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Mark William Neal

University of Tennessee - Knoxville

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**From Iron to Velvet: Solving Environmental Problems in the
Czech Republic**

College Scholars Senior Thesis

Mark William Newbold Neal

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Advisor: Dr. Richard Strange

**Review Committee: Dr. Jack Reese, Dr. Thomas Broadhead,
Dr. David Ostermeier, and Dr. Michael Fitzgerald**

I. Introduction

In a time when America was much greener, the great naturalist Aldo Leopold declared that people should treat the land on this planet as a "whole organism" (Leopold 1949). As a young boy in the rural mountains of southwest Virginia, I learned a very important lesson about nature from my father. He planted three white spruces (Picea glauca) in our backyard in honor of each of the three children and then told us that our respective trees would only grow with tender care from each of us. Many years later, I was able to pass on this lesson as a counselor at a summer camp on the coast of North Carolina. In an effort to restore the natural vegetation of the estuarine marshlands, I worked with a group of young boys to plant a stand of longleaf pines (Pinus palustris), and I told each of them, as my father had told me, to lend special care to the tree that they planted in order to increase its growth. My father taught me that to care for the trees in my backyard is in a greater sense a care for the giant organism that we call Earth. The nurturing words and cups of water must have succeeded because I have returned to both places to find magnificently resilient trees.

As citizens of the United States, we live in the wealthiest society on the planet, and we often have the luxury of using money to buy more resources when they are depleted. This places our society at the apex of the global network of consumers, taking resources from less wealthy consumers when we need them.

Thus, Americans generally learn that resources are infinite, and that, if we fail to protect our natural source of any particular resource, the world market will provide us with more. The blossoming of the environmental movement has created in my generation a more realistic perspective of natural resources as finite: likewise, the ominous forecasts of global warming, UV radiation, and water pollution have stimulated a general concern among the American youth. However, I do not believe that it is our responsibility as Americans to provide a solution for resource management to the entire world. On the contrary, we live in a world of communities, and no one society can sustainably direct the development of an entire planet. Thus, if the America could become a beacon for other developing nations by balancing economic and environmental goals, then each community might have the opportunity to care for the trees in their own backyard. I did not realize the true significance of my father's words until I journeyed halfway across the planet to a place where the survival of the people is threatened here and now by dying trees and animals in their backyard, and my education as a college student culminated in an effort to make a difference in small communities that are fighting to remediate the natural resources of the Czech Republic.

II. My Czech Experience

On May 29, 1995, I arrived at the Masaryk University in the city of Brno at the beginning of the summer recess for the students, and I was placed in a dormitory with other foreign students that would be staying for the summer. I was granted access to a computer and a desk in the Department of Zoology and Ecology. I did not have a specific agenda for working on particular research projects because none of the professors in the department could afford to employ me. Thus, I was primarily a volunteer for the university and the Institute for Landscape Ecology, a national research institution that cooperates on many projects with university staff.

According to my interests as a student, I was placed in the care of the faculty members who specialize in the teaching and research of the many aspects of aquatic ecology; among them, my three primary mentors were Dr. Honza Helesic (aquatic invertebrates), Pavel Jurajda (ichthyology), and Dr. Milan Gelnar (parasitology). All of these men are colleagues of Dr. Richard Strange of the University of Tennessee Department of Wildlife and Fisheries, and I was granted many opportunities to work closely with accomplished scientists. Due to a lack of resources, I would not be able to complete a specific senior research project on one particular ecological issue, so I worked through the guidance of my mentors to contact people who are working to solve environmental problems on all levels of Czech society. My stay in Brno continued until the first week of

September, during which time I collected the field experience which is the basis for this project. I must thank Dr. Strange and all of my Czech colleagues for granting me a memorable glimpse of the contagious curiosity that stems from real **scientific understanding; it will grow in me for a lifetime.**

III. A Brief Socio-Political History of the Czech Republic

Since the first settlement of the European continent, its peoples have endured a never-ending struggle for rights to the land. The geographical arrangement of modern Europe is merely the result of many centuries of conflict created by empires, churches, and bloodthirsty rebels. The story of the modern Czech Republic would be incomplete without a glimpse of the struggles that led to its recent independence.

