rites on land partitioned by the opposite tribe. For the Hopis, one of the greatest concerns is the gathering of the sacred eaglets, whose feathers are used in the making of prayer feathers and kachina dresses. According to George Hardeen of High-CountryNews.org, Hopis have recently been arrested for collecting such eagles on Navajo land without the proper permits. Not only do the Navajo resent Hopi trespassing, they are also said to dislike the eaglet sacrifice itself. According to the Navajo, “The eagles, like other wildlife, come from the Holy People and have power that is not to be interfered with” (Hardeen, 1996). The Hopi tribe, on the other hand, feels that its religious rights have been violated by the Navajo arrests.

For the Navajo, the primary religious concern of recent years has been rights to the controversial sundance grounds of Camp Ana Mae. Perhaps the most interesting quality of this ritual is that it is a completely new ritual for the Navajo, and in fact violates some of the old Navajo religious tenants. This ritual epitomizes the growing and changing nature of the religious tension between the tribes.

Religion As An Increasingly Contentious
Characteristic of Ethnic Interest Groups
In The Navajo-Hopi Dispute

As time has passed, religious activity has been an evolving force in the Navajo-Hopi conflict. An argument can be made that in recent years, the ethno-religious aspects of the conflict have “heated up.” According to the theories of Political Scientist Cynthia Enloe, ethnic divergence is a natural by-product of modernization. It can furthermore be utilized as a counter to internal colonialism—internal colonialism being “a process of national integration and centralization in which the products of one region (wool, arts and crafts, coal, uranium, oil, gas, electricity, water) are consumed in another, and in which the centers of decision-making are removed farther and farther (to Phoenix, Washington D.C., Los Angeles, Window Rock) from the local people (in Hotevilla, Shungopavi, Kuktosmovi, Tuba City, Window Rock)” (Clemmer, 1995, p. 271).

Scholar Richard Clemmer (1995) has said that, according to Enloe, “modernization does not create melting pots but rather promotes tribalism and ethnic groups as interest groups” (p. 271). Clemmer claims that the Hopi and Navajo tribes have attempted in recent years to assert themselves as unique, ethnically based interest groups in order to gain local control.

As Clemmer (1995) said, “The entire Hopi-Navajo land dispute and its legislative, legal and bureaucratic resolution is based on the assumption of ethnicity as the basis for the allocation and possession of resources” (p. 271). Rather than viewing the Navajo-Hopi conflict as a socially engineered third-party conspiracy, Clemmer views the U.S., Hopi, and Navajo land entanglements as a three-way ethnic battle in which the Hopi and Navajo naturally must assert themselves as local interest groups in order to counteract influence from the central, non-Indian, U.S. force.

Building from the ideas of Enloe and Clemmer, it would apparently serve both the Hopi’s and Navajo’s local political interests to assert themselves religiously as much as possible. And religion has indeed played a key role in identi-

fying significant ethnic features of these tribes, helping to mobilize action on the part of both tribes, and offering the Navajo and Hopi tribes privileged legitimacy for social cause.

Clemmer’s theory helps to explain the cultural persistence of the Hopi tribe and its strong protests at any cultural “thievery” from the Navajo end. In recent years, the traditionalists of the culturally persistent Hopi have become more and more upset about the Navajo creation of “Hopi” crafts. While they claim to have originally taught the Navajo how to make these crafts, such as baskets and kachina dolls, today they resent the Navajo from benefiting from “crafts [which] are part of [the Hopi] religious tradition” — a tradition in which “ownership of idea has a great importance” (Benedek, 1992, p. 168).

While the Hopi have persisted in their old traditions more vehemently, the Navajo have recently adopted the sundance — an entirely new ritual for the Navajo — as a religious vocabulary for the resistance to relocation. It was first brought to the Navajo in 1985 by Leonard Crow Dog, Lakota Chief and movement midwife for the sundance resistance to Navajo relocation.

In the Lakota-style sundance practiced by the Benallys and other resisting Navajo tribespeople on Big Mountain, participants dance around a sacred cottonwood tree without food or water for up to four days of rounds. On the fourth day or so, participants may choose to pierce their skin with wooden pegs and string themselves up on the tree. “Ropes are thrown over the tree and attached to the piercing sticks. Each person who pierces is then pulled upward, ‘flying’ by flapping eagle wings, until the sticks break through the skin” (Fisher, 2002, p. 72). The sundance is a tremendously challenging spiritual endeavor and participants are said to reach heights of ecstasy while pushing “the spirit beyond its limits” and transcending pain (Fisher, 2002, p. 72).

The sundance is a spiritual activity originally practiced “to renew the people’s communion with the sun, the wind, the earth, and the gods” (Benedek, 1992, p. 5). It would be ridiculous to suggest that its participants do not have legitimate religious feelings about the ritual; however it is also without doubt that this ceremony was brought in as

a sort of war-tool. This once-outlawed ceremony involves blood-letting a traditional Navajo “no-no” and has more militant overtones than the traditional Navajo ceremonies.

The Navajos themselves knew they were taking a big step when they arranged for Leonard Crow Dog to come in and preside over the first annual sundance and “help out the people faced with relocation” (Benedek, 1992, p. 7). While sitting in his bedroll watching the ceremony, tribesman Dennis Bedonie related his own mixed feelings about the ceremony. “This may be a sign of desperation,” he said. “The people are showing a willingness to stand up and defend the land” (Benedek, 1992, p. 12).

Around the ceremony, participants’ protest signs read “The Creator is the only one who’s going to relocate us” (Benedek, 1992, p. 385). Radical militant talk is common. As Navajo resistance lawyer Lew Gurwitz remarked at one sundance, “There’s going to be a war. It may be a short war. But these people have said, and they mean it, ‘you’ll have to drag me dead out of my hogan.’ And there are people around the country who’ll stand beside them and fight” (qtd. in Benedek, 1992, p. 8).

Such a dramatic ritual as the sundance has drawn more media attention than any other religious ceremony currently taking place in the Navajo or Hopi land. It has allowed the Navajo to distinguish themselves from their Hopi neighbors in a dramatic way. One particularly astounding feature is that the Navajo have allowed non-reservation Indians to come and participate (Benedek, 1992, p. 5). The sacrificial nature of the ceremony vocalizes the distress of the resisters and has attracted the attention of Navajo sympathizers across the United States as well as the U.N. The sundance ceremony is a transcendent motivation and a mobilizing force, a ritualistic undertaking to build a shared identity for the resisters, and a symbolic new mark of distinguishment for the Navajo ethnic identity.

Conclusion

The Navajo-Hopi Land Dispute is a classic example of the entangled nature of religion and social action within the con-

text of an ethnic land dispute. A complete coverage of this complex dispute with all its branches and nuances would require a mammoth thesis. It is a pity that the dispute has not gained more widespread academic attention in our country; it deserves to be examined by scholars as a possible “micro-model” which could have theoretical applications for many land/religion disputes, such as the much more notorious Israeli-Palestinian conflict.

The Navajo-Hopi Land Dispute is still going on, through tribal conflicts and various pending lawsuits (although the Official Hopi Tribal Website claims that the Settlement Acts have officially ended the matter). Lew Gurwitz’s “short war” has not yet occurred. Today it is hard to tell what the final result will look like and whether or not the Navajos will be allowed to stay on the Hopi-partitioned territory; both sides continue to fervently declare that the land is rightfully theirs.

In the meantime, we can hope for peace and healing for both these peoples of the Arizona reservations, and that, within a few years, in the words of a Navajo healing ceremonial:

Over the mountains. All is happiness. All is well...

With roots of Sunlight touching the mind, all is
Happiness, all is well. With Sunshine touching
what lives, all is Happiness, all is well.

...Now all is Happiness, all is well. (Luckert, 1979, p. 180)

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The Debate Over Water Fluoridation

Adding fluoride to drinking water is an issue that has generated much discussion and controversy for decades. Most doctors, dentists, and health professionals have come to agree that it is a safe, effective, and inexpensive way to improve the dental health of communities. However, a smaller but determined group of medical researchers, journalists, and concerned citizens have mounted a steady resistance to this practice. Their claims against water fluoridation range from problems of the central nervous system to higher incidences of hip fractures in the elderly. The words are strong from both sides: The Centers for Disease Control and Prevention in the United States has called water fluoridation one of the ten major public health achievements of the 20th century, while pharmacologist Dr. Arvid Carlsson, 2000 Nobel Prize Laureate for Medicine, says that nations who practice it “should feel ashamed of themselves.” The aim of this report is to sort out these views and facilitate understanding of the controversy behind water fluoridation.

Many respectable organizations support water fluoridation (hereinafter referred to as simply “fluoridation”), including the World Health Organization, the American Dental Association, the British Dental Association, the National Institute of Dental and Craniofacial Research, as well as many others. Their mass of evidence shows again and again that

people in fluoridated communities have lower levels of dental caries (tooth decay). The small amounts of fluoride put in water wash over teeth and strengthen the protective enamel, as well as destroy the enzymes of cavity-producing bacteria.

In July 2004, United States Surgeon General Richard H. Carmona cited an economic analysis that estimates that for every \$1 spent on fluoridation, an average \$38 or more is saved in treatment costs. Another benefit is that fluoridation breaks through social and economic barriers; almost no one is left out because almost everyone consumes tap water in some capacity. That the poor and the rich benefit equally is not something easily said about most medical advances. And the support is not limited to giant Western medical associations. A study of 13,480 Brazilian schoolchildren by the State University of Campinas in Piracicaba, Brazil showed that children in non-fluoridated areas had higher percentages of dental caries.

Despite this, fluoridation has had opponents from the start. Even as far back as 1937 a Danish scientist named Kaj Eli Roholm published “Fluorine Intoxication”, which detailed fluoride poisoning and argued against giving fluoride to children. Many proponents of fluoridation give the impression that the debate is over, and that the issue was resolved years ago. However, a cursory glance through the opposition literature shows that this is far from the truth. The battle is on at all levels—scientific, academic, political, and cultural.

Opponents start with the basic findings of lower rates of dental caries in fluoridated communities. In October, 2005 Time magazine reported that 17 out of 21 Western European countries refuse to fluoridate their water, and that their recent decline in dental caries is “as sharp as that in the U.S.” The magazine also mentioned a 2001 Centers for Disease Control and Prevention study that “found that by the time they were 12, kids in fluoridated communities averaged only 1.4 fewer cavities than those in non-fluoridated areas.” The British government in 2000 reported that fluoridated water might result in a 15% reduction in cavities. (Early advocates promised a roughly 65% reduction.) Opponents say that improved nutrition, better dental

hygiene, and the use of antibiotics are doing most of the work.

The primary source of conflict, however, comes from studies considering the role of fluoridation in bone cancer, behavioral problems, Down Syndrome, and more, some of which have either shown positive associations or have been inconclusive—either way, not something to be taken lightly. Whether these findings are true demands further investigation, but proponents continue to say that the issue has already been settled.

Possible conflicts of interest, suppression of scientific findings, and political maneuverings are also in the mix. When digging deeper into the history of fluoridation, one finds a wealth of shady figures and alliances that prompt further questioning. As a scientist for the US Army’s Manhattan Project, Harold Carpenter Hodge supervised experiments in which hospital patients were unknowingly injected with uranium and plutonium. Hodge became the leading scientific promoter of fluoridation during the Cold War. Edward L. Bernays, famous for his campaign on behalf of tobacco companies to persuade women to smoke, was an early promoter of fluoridation and a consultant for the National Institute of Dental Research. Robert A. Kehoe was the leading defender of the safety of adding lead to gasoline (now banned); he later defended fluoride in lawsuits brought against industries and corporations including U.S. Steel. On the other side of the fence, William J. Marcus, a senior toxicologist in the EPA’s Office of Drinking Water, was fired in the early nineties after protesting that the results of studies involving cancer and fluoride were systematically downgraded. He was later reinstated by a federal judge, who ruled that he had been fired because of his scientific opinions on fluoride.

There is also something inherently suspect about the fact that much of the fluoride added to water is bought from the pollution scrubbers of the phosphate fertilizer industry in Florida. It’s an industrial waste product, and it is cheaper for industry to dispose of it by selling it to municipalities than to abide by the usual industrial waste disposal methods. But the fertilizer industry isn’t the only industry in the game, for the Aluminum Company of America, DuPont,

and other corporations have grappled with lawsuits relating to fluoride pollution. The Federal Security Administrator of the Truman administration, Oscar R. Ewing, endorsed water fluoridation for the United States. He was also a lawyer for the Aluminum Company of America. What's going on?

Less entangling and more basic issues of morality are also at stake. Not surprisingly, the range of statements on morality is wide. Proponents argue that our oral health is essential to our overall health, and if we have the power to reduce dental caries on a grand scale, we would be remiss not to do so. Pro-fluoridation senator Hubert H. Humphrey said in 1962, "The moral test of government and all of society is how we treat those who are at the dawn of life, the children...". Opponents give those words a new meaning when citing the fact that the Environmental Protection Agency allows 4 parts per million of fluoride in drinking water, while the National Academy of Sciences' Food and Nutrition Board states that the safe level for infants under six months of age is 0.7 parts per million.

Philosopher Dr. Howard Cohen and professor of dentistry Dr. David Locker, both from the University of Toronto, frame it in a slightly different way. They argue that because the science behind fluoridation is debated, and since it is virtually impossible for individuals to opt out of consuming fluoridated community water, fluoridation is a morally questionable act. Many parts of Europe are thinking along similar lines:

Luxembourg: "Fluoride has never been added to the public water supplies in Luxembourg. In our views, the drinking water isn't the suitable way for medicinal treatment and that people needing an addition of fluoride can decide by their own to use the most appropriate way, like the intake of fluoride tablets, to cover their [daily] needs." - Jean-Marie RIES, Head, Water Department, Administration de l'Environnement, May 3, 2000

France: "Fluoride chemicals are not included in the list [of 'chemicals for drinking water treatment']. This is due to ethical as well as medical considerations." - Louis Sanchez, Directeur de la Protection de l'Environnement, August 25, 2000

Belgium: "This water treatment has never been of use in Belgium and will never be (we hope so) in the future. The main reason for that is the fundamental position of the drinking water sector that it is not its task to deliver medicinal treatment to people. This is the sole responsibility of health services." - Chr. Legros, Directeur, Belgaqua, Brussels, Belgium, February 28, 2000

Finland: "We do not favor or recommend fluoridation of drinking water. There are better ways of providing the fluoride our teeth need." - Paavo Poteri, Acting Managing Director, Helsinki Water, Finland, February 7, 2000

Those more certain of fluoridation's allegedly harmful effects put it in stronger terms: "How many cavities would have to be saved to justify the death of one man from osteosarcoma [bone cancer]?" asked Dr. John Colquhoun, former chief dental officer of Auckland, New Zealand.