Located in the most central region of Europe, the Czech lands were for many centuries a pawn in the territorial battles of larger empires. The modern nation of Czechoslovakia first gained freedom from the Hapsburg empire in 1848 through a political revolution, establishing a federal empire that was dedicated to the revival of Czech culture and the industrialization of its lands. However, the Austro-Hungarian empire retained official control of Czech lands throughout the latter half of the 19th century, profiting greatly from the continually developing industries. Following the defeat of Austria-Hungary during World War I, the Czech and Slovak territories were united to form the independent state of

Czechoslovakia on October 28, 1918. The new nation quickly became one of the ten most developed countries in the world (National Report 1992), and Czechoslovakia was a harbinger of prosperity and freedom. However, Adolf Hitler and his Nazi forces occupied Czechoslovakia in 1939 and remained for the duration of World War II. In the ensuing territorial agreements which followed the war, the republic was overturned along with several other eastern bloc nations to the control of the Soviet Union.

During the transition that followed the war, the Czechs and Slovaks enjoyed a few years of pseudo-democratic freedom, but the Communist party executed a full takeover of Czech society in February of 1948. All private property was seized by the state, and many human and political rights were suppressed. In the spring of 1968, many student and liberal groups united to make a stand for democracy in the capital city of Prague, but the movement, known as the Prague Spring, was violently terminated by the overwhelming power of the invading Soviet Army. However, the fierce opposition to Soviet occupation endured in sectors of Czech culture external to the political forefront, namely the arts and scientific communities. Led by the dissident playwright Vaclav Havel, mass protests by student and civilian groups, namely the Civic Forum and the Public Against Violence, in the name of human rights led to an overthrow of the Communist regime in November of 1989. Due to its nonviolent nature, this overthrow of the Communist party was termed the "Velvet Revolution." Mr. Havel was elected as

president of the new democratic republic of Czechoslovakia, and as a compromise to the clashing ideals of different cultures, he directed the peaceful separation of the Czech and Slovak Republics on January 1, 1993. A new constitution was drafted to ensure fundamental human rights, and the transition to a free market economy and a parliamentary democracy is ongoing.

IV. Natural Resources of the Czech Republic

The Czech Republic is a fairly small European nation, covering an area of 78.9 square kilometers, and this area lies on an important geological boundary between the Czech Massif (highlands) in the west and the Carpathian system in the east. There are approximately 10.4 million inhabitants of the Czech Republic, and the national population density, which is currently static due to the growth of the elder population, is 122 persons per square kilometer. The largest city and capitol of the Czech Republic is Praha (Prague), and most of the offices of government are located there. The country is divided into three regions based upon cultural boundaries--Bohemia in the east and Moravia and Silesia in the east.

A National Report prepared in 1992 by the ministries of the Czechoslovakian government for the UN Conference on the Environment in Rio de Janeiro released a wealth of information about the state of the republic. The great majority of the people (90+%) in the Czech Republic are white, and Catholicism is the dominant religion. The climate is an interesting mixture

of continental and oceanic influences, separating the dry, warm lowlands and the cold, moist highlands. This variation in climate corresponds to the variation in soil types, from brown-forest soils to black-earth soils. Over three thousand species of vascular plants, about 40 thousand species of insects, 70 species of fish, 18 species of amphibians, 12 species of reptiles, 365 species of birds, and more than 80 species of mammals find their native range within the Czech Republic (Vavrousek 1992).

The total area of the Czech Republic consists of 33% forests and 55% developed land, 41% of which is arable land. Over the last 40 years, this total area of arable land has decreased one-third due to the intensity of agricultural activity (National Report 1992). Most of the forests in the Czech Republic have been planted for wood production, which has tripled since 1950. The intensive planting of spruce and pine monocultures from the 18th century has drastically affected the composition of the once-deciduous forests; pines and spruces are growing where the *Quercus* (oak) and *Fagus* (beech) species grew. On the whole, over half of the land in the Czech Republic is suffering from environmental problems (National Report 1992).

In the Czech Republic, only a small amount of the total water volume can be found in lakes, for there are only five mountain glacial lakes. The land is situated in the center of a primary European watershed between the North, Black, and Baltic Seas, and the Elbe is the largest river basin in the territory. Since the last century, small streams have been

outfitted with weirs and tanks for holding water. More recently in this century, many reservoirs have been created on rivers for energy production, agricultural irrigation, and municipal consumption. The levels of these reservoirs can be manipulated in order to avoid dry periods of the year and to increase fishing harvests. The underground water resources are scattered throughout the territory, mostly in the hilly regions of central Bohemia. The water resources are not being used in full capacity at this time, but the demand is steadily increasing at a per capita level (National Report 1992).

The mineral resources of the territory primarily consist of gold, silver, uranium, and coal. Coal and uranium have been intensively mined since the end of World War II to fuel the gigantic Soviet military, but due to its harmful radioactive effects, uranium mining has been halted. However, the mining of hard, black coal in Moravia and soft, brown coal in northern Bohemia continues (Vavrousek 1992).

V. The Czech Economy: Turning Earth into Money

The Czech people have endured slow economic recovery since the fall of Communism, and the GNP (dollars per head) currently remains at approximately 40% that of Western nations (National Report 1992). More specifically, outdated technology in the production sector of the economy (energy production, steel works, etc.) has led to highly inefficient consumption of natural resources; the Czechs have been consuming more and leaving less

for foreign trade. The basic macroeconomic indicators for the Czech Republic compare poorly to those of other developed nations, and investments in education and the environment are both threadbare. In short, "the economic growth characteristics of the former Czechoslovakia show that it was a very ineffective economy, producing at very high material and energy costs, with heavy dependence on natural resources, and with a large impact on the environment" (National Report 1992). Though the economic reforms of the present regime have stabilized the currency and the national deficit, production is actually slowing in the Czech Republic, and emerging social organizations have no money to fuel their voice to change things.

VI. Environmental Problems in the Czech Republic: More Mouths to Feed

While the economic impacts of the poor management of natural resources have been strongly felt, the environmental impact of this neglect is far more injurious to the future development of the Czech Republic. The deterioration in both the quality and quantity of natural resources is only a symptom of a greater disease which plagues the environment of the Czech Republic. The central nervous system, if you will, of the various ecosystems cannot replenish the balance of resources to sustainable levels under the growing burden of both overconsumption and pollution by humans. The former Federal Committee for the Environment of the post-revolutionary

government of Czechoslovakia best described the amalgum of environmental problems with these words. "The problems connected with the rapidly progressing destruction of the environment of the whole territory of Czechoslovakia can be briefly summarized in three independent groups:

- A. Quality changes in the living environment,
- B. Consequences of these changes for human beings and society, and
- C. Factors influencing environmental quality in a positive or a negative way" (Vavroušek 1992).

Insofar as we can understand the impacts which we as human beings have upon nature, it is impossible to fathom the effects which nature might reap in return. Thus, the solution to environmental problems in the Czech Republic begins with the identification of the deeper connections between society and the environment that have propagated the destruction of nature.