Some communities across the country share these concerns, for while the majority of US cities are fluoridated, many have recently voted against it. The Fluoride Action Network website lists over 70 North American cities that have done so since 1990. The following cities have struck down fluoridation measures since April 2005: Neosho, MO; Hood River, OR; Homer, NY; Mono County, CA; Tooele, UT; Xenia, OH; Springfield, OH; as well one Canadian city, Golden, BC. The vote has become so close and heated in some places that National Public Radio covered the Bellingham, WA vote in November 2005.

The issue is moving more into the general public eye. In September 2005 the Associated Press reported that unions from the Environmental Protection Agency representing 7,000 workers have called for a moratorium on fluoridation. Newsmagazines such as Time are featuring articles on the debate. The website of the Fluoride Action Network, the main

hub for anti-fluoridation activists, disseminates literature and conducts interviews from broad sources, attracting visitors and references from around the world. The homepage of the National Center for Fluoridation, a pro-fluoridation organization, features statements from surgeon generals, state health departments, and dental associations. A major publisher recently released a 358-page book (111 pages of which are endnotes and references) called *The Fluoride Deception* in which journalist Christopher Bryson details alleged collaborations and cover-ups between industries and the National Institute of Dental Research.

It is safe to say that the jury is still out on the effects of fluoridation. This harkens back to the point made by the philosopher and the dental professor: as long the jury is out, and citizens do not have a reasonable way to avoid it, adding fluoride to the public water supply just might be a morally questionable act. This issue demands honest discussion and new, solid, and unbiased science. If we get to that point, perhaps we will be able to reach a resolution that will benefit all parties involved.

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Reading Regina: Revisiting the Education of Upper-Class Women In the Middle Ages*

Medieval women have traditionally been considered less educated and literate than their male counterparts. However, a recent gendered analysis of medieval writings and a revisited definition of medieval literacy have led to a surge of new evidence supporting the idea that women in the upper class of medieval society by the fourteenth century were generally well educated and quite literate. Several scholars including P. Sheingorn (2002) and S. Johns (2003) have recently acknowledged that until now, the study of medieval culture and education has neglected women. Johns also stresses that “the recent historiography on medieval women and literacy stress ways in which women participated in the literary culture as a way of pursuing their own strategies” (p. 30). Recent studies, therefore, indicate that women were not only a part of the literary culture of the time, but were using it to advance themselves in ways unimagined in the past. Women in the medieval upper class were well educated, and possibly as literate as upper-class men. Evidence for this includes an analysis of books owned, commissioned, and written by medieval women. Then, by applying specifically to women the revisited definition of medieval literacy found in F. H.

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Bäumli’s (1980) article, “Varieties and consequences of medieval literacy and illiteracy” a more accurate view of women’s education and literacy in the High Middle Ages may be established.

Many upper class medieval laywomen owned books, particularly from the twelfth-century on. These women typically did not own Latin texts. The education of females at this time did not include Latin because of the sacred and scholarly connotations of the Latin language. However, women did own vernacular texts and translations of Latin texts. Women were entrusted with the rudimentary education of their children, and it was common for upper-class women to own books in order to accomplish this task (Bell, 1988, p. 149).

Few attempts have been made to document the number of books owned by medieval women. The first scholar to attempt this, Susan G. Bell (1988), attempted to identify the number of European Laywomen owning books from 800 to 1500 (p. 151). There are 242 documented women who owned at least one book within these centuries. A majority of these women, one hundred and fifty, only owned one book. Fifty of these women owned two to ten books, twenty owned eleven to fifty books, and fourteen women owned fifty-one to two hundred books. The remaining eight women owned an unspecified number of books. These women were identified through rare book library catalogs, medieval wills, medieval inventories of household goods or libraries, and dedications to patrons (p. 152). Many books were inherited by laywomen from other family members. The *Sachsenspiegel*, or *Mirror of the Saxons*, was a collection of Saxon custom laws first compiled in the thirteenth century. Laws found in the *Sachsenspiegel* suggest that books were transferred from mother to daughter. Many women inherited books from their fathers or husbands as well (p. 155). Some suggestion has been made that women’s wills by the thirteenth century reveal a wider female readership than in previous centuries. Books were becoming less expensive, and women were passing their books on to future generations (Leyser, 1995, p. 248).

Women often owned religious devotional literature because it was the least offensive of the literary genres owing to the pri-

vate nature of religious devotion. Of the 242 laywomen identified who owned books before 1500, 75 percent included books of piety among their possessions, and 60 percent owned books of piety written in the vernacular. When only one book could be attributed to a woman owner, the book was almost always a devotional item. Popular devotional texts included Gospels, Psalters, lives of the saints, and Books of Hours (Bell, 1988, p.160). Since women were expected to read devotional literature, but were excluded from an education in Latin which only the clergy and a small group of male lay society had access to, women often owned vernacular translations of religious texts.

One impressive noblewoman and book owner was Isabelle of France. Though she often is remembered for her role in deposing and murdering her husband King Edward II in the fourteenth century, she is now looked to for evidence on female book ownership. One of the foremost scholars on Isabelle of France, Anne Rudloff Stanton (2003), states that forty-five books can be attributed to her collection at one time or another through records of book purchases and transfers. Isabelle's library reflects her changing roles through time as a bride, mother, and ruler (p.229). She owned Psalters in parallel vernacular and Latin text, books appropriate to educating her son, a future king, and the Queen Mary Psalter, which was one of the most luxurious manuscripts of the period (p. 234). Her collecting habits were evidently not uncommon for Frenchwomen of her time, and yet her library rivals those of many English kings(p.228).

Many noblewomen participated in literary culture through commissioning texts and patronage. Some women commissioned books specifically for the purpose of educating their children, such as Psalters, which often served as an alphabet book. Blanche of Castille ordered a Psalter to educate her son, the future Saint Louis, and Isbeau of Bavaria ordered a Book of Hours and a Psalter for her two daughters (Bell, 1988, p. 163). Bell points out that the patron of any work, particularly a woman determining a book for her child's education was empowered by choice:

...The commissioner of a Book of Hours could choose whether to order Hours of the Cross, Hours of Saint Louis, or Hours of the Virgin. A patron could decided where to place the emphasis in the Testaments... A commissioner had to decide which vignettes of the numerous saints to include, and whether or not to concentrate on female saints' lives in a Book of Hours intended for a young girl. (p. 165)

Since noblewomen were taught to read at an early age in order to model themselves on biblical heroines, the mother or patron played a crucial role in defining who the child would become through the texts she chose to put into the books (p. 158).