While there are numerous cosmic influences upon the cycles of nature which we as human beings can not perceive, there are likewise many observable anthropogenic impacts which are currently decreasing environmental quality in the Czech Republic, as well as the entire world. "The main structural cause of the progressive destruction of the environment has been the high and still growing rate of production and export of products, which is quite exceptional in most industrially advanced countries with a relatively poor raw material base (a category including the Czech Republic)... The inadequate structure of Czech production is connected with the excessive demand for,

and output of, energy" (Vavrousek 1992). From 1970 to 1985, the demand on the primary energy sources increased 24.3%. Meanwhile, the economy can not continue to tolerate the increasing costs of energy due to the inefficiency of the primary energy source, brown coal, which can lose up to 30% of its energy in transformation. For many years, the importance of technological innovation in meeting the high production demands of the economy has outweighed "the ecological parameters of used and projected technologies," and the development of low-waste, ecologically sound technologies is thus falling behind (Kundrata 1995).

On a more fundamental level, changes in the demographic make-up and lifestyles of the inhabitants of the Czech Republic are naturally contributing to changes in environmental quality. While the growth of the total population is nominal in the Czech Republic, the increasing "urbanization" of the population is indeed a problem. From the 12,000 existing parishes in 1961, only 7000 are still remaining. At the present time, nearly 70% of the population is living in towns with more than 10,000 inhabitants, and the countryside is being evacuated. The urbanization of the population also leads to an increase in the material standard of the population; both per capita meat and energy consumption have tripled in the last 50 years (IUCN 1995).

Another significant human impact is the "volume and method of exploitation of natural resources" (Vavrousek 1992). In the years between 1937 and 1987, the commercial logging of

timber increased 1.8 times, and the production of brown coal and lignite increased nearly 6 times. The raw materials extracted along with such natural resources (brick and gravel in the top wall of coal or compost from timber harvest) are rarely used, so the import of raw materials is increasing at the same time. Through the use of pesticides, fertilizers, asbestos, and plastics, humans are introducing more toxic compounds into ecosystems, and these toxins are accumulating in the biological food chains within these ecosystems (Vavrousek 1992).

The synergistic effects of human impact are creating changes which threaten the sustainability of ecosystems in the Czech Republic; one of the more insidious threats to the natural environment is the pollution of the air. Since World War II, the development of heavy industry and rapid growth of electric power, based on the burning of low-grade fossil fuels, have caused a significant increase in air pollution. The increase of heavy metals and toxic elements in the air only magnifies through precipitation, leading to the "acid rain" which is currently destroying the forests of Bohemia. One of the primary sources for air pollution is sulphur dioxide, which is a by-product of the burning of brown coal, lignite, and other fuels containing sulphur by heating power plants; these sources account for 79% of sulphur dioxide emissions. The total amount of sulphur dioxide emissions for the entire territory of Czechoslovakia has risen from 900 thousand tons in 1950 to 2443 thousand tons in 1990 (Vavrousek 1992). In regions such as

Northern Bohemia which are cluttered with heating and power stations, the sulphur dioxide emissions can easily exceed 100 tons/km²/year, the greatest amount of pollution by sulphur dioxide in Europe (National Report 1992).

In addition to sulphur dioxide, heavy industry also contributes large amounts of nitrogen oxide to the atmosphere; these emissions were measured at 988.6 million tons in 1990 (Vavrousek 1992). The concentration of solid particles in the air, primarily fly-ash, is increasing as well due to ineffective particle separation at power stations; this fly ash contains many biohazards, including arsenic, beryllium, cobalt, nickel, selenium, bismuth, and radioactive elements such as uranium and thorium. The increase in transportation has also increased the emission of carbon monoxide, CFC's, and other hydrocarbons (National Report 1992).

A second environmental problem which is of great significance in the Czech Republic is the pollution of the water. Roughly 50% of the drinking water in the Czech Republic does not comply with national standards, and studies have revealed over 400 heterogenous substances in the drinking water that can be harmful even in trace amounts (Vavrousek 1992). The problem is simply stated; the Czechs are depleting surface and ground water supplies beyond renewable amounts. The increasing demand for water by both the private and public sector is stressing the water treatment facilities of the Czech Republic; only 50% of organic pollution in water is removed by municipal and industrial treatment plants (National Report

1992). Through the process of runoff, organic compounds such as sulfates and nitrates are accumulating in both surface and ground water sources. The nitrate concentration in ground water supplies near settlements has increased four times over the last thirty years to 120 mg/l, and the concentration of nitrates in the groundwater near agricultural land has more than doubled to reach 56 mg/l. The legal concentration of nitrates in water is 50 mg/l for adults and 15 mg/l for children. This incomplete treatment of sewage creates a chemical imbalance which we classify as water pollution, and its effects include the loss of 5% of all drinking sources.