Female patronage was one of the few ways in which women during the Middle Ages could freely exercise their choice and power. It is likely that female patronage began in the Carolingian period; this trend steadily grew throughout the remainder of the Middle Ages. The most "visible" patrons were noble women who had access to the monetary resources necessary for acquiring books (Johns, 2003, p. 36). Adela of Blois, Adeliza of Louvain, and Eleanor of Aquitaine were all known for their vigorous support and patronage of literature and poetry. Many women in the lesser nobility also supported literature through patronage and were also literate. Constance, the mid-twelfth century wife of Ralph fitz Gilbert, was a patron of the poet Gaimar. She requested translations of at least one history of the crown from Latin to Anglo-Norman (p. 37-38). Many other noble women were patrons of historical writing in particular. The Lombard princess Adalperga, the Empress Judith, Abbess Gerberga of Gandersheim, Duchess Gunna, and Queen Matilda, wife of Henry I of England are just a small selection of the women who were know for their support of historical writings (Nelson, 1989, pp. 151-152).

Patronage of literary works was a legitimate avenue for women to exercise their power in a variety of social and cultural areas. Patronage allowed women to explore new literary forms, affect the popularity and representations of saints and religious figures, and even participate in the production of the literature

itself (Johns, 2003, p. 43). For many women, patronage was a way to surpass cultural achievements of their male counterparts. An account of this is provided by Baudri, the Bishop of Dol. He writes of his patron Adela of Blois, the daughter of William the Conqueror, that patronage is the “one way daughter excels her father-she will favor verses and she knows how to have leisure for books. She also knows how to reward poets: no-one returns empty-handed from her uprightness...she possesses copious powers of composition, and she knows how to distinguish one poem from another” (Leyser, 1995, p. 240).

Women also participated in medieval literary culture through authorship. Many women who did write chose historical forms of writing. Examples of forms of historical writing in which women participated were letters, the computarium, a book in which the names of the dead were written, and the memoria, literature commemorating the dead (Nelson, 1989, pp. 150-151). Many women became involved in writing historical works because they were already historians of everyday life. Janet Nelson describes this situation:

History dealt with the dead as well as the living: just as women by means of funeral rites, and the memoria, linked the living and the dead; as women by their marriages and their pregnancies were both symbols and transmitters through time of the historical identities of families, of kingdoms... so some literate and learned women took on the role, so to speak quite naturally, of historians. (p. 162)

Margery Kempe is an excellent example of a female author during the fifteenth century. She wrote a spiritual autobiography, *The Book of Margery Kempe*, which is beginning to be researched as it deserves. It is a vernacular work in English, and is a source for medieval mysticism, travel literature, and women’s writings. Although Margery was the first woman to write an autobiography in the English language, her Book was not taken seriously until 1934 (Glenn, 1993, p. 500). She was most likely influenced by a combination of written, oral, and memorized texts. Margery also did not physically write her own book; a scribe transcribed her work (p. 499-502). This was not an uncommon

practice for a writer of any gender at the time, because reading and writing were two separate skills during the Middle Ages.

When the three elements of female book ownership, patronage, and authorship are examined, noble women during the Middle Ages appear to be a vibrant, cultured, well-educated, and literate group. However, these women have not been portrayed through history as educated and literate women. This is because the literacy and level of education of women has not until recently been investigated. For hundreds of years it was assumed that women were illiterate and ill-educated, without observing their contributions to literary culture. To be considered literate in the Middle Ages, or to be a literatus, meant that a person knew Latin. Women did not typically know Latin, regardless of their social status. However, there is evidence that a few women did have knowledge of Latin, thus not excluding women completely from a world of law and learning (Johns, 2003, p. 40).

It is very difficult to measure women’s literacy in the Middle Ages beyond making general statements. Many historians have attempted to measure literacy in general, as well as women’s literacy, but a successful method has not yet been found. For example, one historian attempted to measure literacy by the signatures made on official documents. Other historians have counted wills and tried to use book ownership as a means to measuring literacy. One problem with both of these methods is that women are underrepresented in medieval documents such as wills (Hanawalt & Dronzek, 1999, p. 36). In this instance, the successful historian must be a creative historian.

Literate laypeople, especially women, also often had the stigma of a heretic. The Lollards were a heretical sect made primarily up of artisans who regarded reading and literacy as an important skill in order to read the Bible and religious texts without the aid of clergy. The people who participated “in investigations against the sect...regarded literacy as evidence for adherence to the heresy. Literacy was apparently so uncommon among the socio-economic groups which comprised the Lollard sect that many assumed that reading ability could only have been acquired in heretical circles” (McSheffrey, 1995, p. 158-159). Al-

though the Lollards were from a lower social class than the subjects of this research, it is significant to note the ties literacy had to heresy when the literate subjects were not upper-class males.

Bäuml's (1980) article, "Varieties and consequences of medieval literacy and illiteracy" is a landmark study of medieval literacy; he redefines past perceptions and attempts to create new understandings. Bäuml argues that prior definitions of medieval literacy, or the ability to read and write in Latin, "obscures the social function of literacy, since it neglects the use of literacy by individuals who were themselves illiterate or only partly literate in Latin," and the definition "excludes consideration of the complex relationships between Latin and the vernacular languages" (p. 239). Bäuml states that access to the written word is not necessarily equated with an ability to read and write. Instead, it is determined by the need for access to written material to fulfill one's social function and the use of available means of such access, whether it is one's own ability to read and write, or another's. Through the twelfth century, the accelerated spread of literacy among the lay nobility made this access easier, and vernacular literature from the oral tradition appeared. With the increase in vernacular literacy, access to the written word and the ability to read and write was no longer socially distinctive. Instead, what was read became important. Bäuml argues that illiterati, or the illiterate, "who must and do have access to literacy are, in respect to their dependence on the written word for the exercise of their socio-political function, to be classed with the litterati, and can be referred to, for lack of a better term, as 'quasi-literate.'" Additionally, the illiterati are familiar with the Bible and the written vernacular (pp. 244-247).

This redefinition of literacy has serious implications for perceptions of women's literacy and education in the Middle Ages. Latin had become an isolated and solely a literary language by the High Middle Ages. Owing to its isolation, and the importance of the vernacular in everyday life, knowledge of the vernacular was more important and useful than Latin. Those previously defined as illiterate were not necessarily illiterate, particularly if their social function meant they

depended upon the written word, whether Latin or vernacular. Those who had knowledge of the written vernacular rather than Latin had also been categorized as illiterate. Upper-class women fell into each of these categories. They depended upon books to educate their children and pray. These women were around not only their own book collections, but those of their husbands and family. Additionally, a majority of female book-owners owned vernacular texts rather than Latin. The women could typically read the vernacular texts, but were yet again classified as illiterate because the texts were not Latin.

Upper-class women of the Middle Ages were educated and literate, through not by the definition of literacy that has been in place for so long. These women participated in literary activities such as owning books, commissioning books, and writing books. Their involvement in medieval literary culture has been denied for years but is now beginning to be researched. By applying a revisited definition of literacy to the existing evidence of literary activity, a more accurate view of female education and literacy can be established. With further research, new evidence and widespread support may be generated of the true levels of education and literacy of women in the Middle Ages.

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Schumann's Use of Musical Personae in the Eichendorff-Liederkreis, Op. 39, Nos. 1 & 8 "In der Fremde"

Though the first and eighth songs of Schumann's Eichendorff-Liederkreis, Op. 39, have the same title "In der Fremde" they each illustrate remarkably different landscapes and psychological states of the characters involved, both through text and musical affect. The texts alone provide unique perspectives on the same concept, but it is Schumann's setting of these texts and his manipulation of poetry, voice, and accompaniment combined that truly creates a distinct and complex character and setting within each song.

The poetic persona of No. 1 uses the foreign place of the title, not as the subject of his soliloquy, but rather, as a vantage point from which to speak about both his past and his future. In fact, in this text there is virtually no description of der Fremde the foreign place from which he is speaking. The speaker's lack of attention to his surroundings could imply a number of emotional states apathy, restlessness, unhappiness, to name a few but what is certainly not present in this speaker's mind is a sense of fulfillment or connection with the foreign land that he finds himself in, for if this were the case, he would most likely speak about his life and surroundings there. Instead, he focuses entirely on places other than "here". Clearly this speaker is longing to be somewhere else.

His homeland, however, is not that place. The

physical description he provides – red lightning, clouds moving towards him – suggests a great deal of turmoil there, and his description of his relationship with his homeland – his parents are long dead, no one knows him anymore – suggest an attachment which, while once present, is now completely severed. Thus, from his descriptions (or lack thereof) both of where he once was and where he currently is, the reader could infer that this speaker wants to be, literally, neither here nor there. This is particularly evident in the parallel phraseology between, “Es kennt mich dort Keiner mehr,” and “Keiner kennt mich mehr hier”. The fact that the speaker uses a nearly identical sentence structure when referring to both “here” and “there”, as well as the straightforwardness of the two statements, suggests that his ties to both places are equally broken and that he accepts his disconnection from both places with equal resignation.

The place where he wishes to be, then, is not within the physical realm at all, but rather in the peaceful rest of death. The statements about his own death are by far the most positive in the text, containing such comforting images as “stille Zeit” and “ruhe ich”. In fact, the speaker never even uses the word “death” when referring to himself, and the only way the reader knows for certain that he is referring to death is in his reference back to his parents’ death with the word “auch”. This clearly suggests that the speaker does not think of death as something to be feared, but rather as a much-anticipated ending to the displacement and suffering he has experienced on earth.

Schumann’s setting of this text in many ways remains true to the poetic persona’s emotional state but also adds extra layers of psychological meaning that create a more complex and sometimes ambivalent character. The key of f-sharp minor creates an appropriately dark setting. However, Schumann sets up an immediate and dramatic contrast between the content of the text and the way in which it is portrayed by creating a vocal persona which, while speaking about very tumultuous events surrounding his homeland, sings in what is virtually a monotone – a line with a range of three notes, all centered around the tonic, in a very steady, predictable rhythmic setting. The cadences

at the end of each sentence express a certainty – perhaps even resignation – about the speaker’s statements. By choosing these particular compositional devices, Schumann creates a subtext (one of many which he could have successfully used with this poem) of a man who is so despondent as to be numb to the world around him and has faced his earthly fate with a defeated acceptance.

The accompaniment, on the other hand, provides yet another emotional layer to the character, for while the vocal persona is reserved and almost detached, the accompaniment, with its constant, undulating sixteenth notes and off-beat accents, creates a sense of turbulence which belies the vocal persona’s anesthetized state. Thus, when the poetic, vocal, and accompanimental personas are combined, they create an extremely complex complete musical persona: a man who is speaking of painful events in an unnaturally aloof manner, while experiencing a great inner disturbance which he may not even be consciously aware of. This reading certainly corresponds to the content of the poem, and, yet, with this musical setting, Schumann creates a new and richer set of psychological implications that the poem could not possibly have expressed standing alone.

In the musical setting, as in the poem, it is only in thinking of his own death that the vocal persona finds any hope. This is clearly illustrated musically when, in m. 9, the key changes to A major. More telling, however, is the shift in the character of the vocal line. No longer a static, weighted melody, the voice suddenly begins to make wide leaps and make use of its upper register, indicating a new emotional engagement from the vocal persona. The accompaniment affirms this with right-hand figures that float easily above the vocal line. This newfound hope, however, is not without its doubts, as seen in m. 14-15 when “da ruhe ich auch” is repeated but ends on an unexpected and disconcerting a-sharp which will begin a brief visit to b minor.

By m. 20, both the vocal and accompanimental persona are back where they began – in f-sharp minor, with a limited, tonic-oriented vocal line. As the vocal persona’s thoughts return to earth, he becomes once again depressed and distant, singing a melody which is identical to that of his first statements. He

shows a brief spark of emotion in his final statement as he leaps to a D in m. 34, only to sink back down to the tonic to end his despairing monologue. However, while the vocal persona ends in the same place that he started, the accompanimental persona begins experiencing a shift in character at m. 21, as the a-sharp which had shown such uncertainty at m. 15 now allows the accompaniment to shift to f-sharp major, even while maintaining its constant sixteenth-note motion. This indicates that, while the character may remain outwardly unchanged, and while his inner turbulence may not have ceased, he has, to some degree, made peace with his place in the world, even if he is not fully aware of his change in attitude. The postlude illustrates this well, as the accompaniment, on the one hand, affirms what the vocal persona has said by repeating his final statement, but, on the other hand, suggests a certain degree of hope by ending in f-sharp major.

Unlike the poetic persona of no. 1, who is, for the most part, not psychologically present in *der Fremde* and uses it only as a setting for his thoughts, the poetic persona of no. 8 is both present and involved in *der Fremde* and describes his experience there. However, a more interesting and subtle contrast appears when examining the way in which these two characters describe the events taking place around them. While the character in no. 1 is extremely distanced from his current surroundings, he is nevertheless grounded in reality. He speaks only of actual events—even if they are from the past or the future—and he describes them all in the present tense.

The poetic persona of no. 8, however, moves easily between both reality and fantasy, past and present. One of the clearest indications of this in the text is the poetic persona's consistent use of the subjunctive case—"als wollten sie,"; "als säh' ich"; "als müsste... meine Liebste," all indicating events that seem to be happening, but in actuality are not. This grammatical construction indicates that *der Fremde* in this song is very much toying with the speaker's grasp of reality, and the phrase "ich weiss nicht, wo ich bin." tells the reader unequivocally that this poetic persona finds himself in a disorienting place. However, in spite of his confusion, the speaker is

still able to see beauty in his surroundings, describing the little brooks, the nightingale, moonbeams, and an overflowing rose garden. Such poetic descriptions indicate that while the speaker is most definitely lost, he does not feel that he is in danger.