Several fundamental changes in water chemistry have occurred in the last 30 years; the concentration of salts in the surface water has doubled, primarily due to the runoff of agricultural soils into river basins (National Report 1992). The accumulation of phosphorous in many surface waters from municipal and agricultural point sources leads to an interesting phenomenon called eutrophication, gigantic algal blooms which deplete most available oxygen and overwhelm all life in surface waters. Thus, the Czechs are fighting an uphill battle to protect a water supply that is dwindling due to the growing concentration of pollutants.

A third environmental problem in the Czech Republic is the accumulation of solid wastes from both municipal and industrial sources. The problem with solid wastes is twofold. The inability to reuse waste products leads to the excessive depletion of raw materials, and the unused waste is often

deposited in municipal dumps. The land is running out of raw materials, and the dumps are running out of space. Much of this unused waste consists of raw materials that could be recycled into production, but the lack of sufficient regulations and enforcement has allowed the dumping of these wastes for many years (Vavrousek 1992). As of 1990, the total volume of solid waste in the Czech Republic for the year was nearly 700 million tons, a gigantic amount compared to the 40 million tons produced by the Slovak Republic. Thus, the heavy industrialization of the Czech Republic is the primary cause of the waste burden.

Approximately 80% of the total annual solid waste in the Czech Republic is created by mining activity, and further, 95% of this mining waste comes from the strip mining of coal. In this process of strip mining, many valuable raw materials such as kaolin, sand, gravel, and clay are removed from the earth, but only a small percentage of these materials is reused. Thus, nearly 80% of solid waste per year could be reused in the form of raw materials (National Report 1992).

Furthermore, the volume of radioactive waste created in the Czech Republic is a threat to the soil as well; some 46% of the 11.5 million tons of radioactive matter created annually is dumped in municipal sites (National Report 1992). Nearly every community in the Czech Republic is facing a solid waste crisis; a maximum of 10% of the total volume of municipal waste is treated annually for negative effects to underground and surface waters. Many water sources are being polluted by

leeching of heavy metals and toxic compounds from municipal dumps. Thus, the accumulation of solid waste must be reduced at the point source, namely heavy industry, so that the waters and soils surrounding both industrial and municipal dumps can be protected.

A fourth environmental problem is the loss of suitable agricultural land due to the pollution and erosion of the soil. Due to the industrialization of collective farms by the Communist regime, only 65% of agricultural land contains soil with good productive capacity. In a survey done for the World Conservation Union, Milan Kundera and others determined that the excessive use of fertilizers and pesticides on collective farms is the primary causes of soil degradation. The use of fertilizers can reach 600 kilograms per hectare in some regions, and the increasing use of nitrogen as a fertilizing component, over 10 times in the last 50 years, has reduced the concentration of humus in the soil, increased the concentration of nitrates in the ground water, and increased primary productivity and eutrophication in surface waters. Pesticides, another soil pollutant, are applied to 95% of crops in the Czech Republic. The accumulation of herbicides and pesticides in the soil leads to the build-up of biogenic compounds, such as DDT and PCB's, which destroy the vital organisms, like earthworms and May beetles, at the foundation of terrestrial food webs. These dangerous compounds can accumulate in food chains and destroy higher trophic animals (IUCN 1995). Finally, the use of heavy machinery leads to increased runoff from weakened forest

cachements, and this impact has in turn increased the erosion of fertile agricultural soils (National Report 1992). Thus, the growth of agriculture is reducing the area of quality land by polluting the soil and destabilizing the natural water retention of the soil.