In this setting, Schumann chooses to strongly emphasize the speaker's confusion, so much so that he creates a musical persona who, while still able to notice the beauty around him, is so nervous as to be not at all comforted by it. The choice of a-minor as the primary key area indicates that the vocal persona is quite uneasy with the uncertainty of his mystical environment. (It is interesting to speculate that by simply using the major mode here, Schumann could have possibly created a very different but equally plausible character who was perfectly comfortable with being lost.) Unlike the phraseology of no. 1, with cadences weighting the end of many statements, both voice and accompaniment do not cadence until the very end of the piece, suggesting that the musical persona does not rest in this foreign place. Rather, he is perpetually moving, perhaps searching for a way out.

The vocal persona's frequent leaps, jolting, hesitating rhythms, and avoidance of the tonic show a character who—unlike the vocal persona of no. 1—is visibly disturbed. The accompanimental persona, for the most part, affirms this disturbed emotional state. Its circling, sixteenth-note figure (m. 1) illustrates a sort of dizziness, and the fact that this is alternated with a figure of steady eighths in the left-hand (m. 2) could indicate that the character can not find sure footing, that every time he begins to move along steadily, he is interrupted by some new, puzzling feature of the landscape.

The key scheme is also indicative of how out of touch with reality the character is at any given point in the song. The piece begins in a minor, although the frequent tonicizations of the dominant (m. 3-4, m. 7-8) make it difficult for the listener to get a firm grasp of the tonic. As the character begins to speak of the nightingale in m. 9-10, and at a parallel point in m. 25 when he begins to describe the garden, Schumann shifts keys to the subdominant, D, but by avoiding scale-degree three, is unclear about whether he has entered

d major or d minor. The b flats in m. 10 and 12 suggest d minor, but the very brief touches on f sharp in m. 13 and 15 could indicate d major. This ambiguous shift of keys suggests that the musical persona is entering the realm of fantasy. He moves even further into his own imagination in m. 14 and 30 when the character begins to fantasize about his past and the vocal and accompanimental personas move from the key of D to the key of C. Here Schumann is, again, ambiguous about the mode in which he is working. While the a-flat and b-flat strongly suggest c minor, the lack of an e flat throughout the passage leaves the listener unconvinced. In addition, while the key of C is closely related to the original key of a minor, the fact that Schumann approaches it from the distant key of D causes this passage to sound very strange and foreign. Thus, in the places where the poetic persona is as far from the here and now as he can possibly be -- in both places, the character is speaking about past events in the subjunctive case -- Schumann sets up a distant and ambiguous key to reinforce the disconnection from reality.

The fact that the voice, text, and accompaniment are so closely aligned, not necessarily in musical features, but in emotional affect, implies that this character is more transparent and open than the musical persona of no. 1. His words, actions, and thoughts are, for the most part, consistent. However, his relationship with time and space is far more complicated than the musical persona of no. 1. He freely moves in and out of his own memories and daydreams, and, in some cases, finds it difficult to separate them from reality.

Both characters also have very different relationships with *der Fremde* of their titles. In no. 1, the musical persona is clearly discontent with the place from which he is speaking, but all evidence suggests that he at least understands it -- he knows where he is and why he is there. Schumann illustrates this musically by juxtaposing a static, tonic-oriented vocal line with a surging, fretful accompaniment. In no. 8, on the other hand, the musical persona does not know where he is and is openly upset about this fact. *Der Fremde* in this case is a much more mysterious and disconcerting place than in

no. 1 -- an idea created more by Schumann's setting than by the text. The erratic nature of both voice and accompaniment, as well as the tonal ambiguity throughout, suggest a disorientation in the character that the poem alone never could have expressed. Thus, in both cases, Schumann takes two texts which convey different meanings about a single idea and, through his thoughtful treatment of the three independent personas, creates a rich and distinct musical persona for each individual song.

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Water Quality at Brush Creek

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In an effort to discover the water quality of Brush Creek and its ability to support life, a series of tests coordinated by Dr. James Murowchick were used. Before beginning the project we first read, in Web Lab Module 10, a brief history of Brush Creek; then took a virtual tour of the drainage basin and the creek itself. A visual survey of the site to be tested was then conducted based on photographs in the same Web Lab. On 10/18/2004 at 8:30 A.M. a series of tests were conducted at the site. A visual stream survey was conducted, stream measurements to calculate stream discharge were made, a kick test was also performed in order to estimate the type and number of macroinvertebrates living in the water. This is the basis of the water quality rating. On 10/25/2004 at 8:30 A.M. another series of tests were conducted to determine temperature, nitrite and nitrate content, percent saturation, conductivity, turbidity, pH, hardness and alkalinity, total chlorine and free chlorine. On 11/1/2004 at 8:30 A.M. fecal coliform tests were performed on a sample of water from Brush Creek water collected that day; the colonies were then counted 24 hours later. This is a summary of the history of Brush Creek discussed in web lab module 10, partly upon which the hypothesis is based. The drainage basin of Brush Creek covers an area of about 80 square kilometers and is completely urbanized from its begin-

ning in Overland Park, Kansas until it empties into the Blue River in east central Kansas City, Missouri. The creek bed was first paved with concrete in the mid 1930's. It flooded the plaza area of Kansas City, Missouri in 1977 when 12-16 inches of rain fell over a 24-hour period; it flooded the same area again in 1998 with 7.7 inches of rain. The creek bed has since been widened and deepened to prevent future incidents. The urban setting of Brush Creek's drainage basin is its nonpoint source of pollution; this is pollution comprised of emissions from vehicles, pesticides, refuse, oil, spilled gasoline, animal droppings and many other waste products of urban life. Another source of pollution comes from sewage water discharge into the creek during periods of heavy rainfall and snowmelt. It was discovered in 1995, through fecal coliform bacteria testing, that dry-weather discharges of sewage were flowing into the storm drains and into the creek. This problem was quickly rectified, and with regular maintenance of the sewage system should no longer be a problem. In taking the virtual tour of Brush Creek, it appears that upstream from site #1 usage is basically all residential. A visual survey was conducted on the condition of the creek based on the images shown below. The water looks brown in the photo, this could be because it is very shallow; other than that, the creek and the surrounding banks appear to be clean and free of litter. In the photo where the creek does not appear to be swollen there is no dry-weather discharge shown coming out of the storm drain.

The entire drainage basin of Brush Creek is urbanized. It is known that when excess water flows into the creek, the water brings with it many pollutants from the urban environment. However, based on the history of Brush Creek and the images shown above, the testing conducted during this project is under the hypothesis that, in the absence of excess water, the water quality of Brush Creek is good enough to be within EPA standards.



Photographs of location site #1, from Web Lab Module 10

Site Description

The tests were conducted in Brush Creek at location site #1. This site is located in Johnson County, near the intersection of 63rd Street and Indian Lane in Mission Hills, Kansas. The legal location is NE¼, NE¼, NW¼, Sec. 15, T12S, R25E.

The land use in the flood plain of this site is well manicured and completely residential. Riparian cover, for a distance of 100 feet from the bank, consists mostly of trees and grass. There is almost no bare ground, and, since it is a very affluent neighborhood, there is a minimum of houses and streets. The stream banks are covered mostly by a stone wall and grass; in very few places it is covered by trees, bare ground and a sidewalk built into the wall. Our visual survey was not preceded by rain, so we were able to get a good look at the streambed. It was mostly solid bedrock; it is limestone, but had the look of slate. The rest is a pretty even mixture of sand, gravel, cobble and boulders with a little silt thrown in for luck. The signs of human use are the wall, sidewalk and a small dam. The only bottom cover is trash; there is a rusty grate, a very old deflated football and a few pieces of plastic litter. Below are pie charts to illustrate these observations.