A fifth and most dire problem, the reduction of biodiversity in natural ecosystems, stems directly from the cumulative effects of the aforementioned changes in the environment. While approximately 15% of the total area of the Czech Republic is protected in the form of national parks (4), protected landscape areas (27), and nature preserves (1600+), these areas are still prone to the external effects which are reducing biodiversity (National Report 1992). For example, in the Krkonose (Giant) Mountains National Park in Northern Bohemia, a near complete extinction of boreal tree communities above 700-800 meters has occurred, and thousands of tourists travel there annually to witness the horrifying reality of acid rain. During the last 35 years, the Czech Republic has lost some 240 thousand hectares of barks, 3600 hectares of dispersed green vegetation, and 20% of all meadows (Vavrousek 1992). In the present, nearly 70% of all forest stands are considered to be damaged (IUCN 1995). Wetlands, which are the most diverse ecosystems and home to many migratory species, have nearly been eliminated. The birds and insects, such as partridges and butterflies, that were once common on agricultural lands, are disappearing rapidly; only 20% of the partridge population and 11 of the 46 butterfly species are remaining. Five percent of fish species are

endangered, along with 72% of amphibians, 77% of reptiles, 62% of birds, 65% of mammals, and 21% of insect species (Vavrousek 1992). Finally, 40% of both moss and vascular plant communities are endangered, and humans might as well join the list (National Report 1992).

VII. Sustainable Development in the Czech Republic--Saving the Environment

The Czech Republic, like all the free nations of the world, is working toward the sustainable development of its society so that future generations may prosper in their native lands. Both before and during the Velvet Revolution, the restoration of the environment was at the forefront of the social agenda. Now, in the post-revolutionary era, the goal of meeting European Union standards is the driving force in the effort to achieve sustainable development. The World Commission on the Environment and Development defined sustainable development in 1987 as "meeting the needs of present humans without unduly compromising the capacity of future humans to meet their needs" (Salwasser 1994). Goodland and Daly have defined a common model for maintaining the sustainable development of a large society; this process involves the balancing of social capital (human effort and organization), economic capital (the physical and financial infrastructure), and environmental capital (the resources of the Earth) (Goodland and Daly 1994). As the global population boom continues, the demand of human societies is increasing in dangerous proportions, and less space and fewer resources are available for the living things which are not adapted to anthropogenically modified ecosystems (Wilson 1992). In short, amid the "biodiversity crisis" as defined by Wilson, developing nations must first work to replenish the diminishing environmental capital of the Earth.

Thus, the global effort to create models of sustainable development begins with a process called ecosystem management, which was first suggested by the naturalist Aldo Leopold in the 1950's. The concept of ecosystem management stresses that "knowledge and technology can be used in actions to encourage desired conditions of ecosystems for environmental, economic, and social benefits, both now and for future generations" (Salwasser 1994). David Ostermeier of the University of Tennessee further suggests that the organizations of the peoples, or social capital, play the most important role in shaping a new relationship with the Earth; he claims that the "product-oriented" view of resources, in which humans make products from resources, must become more "ecosystem-oriented," in which resources sustain the ecosystems which in turn sustain humans. "Sustainability and ecosystem management fosters choice and decision making whereby humans view--and act accordingly--our activities within an ecological and systemic context, not outside this context" (Ostermeier 1996). In other words, developing societies like the Czech Republic must consider the ecological consequences of economic activities, so that timber, fertile land, and clean water can be maintained for future generations.

So, with the mission of reuniting a society with sustainable ecosystems, the Czech Republic now turns to the newly formed Ministry of the Environment to revamp the political and legal framework which has long exploited the environment. Following the Velvet Revolution, the Ministry of the Environment was created on January 1, 1990 as the supreme administrative body

in environmental matters. The Ministry was granted one primary responsibility of the government--to enforce and interpret those laws relating to the use and protection of nature. The Ministry was further divided into many sections to handle the many aspects of the natural environment (agriculture, parks, rivers, etc.). More specifically, the Section of Nature and Landscape Protection, with its central office in Brno, where I was doing my field work, is responsible for the "preparation of forecasts, concepts, and strategies for the protection of nature" (Ministry of the Environment 1994).

Of course, the Ministry can not rely solely upon its own resources for keeping a national register of environmental quality. The real data for such forecasting is collected through various research institutes, like the Institute of Landscape Ecology in Brno, which collect data in various scientific disciplines for the National Academy of Sciences, and state-funded research projects at universities, like the Masaryk University in Brno. While the lack of funding for scientific research is slowing the pace of environmental recovery, these institutions continue a collaborative effort to create congruent strategies for nature protection (National Report 1992). Through communication with European Union nations, the Ministry of the Environment is directing many national programs to rehabilitate Czech ecosystems to EU standards. During my stay in the Czech Republic, I was fortunate enough to participate in ecological research projects involving institutions from the local to the national level which are collaborating to remediate environmental

problems, and the devoted scientists with whom I worked convinced me that protecting the land is the key to protecting the beloved freedom of the people.

First, I worked on a nationwide and European project to identify and protect the native ecosystems of the Czech Republic. This project, known as the European Ecological Network (ECONET), is funded by the World Conservation Union (IUCN), and headed by Dr. Jitka Pellantova of the Section for Nature and Landscape Protection of the Ministry of the Environment. The program is still tentative, and the proposal for the Central European Network is still awaiting the approval of the IUCN. This program is designed to improve the stability of ecosystems throughout Europe, and the Czech Republic is employing a concept called TSES (Territorial System of Ecological Stability) in the evaluation of its ecosystems. Under this system, 24 core areas of prime ecosystem stability and 9 specific biocorridors which serve as primary migration routes will be protected, while nature protection zones would be constructed to buffer the core zones (Ochrana 1995). The network would cover 26% of the Czech Republic, and I surveyed the integrity of several aquatic ecosystems in core areas with a hydrobiologist that worked for Dr. Pellantova.

While in the Czech Republic, I spent most of my time doing volunteer field research for the Institute of Landscape Ecology in Brno. My primary mentor at this institute was a young ichthyologist named Dr. Pavel Jurajda, who is researching the effects of decreasing water quality on fish populations. His

primary project, funded by the Academy of Sciences, is the study of juvenile fish populations as biological indicators of the health of surface waters (Jurajda 1995). I assisted him in the sampling of juvenile populations on the Morava River, the largest river in Moravia, and on many small streams as well.

Dr. Jurajda was participating in several interesting international projects as well. Working with Dr. Bill Sutherland and Dr. Carl Smith of the University of East Anglia in the United Kingdom, Dr. Jurajda was collaborating on a project entitled "A Study of Individual Spawning Behaviour and its Effect upon Population Size in the Bitterling (*Rhodeus sericeus*)."

In short, the bitterling, a tiny fish, reproduces by depositing its eggs in the siphons of freshwater mussels (*A. cygnea*, *A. anatina*, *U. pictorum*, *U. tumidus*, and *U. crassus*). "The bitterling is ideally suited to studies of individual behavior and population ecology because they have a precise and readily quantifiable spawning site: freshwater mussels" (Sutherland 1996). I worked with both Dr. Smith and Dr. Jurajda to sample communities of bitterlings and mussels in the oxbow lakes of the Morava River. Finally, Pavel was collecting fish from surface waters in the native home of the river otter (*Vitra vitra*) in the Trebon Protected Landscape Area in order to study its diet. I collected fish from the many artificial reservoirs in this area as a part of the United Nations Man and Biosphere Program, which is funding the protection of endangered species like the river otter.