There is quite a bit of algae; it covers nearly the entire streambed. Most of this is close-growing and only five percent of it is filamentous. The water was quite clear with a small amount of sediment suspended in it. The water had a very mild musty odor; this, from my experience, is a normal smell in a healthy stream.

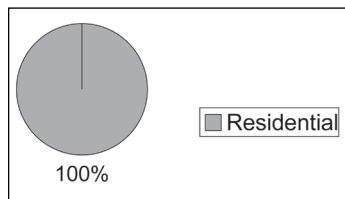


Figure 1: Floodplain land use

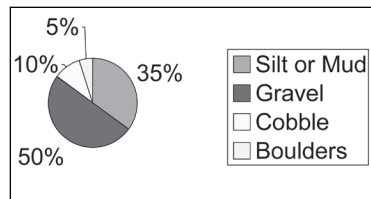


Figure 2: Riparian Cover

Methods

Testing at site #1 began on 10/18/2004 at 8:30 in the morning. To begin a visual survey was conducted; the survey took note of rainfall for the previous week, floodplain land use, riparian cover, condition of the stream banks, bed composition, bottom deposits, signs of human use, algae, water color and water odor. After this, tests were performed to determine stream discharge and to count macroinvertebrate life.

It rained on the first day of testing, but only 0.5 mm and had rained only 3 mm for the previous week (according to The Weather Channel). This small amount of precipitation allowed for a more accurate visual survey. Floodplain land use is determined by observing a 300-foot section of a stream and identifying what is the dominant land use. This is important to water quality in the stream because land use is a pretty good indicator of what types of nonpoint pollution likely will be flowing into the stream during periods of heavy precipitation. Riparian cover is determined by observing what covers the land area 100 feet from the top of the bank. This is important because riparian cover indicates how permeable the ground is and how readily polluted water will drain into the stream. The condition of the stream banks tells of what the banks consist. This is important because, if the bank is composed of materials that will not hold up during heavy flow, it becomes a source of sediment pollution. Bed composition is what the streambed is mostly composed of such as concrete, sediments, and bedrock. This is an indicator how quickly water is able to flow, also is an indicator of how much sediment pollution has occurred in the past. Bottom deposits are out of place deposits on the streambed such as trash, sludge, and precipitates. All are indicators of pollution. Signs of human use, such as paths, equipment and litter, show that people will or have used this stream. This could indicate what types of pollution could be introduced into the system through human use. The presence of algae on the stream bottom indicates a healthy stream capable of supporting life. Too much algae could indicate nitrate or phosphate pollution. Water color

and odor can both be indicators of the presence of pollution.

Determining stream discharge proved difficult due to lack of riffle because it had not rained in the previous week. To begin, the cross sectional area had to be determined, the first step to this is to measure the average depth of the stream. Three measurements were made at one-foot intervals using a ruler since the water was very shallow. The average of the three measurements were multiplied by the width of the stream and this gave the cross sectional area. Next the average velocity of the stream needed to be measured to determine stream discharge. This was done by measuring out a distance of ten feet, releasing a hollow plastic ball at point zero, and then timing how long it took for the ball to float ten feet. This procedure was repeated five times. Due to the presence of a steady breeze, only once did the ball make it the full ten feet. For this reason the velocity was calculated, then these values were averaged to find the average surface velocity of the stream. Since the stream bottom is mostly smooth bedrock, the average surface velocity had to be multiplied by a correction factor of 0.9 to compensate for drag on the streambed to determine the average stream velocity. This value is multiplied by the cross sectional area and this gives the stream discharge in cubic feet per second.

Macroinvertebrate count is perhaps the most important test. The type of creatures found in a stream system will tell the long-term pollution story. Some types of organisms are completely intolerant of pollution and will die out while other organisms will thrive. If there is too little of one type of organism and too much of another, it is an indicator of a problem. To gather this information a kick test was performed. The test was performed in what little riffle we could find, this is because riffle is the part of the stream that supports the most diversity of life. To perform the test a net was held down stream while the stream bottom was disturbed upstream, whatever critters were hanging out would dislodge and float into the net. Then all of the organisms found in the net were sorted into an ice tray, than identified. This procedure was repeated three times, moving downstream to upstream. The

stream was then given a water quality rating based on number of sensitive, somewhat sensitive and tolerant organisms.

The second day of testing was on 10/25/2004 at 8:30 in the morning. It was sunny and cool on this day and had rained only 1.1 mm in the previous week. The tests performed on this day were to test the chemistry of the stream. The tests investigated water temperature, percent saturation of dissolved oxygen, nitrite, nitrate, conductivity, turbidity, pH, hardness, alkalinity, total chlorine, and free chlorine.

The first test of the day was to take the temperature of the water, which was taken with a Fahrenheit thermometer and then converted to Celsius. The temperature of the water is very important because if the water is unseasonably warm it will artificially increase the ability of organisms to metabolize and plants to perform photosynthesis. Oxygen dissolves more readily in colder water. Plants and organisms don't need as much oxygen in the winter, but the bacteria does because it uses oxygen to break down all of the things that die in the winter. It is a very delicate cycle and this is why if an aquatic system is being thermally polluted, it can upset the balance of life in the system. To find the amount of dissolved oxygen in the water, first a sample of the stream water was scooped into a beaker then carefully, to avoid trapping air bubbles, poured into a glass bottle with a stopper. Then Dissolved Oxygen 1 and 2 reagent powder pillows were added to the water and carefully stopped and shaken. As the water and the two reagents mix it should for a precipitate that in the presence of oxygen should turn and orange-brown color. The precipitate was allowed to settle then shaken once again and allowed to settle. The dissolved oxygen 3 reagent pillow was then added, and the process above was repeated, only this time if oxygen is present the precipitate will dissolve and the solution will turn yellow. Some of this mixture was then poured into the small test tube provided and then poured into another bottle. To this Thiosulfate standard solution was added one drop at a time, while swirling, until the solution turned clear, with each drop representing 1 mg/L of oxygen in the water. With these values the quick and easy method was

used to calculate the percent saturation of oxygen in the water.

The next test is for the presence of nitrogen in the water. Nitrogen is essential for the survival of all forms of aquatic life in this system. Nitrates and Nitrites are the usable forms of nitrogen. It is used by bacteria to oxidize organic materials turning this usable form of nitrogen into unusable dissolved nitrogen gases. This is a very important balancing force in the system, because an excess of usable nitrogen will allow algae to grow out of control, this would result in choking out life in the system. This is what we would likely see if unsafe fertilizers and pesticides were being washed into the stream. To test for nitrate and nitrite levels, test strips were used. The strip was dipped into a sample of the stream water for one second. After 30 seconds the color of the pad on the strip gave the Nitrite level, and after sixty seconds gave the Nitrate level.

Next was the test for the conductivity of the water. This means the ability of the water to conduct electricity. It is the presence of dissolved minerals in water that allow it to be a conductor, where pure water is an insulator. Brush Creek has a limestone streambed, so there should be plenty of dissolved minerals. Conductivity was tested using an electric conductivity meter. The meter was dipped into a sample of the water and the value given was multiplied by 10, this is the conductivity.

Turbidity is a test for the amount of suspended particles in water. These particles are a form of pollution and an indicator of water quality problems. This test is performed by pouring a sample of the water into a tube until the black and white markings on the bottom can no longer be seen.

The tests for Total Chlorine, Free Chlorine, Total Hardness, Total Alkalinity and pH were conducted using one test strip. The strip was first dipped into a sample of the water for one second, after thirty seconds the color of the pads indicated the values for hardness, alkalinity and pH. The strip was again dipped into the water and swirled for thirty seconds after which the colors on the pads indicated the values for Free and Total Chlorine. Chlorine occurs naturally in some aquatic systems, mostly salt water. However, in this particular system, any

chlorine would likely come as runoff from our water treatment systems. The average pH of rivers and streams is between six and nine. The pH of clean rainwater is 5.6. It is the presence of the H⁺ hydrogen ion that determines pH; the more H⁺ ions there are the more acidic the water is. In areas such as this one where there is a lot of limestone, the H⁺ ions react with the calcium carbonate in the limestone to release calcium ions into the water, an abundance of which is necessary for life, making the water hard. This reaction leaves behind an excess of OH⁻ ions in the water and thus raising the pH and making the water alkaline. This is a very delicate system; if anything were getting into the stream to make the water more acidic than usual, it should be obvious if any of the factors above are outside of the norm. Such as if the pH were too low or if the water were harder than expected.

The third and last day of testing took place on 11/1/2004 at 8:30 in the morning in the lab. Used for the testing was a sample of water from the site collected that morning. The air temperature was 23 degrees Celsius and the water temperature was 16.8 degrees Celsius. The difference this time is that it had rained 18.3 mm in the previous week, so the condition of the water was quite different. Instead of being clear and free nearly free of suspended particles, the water was murky green and dirty. On this day a fecal coliform test was performed, and will be a very good indicator of the type of pollution that gets dumped into the stream through runoff. Fecal Coliform is a type of bacteria found in the intestines and feces of animals that aids in digestion. As it says in web lab module 12, fecal coliform bacteria are not dangerous; what are dangerous are the pathogenic organisms that are found with it. Bacteria of this type will definitely be found in the water after rain, having been washed out of yards and sewers in the drainage basin. To begin the test, the work area had to be wiped down with a ten percent bleach solution to sterilize. Then six sterilized filter funnels were labeled for the amount of stream water that would be filtered through them. The first was the control, that would have only distilled water filtered through; the other five were labeled for 0.01 mL, 0.1 mL, 1 mL, 10 mL, and 100mL.

A hand pump was used to create a vacuum to pull the water samples through the filter as it was pipetted into the monitor; each sample was followed with a packet of m-FC broth that was pulled through the filter in the same fashion. For the two smallest samples, 1 mL of stream water was added to 99.0 mL of dilution water; then 1 mL and 10 mL of the solution were filtered the same as above. The six Petri dishes were then sealed, placed in a waterproof bag, and placed in an incubator for 24 hours. The next day the colonies were counted.

Results Water Chemistry

Water Temperature: 13.3°C
Dissolved Oxygen: 6 mg/L
Percent Saturation: 57%
Nitrite-N: 2 ppm
Nitrate-N: .15 ppm
Conductivity: 0
Turbidity: >60
pH: 6.8
Hardness: 25 ppm
Alkalinity: 120 ppm
Total Cl: 0 ppm
Free Cl: 0 ppm
Stream Discharge: .476 ft³/s

The results from the water chemistry tests all suggest a healthy stream system. The percent saturation of dissolved oxygen in the water is which is within a normal range with consideration to how much organic matter was within the stream and lack of riffle. The level of Nitrates and Nitrites is acceptable and there was no overgrowth of algae to suggest otherwise. The turbidity test showed clean clear water that appeared to be free of suspended particles; the tube could be filled completely to the top without losing sight of the black and white markers. The

thing that is concerning is the lack of conductivity, for which a value of zero was given. Perhaps it is not the presence of just any dissolved minerals in the water but rather the presence of sodium ions that dictates conductivity. The results of the test for chlorine gave results of zero, which is an indicator of clean water. The water had a pH of 6.8, which is within the normal range for healthy streams. Due to the limestone stream bottom, the hardness and alkalinity seem to be within a normal range.

Fecal Coliform
>200 colonies/100 mL
>60 countable blue colonies per plate

The number of fecal coliform colonies that grew in the Petri dishes was quite high; however, not surprising due to the amount of precipitation experienced in the previous week. The stream itself shows to be quite healthy. The amount of pollution that obviously enters the stream during period of high precipitation, however, is a cause for concern. The number of colonies that grew is way over the allowable limit. It is difficult to believe that animal droppings could contribute this high of a concentration of this type of bacteria.

Macroinvertebrate Counts

Only two types of somewhat-sensitive organisms (crayfish and damselfly nymphs) were found and 6 types of pollution tolerant organisms (aquatic worms, midge larvae, pouch snails, leeches, and tadpoles) were found. No organisms from the sensitive category were found, and of the 60 organisms found only 5 were somewhat-sensitive. The stream shows all of the signs of being healthy, but received a water quality rating of poor (<12). Perhaps the stream is in good condition only in dry weather, but during periods where there is heavy runoff the water quality is entirely too poor to support the pollution intolerant creatures. Another possible solution is the time of year, the water could

be too cold, or perhaps there is not enough oxygen in the water due to the large amount of organic matter and lack of riffle.

Visual Survey

The use of the floodplain leading to this site looks to be mostly residential and at the site it is completely residential. Riparian cover is mostly trees and grass. The stream bank is mostly grass and bedrock. The streambed looks to be mostly bedrock and was about 90% covered with algae, mostly the close growing kind. The look and smell of the water seemed to be very clean. It was a bit shocking to see what trash there was in the seemingly clean water; the trash being a rusty grate, an old football, and a bit of plastic litter. The signs of human use are the trash, the dam, a storm drain, and a narrow walkway across and along side the stream. From the visual survey Brush Creek looks to be a very well kept neighborhood spot.

Conclusion

Based on the test results, the hypothesis is supported. Brush Creek appears to be healthier than originally expected. The macroinvertebrate count gave a poor water quality rating, but this could be due to any number of factors including pollution. It is more likely the fact that the riffle was almost non-existent. The thing that is the most concerning is the results of the fecal coliform test. The look of the water and the number of colonies that grew from it do not suggest a healthy stream. The water used for this test was collected after a few days of rain and looked nothing like the water tested during the previous two weeks. The source of the pollution must be coming from runoff and mostly from sewers. It is difficult to say what can be done, except that the sewer system should be completely cut off from the storm drains. If this experiment were to be performed again, there should be two sets of tests; one where all of the tests are performed during dry-weather conditions and another set of the same tests were performed during periods of high precipitation. The results would likely tell two very different stories.

References

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- Ricklefs, Robert E. (2000). *The Economy of Nature*. (5th ed.) New York: WH Freeman.