Finally, I also did a great deal of voluntary field research for Masaryk University in Brno. While at the university, my two primary mentors were Dr. Jan Helesic and Dr. Milan Gelnar, both of the Department of Zoology and Ecology. Working with Dr. Helesic and his assistant, Svetlana Zharadkova, I collected many mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera) as a part of his project to use the population structure of these insect families as a biological indicator of the health of epi-rhithral (alpine) streams and large rivers such as the Morava and Elbe (Helesic 1996). On the other hand, I could only observe much of Dr. Gelnar's work in the laboratory. As the staff parasitologist, he was researching the ecological relationship between metazoan parasites and their host fish. More specifically, he was collecting specimens of parasites, barbels, and eels from localities in both Austria and the Czech Republic to confirm the health status of fish as a bioindicator in aquatic ecosystems. Dr. Gelnar used his knowledge of the ecological makeup of parasite communities to determine the health of the fish populations in both localities.

All in all, I owe my utmost gratitude to these scientists for convincing me that the Czech Republic can indeed preserve its natural ecosystems and forge a path toward sustainable development for the future. The Czechs are unbearably proud people, and their strong will has brought them quickly from the shackles of Communist occupation to the threshold of European Union membership, making their fledgling nation an example unto

the world. The precepts for sustainable development--eager people, money, and scientific knowledge--are nearly intact in the new Czech Republic, and the rebirth of the Czech nation only awaits the recovery of its natural resources from the grip of environmental degradation. I believe that the birth of grassroots environmental organizations which can encourage the revival of rural communities is the next step toward sustainable development in the Czech Republic; these organizations could provide more education in the ecologically sound principles for life which the community of science is boldly advocating. If the social consciousness can raise to a new level of environmental awareness, then the velvet curtain can remain open, and the embers of revolution can dwindle peacefully in the Czech Republic.

Works Cited

- Binova, Ludmila; Martin Culek, Veronica Kopecka, Igor Michal, and J. Plesnik, 1995: European Ecological Network: A Possible Contribution of the Czech Republic. Ochrana Prirody 50(5): 141-146.
- Catalogue of the Czech Republic Ministry of the Environment. Ministry of the Environment, 1994.
- Catalogue of the Czech Hydrometeorological Institute. Czech Hydrometeorological Institute, 1993.
- Gelnar, Milan, 1996: Health Status of Fish as a Bioindicator in Aquatic Ecosystems. unpublished.
- Helesic, Jan, 1996: The Morava and Elbe River Basins, Czech Republic: A Comparison of Long-Term Changes of Some Localities. unpublished.
- IUCN (World Conservation Union), 1995. Interaction Between Agriculture and Nature Conservation in the Czech and Slovak Republics. IUCN: Gland, Switzerland, and Cambridge, United Kingdom. viii and 123pp.
- Jurajda, Pavel, and Milan Penaz, 1994. Fish Communities of the Lower Regulated Stretch of the River Morava, Czech Republic. Folia Zoologica 43(1): 57-64.
- Leopold, Aldo, 1949. A Sand County Almanac and Sketches from Here and There. Oxford University Press: New York, 228pp.
- National Report of the Czech and Slovak Federal Republic. June 1992. United Nations Conference on the Environment and Development, 146pp.
- Ostermeier, David, 1996. Ecosystem Management and Sustainability: An Institutional Perspective. unpublished.
- Salwasser, Hal, 1994. Ecosystem Management: Can It Sustain Diversity and Productivity? Journal of Forestry 8(1): 6-10.
- Sutherland, W.J., C. Smith, M. Warren, J.D. Reynolds, and P. Jurajda, 1996. A Study of Individual Spawning Behavior and Its Effects upon Population Size in the Bitterling (Rhodeus sericeus). unpublished.
- Vavrousek, J., J. Mikolas, and P. Siemer, eds, 1992. The State of the Environment in Czechoslovakia. Vesmir: Praha, 120pp.
- Wilson, E.O., 1992. The Diversity of Life. Harvard University Press: Cambridge, 424pp.